

**General Electric Company
Albany, New York**

Report

**DEVELOPMENT OF CORRECTIONS FOR
ANALYTICAL BIASES IN THE 1991-1997
GE HUDSON RIVER PCB DATABASE**

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HydroQual, Inc.
Environmental Engineers and Scientists

**General Electric Company
Albany, NY**

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Prepared by:

**HydroQual
4914 West Genesee Street
Camillus, NY 13031**

CONTENTS

<u>Section</u>	<u>Page</u>
1 BACKGROUND	1-1
1.1 GE ANALYTICAL TECHNIQUES	1-1
1.2 SUMMARY OF GE HUDSON RIVER PCB DATABASE	1-2
1.3 EVIDENCE OF ANALYTICAL BIAS IN GE DATA	1-2
1.4 SOURCES OF ANALYTICAL BIAS	1-3
1.4.1 PCB Standard Calibration Errors	1-3
1.4.2 Coelution of PCB Congeners in Capillary Column Analyses	1-4
2 QUANTIFICATION OF ANALYTICAL BIASES	2-1
2.1 REVISION OF THE DB-1 PEAK RESPONSE FACTORS	2-1
2.2 COELUTION CORRECTION FACTOR DEVELOPMENT	2-2
3 CORRECTION OF WATER COLUMN PCB DATA	3-1
3.1 SELECTION OF TARGET PEAKS	3-1
3.2 SELECTION OF A GAS CHROMATOGRAPH CAPILLARY COLUMN FOR REQUIRED CONGENER RESOLUTION	3-2
3.3 DEVELOPMENT OF PRELIMINARY WATER COLUMN CORRECTION FACTORS	3-3
3.3.1 Selection Criteria for Preliminary Water Column Data Set	3-3
3.3.2 Results from Reanalysis of Preliminary Water Column Data Set ...	3-3
3.4 CONFIRMATION OF WATER COLUMN CORRECTION FACTORS	3-4
3.4.1 Selection Criteria for Confirmatory Water Column Data Set	3-4
3.4.2 Results from Analysis of Confirmatory Water Column Data Set ...	3-4
3.5 EVALUATION OF WATER COLUMN CORRECTION FACTORS	3-6
4 CORRECTION OF SEDIMENT PCB DATA	4-1
4.1 DEVELOPMENT OF SEDIMENT PCB CORRECTION FACTORS	4-1
4.1.1 Correction of Sediment Data for Coelution Biases	4-1
4.1.2 Target Peak Selection for Sediment Data	4-2
4.2 DEVELOPMENT OF SEDIMENT CORRECTION FACTORS	4-2
4.2.1 Selection Criteria for Sediment Data Set	4-2
4.2.2 Calibration Standards for Sediment Samples	4-3
4.2.3 Results from Analysis of the Sediment Data Set	4-4
4.3 EVALUATION OF SEDIMENT DATA CORRECTION FACTORS	4-6
5 CORRECTION OF SEDIMENT PORE WATER PCB DATA	5-1
5.1 TARGET PEAK SELECTION FOR PORE WATER DATA	5-1
5.2 DEVELOPMENT OF PORE WATER CORRECTION FACTORS	5-2
5.3 APPLICATION OF PORE WATER CORRECTION FACTORS	5-2
6 CORRECTION OF BIOTA PCB DATA	6-1
6.1 POTENTIAL FOR COELUTION BIAS IN GE BIOTA DATA	6-2
6.2 FEASIBILITY OF COELUTION BIAS CORRECTIONS FOR BIOTA DATA ...	6-2

**Corrections for Analytical
Biases in GE Database**

7	CORRECTION OF THE GE DATABASE	7-1
7.1	SUMMARY OF ANALYSES	7-1
	7.1.1 Error in Original Green Bay Standard Calibration	7-1
	7.1.2 Coelution Biases	7-1
7.2	UPDATING THE GE DATABASE WITH CORRECTED DATA	7-1
	7.2.1 Fields Requiring Correction	7-1
	7.2.2 Algorithms for Database Correction	7-2
	7.2.3 Additions to the Database	7-3
7.3	RELEASE OF THE CORRECTED GE PCB DATABASE	7-3
8	REFERENCES	8-1

TABLES

Table

3-1	DB-1 Peaks with the Highest Potential for Analytical Bias
3-2	Statistics for Regression of DB-1 and C18 Results from the Combined Water Column Data Set
4-1	Average DB-1 Peak 5 Composition in TIP Water and Sediments
4-2	Statistics for Regression of Sediment DB-1 and C18 Results
6-1	Summary of GE Biota Data and Calibration Standards
A-1	DB-1 Chromatograph Peaks and Corresponding PCB Congeners
A-2	GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table
A-3	Summary of GE Hudson River Data Collection Programs
A-4	Mixed Peak Deconvolution Scheme for Analysis of GE PCB Data
A-5	DB-1 Peak Composition for Original and Revised Calibrations of the Green Bay PCB Standard
A-6	DB-1 Peak Green Bay Calibration Correction Factors
A-7	Calculation of Water Column Potential Bias Index for DB-1 Peaks with Coeluting Congeners
A-8	Preliminary Set of Hudson River Water Column Extracts Selected for Reanalysis
A-9	Laboratory Results from Analysis of Preliminary Water Column Data Set
A-10	Confirmatory Set of Hudson River Water Column Extracts Selected for Reanalysis
A-11	Laboratory Results from Reanalysis of Confirmatory Water Column Data Set
A-12	Calculation of Potential Bias Index for Average GE Surface Sediment Data
A-13	Hudson River Sediment Sample Extracts Selected for Reanalysis
A-14	1991 GE Sediment Survey Samples Analyzed Using the Green Bay Standard
A-15	Laboratory Results from Analysis of Sediment Data Set
A-16	Calculation of Potential Bias Index for Average GE Sediment Pore Water Data
A-17	1991 GE Pore Water Samples Analyzed Using the Green Bay Standard
A-18	Calculation of Potential Bias Index for GE Biota Data

FIGURES

Figure

- 1 Comparison of 1993 Water Column PCB Data at TID
- 2 DB-1 Chromatograph Peak with Shouldering Caused by Coelution
- 3 Ratio of Revised to Original Green Bay Standard DB-1 Peak Weight Percents
- 4 Comparison of 1993 Water Column PCB Data at TID: EPA Data, GE Data, and GE Data Recomputed with the Revised Green Bay Standard Calibration
- 5 Comparison of 1993 Water Column DB-1 Peak PCB Data at TID
- 6 DB-1 Reanalysis of Archived Extracts for Preliminary Water Column Data Set: Comparison of Original and Reanalyzed Extracts for PCB Peak Totals
- 7 Preliminary Water Column Correction Factor Data Set: Regression of PCB Peak Concentrations in Original Samples (DB-1 Column) and Reanalyzed Samples (CP-SIL5-C18 Column)
- 8 DB-1 Reanalysis of Archived Extracts for Combined Water Column Correction Data Set: Comparison of Original and Reanalyzed Extracts for PCB Peak Totals
- 9 Combined (Preliminary and Confirmatory) Water Column Correction Factor Data Set: Regression of PCB Peak Concentrations in Original Samples (DB-1 Column) and Reanalyzed Samples (CP-SIL5-C18 Column)
- 10 Comparison of 1993 Water Column PCB Data at TID: EPA Data, GE Data, and Corrected GE Data
- 11 Locations of GE 1991 Sediment Core Composites Selected for Reanalysis
- 12 Reanalysis of Archived Sediment Extracts: Comparison of Original and Reanalyzed Extracts for PCB Peak Totals
- 13 Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Surface Sediment (0-5 cm) Samples
- 14 Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Intermediate (5-10 cm) Sediment Samples
- 15 Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Deep (10-25 cm) Sediment Samples
- 16 Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Sediment Samples (All Depths)
- 17 Average TIP Surface Sediment PCB Homolog Signature
- 18 Average TIP Intermediate Sediment PCB Homolog Signature
- 19 Average TIP Deep Sediment PCB Homolog Signature
- 20 Average TIP Sediment Pore Water PCB Signatures
- 21 Algorithm for Application of Corrections to the GE Database

SECTION 1 BACKGROUND

This report has been developed by HydroQual on behalf of the General Electric Company (GE). This report describes the approach and analyses used to identify and quantify analytical biases in the 1991-1997 GE Hudson River Polychlorinated Biphenyl (PCB) Database. A description of the GE Hudson River database, the analytical method employed for PCB quantification, and the development and application of corrections to the database is provided.

1.1 GE ANALYTICAL TECHNIQUES

The sampling and analysis for Hudson River PCBs by GE and its contractors has been performed in accordance with the Quality Assurance Project Plan (QAPP) developed for the site (O'Brien and Gere, 1993f). The PCB analytical technique involves the extraction of PCBs from the sample matrix, gas chromatographic (GC) separation of PCB congeners on a DB-1 capillary column, and detection with an electron capture detector. Calibration of the DB-1 column is based on the method developed by the U.S. Environmental Protection Agency (EPA) under the Green Bay Mass Balance Study (EPA, 1987). The Green Bay Method involves GC standardization using a 25:18:18 mixture of Aroclors 1232, 1248, and 1262. Individual DB-1 peak response factors¹ (RFs) are calculated based on standard peak weight percent values originally developed by the EPA (EPA, 1987). These RFs are then used to calculate PCB content of environmental samples.

¹ The response factor is defined as the PCB congener mass per unit area of chromatographic peak.

The DB-1 column separates PCBs in 118 unique chromatographic peaks. Several of these peaks contain multiple (coeluting) congeners. DB-1 PCB peaks and the corresponding congeners are listed in Table A-1 of the Appendix.

1.2 SUMMARY OF GE HUDSON RIVER PCB DATABASE

The GE Hudson River PCB database was developed to store the large volume of data collected by GE and its contractors in association with the Reassessment Remedial Investigation and Feasibility Study (RRI/FS) of Hudson River PCBs being conducted by the EPA. The current version of the database (released 05/02/97) contains PCB data for approximately 4400 environmental samples collected from the Hudson River system. The file structure table for the database is provided in Table A-2. Most of the data in the database were collected under the field programs listed in Table A-3. The GE database includes total PCB concentrations and DB-1 peak concentrations for samples analyzed using the DB-1 capillary column. For samples having DB-1 peak concentration data, homolog weight and mole fractions, and chlorination levels (total Cl, ortho-Cl, and meta-Cl + para-Cl) are also included.

1.3 EVIDENCE OF ANALYTICAL BIAS IN GE DATA

Comparison of water column PCB concentrations in samples collected by GE in 1993 (O'Brien and Gere, 1992-96) from the Fort Edward (FE) and Thompson Island Dam (TID) monitoring stations with those measured as part of the EPA RRI/FS Phase II Study (EPA, 1995) suggested that an analytical bias existed between the two data sets. Although total PCB levels exhibited consistency in magnitude and temporal trends (e.g., Figure 1, bottom panel), a close examination of dechlorination products suggested that analytical biases were manifested in individual PCB congeners. Differences between GE and EPA concentration data for DB-1 capillary column peak

5 (PK5), which contains PCB congeners 2,2' dichlorobiphenyl (BZ#4)² and 2,6 dichlorobiphenyl (BZ#10), are especially evident in the 1993 data from TID (Figure 1, top panel).

Differences between GE and EPA data for individual congeners, as illustrated for PK5 in Figure 1, may affect data analyses used to develop an understanding of PCB fate and transport mechanisms in the Hudson River. For the case of PK5, biases (Figure 1, top panel) in mass quantification will affect loading calculations and may influence data interpretation. As the components of PK5 are relatively soluble reductive dechlorination products, such biases may alter the assessment of sediment diffusive flux and reductive dechlorination as PCB fate and transport mechanisms within the river. This is of particular concern for the Thompson Island Pool (TIP).

1.4 SOURCES OF ANALYTICAL BIAS

1.4.1 PCB Standard Calibration Errors

Differences between the GE and EPA congener PCB data can be partly attributed to an error in the original calibration of the PCB standard used by GE for DB-1 analyses (EPA, 1987). The congener distribution (predominantly peak 5 components) within the Green Bay mixed Aroclor standard was apparently miscalculated as a revision to the calibration was later published (EPA, 1994). This error introduced systematic analytical biases in the GE data because underestimation of the PK5 weight percent in the DB-1 calibration standard caused measured PK5 values in Hudson River environmental samples to be underestimated (i.e., biased low). Since the error is in the calibration standard composition, not the PCB mass, it affects data for all DB-1 peaks (i.e., low bias in PK5 requires that other peaks are biased high).

²BZ refers to the numbering system for PCB congeners developed by Ballschmiter and Zell (1980).

1.4.2 Coelution of PCB Congeners in Capillary Column Analyses

Another cause of differences between the GE and EPA databases is related to the methods used to separate and quantify PCB congeners. As discussed in §1.1, GE employs a DB-1 capillary column for separation of PCB congeners. Coelution of congeners with differing RFs causes mass estimates to be sensitive to the assumption made regarding the relative amounts of the congeners that coelute in a single peak. Currently, the assumptions for deconvolution of peaks containing congeners with different chlorination levels (mixed-peaks) are based on mass spectrometry analysis of Aroclor mixtures. Mixed peak deconvolution assumptions used for PCB analysis of GE Hudson River samples are summarized in Table A-4 (Frame et al., 1996). As mixed-peak congener mass ratios in Hudson River environmental samples deviate from those of commercial Aroclors, measurement errors are introduced into results for these peaks. Furthermore, differences in coeluting peak congener compositions between Hudson River environmental samples and those of the DB-1 calibration standard will result in similar errors. The magnitude and significance of these errors depend on differences among coeluting peak congener response factors and the relative abundance of coeluting peak congeners in the Hudson River system.

In samples analyzed by the EPA under the Hudson River RRI/FS Phase II study, PCB congeners were separated using a dual capillary column gas chromatographic electron capture detection technique (EPA, 1992). This technique employs the use of two independent capillary columns with unique resolution capabilities for PCB congener separation, allowing for coelution on the first GC analytical column to be potentially resolved on the second GC analytical column. This allows separation of a larger number of PCB congeners than the single column method used by GE and thus results in fewer peaks that contain coeluting congeners. EPA Phase II PCB analyses quantified between 130 and 140 individual PCB congeners, with no more than three pairs that coeluted on the dual column system. Analytical problems from

coelution were, therefore, minimized in the EPA data. Hence, the 1993 EPA water column data served as a benchmark for comparison with GE data collected from similar locations and time periods. Such comparisons were useful for identifying DB-1 peaks containing the most significant coelution biases.

Another potential bias introduced by coelution is related to the shape of chromatograph peaks with coeluting congeners. Congeners that coelute with slightly different column retention times produce a chromatographic peak that deviates from that of a single component peak (e.g., Figure 2). This may result in area calculation errors if the distorted peak shape changes the integration limits of the peak. For example, the back shouldering that appears in DB-1 peak 5 (Figure 2) contains significant overlap of two congener peaks which reduces the area count from that of two completely separated peaks. This bias can be eliminated by separation of the coeluting congeners.

SECTION 2

QUANTIFICATION OF ANALYTICAL BIASES

2.1 REVISION OF THE DB-1 PEAK RESPONSE FACTORS

Calibration of the gas chromatograph involves determination of the response factors for each DB-1 column peak. This is accomplished using the Green Bay PCB standard. A known mass of the standard is analyzed and a response factor is calculated for each peak from its area ($A_{i,s}$), and weight percent in the standard ($w_{i,o}$), and the total PCB mass analyzed (M_s):

$$RF_{i,o} = \frac{w_{i,o} M_s}{A_{i,s}} \quad 2-1$$

The response factors are used to calculate the PCB mass in each peak of an environmental sample ($m_{i,d}$) from the peak areas ($A_{i,d}$) for the sample:

$$m_{i,d} = A_{i,d} RF_{i,o} \quad 2-2$$

As discussed in §1.4.1, the GE database was developed using published weight percent values (EPA, 1987). Those values were subsequently revised (Table A-5; EPA, 1994). The revised values, ($w_{i,r}$) alter the response factors by the ratio $w_{i,r} / w_{i,o}$:

$$RF_{i,r} = \frac{w_{i,r}}{w_{i,o}} RF_{i,o} \quad 2-3$$

Thus, the PCB mass estimates for the environmental samples are also altered by the same ratio:

$$m_{i,r} = \frac{w_{i,r}}{w_{i,o}} m_{i,d} \quad 2-4$$

These ratios are defined as the Green Bay calibration correction factors (GCF_i) and are tabulated in Table A-6 and plotted in Figure 3. The correction factors range from 0.16 (peak 84) to 9.99 (peak 66), although for most peaks they are close to 1.0. Peak 1 (biphenyl) is not shown in Figure 3 because it had an original weight percent of 0.0 (and thus a ratio of infinity). This peak is not included in the total PCB determination.

Comparison of the revised GE data and the EPA Phase 2 data from the TID station indicates the presence of additional biases (Figure 4). Remaining differences between GE and EPA data were attributed to the effects of coeluting congeners in DB-1 peaks, which includes differences in RFs of the congeners and the effect of peak shouldering, as previously discussed (Figure 2).

2.2 COELUTION CORRECTION FACTOR DEVELOPMENT

The approach to determine errors in PCB mass estimates for peaks containing multiple congeners is as follows:

- 1) GE DB-1 data were corrected for errors in the original Green Bay calibration through application of the GCFs from Table A-6,
- 2) peaks with coeluting congeners were ranked based on their potential for analytical bias,

- 3) archived extracts from Hudson River environmental samples were reanalyzed in the laboratory to separate coeluting congeners from selected target peaks,
- 4) regression analyses were used to quantify single peak analytical biases by relating DB-1 peak concentrations to sums of measured individual coeluting congener concentrations.

The major advantage of using this approach is that the methodology can be applied to develop different correction factors (CFs) for data from different locations, time periods, and environmental media, as deemed necessary.

SECTION 3

CORRECTION OF WATER COLUMN PCB DATA

3.1 SELECTION OF TARGET PEAKS

DB-1 capillary column peaks with coeluting congeners were ranked for potential bias by a surrogate parameter chosen to reflect their contribution to PCB loadings in the TIP and the sensitivity of their mass estimates to the assumptions of the relative contribution of congeners within the peaks. For DB-1 peak i , containing $j = 1, \dots, n$ coeluting congeners, the potential bias index, ϕ , was defined as the product of the relative range in congener relative response factors (RRFs)³ and the peak's average weight percent in GE water column PCB data, W^4 :

$$\phi_i = W_i \left(\frac{RRF_{MAX,j} - RRF_{MIN,j}}{\sum_{j=1}^n \frac{RRF_j}{n}} \right) \times 100\% \quad 3-1$$

Summer 1991-1996 low flow conditions were chosen for calculation of average DB-1 peak weight percents as this season has historically contained the strongest loading signal. Although peak weight percents were initially calculated for both FE and TID data, similarities between the two justified the use of only the peak weight percent from TID data in the potential bias index calculation. Using congener RRFs published by Mullin et al. (1984) and calculated values of W at TID, the potential bias index was computed with Equation 3-1 for all DB-1 peaks containing coeluting congeners. A

³The relative response factor is defined as the ratio of a PCB congener response factor to the RF of a reference standard, which is typically octachloronaphthalene.

⁴DB-1 peak weight percents were based on the revised Green Bay Standard composition (§2.1).

listing of the potential bias index for these peaks is given in Table A-7 of the Appendix, and the peaks with the three highest values for ϕ are listed below in Table 3-1.

DB-1 Peak #	Congener BZ #s			Congener RRFs			Relative Range in RRFs (%)	Average Weight Percent at TID	Potential Bias Index ϕ
	1st	2nd	3rd	1st	2nd	3rd			
5	4	10	-	0.037	0.262	-	150.03	31.1	4671
8	5	8	-	0.119	0.206	-	53.54	5.9	318
14	15	13	-	0.107	0.313	-	98.10	2.9	281

TABLE 3-1. DB-1 Peaks with the Highest Potential for Analytical Bias

The 1993 water column data (corrected for the error in the original calibration of the Green Bay standard) for the three peaks listed in Table 3-1 were graphically compared with coeluting congener sums from the EPA data set (Figure 5). Biases are evident in DB-1 peaks 5, 8, and, to a lesser extent, 14 (Figure 5). Therefore, these three peaks were selected as target peaks for correction of coelution biases in the GE database.

3.2 SELECTION OF A GAS CHROMATOGRAPH CAPILLARY COLUMN FOR REQUIRED CONGENER RESOLUTION

A CP-SIL5/C18 (C18) gas chromatographic capillary column, manufactured by Chromopack, Inc., was selected for laboratory separation of individual PCB congeners from the target peaks. The C18 column was selected primarily based on its ability to resolve lower molecular weight PCB congeners (Frame, 1997), including those coeluting in DB-1 peaks 5, 8, and 14. Comparison of sums of C18 congener concentrations with corresponding DB-1 peak concentrations was thus used in development of corrections for the GE database.

3.3 DEVELOPMENT OF PRELIMINARY WATER COLUMN CORRECTION FACTORS

3.3.1 Selection Criteria for Preliminary Water Column Data Set

Preliminary CFs were developed based on reanalysis of archived GE Hudson River water column sample extracts. Sample extracts selected for reanalysis consisted of recent samples (1995-1996) collected from FE, TID, and the Hudson Falls plunge pool. Selected samples contained greater than 40 ng/L of total PCBs because below this level, detection limit problems arise for individual PCB congeners. Based on these criteria, a preliminary data set consisting of 16 archived extracts (5 from FE, 8 from TID, and 3 from the plunge pool) with total PCBs ranging from 50 to 1400 ng/L (Table A-8) were selected for reanalysis.

3.3.2 Results from Reanalysis of Preliminary Water Column Data Set

Prior to reanalysis of the archived sample extracts on the C18 column, the extracts were reanalyzed using the DB-1 system. This allowed quantification of potential changes in PCB concentrations during extract storage. Comparison of results from DB-1 reanalysis of the archived extracts with original data indicated that the laboratory achieved good analyte recovery (i.e., storage losses or gains were insignificant). A graphical comparison of the original and reanalyzed DB-1 results, which were both corrected for Green Bay calibration errors (§2.1), is shown in Figure 6.

Subsequently, extracts were reanalyzed on the C18 system (Table A-9), and linear regression analyses were performed to relate C18 congener concentration sums to the DB-1 results. Statistics and best fit lines from regression analysis of the preliminary data set target peaks (PK5, PK8, PK14) are displayed in Figure 7. Results from the regression plots suggest that the analytical bias in the target peaks is

systematic and independent of sample location (i.e., correlation coefficients close to unity and small y-intercepts).

The regression analysis results from the preliminary data set suggested that the selected approach could be used to develop CFs (i.e., regression line slopes) that would sufficiently describe the analytical bias present in target peak data from the historical GE database. Therefore, the analysis was expanded to make use of a more comprehensive data set in the development of final database CFs.

3.4 CONFIRMATION OF WATER COLUMN CORRECTION FACTORS

3.4.1 Selection Criteria for Confirmatory Water Column Data Set

The expanded data set for confirmation of preliminary CFs incorporated paired Hudson River water column samples collected from FE and TID during the summer low flow periods of 1991-1996. The paired samples chosen for reanalysis exhibited a strong TIP loading signal (i.e., large difference in total PCB concentrations between FE and TID). The selected data set enabled an evaluation of whether preliminary single peak CFs would be valid for data spanning a much larger time period, and for data that were expected to represent varying levels of PCB loading and composition⁵. A total of 11 paired sample extracts from FE and TID, having total PCBs ranging from 43 to 800 ng/L, were selected to comprise the confirmatory data set (Table A-10).

⁵The magnitude and composition of PCB loadings vary significantly between FE (smaller load, composition similar to Aroclor 1242) and TID (larger load, composition similar to an altered Aroclor 1242 suggestive of dechlorination and/or partitioning with sediments and pore water).

3.4.2 Results from Analysis of Confirmatory Water Column Data Set

DB-1 reanalysis of the extracts for the confirmatory data set again indicated that archive storage changes were insignificant, as shown in Figure 8 (Figure 8 also includes results from the preliminary correction data set).

Reanalysis of confirmatory data set extracts on the C18 column (Table A-11) provided strong relationships between DB-1 and C18 results similar to those of the preliminary data set. Regression analysis results for the combined data set are plotted in Figure 9. The inclusion of the confirmatory data set with the preliminary data set did not result in significantly different CFs (regression line slopes). This suggests that the analytical bias is systematic and independent of the time from which water column samples were collected. Correlation coefficients close to unity suggest that the regression equations are statistically significant and small y-intercept values justify use of regression line slopes to define target peak CFs. Based on the results displayed in Figure 9, final CFs to account for analytical biases in the GE water column data for peaks 5, 8, and 14 were 0.65X, 0.45X, and 1.44X, respectively. Regression statistics for the three target peaks are summarized in Table 3-2.

DB-1 Peak #	Structure of PCB Congeners	Original Extract Data ⁶			Regression Statistics			
		Number of Samples	Max Conc. [ng/L]	Min Conc. [ng/L]	Slope	y-Intercept [ng/L]	R ² for Regression	Standard y-Error [ng/L]
5	2,2' + 2,6	38	117.6	0.0	0.65	1.4	0.931	5.8
8	2,3 + 2,4'	38	109.3	0.0	0.45	0.3	0.995	0.9
14	4,4' + 2,2',5	38	83.8	0.9	1.44	-1.2	0.996	1.6

TABLE 3-2. Statistics for Regression of DB-1 and C18 Results from the Combined Water Column Data Set

⁶Corrected for errors in original Green Bay standard calibration.

3.5 EVALUATION OF WATER COLUMN CORRECTION FACTORS

The coelution bias CFs developed from regression analyses were applied to the 1993 GE water column data set for qualitative comparison with EPA data from the same period. Water column PCB concentrations (total and target DB-1 peaks) from samples collected in 1993 at the TID sampling station are plotted in Figure 10 for GE (original and corrected for calibration errors and coelution biases) and EPA data. Inspection of Figure 10 suggests that application of the corrections to the GE data set significantly improved its comparability with the EPA data, most notably for DB-1 peaks 5 and 8.

SECTION 4

CORRECTION OF SEDIMENT PCB DATA

4.1 DEVELOPMENT OF SEDIMENT PCB CORRECTION FACTORS

4.1.1 Correction of Sediment Data for Coelution Biases

Correction factors to account for coelution biases in GE sediment PCB data were developed independent of the water column CFs⁷. This is because of the expected dissimilarities in coeluting peak congener compositions. For example, analysis of the average PK5 composition, expressed as the ratio of BZ#4 to BZ#10 concentration, for water column and sediment data from the TIP suggests that PK5 composition differs between the two media (Table 4-1).

Sample Location and Matrix	Number of Obs.	BZ#4 / BZ#10 Ratio	Data Source
		Average $\pm$ 95% Confidence Limit of the Mean	
FE & TID Water Column	22	4.95 $\pm$ 1.26	Phase 2 Study (EPA, 1995)
FE & TID Water Column	31	4.91 $\pm$ 1.03	GE C18 Data (this report)
TIP Surface Sediments	5	4.19 $\pm$ 0.38	Phase 2 Study, High Res. Cores 0-2 cm (EPA, 1995)
TIP Deep Sediments	20	8.88 $\pm$ 1.43	Phase 2 Study, High Res. Cores > 10 cm (EPA, 1995)

TABLE 4-1. Average DB-1 Peak 5 Composition in TIP Water and Sediments⁸

⁷Prior to analysis of coelution biases, sediment data were corrected for Green Bay calibration errors (§2.1) through application of GCFs (Table A-5) to DB-1 peak data.

⁸Note, data in which BZ #4 and BZ#10 concentrations equal zero were not included.

It is noted that the average PK5 composition not only differs between water and sediments, but also varies with sediment depth. Depth variation of the PK5 composition is likely due to the effect of reductive dechlorination of PCBs, which produces BZ#4 and BZ#10 in different proportions. Because of this variability in coeluting peak congener mass ratios, correction for analytical biases in GE sediment data required development of a new set of CFs, which varied with sample core section depth.

4.1.2 Target Peak Selection for Sediment Data

The same empirical approach used to develop water column CFs was applied for correction of the sediment data. Analysis of average TIP surface sediment PCB compositions suggested that the target peaks used for water column CF development were also suitable for correction of the sediment data. The three most abundant DB-1 peaks in the TIP surface sediments, as calculated from 1991 GE data, are PK5, PK8, and PK14. Thus, calculation of the potential bias index (i.e., Equation 3-1) using the average TIP surface sediment composition (corrected for calibration errors) to define *W* resulted in these peaks again ranking as the three highest among DB-1 peaks with coeluting congeners (Table A-12).

4.2 DEVELOPMENT OF SEDIMENT CORRECTION FACTORS

4.2.1 Selection Criteria for Sediment Data Set

Archived extracts of 1991 TIP core data were used for correction of coelution biases in GE sediment data. Composite core samples were used to base CF development on a spatially-averaged representation of the TIP sediments. A total of 36 archived TIP sediment extracts were selected for laboratory reanalysis on the C18 column (Table A-13). Archived sediment extracts were chosen such that their sample

locations provided spatial coverage of the TIP, as depicted in Figure 11. The data set included samples having fine (23) and coarse (13) sediment textures, with total PCBs ranging from 0.5 to 250 mg/kg dry weight. Since sediments near the surface have the greatest influence on PCB dynamics in the system, the sediment CF data set was composed of a larger fraction of surface sediment samples (17 from 0-5 cm, 1 surface grab) than from the intermediate (9 from 5-10 cm) and deep (9 from 10-25 cm) core sections.

4.2.2 Calibration Standards for Sediment Samples

During the original analysis of 1991 sediment survey samples, the DB-1 calibration protocol was altered to account for elevated DB-1 peak 5 concentrations within sediment samples (Northeast Analytical, 1997a). Early in the program, the calibration standard was changed from the Green Bay mixed Aroclor Standard to the Green Bay standard plus an independent peak 5 standard consisting of a 4:1 ratio of BZ#4 and BZ#10. This alleviated a PK5 calibration range problem. Only 37 out of 375 samples from the 1991 GE sediment survey were analyzed using the Green Bay Standard (GBS) (Table A-14). The remaining sediment samples were analyzed with the GBS in conjunction with the BZ#4 and BZ#10 standard.

Because of the difference between the PK5 congener mass ratio in the two calibration methods, samples analyzed using the GBS were expected to contain a greater PK5 coelution bias than those analyzed with the BZ#4 and BZ#10 standard (BZS). Sediment samples originally analyzed using the GBS constituted approximately 1/6 of the samples collected from the TIP, and primarily were from its upstream reaches. Due to the use of different standards, development of analytical bias CFs for sediment data required that different PK5 coelution CFs be developed for GBS and BZS samples, respectively.

DB-1 peak 5 quantification in samples analyzed with the BZS was based on a RF calculated from the independent congener standard rather than that from the original Green Bay calibration value. Therefore, correction of PK5 data to account for the error in the original Green Bay calibration is not required for sediment samples analyzed with the BZS.

4.2.3 Results from Analysis of the Sediment Data Set

Similar to the water column extracts, archived sediment extracts were first reanalyzed on the DB-1 column to assess the significance of extract storage changes. As with the water column data, graphical comparison of original and reanalyzed DB-1 target peak sums (Figure 12) suggests that PCB changes during storage of the archived sediment extracts was not significant. Archived sediment extracts were subsequently reanalyzed on the C18 column; laboratory results are tabulated in Table A-15.

Due to expected variations in coeluting peak composition with sediment depth (Table 4-1), statistical analyses of archived extract data from surface (0-5 cm) intermediate (5-10 cm), and deep (10-25 cm) sediment samples were performed separately. Linear regression analyses conducted to compare DB-1 results with C18 congener sums for reanalyzed sediment extracts are displayed in Figures 13, 14, and 15, for surface, intermediate, and deep sediment data, respectively. The linearity of the relationships between DB-1 and C18 data suggests that coelution biases in the sediment data were systematic, and can adequately be quantified using the CF approach. Moreover, the similarity of results for the different sediment depth intervals indicates that regression coefficients do not vary greatly with sediment depth even though significant differences were noted in coeluting congener mass ratios (Table 4-1). This suggests that another factor (possibly peak shouldering; §1.4.2) may contribute to coelution biases. Therefore, sediment data from the three

different depth intervals were combined to develop single sediment target peak CFs (Figure 16).

Regression results for the combined sediment data indicate that grouping the data over sample depth did not degrade the relationships between the two analyses. Regression coefficients for the combined sediment data were consistent with those from the individual analyses. One notable exception was the PK5 data from samples analyzed with the GBS. Individual PK5 GBS regressions exhibited slight variability in regression line slopes (relative range of 16%). This was likely attributable to small sample size as individual GBS PK5 regressions were based on 5, 4, and 4 data points for the surface, intermediate, and deep sediments, respectively.

Sediment PK5 CFs were similar for the BZS data and the GBS data. Since only the GBS data were corrected for Green Bay calibration errors, this suggests that PK5 coelution bias was systematic. Again, this suggests another factor besides differences in BZ#4 and BZ#10 RRFs may be the most significant coelution bias. Furthermore, the similarity between PK5 CFs for the GBS and BZS data suggests that the corrections developed in §2.1 successfully alleviated calibration errors. Based on R^2 values close to 1.0 and small y-intercepts for the least squares analyses, regression line slopes (1.25X for PK5 (GBS), 1.37X for PK5 (BZS), 0.58X for PK8, and 2.23X for PK 14) were accepted for sediment CFs. Regression statistics for analysis of the sediment CF data set (individual and combined depths) are provided in Table 4-2.

**Corrections for Analytical
Biases in GE Database**

DB-1 Peak #	Original Extract Data ⁹			Regression Statistics			
	Number of Samples	Max Conc. [mg/kg]	Min Conc. [mg/kg]	Slope	y-Intercept [mg/kg]	R ² for Regression	Standard y-Error [mg/kg]
DB-1 Peak 5 (Green Bay Standard)							
0-5 cm	5	20.8	0.3	1.40	-0.32	1.000	0.3
5-10 cm	4	22.3	0.1	1.27	-0.27	0.999	0.4
10-25 cm	4	30.4	0.1	1.19	0.52	0.997	1.2
Combined	13	30.4	0.1	1.25	0.02	0.993	1.1
DB-1 Peak 5 (BZ Standard)							
0-5 cm	13	32.9	0.2	1.41	-0.90	0.994	1.0
5-10 cm	5	46.3	12.7	1.38	-2.64	0.997	1.2
10-25 cm	5	83.5	9.8	1.42	-4.04	0.991	4.1
Combined	23	83.5	0.2	1.37	-1.24	0.996	2.0
DB-1 Peak 8							
0-5 cm	18	9.9	0.2	0.57	0.02	0.997	0.1
5-10 cm	9	15.8	0.2	0.56	-0.03	0.999	0.1
10-25 cm	9	30.8	0.0	0.59	-0.14	0.993	0.5
Combined	36	30.8	0.0	0.58	-0.06	0.996	0.3
DB-1 Peak 14							
0-5 cm	18	1.4	0.1	2.44	0.01	0.983	0.1
5-10 cm	9	2.4	0.0	2.24	0.10	0.994	0.1
10-25 cm	9	3.4	0.0	2.24	0.02	0.977	0.4
Combined	36	3.4	0.0	2.23	0.10	0.984	0.2

TABLE 4-2. Statistics for Regression of Sediment DB-1 and C18 Results

4.3 EVALUATION OF SEDIMENT DATA CORRECTION FACTORS

Unlike water column data, the corrected GE sediment data cannot be evaluated against a complete data set. Spatial (vertical and horizontal) heterogeneity in sediment PCB concentrations precludes direct quantitative comparison to data recently collected by the EPA (EPA, 1995). Therefore, comparisons were limited to qualitative assessments of sediment PCB homolog patterns between GE sediment data

⁹Data are corrected for error in original Green Bay standard calibration except for DB-1 Peak 5 data that were analyzed with the BZS.

collected in 1991 and the EPA high resolution core data collected in 1992 (EPA, 1995). Average TIP sediment PCB homolog distributions for original and corrected GE data and EPA high resolution core data for surface, intermediate, and deep sample depths, were used to assess the impact of correction for coelution bias and calibrations errors on PCB composition¹⁰.

Correction of GE sediment data resulted in a slight shift in the average homolog distribution (Figure 17). Application of CFs to intermediate and deep GE sediment data produced a similar, but less observable shift in the average TIP sediment homolog patterns (Figures 18-19). This shift in surface sediment homolog compositions is most likely attributable to two factors:

- 1) Small decreases in dichlorobiphenyls (DiCBs) occurred due to correction of PK5 and PK8 data. Although a significant increase in DiCBs might be expected due to the relatively large calibration error correction (GCF) for PK5 data analyzed with the GBS (CF = 4.5), this increase was not observable because the area associated with these samples only represents a small fraction of the total TIP area used for sediment averaging. Comparison of corrected and original average TIP PK5 concentrations indicates that the effective increase in PK5 due to corrections (after area-weighted averaging) was approximately 30% (i.e., CF = 1.3). Since PK5 and PK8 are present in similar amounts in TIP sediments (average weight percent in surface sediments of 18% and 14%, respectively), the 40% decrease in PK8 due to bias correction (i.e., CF = 0.6) offset the PK5 increase, resulting in a small decrease in average DiCB concentrations.
- 2) Increases in trichlorobiphenyl resulted due to PK14 correction (CF = 2.2).

¹⁰ Averages for GE sediment data are area-weighted averages of the data pooled by TIP subreach and sediment texture. Averages for EPA data are arithmetic averages of the corresponding high resolution core sections for the five cores collected from the TIP.

SECTION 5

CORRECTION OF SEDIMENT PORE WATER PCB DATA

As part of the 1991 GE sediment survey, 86 pore water samples were collected from Hudson River sediment composite cores (O'Brien and Gere, 1993d). The correction of sediment pore water PCB data paralleled the methods used for water column and sediment data. However, there was no comparable pore water data set to examine the results of these corrections. Moreover, since the pore water data are a small part of the GE database, archived extracts were not reanalyzed on the C18 system. Instead, CFs were developed for pore water based upon bulk sediment CFs.

5.1 TARGET PEAK SELECTION FOR PORE WATER DATA

The approach to selecting target peaks for evaluation of coelution biases in pore water data was similar to that used for sediment and water column data¹¹. The potential bias index (Equation 3-1) was used to identify the DB-1 peaks expected to constitute the most significant analytical biases in the GE pore water data. As with water column and sediment bias corrections, target peak identification focused on data collected from TIP (51 total pore water samples). Ranking of peaks by values of ϕ , computed with the parameter W based on the average TIP pore water composition, indicated that DB-1 peaks 5, 8, 25, and 14 represent the largest potential for coelution biases (Table A-16)¹². Comparison of ϕ values for these peaks

¹¹Individual DB-1 peak values were multiplied by GCF values from Table A-5 to yield pore water data that reflected the composition of the revised Green Bay calibration prior to consideration of coelution biases.

¹²As with sediment averaging, average pore water concentrations for TIP were based on area-weighted averages of pooled data. However, small variations in composition with depth justified grouping pore water data from all sample depths

indicated that potential biases in peaks 8, 14, and 25 are an order-of-magnitude less than those of PK5. This difference in potential bias index values is attributed to the high average weight percent of PK5 and the relatively low abundance of peaks 8, 14, and 25 in TIP sediment pore water. Neglecting PK25 because it averaged less than 1% in composition, target peaks for GE pore water bias correction were again limited to DB-1 peaks 5, 8, and 14.

5.2 DEVELOPMENT OF PORE WATER CORRECTION FACTORS

Since the pore water data do not represent a major portion of the GE database, reanalysis of archived pore water extracts was not performed. Coelution bias correction factors developed for bulk sediment PCB data were applied to correct the pore water data. This is justified because of the expected similarities in the relative abundance of coeluting PCB congeners between pore water and bulk sediments. The physicochemical properties that determine capillary column elution sequences (e.g., octanol-water partition coefficient and solubility) are similar among coeluting congeners. These properties also govern PCB partitioning between sediments and sediment pore water (DiToro et al., 1991). Therefore, at equilibrium, the congener composition of coeluting DB-1 peaks in pore water samples should be similar to that of the sediments. Since analytical biases have been regarded to be a function of coeluting peak congener composition, this reasoning suggests that the correction factors developed for GE sediment data can also be applied to the corresponding pore water data.

5.3 APPLICATION OF PORE WATER CORRECTION FACTORS

In using sediment CFs for GE pore water data, knowledge of the DB-1 standards used during original analyses was required so that the proper PK5 CF could be applied. Based on original laboratory documentation, pore water sample analyses

were conducted in the same manner as sediment analyses: samples collected early in the program (upstream reaches of TIP) were analyzed for peak 5 using the GBS, while later samples were analyzed using the BZS (O'Brien and Gere, 1997). Pore water samples analyzed using the GBS are listed in Table A-17. Since two standards were used for pore water analyses, separate PK5 CFs were required for the GBS and BZS pore water samples in the GE database. As with the sediment data, pore water samples analyzed with the BZS did not require correction of DB-1 peak 5 data for the error in the original Green Bay standard calibration.

Although data from which pore water CFs can be assessed do not exist, a heuristic comparison of original and corrected average TIP pore water compositions is included in Figure 20. Inspection of Figure 20 indicates that application of calibration error and coelution bias corrections to the GE pore water data set resulted in a change in the mean TIP pore water PCB composition. A notable increase in dichlorobiphenyls occurred due to correction of PK5, which constitutes a large fraction (over 35%) of average TIP pore water PCBs. The increase in PK5 can be attributed to correction for calibration errors since over 60% of the samples were analyzed using the Green Bay standard (Table A-17) and required correction for the original calibration error ($GCF = 4.5$). Correcting for the calibration error and coelution bias and averaging the TIP data resulted in a net PK5 CF of 2.7. This large increase in DiCBs resulted in a discernible decrease in the proportion of monochlorobiphenyls, and to a lesser extent, in the remaining homolog groups.

SECTION 6

CORRECTION OF BIOTA PCB DATA

Biota data in the GE database consist of tissue samples from fish and other aquatic organisms collected from the Hudson River under four programs (Table 6-1). Of the 649 total biota samples in the GE database, only 313 records have congener-specific data. Of these data, only the Archived Fish collected by LAW in 1990 and the 1992 Food Chain Study samples were analyzed by the Green Bay standard protocols and therefore required correction for standard calibration errors (§2.1).

Program	Investigator	Timeframe	# Samples	Calibration Standard
Archived Extracts	GE CR&D	1977-78, 1982	75	GE Protocol
Archived Fish	GE (LAW)	1990	92	Green Bay
Food Chain	GE (OBG)	1992	18	Green Bay
Lower Hudson Characterization	GE (Harza)	1989-90	464	GE Protocol

TABLE 6-1. Summary of GE Biota Data and Calibration Standards

Samples collected before 1990 were analyzed using an internal GE calibration protocol, as the Green Bay standard calibration method had not yet been developed (Northeast Analytical, 1997b). Therefore, these samples are not affected by Green Bay calibration errors and did not require correction.

6.1 POTENTIAL FOR COELUTION BIAS IN GE BIOTA DATA

As discussed in §1.2, analytical biases in DB-1 data are a function of differences in the congener compositions of coeluting chromatograph peaks. To the extent that PCB uptake mechanisms for aquatic organisms are congener-specific, coelution bias corrections in biota data will differ from those developed for the other environmental media. Analysis of coelution biases in the water column and sediment data indicated that the largest biases are present in di- and trichlorobiphenyls (i.e., DB-1 peaks 5, 8, and 14). These peaks were identified partly based on their relatively large abundance in the average composition of TIP environmental samples. However, the processes of uptake, bioaccumulation, and biomagnification result in biota PCB compositions that differ from those of the water column and sediments. Potential bias indices (i.e., Equation 3-1) were, therefore, computed based upon PCB composition data from the 137 GE biota samples collected from the upper Hudson River (Table A-18)¹³. Based on calculated potential bias indices for GE biota data, the three DB-1 peaks expected to be most significantly affected by coelution biases (i.e., biota data target peaks) are peaks 5, 48, and 69. Furthermore, potential bias index values were high for several other DB-1 peaks (e.g., peaks 31, 47, and 61).

6.2. FEASIBILITY OF COELUTION BIAS CORRECTIONS FOR BIOTA DATA

The biota data target peaks differ from those considered for correction of coelution biases in water column and sediment data. These differences are due to the relatively low average weight percents for peaks 8 and 14 in GE biota data and differences in average DB-1 peak compositions, as biota PCBs are distributed among more coeluting peaks than PCBs in the other sample media. Ideally, correction of biota target peak data would be based on separation of the congeners coeluting in

¹³DB-1 peak values for biota data were corrected for errors in the Green Bay standard calibration prior to evaluation of coelution biases.

these peaks using the C18 column, as performed for the other media. However, while the C18 column can resolve lower molecular weight PCB congeners, it cannot be used to separate out the more chlorinated congeners that coelute in the biota data target peaks (Frame, 1997). Furthermore, evaluation of seven other capillary column elution patterns indicates that separation of biota target coeluting congeners may be difficult on a single column system (Frame, 1997). One possible benchmark for evaluating the importance of coelution biases in the GE biota data is the 1993 National Oceanographic and Atmospheric Administration and U.S. EPA fish data (EPA, 1995). However, since these data were collected after the 1991-1993 loading events in the river (O'Brien and Gere, 1994), they may not be directly comparable to fish collected by GE prior to the event. Presently, correction of biota data is limited to calibration errors for samples that were analyzed with the original Green Bay standard.

SECTION 7

CORRECTION OF THE GE DATABASE

7.1 SUMMARY OF ANALYSES

7.1.1 Error in Original Green Bay Standard Calibration

Original and revised DB-1 peak weight percent data for the Green Bay PCB standard were used to develop CFs to account for the calibration error in the original standard. Individual DB-1 peak CFs listed in Table A-5 were used to update data from samples analyzed with the original Green Bay standard.

7.1.2 Coelution Biases

Coeluting DB-1 peaks were ranked for potential bias based on differences in congener RFs and the relative abundance of the peaks in Hudson River environmental samples. Archived extracts from selected water column and sediment samples were reanalyzed on a C18 column to quantify coelution biases for selected target peaks. Regression analyses were used to develop coelution CFs (Table 3-2 for water column data and Table 4-2 for sediment data). Development of CFs for pore water data was based on sediment data corrections, while biota data were not corrected for coelution biases.

7.2 UPDATING THE GE DATABASE WITH CORRECTED DATA

7.2.1 Fields Requiring Correction

Correction of GE data for Green Bay calibration errors and coelution biases will result in net changes in PCB peak values and all related fields in the database, including:

- all DB-1 peaks (calibration error), or peaks 5,8,14 (coelution bias only),
- total PCBs,
- homolog distributions (weight % and mole %),
- ortho Cl per biphenyl, meta + para Cl per biphenyl, and total Cl per biphenyl,
- total micromoles, and
- average molecular weight.

7.2.2 Algorithms for Database Correction

Database correction will be based on the logic diagram presented in Figure 21. Following correction for calibration errors, coelution bias corrections will be applied for each media, resulting in new values for DB-1 peak data. Based on corrected DB-1 values, homolog distributions, chlorination levels (ortho Cl per biphenyl, meta + para Cl per biphenyl, total Cl per biphenyl), total micromoles, and the average molecular weight for each database record will be computed based upon peak congener composition (Table A-1) and the mixed peak deconvolution scheme in Table A-4. The algorithms for correction of the GE Hudson River PCB database were developed to be consistent with those used by Northeast Analytical, Inc. for laboratory analysis of PCB data. A more elaborate description of database correction will be developed and presented in a work plan. This work plan will present detailed methods for correction of the GE database.

7.2.3 Additions to the Database

In order to allow for reversal of corrections if original data are desired, information regarding application of corrections is required. A data table containing calibration error GCFs for all DB-1 peaks (i.e., Table A-5) will be provided with database updates. Furthermore, a lookup table, which will be linked with the main database, will be constructed to allow identification of samples that were analyzed with the original Green Bay standard (i.e., those requiring correction for calibration errors).

Additional fields will be included with the DB-1 peak portion of the GE database: fields containing sample-specific coelution bias CFs for DB-1 peaks 5, 8, and 14, and fields containing congener concentrations (i.e., BZ#4&10 (PK5), BZ#5&8 (PK8), and BZ#15&18 (PK14)) will be added to the database. Correction factor fields for database records not requiring coelution bias corrections (i.e., biota data) will be left blank, as will the records in the congener fields that do not correspond to C18 data.

7.3 RELEASE OF THE CORRECTED GE PCB DATABASE

The corrected GE database will be released following execution of the correction algorithm and quality assurance / quality control checks. As the corrected database will contain data that are not affected by calibration errors, laboratory PCB analyses performed subsequent to its release will be based on the revised composition of the Green Bay calibration. Furthermore, data from continued C18 analyses to separate DB-1 target peak congeners will be included in new database fields. Future samples not analyzed with the C18 column will be corrected for coelution biases as described above. Also, all future database updates will contain only the corrected GE data.

SECTION 8

REFERENCES

Ballschmiter, K., and Zell, M. 1980. Analysis of Polychlorinated Biphenyls (PCB) by Glass Capillary Chromatography. Composition of Technical Aroclor- and Chlophen-PCB Mixtures. *Fresenius Journal of Analytical Chemistry*, 302:20-31.

DiToro, D.M., et al. 1991. Technical Basis for Establishing Sediment Quality Criteria for Nonionic Organic Chemicals Using Equilibrium Partitioning. *Environmental Toxicology and Chemistry*, 10:1541-1583.

Erickson, M.D. 1992. Analytical Chemistry of PCBs. Lewis Publishers, Chelsea, MI.

Frame, G.M., Wagner, R.E., Carnahan, J.C., Brown, J.F., May, R.J., Smullen, L.J., and Bedard, D.L. 1996. Comprehensive, Quantitative, Congener-Specific Analyses of Eight Aroclors and Complete PCB Congener Assignments on DB-1 Capillary Columns. *Chemosphere*, 33(4):603-623.

Frame, G.M. 1997. A Collaborative Study of 209 PCB Congeners and 6 Aroclors on 20 Different HRGC Columns: 1. Retention and Coelution Database. *Fresenius Journal of Analytical Chemistry*, 357(6):701-713.

General Electric Company. 1991. Comments of the General Electric Company on the August 1991 Review Copy of the Phase 1 Report - Interim Characterization and Evaluation for the Hudson River PCB Reassessment RI/FS.

Harza Engineering Company. 1992. Fort Edward Dam PCB Remnant Deposit Containment Environmental Monitoring, Report of 1991 Results. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

Harza Engineering Company. 1990. Fort Edward Dam PCB Remnant Deposit Containment Environmental Monitoring, 1990 Baseline Monitoring Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

HydroQual, 1997. Sampling and Analysis Plan, 1997 High Flow Monitoring Program, Upper Hudson River. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

HydroQual, 1996. Sampling and Analysis Plan, Thompson Island Pool Transect Study. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

Mullin, M.D. 1994. Personal communication with G. Frame of GE Corporate Research and Development.

Mullin, M.D., Pochini, C.M., McCrindle, S., Romkes, M., Safe, S.H., and Safe, L.M. 1984. High-Resolution PCB Analysis: Synthesis and Chromatographic Properties of All 209 PCB Congeners. *Environmental Science and Technology*, 18:468-476.

Northeast Analytical, Inc. 1997a. Facsimile from R.E. Wagner of Northeast Analytical, Inc. to J.R. Rhea of HydroQual dated 22 March 1997.

Northeast Analytical, Inc. 1997b. Personal communication between R.E. Wagner of Northeast Analytical, Inc. and J.R. Rhea of HydroQual, May 1997.

Northeast Analytical, Inc. 1997c. Personal communication between R.E. Wagner of Northeast Analytical, Inc. and K.T. Russell of HydroQual, May 1997.

O'Brien and Gere Engineers, Inc. 1997. Facsimile from W.A. Ayling of O'Brien & Gere Engineers, Inc. to K.T. Russell of HydroQual dated 29 May 1997.

O'Brien and Gere Engineers, Inc. 1995. Hudson River Project, River Monitoring Test. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1994. Bakers Falls Remedial Investigation Operable Unit 3. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1993a. Hudson River Project, Sampling and Analysis. Program. 1991-1992 High Flow Water Column Monitoring Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1993b. Hudson River Project, 1992 Sampling and Analysis Program. 1992 Channel Characterization Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1993c. Hudson River Project, 1992 Sampling and Analysis Program. 1992 Food Chain Study. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1993d. Hudson River Project, Sampling and Analysis. Program. Data Summary Report for 1991 Sediment Sampling and Analysis Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1993e. Hudson River Project, 1991-1992 Sampling and Analysis Program. Temporal Water Column Monitoring Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1993f. Quality Assurance Project Plan. Hudson River Project. Sampling and Analysis Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1992-96. Reports for Fort Edward Dam PCB Remnant Containment Post-Construction Monitoring Program. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1991a. Hudson River Project Fall 1990 Sampling and Analysis. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

O'Brien and Gere Engineers, Inc. 1991b. Hudson River Research Station. Spring 1991 Sediment Characterization. Prepared for General Electric Company Corporate Environmental Programs, Albany, NY.

U.S. EPA. 1995. Further Site Characterization and Analysis Database Report. Phase 2 Report - Review Copy, Hudson River PCBs Reassessment RI/FS. Prepared by TAMS Consultants, Inc. and Gradient Corporation for U.S. EPA Region II.

U.S. EPA. 1994. Memorandum from M.D. Mullin of the U.S. EPA Environmental Research Laboratory - Duluth, Large Lakes Research Station to G. Frame of GE Corporate Research and Development dated 21 November 1994.

U.S. EPA. 1992. Phase 2A. Sampling and Analysis Plan / Quality Assurance Project Plan, Hudson River PCB Reassessment RI/FS. Prepared by TAMS Consultants, Inc. and Gradient Corporation for U.S. EPA Region II.

U.S. EPA Great Lakes National Program Office (prepared by D.L. Swackhamer). 1987. Quality Assurance Plan: Green Bay Mass Balance Study. I. PCBs and Dieldrin.

FIGURES

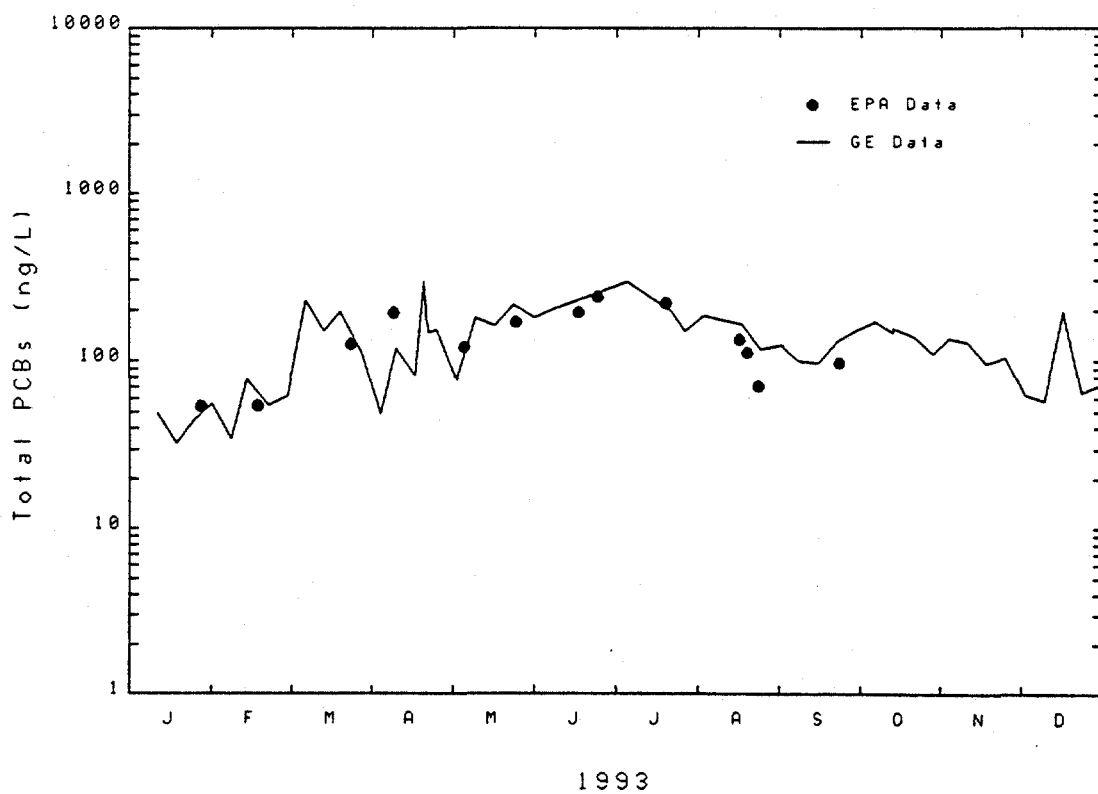
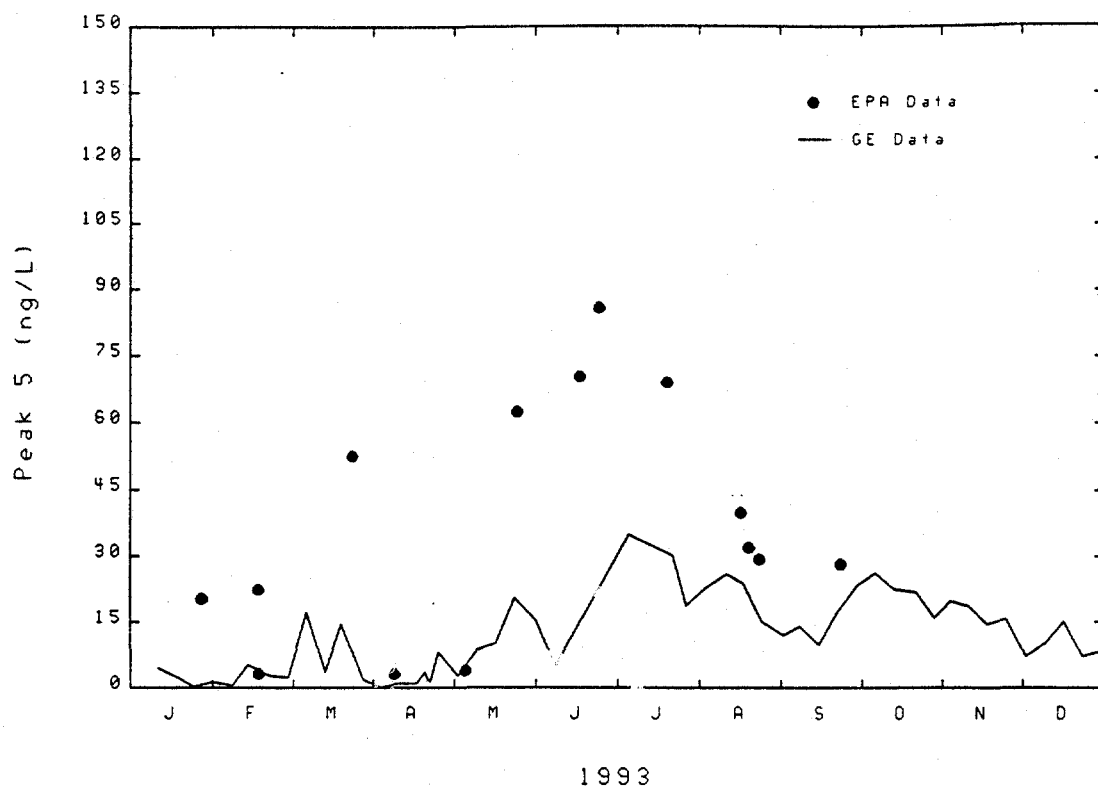
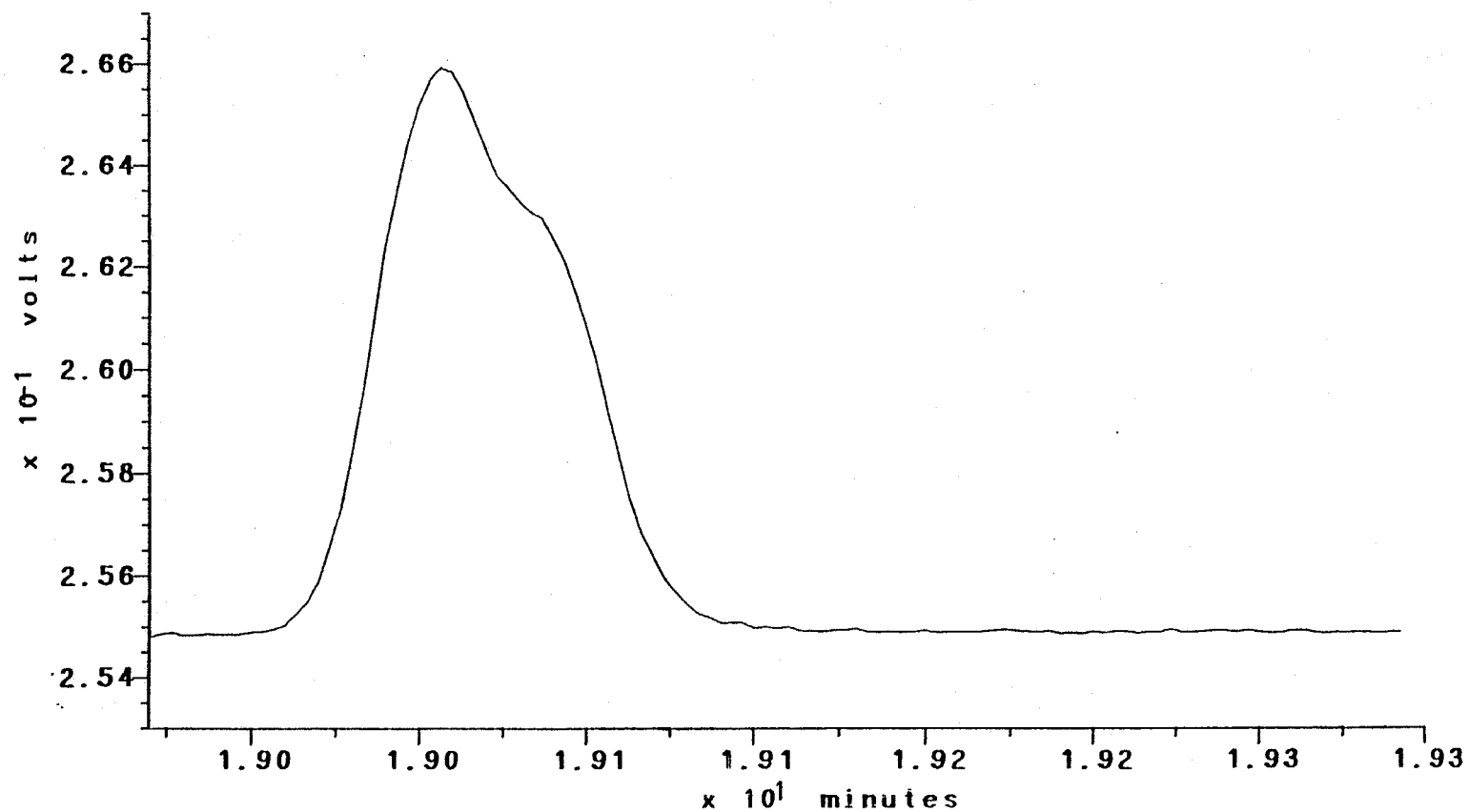


FIGURE 1
Comparison of 1993 Water Column PCB Data at TID

Sample CAL STD 8.27PPM Channel: detector 1
Acquired: 04-DEC-88 19:17 Method: J:\MAX96\GC1\GEW1204A
Comments NORTHEAST ANALYTICAL 301 NOTT STREET SCHENECTADY, NY 518-346-4592
Filename: CS1204
Operator: REW

FIGURE 2
DB-1 Chromatograph Peak with Shouldering Caused by Coelution



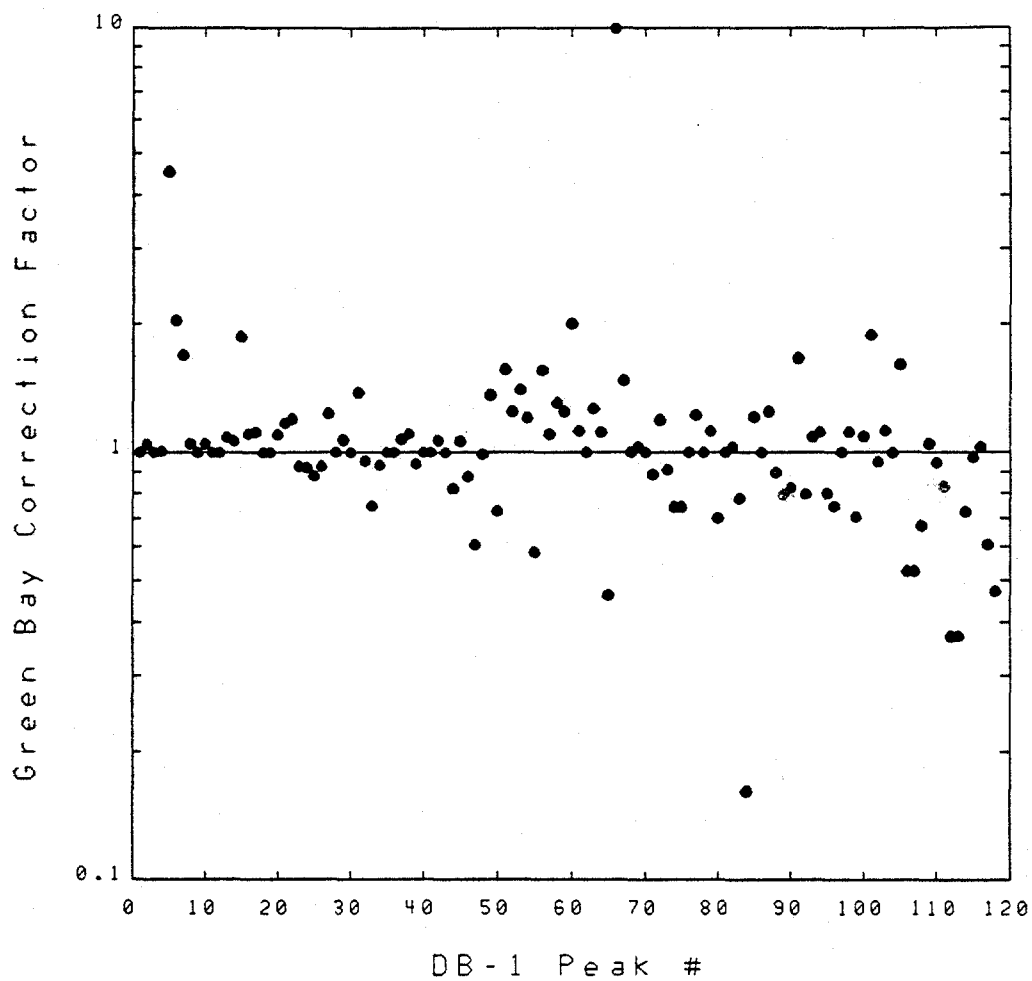


FIGURE 3

Ratio of Revised to Original Green Bay Standard DB-1 Peak Weight Percents

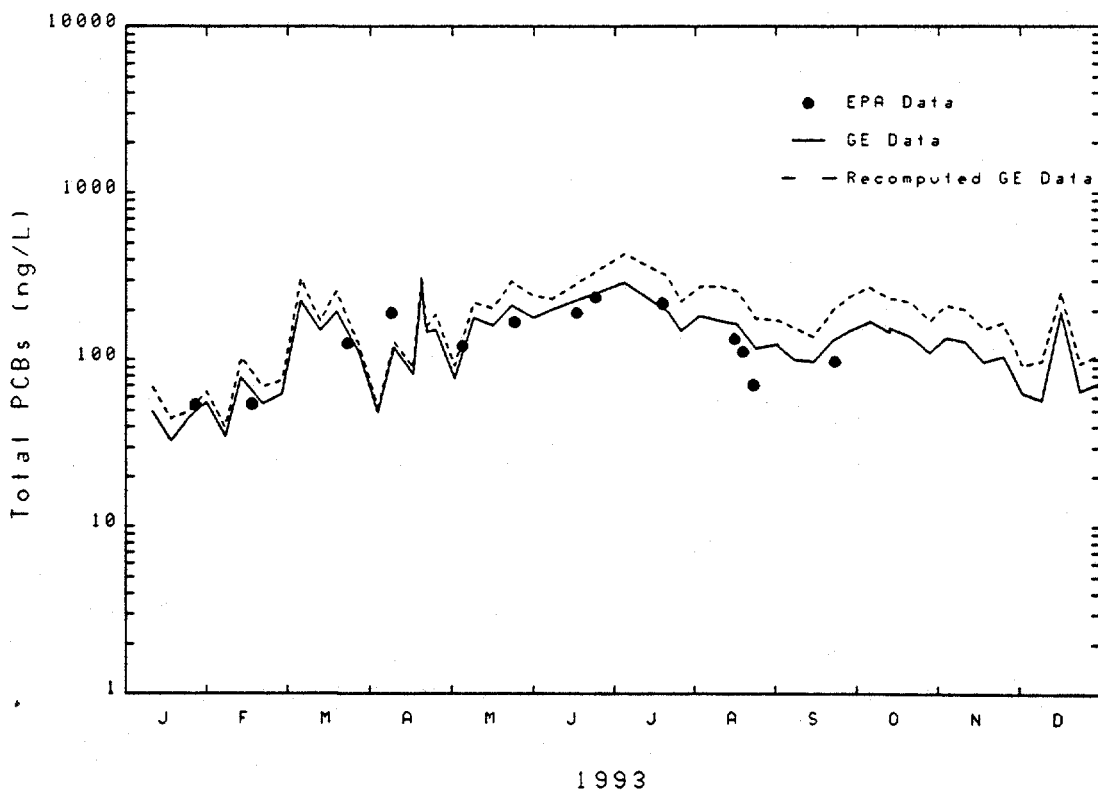
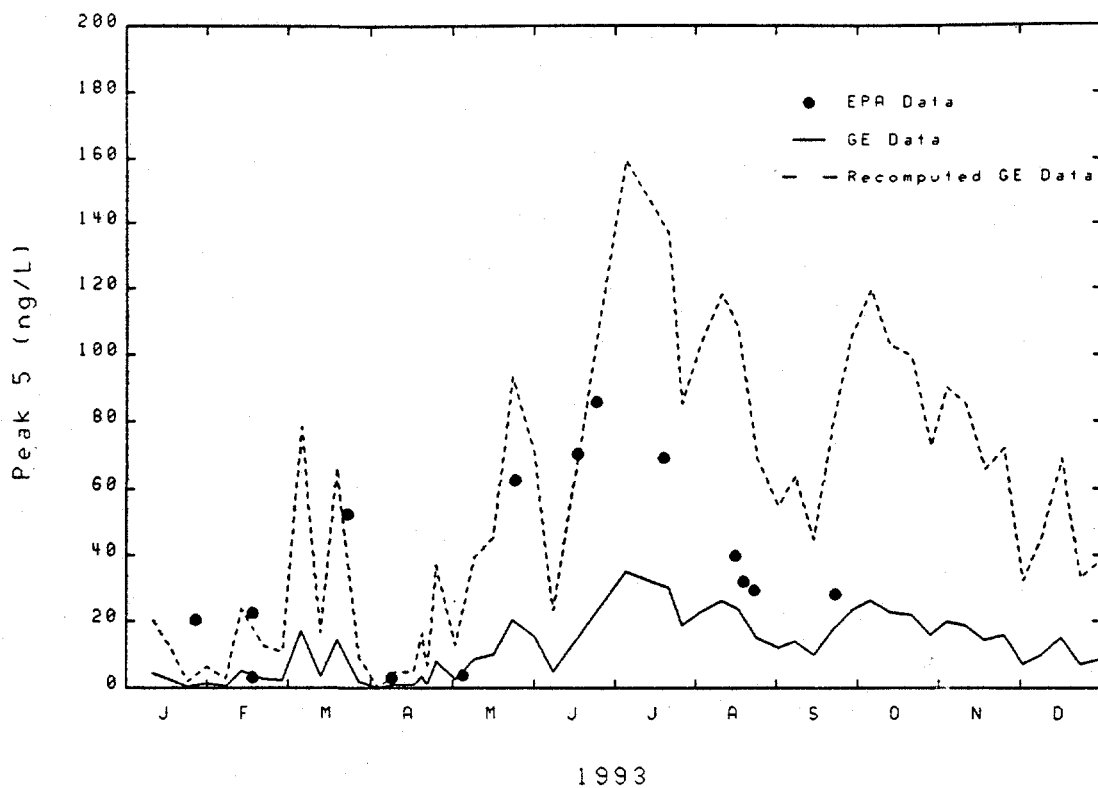


FIGURE 4
Comparison of 1993 Water Column PCB Data at TID: EPA Data, GE Data, and GE Data Recomputed with the Revised Green Bay Standard Calibration

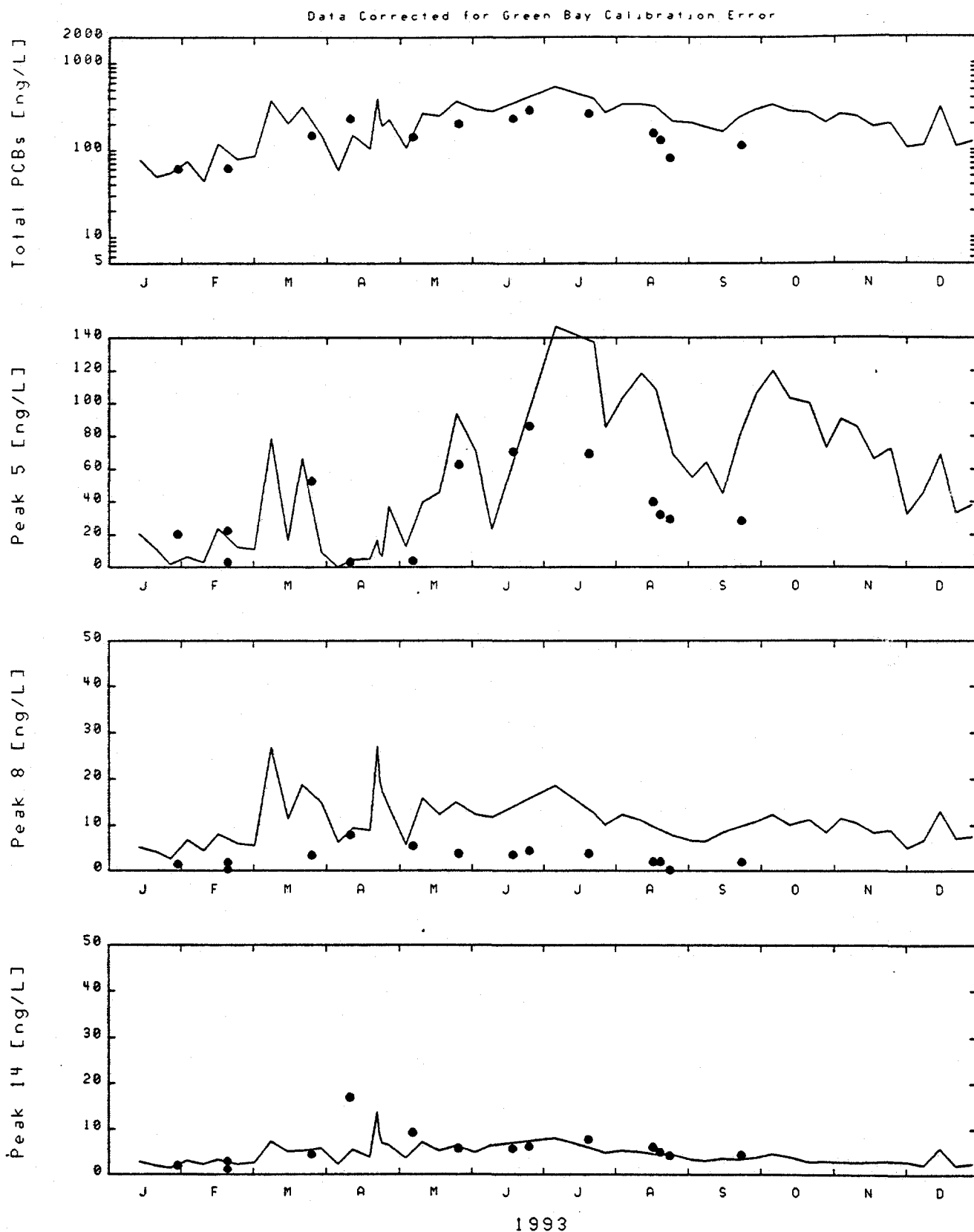


FIGURE 5

Comparison of 1993 Water Column DB-1 Peak PCB Data at TID

• EPA Data — GE Data Corrected for Green Bay Calibration Error

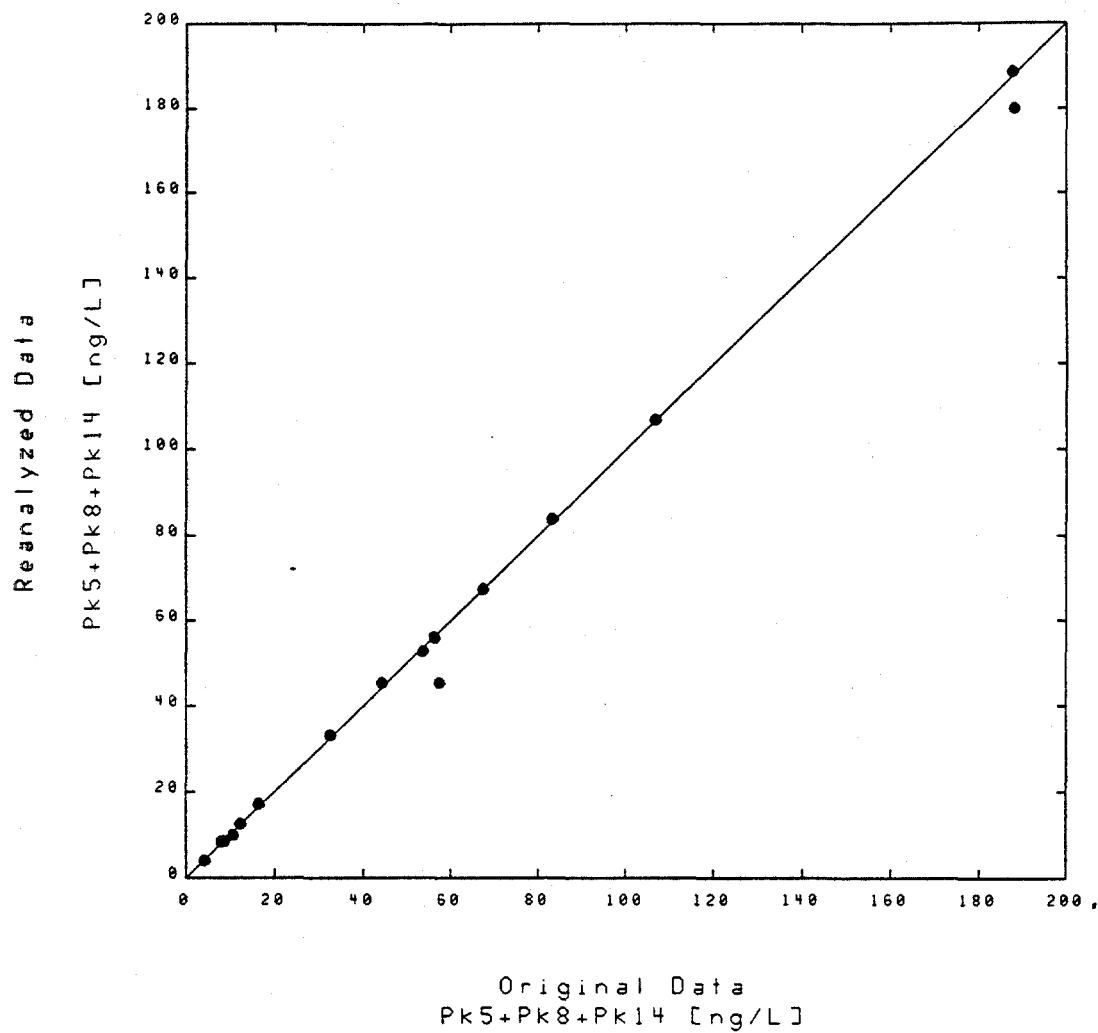


FIGURE 6

DB-1 Reanalysis of Archived Extracts for Preliminary Water Column Data Set: Comparison of Original and Reanalyzed Extracts for PCB Peak Totals

Note: All data are corrected for error in original Green Bay calibration

Note: All DB-1 Data Corrected for GB Calibration Errors

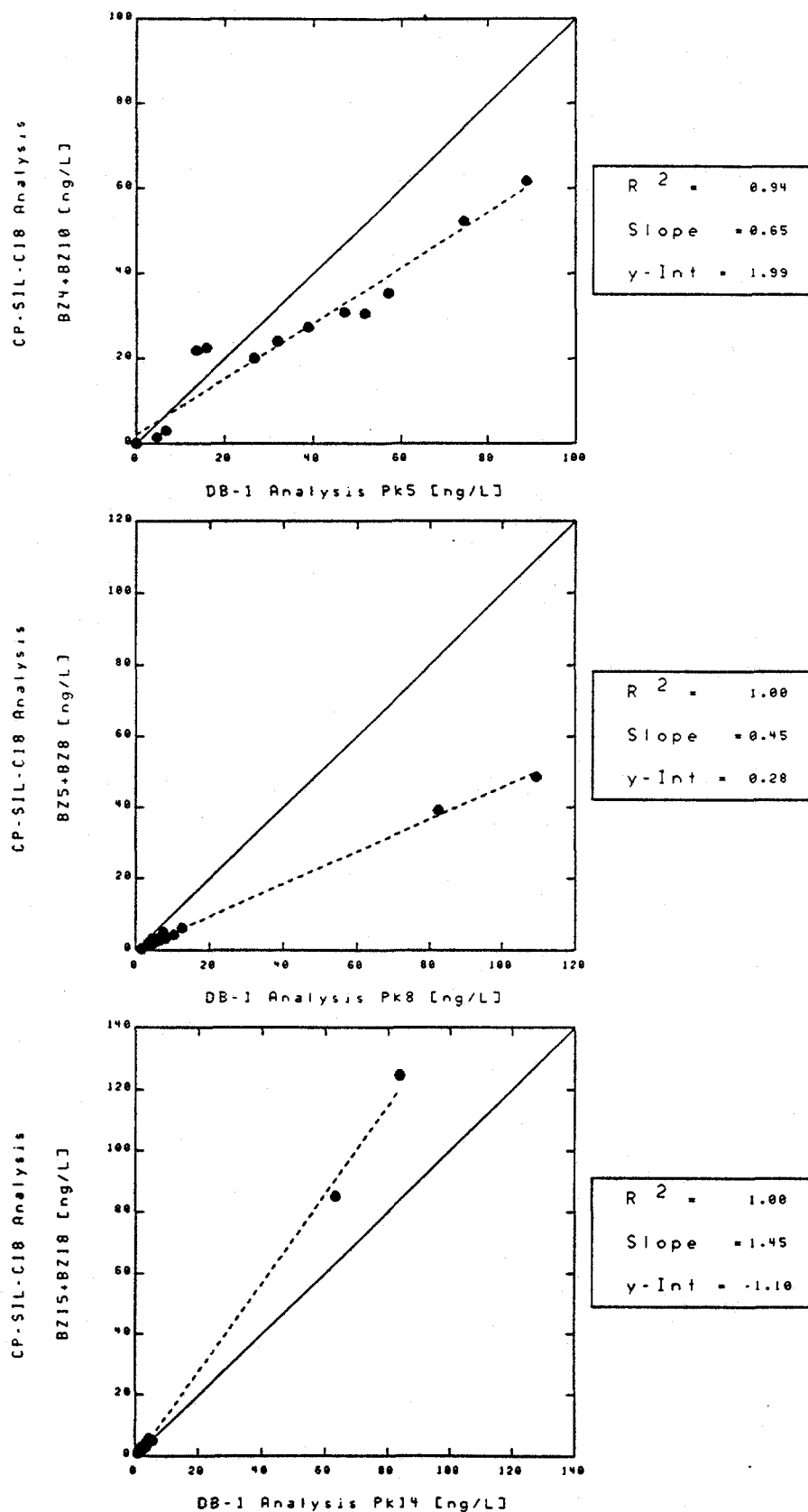


FIGURE 7

Preliminary Water Column Correction Factor Data Set: Regression of PCB Peak Concentrations in Original Samples (DB-1 Column) and Reanalyzed Samples (CP-SIL5-C18 Column)

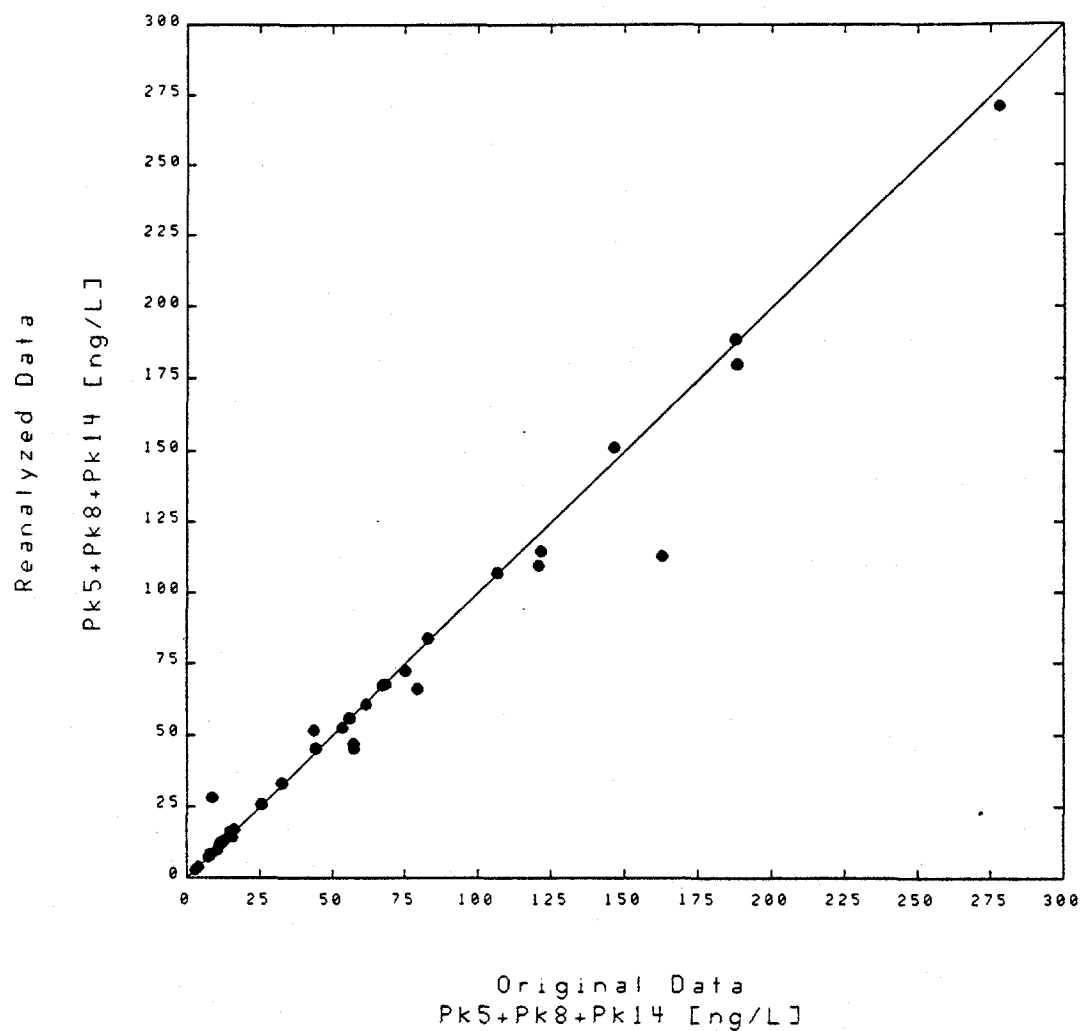


FIGURE 8

DB-1 Reanalysis of Archived Extracts for Combined Water Column Correction Data Set:
Comparison of Original and Reanalyzed Extracts for PCB Peak Totals

Note: All data are corrected for error in original Green Bay calibration

Notes: All DB-1 Data Corrected for GB Calibration Errors

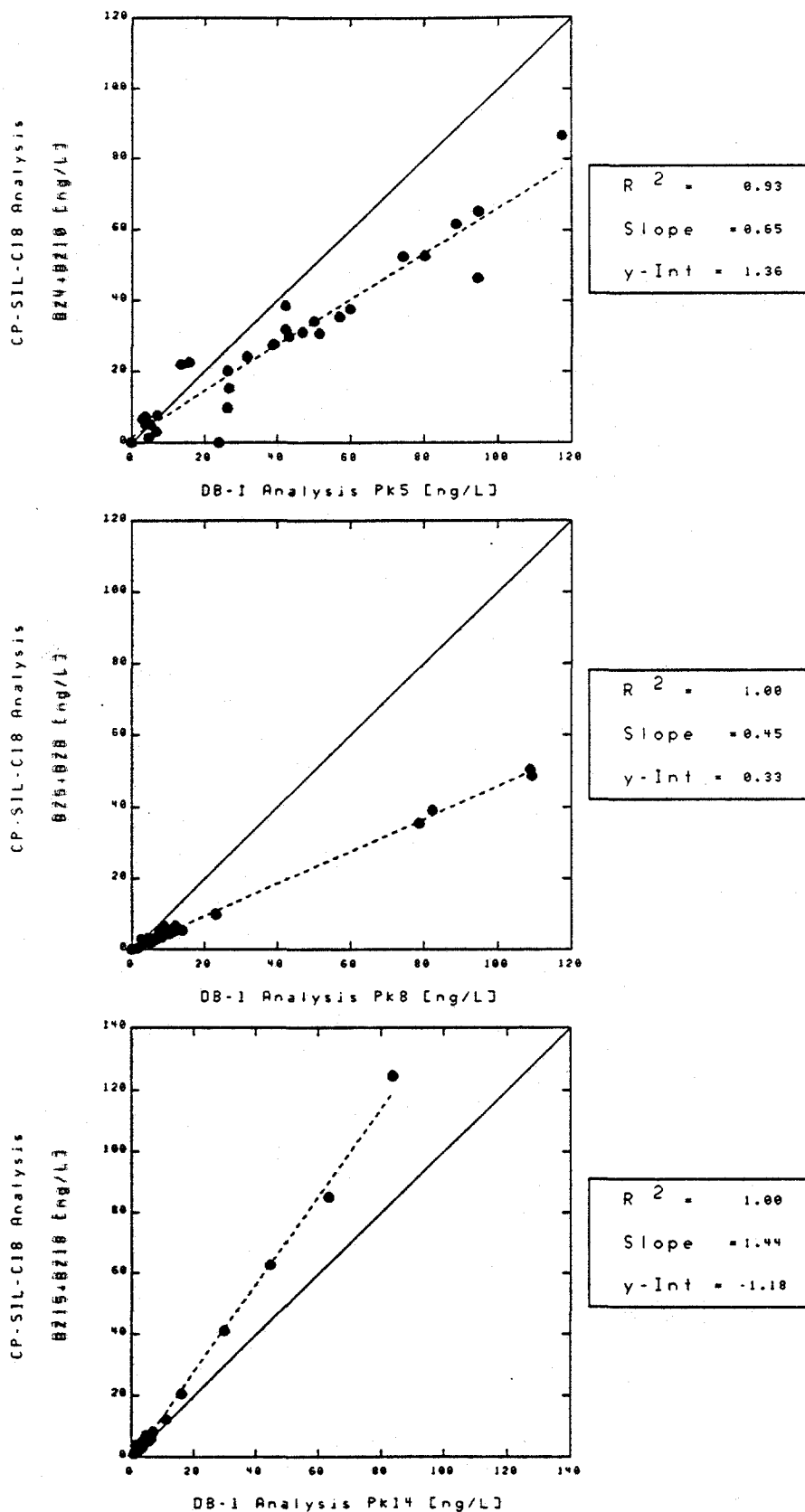


FIGURE 9

Combined (Preliminary and Confirmatory) Water Column Correction Factor Data Set: Regression of PCB Peak Concentrations in Original Samples (DB-1 Column) and Reanalyzed Samples (CP-SIL5-C18 Column)

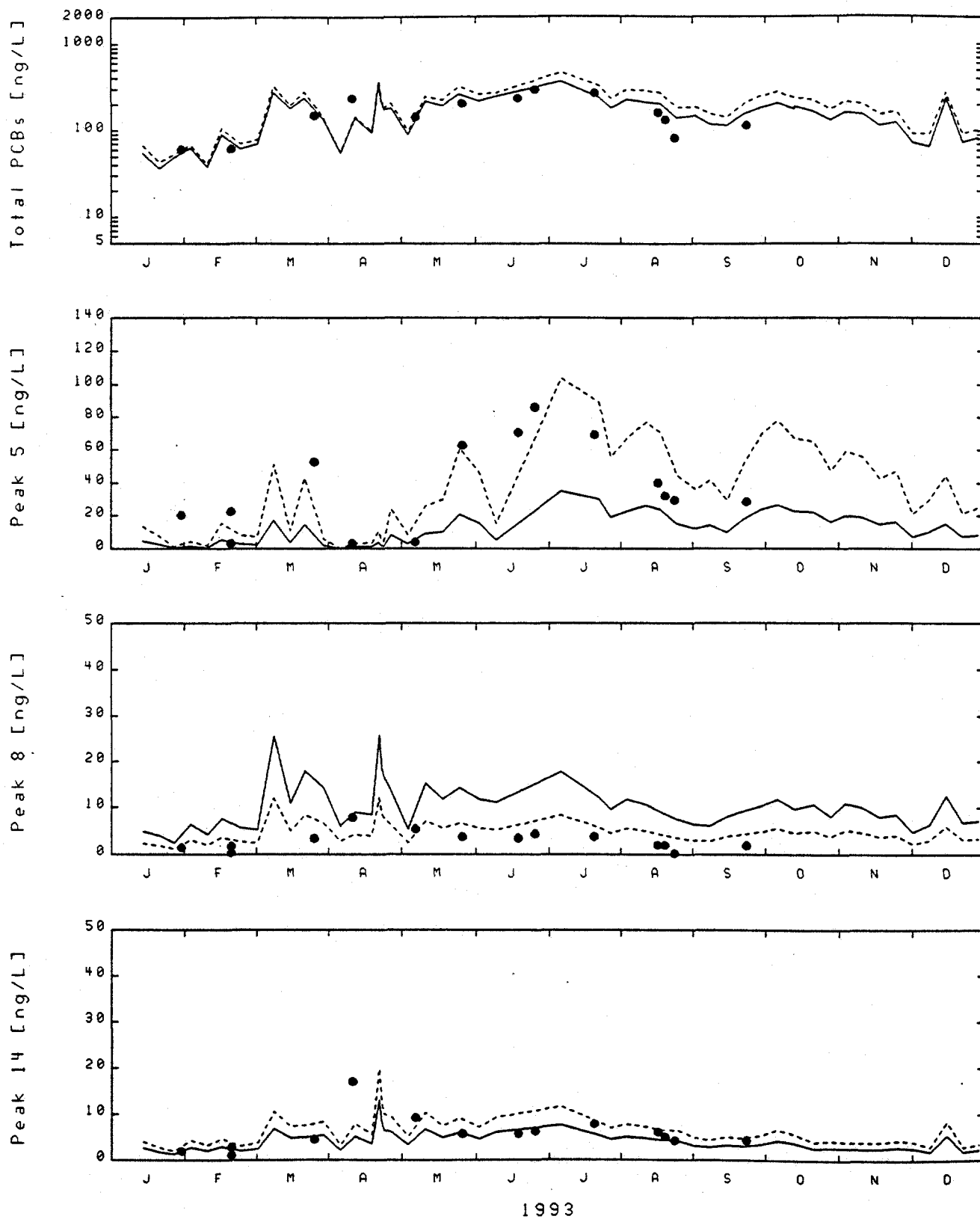


FIGURE 10

Comparison of 1993 Water Column PCB Data at TID

● EPA Data

— Original GE Data

--- Corrected GE Data

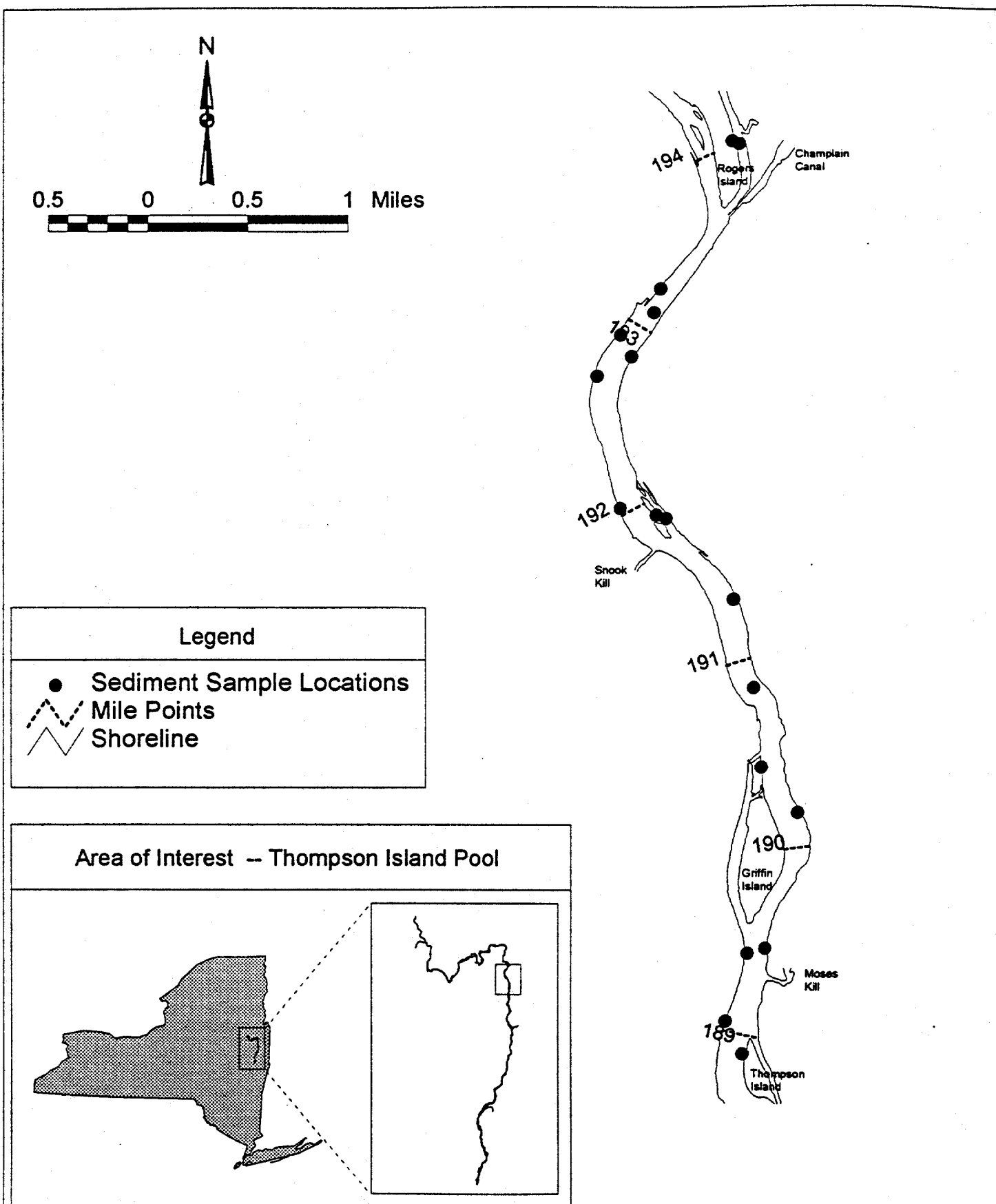


Figure 11. Locations of GE 1991 Sediment Core Composites Selected for Reanalysis

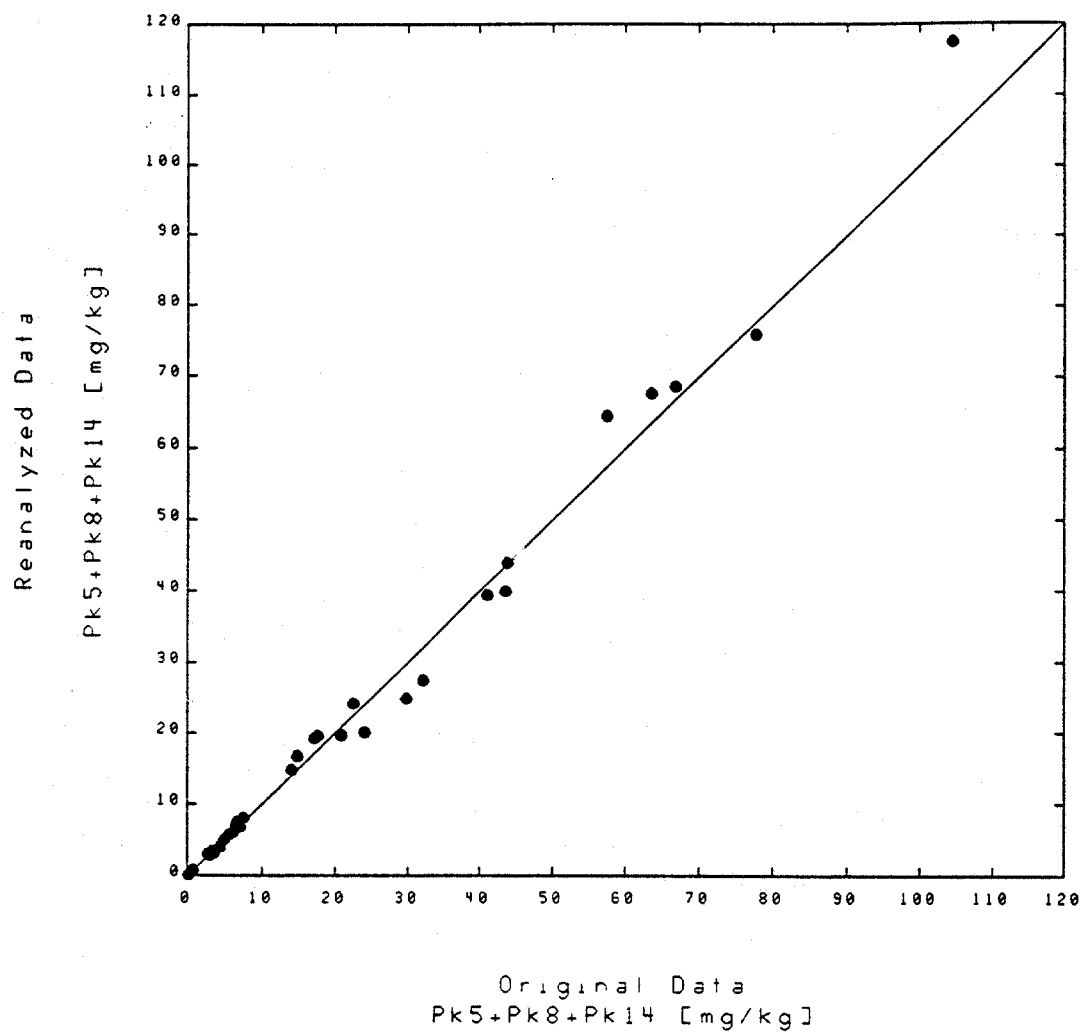


FIGURE 12

Reanalysis of Archived Sediment Extracts: Comparison of Original and Reanalyzed Extracts for PCB Peak Totals

Note: Surface (0-5 cm), intermediate (5-10 cm), and deep (10-25 cm) data combined; all data corrected for Green Bay calibration error

Notes: DB-1 Data Corrected for GB Calibration Errors
Except PK5 Samples Analyzed with BZ Standard

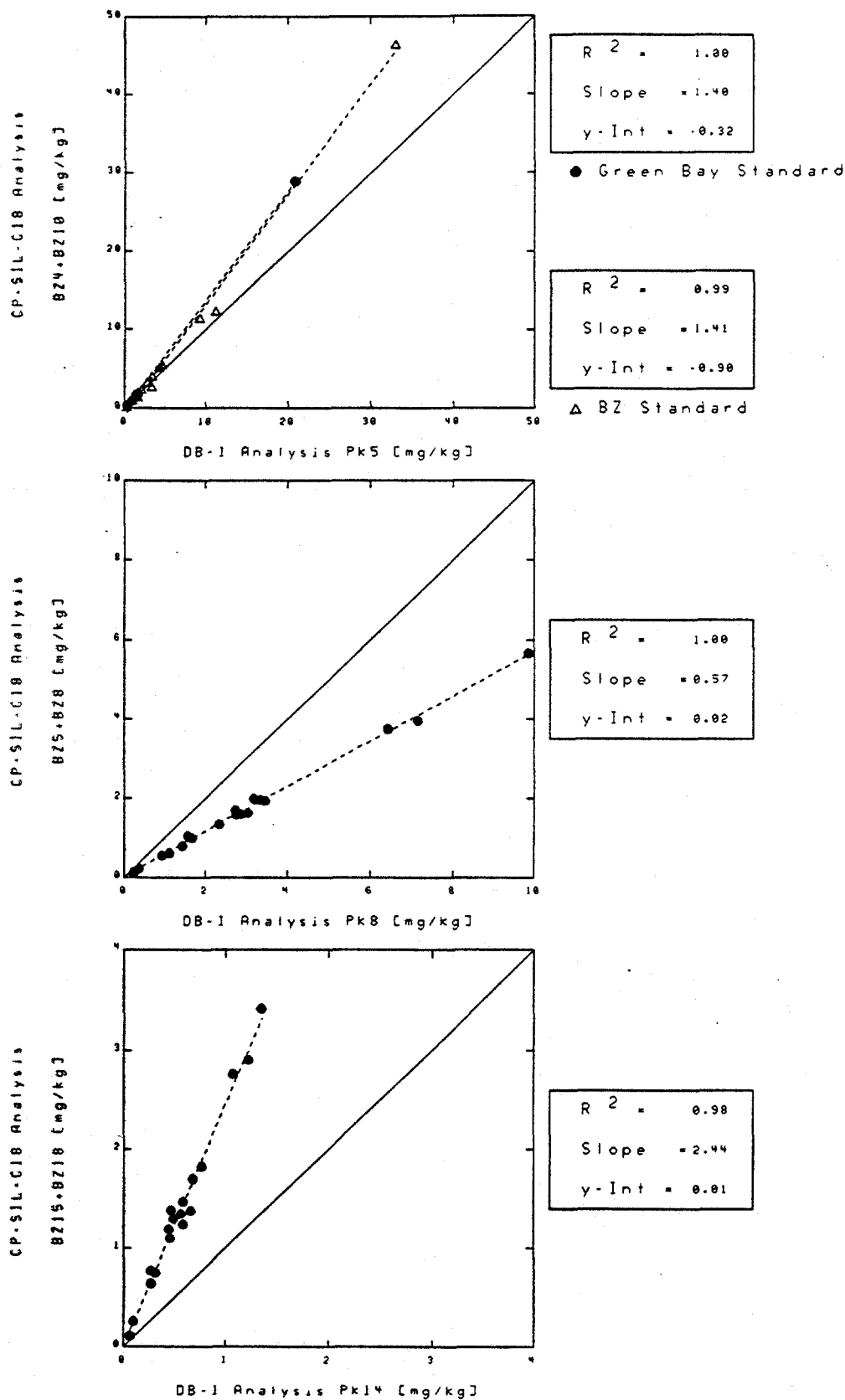


FIGURE 13

Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Surface Sediment (0-5 cm) Samples

Note: DB-1 Data Corrected for GB Calibration Errors
Except PK5 Samples Analyzed with BZ Standard

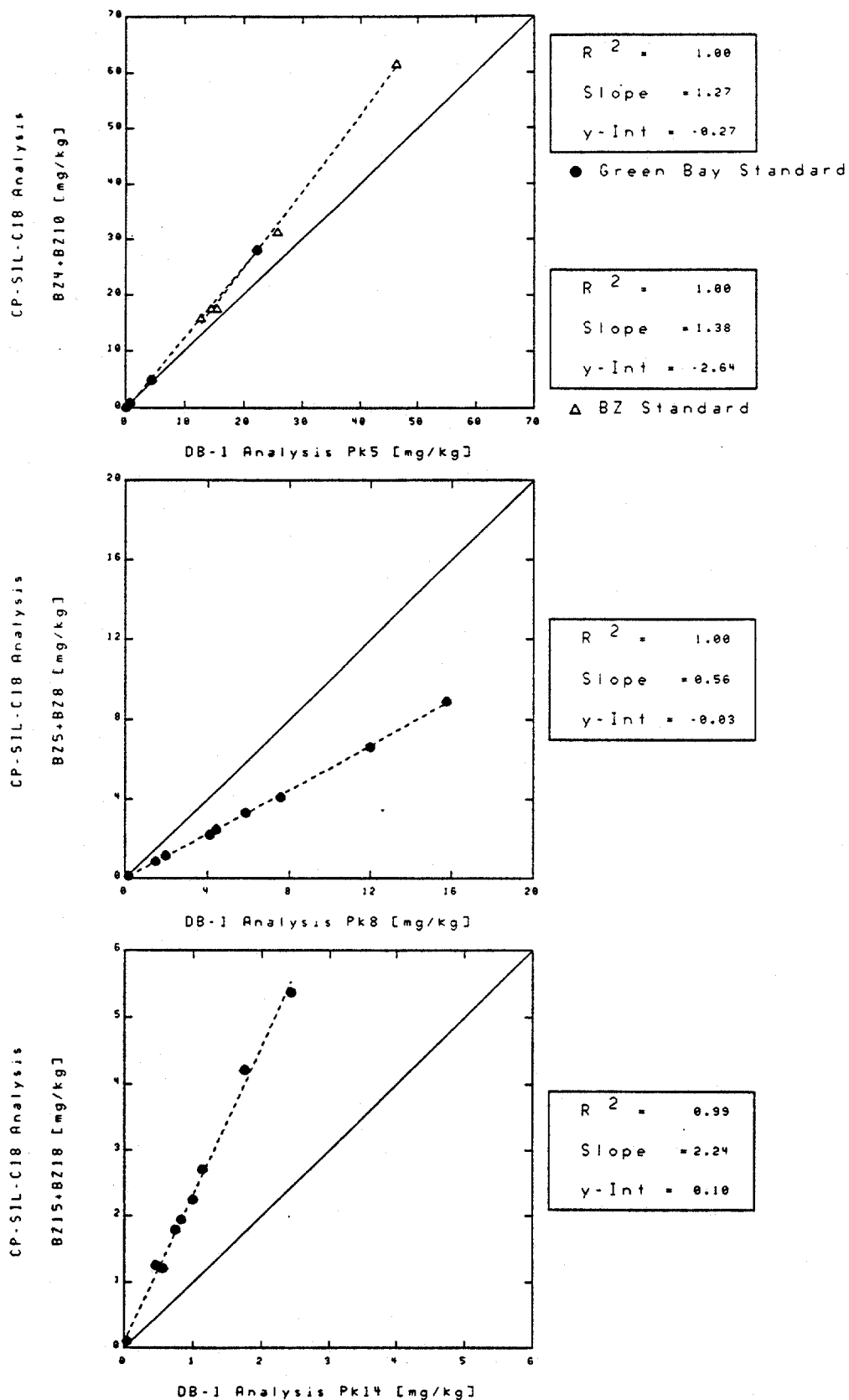


FIGURE 14

Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Intermediate (5-10 cm) Sediment Samples

Notes: DB-1 Data Corrected for GB Calibration Errors
Except PK5 Samples Analyzed with BZ Standard

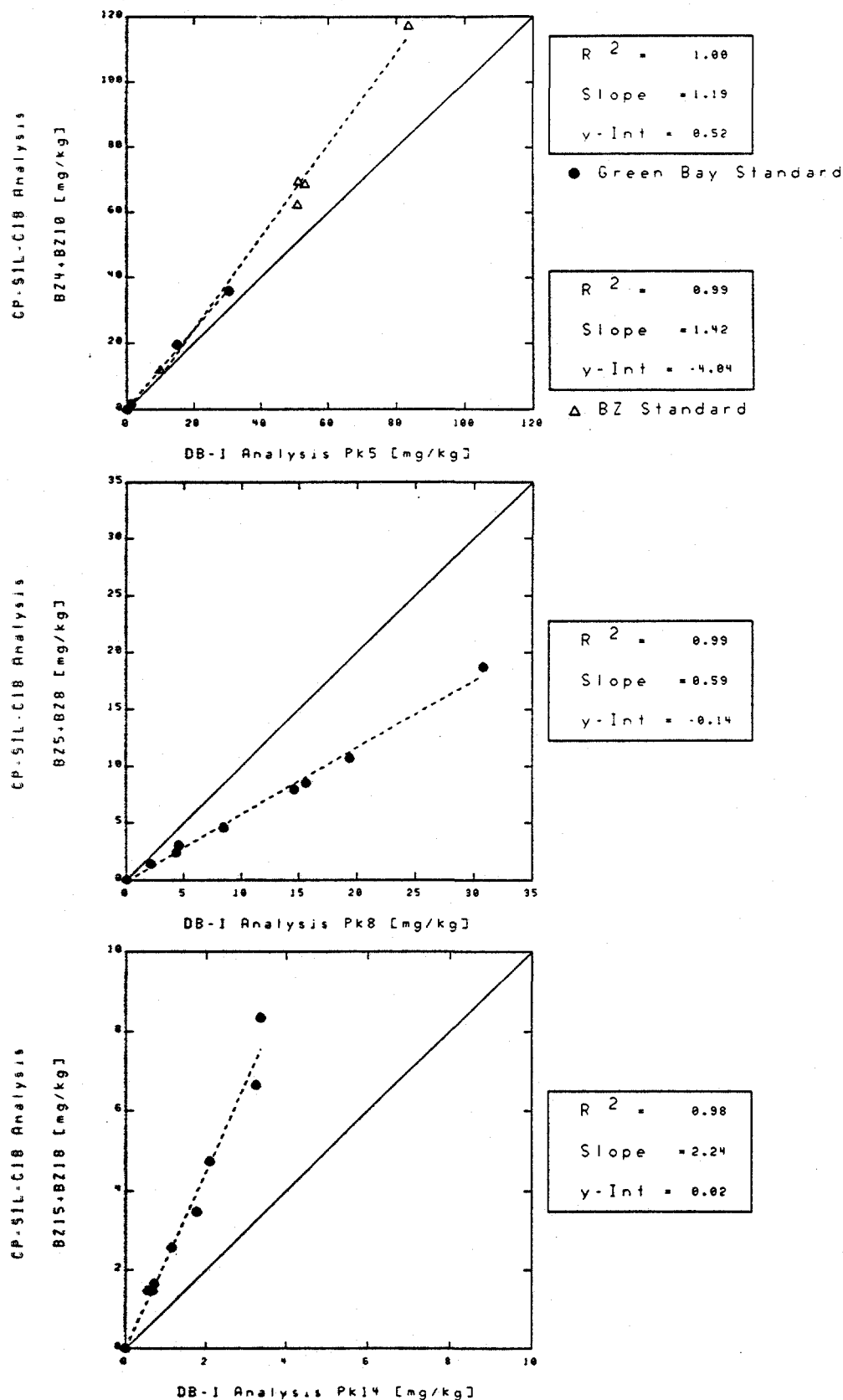


FIGURE 15

Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Deep (10-25 cm) Sediment Samples

Notes: DB-1 Data Corrected for GB Calibration Errors
Except PK5 Samples Analyzed with BZ Standard

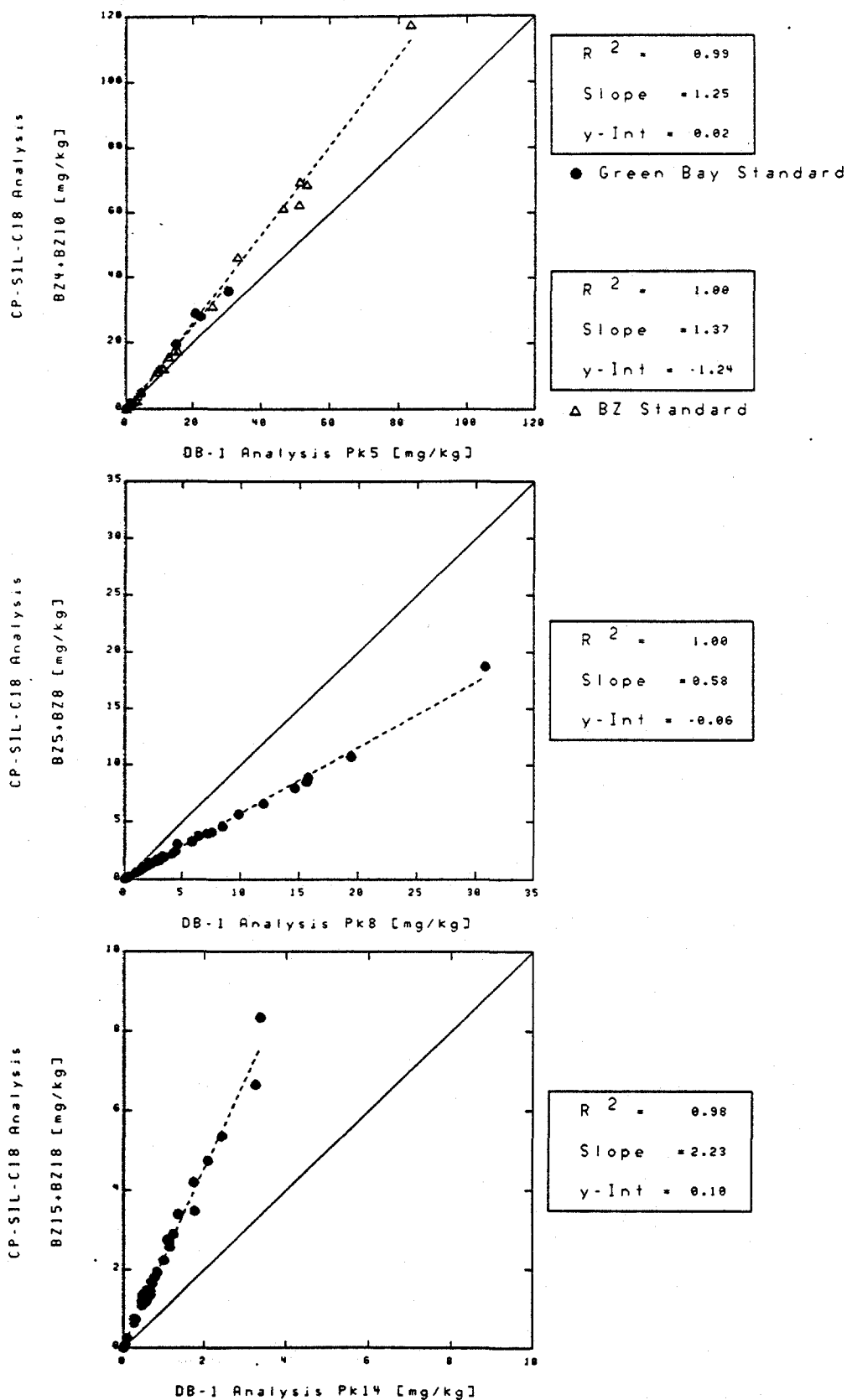


FIGURE 16

Regression of PCB Peak Concentrations in Original (DB-1 Column) and Reanalyzed (CP-SIL5-C18 Column) Sediment Samples (All Depths)

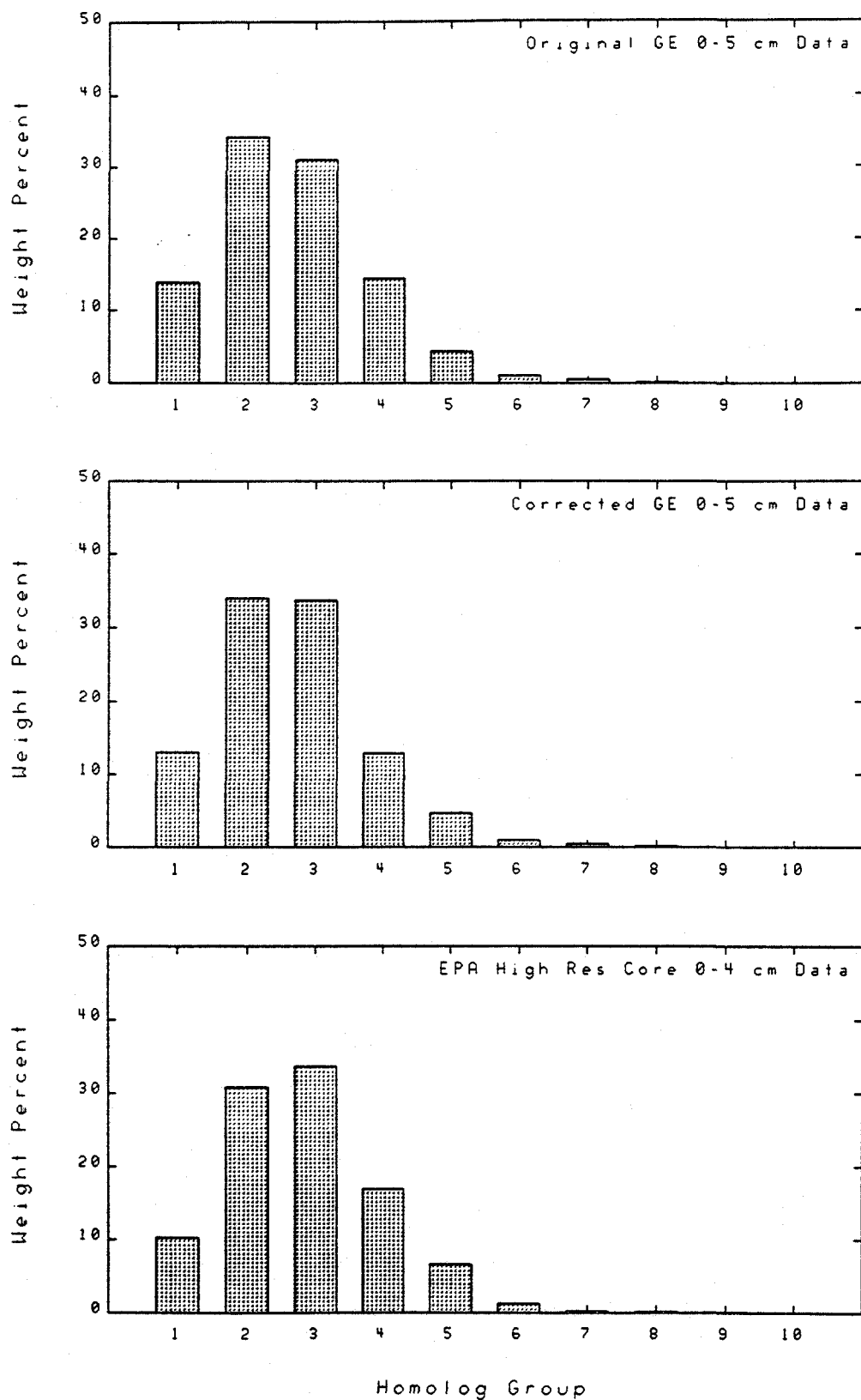


FIGURE 17

Average TIP Surface Sediment PCB Homolog Signature

Note: Area-weighted averages for GE data, arithmetic for EPA data

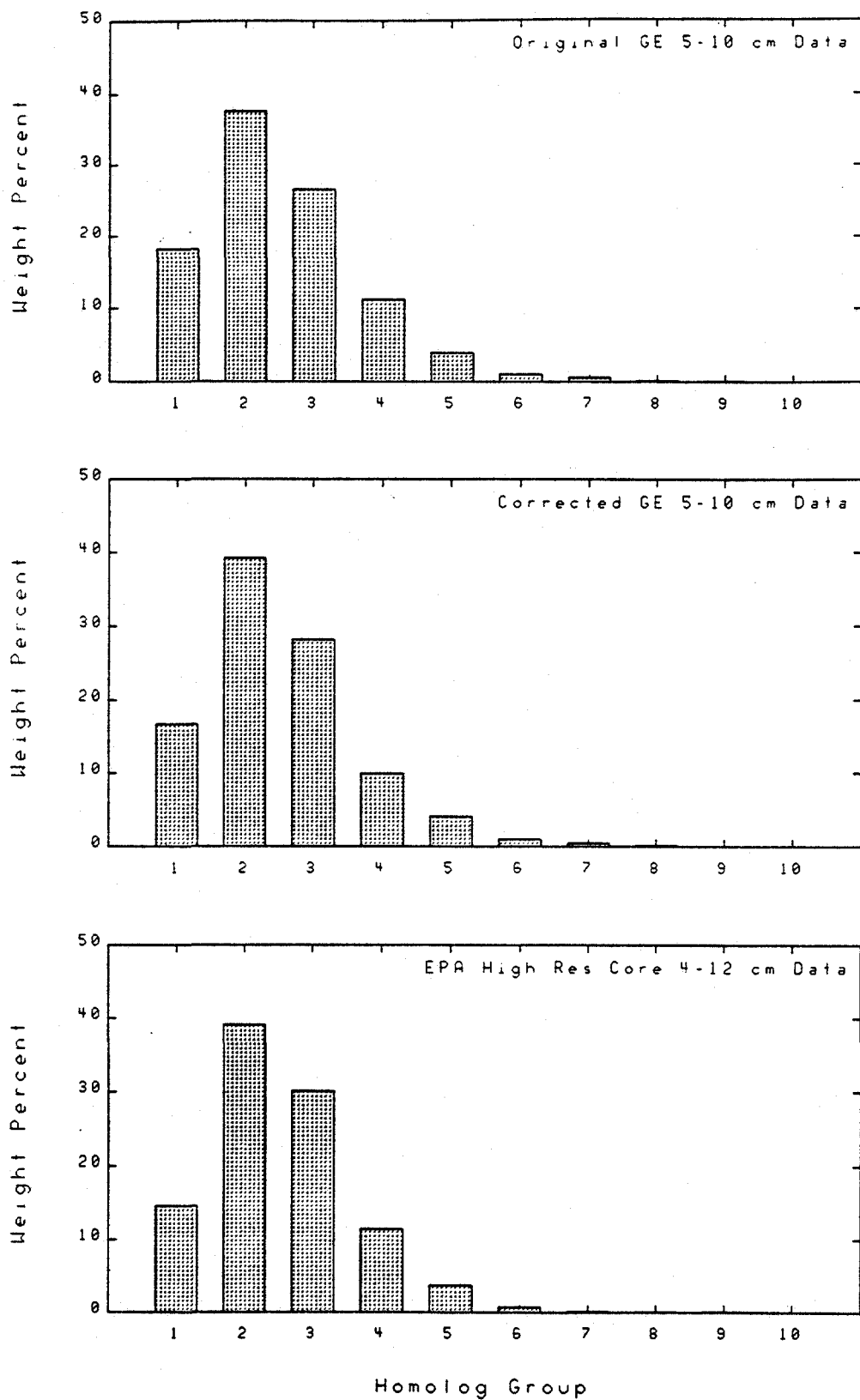


FIGURE 18

Average TIP Intermediate Sediment PCB Homolog Signature

Note: Area-weighted averages for GE data, arithmetic for EPA data

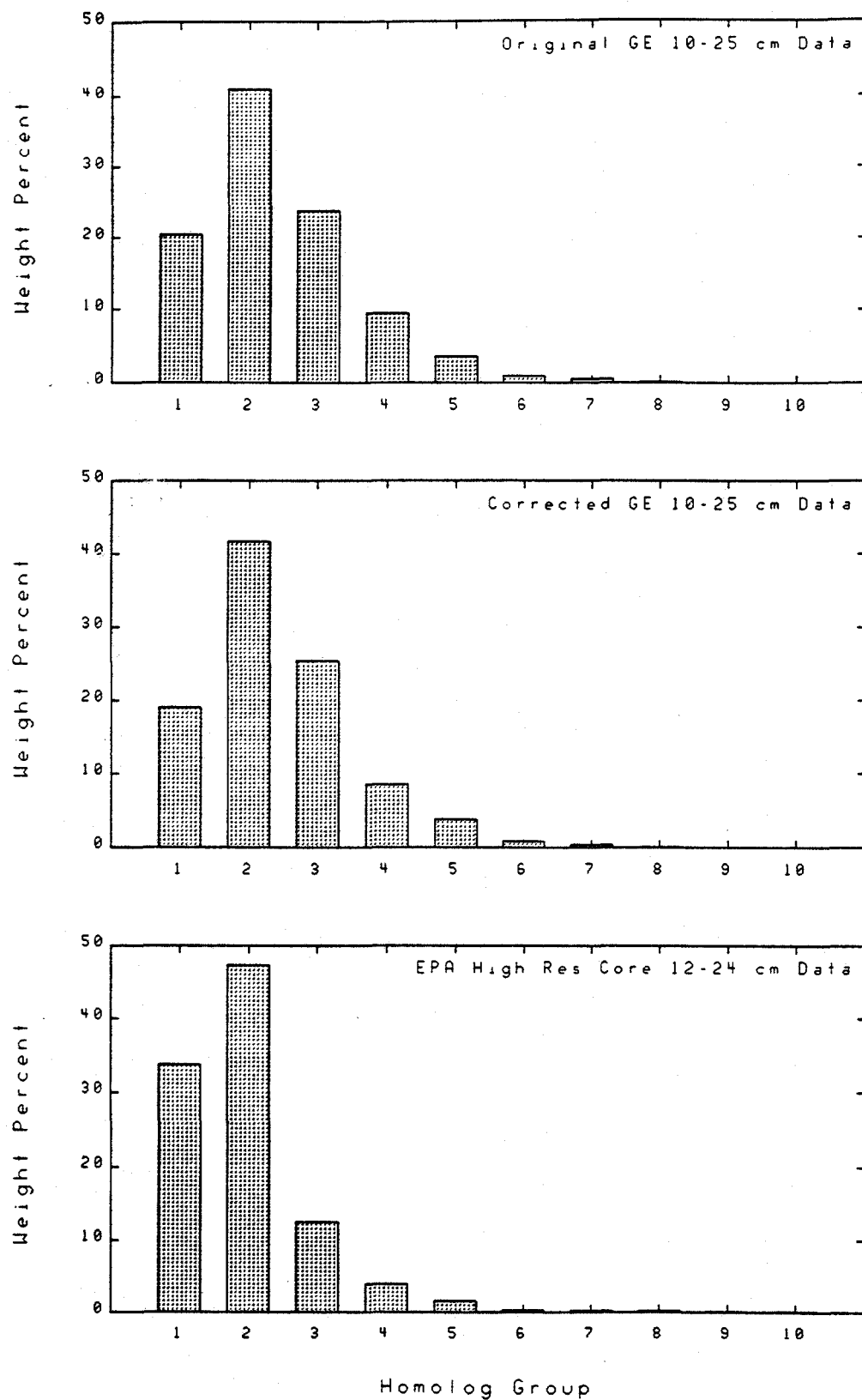


FIGURE 19

Average TIP Deep Sediment PCB Homolog Signature

Note: Area-weighted averages for GE data, arithmetic for EPA data

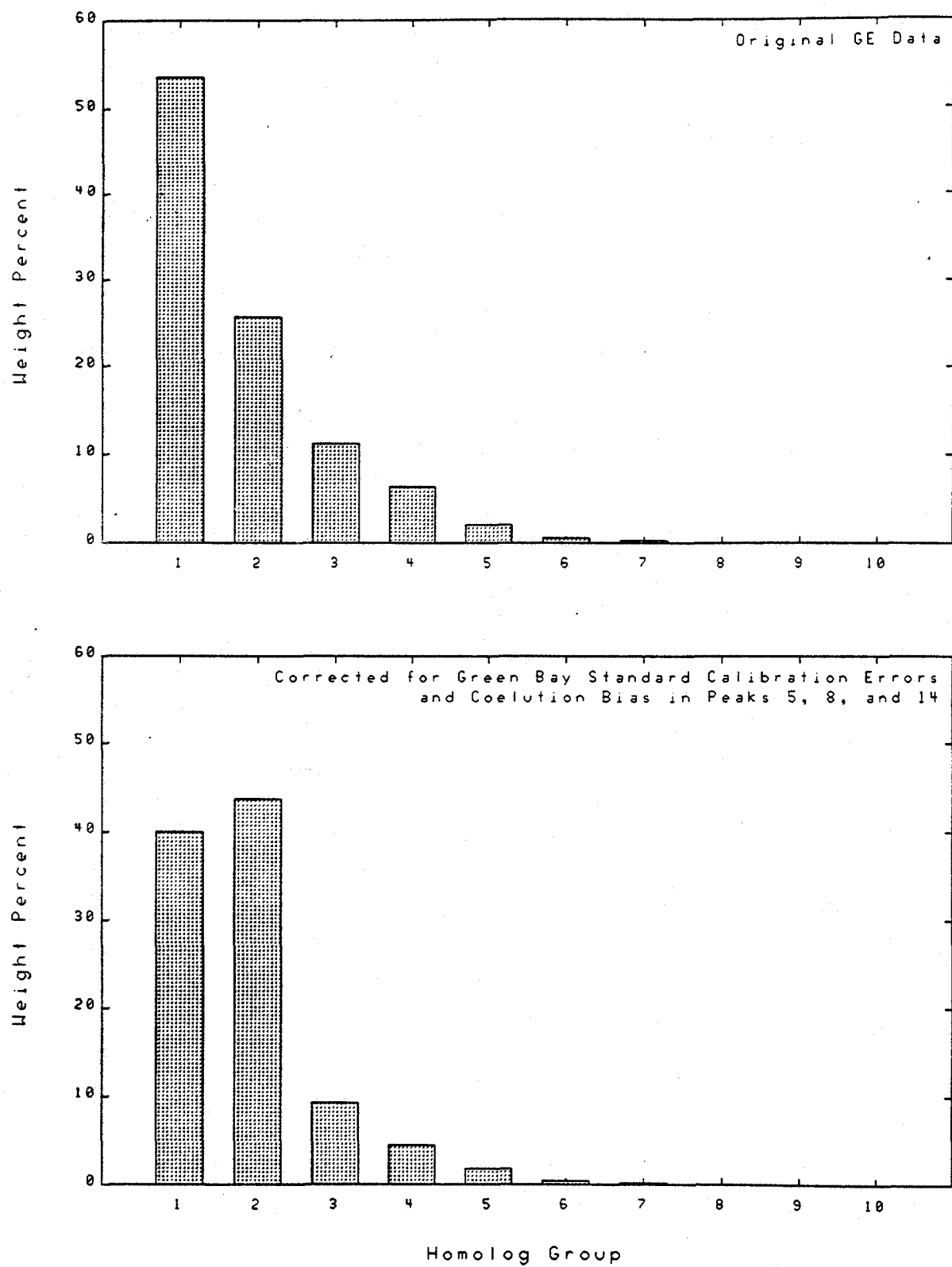


FIGURE 20
Average TIP Sediment Pore Water PCB Signatures
Note: Area-weighted average of data from all depths

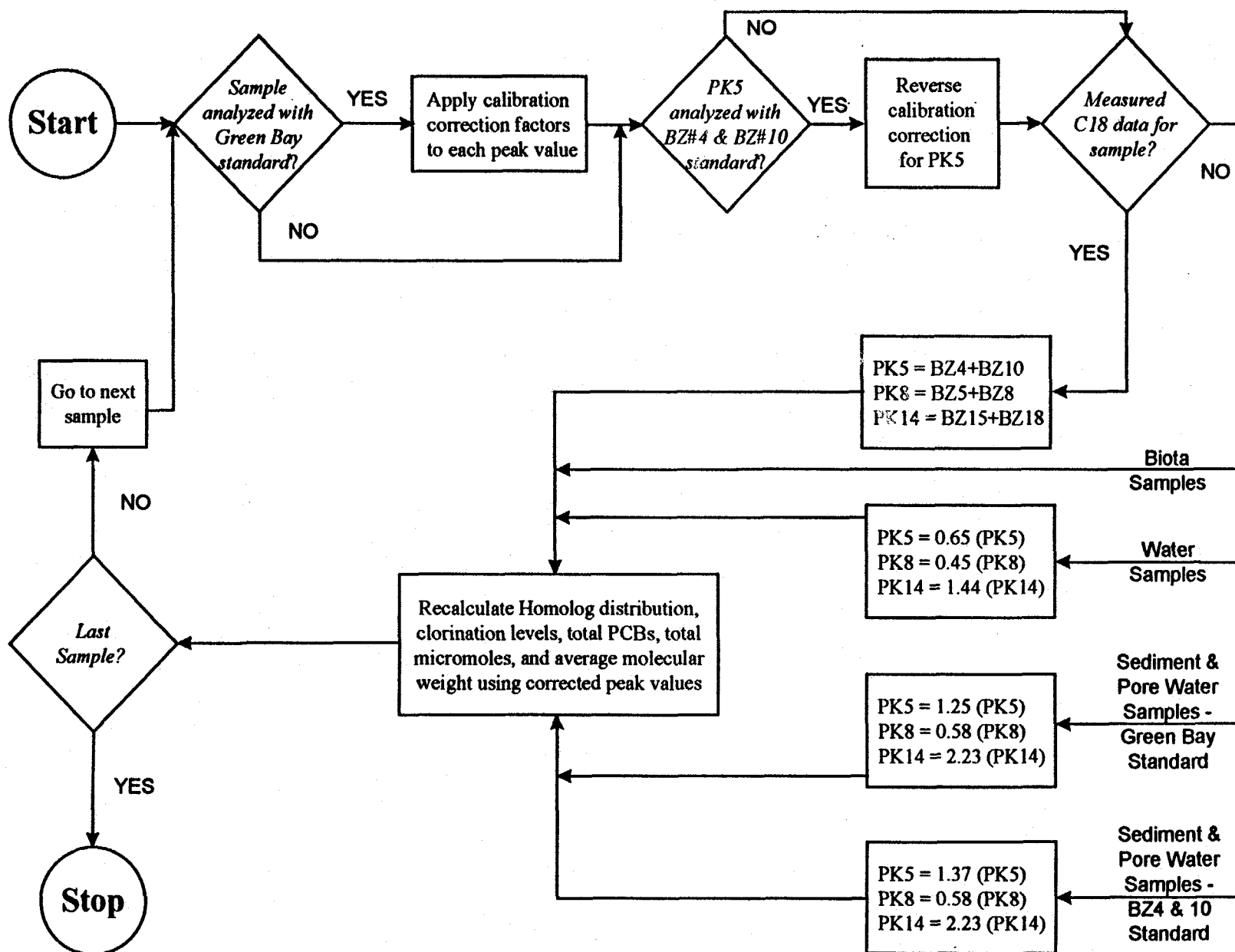


Figure 21. Algorithm for Application of Corrections to the GE Database

APPENDIX

TABLE A-1

DB-1 Chromatograph Peaks and Corresponding PCB Congeners

DB-1 Peak #	Congener BZ #	Chlorination Structure	DB-1 Peak #	Congener BZ #	Chlorination Structure	DB-1 Peak #	Congener BZ #	Chlorination Structure	DB-1 Peak #	Congener BZ #	Chlorination Structure	DB-1 Peak #	Congener BZ #	Chlorination Structure
1	0	biphenyl	31	52	2'2'5'5'	53	90	2'2'3'4'5'	74	105	2'3'3'4'4'	109	201	2'2'3'3'4'5'5'6'
2	1	2	31	73	2'3'5'6'	53	101	2'2'4'5'5'	74	132	2'2'3'3'4'6'	110	196	2'2'3'3'4'4'5'6'
3	2	3	32	49	2'2'4'5'	54	99	2'2'4'4'5'	75	153	2'2'4'4'5'5'	110	203	2'2'3'4'4'5'5'6'
4	3	4	33	47	2'2'4'4'	55	112	2'3'3'5'6'	76	168	2'3'4'4'5'6'	111	189	2'3'3'4'4'5'5'
5	4	2'2'	34	48	2'2'4'5'	55	119	2'3'4'4'6'	77	141	2'2'3'4'5'5'	112	195	2'2'3'3'4'4'5'6'
5	10	2'6'	34	75	2'4'4'6'	55	150	2'2'3'4'6'6'	78	179	2'2'3'3'5'6'6'	113	208	2'2'3'3'4'5'5'6'6'
6	7	2'4'	35	62	2'3'4'6'	56	83	2'2'3'3'5'	79	130	2'2'3'3'4'5'	114	207	2'2'3'3'4'4'5'6'6'
6	9	2'5'	35	65	2'3'5'6'	56	109	2'3'3'4'6'	80	137	2'2'3'4'4'5'	115	194	2'2'3'3'4'4'5'5'
7	6	2'3'	36	35	3'3'4'	57	86	2'2'3'4'5'	81	176	2'2'3'3'4'6'6'	116	205	2'3'3'4'4'5'5'6'
8	5	2'3'	37	44	2'2'3'5'	57	97	2'2'3'4'5'	82	138	2'2'3'4'4'5'	117	206	2'2'3'3'4'4'5'5'6'
8	8	2'4'	37	104	2'2'4'6'6'	57	152	2'2'3'5'6'6'	82	163	2'3'3'4'5'6'	118	209	2'2'3'3'4'4'5'5'6'6'
9	14	3'5'	38	37	3'4'4'	58	87	2'2'3'4'5'	83	158	2'3'3'4'4'6'	NQ	20	2'3'3'
10	19	2'2'6'	38	42	2'2'3'4'	58	111	2'3'3'5'5'	84	129	2'2'3'3'4'5'	NQ	38	3'4'5'
11	30	2'4'6'	38	59	2'3'3'6'	58	115	2'3'4'4'6'	85	178	2'2'3'3'5'5'6'	NQ	41	2'2'3'4'
12	11	3'3'	39	64	2'3'4'6'	59	85	2'2'3'4'4'4'	86	166	2'3'4'4'5'6'	NQ	43	2'2'3'5'
13	12	3'4'	39	71	2'3'4'6'	59	116	2'3'4'5'6'	87	175	2'2'3'3'4'5'6'	NQ	69	2'3'4'6'
13	13	3'4'	40	68	2'3'4'5'	60	136	2'2'3'3'6'6'	88	182	2'2'3'4'4'5'6'	NQ	72	2'3'5'5'
14	15	4'4'	41	96	2'2'3'6'6'	61	77	3'3'4'4'	88	187	2'2'3'4'5'5'6'	NQ	78	3'3'4'5'
14	18	2'2'5'	42	40	2'2'3'3'	61	110	2'3'3'4'6'	89	128	2'2'3'3'4'4'	NQ	79	3'3'4'5'
15	17	2'2'4'	43	57	2'3'3'5'	62	154	2'2'4'4'5'6'	90	183	2'2'3'4'4'5'6'	NQ	80	3'3'5'5'
16	24	2'3'6'	43	103	2'2'4'5'6'	63	82	2'2'3'3'4'	91	167	2'3'4'4'5'5'	NQ	81	3'4'4'5'
16	27	2'3'6'	44	67	2'3'4'5'	64	151	2'2'3'5'5'6'	92	185	2'2'3'4'5'5'6'	NQ	88	2'2'3'4'6'
17	16	2'2'3'	44	100	2'2'4'4'6'	65	124	2'3'4'5'5'	93	174	2'2'3'3'4'5'6'	NQ	102	2'2'4'5'6'
17	32	2'4'6'	45	58	2'3'3'5'	65	135	2'2'3'3'5'6'	93	181	2'2'3'4'4'5'6'	NQ	113	2'3'3'5'6'
18	23	2'3'5'	45	63	2'3'4'5'	66	144	2'2'3'4'5'6'	94	177	2'2'3'3'4'5'6'	NQ	117	2'3'4'5'6'
19	34	2'3'5'	46	74	2'4'4'5'	67	107	2'3'3'4'5'	95	156	2'3'3'4'4'5'	NQ	120	2'3'4'5'5'
19	54	2'2'6'6'	46	94	2'2'3'5'6'	67	108	2'3'3'4'5'	95	171	2'2'3'3'4'4'6'	NQ	121	2'3'4'5'6'
20	29	2'4'5'	47	61	2'3'4'5'	67	147	2'2'3'4'5'6'	96	202	2'2'3'3'5'5'6'6'	NQ	125	2'3'4'5'6'
21	26	2'3'5'	47	70	2'3'4'5'	68	123	2'3'4'4'5'	97	157	2'3'3'4'4'5'	NQ	126	3'3'4'4'5'
22	25	2'3'4'	47	76	2'3'4'5'	69	106	2'3'3'4'5'	98	173	2'2'3'3'4'5'6'	NQ	127	3'3'4'5'5'
23	31	2'4'5'	48	66	2'3'4'4'	69	118	2'3'4'4'5'	99	200	2'2'3'3'4'5'6'6'	NQ	142	2'2'3'4'5'6'
24	28	2'4'4'	48	93	2'2'3'5'6'	69	149	2'2'3'4'5'6'	99	204	2'2'3'4'4'5'6'6'	NQ	145	2'2'3'4'6'6'
24	50	2'2'4'6'	48	95	2'2'3'5'6'	70	139	2'2'3'4'4'6'	100	172	2'2'3'3'4'5'5'	NQ	148	2'2'3'4'5'6'
25	21	2'3'4'	49	55	2'3'3'4'	70	140	2'2'3'4'4'6'	100	192	2'3'3'4'5'5'6'	NQ	159	2'3'3'4'5'5'
25	33	2'3'4'	49	91	2'2'3'4'6'	71	114	2'3'4'4'5'	101	197	2'2'3'3'4'4'6'6'	NQ	160	2'3'3'4'5'6'
25	53	2'2'5'6'	49	98	2'2'3'4'6'	71	134	2'2'3'3'5'6'	102	180	2'2'3'4'4'5'5'	NQ	162	2'3'3'4'5'5'
26	22	2'3'4'	50	56	2'3'3'4'	71	143	2'2'3'4'5'6'	103	193	2'3'3'4'5'5'6'	NQ	164	2'3'3'4'5'6'
26	51	2'2'4'6'	50	60	2'3'4'4'	72	122	2'3'3'4'5'	104	191	2'3'3'4'4'5'6'	NQ	165	2'3'3'5'5'6'
27	45	2'2'3'6'	51	84	2'2'3'3'6'	72	131	2'2'3'3'4'6'	105	199	2'2'3'3'4'5'6'6'	NQ	169	3'3'4'4'5'5'
28	36	3'3'5'	51	92	2'2'3'5'5'	72	133	2'2'3'3'5'5'	106	170	2'2'3'3'4'4'5'	NQ	184	2'2'3'4'4'6'6'
29	46	2'2'3'6'	51	155	2'2'4'4'6'6'	73	146	2'2'3'4'5'5'	107	190	2'3'3'4'4'5'6'	NQ	186	2'2'3'4'5'6'6'
30	39	3'4'5'	52	89	2'2'3'4'6'	73	161	2'3'3'4'5'6'	108	198	2'2'3'3'4'5'5'6'	NQ	188	2'2'3'4'5'6'6'

Note: NQ = Not quantified in DB-1 method

TABLE A-2

(1/9)

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
1	ID		12	0	CHARACTER	25	10037		The unique sample identifier assigned in the field to each environmental sample collected or tested. If a sample is collected and archived, a unique identifier will be given to it and the sample will be entered into an Archive Database. This is the DATABASE KEY field. Each record in the database has a unique ID. This ID is used to relate into the QA/QC database.
2	LOCATION		10	0	CHARACTER	8A-22	B.F.Br Rt.197 Br. TID-West Rt.29 Br. S.W.Br. Rt.4 Br. Hoosic R. Bat. Kill EFI AREA	For a composite enter: COMPOSITE	Sampling location. The actual location where the sample was collected. Water column sample locations: B.F.Br = Baker Falls Bridge (HRM 197.0); HRM 196.8 = Canoe Carry; Rt.197 Br. = Rt. 197 Bridge Fort Edward (HRM 194.2); TID = Thompson Island Dam (HRM 188.5); Rt.29 Br. = Rt. 29 Bridge Schuylerville; S.W.Br. = Stillwater Bridge; Rt.4 Br. = Rt. 4 Bridge Waterford; Hoosic R. = Hoosic River; Bat Kill = Batten Kill. "COMPOSITE" refers to sediment samples composited from more than one location. "EQBL" refers to equipment blanks (included only where PCB concentration exceeds MDL). HRM = approximate Hudson River mile. HRM 0.0 is located at the Battery in New York City. Sample locations within the river may be further differentiated by W = west (shore or channel), C = center (of channel), E = east (shore or channel). "R" indicates the archive sample for a given location.

Note: NA = Not Applicable.
 Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

TABLE A-2

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

(2/9)

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
3	MEDIA		1	0	CHARACTER	f,w,a,b,p,s	f,w,a,b,p,s		Type of matrix: f=fish, w=water, a=air, b=biota, p=pore water, s=sediment
4	INVEST		3	0	CHARACTER	OBG, HAR, D&M	OBG, HAR, D&M	DEC, LAW, EPA, CRD	The organization that collected the sample: OBG = O'Brien & Gere; HAR = Harza; D&M = Dames & Moore; DEC = NYS Dept. Environ. Conserv.; LAW = Law Environmental; EPA = US Environ. Protect. Agency; CRD = GE Corporate Research and Development.
5	DESC		150	0	CHARACTER	ST/CL - 8A-1, 8A-12, 8A-2, 8A-3, 8A-5, 8A-7, 8A-15, 8A-6, 8A-13, 8A-4		Brown bullhead Atlantic tomcod American eel	Sample description. Possible sediment descriptions: CS=coarse sand, MS=medium sand, FS=fine sand, G=gravel, ST=silt, CL=clay, FS/ST=fine sand/silt, ST/CL=silt/clay, WC=wood chips, PD=plant debris, SH=shells. Fish species are abbreviated in Field SPP (number 23) and are spelled out in this Description field. For composites: Enter the description of the composite sample along with the locations of each sample involved in the composite.
6	MILE	mi	5	1	NUMERIC				Approximate Hudson River Mile (HRM). HRM 0.0 is located at the Battery in New York City. The river mile for the Batten Kill and Hoosic River (Temporal Water Column Sampling locations) were estimated at the confluence. The river miles entered for the Float Survey sampling locations are also estimated. In addition, the river mile was estimated at the midpoint of each of the sampling reaches for the Sediment Survey.
7	NORTHING	ft	9	1	NUMERIC	1189500.0	1185467.0		Northing coordinate according to the 1927 State Plane Coordinate System, this coordinate is estimated.
8	EASTING	ft	9	1	NUMERIC	699400.0	699450.0		Easting coordinate according to the 1927 State Plane Coordinate System, this coordinate is estimated.
9	ELEV	ft	5	1	NUMERIC	950.0	950.0		River Elevation, this value is estimated.

Note: NA = Not Applicable

Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

O'BRIEN & GERE ENGINEERS, INC.
i:div52\0612\data\structure\ge960912

Printed: May 30, 1997

TABLE A-2
GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

(3/9)

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
10	DATE COL		8	0	DATE	03/09/91	04/12/91		Date of sample collection (MM/DD/YY)
11	HRCOL	hours	2	0	NUMERIC	NA	14		This value represents the hour of the day that the sample was collected.
12	MINCOL	minutes	2	0	NUMERIC	NA	45		This value represents the minute of the day that the sample was collected.
13	WTR_DPTH	ft	5	1	NUMERIC	8.4	18.0		Depth of water at sample location
14	ST_DPTH	cm or ft	5	1	NUMERIC	0.0	0.0		Starting depth of sediment core (cm) or composite water sample (ft)
15	END DPTH	cm or ft	5	1	NUMERIC	5.0	18.0		Ending depth of sediment core (cm) or composite water sample (ft)
16	LAB		8	0	CHARACTER	NEA	NEA		The laboratory that performed the sample analysis
17	TOT SOL	%	4	1	NUMERIC	78.3	NA		Total percent solids for sediment core composite samples only
18	VOL SOL	%	4	1	NUMERIC	45.6	NA		Volume solids for sediment core composite samples only
19	DENSITY	g(dry)/ml(wet)	4	2	NUMERIC	1.3	NA		Bulk density for sediment core composite samples only
20	MOIST	%	4	1	NUMERIC	92.4	NA		Percent moisture for sediment core composite samples only
21	TOC	mg/kg or mg/l	6	0	NUMERIC	23000	50		Total organic carbon in sediment core composite samples (mg/kg) or water composite samples (mg/l)
22	AGE	yr	1	0	CHARACTER	NA	NA	1	Age of fish in years
23	SPP		4	0	CHARACTER	NA	NA	BB	Fish Species abbreviated: Largemouth Bass, Brown Bullhead, Smallmouth Bass, Pumpkinseed.
24	PCLPD	%	5	2	NUMERIC	NA	NA	34.56	Percent lipids

Note: NA = Not Applicable

Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

TABLE A-2

(4/9)

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
25	LEN	mm	6	1	NUMERIC	NA	NA	14.1	Fish length
26	WGT	grams	9	2	NUMERIC	NA	NA	3.34	Fish weight
27	SEX		1	0	CHARACTER	NA	NA	M,F	Sex of fish: m=male, f=female, U=undetermined
28	PREP		3	0	CHARACTER	NA	NA	F,W, CF, CW	Preparation method: F=fillet, W=whole fish, CF=composite fillets, CW=composite whole fish
29	OBG_ID		8	0	CHARACTER	M2241	M2241		O'Brien and Gere sample identification for fields 30 to 34. If this field is blank then there will be no data available for entry into fields 30 to 34, and zeros can be regarded as "null values".
30	TSS	mg/l	5	0	NUMERIC	NA	6		Total suspended solids in water samples only. Results presented to tenths place for 1995 data, otherwise rounded to whole numbers. Results less than detection limit shown as "11111".
31	TDS	mg/l	5	0	NUMERIC	NA	59		Total dissolved solids in water samples only
32	SP COND	umho/cm	6	0	NUMERIC	NA	89		Specific conductivity in water samples only
33	TOT ALK	mg/l as CaCO ₃	5	0	NUMERIC	NA	11		Total alkalinity in water samples only
34	TOC F	mg/l	5	0	NUMERIC	NA	15		Total organic carbon in filtered water samples only
35	FTEDFLO W	cubic ft/sec	8	0	NUMERIC	NA	7150		United States Department of the Interior USGS daily average flow data for the Hudson River at Fort Edward, NY (station number 01327750). Instantaneous flows are entered for recent dates (typically going back about 3 months) for which preliminary daily average data is not yet available. Preliminary flows are updated quarterly.
36	WTFDFLO W	cubic ft/sec	8	0	NUMERIC	NA	8400		United States Department of the Interior USGS daily average flow data for the Hudson River at Waterford, NY (station number 01335754). Preliminary and finalized values are included.

Note: NA = Not Applicable
 Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

TABLE A-2

(5/9)

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
37	SWTRFLOW	cubic ft/sec	8	0	NUMERIC	NA	3520		United States Department of the Interior USGS daily average flow data for the Hudson River at Stillwater, NY (station number 01331095). Preliminary and finalized values are included.
38	WTR_TMP	Degrees Celsius	4	0	NUMERIC	NA	9		Water temperature for water samples only
39	PCB_WM	ppm	12	7	NUMERIC		0.0000126		Total PCB concentration by Webb & McCall Method or USEPA Method 8080, this entry will be reported as a "zero value" if the sample concentration is less than the detection limit. See field 45 to distinguish a below detection limit entry from a "null value".
40	PCB_USGS	ppm	12	7	NUMERIC		0.0000025		Total PCB concentration by USGS Method, this entry will be reported as a "zero value" if the sample concentration is less than the detection limit. See field 44 to distinguish a below detection limit entry from a "null value".
41	PCB_CAP	ppm	12	7	NUMERIC	65.7800000	0.0000198		Total PCB concentration by Capillary Column Method NEA608CAP, this entry will be reported as a "zero value" if the sample concentration is less than the detection limit. See field 46 to distinguish a below detection limit entry from a "null value".
42	AROC_ID		20	0	CHARACTER	A1242 Altered A1242 A1248 None	A1242 Altered A1242 A1248 None		Visually identified nominal Aroclor pattern reported by NEA for Webb & McCall or Method 8080 analyses.
43	TOT DISS		1	0	CHARACTER	T,D	T,D		Total or Dissolved (derived from a filtered water sample)
44	DL_USGS		7	0	CHARACTER		<11PPT		USGS method detection limit. This field will be blank if the sample was not analyzed by this method and will indicate that a zero in field 40 is a "null value".
45	DL_WM		7	0	CHARACTER		<11PPT		Webb & McCall or Method 8080 method detection limit. This field will be blank if the sample was not analyzed by this method and will indicate that a zero in field 39 is a "null value".

Note: NA = Not Applicable

Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

TABLE A-2

(6/9)

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
46	DL_CAP		7	0	CHARACTER	<1PPM	<11PPT		Capillary Column method detection limit. This field will be blank if the sample was not analyzed by this method and will indicate that a zero in field 41 is a "null value". It should be noted that the method detection limit for pore water analyses will be <100PPB.
47	COL_TYP1		1	0	CHARACTER	P,C	P,C		Type of column used to generate Webb & McCall data: P=packed column, C=capillary column
48	COL_TYP2		1	0	CHARACTER	P,C	P,C		Type of column used to generate homolog values: P=packed column, C=capillary column ** If a packed column was used to generate homolog values, the homolog values are estimates...
49	NEA_FILE		12	0	CHARACTER	910606F or N/A	910566F or 910878X		NEA file identification as reported on PCB summary report sheet. An "X" is only included in the NEA_FILE field if the sample is a Temporal Water Column sample analyzed for dissolved PCBs. N/A applies to samples not analyzed by NEA (e.g. Channel Characterization samples.) "R" indicates reanalyzed sample.
50	CUSTOMER		20	0	CHARACTER	O'BRIEN & GERE	O'BRIEN & GERE	GE: CR and D	NEA Customer identification as reported on the PCB summary report sheet
51	NEA_DESC		40	0	CHARACTER	8A-F1(0-5)	BAKER FALLS BRIDGE (DISSOLVED)	806 0855	NEA file description as reported on PCB summary report sheet RalTech #s reported for Archived Fish analyses.
52	NEA_COM		40	0	CHARACTER	1991 HUDSON RIVER SEDIMENT SURVEY COC:7/16/91	1991 HUDSON RIVER H2O SURVEY COC:5/3/91		NEA comment as reported on PCB summary report sheet
53	NEA_TOT	ppm	12	7	NUMERIC	67.8900000	0.0000182		NEA total PCB concentration as reported on PCB summary report sheet. Value is equal to the value reported for "PCB_CAP" in field 41.

Note: NA = Not Applicable

Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

O'BRIEN & GERE ENGINEERS, INC.
i:\div52\0612\data\structure\ge960912

Printed: May 30, 1997

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TABLE A-2

(7/9)

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
54	MONO_WT	%	5	2	NUMERIC	17.40	50.00		Weight % of monochlorinated PCB by Capillary Column Chromatography
55	DI_WT	%	5	2	NUMERIC	17.90	0.0		Weight % of dichlorinated PCB by Capillary Column Chromatography
56	TRI_WT	%	5	2	NUMERIC	27.00	18.47		Weight % of trichlorinated PCB by Capillary Column Chromatography
57	TERA_WT	%	5	2	NUMERIC	25.20	30.62		Weight % of tetrachlorinated (tetrachlorinated) PCB by Capillary Column Chromatography
58	PENTA_W T	%	5	2	NUMERIC	9.30	17.63		Weight % of pentachlorinated PCB by Capillary Column Chromatography
59	HEXA_WT	%	5	2	NUMERIC	2.10	14.62		Weight % of hexachlorinated PCB by Capillary Column Chromatography
60	HEPTA_W T	%	5	2	NUMERIC	0.90	15.32		Weight % of heptachlorinated PCB by Capillary Column Chromatography
61	OCTA_WT	%	5	2	NUMERIC	0.10	3.34		Weight % of octachlorinated PCB by Capillary Column Chromatography
62	NONA_WT	%	5	2	NUMERIC	0.10	0.00		Weight % of nonachlorinated PCB by Capillary Column Chromatography
63	DECA_WT	%	5	2	NUMERIC	0.10	0.00		Weight % of decachlorinated PCB by Capillary Column Chromatography
64	MONO_ML	%	5	2	NUMERIC	23.00	0.00		Mole % of monochlorinated PCB by Capillary Column Chromatography
65	DI_ML	%	5	2	NUMERIC	19.90	0.00		Mole % of dichlorinated PCB by Capillary Column Chromatography

Note: NA = Not Applicable

Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

TABLE A-2

(8/9)

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
66	TRI_ML	%	5	2	NUMERIC	26.10	22.98		Mole % of trichlorinated PCB by Capillary Column Chromatography
67	TERA_ML	%	5	2	NUMERIC	21.60	33.29		Mole % of tetrachlorinated (tetrachlorinated) PCB by Capillary Column Chromatography
68	PENTA_ML	%	5	2	NUMERIC	7.20	16.92		Mole % of pentachlorinated PCB by Capillary Column Chromatography
69	HEXA_ML	%	5	2	NUMERIC	1.50	12.43		Mole % of hexachlorinated PCB by Capillary Column Chromatography
70	HEPTA_ML	%	5	2	NUMERIC	0.60	12.01		Mole % of heptachlorinated PCB by Capillary Column Chromatography
71	OCTA_ML	%	5	2	NUMERIC	0.10	2.36		Mole % of octachlorinated PCB by Capillary Column Chromatography
72	NONA_ML	%	5	2	NUMERIC	0.10	0.00		Mole % of nonachlorinated PCB by Capillary Column Chromatography
73	DECA_ML	%	5	2	NUMERIC	0.10	0.00		Mole % of decachlorinated PCB by Capillary Column Chromatography
74	ORTHO_CL		4	2	NUMERIC	1.39	1.55		Mole ratio of ortho chlorines per biphenyl
75	MP_CL		4	2	NUMERIC	1.38	2.09		Mole ratio of meta and para chlorines per biphenyl
76	TOT_CL		4	2	NUMERIC	2.77	3.64		Mole ratio of total chlorines per biphenyl
77	VERIFIED		3	0	CHARACTER	YES	YES		Verified data has been checked for accuracy and validated

Note: NA = Not Applicable
 Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

TABLE A-2

(9/9)

GE Hudson River Project Environmental Sample Database - dBASE III File Structure Table

Field	Field Name	Units	Length	Dec	Type	Entry Types			Comments
						Sediment	Water column	Other	
78	QL_WM		2	0	CHARACTER	U,J,UJ	U,J,UJ		Data Validation Qualifier for the Webb & McCall PCB results: J=approximate sample result U=approximate the detection limit UJ=approximate the sample result and the detection limit R=reject the sample result or the detection limit
79	QL_USGS		2	0	CHARACTER	U,J,UJ	U,J,UJ		Data Validation Qualifier for the USGS PCB results: J=approximate sample result U=approximate the detection limit UJ=approximate the sample result and the detection limit R=reject the sample result or the detection limit
80	QL_CAP		2	0	CHARACTER	U,J,UJ	U,J,UJ		Data Validation Qualifier for the Capillary Column PCB results: J=approximate sample result U=approximate the detection limit UJ=approximate the sample result and the detection limit R=reject the sample result or the detection limit
81	PROGRAM		20	0	CHARACTER	SEDIMENT, FOOD CHAIN, BFI,	TWCMP, HIGHFLOW, BFI, PCRDMP	FOOD CHAIN LOWER HUDSON	This field indicates the sampling program under which the sample was collected. Examples: TWCMP = Temporal Water Column Monitoring Program 91-92 PCRDMP = Post Construction Remnant Deposit Monitoring Program 92-96+ SEDIMENT = Sediment Sampling and Analysis Program 91 BFI = Bakers Falls Investigation 92-93

Note: NA = Not Applicable
 Numeric fields containing zeros (0) may indicate either a "zero value" or a "null value". See comments to identify individual numeric fields where zero entries reflect "null values".

TABLE A-3
Summary of GE Hudson River Data Collection Programs

Media	Investigator	Program	Location(s)	# Stations	# Samples	Timeframe	Analytes	In GE Database	Reference
Water	GE (OBG)	Temporal Water Column Monitoring	Upper Hudson	6	752	1991 - 1992	CSPCB	Y	O'Brien & Gere, 1993e
	GE (OBG)	Float Surveys	Reach 9	6	100	Summer 1991, 1992, 1993	CSPCB	Y	O'Brien & Gere, 1992-96
	GE (OBG / HQI)	Float Surveys	Reach 8	18	108	Summer 1996	CSPCB	Y	HydroQual, 1996
	GE (OBG)	High Flow	Upper Hudson	6	68	Spring 1992	CSPCB	Y	O'Brien & Gere, 1993a
	GE (OBG)	High Flow	Upper Hudson	3	15	Spring 1997	CSPCB	Y	HydroQual, 1997
	GE (Harza / OBG)	Remnant Monitoring	Reach 8 and 9	4	1147	1989 - present	CSPCB	Starting in 1992	O'Brien & Gere, 1992-96
	GE (OBG)	River Monitoring Tests	Reach 8 and 9	3 lateral transects	158	1995 and 1996	CSPCB	Y	O'Brien & Gere, 1995
	GE (OBG)	Bakers Falls Investigation	Hudson Falls Plant Site Area		197	1992 - 1993	CSPCB	Y	O'Brien & Gere, 1994
Sediment	GE (Harza)	Baseline Studies	Upper Hudson	5		1989	TPCB	N	Harza, 1990
	GE (OBG)	Hot Spot	Reach 8	> 400		1990	TPCB	N	O'Brien & Gere, 1991a
	GE (OBG)	Bulk Sediment Survey	Upper Hudson	> 1000	375	1991	CSPCB	Y	O'Brien & Gere, 1993d
	GE (Harza / OBG)	H-7	Reach 8	> 200		1990 - 1991	TPCB	N	O'Brien & Gere, 1991b
	GE (OBG)	Sediment Pore Water	Upper Hudson	85	85	1991	CSPCB	Y	O'Brien & Gere, 1993d
	GE (OBG)	Channel Characterization	Upper Hudson	13	19	1992	TPCB	Y	O'Brien & Gere, 1993b
	GE (Harza)	Lower Hudson Characterization	LHR, NYH, LIS	> 100	566	1988 - 1991	CSPCB	Y	General Electric, 1991
	GE (OBG)	Bakers Falls Investigation	Hudson Falls Plant Site Area	> 20	9	1992 - 1993	TPCB, CSPCB	Y	O'Brien & Gere, 1994b
Biota	GE (GE CR&D)	Archived Fish Analysis	Upper & Lower Hudson	3	167	1978 - 1982, 1990	CSPCB	Y	
	GE (OBG)	Food Chain	Upper Hudson	3	18	1992	CSPCB	Y	O'Brien & Gere, 1993c
	GE (Harza)	Lower Hudson Characterization	LHR, NYH, LIS	88	464	1988-1990	TPCB, CSPCB	Y	General Electric, 1991
	GE (Harza)	Remnant Monitoring	Upper Hudson	22		1990 - 1991	CSPCB	N	Harza, 1992

Notes

CSPCB = congener specific PCBs; TPCB = total PCBs

Number of samples for Spring 1997 High Flow Program is preliminary, pending results of further analyses

LHR = Lower Hudson River; NYH = New York Harbor; LIS = Long Island Sound

TABLE A-4

Mixed Peak Deconvolution Scheme for Analysis of GE PCB Data

DB-1 Peak #	Congener BZ #(s)	Chlorination Structure	Percent Composition	DB-1 Peak #	Congener BZ #(s)	Chlorination Structure	Percent Composition
14	15	4 4'	24.8	51	84 + 92	2 2'3 3'6 + 2 2'3 5 5'	100.0
	18	2 2'5	75.2		155	2 2'4 4'6 6'	0.0
19	34	2 3'5'	70.0	55	112 + 199	2 3 3'5 6 + 2 3'4 4'6	100.0
	54	2 2'6 6'	30.0		150	2 2'3 4'6 6'	0.0
24	28	2 4 4'	100.0	57	86 + 97	2 2'3 4 5 + 2 2'3 4'5'	100.0
	50	2 2'4 6	0.0		152	2 2'3 5 6 6'	0.0
25	21 + 33	2 3 4 + 2 3'4'	94.4	61	77	3 3'4 4'	0.0
	53	2 2'5 6'	5.6		110	2 3 3'4'6	100.0
26	22	2 3 4'	96.6	65	124	2 3'4'5 5'	30.0
	51	2 2'4 6'	3.4		135	2 2'3 3'5 6'	70.0
37	44	2 2'3 5'	100.0	67	107 + 108	2 3 3'4'5 + 2 3 3'4 5'	70.0
	104	2 2'4 6 6'	0.0		147	2 2'3 4'5 6	30.0
38	37	3 4 4'	57.0	69	106 + 118	2 3 3'4 5 + 2 3'4 4'5	68.0
	42 + 59	2 2'3 4' + 2 3 3'6	43.0		149	2 2'3 4'5'6	32.0
43	57	2 3 3'5	80.0	70	139	2 2'3 4 4'6	50.0
	103	2 2'4 5'6	20.0		140	2 2'3 4 4'6'	50.0
44	67	2 3'4 5	80.0	71	114	2 3 4 4'5	38.0
	100	2 2'4 4'6	20.0		134 + 143	2 2'3 3'5 6 + 2 2'3 4 5 6'	62.0
46	74	2 4 4'5	100.0	72	122	2 3 3'4'5'	70.0
	94	2 2'3 5 6'	0.0		131 + 133	2 2'3 3'4 6 + 2 2'3 3'5 5'	30.0
48	66	2 3'4 4'	95.5	74	105	2 3 3'4 4'	38.0
	93 + 95	2 2'3 5 6 + 2 2'3 5'6	4.5		132	2 2'3 3'4 6'	62.0
49	55	2 3 3'4	5.0	95	156	2 3 3'4 4'5	38.0
	91 + 98	2 2'3 4'6 + 2 2'3 4'6'	95.0		171	2 2'3 3'4 4'6	62.0

Note: Peak compositions are based on Aroclor data published in Frame et al. (1996).

TABLE A-5

DB-1 Peak Composition for Original and Revised Calibrations of the Green Bay PCB Standard

DB-1 Peak	Orig. WT%	Rev. WT%	DB-1 Peak	Orig. WT%	Rev. WT%	DB-1 Peak	Orig. WT%	Rev. WT%
1		2.41	41			81		
2	6.76	7.05	42	0.52	0.55	82	1.54	1.59
3			43			83	0.19	0.15
4	4.09	4.12	44	0.08	0.06	84	0.05	0.01
5	0.44	2.00	45	0.12	0.12	85	0.53	0.65
6	0.35	0.71	46	1.27	1.12	86		
7	0.66	1.12	47	3.30	2.00	87	0.09	0.12
8	7.86	8.23	48	4.27	4.23	88	2.36	2.12
9			49	0.22	0.30	89	0.07	0.06
10	0.16	0.16	50	2.83	2.06	90	1.21	1.00
11			51	0.68	1.06	91	0.02	0.03
12			52	0.05	0.06	92	0.35	0.28
13	0.14	0.16	53	0.75	1.06	93	1.73	1.88
14	2.04	2.18	54	0.36	0.44	94	0.90	1.00
15	1.16	2.18	55	0.03	0.02	95	0.58	0.46
16	0.14	0.15	56	0.06	0.09	96	0.05	0.04
17	2.06	2.29	57	0.30	0.33	97		0.00
18			58	0.52	0.68	98	0.02	0.02
19			59	0.33	0.41	99	0.33	0.23
20	0.03	0.03	60	0.22	0.44	100	0.30	0.33
21	0.36	0.42	61	1.12	1.25	101	0.03	0.06
22	0.16	0.19	62			102	3.77	3.59
23	2.61	2.42	63	0.20	0.26	103	0.22	0.25
24	3.36	3.10	64	0.90	1.00	104	0.07	0.07
25	2.65	2.34	65	0.35	0.16	105	0.16	0.25
26	1.83	1.70	66	0.04	0.35	106	1.43	0.75
27	0.42	0.52	67	0.05	0.08	107	0.47	0.25
28			68			108	0.11	0.07
29	0.22	0.24	69	2.28	2.35	109	2.36	2.47
30			70			110	2.67	2.53
31	2.03	2.80	71	0.13	0.12	111	0.03	0.02
32	1.41	1.35	72	0.01	0.02	112	0.88	0.33
33	0.79	0.59	73	0.25	0.23	113	0.39	0.15
34	0.63	0.59	74	1.07	0.80	114	0.08	0.05
35			75	2.32	1.73	115	1.08	1.06
36			76			116	0.06	0.06
37	2.36	2.53	77	0.82	1.00	117	0.66	0.40
38	1.38	1.53	78	0.86		118	0.01	0.01
39	2.56	2.41	79	0.04	0.04			
40			80	0.22	0.15			

Notes

- 1 Weight percent data for DB-1 peaks 65 and 66 were reported together as a sum in the revised standard data. Individual peak values were computed based on notes in EPA 1994 which listed these as "Congeners which might separate" and provided data on the relative amounts of each.

TABLE A-6

DB-1 Peak Green Bay Calibration Correction Factors

DB-1 Peak	GCF	DB-1 Peak	GCF	DB-1 Peak	GCF	DB-1 Peak	GCF
1	-NA-	31	1.3824	61	1.1224	91	1.6666
2	1.0441	32	0.9561	62	1.0000	92	0.7993
3	1.0000	33	0.7483	63	1.2663	93	1.0884
4	1.0073	34	0.9353	64	1.1158	94	1.1158
5	4.5431	35	1.0000	65	0.4628	95	0.8010
6	2.0407	36	1.0000	66	9.9882	96	0.7460
7	1.6925	37	1.0725	67	1.4739	97	1.0000
8	1.0476	38	1.1054	68	1.0000	98	1.1168
9	1.0000	39	0.9411	69	1.0321	99	0.7050
10	1.0476	40	1.0000	70	1.0000	100	1.0912
11	1.0000	41	1.0000	71	0.8891	101	1.8878
12	1.0000	42	1.0657	72	1.1923	102	0.9509
13	1.0858	43	1.0000	73	0.9120	103	1.1224
14	1.0648	44	0.8231	74	0.7451	104	0.9977
15	1.8707	45	1.0617	75	0.7447	105	1.6088
16	1.1054	46	0.8776	76	1.0000	106	0.5257
17	1.1138	47	0.6057	77	1.2231	107	0.5255
18	1.0000	48	0.9904	78	1.0000	108	0.6701
19	1.0000	49	1.3629	79	1.1224	109	1.0476
20	1.1016	50	0.7275	80	0.7008	110	0.9463
21	1.1712	51	1.5661	81	1.0000	111	0.8314
22	1.1972	52	1.2471	82	1.0308	112	0.3701
23	0.9293	53	1.4030	83	0.7794	113	0.3711
24	0.9226	54	1.2037	84	0.1621	114	0.7249
25	0.8819	55	0.5820	85	1.2104	115	0.9760
26	0.9297	56	1.5589	86	1.0000	116	1.0289
27	1.2333	57	1.1027	87	1.2471	117	0.6057
28	1.0000	58	1.3072	88	0.8979	118	0.4726
29	1.0690	59	1.2471	89	0.7960		
30	1.0000	60	2.0043	90	0.8260		

Notes

- 1 Correction factor for PK1 (biphenyl) is undefined. This peak is not considered for PCB analysis of Hudson River environmental samples.
- 2 DB-1 Peaks not quantified in Green Bay Standards are shaded. These peaks were assigned a Green Bay Correction Factor of 1.0.
- 3 Weight percent data for DB-1 peaks 65 and 66 were reported together as a sum in the revised standard data. Individual peak values were computed based on notes in EPA 1994 which listed these as "Congeners which might separate and provided data on the relative amounts of each.
- 4 Weight percent for DB-1 peak 78 was not reported in revised standard data. Since original calibration contained PK78 in a significant amount (~1%), revised value is suspected to be in error (Northeast Analytical, 1997c), and Green Bay Correction Factor was assigned a value of 1.0.

TABLE A-7

Calculation of Water Column Potential Bias Index for DB-1 Peaks with Coeluting Congeners

NEA Peak #	Congener BZ#			Relative Response Factor			Relative Range	Avg. WT% in Water		Potential Bias Index	
	1st BZ#	2nd BZ#	3rd BZ#	1st BZ#	2nd BZ#	3rd BZ#		Ft. Edward	TID	Ft. Edward	TID
5	4	10		0.0374	0.262		150.0	5.3	31.1	793.4	4671.0
6	7	9		0.69	0.388		56.0	0.5	0.3	26.2	16.5
8	5	8		0.119	0.206		53.5	8.7	5.9	468.0	318.2
13	12	13		0.179	0.2		11.1	0.0	0.0	0.0	0.1
14	15	18		0.107	0.313		98.1	4.7	2.9	465.8	281.0
16	24	27		0.793	0.495		46.3	0.5	1.6	22.4	75.6
17	16	32		0.447	0.278		46.6	6.7	4.6	310.7	213.6
19	34	54		0.6092	0.3643		50.3	0.0	0.0	0.8	2.0
24	28	50		0.854	0.6817		22.4	5.6	2.6	126.4	58.3
25	21	33	53	1.0598	0.447	0.3606	112.3	3.8	2.0	424.6	229.4
26	22	51		1.0935	0.6		58.3	3.9	1.9	226.0	112.4
31	52	73		0.418	0.5805		32.5	4.9	3.1	159.0	102.1
34	48	75		0.556	0.6461		15.0	0.6	0.4	8.9	5.3
35	62	65		1.1478	0.8408		30.9	0.0	0.0	0.2	0.0
37	44	104		0.524	0.4561		13.9	3.7	1.8	51.5	24.8
38	37	42	59	0.58	0.792	0.6	32.3	2.4	1.3	76.5	41.4
39	64	71		0.607	0.468		25.9	3.3	1.7	85.7	44.8
43	57	103		0.6	0.6068		1.1	0.0	0.1	0.0	0.1
44	67	100		0.6	0.5871		2.2	0.0	0.0	0.1	0.1
45	58	63		0.609	0.728		17.8	0.1	0.1	1.9	2.0
46	74	94		0.671	0.4514		39.1	1.2	0.5	48.6	21.1
47	61	70	76	1.2227	0.658	0.5795	78.4	2.2	1.0	173.8	79.8
48	66	93	95	0.646	0.6676	0.443	38.4	5.8	2.4	221.6	93.8
49	55	91	98	0.829	0.571	0.6246	38.2	0.3	0.2	11.3	7.8
50	56	60		0.829	1.0164		20.3	2.8	1.2	57.9	24.1
51	84	92	155	0.386	0.5375	0.586	39.7	1.9	1.0	74.3	39.5
53	90	101		0.611	0.668		8.9	2.2	0.8	19.7	7.3
55	112	119	150	0.8286	0.8239	0.5676	35.3	0.0	0.0	0.6	0.4
56	83	109		0.6339	0.9625		41.2	0.1	0.1	5.3	3.3
57	86	97	152	0.7968	0.631	0.5235	42.0	0.4	0.2	17.1	7.7
58	87	111	115	1.021	0.6601	1.1328	50.4	1.1	0.4	55.4	21.8
59	85	116		0.7396	1.3987		61.6	0.5	0.2	32.8	13.0
61	77	110		0.3812	0.65		52.1	2.1	0.9	110.6	45.6
65	124	135		0.848	0.7031		18.7	0.1	0.2	1.7	2.8
67	107	108	147	0.8183	1.0654	0.6	56.2	0.0	0.0	0.9	1.3
69	106	118	149	1.0046	0.87	0.572	53.0	2.9	1.0	152.1	55.4
70	139	140		0.7219	0.6732		7.0	0.0	0.0	0.0	0.0
71	134	143	114	0.7331	0.7088	1.0261	38.6	0.0	0.0	0.1	0.0
72	122	131	133	0.7247	0.8492	1.148	46.7	0.0	0.0	0.1	0.0
73	146	161		0.728	0.9672		28.2	0.0	0.0	0.1	0.2
74	105	132		0.94	0.7303		25.1	0.3	0.2	7.7	5.8
82	138	163		0.827	0.9976		18.7	0.2	0.3	4.5	4.9
88	182	187		1.1272	1.122		0.5	0.0	0.0	0.0	0.0
93	174	181		0.806	1.6046		66.3	0.0	0.0	0.5	0.1
95	156	171		1.389	1.1712		17.0	0.0	0.0	0.1	0.0
99	200	204		0.369	0.8034		74.1	0.0	0.0	0.0	0.0
100	172	192		1.172	1.599		30.8	0.0	0.0	0.0	0.0
110	196	203		1.2321	1.629		27.7	0.0	0.0	0.0	0.0

Notes

- 1 Congener - Peak matching from HQI DB-1 peak database
- 2 Relative response factors from Erickson, 1992 (cited from Mullin, 1984)
- 3 Average weight percents are for summer water column samples from 1991 - 1996
- 4 Weight percent values based on data corrected for original Green Bay calibration error
- 5 Potential Bias Index = (Relative Range) x (Mean weight %)

TABLE A-8**Preliminary Set of Hudson River Water Column Extracts Selected for Reanalysis**

NEA File ID	Hudson River Location	River Mile	Sample Date	PCB Concentration (ng/L)			
				Peak 5	Peak 8	Peak 14	Total
950274F	Fort Edward	191.4	1 18 95	0.00	6.71	3.30	92.8
953879F	Fort Edward	192.4	5 11 95	0.00	4.41	3.68	52.6
955225F	Fort Edward	193.4	6 22 95	0.00	4.38	3.25	56.2
957979F	Fort Edward	194.4	10 3 95	1.03	2.93	4.29	84.9
9603897	Plungepool	196.9	7 17 96	3.24	102.71	61.30	867.0
9604293	Plungepool	196.9	8 7 96	1.46	5.71	3.60	84.5
9604954	Plungepool	196.9	9 10 96	2.96	81.44	83.76	1423.8
9604179	Fort Edward	194.4	7 31 96	0.00	1.64	2.32	54.6
961008F	Thompson Island Dam	189.0	3 6 96	9.44	10.87	2.99	123.9
9601648	Thompson Island Dam	189.0	4 24 96	5.77	4.20	1.79	101.6
9603292	Thompson Island Dam	189.0	6 26 96	19.55	12.05	4.99	186.9
9603892	Thompson Island Dam	189.0	7 17 96	12.54	7.64	2.28	91.6
9605127	Thompson Island Dam	189.0	9 18 96	8.34	4.74	1.31	53.1
9605321	Thompson Island Dam	189.0	9 25 96	11.37	3.35	0.99	53.3
9605611	Thompson Island Dam	189.0	10 16 96	10.54	4.58	0.87	57.6
9605873	Thompson Island Dam	189.0	10 29 96	16.26	6.98	1.79	95.7

TABLE A-9

Laboratory Results from Analysis of Preliminary Water Column Data Set

NEA ID	River Mile	Sample Date	Original DB-1 Data [ng/L]			Reanalyzed DB-1 Data [ng/L]			CP-SIL5-C18 Congener Data [ng/L]					
			PK5	PK8	PK14	PK5	PK8	PK14	BZ4	BZ10	BZ5	BZ8	BZ18	BZ15
950274F	191.4	1 18 95	0.00	6.71	3.30	0.00	6.08	3.29	0.00	0.00	0.44	2.13	4.18	0.00
953879F	192.4	5 11 95	0.00	4.41	3.68	0.00	4.53	3.40	0.00	0.00	0.38	1.30	3.00	0.00
955225F	193.4	6 22 95	0.00	4.38	3.25	0.00	4.54	3.37	0.00	0.00	0.55	2.24	4.30	0.00
957979F	194.4	10 3 95	1.03	2.93	4.29	1.02	3.04	4.31	0.95	0.46	0.37	1.31	5.27	0.00
9603897	196.9	7 17 96	3.24	102.71	61.30	3.49	104.36	59.58	20.70	1.76	1.86	46.70	78.70	6.46
9604293	196.9	8 7 96	1.46	5.71	3.60	1.48	5.69	4.13	1.93	1.10	0.44	2.74	5.61	0.00
9604954	196.9	9 10 96	2.96	81.44	83.76	3.00	78.75	78.74	20.40	1.44	1.02	38.10	105.50	19.10
9604179	194.4	7 31 96	0.00	1.64	2.32	0.00	1.56	2.18	0.00	0.00	0.00	0.36	2.07	0.00
961008F	189.0	3 6 96	9.44	10.87	2.99	7.02	9.88	2.92	19.40	4.64	0.47	3.77	3.46	0.00
9601648	189.0	4 24 96	5.77	4.20	1.79	5.85	4.23	2.03	15.80	4.22	0.64	2.58	2.56	0.00
9603292	189.0	6 26 96	19.55	12.05	4.99	19.55	12.08	5.14	48.30	13.40	0.50	5.69	5.05	0.00
9603892	189.0	7 17 96	12.54	7.64	2.28	12.57	7.64	2.16	27.20	8.16	0.33	2.93	1.79	0.00
9605127	189.0	9 18 96	8.34	4.74	1.31	8.54	4.95	1.29	20.50	6.84	0.51	2.23	2.24	0.00
9605321	189.0	9 25 96	11.37	3.35	0.99	11.36	3.17	0.94	24.30	6.28	0.31	1.70	0.95	0.00
9605611	189.0	10 16 96	10.54	4.58	0.87	10.34	4.60	0.84	23.30	7.62	0.25	1.68	0.94	0.00
9605873	189.0	10 29 96	16.26	6.98	1.79	16.38	7.13	1.88	40.90	11.50	0.49	4.60	2.85	0.00

Note: Reported DB-1 values are not corrected for the calibration error in the original Green Bay Standard

TABLE A-10

Confirmatory Set of Hudson River Water Column Extracts Selected for Reanalysis

NEA File ID	Hudson River Location	River Mile	Sample Date	PCB Concentration [ng/L]			
				Total	Peak 5	Peak 8	Peak 14
911287F	Fort Edward	194.4	6 7 91	53.7	0.84	5.05	2.04
911289F	Thompson Island Dam	189.0	6 7 91	141.4	6.91	8.50	3.17
911682F	Fort Edward	194.4	7 11 91	94.6	0.59	7.26	4.32
911684F	Thompson Island Dam	189.0	7 11 91	142.2	11.20	11.50	5.17
912162F	Fort Edward	194.4	7 25 91	55.1	0.78	4.63	2.81
912164F	Thompson Island Dam	189.0	7 25 91	131.4	9.80	10.30	6.00
922022F	Fort Edward	194.4	6 4 92	78.7	0.81	7.38	3.27
922015F	Thompson Island Dam	189.0	6 4 92	128.6	9.40	8.00	4.40
923464F	Fort Edward	194.4	8 19 92	571.7	9.40	71.30	27.40
923469F	Thompson Island Dam	189.0	8 19 92	799.4	27.80	102.40	41.60
924687F	Fort Edward	194.4	10 15 92	123.4	1.53	11.30	6.34
924691F	Thompson Island Dam	189.0	10 15 92	284.2	19.30	21.70	10.50
935526F	Fort Edward	194.4	9 29 93	49.5	0.00	5.64	2.60
935527F	Thompson Island Dam	189.0	9 29 93	151.8	23.40	10.30	3.52
935893F	Fort Edward	194.4	10 13 93	45.4	0.00	3.53	2.22
935894F	Thompson Island Dam	189.0	10 13 93	147.2	22.70	9.70	3.72
944734F	Fort Edward	194.4	8 24 94	42.5	0.00	0.00	2.78
944736F	Thompson Island Dam	189.0	8 24 94	139.6	7.40	14.90	7.59
945544F	Fort Edward	194.4	9 7 94	96.3	0.00	8.30	6.50
945547F	Thompson Island Dam	189.0	9 7 94	249.7	8.30	24.40	15.10
954536F	Fort Edward	194.4	6 7 95	62	1.20	4.25	2.88
954537F	Thompson Island Dam	189.0	6 7 95	236.7	30.72	15.57	6.38
957192F	Fort Edward	194.4	8 31 95	40.5	0.00	5.55	1.68
957193F	Thompson Island Dam	189.0	8 31 95	105.8	13.81	7.89	4.01

TABLE A-11

Laboratory Results from Reanalysis of Confirmatory Water Column Data Set

NEA ID	River Mile	Sample Date	Original DB-1 Data [ng/L]			Reanalyzed DB-1 Data [ng/L]			CP-SIL5-C18 Congener Data [ng/L]					
			PK5	PK8	PK14	PK5	PK8	PK14	BZ4	BZ10	BZ5	BZ8	BZ18	BZ15
911287	194.4	6 7 91	0.84	5.05	2.04	0.84	5.92	2.05	6.02	1.20	0.71	2.26	2.17	0.00
911289	189.0	6 7 91	6.91	8.50	3.17	8.63	8.45	3.42	23.94	3.51	0.87	3.84	4.39	0.00
911682	194.4	7 11 91	0.59	7.26	4.32	0.65	7.64	4.58	5.33	1.20	1.06	3.85	5.16	0.00
911684	189.0	7 11 91	11.20	11.50	5.17	11.05	11.42	5.26	27.27	6.76	0.86	4.46	6.30	0.00
912162	194.4	7 25 91	0.78	4.63	2.81	0.79	4.80	2.86	5.65	1.16	0.93	2.11	3.46	0.00
912164	189.0	7 25 91	9.80	10.30	6.00	9.52	10.77	5.91	23.37	6.31	1.14	3.82	7.62	0.00
922022	194.4	6 4 92	0.81	7.38	3.27	0.85	7.90	3.65	4.29	0.78	0.64	3.62	5.54	0.00
922015	189.0	6 4 92	9.40	8.00	4.40	9.33	8.30	4.60	26.51	5.13	1.47	5.35	5.73	0.00
923464	194.4	8 19 92	9.40	71.30	27.40	9.32	75.30	28.26	35.43	2.97	1.11	34.31	34.29	6.88
923469	189.0	8 19 92	27.80	102.40	41.60	25.88	104.03	41.94	75.48	11.14	1.24	49.10	50.51	12.26
924687	194.4	10 15 92	1.53	11.30	6.34	1.53	11.36	6.53	5.95	1.66	0.79	6.03	8.24	0.00
924691	189.0	10 15 92	19.30	21.70	10.50	17.67	22.18	10.37	44.04	8.58	1.06	8.86	12.31	0.00
935526	194.4	9 29 93	0.00	5.64	2.60	5.29	2.54	1.37	0.00	0.00	0.56	2.32	3.82	0.00
935527	189.0	9 29 93	23.40	10.30	3.52	20.84	10.57	3.53	37.00	9.26	0.90	5.01	4.54	0.00
944734	194.4	8 24 94	0.00	0.00	2.78	0.00	0.00	2.64	0.00	0.00	0.00	0.00	2.34	0.00
944736	189.0	8 24 94	7.40	14.90	7.59	5.82	13.27	6.22	7.44	2.20	0.55	4.79	7.60	0.00
945544	194.4	9 7 94	0.00	8.30	6.50	0.00	7.57	6.02	0.00	0.00	0.49	2.65	5.91	0.00
945547	189.0	9 7 94	8.30	24.40	15.10	5.91	22.12	15.16	12.46	2.61	0.76	9.35	16.60	4.07
954536	194.4	6 7 95	1.20	4.25	2.88	1.14	4.52	3.14	3.60	1.43	0.45	1.69	4.70	0.00
954537	189.0	6 7 95	30.72	15.57	6.38	20.89	12.53	4.53	52.40	12.87	0.46	5.29	7.08	0.00
957192	194.4	8 31 95	0.00	5.55	1.68	0.00	5.17	1.75	0.00	0.00	0.37	1.62	1.71	0.00
957193	189.0	8 31 95	13.81	7.89	4.01	13.20	7.94	3.97	29.21	8.32	0.49	3.17	5.37	0.00

TABLE A-12

Calculation of Potential Bias Index for Average GE Surface Sediment Data

NEA Peak #	Congener BZ#			Relative Response Factor			Relative Range	Avg. WT% in TIP Sediment	Potential Bias Index
	1st BZ#	2nd BZ#	3rd BZ#	1st BZ#	2nd BZ#	3rd BZ#			
5	4	10		0.0374	0.262		150.0	17.8	2675.4
6	7	9		0.69	0.388		56.0	0.4	23.0
8	5	8		0.119	0.206		53.5	13.8	736.3
13	12	13		0.179	0.2		11.1	0.2	2.0
14	15	18		0.107	0.313		98.1	2.7	264.4
16	24	27		0.793	0.495		46.3	2.2	102.4
17	16	32		0.447	0.278		46.6	4.0	187.8
19	34	54		0.6092	0.3643		50.3	0.5	25.9
24	28	50		0.854	0.6817		22.4	3.2	72.3
25	21	33	53	1.0598	0.447	0.3606	112.3	1.9	210.3
26	22	51		1.0935	0.6		58.3	1.7	98.6
31	52	73		0.418	0.5805		32.5	3.1	101.4
34	48	75		0.556	0.6461		15.0	0.3	4.6
35	62	65		1.1478	0.8408		30.9	0.0	1.0
37	44	104		0.524	0.4561		13.9	1.2	16.0
38	37	42	59	0.58	0.792	0.6	32.3	1.3	43.0
39	64	71		0.607	0.468		25.9	1.3	34.8
43	57	103		0.6	0.6068		1.1	0.3	0.3
44	67	100		0.6	0.5871		2.2	0.1	0.2
45	58	63		0.609	0.728		17.8	0.3	4.5
46	74	94		0.671	0.4514		39.1	0.5	19.3
47	61	70	76	1.2227	0.658	0.5795	78.4	0.7	58.4
48	66	93	95	0.646	0.6676	0.443	38.4	1.8	70.2
49	55	91	98	0.829	0.571	0.6246	38.2	0.3	11.2
50	56	60		0.829	1.0164		20.3	0.6	12.8
51	84	92	155	0.386	0.5375	0.586	39.7	1.0	40.9
53	90	101		0.611	0.668		8.9	0.5	4.5
55	112	119	150	0.8286	0.8239	0.5676	35.3	0.0	0.7
56	83	109		0.6339	0.9625		41.2	0.1	5.3
57	86	97	152	0.7968	0.631	0.5235	42.0	0.1	5.3
58	87	111	115	1.021	0.6601	1.1328	50.4	0.3	15.3
59	85	116		0.7396	1.3987		61.6	0.1	6.8
61	77	110		0.3812	0.65		52.1	0.7	37.9
65	124	135		0.848	0.7031		18.7	0.1	1.9
67	107	108	147	0.8183	1.0654	0.6	56.2	0.1	4.5
69	106	118	149	1.0046	0.87	0.572	53.0	0.5	28.0
70	139	140		0.7219	0.6732		7.0	0.0	0.1
71	134	143	114	0.7331	0.7088	1.0261	38.6	0.1	2.0
72	122	131	133	0.7247	0.8492	1.148	46.7	0.0	0.8
73	146	161		0.728	0.9672		28.2	0.1	2.3
74	105	132		0.94	0.7303		25.1	0.2	5.6
82	138	163		0.827	0.9976		18.7	0.3	5.1
88	182	187		1.1272	1.122		0.5	0.1	0.0
93	174	181		0.806	1.6046		66.3	0.0	2.3
95	156	171		1.389	1.1712		17.0	0.0	0.8
99	200	204		0.369	0.8034		74.1	0.0	0.6
100	172	192		1.172	1.599		30.8	0.0	0.4
110	196	203		1.2321	1.629		27.7	0.0	1.4

Notes

- 1 Congener - Peak matching from HQI DB-1 peak database
- 2 Relative response factors from Erickson, 1992 (cited from Mullin, 1984)
- 3 Average weight percents are area weighted averages pooled by sediment texture for 0-5 cm sections of cores collected from TIP during the 1991 GE sediment survey
- 4 Weight percent values based on data corrected for original Green Bay calibration error
- 5 Potential Bias Index = (Relative Range) x (Mean weight %)

TABLE A-13

Hudson River Sediment Sample Extracts Selected for Reanalysis

NEA File ID	River Mile	Date Collected	Core Depth [cm]		Sediment Texture	PCB [mg/kg dry]			
			Start	End		Peak 5	Peak 8	Peak 14	Total
911718	194	07/11/91	0	5	Coarse	0.19	1.45	0.57	16.11
911719	194	07/11/91	5	10	Coarse	0.19	1.48	0.53	15.35
911720	194	07/11/91	10	25	Coarse	0.29	2.24	0.66	15.16
911778	194	07/15/91	0	5	Fine	5.57	3.57	0.75	45.41
911779	194	07/15/91	5	10	Fine	5.82	4.68	0.77	49.85
911780	194	07/15/91	10	25	Fine	4.02	4.98	0.54	35.11
911943	193	07/16/91	0	5	Coarse	0.06	0.34	0.08	2.61
911944	193	07/16/91	5	10	Coarse	0.03	0.15	0.03	0.98
911945	193	07/16/91	10	25	Coarse	0.03	0.04	0.00	0.31
911924	193	07/17/91	0	5	Fine	0.39	0.90	0.24	8.01
911925	193	07/17/91	5	10	Fine	1.02	1.90	0.39	14.07
911926	193	07/17/91	10	25	Fine	7.45	8.27	0.99	65.38
912182	193	07/24/91	0	5	Fine	0.31	1.46	0.40	9.72
912333	193	07/26/91	0	5	Fine	2.84	3.02	0.54	19.69
912334	193	07/26/91	5	10	Fine	13.38	7.61	1.08	55.88
912335	193	07/26/91	10	25	Fine	47.22	16.54	2.10	148.93
912491	192	07/30/91	0	5	Coarse	3.64	2.32	0.44	17.76
912492	192	07/30/91	5	10	Coarse	12.17	4.04	0.70	42.98
912493	192	07/30/91	10	25	Coarse	8.69	4.42	0.69	34.28
912676	192	07/31/91	0	5	Fine	1.80	3.20	0.45	15.37
912804	192	08/02/91	0	5	Fine	10.71	8.17	1.49	60.50
912805	192	08/02/91	5	10	Fine	24.87	13.56	1.88	99.84
912806	192	08/02/91	10	25	Fine	50.77	22.03	3.59	187.77
913273	191	08/07/91	0	5	Fine	31.80	10.24	1.22	102.74
913393	193	08/12/91	0	5	Coarse	1.46	2.68	0.63	13.52
913680	191	08/15/91	0	5	Coarse	0.86	1.55	0.27	7.98
913850	190	08/16/91	0	5	Fine	2.74	2.75	0.48	18.05
914118	190	08/21/91	0	5	Fine	7.65	5.82	0.98	41.87
914119	190	08/21/91	5	10	Fine	39.67	14.72	2.25	139.66
914120	190	08/21/91	10	25	Fine	71.11	28.75	3.07	243.35
914545	189	08/27/91	0	5	Fine	1.81	1.30	0.31	12.65
914546	189	08/27/91	5	10	Fine	10.93	5.45	0.93	46.33
914547	189	08/27/91	10	25	Fine	46.83	14.16	1.74	150.83
914559	189	08/28/91	0	5	Coarse	3.86	2.86	0.59	23.16
914758	189	08/29/91	0	5	Coarse	0.18	0.22	0.06	1.70
914812	189	08/30/91	0	5	Fine	2.63	3.20	0.64	22.18

TABLE A-14

1991 GE Sediment Survey Samples Analyzed Using the Green Bay Standard

NEA File ID	OBG ID	River Mile	Date Collected	Core Depth [cm]		Laboratory Description	Total PCBs [ppm dry]
				Start	End		
911718	1	194	07/11/91	0	5	8A-C1-(0-5)	16.11
911719	2	194	07/11/91	5	10	8A-C1-(5-10)	15.35
911720	3	194	07/11/91	10	25	8A-C1-(10-25)	15.16
911709	7	194	07/12/91	0	5	8A-C2-(0-5)	15.61
911710	8	194	07/12/91	5	10	8A-C2-(5-10)	28.08
911711	9	194	07/12/91	10	25	8A-C2-(10-25)	13.86
911714	13	194	07/12/91	0	0	8A-C2-GRAB	12.38
911778	14	194	07/15/91	0	5	8A-F1-(0-5)	45.41
911779	15	194	07/15/91	5	10	8A-F1-(5-10)	49.85
911780	16	194	07/15/91	10	25	8A-F1-(10-25)	35.11
911787	20	194	07/16/91	0	5	8A-F2-(0-5)	20.49
911788	21	194	07/16/91	5	10	8A-F2-(5-10)	16.86
911789	22	194	07/16/91	10	25	8A-F2-(10-25)	15.54
911943	38	193	07/16/91	0	5	8B-C1-(0-5)	2.61
911944	39	193	07/16/91	5	10	8B-C1-(5-10)	0.98
911945	40	193	07/16/91	10	25	8B-C1-(10-25)	0.31
911871	26	193	07/17/91	0	5	8B-F1-(0-5)	6.51
911872	27	193	07/17/91	5	10	8B-F1-(5-10)	8.17
911873	28	193	07/17/91	10	25	8B-F1-(10-25)	1.88
911937	32	193	07/17/91	0	5	8B-F2-(0-5)	6.81
911938	33	193	07/17/91	5	10	8B-F2-(5-10)	21.35
911939	34	193	07/17/91	10	25	8B-F2-(10-25)	7.55
911924	42	193	07/17/91	0	5	8B-F3-(0-5)	8.01
911925	43	193	07/17/91	5	10	8B-F3-(5-10)	14.07
911926	44	193	07/17/91	10	25	8B-F3-(10-25)	65.38
912060	48	193	07/18/91	0	5	8B-F4-(0-5)	9.43
912061	49	193	07/18/91	5	10	8B-F4-(5-10)	12.43
912062	50	193	07/18/91	10	25	8B-F4-(10-25)	12.79
912182	54	193	07/24/91	0	5	8B-F5-(0-5)	9.72
912183	55	193	07/24/91	5	10	8B-F5-(5-10)	16.58
912184	56	193	07/24/91	10	25	8B-F5-(10-25)	17.33
912231	60	193	07/25/91	0	5	8B-F6-(0-5)	9.87
912232	61	193	07/25/91	5	10	8B-F6-(5-10)	24.7
912233	62	193	07/25/91	10	25	8B-F6-(10-25)	31.15
912239	66	193	07/25/91	0	5	8B-C2-(0-5)	3.59
912240	67	193	07/25/91	5	10	8B-C2-(5-10)	2.81
912241	68	193	07/25/91	10	25	8B-C2-(10-25)	13.67

Note: Samples identified by personnel from Northeast Analytical, Inc. (NEA) upon review of original laboratory data packages.

TABLE A-15
Laboratory Results from Analysis of Sediment Data Set

NEA ID	River Mile	Sample Date	Core Depth [cm]		Original DB-1 Data [mg/kg]			Reanalyzed DB-1 Data [mg/kg]			CP-SIL5-C18 Congener Data [mg/kg]					
			Start	End	PK5	PK8	PK14	PK5	PK8	PK14	B24	B210	B25	B28	B218	B215
911718	194	7 11 91	0	5	0.19	1.45	0.57	0.19	1.37	0.55	0.79	0.10	0.01	0.78	0.76	0.48
911719	194	7 11 91	5	10	0.19	1.48	0.53	0.18	1.42	0.52	0.82	0.09	0.01	0.83	0.72	0.49
911720	194	7 11 91	10	25	0.29	2.24	0.66	0.27	2.04	0.62	1.63	0.14	0.01	1.42	0.86	0.53
911778	194	7 15 91	0	5	5.57	3.57	0.75	4.58	3.19	0.72	24.80	4.12	0.01	1.42	0.86	0.95
911779	194	7 15 91	5	10	5.82	4.68	0.77	4.90	4.22	0.77	23.87	4.14	0.01	2.44	0.80	1.15
911780	194	7 15 91	10	25	4.02	4.98	0.54	3.29	4.38	0.52	16.63	2.98	0.00	3.04	0.55	0.94
911943	193	7 16 91	0	5	0.06	0.34	0.08	0.06	0.35	0.09	0.32	0.04	0.00	0.22	0.10	0.16
911944	193	7 16 91	5	10	0.03	0.15	0.03	0.03	0.17	0.04	0.11	0.02	0.00	0.10	0.03	0.07
911945	193	7 16 91	10	25	0.03	0.04	0.00	0.02	0.04	0.00	0.11	0.01	0.00	0.02	0.01	0.00
911924	193	7 17 91	0	5	0.39	0.90	0.24	0.37	0.89	0.25	1.39	0.32	0.00	0.54	0.25	0.53
911925	193	7 17 91	5	10	1.02	1.90	0.39	0.97	1.88	0.43	4.07	0.81	0.00	1.13	0.41	0.85
911926	193	7 17 91	10	25	7.45	8.27	0.99	6.69	8.08	1.07	30.92	4.95	0.01	4.61	0.95	1.63
912182	193	7 24 91	0	5	0.31	1.46	0.40	0.31	1.50	0.43	1.44	0.23	0.01	1.03	0.60	0.50
912333	193	7 26 91	0	5	2.84	3.02	0.54	3.35	2.90	0.53	2.24	0.52	0.00	1.61	0.49	0.86
912334	193	7 26 91	5	10	13.38	7.61	1.08	15.46	7.22	1.06	15.06	2.62	0.01	4.08	1.05	1.65
912335	193	7 26 91	10	25	47.22	16.54	2.10	50.89	14.94	1.96	54.34	8.56	0.02	8.53	1.83	2.93
912491	192	7 30 91	0	5	3.64	2.32	0.44	4.27	2.23	0.42	4.54	0.73	0.00	1.33	0.47	0.72
912492	192	7 30 91	5	10	12.17	4.04	0.70	14.36	3.92	0.69	15.29	2.44	0.01	2.17	0.71	1.08
912493	192	7 30 91	10	25	8.69	4.42	0.69	9.78	4.14	0.66	10.70	1.89	0.01	2.41	0.68	0.98
912676	192	7 31 91	0	5	1.80	3.20	0.45	2.10	3.04	0.44	2.10	0.32	0.00	1.99	0.38	1.00
912804	192	8 2 91	0	5	10.71	8.17	1.49	11.17	6.82	1.27	10.44	1.94	0.01	3.94	1.34	2.07
912805	192	8 2 91	5	10	24.87	13.56	1.88	25.72	11.44	1.64	27.09	4.39	0.02	6.59	1.59	2.62
912806	192	8 2 91	10	25	50.77	22.03	3.59	53.18	18.51	3.16	59.69	9.45	0.01	10.72	3.51	4.85
913273	191	8 7 91	0	5	31.80	10.24	1.22	32.93	9.41	1.15	40.55	5.97	0.01	5.65	1.23	1.68
913393	193	8 12 91	0	5	1.46	2.68	0.63	1.65	2.61	0.62	1.94	0.21	0.01	1.68	0.84	0.54
913680	191	8 15 91	0	5	0.86	1.55	0.27	1.04	1.59	0.29	0.99	0.15	0.00	0.98	0.35	0.40
913850	190	8 16 91	0	5	2.74	2.75	0.48	2.80	2.63	0.46	2.96	0.44	0.00	1.57	0.45	0.85
914118	190	8 21 91	0	5	7.65	5.82	0.98	9.23	6.13	1.01	9.95	1.61	0.01	3.74	0.98	1.78
914119	190	8 21 91	5	10	39.67	14.72	2.25	46.28	15.04	2.28	53.39	8.28	0.02	8.88	2.36	3.01
914120	190	8 21 91	10	25	71.11	28.75	3.07	83.52	29.39	3.05	103.23	14.45	0.03	18.71	3.18	3.48
914545	189	8 27 91	0	5	1.81	1.30	0.31	1.70	1.07	0.25	1.22	0.29	0.00	0.60	0.28	0.38
914546	189	8 27 91	5	10	10.93	5.45	0.93	12.71	5.59	0.93	13.85	2.16	0.01	7.96	0.94	1.31
914547	189	8 27 91	10	25	46.83	14.16	1.74	51.17	13.99	1.66	61.28	8.60	0.01	7.96	1.64	1.86
914559	189	8 28 91	0	5	3.86	2.86	0.59	4.61	2.75	0.55	4.78	0.79	0.00	1.58	0.60	0.87
914758	189	8 29 91	0	5	0.18	0.22	0.06	0.23	0.22	0.60	0.19	0.03	0.00	0.12	0.06	0.05
914812	189	8 30 91	0	5	2.63	3.20	0.64	3.37	3.29	0.64	3.63	0.51	0.00	1.93	0.69	1.02

Note: Reported DB-1 values are not corrected for the calibration error in the original Green Bay standard

TABLE A-16

Calculation of Potential Bias Index for Average GE Sediment Pore Water Data

NEA Peak #	Congener BZ#			Relative Response Factor			Relative Range	Avg.WT% in TIP Pore Water	Potential Bias Index
	1st BZ#	2nd BZ#	3rd BZ#	1st BZ#	2nd BZ#	3rd BZ#			
5	4	10		0.0374	0.262		150.0	35.5	5319.1
6	7	9		0.69	0.388		56.0	0.1	7.1
8	5	8		0.119	0.206		53.5	2.9	156.5
13	12	13		0.179	0.2		11.1	0.0	0.4
14	15	18		0.107	0.313		98.1	0.6	63.4
16	24	27		0.793	0.495		46.3	0.9	42.3
17	16	32		0.447	0.278		46.6	1.0	47.8
19	34	54		0.6092	0.3643		50.3	0.1	7.4
24	28	50		0.854	0.6817		22.4	0.6	13.7
25	21	33	53	1.0598	0.447	0.3606	112.3	0.7	75.2
26	22	51		1.0935	0.6		58.3	0.5	31.4
31	52	73		0.418	0.5805		32.5	1.1	35.6
34	48	75		0.556	0.6461		15.0	0.1	1.7
35	62	65		1.1478	0.8408		30.9	0.0	0.1
37	44	104		0.524	0.4561		13.9	0.6	7.6
38	37	42	59	0.58	0.792	0.6	32.3	0.4	12.7
39	64	71		0.607	0.468		25.9	0.5	12.8
43	57	103		0.6	0.6068		1.1	0.1	0.1
44	67	100		0.6	0.5871		2.2	0.0	0.1
45	58	63		0.609	0.728		17.8	0.1	0.9
46	74	94		0.671	0.4514		39.1	0.2	6.0
47	61	70	76	1.2227	0.658	0.5795	78.4	0.3	23.1
48	66	93	95	0.646	0.6676	0.443	38.4	0.7	26.6
49	55	91	98	0.829	0.571	0.6246	38.2	0.1	4.2
50	56	60		0.829	1.0164		20.3	0.3	6.0
51	84	92	155	0.386	0.5375	0.586	39.7	0.4	15.9
53	90	101		0.611	0.668		8.9	0.2	1.8
55	112	119	150	0.8286	0.8239	0.5676	35.3	0.0	0.2
56	83	109		0.6339	0.9625		41.2	0.0	1.8
57	86	97	152	0.7968	0.631	0.5235	42.0	0.1	2.6
58	87	111	115	1.021	0.6601	1.1328	50.4	0.1	5.6
59	85	116		0.7396	1.3987		61.6	0.1	3.5
61	77	110		0.3812	0.65		52.1	0.3	14.2
65	124	135		0.848	0.7031		18.7	0.0	0.7
67	107	108	147	0.8183	1.0654	0.6	56.2	0.0	1.1
69	106	118	149	1.0046	0.87	0.572	53.0	0.2	12.6
70	139	140		0.7219	0.6732		7.0	0.0	0.0
71	134	143	114	0.7331	0.7088	1.0261	38.6	0.0	0.7
72	122	131	133	0.7247	0.8492	1.148	46.7	0.0	0.4
73	146	161		0.728	0.9672		28.2	0.0	0.9
74	105	132		0.94	0.7303		25.1	0.1	2.6
82	138	163		0.827	0.9976		18.7	0.1	2.6
88	182	187		1.1272	1.122		0.5	0.1	0.0
93	174	181		0.806	1.6046		66.3	0.0	1.5
95	156	171		1.389	1.1712		17.0	0.0	0.3
99	200	204		0.369	0.8034		74.1	0.0	0.1
100	172	192		1.172	1.599		30.8	0.0	0.1
110	196	203		1.2321	1.629		27.7	0.0	0.2

Notes

- 1 Congener - Peak matching from HQI DB-1 peak database
- 2 Relative response factors from Erickson, 1992 (cited from Mullin, 1984)
- 3 Average weight percents from 1991 composite core pore water samples collected from TIP
Area-weighted averages for all core sections, justified by small variability in composition with depth
- 4 Weight percent values based on data corrected for original Green Bay calibration error
- 5 Potential Bias Index = (Relative Range) x (Mean weight %)

TABLE A-17

1991 GE Pore Water Samples Analyzed Using the Green Bay Standard

NEA File ID	OBG ID	NEA Sample Description	River Mile	Date Collected	Core Depth [cm]		Total PCB (µg/L)
					Start	End	
911715F	10	8A-C2(0-5)PW	194	7/12/91	0	5	1.57
911781F	17	8A-F1-(0-5)PW	194	7/15/91	0	5	11.99
911782F	18	8A-F1-(5-10)PW	194	7/15/91	5	10	10.25
911783F	19	8A-F1-(10-25)PW	194	7/15/91	10	25	43.79
911790F	23	8A-F2-(0-5)PW	194	7/16/91	0	5	6.13
911791F	24	8A-F2-(5-10)PW	194	7/16/91	5	10	5.71
911792F	25	8A-F2-(10-25)PW	194	7/16/91	10	25	4.68
911874F	29	8B-F1-(0-5)PW	193	7/17/91	0	5	3.82
911940F	35	8B-F2(0-5)PW	193	7/18/91	0	5	5.29
911942F	37	8B-F2(10-25)PW	193	7/18/91	10	25	9.03
911946F	41	8B-C1(0-5)PW	193	7/18/91	0	5	4.55
911927F	45	8B-F3-(0-5)PW	193	7/19/91	0	5	2.97
911928F	46	8B-F3-(5-10)PW	193	7/19/91	5	10	3.6
911929F	47	8B-F3(10-25)PW	193	7/19/91	10	25	48.03
912063F	51	8B-F4(0-5)PW	193	7/22/91	0	5	3.32
912064F	52	8B-F4(5-10)PW	193	7/22/91	5	10	8.3
912065F	53	8B-F4(10-25)PW	193	7/22/91	10	25	5.16
912185F	57	8B-F5(0-5)PW	193	7/24/91	0	5	4.39
912187F	59	8B-F5(10-25)PW	193	7/24/91	10	25	3.15
912234F	63	8B-F6(0-5)PW	193	7/25/91	0	5	4.99
912235F	64	8B-F6(5-10)PW	193	7/25/91	5	10	12.61
912236F	65	8B-F6(10-25)PW	193	7/25/91	10	25	21.59
912243F	69	8B-C2(0-5)PW	193	7/25/91	0	5	9.27
912245F	71	8B-C2(10-25)PW	193	7/25/91	10	25	20.16
912336F	75	8B-F7(0-5)PW	193	7/26/91	0	5	4.32
912337F	76	8B-F7(5-10)PW	193	7/26/91	5	10	26.6
912338F	77	8B-F7(10-25)PW	193	7/26/91	10	25	0.87
912348F	81	8B-C3(0-5)PW	193	7/29/91	0	5	0.7
912350F	83	8B-C3(10-25)PW	193	7/29/91	10	25	5.32
912500F	88	8C-F1-(0-5)PW	192	7/30/91	0	5	11.83
912486F	94	8C-F2(0-5)PW	192	7/31/91	0	5	5.47
912487F	95	8C-F2(5-10)PW	192	7/31/91	5	10	5.22
912488F	96	8C-F2(10-25)PW	192	7/31/91	10	25	19.56
912494F	100	8C-C1(0-5)PW	192	7/31/91	0	5	5.15
912673F	120	8C-F5(0-5)PW	192	8/2/91	0	5	15.31
912674F	121	8C-F5(5-10)PW	192	8/2/91	5	10	21.59
912675F	122	8C-F5(10-25)PW	192	8/2/91	10	25	41.01
912773F	120.1	8C-F5-(0-5) PW #120	192	8/2/91	0	5	5.21
912775F	122.1	8C-F5-(10-25)PW #122	192	8/2/91	10	25	10.01
912807F	126	8C-F6-(0-5)PW #126	192	8/5/91	0	5	4.79
913116F	139	8D-F1-(5-10)PW #139	191	8/7/91	5	10	14.49
913278F	147	8D-F2-(10-25)PW #147	191	8/8/91	10	25	38.48
915402F	330	6B-F2(0-5)-330	184.8	9/12/91	0	5	19.58
915403F	331	6B-F2(5-10)-331	184.8	9/12/91	5	10	23.21
915404F	332	6B-F2(10-25)332	184.8	9/12/91	10	25	25.72
915760F	358	5EF-F1(0-5)358	178.5	9/20/91	0	5	2.53
915761F	359	5EF-F1(5-10)359	178.5	9/20/91	5	10	8.33
915762F	360	5EFF1(10-25)360	178.5	9/20/91	10	25	9.77
915958F	377	5GH-F1(0-5)-377	176.5	9/24/91	0	5	1.32
915959F	378	5GH-F1(5-10)378	176.5	9/24/91	5	10	1.83
915960F	379	5GHF1(10-25)379	176.5	9/24/91	10	25	10.35
916129F	390	5IJ-F1(0-5)390	174.5	9/26/91	0	5	2.75
916130F	391	5IJ-F1(5-10)391	174.5	9/26/91	5	10	4.97
916131F	392	5IJF1(10-25)392	174.5	9/26/91	10	25	18.17

Note: Samples identified by personnel from O'Brien and Gere Engineers, Inc. upon review of original laboratory data packages.

TABLE A-18
Calculation of Potential Bias Index for GE Biota Data

NEA Peak #	IUPAC Congener #			Relative Response Factor			Relative Range	Avg. WT% in UHR Biota	Potential Bias Index
	1st BZ#	2nd BZ#	3rd BZ#	1st BZ#	2nd BZ#	3rd BZ#			
5	4	10		0.0374	0.262		150.0	3.0	443.7
6	7	9		0.69	0.388		56.0	0.1	3.3
8	5	8		0.119	0.206		53.5	1.1	60.3
13	12	13		0.179	0.2		11.1	0.0	0.1
14	15	18		0.107	0.313		98.1	1.0	102.4
16	24	27		0.793	0.495		46.3	0.5	23.6
17	16	32		0.447	0.278		46.6	2.1	97.3
19	34	54		0.6092	0.3643		50.3	0.2	8.2
24	28	50		0.854	0.6817		22.4	3.9	86.8
25	21	33	53	1.0598	0.447	0.3606	112.3	1.2	140.1
26	22	51		1.0935	0.6		58.3	1.5	85.1
31	52	73		0.418	0.5805		32.5	6.2	202.7
34	48	75		0.556	0.6461		15.0	0.7	10.8
35	62	65		1.1478	0.8408		30.9	0.0	0.5
37	44	104		0.524	0.4561		13.9	2.7	37.9
38	37	42	59	0.58	0.792	0.6	32.3	2.6	84.9
39	64	71		0.607	0.468		25.9	3.4	86.7
43	57	103		0.6	0.6068		1.1	0.3	0.4
44	67	100		0.6	0.5871		2.2	0.3	0.6
45	58	63		0.609	0.728		17.8	0.8	13.8
46	74	94		0.671	0.4514		39.1	2.4	95.5
47	61	70	76	1.2227	0.658	0.5795	78.4	2.7	209.2
48	66	93	95	0.646	0.6676	0.443	38.4	7.9	302.0
49	55	91	98	0.829	0.571	0.6246	38.2	0.9	35.2
50	56	60		0.829	1.0164		20.3	2.8	56.4
51	84	92	155	0.386	0.5375	0.586	39.7	2.9	115.6
53	90	101		0.611	0.668		8.9	3.2	28.4
55	112	119	150	0.8286	0.8239	0.5676	35.3	0.1	3.7
56	83	109		0.6339	0.9625		41.2	0.6	23.5
57	86	97	152	0.7968	0.631	0.5235	42.0	0.9	38.2
58	87	111	115	1.021	0.6601	1.1328	50.4	2.0	100.9
59	85	116		0.7396	1.3987		61.6	1.3	77.6
61	77	110		0.3812	0.65		52.1	3.4	178.5
65	124	135		0.848	0.7031		18.7	0.2	4.6
67	107	108	147	0.8183	1.0654	0.6	56.2	0.6	34.4
69	106	118	149	1.0046	0.87	0.572	53.0	4.3	226.4
70	139	140		0.7219	0.6732		7.0	0.0	0.1
71	134	143	114	0.7331	0.7088	1.0261	38.6	0.3	12.6
72	122	131	133	0.7247	0.8492	1.148	46.7	0.1	4.6
73	146	161		0.728	0.9672		28.2	0.5	14.8
74	105	132		0.94	0.7303		25.1	1.8	44.5
82	138	163		0.827	0.9976		18.7	2.7	50.8
88	182	187		1.1272	1.122		0.5	0.8	0.4
93	174	181		0.806	1.6046		66.3	0.3	17.9
95	156	171		1.389	1.1712		17.0	0.5	7.7
99	200	204		0.369	0.8034		74.1	0.0	1.4
100	172	192		1.172	1.599		30.8	0.2	6.2
110	196	203		1.2321	1.629		27.7	0.3	9.6

Notes

- 1 Congener - Peak matching from HQI DB-1 peak database
- 2 Relative response factors from Erickson, 1992 (cited from Mullin, 1984)
- 3 Average weight percents based on upper Hudson River biota data from GE database
- 4 Weight percent values based on data corrected for original Green Bay calibration error
- 5 Potential Bias Index = (Relative Range) x (Mean weight %)