

DETERMINATION OF PCDD/PCDF LEVELS

Prepared for:
Rhode Island Department of Health
Attn: Robert R. Vanderslice
Three Capitol Hill
Room 208
Providence, RI 02908

Project: Chemical Analysis

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

5675

REPORT OF: CHEMICAL ANALYSES

PROJECT: PCDD/PCDF ANALYSES **DATE:** September 9, 1999
ISSUED TO: Rhode Island Department of Health **REPORT NO:** 99-1015992
Attn: Mr. Robert Vanderslice
Three Capitol Hill, Room 208
Providence, RI 02908

INTRODUCTION

This report summarizes the results from the analysis performed on eight samples submitted by a representative of Rhode Island Department of Health. The samples were analyzed for the presence of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) using a modified version of USEPA Method 1613 as described below. Co-planar polychlorinated biphenyls are reported under separate cover.

SAMPLE IDENTIFICATION

<u>Client ID</u>	<u>Sample Type</u>	<u>Date Received</u>	<u>Pace ID</u>
Sample 1: 2 Yellow Perch, Canada Pond	Tissue	06/30/99	1370468
Sample 2: 3 Largemouth Bass, Roger Williams Pond	Tissue	06/30/99	1370476
Sample 3: 3 Largemouth Bass, Mashapaug Pond	Tissue	06/30/99	1370484
Sample 4: 2 Eel, Woonasquatucket at Centredale	Tissue	06/30/99	1370492
Sample 5: 2 Pumpkinseed, Woonasquatucket at Esmond	Tissue	06/30/99	1370518
Sample 6: 2 Carp, Mashapaug Pond	Tissue	06/30/99	1370526
Sample 7: 2 Bluegill, Woonasquatucket at Esmond	Tissue	06/30/99	1370542
Sample 8: 2 Eel, Woonasquatucket at Esmond	Tissue	06/30/99	1370559

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

REPORT OF: CHEMICAL ANALYSES

Tel: 612-607-1700
Fax: 612-607-6444PROJECT: PCDD/PCDF ANALYSES

DATE: September 9, 1999

PAGE: 2

REPORT NO: 99-1015992

METHODOLOGY

Sample Extraction

A portion of each sample was spiked with $^{13}\text{C}_{12}$ -labeled PCDD/PCDF internal standards (Table 1) and extracted with hexane/methylene chloride (1:1) in a Soxhlet extractor. The extract was quantitatively transferred to a Kuderna Danish concentrator, concentrated, and solvent exchanged to hexane. The hexane extract was then spiked with the 2,3,7,8-TCDD- $^{37}\text{Cl}_4$ enrichment efficiency standard (Table 1) and processed through the analyte enrichment procedures described below.

Analyte Enrichment for PCDD/PCDF Analyses

The extraction procedure often removes a variety of compounds, in addition to the PCDDs and PCDFs, from the sample matrix. Some of these compounds can directly interfere with the analyses while others can overload the capillary column causing degradation in chromatographic resolution or sensitivity. The analyte enrichment steps described below were used to remove interferences from the extract.

Each sample extract was transferred to a separatory funnel, diluted to 100 mL with hexane, and washed with 1N sodium hydroxide, concentrated sulfuric acid and 5% aqueous sodium chloride (w/v) as needed. The hexane layer was concentrated to 1 mL and quantitatively transferred to a liquid chromatography column containing alternating layers of silica gel, 40% concentrated sulfuric acid on silica gel, and 33% 1N sodium hydroxide on silica gel. The column was eluted with 90 mL of hexane and the entire eluate was collected and concentrated, under ambient conditions, to a volume of 1 mL.

Each extract was then fractionated on a liquid chromatography column containing 4 g of activated alumina. The column was eluted with 20 mL of hexane followed by 15 mL of 60% methylene chloride/hexane. The 60% methylene chloride/hexane fraction was concentrated to 1 mL under a stream of dry nitrogen and applied to the top of a chromatography column containing 1 g of 5% AX-21 activated carbon in silica gel. The column was eluted with two 2 mL portions of hexane, 2 mL of cyclohexane/methylene chloride (50:50 v/v) and cyclohexane/methanol/toluene (75:20:5 v/v) in the forward direction, and then with toluene in the reverse direction. The toluene fraction was collected, spiked with recovery standards (1,2,3,4-TCDD- $^{13}\text{C}_{12}$ and 1,2,3,7,8,9-HxCDD- $^{13}\text{C}_{12}$) and taken to a final volume of 20 μL .

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

REPORT OF: CHEMICAL ANALYSES

Tel: 612-607-1700
Fax: 612-607-6444

PROJECT: PCDD/PCDF ANALYSES

DATE: September 9, 1999

PAGE: 3

REPORT NO: 99-1015992

PCDD/PCDF Analyses

Each extract was analyzed for the presence of PCDDs and PCDFs using combined capillary column gas chromatography / high resolution mass spectrometry (HRGC/HRMS). The instrumentation consisted of a Hewlett Packard Model 5890 gas chromatograph and a VG Model 70VSE high resolution mass spectrometer. The capillary column was interfaced directly into the ion source of the mass spectrometer, thus providing the highest possible sensitivity while minimizing degradation of the chromatographic resolution.

The mass spectrometer was operated in the electron impact ionization mode at a mass resolution of 10,000-11,000 ($M/\Delta M$, 10 percent valley definition). This resolution is sufficient to resolve most interferences, such as PCBs, thus providing the highest level of confidence that the detected levels of PCDD/PCDF are not false positives resulting from interferences. Typical operating parameters for the HRGC/HRMS analyses are summarized in Table 2.

The data were acquired by selected-ion-recording (SIR) monitoring of the groups of ion masses described in USEPA Method 1613. The five groups corresponded to the tetrachlorinated through octachlorinated congener classes. Each group contained two ion masses for the PCDDs, two ion masses for the PCDFs, the corresponding ion masses from the two isotopically labeled internal standards, and the ion mass characteristic of the polychlorinated diphenylether (PCDPE) which, if present, could cause false responses in the dibenzofuran channels.

Each group of ion masses also contained a lock mass which was monitored during the analysis to detect suppressive interferences. It is particularly important to detect this type of interference since it can cause the quantification of congener class levels to be artificially high if it occurs during the elution of an internal standard or low if it occurs during the elution of the native analytes.

The lock mass was also used by the data system to automatically correct the mass focus of the instrument. The data system determined the centroid of the lock mass during each data acquisition cycle and corrected the mass focus of the analyte and internal standard ion masses to assure that the centers of the mass peaks were being monitored.

The criteria used to judge positive responses for the PCDD/PCDF isomer included:

- * Simultaneous response at both ion masses of the PCDD or PCDF
- * Signal to noise ratio equal to or greater than 2.5:1.0 for both ion masses
- * Chlorine isotope ratio within 15% of the theoretical value
- * Chromatographic retention time within +/- 2 seconds of the expected retention times
- * Chromatographic retention times within elution windows determined from analyses of standard mixtures
- * Absence of simultaneous response in the furan and diphenylether ion traces

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

REPORT OF: CHEMICAL ANALYSES

Tel: 612-607-1700
Fax: 612-607-6444PROJECT: PCDD/PCDF ANALYSES

DATE: September 9, 1999

PAGE: 4

REPORT NO: 99-1015992

PCDD/PCDF Analyses (Cont.)

A list of the exact ion masses monitored for the determination of PCDD/PCDF isomers and the PCDFE interferences is presented in Table 3. Also included are the theoretical chlorine isotope ratios for the ten congener classes.

PCDD/PCDF Quantification and Calculations

The PCDD/PCDF isomers were quantified by comparison of their responses to the responses of the labeled internal standards as described in EPA Method 1613. Relative response factors were calculated from analyses of standard mixtures containing representatives of each of the PCDD/PCDF congener classes at five concentration levels, and each of the internal standards at one concentration level, as shown in Table 4. The PCDD/PCDF response factors were calculated by comparing the sum of the responses from the two ion masses monitored for each chlorine congener class to the sum of the responses from the two ion masses of the corresponding isotopically labeled internal standard. The formula for the response factor calculation is:

$$Rf = \frac{A_n \times Q_{is}}{A_{is} \times Q_n}$$

where:

- Rf = Response factor
- A_n = Sum of integrated areas for native isomer
- Q_{is} = Quantity of labeled internal standard
- A_{is} = Sum of integrated areas for labeled internal standard
- Q_n = Quantity of native isomer

The levels of PCDD/PCDF in each sample were quantified using the following equation:

$$C = \frac{A_n \times Q_{is}}{A_{is} \times W \times Rf}$$

where:

- C = Concentration of target isomer or congener class
- A_n = Sum of integrated areas for the target isomer or congener class
- Q_{is} = Quantity of labeled internal standard added to the sample
- A_{is} = Sum of integrated areas for the labeled internal standard
- W = Sample weight, volume or area
- Rf = Response factor

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

REPORT OF: CHEMICAL ANALYSES

Tel: 612-607-1700
Fax: 612-607-6444PROJECT: PCDD/PCDF ANALYSES

DATE: September 9, 1999

PAGE 5

REPORT NO: 99-1015992

PCDD/PCDF Quantification and Calculations (Cont.)

Each pair of ion mass peaks in the selected-ion-current chromatograms was evaluated manually to determine if it met the criteria for a PCDD or PCDF isomer. Areas of all peaks exhibiting correct ion ratios and having retention times within the correct windows were then summed for calculations of total congener concentrations.

A Pace Reporting Limit (PRL), equivalent to the practical quantitation limit, was calculated based on the weight of sample extracted, the volume of the final extract, and the concentration of the lowest level standard in the initial calibration. A PRL was calculated for each isomer/isomer group using the following equation:

$$\text{PRL} = \frac{(C \times V)}{W}$$

where:

PRL = Pace Reporting Limit
C = Concentration of Lowest Level Standard
V = Volume of Final Extract
W = Initial Sample Weight or Volume

The recovery of the enrichment efficiency standard and each $^{13}\text{C}_{12}$ -labeled internal standard, relative to either 1,2,3,4-TCDD- $^{13}\text{C}_{12}$ or 1,2,3,7,8,9-HxCDD- $^{13}\text{C}_{12}$, was calculated using the following equation:

$$\%R = \frac{\text{Ais} \times \text{Qrs} \times 100\%}{\text{Rfr} \times \text{Ars} \times \text{Qis}}$$

where:

%R = Percent recovery of labeled internal standard
Ais = Sum of integrated areas of labeled internal standard
Qrs = Quantity of recovery standard
Ars = Sum of integrated areas of recovery standard
Rfr = Response factor of the specific labeled internal standard relative to the recovery standard
Qis = Quantity of the labeled standard added to the sample

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

REPORT OF: CHEMICAL ANALYSES

Tel: 612-607-1700
Fax: 612-607-6444

PROJECT: PCDD/PCDF ANALYSES

DATE: September 9, 1999

PAGE. 6

REPORT NO: 99-1015992

Quality Control

The performance of the sample processing steps and the instrumentation are monitored on a routine basis. The procedures and criteria are summarized below.

One method blank and one laboratory spike sample are typically prepared with each ten samples of a given matrix. Recoveries of the native PCDD/PCDF analytes in the laboratory spike samples generally range from 70 to 130%. Recoveries of selected analytes outside this range do not invalidate the data but provide information that is used by the laboratory to monitor recovery trends and to assure optimization of the method.

Internal standards are spiked into each sample prior to extraction in order to monitor the level of recovery that is achieved for each individual sample. Acceptable recoveries range from 25 to 150 percent for the internal standards unless a deviation is due to variation in instrument response as a result of analytical interferences.

The resolution of the mass spectrometer is verified prior to each analysis to be 10,000 or greater. Hardcopies of the reference peaks are printed at the beginning and end of each analysis day. The resolving power of the DB-5MS chromatographic column is checked daily by analyzing a standard solution containing 2,3,7,8-TCDD and the adjacent TCDD isomers. The DB-225 column resolution is checked daily by analyzing a standard solution containing 2,3,7,8-TCDF and the adjacent TCDF isomers. Acceptable performance is achieved when 2,3,7,8-TCDD or 2,3,7,8-TCDF is resolved from the adjacent isomers by a valley of 25% or less. The group times for the selected-ion-monitoring data acquisitions are also checked daily by analyzing the column performance mix which has been modified to contain the first and last eluting isomers of each congener class. In this way, one is assured of collecting data representative of the total PCDD/PCDF content and that the 2,3,7,8-substituted isomers are suitably resolved.

Initial calibrations are generated by analyzing standard solutions (see Table 4) containing target native and labeled PCDD/PCDF compounds. Response factors are calculated and averaged for each compound. These averages are used for quantification and for comparison to the daily continuing calibration. The relative standard deviation for each native compound must be 20% or less (30% or less for the labeled compounds) as specified in Method 8290. A continuing calibration standard is analyzed at the beginning of each 12-hour shift on days when initial calibrations are not performed. The initial calibration is considered to be valid when the response factors from the continuing calibration analysis fall to within the ranges specified in Method 1613.

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

REPORT OF: CHEMICAL ANALYSES

Tel: 612-607-1700
Fax: 612-607-6444

PROJECT: PCDD/PCDF ANALYSES

DATE: September 9, 1999

PAGE: 7

REPORT NO: 99-1015992

RESULTS

The results from the analyses are included in the following:

- Appendix A - Chain of Custody Documentation
- Appendix B - PCDD/PCDF Analysis Results

DISCUSSION

The recoveries of the isotopically-labeled PCDD/PCDF internal standards in the sample extracts ranged from 23-93%, indicating a level of efficiency through the extraction and enrichment steps that is considered typical to somewhat low for this matrix. With the exception of the labeled 1,2,3,4,6,7,8-HpCDF in sample 7, all of the labeled standard recoveries obtained for this project were within the control ranges specified in Method 1613. Also, since the quantifications of the native 2,3,7,8-substituted isomers were based on isotope dilution, the data were automatically corrected for variation in recovery and accurate values were obtained.

The labeled cleanup standard was apparently not added to sample #8. Since the internal standard recoveries were similar to the remaining samples and since all internal standard recoveries were within the target recovery range, no further action was taken.

The concentrations reported for positive responses for 2,3,7,8-TCDF are those from the DB-5 MS capillary column. Each analysis using the DB-225 confirmation column resulted in an interference for this compound. The results of confirmation analyses are typically very similar to the DB-5 MS results.

A laboratory method blank was prepared and analyzed with the sample batch as part of our routine quality control procedures. The results, found at the beginning of Appendix B, show the blank to be free of PCDDs and PCDFs and indicate that the sample processing steps did not significantly impact the results of the analysis.

Laboratory spike and spike duplicate samples were also prepared with the sample batch by extracting clean sand that had been fortified with native standard materials. The results, found at the end of Appendix B, show that the spiked native compounds were recovered at 91-123% with relative percent differences of 0.9-16.2%. This indicates high degrees of accuracy and precision for these determinations.

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

REPORT OF: CHEMICAL ANALYSES

Tel: 612-607-1700
Fax: 612-607-6444

PROJECT: PCDD/PCDF ANALYSES

DATE: September 9, 1999

PAGE: 8

REPORT NO: 99-1015992

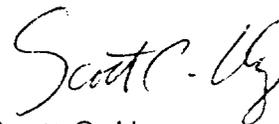
REMARKS

The sample extracts will be retained for a period of 30 days from the date of this report and then discarded unless other arrangements are made. The raw mass spectral data will be archived on magnetic tape for a period of not less than one year. Questions regarding the data contained in this report may be directed to the authors at the numbers provided below.

Pace Analytical Services, Inc.



Charles V. Sueper, Manager
High Resolution Mass Spectrometry
(612) 607-6387



Scott C. Unze
Project Manager, HRMS
(612) 607-6383

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

TABLE 1. Spike Levels of PCDD/PCDF Standards

Tel: 612-607-1700
Fax: 612-607-6444

Internal Standards	Spike Level (ng)
2,3,7,8-TCDF- ¹³ C ₁₂	2.0
2,3,7,8-TCDD- ¹³ C ₁₂	2.0
1,2,3,7,8-PeCDF- ¹³ C ₁₂	2.0
2,3,4,7,8-PeCDF- ¹³ C ₁₂	2.0
1,2,3,7,8-PeCDD- ¹³ C ₁₂	2.0
1,2,3,4,7,8-HxCDF- ¹³ C ₁₂	2.0
1,2,3,6,7,8-HxCDF- ¹³ C ₁₂	2.0
2,3,4,6,7,8-HxCDF- ¹³ C ₁₂	2.0
1,2,3,7,8,9-HxCDF- ¹³ C ₁₂	2.0
1,2,3,4,7,8-HxCDD- ¹³ C ₁₂	2.0
1,2,3,6,7,8-HxCDD- ¹³ C ₁₂	2.0
1,2,3,4,6,7,8-HpCDF- ¹³ C ₁₂	2.0
1,2,3,4,7,8,9-HpCDF- ¹³ C ₁₂	2.0
1,2,3,4,6,7,8-HpCDD- ¹³ C ₁₂	2.0
OCDD- ¹³ C ₁₂	4.0
<u>Recovery Standards</u>	
1,2,3,4-TCDD- ¹³ C ₁₂	2.0
1,2,3,7,8,9-HxCDD- ¹³ C ₁₂	2.0
<u>Enrichment Efficiency Standard</u>	
2,3,7,8-TCDD- ³⁷ Cl ₄	0.2

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

**TABLE 2. High Resolution PCDD/PCDF Analyses
HRGC/HRMS Operating Parameters**

Mass Resolution	10,000-11,000 (M/ Δ M, 10% valley)
Electron Energy	32 electron volts
Accelerating Voltage	8,000 volts
Source Temperature	275°C
Preamplifier Gain	10 ⁻⁶ amp/volt
Multiplier Gain	~ 10 ⁵
Chromatographic Column	60 M DB-5MS
Transfer Line Temperature	240°C
Injection Mode	Splitless
Carrier Gas	Helium
Carrier Flow Velocity	~ 30 cm/sec

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

**TABLE 3. Exact Ion Masses Monitored
for the Determination of PCDDs, PCDFs, and PCDEs**

Compound	Accurate Mass		Theoretical Ratio Mass 1/Mass 2
	Mass 1	Mass 2	
Tetra-CDDs	319.8965	321.8936	0.77
Tetra-CDFs	303.9016	305.8987	0.77
Hexa-CDEs	375.8364		
Penta-CDDs	355.8546	357.8517	1.54
Penta-CDFs	339.8597	341.8567	1.54
Hepta-CDEs	409.7974		
Hexa-CDDs	389.8156	391.8127	1.23
Hexa-CDFs	373.8207	375.8178	1.23
Octa-CDEs	445.7555		
Hepta-CDDs	423.7766	425.7737	1.03
Hepta-CDFs	407.7817	409.7788	1.03
Nona-CDEs	479.7165		
Octa-CDD	457.7377	459.7347	0.88
Octa-CDF	441.7428	443.7398	0.88
Deca-CDE	513.6775		

CDDs = Chlorinated Dibenzo-p-dioxins

CDFs = Chlorinated Dibenzofurans

CDEs = Chlorinated Diphenylethers

REPORT OF LABORATORY ANALYSISThis report shall not be reproduced, except in full
without the written consent of Pace Analytical Services, Inc.

TABLE 4. High Resolution Calibration Solutions

Native CDDs/CDFs	Concentration (pg/uL)				
	CS1	CS2	CS3	CS4	CS5
2,3,7,8-TCDD	0.5	2	10	40	200
2,3,7,8 TCDF	0.5	2	10	40	200
1,2,3,7,8-PeCDD	2.5	10	50	200	1000
1,2,3,7,8-PeCDF	2.5	10	50	200	1000
2,3,4,7,8-PeCDF	2.5	10	50	200	1000
1,2,3,4,7,8-HxCDD	2.5	10	50	200	1000
1,2,3,6,7,8-HxCDD	2.5	10	50	200	1000
1,2,3,7,8,9-HxCDD	2.5	10	50	200	1000
1,2,3,4,7,8-HxCDF	2.5	10	50	200	1000
1,2,3,6,7,8-HxCDF	2.5	10	50	200	1000
1,2,3,7,8,9-HxCDF	2.5	10	50	200	1000
2,3,4,6,7,8-HxCDF	2.5	10	50	200	1000
1,2,3,4,6,7,8-HpCDD	2.5	10	50	200	1000
1,2,3,4,6,7,8-HpCDF	2.5	10	50	200	1000
1,2,3,4,7,8,9-HpCDF	2.5	10	50	200	1000
OCDD	5.0	20	100	400	2000
OCDF	5.0	20	100	400	2000
Internal Standards					
2,3,7,8-TCDD- ¹³ C ₁₂	100	100	100	100	100
2,3,7,8-TCDF- ¹³ C ₁₂	100	100	100	100	100
1,2,3,7,8-PeCDD- ¹³ C ₁₂	100	100	100	100	100
1,2,3,7,8-PeCDF- ¹³ C ₁₂	100	100	100	100	100
2,3,4,7,8-PeCDF- ¹³ C ₁₂	100	100	100	100	100
1,2,3,4,7,8-HxCDD- ¹³ C ₁₂	100	100	100	100	100
1,2,3,6,7,8-HxCDD- ¹³ C ₁₂	100	100	100	100	100
1,2,3,4,7,8-HxCDF- ¹³ C ₁₂	100	100	100	100	100
1,2,3,6,7,8-HxCDF- ¹³ C ₁₂	100	100	100	100	100
1,2,3,7,8,9-HxCDF- ¹³ C ₁₂	100	100	100	100	100
2,3,4,6,7,8-HxCDF- ¹³ C ₁₂	100	100	100	100	100
1,2,3,4,6,7,8-HpCDD- ¹³ C ₁₂	100	100	100	100	100
1,2,3,4,6,7,8-HpCDF- ¹³ C ₁₂	100	100	100	100	100
1,2,3,4,7,8,9-HpCDF- ¹³ C ₁₂	100	100	100	100	100
OCDD- ¹³ C ₁₂	200	200	200	200	200
Recovery Standards					
1,2,3,4-TCDD- ¹³ C ₁₂	100	100	100	100	100
1,2,3,7,8,9-HxCDD- ¹³ C ₁₂	100	100	100	100	100
Enrichment Efficiency Standard					
2,3,7,8-TCDD- ³⁷ C ₁₄	0.5	2	10	40	200

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

TABLE 5. 2,3,7,8-TCDD Equivalency Factors (TEFs) for the Polychlorinated Dibenzop-dioxins and Dibenzofurans

Number	Compound(s)	TEF
1	2,3,7,8-TCDD	1.00
2	1,2,3,7,8-PeCDD	0.50
3	1,2,3,6,7,8-HxCDD	0.1
4	1,2,3,7,8,9-HxCDD	0.1
5	1,2,3,4,7,8-HxCDD	0.1
6	1,2,3,4,6,7,8-HpCDD	0.01
7	OCDD	0.001
8	* Total - TCDD	0.0
9	* Total - PeCDD	0.0
10	* Total - HxCDD	0.0
11	* Total - HpCDD	0.0
12	2,3,7,8-TCDF	0.10
13	1,2,3,7,8-PeCDF	0.05
14	2,3,4,7,8-PeCDF	0.5
15	1,2,3,6,7,8-HxCDF	0.1
16	1,2,3,7,8,9-HxCDF	0.1
17	1,2,3,4,7,8-HxCDF	0.1
18	2,3,4,6,7,8-HxCDF	0.1
19	1,2,3,4,6,7,8-HpCDF	0.01
20	1,2,3,4,7,8,9-HpCDF	0.01
21	OCDF	0.001
22	* Total - TCDF	0.0
23	* Total - PeCDF	0.0
24	* Total - HxCDF	0.0
25	* Total - HpCDF	0.0

*Excluding the 2,3,7,8-substituted congeners.

Reference: 1989 ITEFs

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc.

APPENDIX A

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

101599Z

5/20	Sample 1: 2 yellow perch	Canada Pond 1370468-
5/20	Sample 2: 3 largemouth bass	Roger Williams Pond 1370476-
5/24	Sample 3: 3 largemouth bass	Mashapaug Pond 1370484-
5/24	Sample 4: 2 eel	Woonasquatucket at Centredale 1370492-
5/24	Sample 5: 2 pumpkinseed	Woonasquatucket at Esmond 1370518-
5/24	Sample 6: 2 carp	Mashapaug Pond 1370526-
5/24	Sample 7: 2 bluegill	Woonasquatucket at Esmond 1370542-
5/24	Sample 8: 2 eel	Woonasquatucket at Esmond 1370559-

Scott C. Key / PACE 6/30 14:00

101599Z

✓	Sample 1: 2 yellow perch	Canada Pond 1370468
5/20	Sample 2: 3 largemouth bass	Roger Williams Pond 1370475
5/20	Sample 3: 3 largemouth bass	Mashapaug Pond 1370484
5/24	Sample 4: 2 eel	Woonasquatucket at Centredale 1370492
5/24	Sample 5: 2 pumpkinseed	Woonasquatucket at Esmond 1370518
5/20	Sample 6: 2 carp	Mashapaug Pond 1370526
5/24	Sample 7: 2 bluegill	Woonasquatucket at Esmond 1370542
5/24	Sample 8: 2 eel	Woonasquatucket at Esmond 1370559



STATE OF RHODE ISLAND
DEPARTMENT OF HEALTH
ENVIRONMENTAL HEALTH RISK ASSESSMENT

ROBERT R. VANDERSLICE, Ph. D.
CHIEF

Three Capitol Hill, Room 208
Providence, RI 02908-5907

Phone: (401) 222-4948 ext. 2103
Fax: (401) 222-6953

02908

Scott C. Key / PHCE 6/30 14:00

Dioxin & coplanar PCBs

APPENDIX B

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

```

Lab Sample ID.....BLANK-072399
Filename.....V90805K
Injected By.....BAL
Total Amount Extracted...0.0100 kg
% Moisture.....NA %
Dry Weight Extracted.....NA
ICAL Date.....08/04/99
CCAL Filename(s).....V90805I
Method Blank ID.....NA
Matrix.....TISSUE
Dilution....NA
Collected...NA
Received....NA
Extracted...07/23/99
Analyzed....08/05/99 18:59
    
```

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	ND	1.0	2378-TCDF-13C....	2.00	51
TOTAL TCDF	ND	-----	2378-TCDD-13C....	2.00	64
			12378-PeCDF-13C..	2.00	44
2378-TCDD	ND	1.0	23478-PeCDF-13C..	2.00	51
TOTAL TCDD	ND	-----	12378-PeCDD-13C..	2.00	60
			123478-HxCDF-13C.	2.00	64
12378-PeCDF	ND	5.0	123678-HxCDF-13C.	2.00	68
23478-PeCDF	ND	5.0	234678-HxCDF-13C.	2.00	76
TOTAL PeCDF	ND	-----	123789-HxCDF-13C.	2.00	71
			123478-HxCDD-13C.	2.00	86
12378-PeCDD	ND	5.0	123678-HxCDD-13C.	2.00	68
TOTAL PeCDD	ND	-----	1234678-HpCDF-13C	2.00	58
			1234789-HpCDF-13C	2.00	57
123478-HxCDF	ND	5.0	1234678-HpCDD-13C	2.00	75
123678-HxCDF	ND	5.0	OCDD-13C.....	4.00	95
234678-HxCDF	ND	5.0			
123789-HxCDF	ND	5.0	1234-TCDD-13C....	2.00	NA
TOTAL HxCDF	ND	-----	123789-HxCDD-13C.	2.00	NA
123478-HxCDD	ND	5.0	2378-TCDD-37C14..	0.20	60
123678-HxCDD	ND	5.0			
123789-HxCDD	ND	5.0			
TOTAL HxCDD	ND	-----			
1234678-HpCDF	ND	5.0			
1234789-HpCDF	ND	5.0			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	5.0			
TOTAL HpCDD	ND	-----			
OCDF	ND	10.0			
OCDD	ND	10.0			

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)
PRL = Pace Reporting Limit
ND = Not Detected
NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

```

Client's Sample ID.....SAMPLE 1: 2 YELLOW PERCH, CANADA POND
Lab Sample ID.....1370468
Filename.....V90805M
Injected By.....BAL
Total Amount Extracted...0.0102 kg
% Moisture.....NA %
Dry Weight Extracted.....NA
ICAL Date.....08/04/99
CCAL Filename(s).....V90805I
Method Blank ID.....BLANK-072399

Matrix.....TISSUE
Dilution.....NA
Collected...NA
Received....06/30/99
Extracted...07/23/99
Analyzed....08/05/99 21:04
    
```

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	ND	1.0	2378-TCDF-13C....	2.00	57
TOTAL TCDF	11.0	-----	2378-TCDD-13C....	2.00	73
			12378-PeCDF-13C..	2.00	41
2378-TCDD	1.2	1.0	23478-PeCDF-13C..	2.00	45
TOTAL TCDD	1.2	-----	12378-PeCDD-13C..	2.00	58
			123478-HxCDF-13C.	2.00	65
12378-PeCDF	ND	4.9	123678-HxCDF-13C.	2.00	76
23478-PeCDF	ND	4.9	234678-HxCDF-13C.	2.00	74
TOTAL PeCDF	ND	-----	123789-HxCDF-13C.	2.00	65
			123478-HxCDD-13C.	2.00	92
12378-PeCDD	ND	4.9	123678-HxCDD-13C.	2.00	58
TOTAL PeCDD	ND	-----	1234678-HpCDF-13C	2.00	35
			1234789-HpCDF-13C	2.00	31
123478-HxCDF	ND	4.9	1234678-HpCDD-13C	2.00	44
123678-HxCDF	ND	4.9	OCDD-13C.....	4.00	70
234678-HxCDF	ND	4.9			
123789-HxCDF	ND	4.9	1234-TCDD-13C....	2.00	NA
TOTAL HxCDF	ND	-----	123789-HxCDD-13C.	2.00	NA
123478-HxCDD	ND	4.9	2378-TCDD-37C14..	0.20	76
123678-HxCDD	ND	4.9			
123789-HxCDD	ND	4.9			
TOTAL HxCDD	ND	-----			
1234678-HpCDF	ND	4.9			
1234789-HpCDF	ND	4.9			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	5.9	4.9			
TOTAL HpCDD	5.9	-----			
OCDF	ND	9.8			
OCDD	ND	9.8			

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)
PRL = Pace Reporting Limit
ND = Not Detected
NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

Client's Sample ID.....SAMPLE 2: 3 LARGEMOUTH BASS, ROGER WILLIAMS
Lab Sample ID.....1370476 POND
Filename.....V90805N
Injected By.....BAL
Total Amount Extracted...0.0106 kg Matrix.....TISSUE
% Moisture.....NA % Dilution....NA
Dry Weight Extracted.....NA Collected...NA
ICAL Date.....08/04/99 Received....06/30/99
CCAL Filename(s).....V90805I Extracted...07/23/99
Method Blank ID.....BLANK-072399 Analyzed....08/05/99 22:21

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	2.1 *	0.9	2378-TCDF-13C....	2.00	50
TOTAL TCDF	35.0	-----	2378-TCDD-13C....	2.00	57
2378-TCDD	ND	0.9	12378-PeCDF-13C..	2.00	35
TOTAL TCDD	ND	-----	23478-PeCDF-13C..	2.00	39
12378-PeCDF	ND	4.7	12378-PeCDD-13C..	2.00	45
23478-PeCDF	ND	4.7	123478-HxCDF-13C.	2.00	54
TOTAL PeCDF	ND	-----	123678-HxCDF-13C.	2.00	59
12378-PeCDD	ND	4.7	234678-HxCDF-13C.	2.00	64
TOTAL PeCDD	ND	-----	123789-HxCDF-13C.	2.00	59
123478-HxCDF	ND	4.7	123478-HxCDD-13C.	2.00	72
123678-HxCDF	ND	4.7	123678-HxCDD-13C.	2.00	74
234678-HxCDF	ND	4.7	1234678-HpCDF-13C	2.00	58
123789-HxCDF	ND	4.7	1234789-HpCDF-13C	2.00	51
TOTAL HxCDF	4.7	-----	1234678-HpCDD-13C	2.00	70
123478-HxCDD	ND	4.7	OCDD-13C.....	4.00	58
123678-HxCDD	ND	4.7	1234-TCDD-13C....	2.00	NA
123789-HxCDD	ND	4.7	123789-HxCDD-13C.	2.00	NA
TOTAL HxCDD	ND	-----	2378-TCDD-37Cl4..	0.20	49
1234678-HpCDF	ND	4.7			
1234789-HpCDF	ND	4.7			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	4.7			
TOTAL HpCDD	ND	-----			
OCDF	ND	9.4			
OCDD	ND	9.4			

* May include contributions from other TCDF isomers (see Discussion).

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)
PRL = Pace Reporting Limit
ND = Not Detected
NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

Client's Sample ID.....SAMPLE 3: 3 LARGEMOUTH BASS, MASHAPAUG POND
 Lab Sample ID.....1370484
 Filename.....V908050
 Injected By.....BAL
 Total Amount Extracted...0.0122 kg
 % Moisture.....NA %
 Dry Weight Extracted....NA
 ICAL Date.....08/04/99
 CCAL Filename(s).....V90805I
 Method Blank ID.....BLANK-072399

Matrix.....TISSUE
 Dilution....NA
 Collected...NA
 Received....06/30/99
 Extracted...07/23/99
 Analyzed....08/05/99 23:22

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	1.1 *	0.8	2378-TCDF-13C....	2.00	54
TOTAL TCDF	50.0	-----	2378-TCDD-13C....	2.00	59
2378-TCDD	ND	0.8	12378-PeCDF-13C..	2.00	40
TOTAL TCDD	ND	-----	23478-PeCDF-13C..	2.00	42
12378-PeCDF	ND	4.1	12378-PeCDD-13C..	2.00	51
23478-PeCDF	ND	4.1	123478-HxCDF-13C.	2.00	58
TOTAL PeCDF	ND	-----	123678-HxCDF-13C.	2.00	60
12378-PeCDD	ND	4.1	234678-HxCDF-13C.	2.00	63
TOTAL PeCDD	ND	-----	123789-HxCDF-13C.	2.00	56
123478-HxCDF	ND	4.1	123478-HxCDD-13C.	2.00	72
123678-HxCDF	ND	4.1	123678-HxCDD-13C.	2.00	70
234678-HxCDF	ND	4.1	1234678-HpCDF-13C	2.00	56
123789-HxCDF	ND	4.1	1234789-HpCDF-13C	2.00	51
TOTAL HxCDF	ND	-----	1234678-HpCDD-13C	2.00	67
123478-HxCDD	ND	4.1	OCDD-13C.....	4.00	67
123678-HxCDD	ND	4.1	1234-TCDD-13C....	2.00	NA
123789-HxCDD	ND	4.1	123789-HxCDD-13C.	2.00	NA
TOTAL HxCDD	ND	-----	2378-TCDD-37C14..	0.20	42
1234678-HpCDF	ND	4.1			
1234789-HpCDF	ND	4.1			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	4.1			
TOTAL HpCDD	ND	-----			
OCDF	ND	8.2			
OCDD	ND	8.2			

* May include contributions from other TCDF isomers (see Discussion).

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)
 PRL = Pace Reporting Limit
 ND = Not Detected
 NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

Client's Sample ID.....SAMPLE 4: 2 EEL, WOONASQUATUCKET AT CENTREDALE
 Lab Sample ID.....1370492
 Filename.....V90805P
 Injected By.....BAL
 Total Amount Extracted...0.0105 kg
 % Moisture.....NA %
 Dry Weight Extracted.....NA
 ICAL Date.....08/04/99
 CCAL Filename(s).....V90805I
 Method Blank ID.....BLANK-072399

Matrix.....TISSUE
 Dilution....NA
 Collected....NA
 Received....06/30/99
 Extracted...07/23/99
 Analyzed....08/06/99 00:22

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	ND	1.0	2378-TCDF-13C....	2.00	54
TOTAL TCDF	5.7	-----	2378-TCDD-13C....	2.00	68
2378-TCDD	37.0	1.0	12378-PeCDF-13C..	2.00	37
TOTAL TCDD	37.0	-----	23478-PeCDF-13C..	2.00	39
12378-PeCDF	ND	4.7	12378-PeCDD-13C..	2.00	51
23478-PeCDF	ND	4.7	123478-HxCDF-13C.	2.00	63
TOTAL PeCDF	ND	-----	123678-HxCDF-13C.	2.00	69
12378-PeCDD	ND	4.7	234678-HxCDF-13C.	2.00	69
TOTAL PeCDD	ND	-----	123789-HxCDF-13C.	2.00	65
123478-HxCDF	ND	4.7	123478-HxCDD-13C.	2.00	81
123678-HxCDF	ND	4.7	123678-HxCDD-13C.	2.00	78
234678-HxCDF	ND	4.7	1234678-HpCDF-13C	2.00	40
123789-HxCDF	ND	4.7	1234789-HpCDF-13C	2.00	32
TOTAL HxCDF	7.9	-----	1234678-HpCDD-13C	2.00	49
123478-HxCDD	ND	4.7	OCDD-13C.....	4.00	58
123678-HxCDD	ND	4.7	1234-TCDD-13C....	2.00	NA
123789-HxCDD	ND	4.7	123789-HxCDD-13C.	2.00	NA
TOTAL HxCDD	ND	-----	2378-TCDD-37Cl4..	0.20	61
1234678-HpCDF	ND	4.7			
1234789-HpCDF	ND	4.7			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	4.7			
TOTAL HpCDD	ND	-----			
OCDF	ND	9.5			
OCDD	ND	9.5			

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)
 PRL = Pace Reporting Limit
 ND = Not Detected
 NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

Client's Sample ID.....SAMPLE 5: 2 PUMPKINSEED, WOONASQUATUCKET AT
Lab Sample ID.....1370518
Filename.....V90805Q
Injected By.....MCH
Total Amount Extracted...0.0104 kg
% Moisture.....NA %
Dry Weight Extracted.....NA
ICAL Date.....08/04/99
CCAL Filename(s).....V90805I
Method Blank ID.....BLANK-072399

Matrix.....TISSUE
Dilution....NA
Collected...NA
Received....06/30/99
Extracted...07/23/99
Analyzed....08/06/99 01:22

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	1.7 *	1.0	2378-TCDF-13C....	2.00	55
TOTAL TCDF	7.7	-----	2378-TCDD-13C....	2.00	67
2378-TCDD	ND	1.0	12378-PeCDF-13C..	2.00	40
TOTAL TCDD	ND	-----	23478-PeCDF-13C..	2.00	47
12378-PeCDF	ND	4.8	12378-PeCDD-13C..	2.00	59
23478-PeCDF	ND	4.8	123478-HxCDF-13C.	2.00	58
TOTAL PeCDF	ND	-----	123678-HxCDF-13C.	2.00	72
12378-PeCDD	ND	4.8	234678-HxCDF-13C.	2.00	67
TOTAL PeCDD	ND	-----	123789-HxCDF-13C.	2.00	52
123478-HxCDF	ND	4.8	123478-HxCDD-13C.	2.00	42
123678-HxCDF	ND	4.8	123678-HxCDD-13C.	2.00	90
234678-HxCDF	ND	4.8	1234678-HpCDF-13C	2.00	28
123789-HxCDF	ND	4.8	1234789-HpCDF-13C	2.00	28
TOTAL HxCDF	ND	-----	1234678-HpCDD-13C	2.00	33
123478-HxCDD	ND	4.8	OCDD-13C.....	4.00	89
123678-HxCDD	ND	4.8	1234-TCDD-13C....	2.00	NA
123789-HxCDD	ND	4.8	123789-HxCDD-13C.	2.00	NA
TOTAL HxCDD	ND	-----	2378-TCDD-37C14..	0.20	81
1234678-HpCDF	ND	4.8			
1234789-HpCDF	ND	4.8			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	4.8			
TOTAL HpCDD	ND	-----			
OCDF	ND	9.6			
OCDD	ND	9.6			

* May include contributions from other TCDF isomers (see Discussion).

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)

PRL = Pace Reporting Limit

ND = Not Detected

NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

```

Client's Sample ID.....SAMPLE 6: 2 CARP, MASHAPAUG POND
Lab Sample ID.....1370526
Filename.....V90805R
Injected By.....MCH
Total Amount Extracted...0.0116 kg           Matrix.....TISSUE
% Moisture.....NA %                         Dilution...NA
Dry Weight Extracted....NA                   Collected...NA
ICAL Date.....08/04/99                       Received....06/30/99
CCAL Filename(s).....V90805I                 Extracted...07/23/99
Method Blank ID.....BLANK-072399            Analyzed....08/06/99 02:28
    
```

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	ND E	1.8	2378-TCDF-13C....	2.00	51
TOTAL TCDF	23.0	-----	2378-TCDD-13C....	2.00	68
2378-TCDD	ND	0.9	12378-PeCDF-13C..	2.00	40
TOTAL TCDD	ND	-----	23478-PeCDF-13C..	2.00	46
12378-PeCDF	ND	4.3	12378-PeCDD-13C..	2.00	60
23478-PeCDF	ND	4.3	123478-HxCDF-13C.	2.00	57
TOTAL PeCDF	49.0	-----	123678-HxCDF-13C.	2.00	60
12378-PeCDD	ND	4.3	234678-HxCDF-13C.	2.00	64
TOTAL PeCDD	ND	-----	123789-HxCDF-13C.	2.00	61
123478-HxCDF	ND	4.3	123478-HxCDD-13C.	2.00	67
123678-HxCDF	ND	4.3	123678-HxCDD-13C.	2.00	91
234678-HxCDF	ND	4.3	1234678-HpCDF-13C	2.00	37
123789-HxCDF	ND	4.3	1234789-HpCDF-13C	2.00	29
TOTAL HxCDF	6.2	-----	1234678-HpCDD-13C	2.00	52
123478-HxCDD	ND	4.3	OCDD-13C.....	4.00	93
123678-HxCDD	ND	4.3	1234-TCDD-13C....	2.00	NA
123789-HxCDD	ND	4.3	123789-HxCDD-13C.	2.00	NA
TOTAL HxCDD	ND	-----	2378-TCDD-37C14..	0.20	41
1234678-HpCDF	ND	4.3			
1234789-HpCDF	ND	4.3			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	4.3			
TOTAL HpCDD	ND	-----			
OCDF	ND	8.7			
OCDD	ND	8.7			

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)
PRL = Pace Reporting Limit
ND = Not Detected
NA = Not Applicable
E = PCDE Interference (see Discussion)

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

Client's Sample ID.....SAMPLE 7: 2 BLUEGILL, WOONASQUATUCKET AT ESMOND
 Lab Sample ID.....1370542
 Filename.....V90805S
 Injected By.....MCH
 Total Amount Extracted...0.0107 kg
 % Moisture.....NA %
 Dry Weight Extracted.....NA
 ICAL Date.....08/04/99
 CCAL Filename(s).....V90805I
 Method Blank ID.....BLANK-072399

Matrix.....TISSUE
 Dilution....NA
 Collected...NA
 Received....06/30/99
 Extracted...07/23/99
 Analyzed....08/06/99 03:35

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	ND	0.9	2378-TCDF-13C....	2.00	46
TOTAL TCDF	2.5	-----	2378-TCDD-13C....	2.00	62
2378-TCDD	ND	0.9	12378-PeCDF-13C..	2.00	35
TOTAL TCDD	ND	-----	23478-PeCDF-13C..	2.00	41
12378-PeCDF	ND	4.7	12378-PeCDD-13C..	2.00	52
23478-PeCDF	ND	4.7	123478-HxCDF-13C.	2.00	74
TOTAL PeCDF	ND	-----	123678-HxCDF-13C.	2.00	61
12378-PeCDD	ND	4.7	234678-HxCDF-13C.	2.00	62
TOTAL PeCDD	ND	-----	123789-HxCDF-13C.	2.00	52
123478-HxCDF	ND	4.7	123478-HxCDD-13C.	2.00	69
123678-HxCDF	ND	4.7	123678-HxCDD-13C.	2.00	80
234678-HxCDF	ND	4.7	1234678-HpCDF-13C	2.00	23 I
123789-HxCDF	ND	4.7	1234789-HpCDF-13C	2.00	28
TOTAL HxCDF	ND	-----	1234678-HpCDD-13C	2.00	30
123478-HxCDD	ND	4.7	OCDD-13C.....	4.00	81
123678-HxCDD	ND	4.7	1234-TCDD-13C....	2.00	NA
123789-HxCDD	ND	4.7	123789-HxCDD-13C.	2.00	NA
TOTAL HxCDD	ND	-----	2378-TCDD-37C14..	0.20	57
1234678-HpCDF	ND	4.7			
1234789-HpCDF	ND	4.7			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	4.7			
TOTAL HpCDD	ND	-----			
OCDF	ND	9.4			
OCDD	ND	9.4			

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)
 PRL = Pace Reporting Limit
 ND = Not Detected
 NA = Not Applicable
 I = Interference

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 ANALYSIS RESULTS

Client....RHODE ISLAND DOH

Client's Sample ID.....SAMPLE 8: 2 EEL, WOONASQUATUCKET AT ESMOND
 Lab Sample ID.....1370559
 Filename.....V90806I
 Injected By.....BAL
 Total Amount Extracted...0.0108 kg
 % Moisture.....NA %
 Dry Weight Extracted.....NA
 ICAL Date.....08/04/99
 CCAL Filename(s).....V90806B
 Method Blank ID.....BLANK-072399

Matrix.....TISSUE
 Dilution...NA
 Collected...NA
 Received....06/30/99
 Extracted...07/23/99
 Analyzed....08/06/99 17:50

NATIVE ISOMERS	CONC ng/kg	PRL ng/kg	INTERNAL STANDARDS	ng's ADDED	PERCENT RECOVERY
2378-TCDF	ND	0.9	2378-TCDF-13C....	2.00	52
TOTAL TCDF	3.3	-----	2378-TCDD-13C....	2.00	59
2378-TCDD	ND	0.9	12378-PeCDF-13C..	2.00	38
TOTAL TCDD	ND	-----	23478-PeCDF-13C..	2.00	41
12378-PeCDF	ND	4.6	12378-PeCDD-13C..	2.00	46
23478-PeCDF	ND	4.6	123478-HxCDF-13C.	2.00	65
TOTAL PeCDF	ND	-----	123678-HxCDF-13C.	2.00	65
12378-PeCDD	ND	4.6	234678-HxCDF-13C.	2.00	67
TOTAL PeCDD	ND	-----	123789-HxCDF-13C.	2.00	57
123478-HxCDF	ND	4.6	123478-HxCDD-13C.	2.00	70
123678-HxCDF	ND	4.6	123678-HxCDD-13C.	2.00	84
234678-HxCDF	ND	4.6	1234678-HpCDF-13C	2.00	35
123789-HxCDF	ND	4.6	1234789-HpCDF-13C	2.00	27
TOTAL HxCDF	7.2	-----	1234678-HpCDD-13C	2.00	44
123478-HxCDD	ND	4.6	OCDD-13C.....	4.00	48
123678-HxCDD	ND	4.6	1234-TCDD-13C....	2.00	NA
123789-HxCDD	ND	4.6	123789-HxCDD-13C.	2.00	NA
TOTAL HxCDD	ND	-----	2378-TCDD-37C14..	0.20	*
1234678-HpCDF	ND	4.6			
1234789-HpCDF	ND	4.6			
TOTAL HpCDF	ND	-----			
1234678-HpCDD	ND	4.6			
TOTAL HpCDD	ND	-----			
OCDF	ND	9.2			
OCDD	ND	9.2			

* Not Added (see Discussion)

All values are expressed on a total (as received) weight basis.

CONC= Concentration (Totals include 2378-substituted isomers.)

PRL = Pace Reporting Limit

ND = Not Detected

NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 SPIKE SAMPLE RESULTS

Client: RHODE ISLAND DOH

Lab Sample ID.....	SPIKE-072399	Matrix....	TISSUE
Filename.....	V90806F	Dilution..	NA
Injected By.....	DGP	Collected..	NA
Amount Extracted.....	0.0101 kg	Received..	NA
% Moisture.....	NA %	Extracted..	07/23/99
Dry Wt. Extracted.....	NA	Analyzed..	08/06/99 14:14
ICAL Date.....	08/04/99		
CCAL Filename(s).....	V90806B		
Method Blank ID.....	BLANK-072399		

Compound	Cs	Cr	Lower Limit	Upper Limit	% Rec
2378-TCDF	10	11.3	7.5	15.8	113
2378-TCDD	10	10.5	6.7	15.8	105
12378-PeCDF	50	54.5	40.0	67.0	109
23478-PeCDF	50	55.9	34.0	80.0	112
12378-PeCDD	50	53.0	35.0	71.0	106
123478-HxCDF	50	58.4	36.0	67.0	117
123678-HxCDF	50	58.0	42.0	65.0	116
234678-HxCDF	50	57.4	35.0	78.0	115
123789-HxCDF	50	61.1	39.0	65.0	122
123478-HxCDD	50	49.8	35.0	82.0	100
123678-HxCDD	50	50.1	38.0	67.0	100
123789-HxCDD	50	45.3	32.0	81.0	91
1234678-HpCDF	50	51.2	41.0	61.0	102
1234789-HpCDF	50	55.5	39.0	69.0	111
1234678-HpCDD	50	52.6	35.0	70.0	105
OCDF	100	99.3	63.0	170.0	99
OCDD	100	101.3	78.0	144.0	101
2378-TCDF-13C	100	56.6	22.0	152.0	57
2378-TCDD-13C	100	62.9	20.0	175.0	63
2378-TCDD-37Cl4	10	6.3	3.1	19.1	63
12378-PeCDF-13C	100	50.0	21.0	192.0	50
23478-PeCDF-13C	100	54.1	13.0	328.0	54
12378-PeCDD-13C	100	62.4	21.0	227.0	62
123478-HxCDF-13C	100	65.4	19.0	202.0	65
123678-HxCDF-13C	100	69.0	21.0	159.0	69
234678-HxCDF-13C	100	75.9	22.0	176.0	76
123789-HxCDF-13C	100	70.1	17.0	205.0	70
123478-HxCDD-13C	100	90.1	21.0	193.0	90
123678-HxCDD-13C	100	89.4	25.0	163.0	89
1234678-HpCDF-13C	100	64.4	21.0	158.0	64
1234789-HpCDF-13C	100	60.9	20.0	186.0	61
1234678-HpCDD-13C	100	79.1	26.0	166.0	79
OCDD-13C	200	149.0	26.0	397.0	74

Cs = Concentration Spiked (ng/mL)
Cr = Concentration Recovered (ng/mL)
Rec = Recovery (Expressed as Percent)
Control Limit Reference: Method 1613, Table 6, 10/94 Revision.

Report No..99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

METHOD 1613 SPIKE SAMPLE RESULTS

Client: RHODE ISLAND DOH

```

Lab Sample ID.....SPIKE-072399-DUPLICATE
Filename.....V90806G
Injected By.....DGP
Amount Extracted..... 0.0101 kg           Matrix....TISSUE
% Moisture.....NA %                       Dilution..NA
Dry Wt. Extracted.....NA                 Collected.NA
ICAL Date.....08/04/99                   Received..NA
CCAL Filename(s).....V90806B             Extracted..07/23/99
Method Blank ID.....BLANK-072399        Analyzed..08/06/99 15:29
    
```

Compound	Cs	Cr	Lower Limit	Upper Limit	% Rec
2378-TCDF	10	11.0	7.5	15.8	110
2378-TCDD	10	11.1	6.7	15.8	111
12378-PeCDF	50	51.1	40.0	67.0	102
23478-PeCDF	50	51.9	34.0	80.0	104
12378-PeCDD	50	52.3	35.0	71.0	105
123478-HxCDF	50	56.8	36.0	67.0	114
123678-HxCDF	50	61.4	42.0	65.0	123
234678-HxCDF	50	59.0	35.0	78.0	118
123789-HxCDF	50	60.1	39.0	65.0	120
123478-HxCDD	50	57.8	35.0	82.0	116
123678-HxCDD	50	54.5	38.0	67.0	109
123789-HxCDD	50	53.7	32.0	81.0	107
1234678-HpCDF	50	57.4	41.0	61.0	115
1234789-HpCDF	50	55.9	39.0	69.0	112
1234678-HpCDD	50	53.5	35.0	70.0	107
OCDF	100	105.3	63.0	170.0	105
OCDD	100	108.4	78.0	144.0	108
2378-TCDF-13C	100	50.7	22.0	152.0	51
2378-TCDD-13C	100	60.9	20.0	175.0	61
2378-TCDD-37C14	10	5.8	3.1	19.1	58
12378-PeCDF-13C	100	41.1	21.0	192.0	41
23478-PeCDF-13C	100	46.8	13.0	328.0	47
12378-PeCDD-13C	100	57.5	21.0	227.0	57
123478-HxCDF-13C	100	63.0	19.0	202.0	63
123678-HxCDF-13C	100	53.7	21.0	159.0	54
234678-HxCDF-13C	100	71.1	22.0	176.0	71
123789-HxCDF-13C	100	66.8	17.0	205.0	67
123478-HxCDD-13C	100	74.9	21.0	193.0	75
123678-HxCDD-13C	100	79.4	25.0	163.0	79
1234678-HpCDF-13C	100	39.8	21.0	158.0	40
1234789-HpCDF-13C	100	49.4	20.0	186.0	49
1234678-HpCDD-13C	100	65.4	26.0	166.0	65
OCDD-13C	200	161.4	26.0	397.0	81

Cs = Concentration Spiked (ng/mL)
 Cr = Concentration Recovered (ng/mL)
 Rec = Recovery (Expressed as Percent)
 Control Limit Reference: Method 1613, Table 6, 10/94 Revision.

Report No..99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, Inc.

Pace Analytical

Tel: 612-607-1700
 Fax: 612-607-6444

SPIKE RECOVERY RELATIVE PERCENT DIFFERENCE (RPD) RESULTS

Client....RHODE ISLAND DOH

SPIKE 1 ID.....SPIKE-072399
 SPIKE 1 Filename.....V90806F
 SPIKE 2 ID.....SPIKE-072399-DUPLICATE
 SPIKE 2 Filename.....V90806G

COMPOUND	SPIKE 1 REC, %	SPIKE 2 REC, %	RPD, %
2378-TCDF	113	110	2.7
2378-TCDD	105	111	5.6
12378-PeCDF	109	102	6.6
23478-PeCDF	112	104	7.4
12378-PeCDD	106	105	0.9
123478-HxCDF	117	114	2.6
123678-HxCDF	116	123	5.9
234678-HxCDF	115	118	2.6
123789-HxCDF	122	120	1.7
123478-HxCDD	100	116	14.8
123678-HxCDD	100	109	8.6
123789-HxCDD	91	107	16.2
1234678-HpCDF	102	115	12.0
1234789-HpCDF	111	112	0.9
1234678-HpCDD	105	107	1.9
OCDF	99	105	5.9
OCDD	101	108	6.7

REC = Percent Recovered
 RPD = The difference between the two values divided by the average.
 NA = Not Applicable

Report No...99-1015992

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
 without the written consent of Pace Analytical Services, Inc.