Final Report

Distribution of Chemical Contaminants in Wild Fish Species in Washington, D.C.

Submitted by:

David J. Velinsky
and
James D. Cummins

Interstate Commission on the Potomac River Basin
Suite 300
6110 Executive Blvd.
Rockville, MD 20852

Submitted to:

District of Columbia
Department of Consumer and Regulatory Affairs
Water Quality Control Branch
2100 Martin Luther King Ave., S.E.
Washington, D.C. 20020

June 1994

ICPRB Report # 94-1

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

This publication has been prepared by the Interstatė Commission on the Potomac River Basin. Support was provided by the United States Government, the U.S. Environmental Protection Agency, and the signatory bodies to ICPRB: Maryland, Pennsylvania, Virginia, West Virginia and the District of Columbia. The opinions expressed are those of the authors and should not be construed as representing the opinions or polices on the United States or any of its agencies, the several states, or the Commissioners of ICPRB.

This document should be cited as:
Velinsky, D.J. and J.C. Cummins. 1994. Distribution of chemical contaminants in wild fish species in Washington, D.C. **ICPRB Report # 94-1**. Interstate Commission on the Potomac River Basin, Rockville, MD.

Final Report:
Distribution of Chemical Contaminants in Wild Fish Species in Washington, D.C.

(Grant No. 92g-92-WRMDO2)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Executive Summary

Polychlorinated biphenyls (PCBs) and chlordanes are suspected to have a long-term presence in the tissue of wild fish within the Potomac and Anacostia Rivers. These two chemicals, and possibly others, pose an ongoing concern for consumers of fish from these rivers in the District of Columbia. Therefore, continued monitoring of these and other contaminants (i.e., U.S. EPA priority pollutants) is important to assess trends in contaminant level and to address public health and environmental concerns. This study represents an important component of the District of Columbia's commitment to evaluate chemical contaminants as they relate to aquatic living resources and human health concerns.

The objective of this work was to determine the concentration and distribution of 129 chemical contaminants in fish tissue samples collected from the waters of the District of Columbia. The District of Columbia's Environmental Regulation Administration (ERA) was responsible for the assemblage, collection and preparation (i.e., cleaning and filleting) of fish samples for chemical analysis. Fish were collected and stored using standard procedures developed by the ERA. For this study, thirty-eight fish sample-composites were obtained from ERA's archived inventories. Similar species of fish were collected in both 1991 and 1992 (only three brown bullhead catfish were analyzed in 1989). However, not all species were collected from the same location each year. Notably, there were no channel catfish collected in 1992 from the Anacostia River. All samples were kept frozen with dry ice (-78°C) and hand delivered to the laboratory (Eco Logic, Inc., Rockwood, Ontario) for chemical processing. The majority of samples were collected in 1989, 1991, and 1992. The results of these analyses were used to assess temporal and spatial trends in the contamination of fish from the District's waters.

The present study indicates that detectable levels of many chemicals were present in the edible portion of certain species of fish collected in the District of Columbia's waters. Of the approximately 129 chemicals investigated, 50 were detected in one or more species. These chemicals ranged from trace inorganics such as mercury (Hg) and selenium (Se) to organic chemicals like polychlorinated biphenyls (PCBs) and DDTs (sum of DDT, DDD, and DDE). While the trace metals and metalloids detected most often (i.e., As, Se, and Hg) did not show

any species or geographic variations, concentrations of many organics (naphthalene, bis(2-ethylhexyl)phthalate, total PCBs, total DDT (pp' forms of DDE+DDD+DDT), $\alpha+\gamma$-chlordane, dieldrin, heptachlor epoxide, and dioxins/furans) were greatest in either the American eel or channel catfish species. Some of this variation can be explained by the lipid content of each fish species which was highest for American eel and channel catfish composites. Geographical variations for all organic compounds were not identifiable with the limited data set available.

Comparison of the current data with previous studies of fish tissue indicate that similar chemicals are persistent, but because of analytical and sampling differences between studies, a quantitative trend analysis was not possible at this time. PCBs and $\alpha+\gamma$ chlordane concentrations had been elevated since tissue samples were collected in 1987. The median concentrations of total PCBs (360 to 640 ng/g wet) and $\alpha+\gamma$ chlordane (37 to 118 ng/g wet) were higher in the Washington, D.C. area from the current data set compared to national data obtained during the National Dioxin Study (median total PCBs for industrial/urban sites: 210 ng/g wet, median $\alpha+\gamma$ chlordane: 11 ng/g wet; EPA, 1992). Similarly, median concentrations of pp'-DDE, a breakdown product of DDT, were similar to the national for industrial/urban median (79 ng/g wet) while dieldrin concentrations were lower in the Washington, D.C. area. Dioxin concentrations, especially 2,3,7,8-TCDD, were low and in many cases below the detection limit (i.e., <0.5 pg/g wet).

Three methods for estimating the health effect (i.e., FDA action and tolerance levels, toxic equivalents for PCBs and dioxins, and a risk assessment model) suggested that concentrations of PCBs and chlordane are elevated and of concern in this area. Of the 36 composite samples, four samples contained concentrations of total PCBs higher than the FDA tolerance level (2000 ng/g wet), while only one composite had concentrations of chlordane higher than its action level (300 ng/g wet). Preliminary toxic equivalent (TEQ) calculations suggested that specific components of the PCBs were elevated. Similar toxic equivalent calculations for the various components of the dioxins and furans indicated that this class of compounds were detectable and in many cases higher than the current screening value U.S. EPA is using for dioxin-TEQ (0.7 pg/g wet @ 10^{-5} risk factor).

Using a risk assessment model given in EPA (1992), indications were that the levels of total PCBs and in some cases chlordane, in this area, posed a potential excess cancer risk greater than 10^{-4} or 10^{-3}. There are many limitations to this model, and all of the higher risks, both carcinogenic and non-carcinogenic, were using a fish ingestion rate of 140 g/day. This rate is for subsistence fishing as well as the upper 95th percentile for sportfishing. Regardless, the various health effect indicators suggest that PCBs and chlordane are of concern from wild fish, especially bottom dwelling species, collected in the Washington, D.C. area.

Monitoring of fish tissue in this area should be continued. For this monitoring, consistent and up-to-date analytical methods along with an adequate sampling scheme should be used to help evaluate geographic and species variations. Also, the data from recent local anglers surveys by the District's Fisheries Management Branch should be used to determine the area specific risk assessment of potential health effects to the local population.

Introduction

Since July of 1989, a fish consumption advisory for the Potomac and Anacostia rivers has been in effect for the waters of the District of Columbia (Appendix I). Based upon polychlorinated biphenyls (PCB's) and chlordane concentrations detected in channel catfish (*Ictalurus punctatus*), the advisory warned the public of possible risks to human health from eating channel catfish, common carp (*Cyprinus carpio*) and American eels (*Anquilla rostrata*) captured in D.C. waters. This advisory is based upon research conducted by the Interstate Commission on the Potomac River Basin (ICPRB) with funding by the D.C. Department of Consumer and Regulatory Affairs (Sommerfield and Cummins, 1989). The findings of this study helped to confirm the results of the 1987 fish tissue investigation by U.S. Fish and Wildlife Service (Block, 1990).

Water, sediment, and food are sources of chemicals to aquatic organisms like fish. The bioaccumulation of contaminants is related to their retention in tissue and is a balance between the rate of intake and the rate of loss via metabolic processes, degradation, and excretion. If the rate of intake is greater, contaminants accumulate into specific body parts (e.g., fatty tissue, bone, and liver) dependent on the chemical. In many cases, fish accumulate contaminants that are undetected with routine water quality monitoring; thus fish tissue can provide a good indicator of the environment. The accumulation of chemicals in fish tissue is of concern for both ecosystem health (i.e., food chain transfers) and human health impacts. This study investigated the latter by looking at the concentrations and distributions of chemical contaminants in fish fillets from the Potomac and Anacostia rivers.

PCBs and chlordane are suspected to have a long term presence in the environment. These two chemicals, and possibly others, pose an ongoing concern for consumers of fish using the Potomac and Anacostia rivers in the District of Columbia. Therefore, continued monitoring of these and other contaminants (e.g., Hg, DDT, specific aromatic hydrocarbons) is needed to assess trends in contaminant levels, and to address public health and environmental concerns. This study represents an important component of the District of Columbia's commitment to evaluate chemical contaminants as they relate to aquatic living resources and human health concerns.

Objective and Approach

The objective of this work was to determine the concentration and distribution of 129 chemical contaminants in fish tissue samples collected from the waters of the District of Columbia. The 37 samples were collected in 1989, 1991, 1992, and 1993 (see Appendix II). All samples were collected in the late summer or early fall of each year (Karimi, personal communication) with specific dates provided in Appendix II when available. One additional sample was collected in 1993. Laboratory results for the 1993 sample are included in Appendix III, but are not discussed in this report. The results of these analyses were used to assess temporal and spatial trends in the contamination of fish from the District's waters.

The District of Columbia's Environmental Regulation Administration (ERA) was responsible for the assemblage, collection and preparation (i.e., cleaning and filleting) of fish samples for chemical analysis. Fish were collected and stored using standard procedures developed by the ERA. For this study, thirty-seven fish sample-composites were obtained from ERA's archived inventories. Samples were kept frozen with dry ice (-78°C) and hand delivered to the laboratory (Eco Logic, Inc., Rockwood, Ontario) for chemical processing. All transfers of samples were done using chain-of-custody requirements and these forms are available on request.

Study Area

Fish samples were collected in the tidal freshwater sections of the Potomac and Anacostia rivers around the District of Columbia. The rivers were divided into upper and lower sections (Figure 1): the upper Anacostia River is between the District's boundary at the New York Avenue Bridge and the railroad bridge just downstream of Kingman Lake and the lower Anacostia is from the railroad bridge to Hains Point at the Potomac River. The lower section of the river is the more developed urban center portion of the Anacostia. The upper Potomac River is bounded by Fletcher's Boathouse downstream of Chain Bridge to the 14th Street Bridge, while the lower Potomac River is from the bridge to the Woodrow Wilson Bridge near Jones Point.

The District of Columbia (DC) lies along the fall line at the boundary between the Atlantic

Coastal Plain and the Piedmont Plateau and is at the head of navigation of the Potomac estuary (Figure 1). The western and northern sections of the DC area are part of the Piedmont while the mid-section of the city to the south is the Coastal Plain (Reed and Obermeier, 1989).

There are three major rivers or streams in the DC area: the Potomac and Anacostia rivers, and Rock Creek, which drains into the Potomac River just south of Georgetown (Figure 1). Average yearly flows for the Potomac River at Chain Bridge, Anacostia River, and Rock Creek are 1.03×10^{10}, 1.16×10^{8}, and 5.5×10^{7} m^3/yr, respectively. Even though the drainage areas of the Anacostia River (310 km^2) and Rock Creek (160 km^2) are small compared to the Potomac River at Chain Bridge (30,000 km^2), both water bodies drain predominantly urban environments and therefore have large inputs of anthropogenic materials (Velinsky et al., 1992). While DC is currently not an industrialized area, there are facilities bordering the Potomac and Anacostia Rivers that could adversely affect sediment and water quality. There is also a potential for contamination of the sediments in the rivers due to past shipping and boating uses in the area. Most industrial facilities in the DC area have pretreatment programs that eventually discharge to Blue Plains WasteWater Treatment Plant (WWTP).

Numerous storm and combined sewers drain into the Tidal Basin, Washington Ship Channel, and Anacostia Rivers. There are approximately 30 storm and 6 combined sewers that can discharge into the lower Anacostia River (i.e., south of the Kingman Lake area to Greenleaf Point at the mouth of the Washington Ship Channel). These storm and combined sewers draining into the tidal Anacostia River cover a drainage area of approximately 2.6 mi^2, or approximately 27% of the Anacostia drainage area within the District of Columbia (O'Brien and Gere, 1979; ICPRB, 1988). Approximately 54% of the total drainage area of the Anacostia Basin, which includes suburban Maryland, is urban (ICPRB, 1988). Within DC, ~95% of the drainage to the Anacostia is developed (ICPRB, 1988). Runoff through the storm and combined sewer system has been shown to cause elevated concentrations of trace metals and organic compounds (e.g., PCBs, PAHs, and chlordane) to the sediments of the lower Anacostia River, Tidal Basin and sections of the Potomac River near Rock Creek (Velinsky et al., 1992).

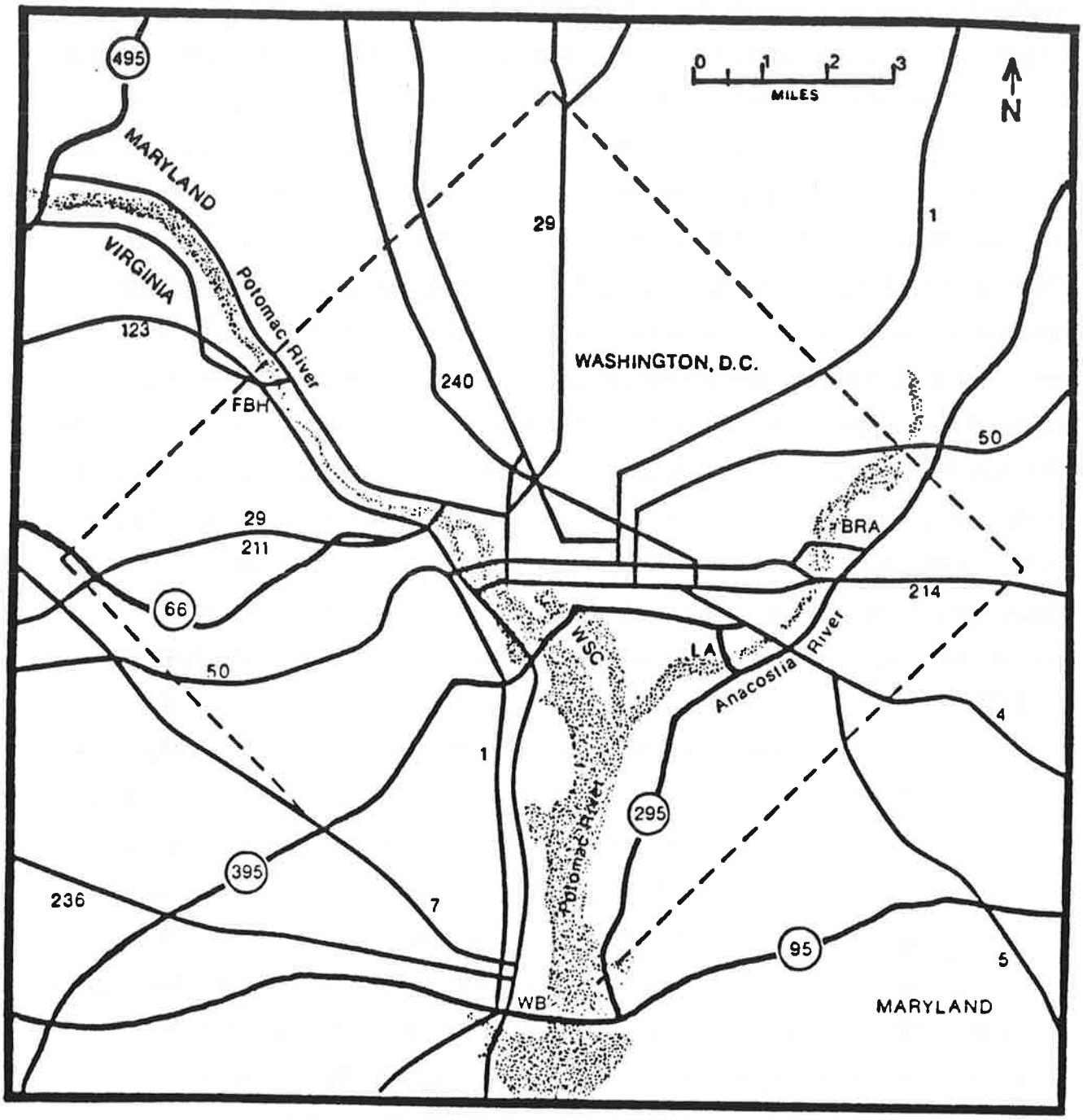


Figure 1. Potomac and Anacostia Rivers within the District of Columbia. The rivers were divided into upper and lower sections where the fish were collected. The upper Anacostia River is between the District's boundary at the New York Avenue Bridge (Route 50) and the railroad bridge just downstream of Kingman Lake and the lower Anacostia (LA) is from the railroad bridge to Hains Point at the Potomac River. The upper Potomac River is bounded by Fletcher's Boathouse (FBH) to the 14th Street Bridge near the Washington Ship Channel (WSC), while the lower Potomac River is from the 14th Street Bridge to the Woodrow Wilson Bridge (WB) near Jones Point. (Adapted from Block, 1990)

Materials and Methods

Chemical analyses of the prepared fish composite samples for 129 priority pollutants were performed by Eco Logic, Inc. of Rockwood, Ontario using U.S. EPA approved methods (see Velinsky and Cummins, 1993 for details). Each composite sample was composed of at least three individual fillets, unless otherwise noted (Tables 1 and 2; see Appendix II). Additional laboratory analyses were performed for seven chlorinated dibenzo-p-dioxins and ten chlorinated dibenzofurans congeners, and congener specific PCB's including 17 coplanar PCB congeners. These data yielded information concerning specific compounds or congeners within the dioxins/furans and PCBs which may have higher enzyme induction activity and possible toxicity compared to other congeners to certain aquatic species and human health (e.g., Ahlborg et al., 1994; McFarland and Clarke, 1989; Swain, 1991).

Results

In the following sections, the data are given as ranges and median concentrations for 1989, 1991, and 1992. All concentrations are presented on a wet weight basis. Appendix II provides a complete listing of the individual fish fillets and the samples that make up each composite. Within Appendix II, when the data were provided by ERA, live weight and length for individual fish are provided. The complete listing of the data along with QA/QC documentation are provided in Appendix III.

Water and Lipid Content

Tissue water contents ranged from 76 to 78% (77.4 $\pm$ 0.7%, mean $\pm$ 1σ standard deviation) for the three samples analyzed from 1989, all brown bullheads (*Ictalurus nebulosus*). The lipid contents were variable and ranged from 1.6 to 9.3% (Table 1).

Nineteen composite samples were collected and analyzed for 1991 (Table 1). Tissue water contents ranged from 59 to 81% (75.0 $\pm$ 6.4%, n=19), while the lipid contents were more variable and ranged from 0.5 to 15%. Fish samples with lipid contents greater than 10% included common carp (n=1), channel catfish (n=2), and American eel (n=3). The other fish composites, with lower amounts of total lipids (<1.5%), included largemouth bass

Table 1. Summary data for 1989 and 1991 fish composite samples.

Composite ID.	Fish Species	Location	Wet Weight	% Moisture	% Lipid
1-89	Brown Bullhead	Lower Anacostia	1268	76.4	9.34
15-89	Brown Bullhead	Upper Anacostia	ND	77.6	1.70
16-89	Brown Bullhead	Lower Potomac	ND	78.1	2.67
1-91	Common Carp	Upper Potomac	2295	73.1	10.14
2-91	Largemouth Bass	Upper Potomac	564	78.6	0.48
3-91	American Eel	Upper Potomac	604	60.9	15.38
4-91	Channel Catfish	Upper Potomac	757	69.8	10.71
5-91	Bluegill	Upper Potomac	539	81.1	0.32
6-91	Channel Catfish	Lower Potomac	870	73.7	5.89
7-91	Largemouth Bass	Lower Potomac	699	79.8	1.04
8-91	American Eel	Lower Potomac	610	68.2	15.15
9-91	Channel Catfish	Lower Potomac	1039	78.2	6.56
10-91	Bluegill	Lower Potomac	550	79.7	0.58
11-91	Common Carp	Upper Anacostia	1252	80.3	1.72
12-91	Largemouth Bass	Upper Anacostia	636	78.7	0.19
13-91	Brown Bullhead	Upper Anacostia	322	80.4	1.69
14-91	Bluegill	Upper Anacostia	71	80.3	0.70
15-91	Common Carp	Lower Anacostia	803	76.6	1.71
16-91	Largemouth Bass	Lower Anacostia	798	78.0	1.19
17-91	American Eel	Lower Anacostia	665	58.7	14.75
18-91	Channel Catfish	Lower Anacostia	510	71.4	14.42
19-91	Bluegill	Lower Anacostia	561	78.3	1.06

Wet weight in grams for sample composites not for individual fish. ND - No data.

(*Micropterus salmoides*) and bluegill sunfish (*Lepomis macrochirus*).

For 1992, fourteen fish composite samples were analyzed (Table 2). Similar species of fish were collected from the Potomac and Anacostia rivers with the exception of channel catfish. No channel catfish were obtained in the Anacostia River for the 1992 collection. Water content ranged from 60 to 80% (74.8 $\pm$ 5.4%, n = 14), while lipid content was variable and ranged from 0.8 to 17% (Table 2). Fish composites with greater than 10% lipid content included the American eel (n = 2) and one channel catfish sample. Samples with less than 1% lipid content included bluegill, largemouth bass and pumpkinseed sunfish (*Lepomis gibbosus*).

Table 2. Summary data for 1992 and 1993 fish composite samples.

Composite ID.	Fish Species	Location	Wet Weight	% Moisture	% Lipid
1-92	Bluegill	Lower Potomac	521	78.5	0.79
2-92	Largemouth Bass	Lower Potomac	571	78.1	4.79
3-92	Channel Catfish	Lower Potomac	729	72.4	2.42
4-92	Common Carp	Lower Potomac	1258	77.5	4.73
5-92	Channel Catfish	Upper Potomac	205	67.9	12.08
6-92	Common Carp	Upper Potomac	1733	77.6	3.75
7-92	American Eel	Upper Potomac	49	69.7	10.57
8-92	Pumpkinseed	Lower Anacostia	349	79.3	0.88
9-92	Largemouth Bass	Lower Anacostia	849	77.6	3.85
10-92	Common Carp	Lower Anacostia	1235	75.5	2.85
11-92	Bluegill	Upper Anacostia	91	80.0	0.91
12-92	Largemouth Bass	Upper Anacostia	466	79.2	0.76
13-92	Common Carp	Upper Anacostia	1558	74.3	5.21
14-92	American Eel	Upper Anacostia	31	60.1	16.96
17-93	White Perch	Upper Potomac	ND	76.7	2.19

Wet weight in grams for sample composites not for individual fish. ND - No data.

The two American eel composites were small (< 50 grams wet) and were skin-on-fillets, which may bias these results. All other composites were composed of greater than three fillets of varying size.

Trace Metals

Trace metals and metalloids (As, Se, Sb) were determined in three composite samples taken in 1989 (Table 3; see Appendix III). Minimum, maximum, and median concentrations are presented in Table 3, along with the number of samples above the method detection level (MDL). Arsenic, Se, and Hg were detected in all or a majority of the samples. Beryllium, Cr, Pb, and Ni were detected in at least one of the three sample composites. All three samples are brown bullhead composites from different locations in the Washington, D.C. area, and may reflect within-species variability.

Concentrations of trace metals from composite samples taken in 1991 are presented in Table 4. Of the seven metals and three metalloids measured, only As, Se, and Hg were detected at or above the detection limit in a majority of samples. Chromium was detected in seven samples while the other metals and metalloids were detected only once or were below the detection limit. Highest concentrations of Se and Hg were found in a largemouth bass composite sample taken from the upper Potomac River. Of the 19 composite samples measured for As, only nine samples were above the detection limit (<0.10 μg/g wet), while the rest were either at or below the detection limit. A single largemouth bass composite taken from the lower Anacostia River had the highest concentration of total arsenic.

Trace metal ranges and median concentrations in 1992 are presented in Table 5. As with the 1989 and 1991 sample sets, As, Se, and Hg were detected in a majority of the composite samples. In 1992, chromium was detected in only two composites, while the other metals were either detected once or were below the detection limit. The highest concentration of Se (0.53 μg/g wet) was determined from a common carp composite from the upper Anacostia River, while the highest Hg concentration (0.16 μg/g wet) was found in a largemouth bass composite from the lower Potomac River. Arsenic concentrations were just at or below the detection limit (0.1 μg/g wet) for all samples.

Table 3. Trace metal concentration ranges for 1989 fish composite samples*.

Chemical	Minimum	Maximum	Median	# >MDL
As	<0.10	0.10	<0.10	2
Se	0.16	0.53	0.27	3
Sb	<0.01	<0.01	<0.01	0
Hg	0.020	0.130	0.061	3
Total CN	<0.05	0.05	<0.05	1
Be	<0.005	0.009	<0.005	1
Cd	<0.05	<0.05	<0.05	0
Cr	<0.10	0.10	<0.10	1
Pb	<0.50	0.80	<0.50	1
Ni	<0.10	0.10	<0.10	1
Ag	<0.05	<0.05	<0.05	0
TL	<0.01	<0.01	<0.01	0

* Concentrations in μg per gram wet weight. MDL - Method detection limit. (n = 3 samples, 1 species)

Table 4. Trace metal concentration ranges for 1991 fish composite samples*.

Chemical	Minimum	Maximum	Median	# > MDL
As	<0.10	0.80	0.10	18
Se	0.04	0.46	0.25	19
Sb	<0.01	<0.01	<0.01	0
Hg	<0.03	0.458	0.107	19
Total CN	<0.05	0.30	<0.05	13
Be	<0.005	<0.005	<0.005	0
Cd	<0.05	0.08	<0.05	1
Cr	<0.10	0.90	<0.10	7
Pb	<0.50	0.90	<0.50	1
Ni	<0.10	0.50	<0.10	1
Ag	<0.05	<0.05	<0.05	0
Tl	<0.01	<0.01	<0.01	0

* Concentrations in μg per gram wet weight. MDL - Method detection limit. (n = 19 samples, 6 species).

Table 5. Trace metal concentration ranges for 1992 fish composite samples*.

Chemical	Minimum	Maximum	Median	# > MDL
As	<0.10	0.10	0.10	9
Se	0.16	0.53	0.32	14
Sb	<0.01	<0.01	<0.01	0
Hg	0.040	0.162	0.073	14
Total CN	0.05	41.2	0.18	14
Be	<0.005	0.006	<0.005	1
Cd	<0.05	<0.05	<0.05	0
Cr	<0.10	0.90	<0.10	2
Pb	<0.50	0.60	<0.50	1
Ni	<0.10	0.60	<0.10	1
Ag	<0.05	<0.05	<0.05	0
Tl	<0.01	<0.01	<0.01	0

* Concentrations in μg per gram wet weight. MDL - Method detection limit. (n = 14 samples, 5 species).

Volatile Organic Compounds

Fish composite samples collected in 1989, 1991, and 1992 had similar volatile organic compounds detected (Tables 6-8; see Appendix III). Compounds that were detected in a majority of samples included methylene chloride, chloroform, 1,1,1 -trichloroethane, benzene, ethylbenzene, and meta, ortho, and para-xylene. Many of these compounds (e.g., methylene chloride and toluene) are used within the laboratory for the cleaning of glassware and extraction of pesticides and hydrocarbons. Also, xylene is used by the District of Columbia Fisheries to rinse and clean the aluminum foil that is used to store fish fillets. Methylene chloride, 1,1,1-trichloroethane, benzene, and toluene were detected in the blanks but at much lower levels than the samples (Appendix III). However, because the samples were subjected to a greater amount of handling than the blanks, there is a greater opportunity for contamination from the laboratory environment. Also, the material used in the trapping of the purged compounds (Tenax) can bleed benzene and toluene during analysis. These factors suggest that these data, especially for methylene chloride, benzene, xylenes, and toluene,

Table 6. Volatile organic concentration ranges for 1989 fish composite samples.*

Chemical	Minimum	Maximum	Median	# >MDL
1,1-dichloroethene	<0.4	<0.4	<0.4	0
methylene chloride	31	1300	550	3
trans-1,2-dichloroethene	<0.2	<0.2	<0.2	0
1,1-dichloroethane	<0.2	<0.2	<0.2	0
chloroform	0.4	2.0	1.0	3
1,1,1-trichloroethane	0.7	1.0	0.9	3
carbon tetrachloride	<0.2	<0.2	<0.2	0
1,2-dichloroethane	<0.2	0.9	<0.2	2
benzene	2.0	2.8	2.8	3
trichloroethene	<0.2	0.60	<0.2	2
1,2-dichloropropane	<0.2	<0.2	<0.2	0
bromodichloromethane	<0.2	0.90	<0.5	2
cis-1,3-dichloropropene	<0.2	<0.2	<0.2	0
toluene	22	35	34	3
trans-1,3-dichloropropene	<0.2	<0.2	<0.2	0
1,1,2-trichloroethane	<0.2	<0.2	<0.2	0
tetrachloroethene	0.7	18	5.2	3
dibromochloromethane	<0.2	<0.2	<0.2	0
chlorobenzene	<0.2	<0.2	<0.2	0
ethylbenzene	<0.2	0.8	0.5	2
m,p-xylene	1.0	1.1	1.0	3
o-xylene	<0.2	1.0	0.8	2
bromoform	<0.2	0.4	0.3	2
1,1,2,2-tetrachloroethane	<0.2	<0.2	<0.2	0

* Concentrations in ng per gram wet weight. MDL - Method detection limit (n = 3 samples, 1 species).

Table 7. Volatile organic concentration ranges for 1991 fish composite samples.*

Chemical	Minimum	Maximum	Median	# >MDL
1,1-dichloroethene	<0.4	<0.4	<0.4	0
methylene chloride	3.0	59	16	19
trans-1,2-dichloroethene	<0.4	<0.4	<0.4	0
1,1-dichloroethane	<0.2	<0.2	<0.2	0
chloroform	<0.2	4.7	0.5	17
1,1,1-trichloroethane	<0.4	3.5	0.6	15
carbon tetrachloride	<0.7	1.3	<0.7	1
1,2-dichloroethane	<0.5	<0.5	<0.5	0
benzene	1.3	6.5	2.3	19
trichloroethene	<0.9	2.2	<0.9	2
1,2-dichloropropane	<0.7	<0.7	<0.7	0
bromodichloromethane	<0.5	0.7	<0.5	1
cis-1,3-dichloropropene	<4	<4	<0.4	0
toluene	6.5	63	20	19
trans-1,3-dichloropropene	<3	<3	<3	0
1,1,2-trichloroethane	<1	<1	<1	0
tetrachloroethene	<5	17	<5	1
dibromochloromethane	<10	<10	<10	0
chlorobenzene	<1	<1	<1	0
ethylbenzene	<0.9	16	2	18
m,p-xylene	<0.6	20	3	18
o-xylene	<1	19	3	17
bromoform	NR	NR	NR	NR
1,1,2,2-tetrachloroethane	<5	<5	<5	0

* Concentrations in ng per gram wet weight. NR - Not reported. MDL - Method detection limit. (n = 19 samples, 6 species)

Table 8. Volatile organic concentration ranges for 1992 fish composite samples.*

Chemical	Minimum	Maximum	Median	# >MDL
1,1-dichloroethene	<0.2	<0.2	<0.2	0
methylene chloride	11	1700	410	12
trans-1,2-dichloroethene	<0.2	<0.2	<0.2	0
1,1-dichloroethane	<0.2	<0.2	<0.2	0
chloroform	0.4	2.3	0.7	12
1,1,1-trichloroethane	0.5	2.0	0.85	12
carbon tetrachloride	<0.2	<0.2	<0.2	0
1,2-dichloroethane	0.5	0.9	0.65	12
benzene	3.1	37	6.4	12
trichloroethene	<0.2	1.0	0.4	7
1,2-dichloropropane	<0.2	0.6	<0.2	8
bromodichloromethane	<0.2	<0.2	<0.2	0
cis-1,3-dichloropropene	<0.2	0.4	<0.2	1
toluene	15	90	40	12
trans-1,3-dichloropropene	<0.2	0.8	<0.2	2
1,1,2-trichloroethane	<0.2	1.0	<0.2	3
tetrachloroethene	0.6	20	1.0	12
dibromochloromethane	<0.2	<0.2	<0.2	0
chlorobenzene	<0.2	2.5	0.55	11
ethylbenzene	0.4	15	2.0	12
m,p-xylene	0.7	30	2.7	12
o-xylene	0.6	21	2.3	12
bromoform	<0.2	0.8	<0.2	1
1,1,2,2-tetrachloroethane	<0.2	1.0	<0.2	0

* Concentrations in ng per gram wet weight. MDL - Method detection limit. (n = 12 samples, 5 species) .

should be interpreted with caution. In many composite samples, however, concentrations were low with the median concentration below 5 ng/g wet (Tables 6-8).

Semi-Volatile Organic Compounds

Fish collected in 1989 (n=3) contained twelve semi-volatile organic compounds above the detection limit (Table 9). Polycyclic aromatic hydrocarbons (e.g., naphthalene, phenanthrene, fluoranthene, and pyrene) were detected only once, while fluorene was detected in all three brown bullhead composites. Phthalate compounds were also detected in these samples. Di-n-butylphthalate and bis-(2-ethylhexyl)phthalate were detected in the blank at levels of approximately 100 ng/g wet; thus these data should be viewed with caution (Appendix III). Certain phthalates are known laboratory contaminants derived from rubber gloves and other plasticware that might be used during extraction and sample preparation (Zitko, 1972).

Thirteen out of thirty semi-volatile organic compounds were detected in the nineteen fish composite samples from 1991 (Table 10). These compounds included similar phthalates as the 1989 samples; phenol (n=3) and seven polycyclic aromatic hydrocarbons: naphthalene (n=19), acenaphthylene (n=1), and acenaphthene (n=2), fluoranthene (n=2), pyrene (n=2), fluorene (n=2), and phenanthrene (n=5). Bis(2-ethylhexyl)phthalate ranged in concentration from <9 to 1500 ng/g wet (median = 140 ng/g wet) and was detected in 18 samples. Naphthalene, a 2-ring aromatic hydrocarbon, was the only aromatic hydrocarbon compound detected in all fish composite samples with concentrations ranging from 4 to 99 ng/g wet (median concentration = 20 ng/g wet).

Six semi-volatile organic compounds were detected in the fourteen fish composite samples obtained in 1992. Naphthalene and three phthalates were the compounds most detected (Table 11; Appendix III). Again, laboratory contamination could be the source of some phthalates in these samples (Zitko, 1972), with bis(2-ethylhexyl)phthalate detected in all samples with a median concentration of 210 ng/g wet. Naphthalene concentrations ranged from <0.1 to 160 μg/g wet with a median concentration of 5 μg/g wet, which was slightly lower than in 1991 samples.

Table 9. Semi-volatile organic concentration ranges for 1989 fish composite samples.*

Chemical	Minimum	Maximum	Median	# >MDL
Phenol	<1	40	<1	1
Naphthalene	<0.1	<0.1	<0.1	1
Diethylphthalate	<1	9	<1	1
Fluorene	<0.3	14	<0.3	3
Phenanthrene	<0.3	54	<0.3	1
Di-n-butylphthalate	70	180	95	3
Fluoranthene	<0.4	19	<0.4	1
Pyrene	<0.3	33	<0.3	1
bis(2-Ethylhexyl)phthalate	<1	220	140	2
Di-n-octylphthalate	<6	90	<6	1

* Concentrations are in ng per gram wet weight. MDL - Method detection limit.
(n = 3 samples, 1 species).

Table 10. Semi-volatile organic concentration ranges for 1991 fish composite samples.*

Chemical	Minimum	Maximum	Median	# >MDL
Phenol	<10	30	<10	3
Naphthalene	4	99	21	19
Acenaphthylene	<0.9	2.2	<0.9	1
Aceanaphthene	<2	27	<2	2
Diethylphthalate	<1	26	6	16
Fluorene	<2	19	<2	2
Phenanthrene	<4	23	<4	5
Anthracene	<4	5	<4	1
Di-n-butylphthalate	<5	100	39	18
Fluoranthene	<2	16	<2	2
Pyrene	<3	18	<3	2
bis(2-Ethylhexyl)phthalate	<9	1500	140	18
Di-n-octylphthalate	250	6700	2300	19

* Concentrations are in ng per gram wet weight. MDL - Method detection limit.
(n = 19 samples, 6 species).

Table 11. Semi-volatile organic concentration ranges for 1992 fish composite samples.*

Chemical	Minimum	Maximum	Median	# >MDL
Phenol	<1	18	<1	1
Isophorone	<0.4	1900	<0.4	1
Naphthalene	<0.1	160	4.8	8
Di-n-butylphthalate	48	160	76	14
bis(2-Ethylhexyl)phthalate	58	810	210	14
Di-n-octylphthalate	39	690	190	14

* Concentrations are in ng per gram wet weight. MDL - Method detection limit.
(n = 14 samples, 5 species).

Organochlorine Pesticides

Organochlorine pesticide concentration ranges and median values for the three fish samples collected in 1989 are presented in Table 12. Nine compounds were detected in these samples with heptachlor epoxide, pp'-DDE, pp'-DDD, and $\gamma+\alpha$-chlordane detected in all three samples. Total ($\gamma+\alpha$) chlordane ranged from 27 to 418 ng/g wet, while total DDT, which is the sum of the pp' forms of DDE (1,1-(2,2,2-trichloroethenylidene)bis[4-chlorobenzene]), DDD (1,1-(2,2-dichloroethylidene)bis[4-chlorobenzene]), and DDT (1,1-(2,2,2-trichloroethylidene)bis[4-chlorobenzene]), ranged from 40 to 280 ng/g wet for the three samples.

Ten organochlorine pesticides were detected from the fourteen samples analyzed from 1991 (Table 13). Heptachlor epoxide, dieldrin, pp'-DDE, pp'-DDD, pp'-DDT and γ, α-chlordane were detected in the majority of samples, while α-BHC, γ-BHC, and heptachlor were detected three or fewer times. Total ($\gamma+\alpha$) chlordane ranged from 3 to 234 ng/g wet and total DDT ranged 7 to 234 ng/g wet, with median concentrations of 56 ng/g wet and 70 ng/g wet for chlordane and DDT, respectively. The highest concentrations of total chlordane and DDT were found in the lower Anacostia River in channel catfish and American eel composites, respectively. Largemouth bass, channel catfish, and American eel composites (a total of 5 samples out of 19) with total chlordane concentrations >100 ng/g wet were found in the lower

Table 12. Organic pesticide concentration ranges for 1989 fish composite samples.*

Chemical	Minimum	Maximum	Median	# > MDL
α-BHC	<1	2.7	<1	1
β-BHC	<1	<1	<1	0
γ-BHC	<1	1.2	<1	1
δ-BHC	<1	<1	<1	0
Heptachlor	<0.8	<0.8	<0.8	0
Aldrin	<0.8	<0.8	<0.8	0
Heptachlor Epoxide	1.2	17	2.2	3
α-Endosulphan	<0.6	<0.6	<0.6	0
Dieldrin	<0.5	6.9	<0.5	1
pp'-DDE	21	130	30	3
Endrin	<1	<1	<1	0
β-Endosulphan	<0.6	<0.6	<0.6	0
pp'-DDD	11	140	18	3
Endrin Aldehyde	<1	<1	<1	0
Endosulfan Sulfate	<1	<1	<1	0
pp'-DDT	<1	10	<1	1
Methoxychlor	<2	<2	<2	0
γ-chlordane	<7	78	47	3
α-chlordane	20	340	71	3

* Concentrations are in ng per gram wet weight. MDL - Method detection limit. (n = 3 samples, 1 species).

Table 13. Organic pesticide concentration ranges for 1991 fish composite samples.*

Chemical	Minimum	Maximum	Median	# > MDL
α-BHC	<0.6	2.3	<0.6	2
β-BHC	<1	<1	<1	0
γ-BHC	<0.3	4.0	<0.3	1
δ-BHC	<0.9	<0.9	<0.9	0
Heptachlor	<0.3	0.9	<0.3	3
Aldrin	<0.5	<0.5	<0.5	0
Heptachlor Epoxide	<0.5	18	1.4	14
α-Endosulphan	<0.5	<0.5	<0.5	0
Dieldrin	<0.5	42	4.0	16
pp'-DDE	4.7	140	41	19
Endrin	<0.5	<0.5	<0.5	0
β-Endosulphan	<0.5	<0.5	<0.5	0
pp'-DDD	2.1	82	18	19
Endrin Aldehyde	<1	<1	<1	0
Endosulfan Sulfate	<1	<1	<1	0
pp'-DDT	<1	51	2.0	10
Methoxychlor	<2	<2	<2	0
γ-chlordane	<1	84	14	17
α-chlordane	2.0	150	37	19

* Concentrations are in ng per gram wet weight. MDL - Method detection limit. (n = 19 samples, 6 species).

and upper Potomac River and in the lower Anacostia River. Fish composites (6 samples out of 19) with total DDT concentrations > 100 ng/g wet were found in all locations and included common carp, American eel and channel catfish composites.

Similar organochlorine pesticides compounds were detected in 1992 as in both 1989 and 1991 (Table 14). Heptachlor epoxide, dieldrin, pp'-DDE, pp'-DDD, pp'-DDT and $\gamma+\alpha$-chlordane were detected in the majority of samples. Heptachlor was detected seven times while endrin sulfate, which was not detected in the previous years, was detected once. Total chlordane concentrations ranged from 3 to 290 ng/g wet, with a median concentration of 37 ng/g wet. The highest concentration was in an American eel composite from the upper Anacostia River. Total DDT concentrations ranged from 5 to 133 ng/g wet, with a median value of 57 ng/g wet. The highest concentration was found in a largemouth bass composite from the lower Anacostia River. Fish composites with concentrations > 100 ng/g wet included American eel and largemouth bass species (3 samples out of 14) from the Anacostia River and upper Potomac River. Similarly, fish composites with total chlordane concentrations > 100 ng/g wet included largemouth bass, common carp, and American eel species (3 samples out of 14) from the lower and upper Anacostia River.

Polychlorinated Biphenyls, Dioxins, and Furans

Polychlorinated biphenyls (total PCBs; the sum of specific congeners, see Appendix III) ranged from 205 to 1284 ng/g wet for brown bullhead samples collected in 1989 (Table 15). These samples were collected from the lower Potomac and the upper and lower Anacostia rivers. Various congeners of polychlorinated dibenzo-dioxins (PCDD) and furans (PCDF) were also detected in these fish samples (Table 15; see Appendix III). Concentrations of the specific congener 2,3,7,8-TCDD were low and ranged from the detection limit (approximately < 0.2 pg/g wet) to 2.1 pg/g wet.

Concentration ranges of total PCBs, total PCDDs, and total PCDFs are presented in Table 16 for samples collected in 1991. As in 1989, various congeners of these groups were detected throughout the Washington, D.C. area. The dioxin, 2,3,7,8-TCDD, was detected in seven out of nineteen composites (Table 16; see Appendix III). Highest concentrations

Table 14. Organic pesticide concentration ranges for 1992 fish composite samples.*

Chemical	Minimum	Maximum	Median	# > MDL
α-BHC	<1	<1	<1	0
β-BHC	<1	<1	<1	0
γ-BHC	<1	<1	<1	0
δ-BHC	<1	<1	<1	0
Heptachlor	<0.8	6.1	<0.8	4
Aldrin	<0.8	<0.8	<0.8	0
Heptachlor Epoxide	<0.6	15	2.2	10
α-Endosulphan	<0.6	<0.6	<0.6	0
Dieldrin	<0.5	37	4.2	14
pp'-DDE	3.7	91	38	14
Endrin	<1	<1	<1	0
β-Endosulphan	<0.6	<0.6	<0.6	0
pp'-DDD	1.0	56	12	14
Endrin Aldehyde	<1	<1	<1	0
Endosulfan Sulfate	<1	4.0	<1	1
pp'-DDT	<1	9.0	1.0	7
Methoxychlor	<2	<2	<2	0
γ-chlordane	<1	90	10	10
α-chlordane	2.0	200	26	14

* Concentrations are in ng per gram wet weight. MDL - Method detection limit. (n = 14 samples, 5 species).

Table 15. Total polychlorinated biphenyls, dioxins, and furans ranges from 1989 composite fish samples.*

Chemical	Minimum	Maximum	Median	# >MDL
Total PCBs	205	1284	359	NA
Total PCDDs	7.5	77.5	21.9	NA
Total PCDFs	11.4	73.4	48.2	NA
2,3,7,8 - TCDD	<0.2	2.1	<0.2	1

* Dioxin/furan concentrations are in pg per gram wet weight, PCB concentrations in ng/g wet weight. MDL - Method detection limit. (n = 3 samples, 1 species). NA- Not applicable, concentrations of individual congeners that were below the detection limit were summed at half their detection limit (see Appendix III for raw data).

Table 16. Total polychlorinated biphenyls, dioxins, and furans ranges from 1991 composite fish samples.*

Chemical	Minimum	Maximum	Median	# >MDL
Total PCBs	117	2567	640	NA
Total PCDDs	7.5	77.5	21.9	NA
Total PCDFs	11.7	73.4	48.2	NA
2,3,7,8 - TCDD	<0.2	2.3	<0.2	7

* Dioxin/furan concentrations are in pg per gram wet weight, PCB concentrations in ng/g wet weight. MDL - Method detection limit. (n = 19 samples, 6 species). NA- Not applicable, concentrations of individual congeners that were below the detection limit were summed at half their detection limit (see Appendix III for raw data).

Table 17. Total polychlorinated biphenyls, dioxins, and furans ranges from 1992 composite fish samples.*

Chemical	Minimum	Maximum	Median	# >MDL
Total PCBs	81	1217	493	NA
Total PCDDs	3.3	155.3	8.2	NA
Total PCDFs	2.2	158.3	40	NA
2,3,7,8 - TCDD	<0.2	3.6	<0.2	2

* Dioxin/furan concentrations are in pg per gram wet weight, PCB concentrations in ng/g wet weight. MDL - Method detection limit. (n = 14 samples, 5 species). NA- Not applicable, concentrations of individual congeners that were below the detection limit were summed at half their detection limit (see Appendix III for raw data).

of total PCBs were found in American eel samples from the lower Anacostia River and the upper and lower Potomac River. Concentrations of 2,3,7,8-TCDD were highest in brown bullhead and channel catfish composites from the same locations. However, these concentrations were low and generally less than 2 pg/g wet.

Polychlorinated biphenyls ranged from 81 to 1218 ng/g wet for samples collected in 1992 (Table 17). Concentrations of PCBs, PCDDs, and PCDFs were detected in a majority of the fourteen fish composite samples. Detectable concentrations of 2,3,7,8-TCDD were found in only two samples in 1992 (Table 17, Appendix III), with a the highest concentration <4 pg/g wet. Highest concentrations of total PCBs and 2,3,7,8-TCDD were found in largemouth bass and American eel samples collected from the Anacostia River and upper Potomac River.

Discussion

The following sections provide a discussion of the variations, including variations between species and geographical, observed within these data sets (1989-1992). Additionally, a comparison is made to previous studies in the local area and a recently completed national fish contamination study (U.S. EPA, 1992). Lastly, a brief discussion of the possible health effects of the levels observed from this data set is presented. Due to the extent of this data set however, only selected parameters will be discussed in more detail. Chemicals include the trace metal Hg and metalloids As and Se, the PAH naphthalene, bis(2-ethylhexyl)phthalate, total PCBs, total DDT (pp' forms of DDE+DDD+DDT), $\alpha+\gamma$ chlordane, dieldrin, heptachlor epoxide, and dioxins/furans (Tables 18-20). These chemicals were selected due to their presence in previous studies, and their inclusion in the Chesapeake Bay's primary or secondary Toxics of Concern List (EPA, 1991).

Contaminant Variations between Species

Ten different species of fish were analyzed for this study. It is important to note that contaminant variations between species can be the result of many factors. These factors include feeding habits (e.g., top predator versus scavenger), living area (e.g., benthic versus pelagic), physiological differences (e.g., varying lipid content), type of contaminant (e.g.,

organic versus inorganic), and uptake mechanism (e.g., particle or sediment versus water). In analyzing these data for differences between species, it was necessary to assume that there are limited geographical factors which can influence the concentration of inorganic and organic contaminants in the fish tissue. This may not be the best assumption given that sediments in the Anacostia River, especially the lower section, has been shown to be impacted with trace metals and organic compounds compared to the upper Anacostia River and Potomac River (Velinsky et al., 1992; Pinkney et al., 1993). However, fish are highly mobile and may not reside in just one location.

Of the trace elements determined during this study, As, Hg, and Se were detected most often in both 1991 and 1992 (see Results). In 1991, six species of fish were examined (Table 1), and results for As, Hg, and Se are presented in Table 19 and graphically in Figures 2 and 3. In 1992, six slightly different species were examined and results are presented in Table 20 and graphically in Figures 4 and 5. A one-way analysis of variance (ANOVA) at a 95% confidence level ($p < 0.05$) was used to test if there were significant differences between species for these trace elements for 1991. Due to sample limitations for 1992 (i.e., many species had only two replicates), a one-way ANOVA could not be performed. In 1991 and 1992, many samples had As concentrations below the detection limit (< 0.1 μg/g wet) which causes severe problems with statistics. Therefore, these concentrations were set at the detection limit to provide a conservative estimate of the differences between species. There were no significant differences ($p > 0.05$) in the concentrations of either As, Hg, and Se between species for 1991. Overall, concentrations of Se and Hg were similar between 1991 and 1992 with average concentrations ($\pm$ 1 standard deviation) of 0.24 ± 0.10 and 0.32 ± 0.11 μg Se /g wet, and 0.13 ± 0.09 and 0.088 ± 0.036 μg Hg/g wet, respectively. Arsenic concentrations were different between these two years in that the majority of samples were at the detection limit in 1992 and slightly higher in 1991 (Tables 19 and 20).
Concentrations of naphthalene, bis(2-ethylhexyl)phthalate, dieldrin, total PCBs, DDTs, heptachlor epoxide, and chlordanes were also statistically evaluated to determine if differences existed between species within the 1991 data set (Figures 6-9). Qualitatively, average concentrations of PCBs, DDTs, chlordanes, dieldrin, and heptachlor epoxide in channel catfish

Table 18. Concentrations of selected trace metals and organic compounds in fish composites of 1989*.

Field ID	Fish ID	Loc	As	Se	Hg	Napth	ΣPCB	ΣDDT	Chlor	Dieldrin	Hepta	Phthalate	TCDD
1-89	BB	LP	0.1	0.33	0.021	9.0	1284	280	418	<0.5	17	<9.0	2.1
15-89	BB	UA	<0.1	0.27	0.061	<0.1	205	40	118	6.9	2.2	140	<0.9
16-89	BB	LA	0.5	0.16	0.13	<0.1	359	42	27	<0.6	1.2	220	<3.5

* Concentrations of As, Se, and Hg in μg/g wet. Naphthalene (Napth), ΣPCB, ΣDDT, Chlor (α + γ chlordane), and dieldrin concentrations in ng/g wet, and tetra-chlorodibenzo-dioxin (2,3,7,8-TCDD) concentrations in pg/g wet. ΣPCB is the sum of 70 individual congeners (see appendix II), ΣDDT is the sum of the pp' forms of DDE, DDD, and DDT; Hepta is heptachlor epoxide and phthalate is bis(2ethylhexyl)phthalate. Locations (Loc): LP - Lower Potomac, UP - Upper Potomac, LA - Lower Anacostia, and UA - Upper Anacostia. Fish ID: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish.

Table 19. Concentrations of selected trace metals and organic compounds in fish composites of 1991*.

Field ID	Fish ID	Loc	As	Se	Hg	Napth	ΣPCB	ΣDDT	Chlor	Dieldrin	Hepta	Phthalate	TCDD
1-91	COC	UP	0.3	0.35	0.116	29.0	788	87.0	86.0	10.0	4.9	1300	1.0
2-91	LMB	UP	0.1	0.46	0.458	15.0	640	78.0	102.0	5.7	2.2	46	0.4
3-91	AE	UP	0.1	0.37	0.221	99.0	2024	193.0	57.0	9.5	3.7	1500	<0.4
4-91	CC	UP	0.3	0.04	0.076	54.0	1216	39.0	39.0	3.8	1.4	190	1.9
5-91	BG	UP	0.1	0.27	0.116	11.0	150	13.8	2.5	1.7	<0.5	93	<0.4
6-91	CC	LP	0.5	0.27	0.068	40.0	685	70.0	70.0	9.1	3.4	130	0.9
7-91	LMB	LP	0.1	0.23	0.108	4.0	213	22.7	7.0	<0.5	<0.5	64	<0.3
8-91	AE	LP	0.1	0.17	0.116	32.0	2567	191.0	132.0	42.0	18	120	0.7
9-91	CC	LP	0.2	0.12	0.106	23.0	1322	146.0	106.0	11.0	3.3	190	1.9
10-91	BG	LP	0.1	0.25	0.068	12.0	131	8.0	2.5	<0.5	<0.5	110	<0.4
11-91	COC	UA	0.2	0.27	0.076	9.0	941	101.0	56.0	4.0	0.9	140	<0.2
12-91	LMB	UA	0.1	0.21	0.126	9.0	363	26.8	21.0	3.2	<0.5	220	<0.4
13-91	BB	UA	<0.1	0.08	0.033	22.0	307	37.5	66.0	4.9	2.1	140	<0.3
14-91	BG	UA	0.1	0.25	0.043	9.0	117	7.3	4.0	2.2	<0.5	250	<0.4
15-91	COC	LA	0.2	0.29	0.21	21.0	165	14.6	23.0	3.4	0.8	88	<0.2
16-91	LMB	LA	0.8	0.33	0.271	14.0	577	80.0	36.0	<0.5	1.3	90	0.6
17-91	AE	LA	0.5	0.25	0.113	41.0	2077	234.0	132.0	32.0	10	160	<0.2
18-91	CC	LA	0.2	0.15	0.091	84.0	2033	232.0	234.0	21.0	8.3	140	2.3
19-91	BG	LA	0.1	0.25	0.078	16.0	126	13.0	5.0	1.6	<0.5	<9.0	<0.2

* Concentrations of As, Se, and Hg in μg/g wet. Naphthalene (Napth), ΣPCB, ΣDDT, Chlor (α+γ chlordane), and dieldrin concentrations in ng/g wet, and tetra-chlorodibenzo-dioxin (2,3,7,8-TCDD) concentrations in pg/g wet. ΣPCB is the sum of 70 individual congeners (see appendix II), ΣDDT is the sum of the pp' forms of DDE, DDD, and DDT; Hepta is heptachlor epoxide and phthalate is bis(2ethylhexyl)phthalate. Locations (Loc): LP - Lower Potomac, UP - Upper Potomac, LA - Lower Anacostia, and UA - Upper Anacostia. Fish ID: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish.

Table 20. Concentrations of selected trace metals and organic compounds in fish composites of 1992*.

Field ID	Fish ID	Loc	As	Se	Hg	Napth	ΣPCB	ΣDDT	Chlor	Dieldrin	Hepta	Phthalate	TCDD
1-92	BG	LP	<0.1	0.22	0.052	<0.1	121	15.1	3.5	1.6	<0.6	140	<0.4
2-92	LMB	LP	0.1	0.38	0.162	5.1	283	40.0	2.5	4.0	<0.6	210	<0.9
3-92	CC	LP	0.1	0.16	0.096	5.7	544	73.0	19.0	8.8	2.5	810	<1.2
4-92	COC	LP	0.1	0.31	0.044	5.7	441	47.5	66.0	<0.6	1.8	180	<0.8
5-92	CC	UP	0.1	0.18	0.058	<0.1	598	66.0	62.0	5.9	3.1	630	NR
6-92	COC	UP	0.1	0.40	0.091	<0.1	545	77.5	52.0	3.5	5.6	220	<0.7
7-92	AE	UP	0.1	0.45	0.132	13.0	1218	120.0	44.0	16.0	4.4	310	3.6
8-92	PS	LA	0.1	0.25	0.063	<0.1	81	5.2	2.5	1.5	<0.6	140	NR
9-92	LMB	LA	<0.1	0.33	0.132	<0.1	965	133.0	165.0	16.0	5.1	110	2.8
10-92	COC	LA	<0.1	0.38	0.130	<0.1	303	29.5	29.0	2.2	<0.6	250	<0.8
11-92	BG	UA	<0.1	0.25	0.060	4.8	83	7.5	4.5	3.7	1.0	340	<0.6
12-92	LMB	UA	<0.1	0.20	0.069	5.6	123	17.0	18.0	4.4	0.9	110	<0.9
13-92	COC	UA	0.1	0.53	0.063	7.8	704	77.5	180.0	11.0	5.6	58	<0.6
14-92	AE	UA	0.1	0.45	0.077	160.0	952	123.0	290.0	37.0	15	640	<5.6

* Concentrations of As, Se, and Hg in μg/g wet. Naphthalene (Napth), ΣPCB, ΣDDT, Chlor ($\alpha + \gamma$ chlordane), and dieldrin concentrations in ng/g wet, and tetra-chlorodibenzo-dioxin (2,3,7,8-TCDD) concentrations in pg/g wet. ΣPCB is the sum of 70 individual congeners (see appendix II), ΣDDT is the sum of the pp' forms of DDE, DDD, and DDT; Hepta is heptachlor epoxide and phthalate is bis(2ethylhexyl)phthalate. Locations (Loc): LP - Lower Potomac, UP - Upper Potomac, LA - Lower Anacostia, and UA - Upper Anacostia. Fish ID: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish.

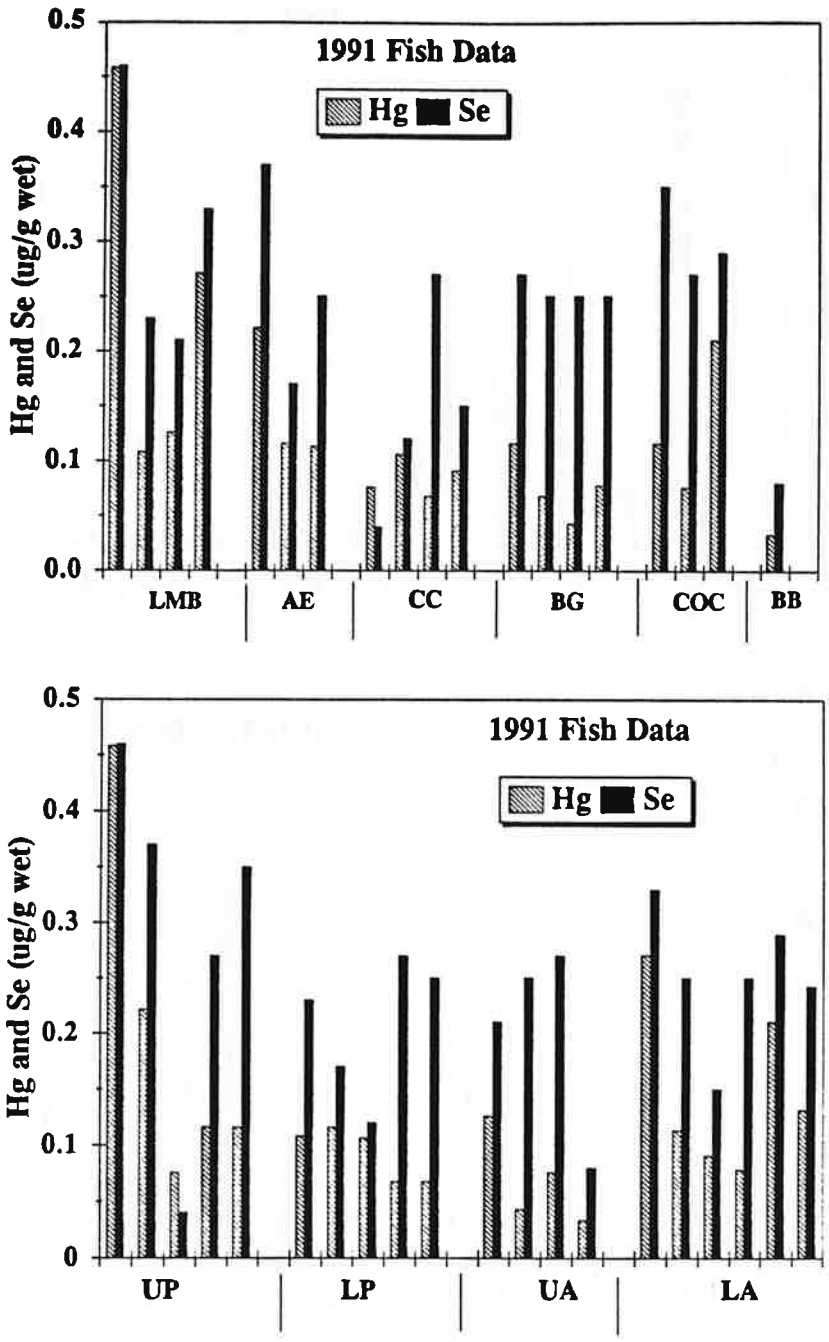


Figure 2. Concentrations of Hg and Se by species and location for 1991.
Key: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish. UP - upper Potomac, LP - lower Potomac, UA - upper Anacostia, LA - lower Anacostia.

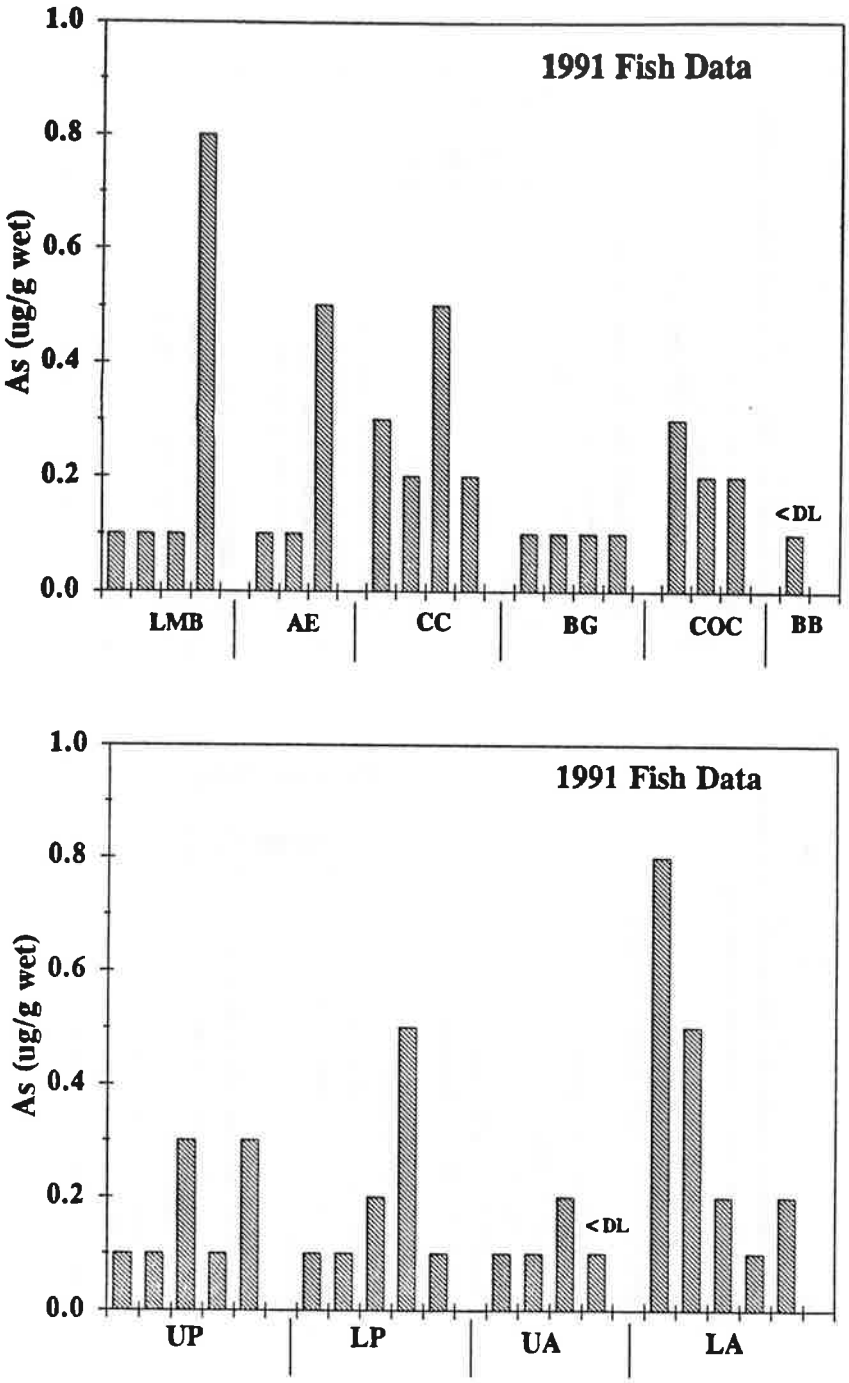


Figure 3. Concentrations of As by species and location for 1991 (See key in Figure 1). Samples concentrations below the detection limit are marked with <DL.

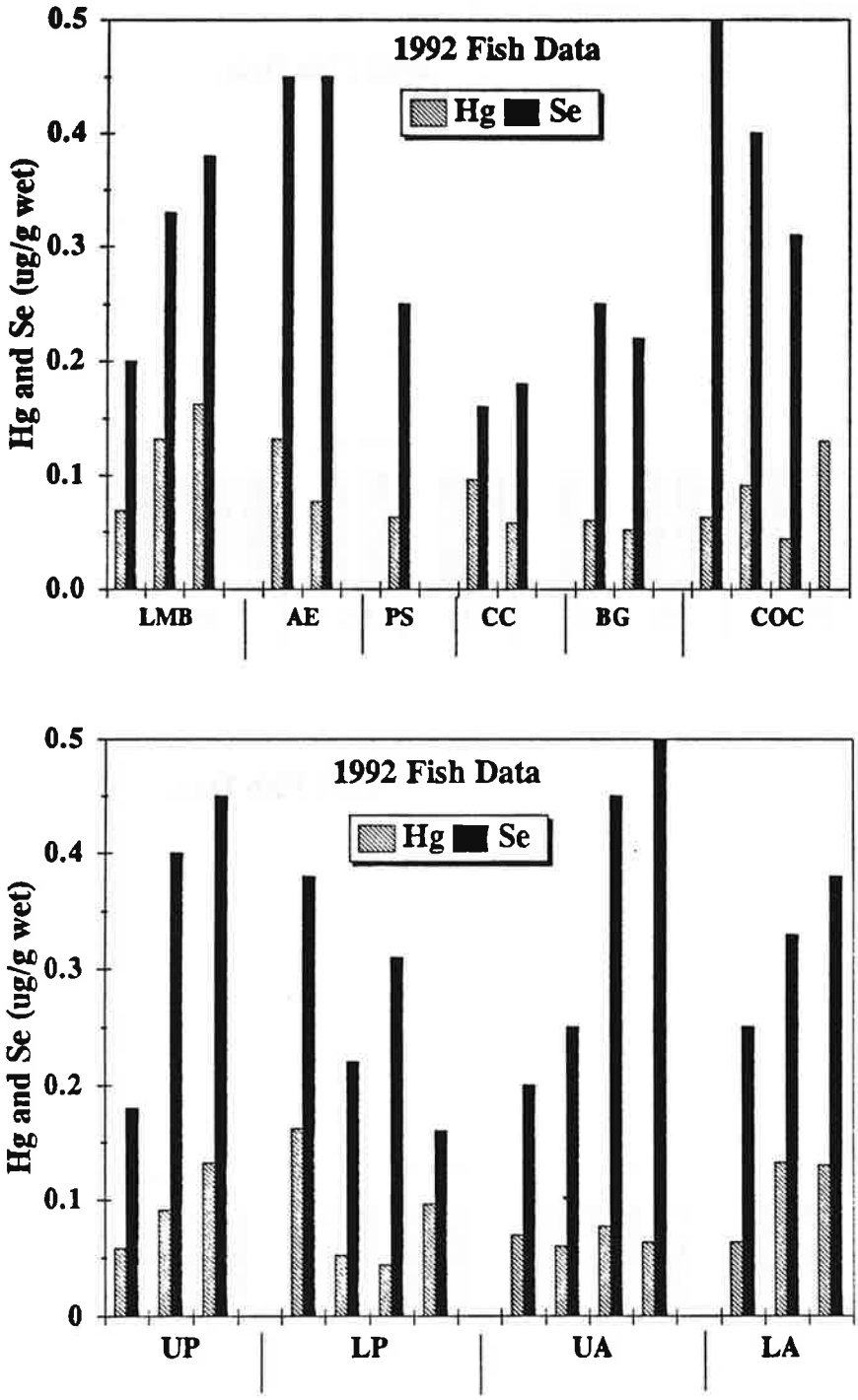
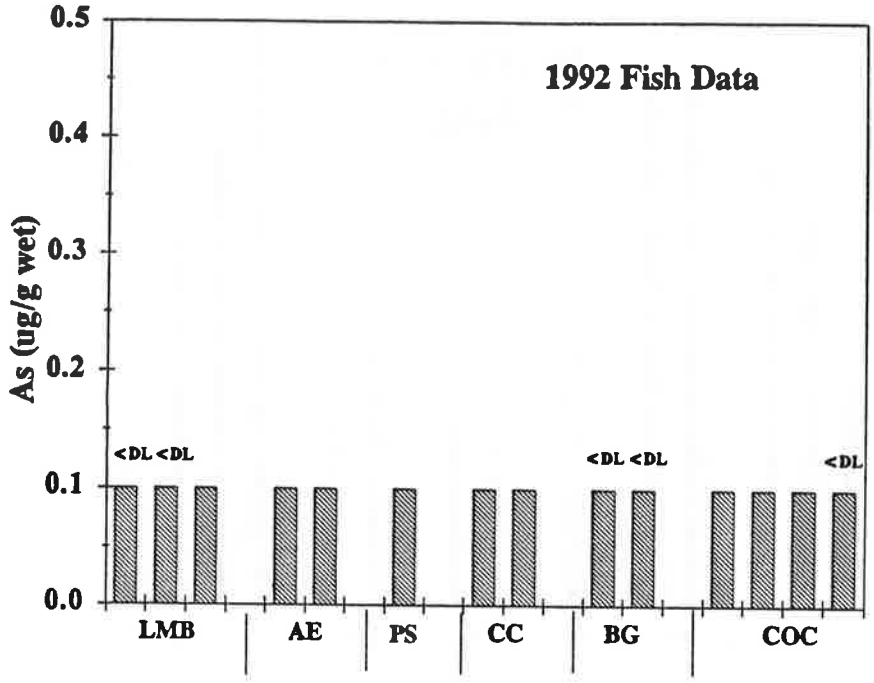


Figure 4. Concentrations of Hg and Se by species and location for 1992.
Key: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish. UP - upper Potomac, LP - lower Potomac, UA - upper Anacostia, LA - lower Anacostia.



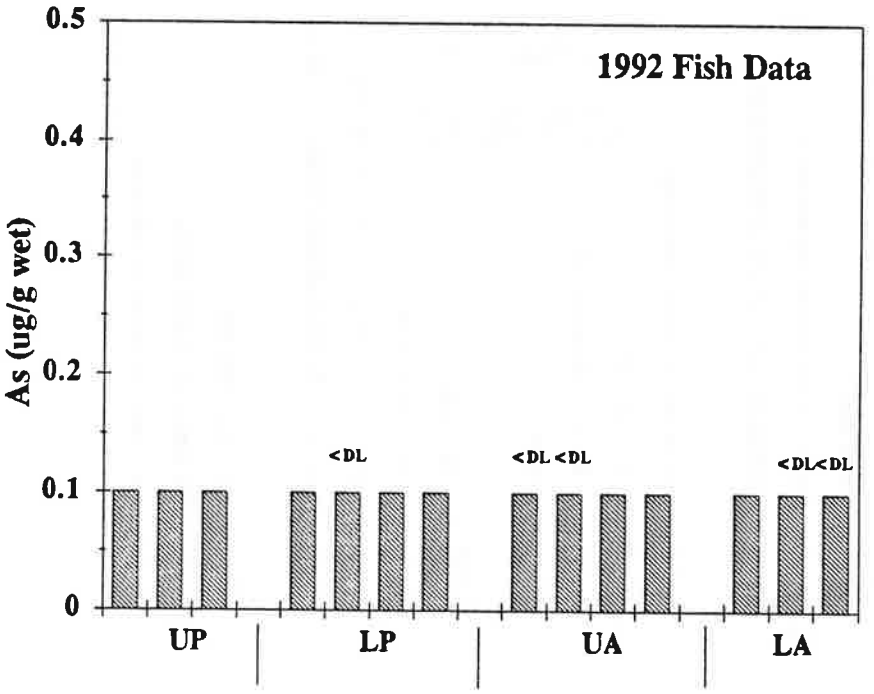


Figure 5. Concentrations of As by species and location for 1992 (See key in Figure 4). Samples concentrations below the detection limit are marked with < DL.

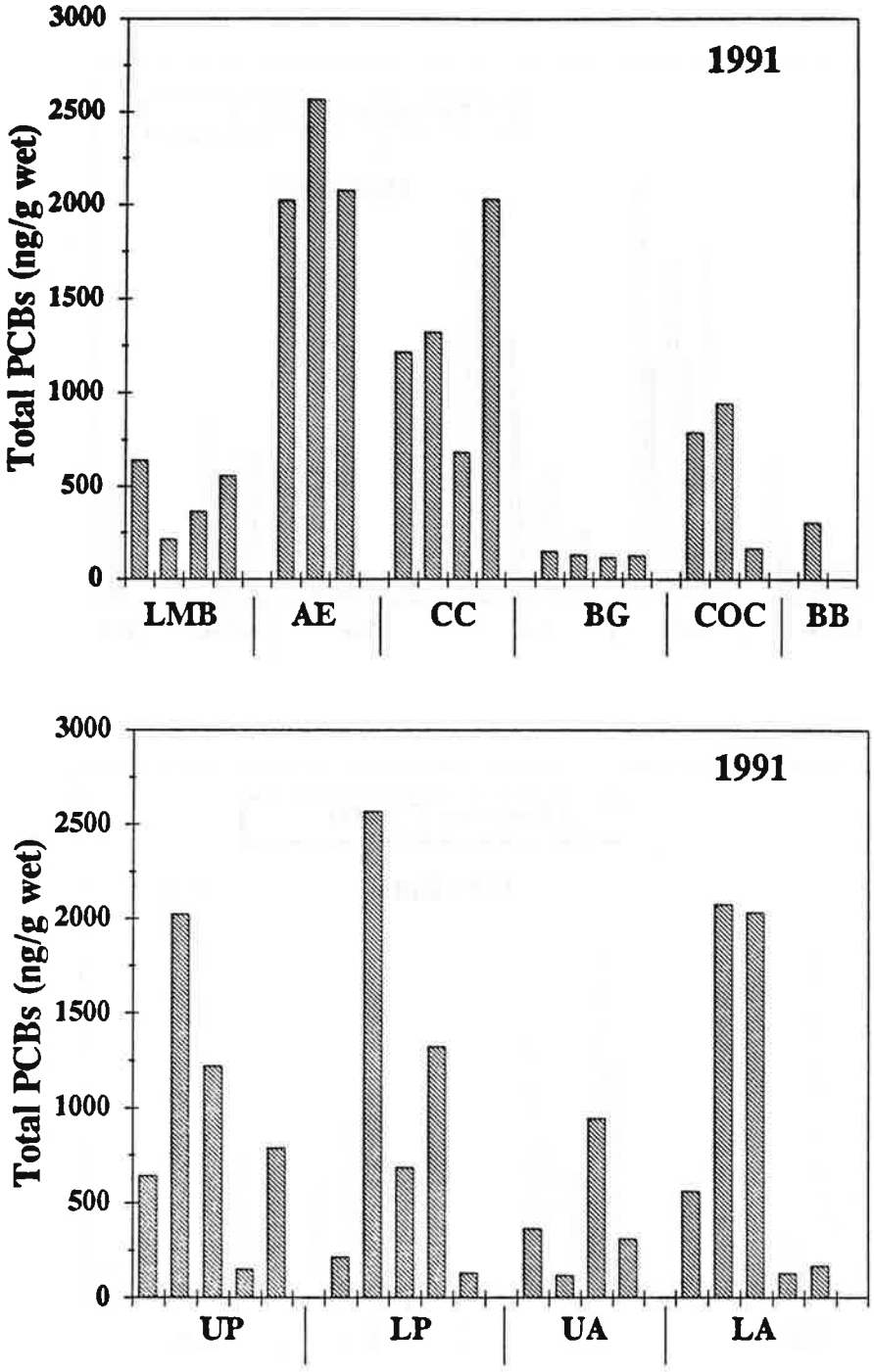


Figure 6. Concentrations of total PCBs by species and location for 1991.
Key: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish. UP - upper Potomac, LP - lower Potomac, UA - upper Anacostia, LA - lower Anacostia.

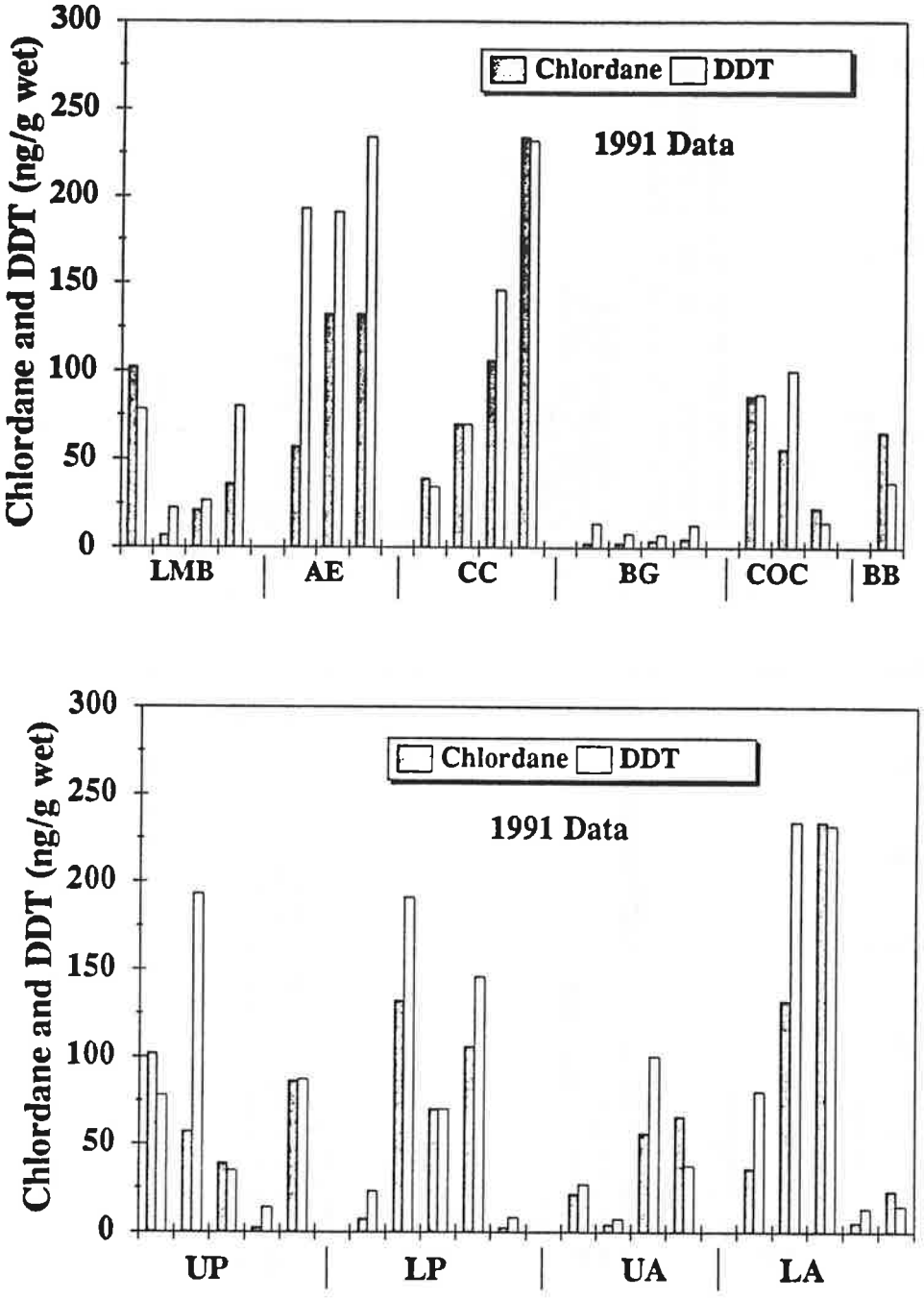


Figure 7. Concentrations of total chlordanes and DDTs by species and location for 1991 (See key in Figure 6).

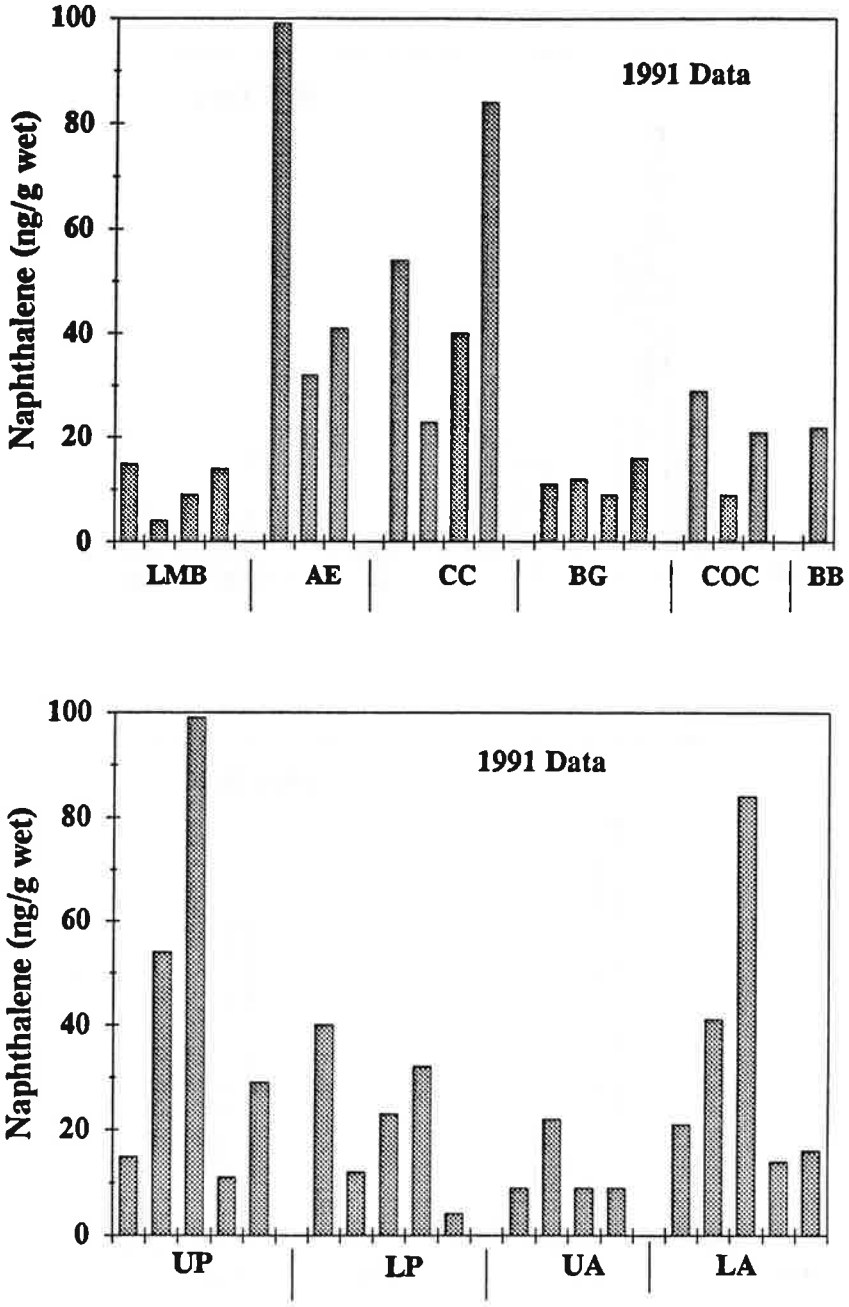


Figure 8. Concentrations of naphthalene by species and location for 1991 (See key in Figure 6).

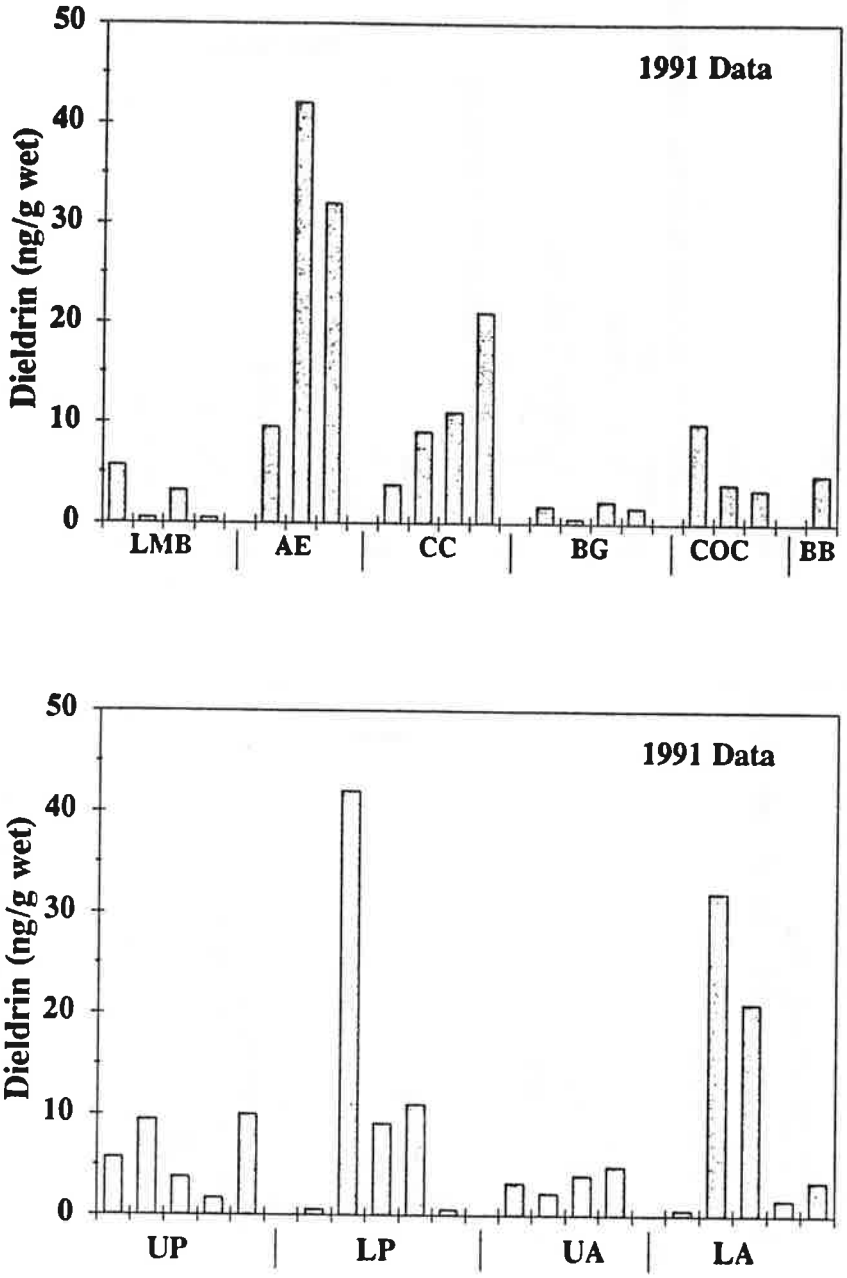


Figure 9. Concentrations of dieldrin by species and location for 1991(See key in Figure 6).

and American eel composites were higher than other fish species and the overall mean for the entire population (Table 21). On average, concentrations of bis(2-ethylhexyl)phthalate were higher in American eel and common carp composites. Significant differences were found between species for total PCBs, DDTs, and heptachlor epoxide at $p < 0.05$. A Tukey's Honestly Significance Pair-wise Comparison Test was used to determine which species were different from another. For total PCBs, the American eel composite concentrations were significantly higher than for the other species, while channel catfish concentrations were higher than both largemouth bass and bluegill sunfish. Concentrations of total DDT in American eel composites were significantly higher than largemouth bass, bluegill sunfish, and common carp samples. There was no significant concentration difference for total DDT between channel catfish and American eel concentrations (Figures 6-9). Heptachlor epoxide concentrations were significantly higher in the American eel composites and lowest in the largemouth bass composites.

Unfortunately, there was insufficient data and replication to perform statistical analyses (i.e., ANOVA) on the 1992 data set. Total PCBs concentrations were higher, on average, for American eel, common carp, and channel catfish species, with pumpkinseed and bluegills containing the least (Figures 10-13). One largemouth bass composite from the lower Anacostia had concentrations as high as those measured in the American eel or common carp composites. Similar trends were observed for the other organic groups (e.g., chlordanes, DDTs, dieldrin, heptachlor epoxide, and bis(2-ethylhexyl)phthalate) in which American eel and, in some cases, channel catfish composites exhibited highest concentrations compared to other species and the overall average for the entire data set (Table 21). These trends, which could not be statistically tested, were similar to those determined in the 1991 data set.

An important variable in the accumulation of organic contaminants is the lipid content of a fish (e.g., Mackay, 1982; Connolly and Pedersen, 1988; Thomann et al., 1992; Cullen and Connell, 1992). Physiological differences between species can result in varying amounts of lipids stored in various body parts. The lipid content is operationally defined, and is the weight of methylene chloride extracted-material contained in the fillets. The

Table 21. Average concentrations of selected trace metals and organics in fish composites collected in the waters of the District of Columbia*.

Year	1991					1992				
Fish ID	All	CC	AE	COC	LMB	All	CC	AE	COC	LMB
Number of Samples	19	4	3	3	4	14	2	2	4	3
Trace Metals (µg/g wet)										
Arsenic	0.22	0.3	0.23	0.23	0.28	0.082	0.1	0.1	0.088	0.067
Mercury	0.131	0.085	0.15	0.134	0.241	0.088	0.077	0.105	0.082	0.121
Organics (ng/g wet)										
Chlordanes	62	112	107	55	42	67	41	167	82	62
DDTs	84	121	206	68	52	59	70	122	58	63
Dieldrin	8.8	11.3	27.8	5.8	2.4	8.3	7.4	26.5	4.3	8.1
Heptachlor epoxide	3.3	4.1	10.6	2.2	1.0	3.1	2.8	9.7	3.3	1.1
PCBs	864	1314	2222	631	443	497	574	1085	498	457
Bis(2-ethylhexyl)phthalate	262	163	593	509	105	296	720	475	177	143

Key: CC - Channel Catfish, AE - American Eel, COC - Common Carp, LMB - Largemouth Bass Chlordanes is the sum of $\alpha + \gamma$ forms, DDTs is the sum of the p,p forms of DDT, DDE, and DDD; and PCBs is the sum of individual congeners (see Appendix III). For averages, concentrations were set at half the detection limit where appropriate.

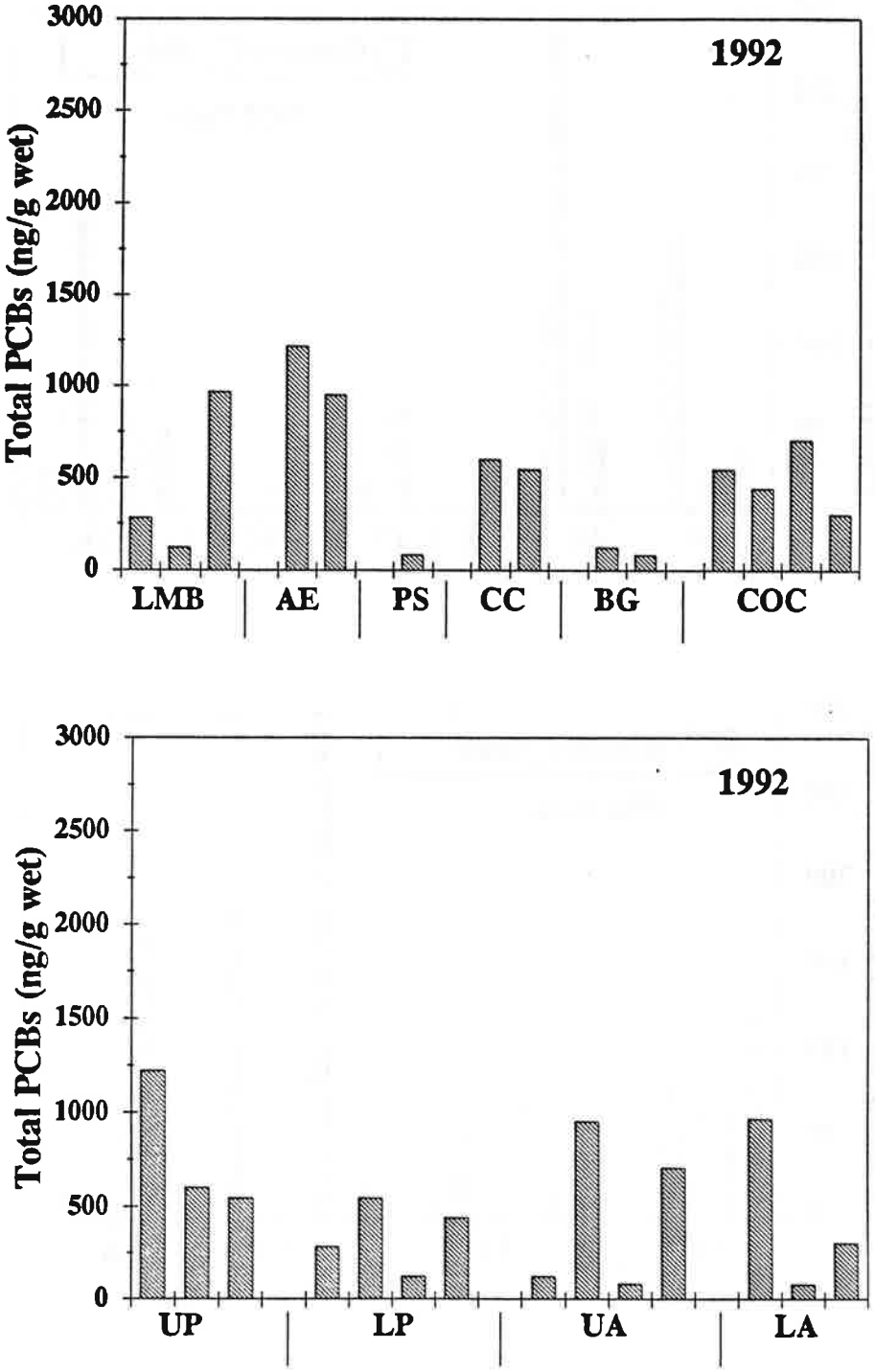
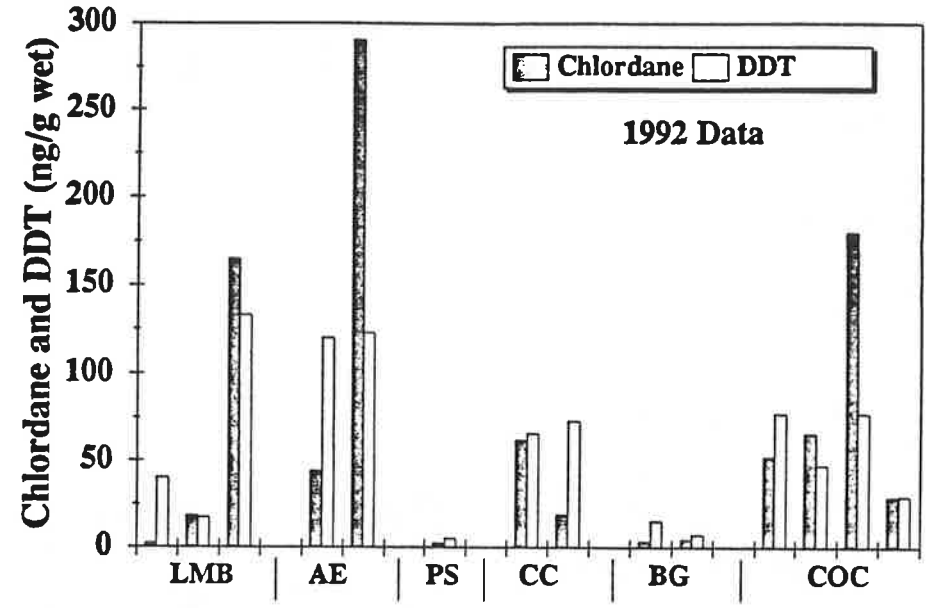


Figure 10. Concentrations of total PCBs by species and location for 1992.
Key: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish. UP - upper Potomac, LP - lower Potomac, UA - upper Anacostia, LA - lower Anacostia.



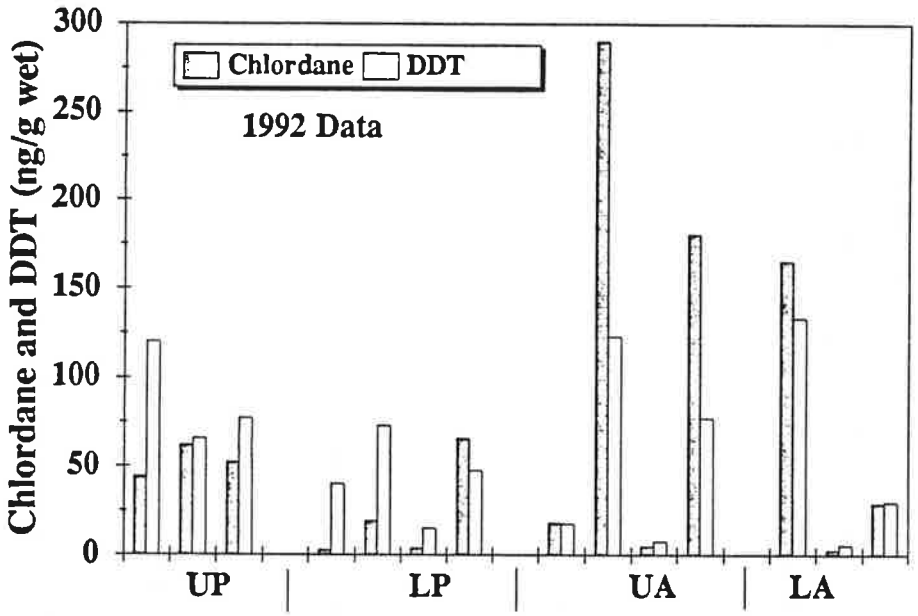


Figure 11. Concentrations of total chlordanes and DDTs by species and location for 1992 (See key in Figure 10).

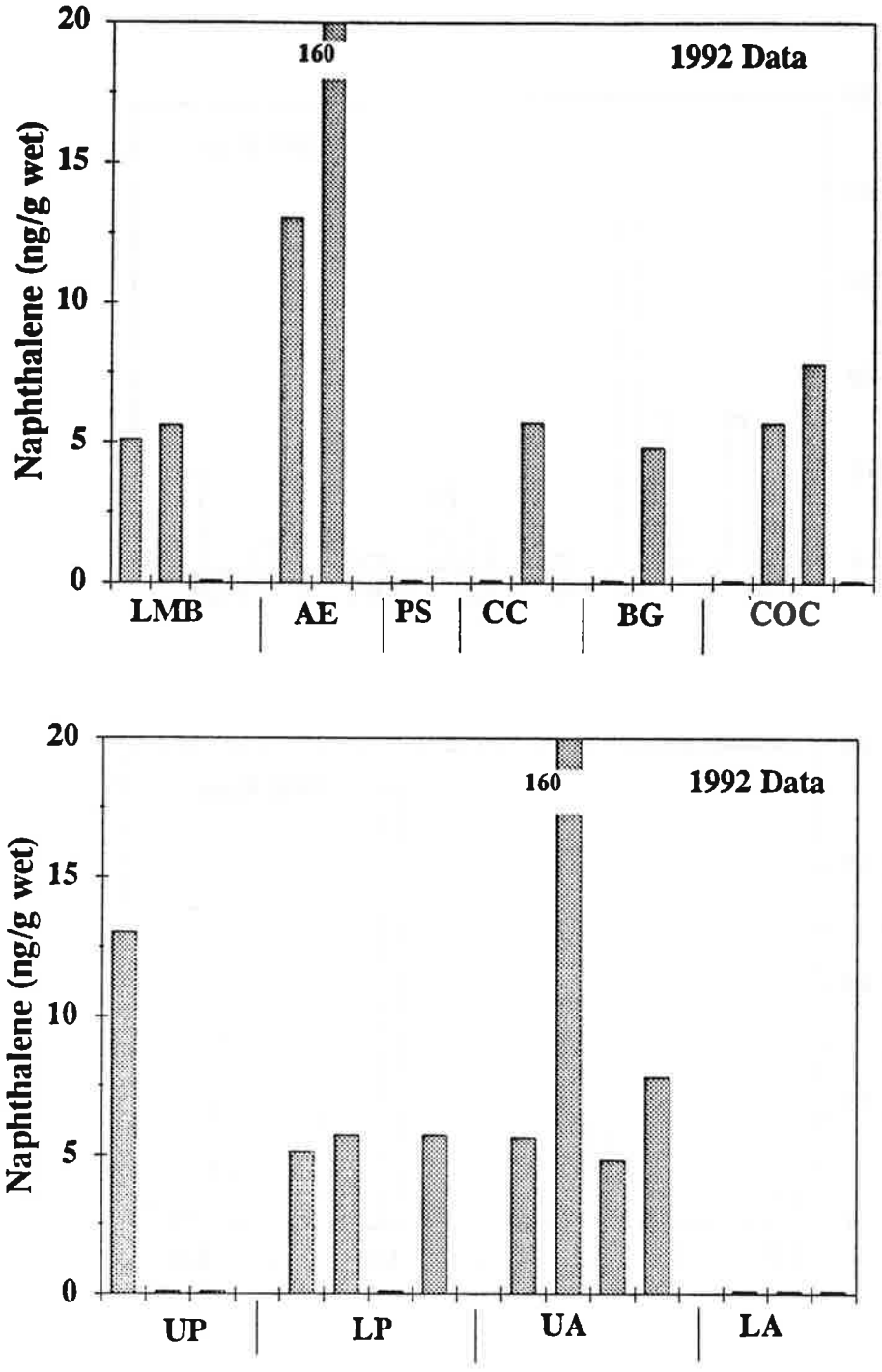


Figure 12. Concentrations of naphthalene by species and location for 1992 (See key in Figure 10).

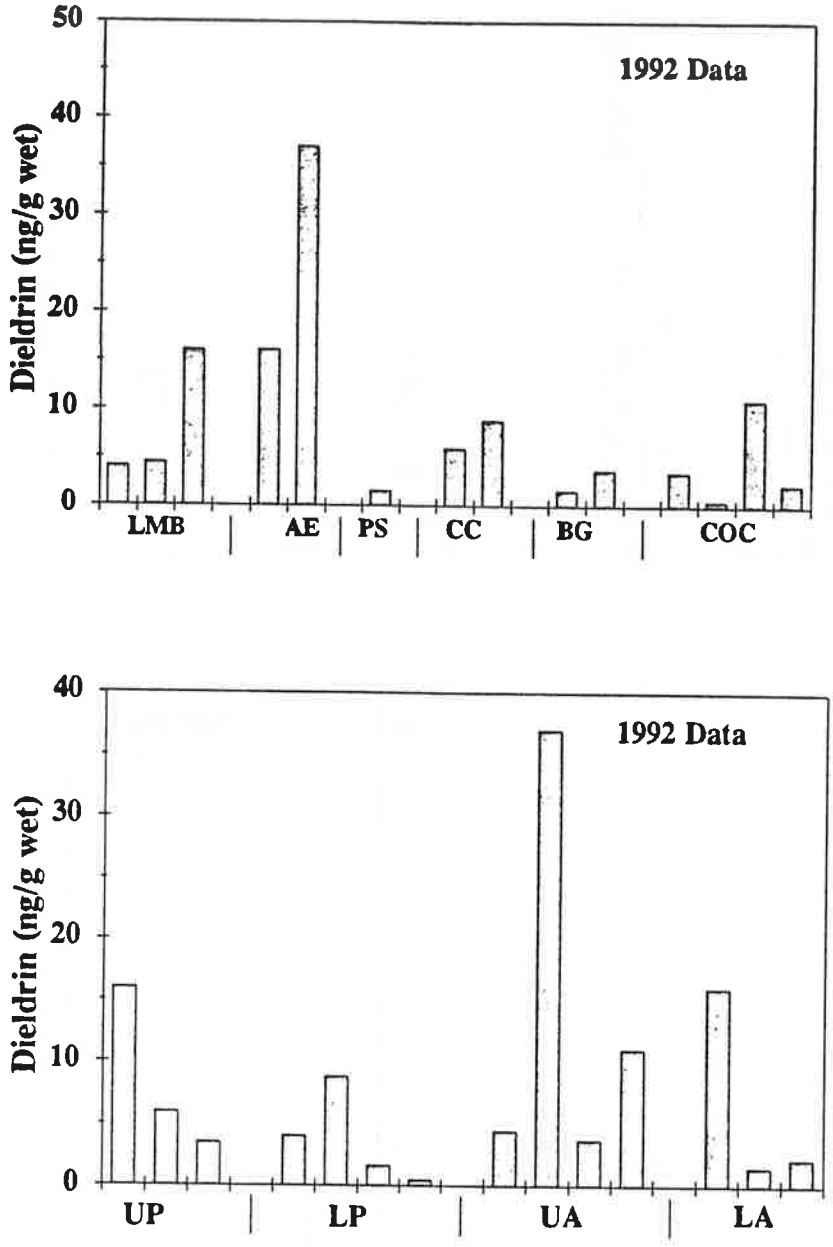


Figure 13. Concentrations of dieldrin by species and location for 1992 (See key in Figure 10).

amount of total lipid in each species can affect the amount of organic contaminants contained in the tissue and is a factor in the bioaccumulation and partitioning of organic contaminants. In this study, American eel and channel catfish samples for both 1991 and 1992 contained the greatest amount of total lipids, while bluegill and pumpkinseed sunfishes contained the least (Figure 14). The three brown bullhead samples analyzed from 1989, contained varying amounts of lipids (Table 1). For 1991, a one-way analysis of variance (ANOVA) was used to determine if there was a significant difference in the sample means between species. The analysis showed that there was a significant difference between sample means for lipids in 1991. A Tukey's Pair-Wise Comparison Test was used to determine which species were different at the $p < 0.05$ level. Results indicated that both American eel and channel catfish contained significantly higher lipid contents than the other species of fish.

A simple linear regression model was used to determine if there was a relationship between lipid content and the concentration of lipophilic organic compounds (i.e., naphthalene, PCBs, DDTs, chlordane, dieldrin and 2,3,7,8-TCDD). For this regression, all data from 1989, 1991, and 1992 were grouped. For naphthalene, total PCBs, total DDTs, and dieldrin the coefficient of determinations were greater than +0.7 and were significant at $p < 0.05$ ($n = 36$) (Table 22). Both chlordane and 2,3,7,8-TCDD had lower coefficient of determinations indicating a weaker relationship. These results indicated that a strong relationship exists between lipid content and the concentration of naphthalene, total PCBs, total DDTs, and dieldrin, and that between 50 and 70% of the variation in concentration is accounted for by the content of lipid in each species. These differences may help explain some of the variations of the more lipophilic organic and inorganic contaminants observed during this study. While this information is important in ecosystem modeling for the prediction of transfers and partitioning of contaminants, it is the total concentration of these chemicals that is used for the prediction of human health impacts (see below).

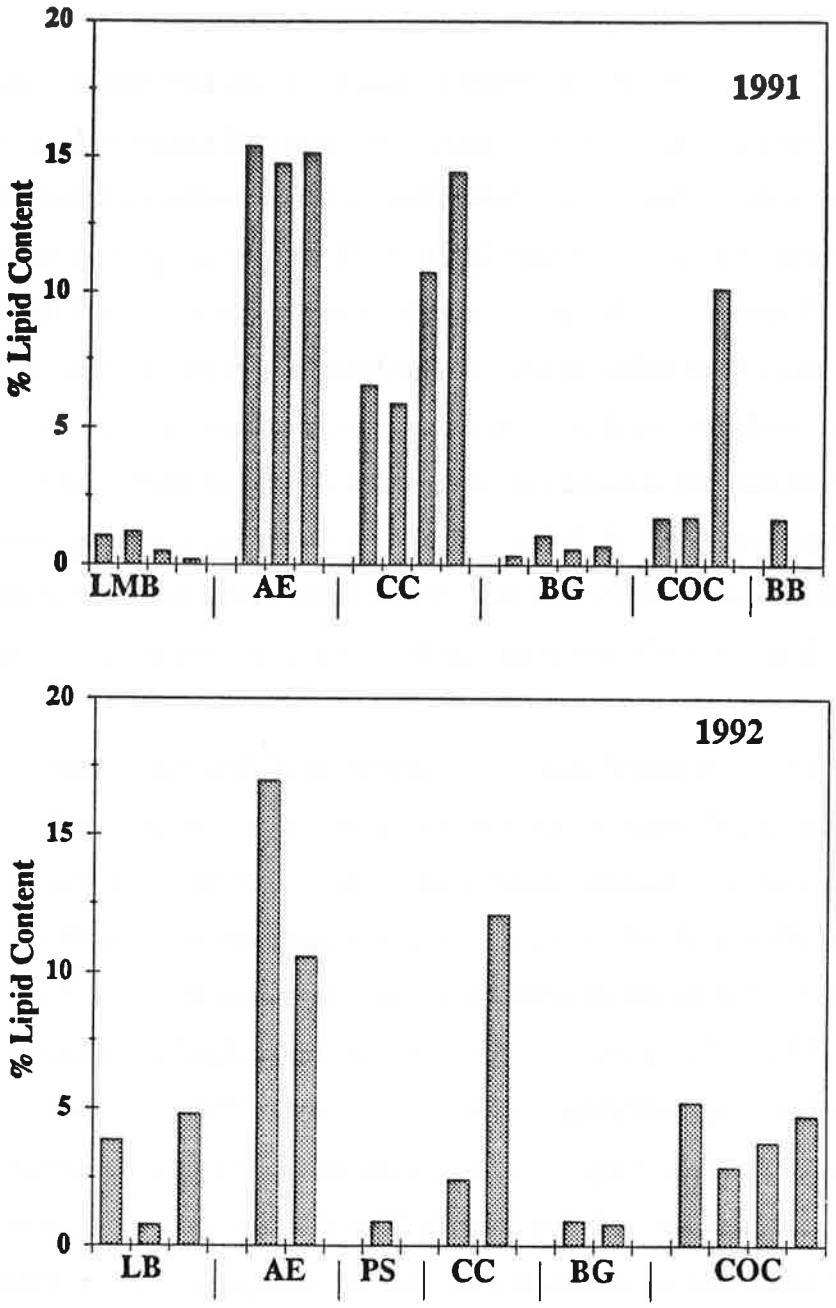


Figure 14. Lipid content of fish composites for 1991 and 1992.
Key: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish.

Table 22. Simple linear-regression model results between lipid content and various contaminants.

Chemical	Sample Size	Correlation Coefficient (r^2)	Coefficient of Determination (r)
Naphthalene	31	0.506	0.711
ΣPCBs	31	0.699	0.837
ΣDDTs	31	0.563	0.750
α + γ chlordane	31	0.323	0.568
Dieldrin	29	0.562	0.748
2,3,7,8-TCDD	11	0.094	0.307

ΣPCBs are the sum of 70 individual congeners (see Appendix III), ΣDDTs are the sum of the pp' forms of DDE, DDD, and DDT.

Contaminant Variations between the Anacostia and Potomac Rivers

In 1991 and 1992, fish samples were collected from both the Anacostia and Potomac Rivers. Past studies have shown that higher levels of most contaminants are present in the sediments of the Anacostia River compared to the Potomac River (Velinsky et al., 1992; Pinkney et al., 1993). These studies suggested that fish resident in the Anacostia River may be exposed to greater levels of contaminants and could therefore accumulate chemicals to a greater degree. However, many of these species are highly mobile and could easily move from one river to another over their lifetime. The tissue burden would reflect their exposure, mostly through diet, along a chemical gradient defined by their movements over seasons and years. These factors limit any geographic analyses of the tissue data.

To facilitate the geographic analyses, fish composites for 1991 and 1992 were placed into two groups; the Potomac and Anacostia rivers, and not sub-divided into lower and upper sections. This increases the power of the statistical test by increasing the sample size, but decreases the resolution of contaminant levels in each river section. Studies by Velinsky et al. (1992) and Pinkney et al. (1993) have shown that only certain sections or reaches of the Potomac or Anacostia Rivers are contaminated, not their entire lengths. The most impacted areas appear to be the lower Anacostia River and the mouth of Rock Creek in the Potomac River. Only chemicals that did not show any species variations were analyzed. This

eliminates any bias due to different numbers of species being obtained in each area. For example, species such as the American eel, pumpkinseed sunfish, and common carp were not obtained in all areas (i.e., upper or lower sections of each river). Since these species did exhibit statistically higher concentrations of total PCBs, total DDTs, and dieldrin, this would bias the geographical analysis towards the areas they were collected from. Only if there was no statistical difference between species could the fish be geographically-pooled for this analysis.

Qualitatively, by comparing the mean and median values, concentrations of Hg, naphthalene, total PCBs, total DDTs, and chlordane appear to be higher in the Potomac relative to the Anacostia River for both 1991 and 1992. A student *t* test was used to statistically compare these data and the chemicals listed in Tables 19 and 20 were tested. Total PCBs, DDTs, and dieldrin did exhibit species variations for 1991 and were not analyzed. Also, species variations could not be tested for 1992 due to a lack of replication within the data set (see above). Results from student *t* tests ($p > 0.05$) indicated no significant difference between the concentrations of contaminants in the fish composites between the Anacostia and Potomac Rivers for either year. However, it should be pointed out that this test is statistically weak due to the small sample size and lack of replication.

Comparison to Previous Studies

This study analyzed 37 fish composite samples with the majority collected in 1989, 1991, and 1992. These data were compared to previous fish tissue data collected in the local area. Also, a broader comparison was made between this study and the recently completed National Study of Chemical Residues in Fish (EPA, 1992).

Comparison between different databases should be made with caution. Different analytical methods, sampling methods, method of making composites, and study design can make comparisons difficult. Also, differences between size/age of the fish and time of year, can effect the concentrations of contaminants in fish tissue. Previous studies determined concentrations of total PCBs, technical chlordane and the various forms of DDT (Sommerfield and Cummins, 1989; Block, 1990). The previous studies used an Arochlor

method, specific for certain groups of PCBs, while this study used a congener specific PCB method. These two analytical methods and results are not directly comparable (EPA, 1993). Between the current study, Pinkney et al. (1993), and EPA (1992) analytical procedures are fairly similar and are well documented. Also, similar chemical fractions and groups were generally determined. However, the current study uses only skin-off fillet composites, while the EPA (1992) study used both skin-off and whole fish sample composites. Therefore, the type of samples are not exactly similar and may bias the comparison between these data sets. Still, these comparisons allow a general assessment of the level of contaminants in the fish samples collected in the Potomac and Anacostia rivers.

Previous Studies in the Local Area

There are three previous studies in which comparisons can be made to the current study (Block, 1990; Sommerfield and Cummins, 1989; Pinkney et al., 1993). These studies collected and analyzed channel catfish, brown bullhead, largemouth bass, and sunfish (sp.) species. While samples were collected from 1987 to the present, a quantitative trend analysis can not be performed due to the number of samples collected (i.e., small amount of replication), and differences in analytical methodologies between each study.

Block (1990) collected fish samples in 1987 from five locations in the District of Columbia, and analyzed whole fish and fillets for total PCBs (i.e., Arochlor 1254+1260), total DDT (e.g., pp-DDE+DDD+DDT), cis+trans chlordane, and dieldrin. Fish species included channel and white catfish (n= 5) and largemouth bass (n=5). Sommerfield and Cummins (1989) analyzed individual fillets of channel catfish (n=40), largemouth bass (n=38), and sunfish (sp.) (n=15) collected from various locations within the Potomac and Anacostia Rivers. These samples were collected in 1988 and were analyzed for total PCBs (Arochlor 1254+1260) and technical chlordane. The mean, standard deviation ($\pm 1\sigma$), median, and maximum concentrations for each study and groups of fish are presented in Table 23, along with results from this study. The concentrations presented in Table 23 for the Block (1990) and Sommerfield and Cummins (1989) studies represent statistical summary results from individual fillets, not composite samples as from the current study. It must also be noted that the PCB analyses from the earlier studies were for two specific

Arochlors (1254+1260), and the results are most likely not comparable to the current study in which PCBs were determined by a congener specific method. However, a qualitative comparison is made to determine general trends in these data.

Channel catfish generally had the highest concentrations of all contaminants, with sunfish (sp.) containing the least (Table 23). As shown from this study (see above), this is related to the higher lipid content in channel catfish compared to the other species. Median concentrations of total PCBs were similar for channel catfish between 1987 and 1991, with lower concentrations measured in 1992 (Table 23). Largemouth bass and sunfish (sp.) median PCB concentrations were similar, and were approximately five times lower than the median concentration for the channel catfish samples. Chlordane median concentrations for channel catfish and largemouth bass were variable (Table 23). Average chlordane concentrations were fairly similar for channel catfish (i.e., 140 to 170 ng/g wet) except for the 1992 samples, which were lower (40 ng/g wet). Although there was limited chlordane data for the sunfish, concentrations decreased from 20 to 3 ng/g wet between 1988 and 1992. Median (or mean) concentrations of DDT and dieldrin ranged from 70 to 273 ng DDT/g wet and 7 to 31 ng dieldrin/g wet for channel catfish, and 40 to 52 ng DDT/g wet and 2 to 10 ng dieldrin/g wet for largemouth bass samples. There may have been a small decrease in concentration of total DDT in catfish samples from 1987 to 1992, while largemouth bass concentrations remained unchanged (Table 23). These chemicals were not determined for the sunfish (sp.) in the previous studies.

The study by Pinkney et al. (1993) was initiated after an oil storage tank spill in January 1992. Samples for brown bullhead, channel catfish, and common carp were taken in August 1992 to investigate potential impacts to fish. The fish were filleted and analyzed with analytical methods similar to the present study. A summary of this data set is presented in Table 24. Concentrations of total PCBs, total DDT, $\alpha+\gamma$ chlordane, and dieldrin, determined in the Pinkney et al. (1993) study, were substantially higher than those determined in the current study (e.g., compare Tables 23 and 24). Mercury concentrations were similar between the two studies with median concentrations generally below 0.1 μg/g wet weight. It is unclear why the organic concentrations determined during the current

Table 23. Summary statistics for fish collections in the Potomac and Anacostia Rivers*.

Channel Catfish					Largemouth Bass				Sunfish (sp.)			
Samples Collected: 1987[1]												
	PCB	Chlor.	DDT	Dieldrin	PCB	Chlor.	DDT	Dieldrin	PCB	Chlor.	DDT	Dieldrin
Mean	1592	166	285	31	248	28	53	16	NA	NA	NA	NA
± S.D.	960	129	194	14	94	36	31	12	NA	NA	NA	NA
Median	1400	146	273	31	290	10	49	10	NA	NA	NA	NA
Max	2958	380	501	52	350	100	99	41	NA	NA	NA	NA
Samples Collected: 1988[2]												
Mean	2099	160	NA	NA	274	23	NA	NA	383	46	NA	NA
± S.D.	1028	350	NA	NA	334	9.2	NA	NA	124	50	NA	NA
Median	1900	20	NA	NA	175	20	NA	NA	390	20	NA	NA
Max	5430	1610	NA	NA	1520	50	NA	NA	560	170	NA	NA
Samples Collected: 1991[3]												
Mean	1293	137	149	14	423	42	52	2.2	93	3.3	10	1.4
± S.D.	473	70	66	5.2	174	36	27	2.4	11	1.3	2.9	0.9
Median	1250	106	146	11	445	29	52	1.6	90	3.0	10	1.7
Max	2000	234	232	21	620	102	80	5.7	110	5.0	13	2.2
Samples Collected: 1992[3]												
Mean	545	41	70	7.4	430	62	63	8.1	60	3.0	8.9	2.3
± S.D.	NC	NC	NC	NC	374	73	50	5.6	22	0.8	4.5	1.0
Median	NC	NC	NC	NC	250	18	40	4.4	50	3.0	7.0	1.6
Max	570	62	73	8.8	950	165	133	16	90	4.0	15	3.7

*All concentrations are in nanogram per gram wet weight. 1- Block (1990): PCBs are the sum of Arochlor 1242+1260, DDT is the sum of pp-DDE, DDD, DDT, and chlordane is the sum of cis and trans chlordane. 2- Sommerfield and Cummins (1989); PCBs are the sum of Arochlor 1242+1260, DDT was not analyzed (NA), and chlordane is technical chlordane. 3- Present Study: PCBs are the sum of individual congeners, DDT is the sum of pp-DDE, DDD, DDT, and chlordane is the sum of $\alpha+\gamma$ chlordane. NC - Not calculated (n =2 samples). See text for further details.

Table 24. Summary statistics for fish fillets collected in August 1992 from the Anacostia River (Pinkney et al., 1993).

Chemical	PCB	Chlordane	DDT	Dieldrin	Hg
Channel Catfish (n=7)					
Mean	6755	613	828	58	0.116
± S.D.	6038	510	747	44	0.052
Median	2794	326	276	37	0.099
Maximum	17951	1487	2174	149	0.240
Brown Bullhead (n=9)					
Mean	1986	202	252	21	0.033
± S.D.	1482	137	198	15	0.008
Median	1225	133	146	12	0.034
Maximum	5507	525	740	55	0.049
Common Carp (n=9)					
Mean	3447	217	475	21	0.077
± S.D.	2455	210	373	19	0.028
Median	2136	145	338	11	0.063
Maximum	6914	716	1100	62	0.144

*Concentrations are in ng per gram wet weight, except for Hg which is in μg per gram wet weight. PCBs are the sum of individual congeners, Chlordane is the sum of $\alpha + \gamma$ chlordane, and DDT is the sum of pp-DDE, DDD, and DDT.

study were lower than those in Pinkney et al. (1993). Since both sets of samples were taken in the same year and prepared similarly (i.e., skin-off fillets), methodological differences could be the cause. Also, because samples were collected in the late summer/early fall, it is unlikely that the time of year would effect the accumulation of organic compounds in the fish. A closer examination of the QA/QC results indicated no specific cause (e.g., low surrogate recoveries) for these differences. Other factors, such as age and size of the fish and specific locations or collection, need to be accounted for in order to understand these differences.

These data sets provide a first-order overview of the level of chemical contaminants in fish tissue samples from the Washington, D.C. area. However, it should be noted that the

chemical methods and sample types (i.e., single fillets versus composites) are not similar across all years which would limit the cross comparison of data in Tables 23 and 24. Differences are due, in part, to improvements in laboratory analyses. A consistent and well-documented sampling program using up-to-date methods needs to be in place before long-term trends in the levels of chemical compounds can be ascertained.

National Chemical Residues in Fish

In 1986 the U.S. Environmental Protection Agency (EPA) initiated a study of chemical residues in fish tissue called the National Study of Chemical Residues in Fish (EPA, 1992), an outgrowth of the National Dioxin Study. Approximately 14 different fish species, including both game and bottom feeders, were collected from around the United States and analyzed for 15 dioxins and furans, PCBs by level of chlorination (i.e., 10 levels), 21 pesticides, Hg, along with 13 other organic compounds. Approximately 380 fish composite samples were analyzed as part of the EPA study. Gamefish were analyzed as skin-off fillets while bottom feeders were analyzed as whole fish. For cumulative statistics, no separation of these data (i.e., whole fish versus fillets) was presented (EPA, 1992), and only a subset of data were reviewed and compared to the present study (Table 25). For a detailed description of the study and results refer to the report by EPA (1992).

Table 25. Summary of chemical contaminants in fish tissue from EPA (1992)*.

Chemical	Mean	±SD (1σ)	Median	% Detected
p,p' -DDE	295	973	58	99
Total Hg	260	0.3	170	92
Total PCBs	1898	7558	209	91
Total Chlordane	37	NC	7	63
Dieldrin	28	58	3	61
2,3,7,8- TCDD	6.9	19	1.4	70
TEQ	11	24	2.8	NA

* All concentrations are in nanogram per gram wet weight, except 2,3,7,8 - TCDD and TEQ which are in picogram per gram wet weight. TEQ - Toxic equivalent concentrations for dioxins. ΣPCB is the sum 10 levels of chlorination, Chlordane is the sum of $\alpha + \gamma$ forms. NC - Not calculated, NA -Not applicable.

Mercury was detected in a majority of sites around the country (EPA, 1992). Concentrations were usually higher in fillets compared to whole fish because organo-Hg compounds (e.g., methyl-mercury), the dominant forms in fish tissue, are stored in muscle (EPA, 1992). The national median concentration (Table 25) was lower than the median values from this study in all three years (refer to Tables 3-17). As a further comparison, the maximum value determined in this study (0.46 μg /g wet) was lower than the upper 90th percentile from the EPA (1992) study.

Total polychlorinated biphenyls (PCBs) median values for the present study are presented in Tables 15-17, and those from the EPA (1992) in Table 25. Nationally, total PCBs were detected at over 91% of the sites sampled with a median value of 209 ng/g wet (EPA, 1992). In the national study, samples were collected in specific areas related to the type of sources that may cause elevated levels of contaminants, especially dioxin/furans, in tissue samples. Samples from industrial/urban areas had a median concentration of 210 ng/g wet (n = 31 sites) and stations considered background, areas generally free from industrial releases, urban runoff, or agricultural runoff, reported an average concentration of 109 ng/g wet (n=20 sites) (NOTE: median value is below the detection limit so mean is reported). Median concentrations from this study ranged from 300 to 620 ng/g wet from 1989 to 1992. The median concentrations from the Washington, D.C. area were higher than the national median and were also higher than the median industrial/urban value.

Total chlordane is the sum of the $\alpha + \gamma$ forms (cis and trans forms), and related forms such as cis and trans nonachlor and oxychlordane were not determined in the present study. Nonachlor, which can be 7 to 10% of technical-grade chlordane, and chlordane have a high potential to bioaccumulate while oxychlordane is more water soluble and a lower bioconcentration factor (EPA, 1992). The national median concentration for total chlordane was 7 ng/g wet (Table 25), and was detected at 31 industrial/urban sites with a median value of 11 ng/g wet (EPA, 1992). Background sites (n=20) had a median concentration below the detection limit and a mean value of 10 ng/g wet (EPA, 1992). Median concentrations were higher in the Washington, D.C. area compared to the national industrial/urban value and ranged from 40 to 120 ng/g wet for all three years, and

maximum concentrations (range of 230 to 420 ng/g wet) were also higher compared to the median concentration for industrial/urban locations.

Dieldrin was detected at 60% of the national sites with an overall median concentration of 3 (Table 25). Median concentrations for the Washington, D.C. area ranged from <0.5 ng/g wet in 1989 (n=3) to 4.0 and 4.2 ng/g wet for 1991 and 1992, respectively. These median concentrations were approximately half the national median for industrial/urban areas (10 ng/g wet; EPA, 1992). Maximum concentrations were up to four times higher in the Washington, D.C. area than the median for industrial/urban areas, while the national background median concentration was below the detection limit (mean = 14 ng/g wet).

The national study analyzed for pp-DDE which is a breakdown product of pp-DDT and has been shown to bioaccumulate in fish tissue. The national median concentration (Table 25) is similar to the median concentrations determine for this study (Tables 12-14), and pp-DDE was the most frequently detected chemical compound in the national study (Table 25). The median values in the Washington, D.C. area are between the values for industrial/urban and background areas of 79 and 12 ng/g wet, respectively.

The various forms of dioxin and furan were determined as part of the present study. For this comparison however, only 2,3,7,8-TCDD is compared to the national study. This form of dioxin is believed to be the most harmful of the various dioxin and furan congeners and can bioaccumulate in fish. Nationally, 2,3,7,8-TCDD was detected at 70% of the sites sampled with an overall median of 1.4 pg/g wet (Table 25). Background (n=20) and industrial/urban (n=31) sites had median values of 0.5 and 0.6 pg/g wet, respectively. Concentrations from fish samples collected in the Washington, D.C. area had median concentrations at the detection limit which was usually <0.5 pg/g wet. Highest concentrations were within a factor of three of the national median and much lower than the national maximum value. The majority of samples had concentrations generally near the median and range of background locations from the national study.

Comparison to Health Effect Levels

In this section contaminant concentrations are evaluated by various methods used to

estimate human health effects. These include comparisons with Food and Drug Administration (FDA) action levels, calculations of newly developed toxic equivalency factors for both dioxins and PCBs, and risk assessment calculations proposed by the U.S. EPA. These methods are tools which help evaluate the potential health effects of the consumption of fish tissue. However, there are many caveats in using each of these methods that would affect their usefulness, and this analysis is tentative and should be used only as a screening tool.

Food and Drug Administration Action Levels

Table 26 provides current action levels and tolerance levels from the FDA (EPA, 1993a). Pesticide levels are U.S. EPA recommendations to the FDA. These "action or tolerance levels" are for seafood sold through interstate commerce, and can be used to remove seafood from the market place. They were developed to protect humans from the chronic effects of toxic substances consumed in food stuffs. For wild non-commercial freshwater fish, they provide guidance for regulatory action (but are not regulatory standards). In fact, FDA recommends that States do not use the action or tolerance levels to set local advisories because local consumption patterns vary considerably (R.G. Kramer, 1994, personnel communication).

Table 26. Food and Drug Administration (FDA) action or tolerance levels for selected contaminants*.

Chemical	Concentration
Methyl Mercury	1.0
Dieldrin	300
Chlordane	300
DDT, DDE, and TDE	5000
Polychlorinated Biphenyls (PCBs)	2000

* Concentrations of methyl mercury are in μg per gram wet weight, pesticides are in ng per gram wet weight, and 2,3,7,8-TCDD are in pg/g wet weight. PCBs are tolerance levels set by the U.S. FDA, while action levels were developed by the U.S. EPA.

Food and Drug Administration levels for total PCBs are determined by Arochlor analyses,

and for this comparison it is assumed that the FDA forms of PCBs (and pesticides) are equivalent to the forms determined in this study. Also, because the majority of Hg in fish tissue is in the methylated form (Sensen and Jernelov, 1969; Tollefson, 1989; Gill and Bruland, 1990), total Hg, determined in this study will be compared to the FDA action level which is for methyl-Hg.

Concentrations of total Hg, dieldrin, or DDT did not exceed the published FDA action levels. For total Hg, the highest and closest concentration was 0.46 μg/g wet for a largemouth bass composite taken from the upper Potomac River (Figure 15), approximately half of the FDA action level. Dieldrin concentrations were at least seven times lower than the published action level (Figure 16), while total DDT concentrations were at least 16 times lower than the FDA action level (Figure 16).

In only one instance was the FDA action level of 300 ng/g wet for chlordane exceeded in this study in any samples (Figure 17). This sample was a brown bullhead composite taken in 1989 from the lower Anacostia River with a chlordane concentration of 420 ng/g wet. This sample was filleted in the laboratory (i.e., not in the field), which should not effect these results. Two other samples had concentrations below the action level but greater than 200 ng/g wet. These samples were an American eel composite (290 ng/g wet) from the upper Anacostia River collected in 1992 and a channel catfish collected from the lower Anacostia collected in 1991. The FDA tolerance level was exceeded four times for total PCBs (Figure 17). Samples (ID: 3-91, 8-91, 17-91, 18-91) were collected in 1991 from the Potomac River and lower Anacostia River (Table 1) and included three American eel, and one channel catfish composite.

It is apparent, when comparing the FDA action or tolerance levels to the various data bases (Sommerfield and Cummins, 1989; Block, 1990; Pinkney et al., 1993), that for all years, concentrations of PCBs and to a lesser extent chlordane, have exceeded the published values in one or more species. These include channel catfish, brown bullhead, common carp, and largemouth bass species. In 1987, channel catfish exceeded the FDA levels for PCBs and chlordane in 45% and 16% of the samples for PCBs and chlordane, respectively (Block, 1990). Similar percentages for both PCBs and chlordane were observed for the

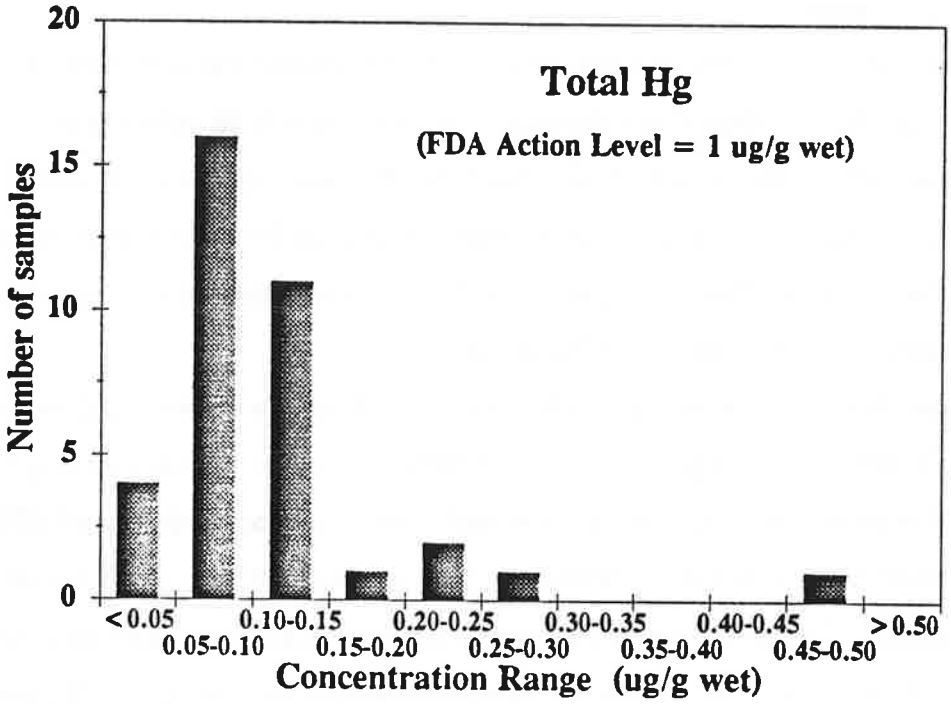
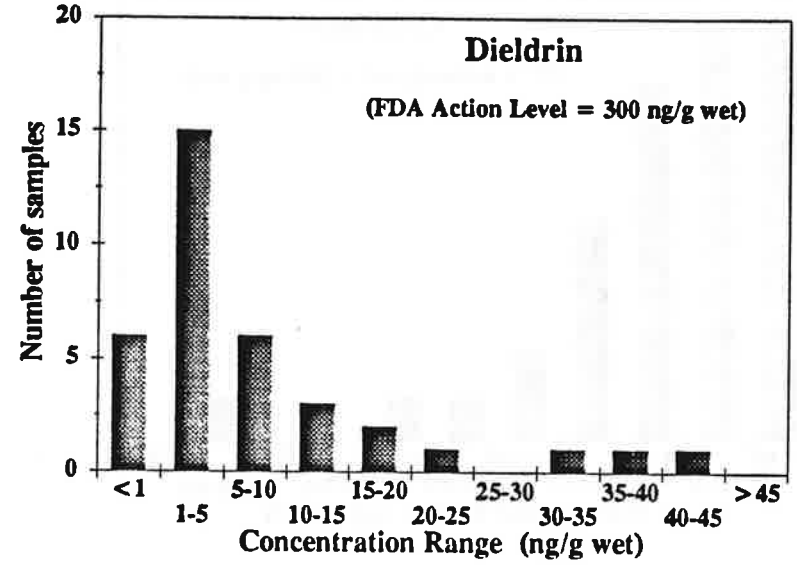


Figure 15. Histogram of total Hg concentrations for all years.



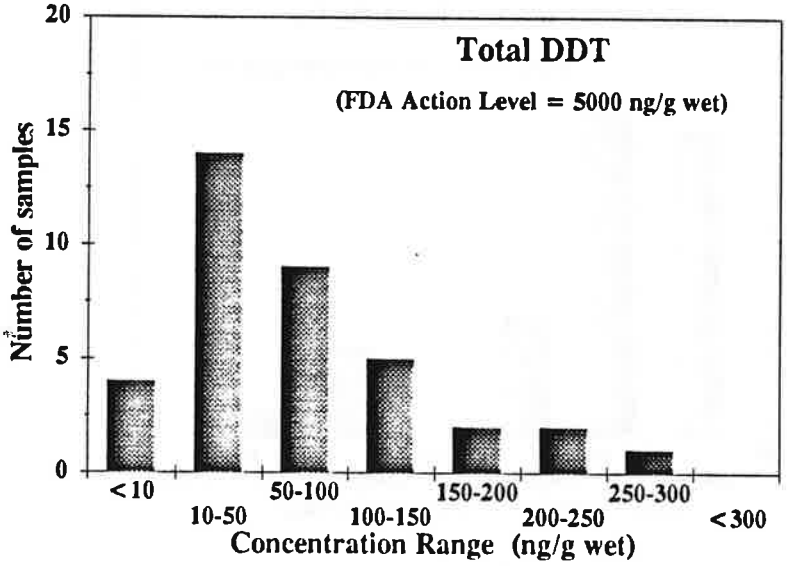
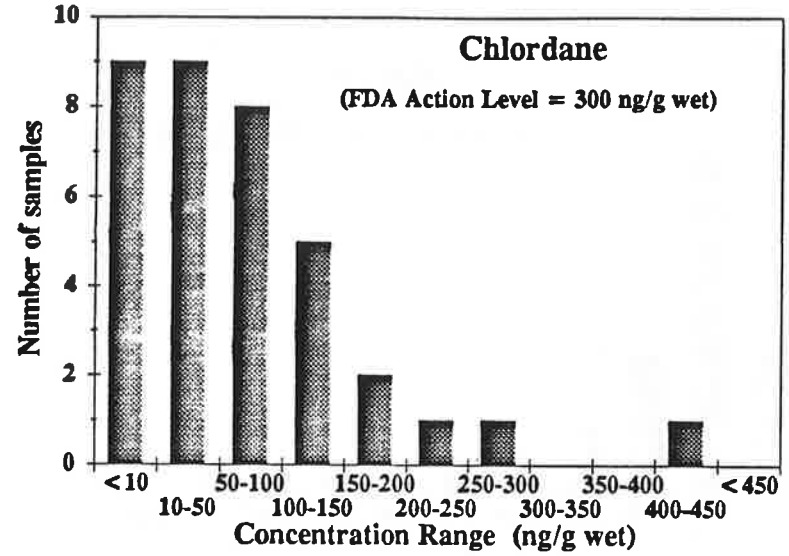


Figure 16. Histograms for dieldrin and total DDTs concentrations for all years.



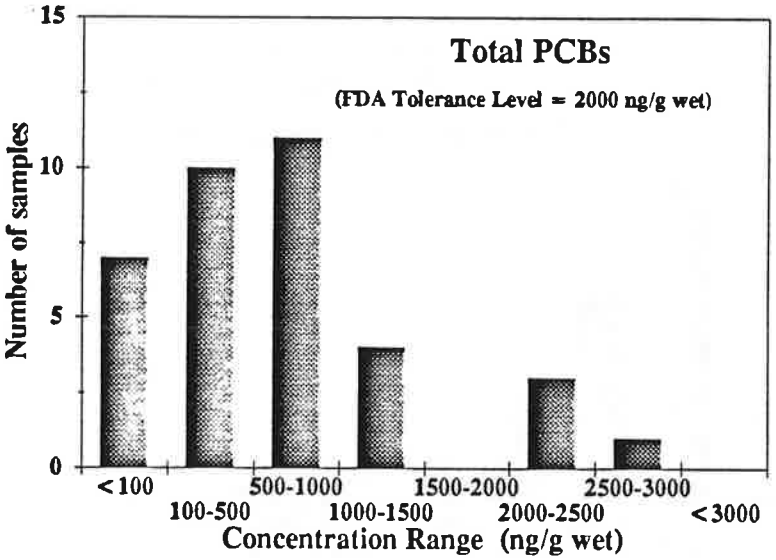


Figure 17. Histograms for total chlordanes and PCBs concentrations for all years.

channel catfish samples collected in 1988 (Sommerfield and Cummins, 1989). The data from Pinkney et al. (1993) showed the greatest amount of exceedences (and highest overall concentrations) for channel catfish for PCBs and chlordane of 86% and 57%, respectively. Brown bullhead and common carp samples had lower exceedences, closer to the 1987 and 1988 databases. In the current study, all American eel composites from 1991 were above the FDA action level for PCBs as were 33% of the channel catfish samples. Samples collected in 1992 were not above any of the published action levels.

Toxic Equivalency Factors for PCBs and Dioxins

Current methods used to develop consumption advisories for PCBs are based on the quantification of total polychlorinated biphenyls (PCBs) as the sum of specific Arochlors (e.g., 1260, 1254) or the sum of specific PCB congeners. However, there are 209 PCB congeners, and due to the differential cycling and fate (e.g., partitioning, degradation, excretion) of the various congeners, the relative amounts of specific congeners can vary greatly within the environment and in organisms (e.g., fish). Also, individual congeners vary in toxicity dependent on their resistance to degradation, metabolism, and structure. The most toxic PCB congeners are those that elicit the same effect as polychlorinated dibenzo-p-dioxins and furans (McFarland and Clarke, 1989; Safe, 1990). The most potent of these PCB congeners are those that are similar in structure to 2,3,7,8-TCDD. These include PCB congeners that have no or one chlorine substituted in the ortho positions (i.e., termed coplanar PCBs), and are considered AHH-active congeners because, like 2,3,7,8-TCDD, they induce aryl hydrocarbon hydroxylase (AHH) or ethoxyresorufin O-deethylase (EROD) activities, endpoints in mammalian toxicity (Safe, 1990; Kafafi et al., 1993).

Safe (1990) and others developed a model to estimate the equivalent concentration of 2,3,7,8-TCDD relative to the measured concentrations of specific coplanar PCBs. This model is based on the assumption that toxicity is controlled by the receptor mediated action of 2,3,7,8-TCDD at specific binding sites, and that specific coplanar PCBs act on the same binding sites as 2,3,7,8-TCDD to a degree relative to 2,3,7,8-TCDD. Importantly, this model also assumes that the equivalent concentrations are additive, so that by multiplying the concentration of the specific coplanar PCB by its toxic equivalency factor (TEF) then

adding these values, an estimate of the total TCDD equivalents can be obtained. This method may provide a better estimate of the potential toxicity of PCBs in the fish tissue. However, it must be recognized that different structure-activity-receptor models provide different TEFs (e.g., de Boer et al., 1993; Kafafi et al., 1993), and that dose-response and exposure may not be adequately described for many risk assessment models. For this study, the TEFs reported by Safe (1990) were used (Table 27) and are thought to be a conservative estimate of the toxic potential of the various coplanar PCBs.

In a similar fashion, the various congeners of dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) have varying toxicity relative to 2,3,7,8-TCDD (Safe, 1990). There are 75 PCDDs and 135 PCDFs congeners, although most studies focus on 2,3,7,8-TCDD because of its potential toxicity. Like PCBs, the structure of the various PCDD/PCDDF congeners is very important in determining their binding activity and toxicity (i.e., AHH or EROD activities). The most active congeners are the 2,3,7,8-substituted tetra-to hexa- PCDDs and PCDFs (Safe, 1990). Therefore, Safe (1990) developed a relationship that relates the relative toxicity of various congeners to the most potent member of the dioxins or furans (i.e., 2,3,7,8-TCDD). The TEFs for the various dioxins and furans are also presented in Table 27. The U.S. EPA has recommended this approach to determine the relative toxicity in fish tissue due to dioxins and furans (EPA, 1992).

While various researchers have used this approach of assigning TCDD equivalents to specific congeners of PCBs, dioxins, and furans, there are many limitations that can effect the calculations and interpretations. This technique assumes that the calculated TEQs are additive and does not allow for interactions among active and inactive congeners. Since many of the ortho-substituted PCB congeners are sometimes an order of magnitude higher in concentration than non-ortho substituted, a blocking of active sites could occur. Also, in many cases the relative potency of the non ortho-substituted PCBs have not been determined in a consistent manner. Additionally, the TEFs reported in the literature vary and therefore effect the calculated PCB-TEQs and Dioxin-TEQs.

Using the data in Appendix III (see Tables 8a,b and 9a,b) and the TEFs for PCBs,

Table 27. Toxic equivalency factors used for this study*.

Congener	Toxic Equivalency Factor (TEF)
Dioxins	
2,3,7,8-tetra	1.0
1,2,3,7,8-penta	0.5
1,2,3,4,7,8-hexa	0.1
1,2,3,6,7,8-hexa	0.1
1,2,3,7,8,9-hexa	0.1
1,2,3,4,6,7,8-hepta	0.01
Furans	
2,3,7,8-tetra	0.1
1,2,3,7,8-penta	0.1
2,3,4,7,8-penta	0.5
1,2,3,4,7,8-hexa	0.1
2,3,4,6,7,8-hexa	0.1
1,2,3,6,7,8-hexa	0.1
1,2,3,7,8,9-hexa	0.1
1,2,3,4,6,7,8-hepta	0.1
1,2,3,4,7,8,9-hepta	0.1
Polychlorinated Biphenyls (PCBs)	
77 (3,3',4,4'-tetra)	0.01
81 (3,4,4',5-tetra)	0.01
105 (2,3,3',4,4'-penta)	0.001
114 (2,3,4,4',5-penta)	0.0001
118 (2,3',4,4',5-penta)	0.001
123 (2',3,4,5',5-penta)	0.001
126 (3,3',4,4',5-penta)	0.1
156 (2,3,3',4,4',5-hexa)	0.001
157 (2,3,3',4,4',5'-hexa)	0.00002
167 (2,3',4,4',5,5'-hexa)	0.001
189 (2,3,3',4,4',5,5'-hepta)	0.001

* Taken from Safe (1990). Ortho positions in the PCB molecule are in the 2,6 and 2',6' positions, and octa-chlorinated dioxins and furans were assigned TEFs of 0.001.

dioxins, and furans in Table 27, the total TCDD equivalents for PCBs (PCB-TEQ) and dioxins/furans (Dioxin-TEQ), in pg/g wet weight were calculated. Also included in Table 28 are the respective concentrations of total PCBs and 2,3,7,8-TCDD. For these calculations, specific congeners of the PCBs and dioxins/furans that were at the detection limit were set at half the detection limit.

Total dioxin equivalents (Dioxin-TEQ) ranged from 0.3 to 17 pg/g wet with most values less than 5 pg/g wet. The median Dioxin-TEQ for the national fish contamination study was approximately 3 pg/g wet, while for this study the median concentration was substantially lower (1.8 pg/g wet). These data, along with the low concentrations of 2,3,7,8-TCDD determined in the fish tissue, indicated that dioxins and furans are not of concern in the Washington, D.C. area. Since these concentrations are relative to 2,3,7,8-TCDD, a comparison to the FDA guidelines for 2,3,7,8-TCDD can be made (Table 26), keeping in mind this level is more site specific (i.e., Lake Michigan). Concentrations of both Dioxin-TEQ and 2,3,7,8-TCDD are below these guidelines of 25 and 23 pg/g wet for the FDA and median international standards, respectively. However, the U.S. EPA screening value for Dioxin-TEQ is 0.7 pg/g wet weight, based on the EPA-OWOW risk assessment model. Concentrations above this value may be of concern at a risk level of 10^{-5} (see below for a further discussion of the risk assessment model).

The concentrations of PCB-TEQ ranged from 20 to 994 pg/g wet for all fish from 1989 to 1992 (Table 28). The highest concentration was measured in an American eel composite from the lower Potomac River collected in 1991. There was a significant linear relationship ($r^2 = 0.947$, $n=36$, $p > 0.05$) between the concentration of PCB-TEQ and total PCBs in these samples indicating that it may be possible to predict the concentration of PCB-TEQ from congener specific total PCBs in this area. Also, this relationship suggests that a similar source and type of PCBs are contaminating the fish within this area. However, differential degradation, metabolism, and excretion of the various congeners must be taken into account to properly address this issue. A further study of the congener distribution in the various species of fish could yield information as to the source of PCBs to the fish in the waters of the District.

Table 28. PCB and Dioxin-TEQs for 1989, 1991, and 1992 fish composite samples*.

Field ID-Yr.	Fish ID	Loc.	PCB-TEQ (pg/g wet)	Dioxin-TEQ (pg/g wet)	2,3,7,8-TCDD (pg/g wet)	Total PCBs (ng/g wet)
1-89	BB	LA	345	7.8	2.1	1284
15-89	BB	UA	20	2.2	<0.9	205
16-89	BB	LA	147	1.1	<3.5	359
1-91	COC	UP	252	3.9	1	788
2-91	LMB	UP	214	0.6	0.4	640
3-91	AE	UP	536	1.5	<0.4	2024
4-91	CC	UP	515	4.8	1.9	1216
5-91	BG	UP	54	0.4	<0.4	150
6-91	CC	LP	217	2.9	0.9	685
7-91	LMB	LP	57	0.9	<0.3	213
8-91	AE	LP	994	2.4	0.7	2567
9-91	CC	LP	504	3.9	1.9	1322
10-91	BG	LP	50	0.5	<0.4	131
11-91	COC	UA	200	0.6	<0.2	941
12-91	LMB	UA	68	0.9	<0.4	363
13-91	BB	UA	66	0.5	<0.3	307
14-91	BG	UA	52	0.4	<0.4	117
15-91	COC	LA	52	0.4	<0.2	165
16-91	LMB	LA	195	1.2	0.6	577
17-91	AE	LA	679	1.4	<0.2	2077
18-91	CC	LA	797	6.4	2.3	2033
19-91	BG	LA	52	0.3	<0.2	126
1-92	BG	LP	37	2.4	<0.4	121
2-92	LMB	LP	101	2.2	<0.9	283
3-92	CC	LP	224	1.8	<1.2	544
4-92	COC	LP	140	3.5	<0.8	440
5-92	CC	UP	193	2	0.6	598
6-92	COC	UP	126	3.3	<0.7	545
7-92	AE	UP	438	16.9	3.6	1218
8-92	PS	LA	35	0.4	<0.1	81
9-92	LMB	LA	264	5.8	2.8	965
10-92	COC	LA	47	2.9	<0.8	303
11-92	BG	UA	36	1.2	<0.6	83
12-92	LMB	UA	42	1.7	<0.9	123
13-92	COC	UA	164	2.9	<0.6	704
14-92	AE	UA	307	13.5	<5.6	952

* See text for details. 2,3,7,8-TCDD - tetra-chlorodibenzo-dioxin, total PCBs is the sum of 70 individual congeners (see Appendix II). Locations (Loc): LP - Lower Potomac, UP - Upper Potomac, LA - Lower Anacostia, and UA - Upper Anacostia. Fish ID: LMB - largemouth bass, AE - American eel, CC - channel catfish, BG - Bluegill sunfish, COC - common carp, BB - brown bullhead catfish, PS - pumpkinseed sunfish.

Risk Assessment for PCBs, Chlordane, and Dieldrin

This section presents risk assessment estimates to human health based on the concentrations presented in Tables 18-20 (also see Appendix II). This information, along with the previous two sections, is provided as a screening tool to assess the levels of contamination in fish from the District of Columbia. Carcinogenic and non-carcinogenic risks were estimated for chlordane, dieldrin, and polychlorinated biphenyls using cancer potency factors and reference doses respectively, provided by the EPA (1992). These calculations were based on EPA carcinogenic risk assessment equations for lifetime exposure with 95th percentile upper-bound cancer potency factor estimates at two fish ingestion rates (EPA, 1989; 1992).

Exposure doses were determined using equation (1):

$$D_{ij} = (C_j \times I_j)/W \qquad (1)$$

where: D_{ij} is the estimated dose (mg/kg/day) for chemical i at ingestion rate j; C_i is the concentration of chemical i in fish fillet; I_i is the ingestion rate of the specific population; and W is the selected human body weight (70 kg or 150 lbs).

Risk characterization associated with each chemical was estimated as the probability of excess cancers using equation (2):

$$R_{ij} = 1 - \exp(-D_{ij} \times P_i) \qquad (2)$$

where: R_{ij} is the risk associated with chemical i at an ingestion rate j; P_i is the carcinogenic potency factor for chemical i $(mg/kg/day)^{-1}$; and D_{ij} which is the estimated dose of chemical i at an ingestion rate j (mg/kg/day).

To estimate the potential hazards associated with non-carcinogenic toxic effects of these chemicals, the hazard index (H_{ij}) was calculated. This is the ratio of the estimated dose of chemical i (D_{ij}) and reference dose (RfD) at which non-carcinogenic effects are not expected to occur (EPA, 1992). If the value of H_{ij} is less than one, toxic effects are not expected to occur.

Table 29 provides the dose-response variables used in this risk assessment and is a subset of the data given in the EPA (1992) report. There are many limitations using these data and the model described above. First, the ingestion rates can vary widely dependent on the specific population that is sampled. The U.S. EPA uses 6.5 g fish/day (ca. 0.5 lb. per

month) as the average fish ingestion rate of freshwater and estuarine fish across the U.S.

Table 29. Dose-response variables used in risk assessment*.

Chemical	Cancer Potency Factor $(mg/kg/day)^{-1}$	Reference Dose (mg/kg/yr)	EPA Cancer Rating
Chlordane	1.3×10^{0}	6.0×10^{-5}	B2
Dieldrin	1.6×10^{1}	5.0×10^{-4}	B2
Polychlorinated Biphenyls	7.7×10^{0}	7.0×10^{-5}	B2

* Information from various databases given in EPA (1992) and Kramer (1994, personel communication). B2 -probable human carcinogen. PCB cancer risk data were derived from studies based on Arochlor 1260, while the reference dose is based on Arochlor 1016.

and 140 g fish/day (ca. 9 lbs per month) to represent the upper 95th percentile of sport fisherman and maybe more suitable for subsistence consumers (EPA, 1989; 1993b). For the Washington, D.C. area, an angler survey is needed that would determine a site specific ingestion rate to better quantify the overall risks to the population. For this study, fish ingestion rates of 6.5 g fish/day and 140 g fish/day were used. Secondly, the endpoint of these calculations is the probability of excess cancer risk; other endpoints are accounted for in the calculation of the non-carcinogenic risks using the reference dose. Lastly, many of the variables used for these calculations are derived from laboratory animal studies that may not be applicable to human consumption of these contaminants. Given these caveats, these calculations, along with the other human health tools (see above), do provide a screening method to help determine the potential risk of ingesting fish tissue caught in the waters of the District of Columbia.

Potential upper-bound excess carcinogenic risks for chlordane, dieldrin, and total PCBs are presented in Table 30, and the non-carcinogenic hazard index results are presented in Table 31. These calculations were run for both 6.5 and 140 g fish/day ingestion rates. These chemicals were chosen as both an example of the usefulness of these types of calculations and because of their past and present levels measured in fish tissue of this area. It must be pointed out that the measured chemicals from this study may not be the exact compounds in

Table 30. Estimates of potential upper-bound carcinogenic risk assessment on wild fish tissue samples collected in the District of Columbia.*

	Chlordane	Dieldrin	Total PCBs
Ingestion Rate = 6.5 g fish/day			
Maximum	5.0×10^{-5}	6.2×10^{-5}	1.9×10^{-3}
Minimum	2.4×10^{-7}	7.4×10^{-7}	2.9×10^{-5}
Median	5.8×10^{-6}	5.9×10^{-6}	3.7×10^{-4}
Mean	9.0×10^{-6}	1.2×10^{-5}	4.8×10^{-4}
Standard Deviation	1.1×10^{-5}	1.5×10^{-5}	4.7×10^{-4}
# of samples	36	36	36
Ingestion Rate = 140 g fish/day			
Maximum	1.1×10^{-3}	1.3×10^{-3}	3.9×10^{-2}
Minimum	5.2×10^{-6}	1.6×10^{-5}	6.2×10^{-4}
Median	1.2×10^{-4}	1.3×10^{-4}	8.0×10^{-3}
Mean	1.9×10^{-4}	2.6×10^{-4}	1.0×10^{-2}
Standard Deviation	2.3×10^{-4}	3.2×10^{-4}	9.9×10^{-3}
# of samples	36	36	36

* See text for details.

Table 31. Potential hazards associated with non-carcinogenic risk assessment.*

	Chlordane	Dieldrin	Total PCBs
Ingestion Rate = 6.5 g fish/day			
Maximum	0.650	0.078	2.41
Minimum	0.003	0.001	0.04
Median	0.074	0.007	0.48
Mean	0.115	0.015	0.63
Standard Deviation	0.138	0.019	0.61
# of samples	36	36	36
Ingestion Rate = 140 g fish/day			
Maximum	13.93	1.68	52.0
Minimum	0.07	0.02	0.8
Median	1.60	0.16	10.4
Mean	2.48	0.32	13.6
Standard Deviation	2.97	0.40	13.0
# of samples	36	36	36

* See text for details.

which dose-response data were reported (Table 29). For example, total PCBs for this study are the sum of 70 individual congeners, whereas the cancer risk information was for PCB Arochlor 1260. Mammalian carcinogenic data does not exist for individual congeners, as well as for the more toxic congeners (see above). Also, chlordane concentrations are the sum of the $\alpha+\gamma$ forms of chlordane, while dose-response data (Table 29) are for the sum of $\alpha+\gamma$ chlordane, oxychlordane, and cis+trans nonachlor.

Potential upper-bound risks for chlordane, dieldrin, and total PCBs were as high as 10^{-3}, 10^{-3}, and 10^{-2} at an ingestion rate of 140 g fish/day, respectively (10^{-3} = 1 excess cancer out of 1000). They were approximately one order of magnitude lower for an ingestion rate of 6.5 g fish/day (Table 30). The potential excess cancer risk exceeded 10^{-5} for all composites for total PCBs at an ingestion rate of 6.5 g fish/day and 140 g fish/day. Excess cancer risks were highest for channel catfish and American eel composite samples and ranged from 10^{-4} to 10^{-2} (at 6.5 to 140 g fish/day, respectively) in both all years. For chlordane, the potential excess cancer risk exceeded 10^{-5} for an ingestion rate of 6.5 g fish/day in 11 out of 36 samples, and in 31 samples at an ingestion rate of 140 g fish/day. Again, highest levels were for channel catfish and American eel composites. The potential excess cancer risk for dieldrin were above 10^{-5} for 13 of the 36 samples and for 31 samples at ingestion rates of 6.5 and 140 g fish/day.

Non-carcinogenic risks, as calculated from the hazard index, are presented in Table 31. Using an ingestion rate of 6.5 g fish/day, 11 fish composites, mostly American eel and channel catfish, had an index greater than one for total PCBs, while for both chlordane and dieldrin concentrations all samples had an index less than one. At an ingestion rate of 140 g fish/day, all composites had indexes greater than one for total PCBs, and for 18 and 3 samples (out of 36 samples) for chlordane and dieldrin concentrations, respectively (Table 31). These data, along with the excess cancer risk results, indicate PCBs are at levels of concern in fish tissue around the District of Columbia. The data in Tables 30 and 31 indicate that the amount of risk is very dependent on the ingestion rate for the specific population that consumes the fish. Using the national database (EPA, 1992), a general sense of these risks were obtained; however to better determine and understand the risk and hazards for the

population of the District of Columbia, a site specific fish consumption survey within the District of Columbia should be undertaken. This information, along with newer dose-response information, will help in better defining the potential risks to the population of this area.

Summary

The present study indicates that detectable levels of many chemicals were present in the edible portion of certain species of fish collected in the District of Columbia's waters. Of the approximately 129 chemicals investigated, 50 were detected in one or more species. These chemicals ranged from trace inorganics such as Hg and Se to organic chemicals like PCBs and DDTs. While trace metals and metalloids detected most often (i.e., As, Se, and Hg) did not show any species or geographic variations, concentrations of many organics were greatest in the American eel and channel catfish species. Some of this variation can be explained by the lipid content of each fish species. Geographical variations for all organic compounds were not identifiable with the limited data set available.

Previous studies of fish tissue contamination indicated that similar chemicals are persistent, however because of analytical and sampling differences between studies, a quantitative trend analysis was not possible at this time. PCBs and chlordane had been in elevated concentrations since samples were collected in 1987. The median concentrations of total PCBs (360 to 640 ng/g wet) and $\alpha+\gamma$ chlordane (37 to 118 ng/g wet) were higher in the Washington, D.C. area from the current data set compared to national data obtained during the National Dioxin Study (median total PCBs for industrial/urban sites: 210 ng/g wet, median $\alpha+\gamma$ chlordane: 11 ng/g wet; EPA, 1992). Similarly, median concentrations of pp'-DDE, a breakdown product of DDT, were similar to the national for industrial/urban median (79 ng/g wet) while dieldrin concentrations were lower in the Washington, D.C. area. Dioxin concentrations, especially 2,3,7,8-TCDD, were low and in most cases below the detection limit (i.e., <0.5 pg/g wet).

In estimating the health effect of these data (i.e., FDA action levels, toxic equivalents for PCBs and dioxins, and a risk assessment model), results suggested that concentrations of

PCBs and chlordane were elevated and of concern in this area. Of the 36 composite samples, four samples contained concentrations of total PCBs higher than the FDA tolerance level (2000 ng/g wet), while only one composite had concentrations of chlordane higher than its action level (300 ng/g wet). Preliminary toxic equivalent (PCB-TEQ) calculations suggested that specific components of the PCBs were elevated. Similar calculations for the various components of the dioxins and furans (Dioxin-TEQ) indicated that this class of compounds were detectable in the fish of this area. Concentrations of Dioxin-TEQ were higher than the proposed U.S. EPA screening value (0.7 pg/g wet @ 10^{-5} risk) in 25 out 36 samples.

Using a risk assessment model given by the U.S. EPA (EPA, 1992), indications were that the levels of total PCBs, and in some cases chlordane, in this area pose an excess cancer risk (i.e., 95th upper bound estimates) greater than 10^{-5} or 10^{-2}. There are many limitations to this model, and all of the higher risks, both carcinogenic and non-carcinogenic, were using a fish ingestion rate of 140 g/day. This rate was used to estimate potential risks to subsistence fishing as well as the upper 95th percentile for sports fishing. Regardless, the various health effect indicators suggests that PCBs and chlordane are of concern from fish, especially bottom dwelling species, collected in the Washington, D.C. area.

Monitoring of fish tissue in this area should be continued. For this monitoring, consistent and up-to-date analytical methods along with an adequate sampling scheme should be used to help evaluate geographic and species variations. Also, the data from recent local anglers surveys by the District's Fisheries Management Branch should be used to determine the area specific risk assessment of potential health effects to the local population.

References

Ahlborg, U.G., Becking, G.C., Birnbaum, L.S., Brouwer, A., Derks, H.J.G.M., Feeley, M., Golor, G., Hanberg, A., Larsen, J.C., Liem, A.K.D., Safe, S.H., Schlatter, C., Waern, F., Younes, M., and Yrjanheikki, E. 1994. Toxic equivalency factors for dioxin like PCBs. **Chemosphere** 28: 1049-1067.

Block, E. 1990. Organochlorine residues and histopathological examination of fish from the Potomac and Anacostia Rivers, Washington, D.C. **Publication No. AFO-C90-01**, U.S. Fish and Wildlife Service, Environ. Contam. Div., Annapolis, MD.

Connolly, J. and C. Pedersen. 1988. A thermodynamic-based evaluation of organic chemical accumulation in aquatic organisms. **Environ. Sci. Technol.** 22: 99-103.

Cullen, M.C. and D.W. Connell. 1992. Bioaccumulation of chlorohydrocarbon pesticides by fish in the natural environment. **Chemosphere** 25: 1579-1587.

de Boer, J., C.J.N. Stronck, W.A. Traag, and J.van der Meer. 1993. Non-ortho and mono-ortho substituted chlorobiphenyls and chlorinated dibenzo-p-dioxins and dibenzofurans in marine and freshwater fish and shellfish from the Netherlands. **Chemosphere** 26: 1823-1842.

Gill, G.A. and K.W. Bruland. 1990. Mercury speciation in surface freshwater systems in California and other areas. **Environ. Sci. Technol.** 24: 1392-1400.

Interstate Commission on the Potomac River Basin (ICPRB). 1988. **Anacostia: The Other River**. ICPRB Publication 88-1, January 1988, Rockville, MD.

Jensen, S. and A. Jernelov. 1969. Biological methylation of mercury in aquatic organisms. **Nature** 223: 753-754.

Kafafi, S.A., H.Y. Afeefy, A.H. Ali, H.K. Said, and A.G. Kafafi. 1993. Binding of polychlorinated biphenyls to the aryl hydrocarbon receptors. **Environ. Health Perspectives** 101: 422-428.

Mackay, D. 1982. Correlation of bioconcentration factors. **Environ. Sci. Technol.** 16:274-278.

McFarland, V.A. and J.U. Clarke. 1989. Environmental occurrence, abundance, and potential toxicity of polychlorinated biphenyl congeners: Considerations for congener specific analysis. **Environ. Health Perspectives.** 81: 225-239.

O'Brien & Gere. 1979. Potomac-Anacostia River System, Phase I Combined Sewer Overflow Study. Final Report to District of Columbia Department of Environmental Services. Washington, D.C.

Pinkney, A.E., W.H. Burton, L.C. Scott, and J.B Frithsen. 1993. An assessment of the potential residual effects of the January 1992 oil spill in the Anacostia River. Final Report. Versar, Inc., Columbia, MD.

Reed, J.C. and S.F. Obermeier. 1989. The geology beneath Washington, D.C. - The foundations of a nation's capitol. In: **Geology, Hydrology and History of the Washington, D.C. Area.** Eds: J.E. Moore and J.A. Jackson; American Geological Institute, Alexandria, VA., pp. 27-50.

Safe, S. 1990. Polychlorinated biphenyls (PCBs), dibenzo-p-dioxins (PCDDs), dibenzofurans (PCDFs), and related compounds: Environmental and mechanistic considerations which support the development of toxic equivalency factors (TEFs). **Crit. Rev. Toxicol.** 21: 51-88.

Sommerfield, M. and J. Cummins. 1989. Statistical analysis of fish tissue toxics data collected by the District of Columbia. Final Report. Interstate Commission on the Potomac River Basin, Rockville, MD.

Swain, W.R. 1991. Effects of organochlorine chemicals on the reproductive outcome of humans who consumed contaminated Great Lakes Fish: an epidemiologic consideration. **J. Toxicol. Environ. Health** 33: 587-639.

Thomann, R.V., J.P. Connolly, and T.F. Parkerton. 1992. An equilibrium model of organic chemical accumulation in aquatic food webs with sediment interactions. **Environ. Toxicol. Chem.** 11: 615-629.

Tollefson, L. Methylmercury in fish: Assessment of risk for U.S. consumers. In: **The Risk Assessment of Environmental and Human Health Hazards: A Textbook of Case Studies**, Eds: Paustenback, D.J.. John Wiley & Sons, New York, NY.

U.S. EPA. 1989. Exposure Factors Handbook. **EPA 600/8-89/043,** U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Exposure Assessment Group, Washington, D.C.

U.S. EPA. 1991. Chesapeake Bay Toxics of Concern List: Information Sheets. Chesapeake Bay Program, Annapolis, MD.

U.S. EPA. 1992. National Study of Chemical Residues in Fish. Volume I. **EPA 823-R-92- 008a**, Office of Science and Technology (WH-551), Washington, D.C.

U.S. EPA. 1993a. Chesapeake Bay finfish/shellfish tissue contamination: Critical Issue Forum Proceedings. Chesapeake Bay Program, Annapolis, MD.

U.S. EPA. 1993b. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 1. Fish Sampling and Analysis. **EPA 823-R-93-002.** Office of Water, U.S. Environmental Protection Agency, Washington, D.C.

Velinsky, D.J., H.C.Haywood, T.L. Wade, and E. Reinharz. 1992a. Sediment Contamination Studies of the Potomac and Anacostia Rivers around the District of Columbia. **ICPRB Publication 92-2**, Interstate Commission on the Potomac River Basin, Rockville, MD.

Velinsky, D.J. and J. Cummins 1993. Revised QA/QC Documentation: Analysis of fish tissue from the Washington, D.C. Area: Phases I and II. Interstate Commission on the Potomac River Basin, Rockville, MD.

Zitko, V. 1972. Determination, toxicology, and environmental levels of phthalate plasticizers. **Fish. Res. Bd. Can. Tech. Report # 244**: 1-37.

Appendix I. Fish Advisory for the District of Columbia.

Below is the current District of Columbia public health advisory for the consumption of wild fish caught in the waters of the District of Columbia[1]:

D.C. Commissioner of Public Health Urges Limited Consumption of Anacostia and Potomac River Channel Catfish.

The District Government's Commissioner of Public Health advises the public to limit consumption of channel catfish, carp, and American eel caught in the District stretch of the Potomac and Anacostia rivers. The Commissioner recommends that individuals consume no more than one meal (one-half pound) per week of channel catfish, carp or eel. Since PCBs and pesticides tend to be stored in the fat of the fish, it is further recommended that fish be prepared as boneless, skinless filets for cooking. This includes removing the fat layer along the belly flap and the midpoint of the back.

The Commissioner also notes that other species of fish found in the District's waters: sunfish, bass, perch, and herring, did not have elevated levels of PCBs or pesticides.

[1]Taken from: District of Columbia Fishing Regulations, DCRA, ERD, DC Fisheries Management Branch, Washington, D.C. (202-404-1155)

Appendix II. Fish Identification

Appendix I-1. Summary information for fish tissue samples.

Composite #	Sample #	Date Collected	Wet Weight (gms)	Fish Species	Location
1-91	95	10/10/91	981	Common Carp	Upper Potomac
"	96	"	818	"	"
"	97	"	506	"	"
2-91	98	"	85	Largemouth Bass	Upper Potomac
"	99	"	141	"	"
"	100	"	338	"	"
3-91	94	9/26/91	31	American Eel	Upper Potomac
"	101	10/10/91	153	"	"
"	102	"	17	"	"
"	103	"	39	"	"
"	104	"	13	"	"
"	112	"	35	"	"
"	121	10/22/91	40	"	"
"	122	"	26	"	"
"	123	"	29	"	"
"	124	"	35	"	"
"	125	"	17	"	"
"	130	10/30/91	169	"	"
4-91	131	"	235	Channel Catfish	Upper Potomac
"	132	"	388	"	"
"	133	"	134	"	"
5-91	90	9/26/91	20	Bluegill	Upper Potomac
"	105	10/10/91	31	"	"
"	106	"	23	"	"
"	107	"	36	"	"
"	108	"	39	"	"
"	109	"	23	"	"
"	110	"	23	"	"
"	111	"	19	"	"
"	120	"	17	"	"
"	134	10/30/91	21	"	"
"	135	"	21	"	"
"	138	"	21	"	"
"	139	"	21	"	"
"	92	9/26/91	18	Pumpkinseed	"
"	113	10/10/91	16	"	"
"	114	"	12	"	"
"	115	"	12	"	"
"	116	"	14	"	"
"	117	"	16	"	"
"	126	10/22/91	12	"	"
"	136	10/30/91	10	"	"
"	91	9/26/91	22	Sunfish	"
"	93	"	24	"	"
"	118	10/10/91	13	"	"
"	119	10/10/91	22	"	"
"	127	10/22/91	19	"	"
"	137	10/30/91	14	Redgear Sunfish	"
6-91	1	7/31/91	215	Channel Catfish	Lower Potomac
"	2	"	190	"	"
"	3	"	465	"	"

Appendix I-1. Cont.

Composite #	Sample #	Date Collected	Wet Weight (gms)	Fish Species	Location
7-91	4	"	90	Largermouth Bass	Lower Potomac
"	5	"	100	"	"
"	6	"	135	"	"
"	7	"	90	"	"
"	8	"	284	"	"
8-91	22	"	46	American Eel	Lower Potomac
"	23	"	360	"	"
"	34	8/2/91	204	"	"
9-91	26	8/2/91	266	Channel Catfish	Lower Potomac
"	55	8/22/91	323	"	"
"	78	8/29/91	450	"	"
10-91	10	7/31/91	24	Bluegill	Lower Potomac
"	11	"	12	"	"
"	12	"	32	"	"
"	13	"	12	"	"
"	14	"	40	"	"
"	15	"	52	"	"
"	16	"	32	"	"
"	17	"	24	"	"
"	18	"	16	"	"
"	19	"	34	"	"
"	25	8/2/91	52	"	"
"	28	"	44	"	"
"	29	"	36	"	"
"	9	7/31/91	6	Pumpkinseed	"
"	20	"	14	"	"
"	21	"	14	"	"
"	24	8/2/91	12	"	"
"	27	"	12	"	"
"	30	"	12	"	"
"	31	"	22	"	"
"	32	"	20	"	"
"	33	"	28	"	"
11-91	65	8/28/91	669	Common Carp	Upper Anacostia
"	66	"	485	"	"
"	67	"	98	"	"
12-91	86	8/30/91	73	Largemouth Bass	Upper Anacostia
"	88	"	325	"	"
"	89	"	238	"	"
13-91	70	8/28/91	52	Brown Bullhead	Upper Anacostia
"	71	"	53	"	"
"	72	"	48	"	"
"	73	"	62	"	"
"	74	"	38	"	"
"	75	"	29	"	"
"	76	"	40	"	"
14-91	87	8/30/91	29	Bluegill	Upper Anacostia
"	68	8/28/91	17	"	"
"	69	"	14	"	"
"	77	"	11	"	"
15-91	49	8/6/91	301	Common Carp	Lower Anacostia
"	56	8/23/91	251	"	"

Appendix I-1. Cont.

Composite #	Sample #	Date Collected	Wet Weight (gms)	Fish Species	Location
16-91	50	8/6/91	65	Largemouth Bass	Lower Anacostia
"	80	8/30/91	122	"	"
"	81	"	220	"	"
"	129	10/30/91	391	"	"
17-91	51	8/6/91	37	American Eel	Lower Anacostia
"	52	"	43	"	"
"	53	"	42	"	"
"	54	"	43	"	"
"	128	10/24/91	500	"	"
18-91	35	8/6/91	266	Channel Catfish	Lower Anacostia
"	36	"	154	"	"
"	37	"	90	"	"
19-91	41	"	44	Bluegill	Lower Anacostia
"	42	"	28	"	"
"	43	"	47	"	"
"	44	"	31	"	"
"	45	"	17	"	"
"	46	"	29	"	"
"	62	8/23/91	24	"	"
"	63	"	33	"	"
"	64	"	37	"	"
"	38	8/6/91	14	Pumkinseed	"
"	39	"	22	"	"
"	40	"	16	"	"
"	47	"	20	"	"
"	48	"	22	"	"
"	57	8/23/91	19	"	"
"	58	"	24	"	"
"	59	"	21	"	"
"	60	"	15	"	"
"	61	"	20	"	"
"	82	8/30/91	19	"	"
"	83	"	25	"	"
"	84	"	22	"	"
"	85	"	12	"	"
1-89	29	10/9/89	171	Brown Bullhead	Lower Anacostia
"	31	"	187	"	"
"	32	"	98	"	"
"	33	"	160	"	"
"	34	"	178	"	"
"	35	"	202	"	"

Note: Data provided by the District of Columbia.

Key: ND - No Data Provided

Appendix I-2. Summary information for fish tissue samples.

Composite #	Sample #	Date Collected	Wet Weight (gms)	Fish Species	Location
1-92	1	ND	26	Bluegill	Lower Potomac
"	2	ND	15	"	"
"	3	ND	39	"	"
"	4	ND	22	"	"
"	9	ND	31	"	"
"	10	ND	28	"	"
"	11	ND	25	"	"
"	12	ND	27	"	"
"	13	ND	24	"	"
"	14	ND	22	"	"
"	15	ND	16	"	"
"	16	ND	17	"	"
"	17	ND	21	"	"
"	18	ND	15	"	"
"	20	ND	16	"	"
"	22	ND	25	"	"
"	23	ND	20	"	"
"	24	ND	19	"	"
"	25	ND	18	"	"
"	26	ND	17	"	"
"	27	ND	19	"	"
"	28	ND	13	"	"
"	29	ND	6	"	"
"	30	ND	11	"	"
"	31	ND	13	"	"
"	32	ND	16	"	"
2-92	5	ND	150	Largemouth Bass	"
"	6	ND	289	"	"
"	45	ND	132	"	"
3-92	7	ND	188	Channel Cartfish	"
"	8	ND	279	"	"
"	33	ND	262	"	"
4-92	34	ND	486	Common Carp	"
"	35	ND	406	"	"
"	36	ND	366	"	"
5-92	38	ND	205	Channel Catfish	Upper Potomac
6-92	40	ND	613	Common Carp	"
"	43	ND	506	"	"
"	44	ND	614	"	"
7-92	41	ND	26	American Eel	"
"	42	ND	23	"	"

APPENDIX 2

copy of

National Bureau of Standards
Certificate of Analysis

U.S. Department of Commerce
Juanita M. Kreps
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Stand

Certificate of Analysis

Standard Reference Material

Oyster Tissue

This Standard Reference Material is intended primarily for use in calibrating inc methodology for the chemical analysis of marine animal tissue.

Certified Values of Constituent Elements: The certified values for the constituent e Certified values are based on results obtained by reference methods of known ac results obtained by two or more independent and reliable analytical methods. Nor information only in Table 2. All values are based on a minimum sample size of

NOTICE AND WARNINGS TO USERS

Expiration of Certification: This certification is invalid after 5 years from the date invalid before then, purchasers will be notified by NBS.

Storage: The material should be kept tightly closed in its original bottle and stor tures between 10-30 °C. It should not be exposed to intense sources of radiation, sunlight.

Use: A minimum sample weight of 250 mg of the *dried* material (see Instruction any certified value in Table 1 to be valid within the stated uncertainty. The bottle each use, and closed tightly immediately after use.

The statistical analysis of the data was performed by K. R. Eberhardt and H. H. ing Division.

The overall direction and coordination of the analytical chemistry measurement performed in the NBS Center for Analytical Chemistry by P. D. LaFleur.

The technical and support aspects involved in the preparation, certification, Reference Material were coordinated through the Office of Standard Referen

Washington, D.C. 20234
December 12, 1979

G
Office of

(over)

Appendix I-2. Cont.

Composite #	Sample #	Date Collected	Wet Weight (gms)	Fish Species	Location
17-93	6	ND	19	White Perch	Upper Potomac
"	7	ND	19	"	"
"	8	ND	20	"	"
"	9	ND	ND	"	"
"	10	ND	ND	"	"
"	11	ND	ND	"	"
"	12	ND	ND	"	"
18-93	13	ND	ND	White Perch	Upper Potomac
"	14	ND	ND	"	"
"	15	ND	ND	"	"
"	16	ND	ND	"	"
"	17	ND	ND	"	"
"	18	ND	ND	"	"
"	19	ND	ND	"	"
"	20	ND	ND	"	"

Key: ND - No Data Provided

Note: Data provided by the District of Columbia.

Appendix I-2. Cont.

Composite #	Sample #	Date Collected	Wet Weight (gms)	Fish Species	Location
8-92	57	ND	32	Pumpkin Seed	Lower Anacostia
"	58	ND	25	"	"
"	59	ND	50	"	"
"	60	ND	25	"	"
"	61	ND	45	Bluegill	"
"	62	ND	15	Pumpkin Seed	"
"	63	ND	20	"	"
"	64	ND	20	"	"
"	65	ND	17	Pumpkin Seed	"
"	66	ND	19	Bluegill	"
"	67	ND	20	Pumpkin Seed	"
"	68	ND	17	Bluegill	"
"	69	ND	12	Pumpkin Seed	"
"	70	ND	15	"	"
"	71	ND	17	Bluegill	"
9-92	46	ND	66	Largemouth Bass	Lower Anacostia
"	72	ND	225	"	"
"	73	ND	558	"	"
10-92	74	ND	510	Common Carp	Lower Anacostia
"	78	ND	390	"	"
"	79	ND	335	"	"
11-92	47	ND	16	Bluegill	Upper Anacostia
"	48	ND	15	"	"
"	50	ND	20	"	"
"	55	ND	20	"	"
"	56	ND	20	"	"
12-92	51	ND	65	Largemouth Bass	Upper Anacostia
"	52	ND	142	"	"
"	53	ND	140	"	"
"	54	ND	119	"	"
13-92	75	ND	450	Common Carp	Upper Anacostia
"	76	ND	570	"	"
"	77	ND	538	"	"
14-92	49	ND	31	American Eel	Upper Anacostia
15-89	44	ND	ND	Brown Bullhead	Upper Anacostia
"	41	ND	ND	"	"
"	42	ND	ND	"	"
"	43	ND	ND	"	"
"	40	ND	ND	"	"
"	39	ND	ND	"	"
16-89	52	ND	ND	Brown Bullhead	Lower Potomac
"	51	ND	ND	"	"
"	53	ND	ND	"	"

Appendix III. Data Report from Eco-Logic, Inc.

FINAL REPORT

THE ANALYSIS OF FISH

for the

INTERSTATE COMMISSION ON THE

POTOMAC RIVER BASIN

February 24, 1994

Prepared for

David J. Velinsky, Ph.D
Interstate Commission on The Potomac River Basin
6610 Executive Blvd., Ste. 300
Rockville, MD 20852-3903

by

ELI Eco Logic International Inc.
143 Dennis Street
Rockwood, Ontario
N0B 2K0

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

This final report describes the results for the analyses of fish from the Potomac River Basin. Analyses were performed by ELI Eco Logic Laboratories under contract to the Interstate Commission for the Potomac River Basin. The results presented are for the first lot of 20 fish and a second lot of 17 fish, for a total of 37 fish. This report summarizes the analyses of trace metals, volatile organics (VOCs), semi-volatile organics, polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs), organochlorine pesticides, and polychlorinated biphenyls (PCBs; total, congener specific, and co-planar). Moreover, this report includes the dioxin and furan analysis results not incorporated in the interim report dated April 26, 1993 (namely samples 1-91, 4-91, 8-91, 12-91 and 16-91). All sample analysis results are reported on a wet weight basis.

2 METHODOLOGY

2.1 Sample Handling and Subsampling

Samples arrived at the laboratory as either whole fish or skinless fillets. All samples were stored in a freezer immediately upon submission. Prior to analysis the frozen samples were thawed slightly and then homogenized as cold as possible using a Waring blender. Whole fish were homogenized as received without skinning or filleting. Initially, the homogenized fish tissue was subsampled cold for volatiles (5 g) and then refrozen until analysis. Subsamples were also taken for metals (50 g) and trace organics (20 g) analyses. Stainless steel implements were used throughout for sample handling. At the time of homogenization, the general integrity of each sample was noted. A flow chart outlining sample treatment, subsampling, fractionation and analysis is shown in Figure 1.

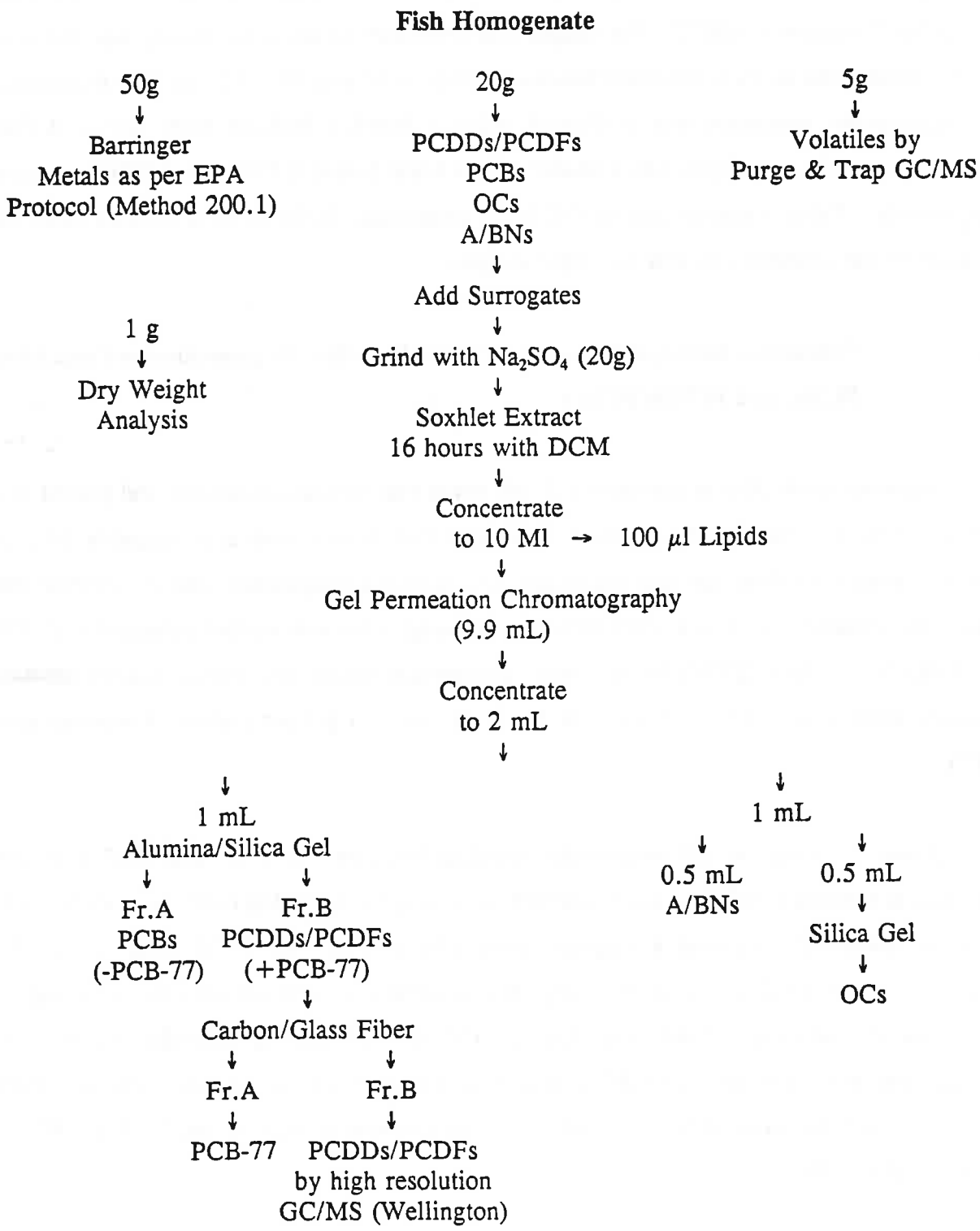
2.2 Trace Metals

The atomic absorption (AA) analyses of metals and inorganics required acid digestion of the sub-sample. Mercury levels were analysed by cold vapour atomic absorption (AA). Lead, cadmium, beryllium, nickel, silver and thallium were determined using inductively coupled argon plasma. Arsenic, selenium and antimony concentrations were determined by hydride generation AA. Cyanide was analysed by colorimetry. All analyses were performed using EPA Methodologies. Refer to Appendix D of the QA/QC project plan for complete methodology and QA/QC.

2.3 Volatile Organics

A Tekmar purge and trap Model LSC 2000 equipped with an ALS 2016 and a cryofocussing module was used to extract the volatiles from the fish samples. Approximately 5 grams (g) of frozen homogenized fish tissue was weighed accurately into a purge and trap sampling tube and immediately attached to the Tekmar purge and trap instrument. Organic free deionized water (5 mL) was then added containing surrogates and internal standard compounds before commencing the purge and trap sampling procedure. The samples were warmed to 40°C

Figure 1 Analytical Flow Chart



in heating jackets during the 12 minute purge with helium. During purge mode the analytes were trapped onto to a Tenax/silica-gel/charcoal trap. The analytes were then desorbed from the trap for 7 minutes at 180°C. The sample was cryofocussed and then directly injected onto the GC column (60 m RTX volatiles (Restek) column; 0.32 mm ID; 1.5 μm film thickness). Chromatographic separation was performed using a Hewlett Packard 5890 Series II Gas Chromatograph (GC) equipped with a Model 5971A Mass Selective Detector (MSD) operating in scan mode. Table 1 summarizes the GC/MSD conditions. Refer to EPA Method 8240 for quantitation and confirmation ions for target analytes.

2.4 Extraction and Lipid Removal for Semi-Volatiles, Organochlorine Pesticides, PCBs, and PCDDs/PCDFs

Approximately 20 g of homogenized fish tissue was weighed accurately and placed in a mortar and pestle. The tissue was then ground until free flowing with approximately 20 g of anhydrous granular sodium sulphate and spiked with surrogate compounds. The dried tissue was transferred quantitatively to a soxhlet-thimble containing celite and soxhlet extracted with 300 mL of dichloromethane (DCM) for 16 hours. The solvent extract was collected, dried through powdered sodium sulphate and evaporated to 10 mL prior to gel permeation chromatography (GPC).

Large molecular weight compounds including lipids and large proteins were removed from sample extracts by GPC. A calibrated GPC Autoprep model 1002B (ABC Inc., Columbus, Mo.) was employed to collect a lipid-free extract by eluting with DCM under 30 psi N_2 pressure. Exactly 5 mL of the 10 mL extract was injected onto a 50 cm column containing 70 g Biobeads SX-3 at a rate of 5 mL/min. The first 100 mL collected was discarded, and the next 125 mL retained. The retained GPC extract was evaporated to 2 mL and split into three aliquots: 1/2 mL for semi-volatiles; 1/2 mL for organochlorine pesticides; and 1 mL for PCBs, PCDDs and PCDFs.

Table 1 Gas Chromatograph Conditions				
	Volatiles	Semi-volatiles	OC Pesticides	PCBs
Injector Temp.	150°C	280°C	250°C	250°C
Detector Temp.	210°C	260°C	300°C	310°C
Initial Oven Temp.	35°C	35°C	50°C	50°C
Initial Hold	5 min.	2.5 min.	2 min.	2 min.
Ramp A	4°C/min	5°C/min	2°C/min	6°C/min
Final Temp. A	110°C	60°C	260°C	170°C
Hold A	5 min.	0 min.	15 min.	0 min.
Ramp B	10°C/min	5°C/min	-	4°C/min
Final temp. B	210°C	200°C	-	270°C
Hold B	2 min.	0 min.	-	10 min.
Ramp C	-	10/min°	-	-
Final Temp. C	-	270°C	-	-
Hold C	-	17.5 min	-	-
Total Time	41.75 min.	60 min.	122 min.	57 min.

2.5 Semi-Volatile Organics

The designated 1/2 mL GPC aliquot was analysed for semi-volatile organic compounds using a Hewlett Packard model 5890 GC equipped with a model 5970 MSD. A full-scan monitoring of ions with mass/charge ratio of 35 to 500 was employed. The GC is equipped with a 25 meter DB-5 (J&W Scientific) column having a 0.25 mm I.D. and 0.1 μm film thickness. A 1 μL splitless injection was used with a purge delay of 1.0 minutes. Refer to Table 1 for GC/MSD conditions. See EPA Method 8270 for quantitation and confirmation ions for target analytes.

2.6 Organochlorine Pesticides

The designated 1/2 mL GPC aliquot for organochlorine pesticides was subjected to silica gel cleanup. A 10 mm x 800 mm column containing 5 g of activated silica gel in hexane topped with 1 cm of powdered sodium sulphate was used. The extract was added to the top of the column and eluted with 120 ml of 25% DCM in hexane. The eluent was then evaporated to 1/2 ml for organochlorine pesticide analyses by GC/ECD using a Hewlett Packard 5890 GC equipped with dual capillary columns and dual electron capture detectors (ECD). The GC/ECD employs a 30 m DB-5 and a 30 m DB-17 (J&W Scientific) capillary column; each with 0.25 mm ID and 0.2 μm film thickness. A 2 μl splitless injection was used with a purge delay of 1 minute. Refer to Table 1 for GC/ECD conditions.

The sample is split equally onto the two ECD columns and the difference in polarity between the two provides for a different retention time for each analyte on either column. Once a compound is confirmed, the result from the column with the lowest quantitated number is chosen. Therefore, any area contribution resulting from an interfering peak on one of the columns is excluded.

2.7 Co-planer, Congener-specific, and Total PCBs (PCDD/PCDF Clean-up)

The 1 mL aliquot from the GPC clean-up designated for PCBs, PCDDs, and PCDFs was subjected to a two stage samples preparation procedure. The aliquot first underwent acid silica gel (top)/alumina (bottom) column chromatography to remove interferences. Two fractions were collected from this stage. Fraction A, eluted with 150 mL of 1% DCM in hexane, was analysed for coplaner, congener-specific, and total PCBs, with the exception of PCB-77, which was retained in the second fraction. The column was then eluted with 150 mL of 50% DCM in hexane. This fraction contained the dioxins, furans and PCB-77.

Fraction B was evaporated to 1 mL of hexane and fractionated further on a carbon/glass fiber column. The extract was added to the top of the column and eluted with 15 mL of DCM followed by 15 mL of 25% toluene in DCM. Those fractions were combined to form fraction

A, which was analysed for PCB-77 by GC-MSD. The column was then eluted with 50 mL of toluene (reverse flow) to collect the dioxins and furans.

The PCBs were analysed using a Hewlett Packard 5890 Series II GC equipped with a model 5971A MSD. Selective ion monitoring (SIM) mode was used. The GC is equipped with a 30 m DB-5 (J&W Scientific) column having a 0.25 mm ID and 0.25 μm film thickness. A 2 μl splitless injection was used for PCB analysis with a purge delay of 1 minute. Refer to Table 1 for GC/MSD conditions.

2.8 Chlorinated Dioxins and Furans

The carbon/glass fiber chromatography fraction containing the chlorinated dioxins and furans was evaporated to approximately 100 μL and transported to Wellington Laboratories for high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) analysis. At Wellington the sample was evaporated to near dryness and brought to 20 μL with the addition of the recovery standard (200 ng/mL of ^{13}C-1234-T_4CDD). The gas chromatographic separation was accomplished using an HP Series II capillary GC equipped with a 60 m DB-5 column. The mass spectrometer is a VG 70-SE HRMS. A 2 μL aliquot was injected using a CTC autosampler through a splitless injector.

The samples were analysed for 2,3,7,8-isomer specific PCDDs and PCDFs, and total homologues with strict adherence to EPA Method 1613 ("Tetra- through Octa- Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS") for the set-up, calibration and tuning of the HRGC/HRMS system. This method may be referred to for additional information.

2.9 Identification and Calculation

2.9.1 Peak Identification and Qualification

Data files generated from instrumental analysis are integrated and quantitated using the provided software. The experience of the analyst is also essential, and in many instances, manual integration and quantitation is used to override the computer in the estimation of

maximal peak response. In order for a peak to qualify as a positive detection of target analyte. the following criteria must be met:

2.9.1.1 The peak response of the quantitation and confirmation ion must be greater than 3 times the background noise.

2.9.1.2 The peak area ratio of the confirmation to quantitation ion must be within ±20% (absolute) of the ratios observed within the calibration standards and elute simultaneously ±0.02 minutes.

2.9.1.3 The observed retention times within the samples should not vary more than ± 0.05 minutes relative to the standards.

2.9.1.4 The peak response of all internal standards must be observed.

2.9.2 Determination of Response Factors

The response factors (RF) for each target compound are determined by tabulating the area response of the characteristics ions against concentration and the concentration of the internal standard. The internal standard selected for the calculation of the RF for a compound is the internal standard that has a retention time closest to the compound being measured. The response factor is calculated according to equation (1).

$$RF = \frac{(A_x C_{is})}{(A_{is} C_x)} \quad (1)$$

where:

A_x = Area of the characteristic ion for the compound being measured.

A_{is} = Area of the characteristic ion for the specific internal standard.

C_{is} = Concentration of the specific internal standard.

C_x = Concentration of the compound being measured.

2.9.3 Calculation for Analyte Concentration

When a compound has been identified, the quantification of that compound is based on the integrated abundance determined from the ion chromatogram of the primary characteristic ion. The internal standard used is the one nearest in retention time to the target analyte. The concentration of each identified analyte in the sample is calculated from Equation (2).

$$Concentration\ (ng/g) = \frac{(A_x)(I_s)(V_t)}{(A_{is})(RF)(V_i)(W_s)(F_r)} \quad (2)$$

where:

A_x = Area of characteristic ion for compound being measured.

I_s = Amount of internal standard injected (ng).

V_t = Volume of total extract (μL)

A_{is} = Area of characteristic ion for the internal standard.

RF = Response factor for the compound being measured (see Section 2.9.2)

V_i = Volume of extract injected (μL)

W_s = Weight of sample extracted or purged (wet weight, g).

F_r = Fraction of original extract separated for analyte group (eg. for semi-volatiles, 1/2 of extract to GPC x 1/4 of GPC retained fraction allocated for semi-volatile analysis = 1/8 = F_r)

2.10 Lipid Determination

Lipids were determined gravimetrically prior to gel permeation chromatography. A 100 μl aliquot of the 10 mL sample extract was placed in a pre-weighed weighing dish and air dried. The amount of extractable lipid was then calculated as a percentage of whole sample mass according to equation (3).

$$\%\ Lipid = \frac{(V_t)(W_l)}{(V_l)(W_s)} \times 100 \quad (3)$$

where:

V_t = Volume of sample extract

W_l = Weight of dried lipid subsample

V_l = Volume of lipid subsample

W_s = Weight of sample extracted

2.11 Dry Weight Determinations

A portion of the homogenized fish tissue was placed in a pre-weighed weighing dish and dried in an oven at 130°C overnight. The water content was then calculated as a percentage of whole sample mass according to equation (4).

$$\% \ moisture = \frac{(W_w - W_d)}{W_w} \times 100 \qquad (4)$$

where:

W_w = Wet weight of subsample

W_d = Dry weight of subsample

3 RESULTS

The results presented below were determined according to the method described in Section 2. The analytical results are reported on a wet sample weight basis along with the percent water and lipid content. The uncorrected sample results reported are accompanied by the surrogate recoveries. The analytical data pertaining to the first set of 20 fish samples analyzed are provided in all Table "A's" while the results for the second lot of 17 fish are given in all Table "B's". The general condition of the fish upon receipt is summarized in Table 2A and Table 2B. (Please note, all Tables referred to in the following sections are located at the end of this chapter.) Surrogate recovery corrected results are reported in Appendix A.

The detection limits stated for both sets of analyses compared very well with the original method detection limits stated in the QA/QC Project Plan (October 16, 1992). However, due to normal instrumental (GC/MSD) fluctuations (eg., chromatography retention times, peak shape, chromatographic interferences relative to target analytes, detector sensitivity) it is common to observe changes in the absolute response of certain target analytes. These differences are reflected in modified detection limits. Generally, the lighter semi-volatiles and VOCs are more likely to succumb to these daily changes.

3.1 Water and Lipid Content

Water and lipid determination results are given in Table 3A and Table 3B. The percent water content for the first set of analyses varied from 59% to 80% and for the second from 60% to 80%. The percent lipid content for the first set varied from 0.19% to 15% and for the second from 0.76% to 17%.

3.2 Trace Metals

The analytical results for metals are provided in Table 4A and Table 4B. The first data set showed significant amounts of arsenic, selenium, mercury and chromium. Other metals detected included cyanide, beryllium, lead, nickel and cadmium. The second set indicated the presence of relatively high levels of arsenic, selenium, mercury and cyanide. Chromium, nickel,

beryllium and lead were also detected. The laboratory blank data (Table 10A and Table 10B) did not identify any interferences.

3.3 Volatile Organics

The results for the analysis of VOCs are provided in Table 5A and Table 5B and the laboratory blank data are summarized in Table 11A and Table 11B. Samples 7-92 and 14-92 were not analyzed in the second set of analyses because of insufficient amounts of sample. Also, two of the surrogates used in the first set of analyses, trichlorofluoromethane and ethylbenzene-d_{10}, were replaced with fluorobenzene and toluene-d_8 for the second set of analyses. In the first set high interferences were indicated by the unusually high rates of recovery of trichlorofluoromethane and ethylbenzene-d_{10}, and thus only benzene-d_6 was used to estimate surrogate recovery.

In the first set of analyses the VOCs notable in the samples and absent in the blanks included chloroform, trichloroethene, tetrachloroethene, ethylbenzene, and o, m, and p-xylenes. The VOCs carbon tetrachloride and bromodichloromethane were also detected. Methylene chloride, 1,1,1-trichloroethane, benzene and toluene were detected in the samples but were also detected in the blanks (note, however, that the levels of these compounds in the blank were well below the practical quantitation limits for these compounds in solids as indicated in US EPA Method 8240 (5 ng/g)). Methylene chloride and toluene were present at significantly higher levels in the samples than in blanks. However, because the samples were subjected to a greater degree of handling than the blanks, there is a greater opportunity for uptake of methylene chloride and toluene from the laboratory atmosphere, although measures were taken to limit such exposures. Bleeding from the Tenax trap (2,6-diphenylene oxide polymer) also likely contributed to elevated benzene and toluene levels. It is therefore recommended that the methylene chloride and toluene results be interpreted with caution.

The second set of analyses indicated a trend similar to the first. The VOCs predominant in the samples included chloroform, trichloroethene, tetrachloroethene, chlorobenzene, ethyl benzene, and o,m and p-xylenes. The VOCs 1,2-dichloropropane, cis- and trans-1,3-dichloropropene, 1,1,2-trichloroethane, bromoform, 1,1,2,2-tetrachloroethane and carbon

tetrachloride were also detected. The volatiles determined in both the blank and samples included methylene chloride, 1,1,1-trichloroethane, 1,2-dichloroethane, benzene and toluene. This data indicated that methylene chloride and toluene continued to cause laboratory interferences.

The data from the first lot of fish analyses indicated poor analytical results for bromoform. This instrumental problem was resolved before the second set of fish samples were analysed. Not only was the response for bromoform greatly improved but the method detection limits for all target analytes were significantly enhanced.

3.4 Semi-Volatile Organics

The results for the analysis of semi-volatiles for both sets of fish analyses are provided in Table 6A and Table 6B. The laboratory blank data is summarized in Table 12A and Table 12B. In both sets of analyses most semi-volatiles were not detected in the fish samples, with the exception of certain polyaromatic hydrocarbons (PAHs), phenol, and phthalates. The PAHs found in the first set of analyses included naphthalene, acenaphthene, phenanthrene, fluoranthene, pyrene, fluorene, anthracene and acenaphthylene. Only naphthalene was detected in the second set of analyses. These compounds were not detected in laboratory blanks.

Phthalate compounds were identified in both sets of analyses. In the first lot of samples diethylphthalate, di-n-butylphthalate, bis(2-ethylhexyl)phthalate, and di-n-octylphthalate were found. However, di-n-butylphthalate was detected in laboratory blanks at levels comparable to those found in fish samples. Bis(2-ethylhexyl)phthalate was also detected in the blank up to 50 ng/mL, thus results near or below this level in the fish should be interpreted with caution. Di-n-octylphthalate was not detected in any of the laboratory blanks analysed with the fish samples but has been detected in laboratory blanks from this laboratory in the past (at levels up to about 100 ng/mL in the final extract). The levels found in the Potomac River fish exceeded this level by more than an order of magnitude in several samples, and should therefore be considered contaminants in those samples. In the second set of analyses di-n-butylphthalate, bis(2-ethylhexyl)phthalate and di-n-octylphthalate were present within some samples. However, bis(2-

ethylhexyl)phthalate and di-n-octylphthalate were also determined in the blanks at 120 and 70 ng/ml, respectively.

Because N-nitrosodimethylamine is poorly recovered and may co-elute with the solvent peak, quantitation of this compound was not possible for these set of analyses. Poor recoveries were also exhibited by the acid surrogates and are thus expected of phenolic analytes in the fish tissue. This was especially true in the second set of analyses where the recovery of 2-fluorophenol was not possible. This surrogate provided no recovery information because of its co-elution with the solvent peak. Acidic compounds are more volatile than typical semi-volatiles and are therefore more readily lost during the concentration steps of sample preparation. In addition, poor extraction efficiencies are often encountered with polar compounds when attempting to extract them from high water content matrices. This is precisely the case with respect to the surrogate nitrobenzene-d_5 and other nitrogen containing target compounds (eg., nitrobenzene, 2-nitrophenol).

One analytical problem that was difficult to overcome was the very high method detection limit for indeno(1,2,3-cd)pyrene in the second lot of analyses. This was due to the co-elution on the GC/MSD of this PAH with cholesterol. In particular, cholesterol provided a response at the same retention time for the quantitation ion with the mass 276 amu. In the first set of analyses this was not a concern because of a significant shift in retention times between the two compounds. Cholesterol, a relatively large molecule, elutes first with the heavy PAHs and phthalates on the gel permeation chromatography (GPC) clean-up. The GPC elution windows could not have been adjusted nor could any other clean-up procedure be applied to these extracts because of the real potential for the removal of target analytes.

3.5 Organochlorine Pesticides

The results for the analyses of organochlorine pesticides are summarized in Table 7A and Table 7B. No interferences for the target analytes were detected in the blank samples in either set of analyses (See Table 13A and Table 13B). The notable pesticides detected in both sets of analyses included heptachlor epoxide, dieldrin, pp'-DDE, pp'-DDD, pp'-DDT, γ-chlordane and α-chlordane.

3.6 Polychlorinated Biphenyls

The results of the first and second set of fish analyses are summarized in Table 8A and Table 8B. The blank data, shown in Table 14A and Table 14B, show no presence of target PCB analytes. All co-planar PCB data is reported separately and is part of the total PCB concentration. The results for the first set of analyses range from 80 to 2600 ng/g and the results for the second set range from 40-1200 ng/g. The surrogate recoveries for the PCBs were generally excellent for both sets of analyses. However, the recoveries may have been marginally lower in the second set due to its greater volatility and perhaps a slight alteration in the activity of the alumina with respect to PCBs (see Section 3.7).

3.7 Chlorinated Dioxins and Furans

The high resolution GC-high resolution MS results for the analyses of PCDDs and PCDFs are provided in Table 9A and Table 9B. The laboratory blank data is shown in Table 15A and Table 15B. Included in these data are the results for the samples 1-91, 4-91, 8-91, 12-91 and 16-91 which were missing in the interim report of April 26, 1993. The total TEQ (2,3,7,8-TCDD toxic equivalent) value for each sample is also reported.

The second set of fish analyses was performed using a modification of the original protocol provided in Section 2.7. The alumina used in the acid silica gel/alumina clean-up was selectively removing certain congeners from the PCDD/PCDF fraction but keeping the PCB fraction well intact. For the second set of analyses the PCDD/PCDF fraction was derived from a carbon column clean-up of the pesticide fraction following pesticide analyses. Appropriate corrections were made within the internal standard method used for dioxin/furan analyses, but it did provide for higher than normal method detection limits (up to a factor of 2).

In the first lot of fish analyses, 2,3,7,8-T_4CDD was identified in 9 samples; 1,2,3,7,8-P_5CDD was determined in 8 samples; 2,3,7,8-T_4CDF was found in 10 samples; 1,2,3,7,8-P_5CDF was identified in 3 samples and 2,3,4,7,8-P_5CDF was found in 10 samples. In the second set of analyses 2,3,7,8-T_4CDD was determined in 2 samples; 2,3,7,8-T_4CDF in 1 sample; 2,3,4,7,8-P_5CDF was found in 2 samples. The congeners 1,2,3,7,8-P_5CDD and

1,2,3,7,8-P_5CDF were not identified in any samples from the second lot of fish. The highest concentration of the toxicologically potent congener 2,3,7,8-T_4CDD was found in sample 7-92 at 3.6 ppt. Not surprisingly, this sample was found to have the highest overall TEQ level at 12.17. Non-2,3,7,8-T_4CDFs were more frequently seen in the second lot of samples, as well as other P_5CDFs. Diphenylether interferences were more significant in the second lot.

The dioxin and furan results for the laboratory blanks from both sets of fish analyses indicated the presence of trace amounts of hexa-, hepta- and octachlorinated dioxins and furans. Generally, the hexa-, hepta- and octachlorinated dibenzofurans were detected throughout both sets of samples (excluding 2-91, 14-91 and 19-91 from the first lot). These values were found to be comparable to the laboratory blank levels. The hexa-, hepta- and octachlorinated dibenzo-p-dioxins were identified in all samples excluding sample 19-91. Again, the sample values were found to be near the values of the laboratory blank and should be considered due to laboratory interferences.

The Toxic Equivalency Factors (TEFs) used in these analyses are internationally recognized by the scientific community (See below). All resulting TEQs were determined by calculating the product between the specific analyte concentration (pg/g) and the appropriate TEF. All TEFs were then summed to provide the final total 2,3,7,8-TCDD Toxic Equivalents.

Target PCDDs	TEF	Target PCDFs	TEF
2,3,7,8-T4CDD	1	2,3,7,8-T4CDF	0.1
1,2,3,7,8-P5CDD	0.5	1,2,3,7,8-P5CDF	0.05
1,2,3,4,7,8-H6CDD	0.1	2,3,4,7,8-P5CDF	0.5
1,2,3,6,7,8-H6CDD	0.1	1,2,3,4,7,8-H6CDF	0.1
1,2,3,7,8,9-H6CDD	0.1	1,2,3,6,7,8-H6CDF	0.1
1,2,3,4,6,7,8-H7CDD	0.01	2,3,4,6,7,8-H6CDF	0.1
O8CDD	0.001	1,2,3,7,8,9-H6CDF	0.1
		1,2,3,4,6,7,8-H7CDF	0.01
		1,2,3,4,7,8,9-H7CDF	0.01
		O8CDF	0.001

Table 2A Sample Conditions

Field ID	Lab ID	# Fish/ Fillets	Discolouration	Post Homo Wt. (g)	Comments
1-91	92-828	3/6	white in patches	2226.3	well-wrapped but leaking blood
2-91	92-829	3/6	white in patches	545.08	well-wrapped
3-91	92-830	12 eel fillets	none apparent	551.1	well-wrapped
4-91	92-831	3/6	white in patches	722.26	well-wrapped but leaking blood
5-91	92-832	27/54	white in patches	486.18	--
6-91	92-833	3/6	none apparent	840.3	leaking very slightly
7-91	92-834	5/10	white in patches	666.32	--
8-91	92-835	3 eel fillets	none apparent	551.66	well-wrapped but leaking blood
9-91	92-836	3/6	very occasional white patches	1022.54	well-wrapped, leaking very slightly
10-91	92-837	22/44	white in patches	463.66	--
11-91	92-838	3/6	white in patches	1202	well-wrapped
12-91	92-839	3/6	white in patches	602.16	well-wrapped
13-91	92-840	7/14	white in patches	266.46	well-wrapped but leaking blood
14-91	92-841	4/8	white in patches	63.7	very little sample - approx. 23g sent to Barringer Labs
15-91	92-842	3/6	white in patches	553.16	well-wrapped but leaking blood
16-91	92-843	4/8	white in patches	772.94	--
17-91	92-844	5 eel fillets	none apparent	623.86	well-wrapped
18-91	92-845	3/6	white in patches	485.18	leaking very slightly
19-91	92-846	23/46	white in patches	529.87	well-wrapped
1-89	92-847	6 whole fish	white in patches	915.38	well-wrapped

Table 2B	Sample Conditions				
Field ID	Lab ID	# Fillets	Discolouration	Post Homo Wt. (g)	Comments
1-92	93-251	56	white in patches	472.72	well wrapped
2-92	93-252	6	white in patches	522.29	well wrapped
3-92	93-253	6	white in patches	697.19	well wrapped
4-92	93-254	6	white in patches	1239.27	well wrapped
5-92	93-255	2	none apparent	146.53	well wrapped
6-92	93-256	6	white in patches	1615.74	well wrapped
7-92	93-257	2 eel fillets (with skin)	none apparent	43.59	well wrapped
8-92	93-258	30	none apparent	295.35	well wrapped
9-92	93-259	6	white in patches	824.57	well wrapped
10-92	93-260	6	white in patches	998.30	well wrapped
11-92	93-261	8	white in patches	75.33	well wrapped
12-92	93-262	8	none apparent	430.39	well wrapped
13-92	93-263	6	white in patches	1428.04	well wrapped
14-92	93-264	1 eel fillets (with skin)	none apparent	24.57	well wrapped
15-89	93-265	12	pre-fillet foil dissolving into fish; no discoloration post-fillet	182.43	well wrapped
16-89	93-266	6	pre-fillet foil dissolving into fish; no discoloration post-fillet	108.64	well wrapped
17-93	93-267	14 fillets (8 with skin)	none apparent	179.15	well wrapped

Table 3A Percent Moisture & Lipid

Field ID	Lab ID	Percent Water	Field ID	Lab ID	Percent Lipid
1–89	92–847	76	1–89	92–847	9.3
1–91	92–828	73	1–91	92–828	10
2–91	92–829	79	2–91	92–829	0.48
3–91	92–830	61	3–91	92–830	15
4–91	92–831	70	4–91	92–831	11
5–91	92–832	81	5–91	92–832	0.32
6–91	92–833	74	6–91	92–833	5.9
7–91	92–834	80	7–91	92–834	1.0
8–91	92–835	68	8–91	92–835	15
9–91	92–836	78	9–91	92–836	6.6
10–91	92–837	80	10–91	92–837	0.58
11–91	92–838	80	11–91	92–838	1.7
12–91	92–839	79	12–91	92–839	0.19
13–91	92–840	80	13–91	92–840	1.7
14–91	92–841	80	14–91	92–841	0.70
15–91	92–842	77	15–91	92–842	1.7
16–91	92–843	78	16–91	92–843	1.2
17–91	92–844	59	17–91	92–844	15
18–91	92–845	71	18–91	92–845	14
19–91	92–846	78	19–91	92–846	1.1
Duplicate Sample			Duplicate Sample		
4–91	92–831d	70	4–91	92–831d	9.1
18–91	92–845d	71	18–91	92–845d	12
Matrix Spike Samples			Matrix Spike Samples		
7–91	92–834m	80	7–91	92–834m	0.43
7–91	92–834md	80	7–91	92–834md	0.78

Table 3B Percent Lipid & Water

Field ID	Lab ID	Percent Water	Field ID	Lab ID	Percent Lipid
1–92	93–251	78	1–92	93–251	0.79
2–92	93–252	78	2–92	93–252	4.8
3–92	93–253	72	3–92	93–253	2.4
4–92	93–254	78	4–92	93–254	4.7
5–92	93–255	68	5–92	93–255	12
6–92	93–256	78	6–92	93–256	3.7
7–92	93–257	70	7–92	93–257	11
8–92	93–258	79	8–92	93–258	0.88
9–92	93–259	78	9–92	93–259	3.8
10–92	93–260	76	10–92	93–260	2.8
11–92	93–261	80	11–92	93–261	0.91
12–92	93–262	79	12–92	93–262	0.76
13–92	93–263	74	13–92	93–263	5.2
14–92	93–264	60	14–92	93–264	17
15–89	93–265	78	15–89	93–265	1.7
16–89	93–266	78	16–89	93–266	2.7
17–93	93–267	77	17–93	93–267	2.2
Duplicate Sample			Duplicate Sample		
2–92	93–252d	78	2–92	93–252d	1.3
4–92	93–254d	76	4–92	93–254d	1.4
Matrix Sample			Matrix Sample		
3–92	93–253m	76	3–92	93–253m	8.0
3–92	93–253md	76	3–92	93–253md	7.5

Table 4A Sample Results for Metals (μg/g)

Field ID: / Lab ID:	MDL	1-89 92-847	1-91 92-828	2-91 92-829	3-91 92-830	4-91 92-831	5-91 92-832	6-91 92-833
Target Metals								
As	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.5
Se	0.05	0.33	0.35	0.46	0.37	0.04	0.27	0.27
Sb	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hg	0.005	0.021	0.116	0.458	0.221	0.076	0.116	0.068
Total CN	0.05	<0.05	<0.05	<0.05	0.1	<0.05	0.3	<0.05
Be	0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cd	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cr	0.1	0.1	0.2	0.4	<0.1	<0.1	0.9	<0.1
Pb	0.5	0.8	<0.5	<0.5	<0.5	<0.5	0.9	<0.5
Ni	0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1
Ag	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Field ID: / Lab ID:	MDL	7-91 92-834	8-91 92-835	9-91 92-836	10-91 92-837	11-91 92-838	12-91 92-839	13-91 92-840
Target Metals								
As	0.1	0.1	0.1	0.2	0.1	0.2	0.1	<0.1
Se	0.05	0.23	0.17	0.12	0.25	0.27	0.21	0.08
Sb	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hg	0.005	0.108	0.116	0.106	0.068	0.076	0.126	0.033
Total CN	0.05	0.05	<0.05	<0.05	0.05	0.15	<0.05	0.1
Be	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cd	0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05
Cr	0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	<0.1
Pb	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ni	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ag	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Field ID: / Lab ID:	MDL	14-91 92-841	15-91 92-842	16-91 92-843	17-91 92-844	18-91 92-845	19-91 92-846
Target Metals							
As	0.1	0.1	0.2	0.8	0.5	0.2	0.1
Se	0.05	0.25	0.29	0.33	0.25	0.15	0.25
Sb	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hg	0.005	0.043	0.21	0.271	0.113	0.091	0.078
Total CN	0.05	0.25	0.05	0.05	<0.05	<0.05	<0.05
Be	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cd	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cr	0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1
Pb	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ni	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ag	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 4B Sample Results for Metals (μg/g)

Field ID:		1-92	2-92	3-92	4-92	5-92	6-92
Lab ID:	MDL	93-251	93-252	93-253	93-254	93-255	93-256
Target Metals							
As	0.05	<0.1	0.1	0.1	0.1	0.1	0.1
Se	0.01	0.22	0.38	0.16	0.31	0.18	0.40
Sb	0.005	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hg	0.05	0.052	0.162	0.096	0.044	0.058	0.091
Total CN	0.1	1.28	0.13	0.38	0.05	0.05	0.08
Be	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cd	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cr	0.1	<0.1	<0.1	<0.1	<0.1	0.6	<0.1
Pb	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ni	0.1	<0.5	<0.5	<0.5	<0.5	0.6	<0.5
Ag	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Field ID:		7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	MDL	93-257	93-258	93-259	93-260	93-261	93-262
Target Metals							
As	0.05	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Se	0.01	0.45	0.25	0.33	0.38	0.25	0.20
Sb	0.005	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hg	0.05	0.132	0.063	0.132	0.130	0.060	0.069
Total CN	0.1	0.08	0.32	0.05	0.25	4.27	0.05
Be	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cd	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cr	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pb	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ni	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ag	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Field ID:		13-92	14-92	15-89	16-89	17-93
Lab ID:	MDL	93-263	93-264	93-265	93-266	93-267
Target Metals						
As	0.05	0.1	0.1	<0.1	0.5	0.3
Se	0.01	0.53	0.45	0.27	0.16	0.77
Sb	0.005	<0.05	<0.05	<0.05	<0.05	<0.05
Hg	0.05	0.063	0.077	0.061	0.130	0.132
Total CN	0.1	0.22	41.2	<0.05	0.05	0.80
Be	0.005	<0.005	0.006	<0.005	<0.005	<0.005
Cd	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cr	0.1	<0.1	0.9	<0.1	<0.1	<0.1
Pb	0.5	<0.5	0.6	<0.5	<0.5	<0.5
Ni	0.1	<0.5	<0.5	<0.5	<0.5	<0.5
Ag	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 5A Sample Results for VOCs (ng/g)

Lab ID: / Field ID:	MDL	92-847 1-89	92-828 1-91	92-829 2-91	92-830 3-91	92-831 4-91	92-832 5-91	92-833 6-91
Target Volatiles								
1,1-Dichloroethene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Methylene Chloride	0.2	31	58	3.0	36	59	25	23
Trans-1,2-Dichloroethene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1-Dichloroethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform	0.2	0.4	0.6	0.4	0.6	0.4	0.5	1.4
1,1,1,Trichloroethane	0.4	1.0	<0.4	1.1	<0.4	1.1	<0.4	0.89
Carbon Tetrachloride	0.8	<0.8	<0.8	<0.8	<0.7	<0.7	<0.8	<0.7
1,2-Dichloroethane	0.6	<0.6	<0.6	<0.6	<0.6	<0.5	<0.6	<0.6
Benzene	0.2	2.8	6.5	4.0	4.8	2.4	4.7	6.2
Trichloroethene	1	<1	<1	1.5	<0.9	<0.9	<0.9	<0.9
1,2-Dichloropropane	0.8	<0.8	<0.8	<0.8	<0.7	<0.7	<0.8	<0.7
Bromodichloromethane	0.6	<0.6	<0.6	<0.6	<0.6	<0.5	<0.6	<0.6
Cis-1,3-Dichloropropene	4	<4	<4	<4	<4	<4	<4	<4
Toluene	0.2	22	35	33	19	14	34	15
Trans-1,3-Dichloropropene	3	<3	<3	<3	<3	<3	<3	<3
1,1,2-Trichloroethane	2	<2	<2	<2	<2	<1	<2	<2
Tetrachloroethene	6	18	<6	<6	<6	<5	<6	<6
Dibromochloromethane	10	<10	<10	<10	<10	<10	<10	<10
Chlorobenzene	2	<2	<2	<2	<2	<1	<2	<2
Ethyl benzene	1	<1	4.1	4.2	4.2	5.8	1.5	3.2
m,p-Xylene	0.6	1.1	5.9	4.8	5.5	9.5	2.3	4.8
o-Xylene	1	<1	5.2	5.5	5.3	7.4	2.8	4.6
Bromoform	NR	NR	NR	NR	NR	NR	NR	NR
1,1,2,2-Tetrachloroethane	6	<6	<6	<6	<6	<5	<6	<6
Surrogate Recovery (%)								
Trichlorofluoromethane		380	350	180	430	350	140	340
Benzene-d6		100	98	85	100	100	110	96
Ethylbenzene-d10		120	130	92	140	150	63	130

Lab ID: / Field ID:	MDL	92-834 7-91	92-835 8-91	92-836 9-91	92-837 10-91	92-838 11-91	92-839 12-91	92-840 13-91
Target Volatiles								
1,1-Dichloroethene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Methylene Chloride	0.2	23	22	6.9	12	29	9.9	10
Trans-1,2-Dichloroethene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1-Dichloroethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform	0.2	0.6	4.7	1.0	0.5	0.3	0.3	<0.2
1,1,1,Trichloroethane	0.4	0.6	3.5	0.8	0.6	0.5	0.5	0.5
Carbon Tetrachloride	0.8	<0.7	1.3	<0.8	<0.8	<0.8	<0.8	<0.7
1,2-Dichloroethane	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Benzene	0.2	1.8	6.1	1.7	1.6	1.5	1.3	1.4
Trichloroethene	1	<0.9	2.2	<1	<1	<1	<0.9	<0.9
1,2-Dichloropropane	0.8	<0.7	<0.8	<0.8	<0.8	<0.8	<0.8	<0.7
Bromodichloromethane	0.6	<0.6	<0.6	0.7	<0.6	<0.6	<0.6	<0.6
Cis-1,3-Dichloropropene	4	<4	<4	<4	<4	<4	<4	<4
Toluene	0.2	6.5	63	9.9	13	15	17	39
Trans-1,3-Dichloropropene	3	<3	<3	<3	<3	<3	<3	<3
1,1,2-Trichloroethane	2	<2	<2	<2	<2	<2	<2	<2
Tetrachloroethene	6	<6	17	<6	<6	<6	<6	<6
Dibromochloromethane	10	<10	<10	<10	<10	<10	<10	<10
Chlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
Ethyl benzene	1	<0.9	15	5.0	1.6	2.2	1.5	1.4
m,p-Xylene	0.6	<0.6	20	6.2	2.0	2.5	1.6	1.6
o-Xylene	1	<1	19	4.8	2.4	2.2	1.4	1.7
Bromoform	NR	NR	NR	NR	NR	NR	NR	NR
1,1,2,2-Tetrachloroethane	6	<6	<6	<6	<6	<6	<6	<6
Surrogate Recovery (%)								
Trichlorofluoromethane		82	700	280	230	250	140	270
Benzene-d6		100	82	90	85	84	87	85
Ethylbenzene-d10		120	100	230	160	160	150	160

NR = NOT RECOVERED

Table 5A Sample Results for VOCs (ng/g)

Lab ID: / Field ID:	MDL	92-841 14-91	92-842 15-91	92-843 16-91	92-844 17-91	92-845 18-91	92-846 19-91
Target Volatiles							
1,1-Dichloroethene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Methylene Chloride	0.2	16	6.7	15	21	4.9	12
Trans-1,2-Dichloroethene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,1-Dichloroethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform	0.2	<0.2	0.3	0.4	2.0	0.8	<0.2
1,1,1,Trichloroethane	0.4	<0.4	0.6	0.4	2.2	0.5	0.7
Carbon Tetrachloride	0.8	<0.8	<0.7	<0.8	<0.8	<0.7	<0.8
1,2-Dichloroethane	0.6	<0.6	<0.5	<0.6	<0.6	<0.5	<0.6
Benzene	0.2	1.3	2.6	1.7	5.6	2.2	1.8
Trichloroethene	1	<1	<0.9	<0.9	<1	<0.9	<0.9
1,2-Dichloropropane	0.8	<0.8	<0.7	<0.8	<0.8	<0.7	<0.8
Bromodichloromethane	0.6	<0.6	<0.5	<0.6	<0.6	<0.5	<0.6
Cis-1,3-Dichloropropene	4	<4	<4	<4	<4	<4	<4
Toluene	0.2	24	20	12	42	14	29
Trans-1,3-Dichloropropene	3	<3	<3	<3	<3	<3	<3
1,1,2-Trichloroethane	2	<2	<2	<2	<2	<1	<2
Tetrachloroethene	6	<6	<5	<6	<6	<5	<6
Dibromochloromethane	10	<10	<10	<10	<10	<10	<10
Chlorobenzene	2	<2	<2	<2	<2	<1	<2
Ethyl benzene	1	1.6	1.9	1.6	16	8.7	1.4
m,p-Xylene	0.6	2.1	2.3	1.9	18	11	1.8
o-Xylene	1	1.9	2.1	1.6	15	8.8	1.9
Bromoform	NR	NR	NR	NR	NR	NR	NR
1,1,2,2-Tetrachloroethane	6	<6	<5	<6	<6	<5	<6
Surrogate Recovery (%)							
Trichlorofluoromethane		170	400	290	890	190	400
Benzene-d6		84	84	85	83	85	96
Ethylbenzene-d10		160	160	150	210	310	110

NR = NOT RECOVERED

Table 5B Sample Results for VOCs (ng/g)

Lab ID: / Field ID:	MDL	93-251 1-92	93-252 2-92	93-253 3-92	93-254 4-92	93-255 5-92	93-256 6-92
Target Volatiles							
1,1-Dichloroethene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methylene Chloride	0.2	19	950	1700	170	52	1100
Trans-1,2-Dichloroethene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform	0.2	0.4	0.5	2.0	2.3	0.5	0.5
1,1,1,Trichloroethane	0.2	0.7	0.9	2.0	1.5	1.0	0.8
Carbon Tetrachloride	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloroethane	0.2	0.9	0.9	0.7	0.9	0.6	0.6
Benzene	0.2	6.7	3.7	11	37	3.2	6.2
Trichloroethene	0.2	0.4	0.5	0.4	1.1	0.3	<0.2
1,2-Dichloropropane	0.2	<0.2	0.3	<0.2	0.6	<0.2	<0.2
Bromodichloromethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cis-1,3-Dichloropropene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.2	78	15	38	77	46	26
Trans-1,3-Dichloropropene	0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-Trichloroethane	0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene	0.2	0.6	0.7	3.1	8.4	1.4	1.4
Dibromochloromethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.2	0.6	0.5	1.0	1.1	0.3	0.4
Ethyl benzene	0.2	1.2	1.2	3.0	5.7	1.6	1.8
m,p-Xylene	0.2	1.8	2.2	5.5	8.3	2.4	2.9
o-Xylene	0.2	1.9	1.8	4.2	4.8	1.7	2.4
Bromoform	0.2	0.7	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2,2-Tetrachloroethane	0.2	1.3	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate Recovery (%)							
d6-Benzene		100	110	110	150	110	115
Fluorobenzene		100	100	100	120	100	103
d8-Toluene		72	65	76	120	83	70

Lab ID: / Field ID:	MDL	93-258 8-92	93-259 9-92	93-260 10-92	93-261 11-92	93-262 12-92	93-263 13-92
Target Volatiles							
1,1-Dichloroethene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methylene Chloride	0.2	1400	62	11	1100	650	160
Trans-1,2-Dichloroethene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform	0.2	0.8	0.6	0.5	0.8	0.7	0.9
1,1,1,Trichloroethane	0.2	0.7	1.0	0.5	0.5	0.5	1.0
Carbon Tetrachloride	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloroethane	0.2	0.9	0.6	0.6	0.6	0.5	0.9
Benzene	0.2	7.0	3.1	3.2	6.5	5.7	6.6
Trichloroethene	0.2	0.4	0.4	<0.2	<0.2	<0.2	0.7
1,2-Dichloropropane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromodichloromethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cis-1,3-Dichloropropene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4
Toluene	0.2	42	28	23	48	37	90
Trans-1,3-Dichloropropene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.8
1,1,2-Trichloroethane	0.2	<0.2	<0.2	1.0	<0.2	<0.2	1.0
Tetrachloroethene	0.2	0.7	2.9	0.7	1.0	2.5	20
Dibromochloromethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.2	0.6	0.4	<0.2	0.3	0.6	2.5
Ethyl benzene	0.2	1.3	1.3	0.4	3.7	10	15
m,p-Xylene	0.2	2.3	2.1	0.7	7.3	20	30
o-Xylene	0.2	2.1	1.9	0.6	6.3	11	21
Bromoform	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.8
1,1,2,2-Tetrachloroethane	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate Recovery (%)							
d6-Benzene		112	115	108	110	114	111
Fluorobenzene		104	103	101	104	105	100
d8-Toluene		73	65	71	72	77	85

Table 5B Sample Results for VOCs (ng/g)

Lab ID: / Field ID:	MDL	93-265 15-89	93-266 16-89	93-267 17-93
Target Volatiles				
1,1-Dichloroethene	0.2	<0.2	<0.2	<0.2
Methylene Chloride	0.2	550	1300	68
Trans-1,2-Dichloroethene	0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane	0.2	<0.2	<0.2	<0.2
Chloroform	0.2	1.3	1.9	0.9
1,1,1,Trichloroethane	0.2	0.7	0.9	0.5
Carbon Tetrachloride	0.2	<0.2	<0.2	0.4
1,2-Dichloroethane	0.2	0.5	0.5	0.7
Benzene	0.2	2.8	1.9	14
Trichloroethene	0.2	0.4	0.3	0.8
1,2-Dichloropropane	0.2	<0.2	<0.2	<0.2
Bromodichloromethane	0.2	0.7	0.9	<0.2
Cis-1,3-Dichloropropene	0.2	<0.2	<0.2	<0.2
Toluene	0.2	35	34	94
Trans-1,3-Dichloropropene	0.2	<0.2	<0.2	<0.2
1,1,2-Trichloroethane	0.2	<0.2	<0.2	<0.2
Tetrachloroethene	0.2	5.2	0.7	2.3
Dibromochloromethane	0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.2	<0.2	<0.2	<0.2
Ethyl benzene	0.2	0.8	0.5	2.6
m,p-Xylene	0.2	1.4	1.1	3.7
o-Xylene	0.2	1.1	0.8	2.2
Bromoform	0.2	0.3	0.4	<0.2
1,1,2,2-Tetrachloroethane	0.2	<0.2	<0.2	<0.2
Surrogate Recovery (%)				
d6-Benzene		113	110	145
Fluorobenzene		101	99	112
d8-Toluene		77	77	135

Table 6A Sample Results for Semi-Volatiles (ng/g)

Field ID: / Lab ID:	MDL	1-89 92-847	1-91 92-828	2-91 92-829	3-91 92-830	4-91 92-831	5-91 92-832	6-91 92-833
Target Semi-Volatiles								
N-Nitrosodimethylamine	10	<10	<10	<10	<10	<10	<10	<10
Phenol	10	40	30	<10	30	<10	<10	<10
bis(2-Chloroethyl)ether	3	<3	<3	<3	<3	<3	<3	<3
2-Chlorophenol	5	<5	<5	<5	<5	<5	<5	<5
1,3-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
1,4-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
1,2-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
bis(2-Chloroisopropyl)ether	10	<10	<10	<10	<10	<10	<10	<10
N-Nitroso-Di-n-propylamine	30	<30	<30	<30	<30	<30	<30	<30
Hexachloroethane	10	<10	<10	<10	<10	<10	<10	<10
Nitrobenzene	8	<8	<8	<8	<8	<8	<8	<8
Isophorone	1	<1	<1	<1	<1	<1	<1	<1
2-Nitrophenol	4	<4	<4	<4	<4	<4	<4	<4
2,4-Dimethylphenol	3	<3	<3	<3	<3	<3	<3	<3
bis(2-Chloroethoxy)methane	2	<2	<2	<2	<2	<2	<2	<2
2,4-Dichlorophenol	9	<9	<9	<9	<9	<9	<9	<9
1,2,4-Trichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
Naphthalene	1	9	29	15	99	54	11	40
Hexachlorobutadiene	4	<4	<4	<4	<4	<4	<4	<4
4-Chloro-3-methylphenol	10	<10	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	10	<10	<10	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol	4	<4	<4	<4	<4	<4	<4	<4
2-Chloronaphthalene	1	<1	<1	<1	<1	<1	<1	<1
Dimethylphthalate	2	<2	<2	<2	<2	<2	<2	<2
Acenaphthylene	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2,6-Dinitrotoluene	6	<6	<6	<6	<6	<6	<6	<6
Acenaphthene	2	<2	<2	<2	<2	<2	<2	27
2,4-Dinitrophenol	9	<9	<9	<9	<9	<9	<9	<9
4-Nitrophenol	20	<20	<20	<20	<20	<20	<20	<20
2,4-Dinitrotoluene	8	<8	<8	<8	<8	<8	<8	<8
Diethylphthalate	1	9	<1	6	7	26	5	6
4-Chlorophenyl-phenylether	2	<2	<2	<2	<2	<2	<2	<2
Fluorene	2	14	<2	<2	<2	<2	<2	19
4,6-Dinitro-2-methylphenol	10	<10	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	10	<10	<10	<10	<10	<10	<10	<10
4-Bromophenyl-phenylether	5	<5	<5	<5	<5	<5	<5	<5
Hexachlorobenzene	4	<4	<4	<4	<4	<4	<4	<4
Pentachlorophenol	9	<9	<9	<9	<9	<9	<9	<9
Phenanthrene	4	54	16	<4	<4	<4	<4	20
Anthracene	4	<4	<4	<4	<4	<4	<4	<4
Di-n-butylphthalate	5	70	100	34	52	89	23	34
Fluoranthene	2	19	<2	<2	<2	<2	<2	<2
Benzidine	6	<6	<6	<6	<6	<6	<6	<6
Pyrene	3	33	<3	<3	<3	<3	<3	<3
Butylbenzylphthalate	200	<200	<200	<200	<200	<200	<200	<200
3,3'-Dichlorobenzidine	20	<20	<20	<20	<20	<20	<20	<20
Benzo(a)anthracene	5	<5	<5	<5	<5	<5	<5	<5
Chrysene	5	<5	<5	<5	<5	<5	<5	<5
bis(2-Ethylhexyl)phthalate	9	<9	1300	46	1500	190	93	130
Di-n-octylphthalate	30	<30	1700	420	3700	960	2100	2200
Benzo(b)fluoranthene	3	<3	<3	<3	<3	<3	<3	<3
Benzo(k)fluoranthene	3	<3	<3	<3	<3	<3	<3	<3
Benzo(a)pyrene	2	<2	<2	<2	<2	<2	<2	<2
Indeno(1,2,3-cd)pyrene	5	<5	<5	<5	<5	<5	<5	<5
Dibenz(a,h)anthracene	2	<2	<2	<2	<2	<2	<2	<2
Benzo(g,h,i)perylene	5	<5	<5	<5	<5	<5	<5	<5
Surrogate Recovery (%)								
2-Fluorophenol		8	26	25	54	29	12	12
Phenol-d6		2	65	80	94	67	18	50
2,4,6-Tribromophenol		62	79	66	77	72	46	80
Nitrobenzene-d5		42	71	69	85	68	39	71
2-Fluorobiphenyl		49	89	66	86	70	53	76
Terphenyl-d14		84	55	42	71	52	39	57

Table 6A Sample Results for Semi-Volatiles (ng/g)

Field ID:		7-91	8-91	9-91	10-91	11-91	12-91	13-91
Lab ID:	MDL	92-834	92-835	92-836	92-837	92-838	92-839	92-840
Target Semi-Volatiles								
N-Nitrosodimethylamine	10	<10	<10	<10	<10	<10	<10	<10
Phenol	10	<10	30	<10	<10	<10	<10	<10
bis(2-Chloroethyl)ether	3	<3	<3	<3	<3	<3	<3	<3
2-Chlorophenol	5	<5	<5	<4	<5	<5	<5	<5
1,3-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
1,4-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
1,2-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
bis(2-Chloroisopropyl)ether	10	<10	<10	<10	<10	<10	<10	<10
N-Nitroso-Di-n-propylamine	30	<30	<30	<30	<30	<30	<30	<30
Hexachloroethane	10	<10	<10	<10	<10	<10	<10	<10
Nitrobenzene	8	<8	<8	<8	<8	<8	<8	<8
Isophorone	1	<1	<1	<1	<1	<1	<1	<1
2-Nitrophenol	4	<4	<4	<4	<4	<4	<4	<4
2,4-Dimethylphenol	3	<3	<3	<3	<3	<3	<3	<3
bis(2-Chloroethoxy)methane	2	<2	<2	<2	<2	<2	<2	<2
2,4-Dichlorophenol	9	<9	<9	<9	<9	<9	<9	<9
1,2,4-Trichlorobenzene	2	<2	<2	<2	<2	<2	<2	<2
Naphthalene	1	4	32	23	12	9	9	22
Hexachlorobutadiene	4	<4	<4	<4	<4	<4	<4	<4
4-Chloro-3-methylphenol	10	<10	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	10	<10	<10	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol	4	<4	<4	<4	<4	<4	<4	<4
2-Chloronaphthalene	1	<1	<1	<1	<1	<1	<1	<1
Dimethylphthalate	2	<2	<2	<2	<2	<2	<2	<2
Acenaphthylene	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	2.2	<0.9
2,6-Dinitrotoluene	6	<6	<6	<6	<6	<6	<6	<6
Acenaphthene	2	<2	<2	<2	<2	<2	4	<2
2,4-Dinitrophenol	9	<9	<9	<9	<9	<9	<9	<9
4-Nitrophenol	20	<20	<20	<20	<20	<20	<20	<20
2,4-Dinitrotoluene	8	<8	<8	<8	<8	<8	<8	<8
Diethylphthalate	1	6	16	12	8	8	<1	4
4-Chlorophenyl-phenylether	2	<2	<2	<2	<2	<2	<2	<2
Fluorene	2	<2	<2	<2	<2	<2	<2	8
4,6-Dinitro-2-methylphenol	10	<10	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	10	<10	<10	<10	<10	<10	<10	<10
4-Bromophenyl-phenylether	5	<5	<5	<5	<5	<5	<5	<5
Hexachlorobenzene	4	<4	<4	<4	<4	<4	<4	<4
Pentachlorophenol	9	<9	<9	<9	<9	<9	<9	<9
Phenanthrene	4	<4	<4	<4	<4	<4	12	23
Anthracene	4	<4	<4	<4	<4	<4	5	<4
Di-n-butylphthalate	5	39	55	93	31	56	66	25
Fluoranthene	2	<2	<2	<2	<2	<2	7	16
Benzidine	6	<6	<6	<6	<6	<6	<6	<6
Pyrene	3	<3	<3	<3	<3	<3	5	18
Butylbenzylphthalate	200	<200	<200	<200	<200	<200	<200	<200
3,3'-Dichlorobenzidine	20	<20	<20	<20	<20	<20	<20	<20
Benzo(a)anthracene	5	<5	<5	<5	<5	<5	<5	<5
Chrysene	5	<5	<5	<5	<5	<5	<5	<5
bis(2-Ethylhexyl)phthalate	9	64	120	190	110	140	220	140
Di-n-octylphthalate	30	1200	4700	4300	3500	1700	2600	250
Benzo(b)fluoranthene	3	<3	<3	<3	<3	<3	<3	<3
Benzo(k)fluoranthene	3	<3	<3	<3	<3	<3	<3	<3
Benzo(a)pyrene	2	<2	<2	<2	<2	<2	<2	<2
Indeno(1,2,3-cd)pyrene	5	<5	<5	<5	<5	<5	<5	<5
Dibenz(a,h)anthracene	2	<2	<2	<2	<2	<2	<2	<2
Benzo(g,h,i)perylene	5	<5	<5	<5	<5	<5	<5	<5
Surrogate Recovery (%)								
2-Fluorophenol		12	5	20	12	11	23	17
Phenol-d6		29	30	57	21	24	54	39
2,4,6-Tribromophenol		61	47	85	53	54	55	64
Nitrobenzene-d5		45	45	74	42	39	58	58
2-Fluorobiphenyl		59	61	76	60	62	60	72
Terphenyl-d14		53	50	56	60	51	41	63

Table 6A Sample Results for Semi-Volatiles (ng/g)

Field ID:		14-91	15-91	16-91	17-91	18-91	19-91
Lab ID:	MDL	92-841	92-842	92-843	92-844	92-845	92-846
Target Semi-Volatiles							
N-Nitrosodimethylamine	10	<10	<10	<10	<10	<10	<10
Phenol	10	<10	<10	<10	<10	<10	<10
bis(2-Chloroethyl)ether	3	<3	<3	<3	<3	<3	<3
2-Chlorophenol	5	<5	<5	<5	<5	<5	<5
1,3-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2
1,4-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2
1,2-Dichlorobenzene	2	<2	<2	<2	<2	<2	<2
bis(2-Chloroisopropyl)ether	10	<10	<10	<10	<10	<10	<10
N-Nitroso-Di-n-propylamine	30	<30	<30	<30	<30	<30	<30
Hexachloroethane	10	<10	<10	<10	<10	<10	<10
Nitrobenzene	8	<8	<8	<8	<8	<8	<8
Isophorone	1	<1	<1	<1	<1	<1	<1
2-Nitrophenol	4	<4	<4	<4	<4	<4	<4
2,4-Dimethylphenol	3	<3	<3	<3	<3	<3	<3
bis(2-Chloroethoxy)methane	2	<2	<2	<2	<2	<2	<2
2,4-Dichlorophenol	9	<9	<9	<9	<9	<9	<9
1,2,4-Trichlorobenzene	2	<2	<2	<2	<2	<2	<2
Naphthalene	1	9	21	14	41	84	16
Hexachlorobutadiene	4	<4	<4	<4	<4	<4	<4
4-Chloro-3-methylphenol	10	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	10	<10	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol	4	<4	<4	<4	<4	<4	<4
2-Chloronaphthalene	1	<1	<1	<1	<1	<1	<1
Dimethylphthalate	2	<2	<2	<2	<2	<2	<2
Acenaphthylene	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2,6-Dinitrotoluene	6	<6	<6	<6	<6	<6	<6
Acenaphthene	2	<2	<2	<2	<2	<2	<2
2,4-Dinitrophenol	9	<9	<9	<9	<9	<9	<9
4-Nitrophenol	20	<20	<20	<20	<20	<20	<20
2,4-Dinitrotoluene	8	<8	<8	<8	<8	<8	<8
Diethylphthalate	1	<1	7	5	7	14	6
4-Chlorophenyl-phenylether	2	<2	<2	<2	<2	<2	<2
Fluorene	2	<2	<2	<2	<2	<2	<2
4,6-Dinitro-2-methylphenol	10	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	10	<10	<10	<10	<10	<10	<10
4-Bromophenyl-phenylether	5	<5	<5	<5	<5	<5	<5
Hexachlorobenzene	4	<4	<4	<4	<4	<4	<4
Pentachlorophenol	9	<9	<9	<9	<9	<9	<9
Phenanthrene	4	8	<4	<4	<4	<4	<4
Anthracene	4	<4	<4	<4	<4	<4	<4
Di-n-butylphthalate	5	60	34	<5	31	69	25
Fluoranthene	2	<2	<2	<2	<2	<2	<2
Benzidine	6	<6	<6	<6	<6	<6	<6
Pyrene	3	<3	<3	<3	<3	<3	<3
Butylbenzylphthalate	200	<200	<200	<200	<200	<200	<200
3,3'-Dichlorobenzidine	20	<20	<20	<20	<20	<20	<20
Benzo(a)anthracene	5	<5	<5	<5	<5	<5	<5
Chrysene	5	<5	<5	<5	<5	<5	<5
bis(2-Ethylhexyl)phthalate	9	250	88	90	160	140	<9
Di-n-octylphthalate	30	4200	1800	2300	4800	6700	4200
Benzo(b)fluoranthene	3	<3	<3	<3	<3	<3	<3
Benzo(k)fluoranthene	3	<3	<3	<3	<3	<3	<3
Benzo(a)pyrene	2	<2	<2	<2	<2	<2	<2
Indeno(1,2,3-cd)pyrene	5	<5	<5	<5	<5	<5	<5
Dibenz(a,h)anthracene	2	<2	<2	<2	<2	<2	<2
Benzo(g,h,i)perylene	5	<5	<5	<5	<5	<5	<5
Surrogate Recovery (%)							
2-Fluorophenol		7	11	11	19	13	18
Phenol-d6		10	30	20	46	49	32
2,4,6-Tribromophenol		42	56	56	41	63	54
Nitrobenzene-d5		31	49	44	54	69	50
2-Fluorobiphenyl		51	64	60	60	81	62
Terphenyl-d14		56	52	52	57	61	58

Table 6B Sample Results for Semi-Volatiles (ng/g)

Field ID:		1-92	2-92	3-92	4-92	5-92	6-92
Lab ID:	MDL	93-251	93-252	93-253	93-254	93-255	93-256
Target Semi-Volatiles							
2-Chlorophenol	0.6	<0.6	<3	<1	<2	<0.6	<0.6
Bis(2-chloroethyl)ether	1	<1	<2	<2	<2	<1	<1
Phenol	1	<1	<6	<3	<6	<1	18
1,3-Dichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,4-dichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,2-dichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-chloroisopropyl)ether	4	<4	<6	<5	<6	<4	<4
Hexachloroethane	2	<2	<2	<2	<2	<2	<2
N-Nitrosodi-n-propyl amine	4	<4	<4	<4	<4	<4	<4
Nitrobenzene	1	<1	<2	<2	<2	<1	<1
Isophorone	0.4	<0.4	<2	<1	<1	<0.4	<0.4
2-Nitrophenol	1	<1	<2	<1	<2	<1	<1
2,4-Dimethylphenol	0.7	<0.7	<4	<2	<2	<0.7	<0.7
Bis(2-chloroethoxy)methane	0.5	<0.5	<0.7	<0.6	<0.7	<0.5	<0.5
2,4-Dichlorophenol	0.4	<0.4	<2	<1	<1	<0.4	<0.4
1,2,4-Trichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Naphthalene	0.1	<0.1	5.1	5.7	5.7	<0.1	<0.1
Hexachlorobutadiene	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
4-Chloro-3-methylphenol	2	<2	<9	<5	<6	<2	<2
Hexachlorocyclopentadiene	0.9	<0.9	<0.9	<0.8	<1	<0.9	<0.9
2,4,6-Trichlorophenol	0.6	<0.6	<0.7	<0.7	<0.8	<0.6	<0.6
2-Chloronaphthalene	0.2	<0.2	<0.2	<0.1	<0.2	<0.2	<0.2
Acenaphthylene	0.4	<0.4	<0.3	<0.3	<0.3	<0.4	<0.4
Dimethylphthalate	0.2	<0.2	<0.2	<0.2	<0.3	<0.2	<0.2
2,6-Dinitrotoluene	1	<1	<2	<2	<2	<1	<1
Acenaphthene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrophenol	PC	PC	PC	PC	PC	PC	PC
2,4-Dinitrotoluene	1	<1	<2	<1	<2	<1	<1
4-Nitrophenol	3	<3	<4	<4	<4	<3	<3
Fluorene	0.3	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3
4-chlorophenyl phenyl ether	0.4	<0.4	<0.4	<0.3	<0.4	<0.4	<0.4
Diethylphthalate	1	<1	<1	<0.9	<1	<1	<1
4,6-Dinitro-2-methylphenol	4	<4	<5	<5	<6	<4	<4
N-Nitrosodiphenylamine	0.5	<0.5	<0.5	<0.5	<0.6	<0.5	<0.5
4-bromophenyl phenyl ether	0.6	<0.6	<0.6	<0.5	<0.6	<0.6	<0.6
Hexachlorobenzene	0.5	<0.5	<0.4	<0.3	<0.4	<0.5	<0.5
Pentachlorophenol	4	<4	<4	<4	<5	<4	<4
Phenanthrene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Anthracene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Di-n-Butylphthalate	0.6	79	51	120	57	160	91
Fluoranthene	0.4	<0.4	<0.3	<0.3	<0.3	<0.4	<0.4
Pyrene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Benzidine	2	<2	<2	<2	<2	<2	<2
Butylbenzylphthalate	1	<1	<0.9	<0.8	<0.9	<1	<1
Benzo[a]anthracene	0.4	<0.4	<0.3	<0.3	<0.3	<0.4	<0.4
Chrysene	0.4	<0.4	<0.3	<0.3	<0.3	<0.4	<0.4
3,3'-Dichlorobenzidine	2	<2	<2	<1	<2	<2	<2
Bis(2-ethylhexyl)phthalate	1	140	210	810	180	630	220
Di-n-octylphthalate	6	220	160	690	220	340	180
Benzo[b]fluoranthene	0.5	<0.5	<0.4	<0.4	<0.4	<0.5	<0.5
Benzo[k]fluoranthene	0.5	<0.5	<0.4	<0.4	<0.4	<0.5	<0.5
Benzo[a]pyrene	0.6	<0.6	<0.5	<0.5	<0.5	<0.6	<0.6
Indeno(1,2,3-c,d)pyrene	800	<800	<700	<600	<700	<800	<800
Dibenzo[a,h]anthracene	1	<1	<1	<0.8	<1	<1	<1
Benzo[g,h,k]perylene	0.5	<0.5	<0.4	<0.4	<0.4	<0.5	<0.5
Surrogate Recovery (%)							
2-Fluorophenol		IF	IF	IF	IF	IF	IF
Phenol-d6		20	11	16	18	40	33
2,4,6-Tribromophenol		90	65	63	60	90	75
Nitrobenzene-d5		70	36	32	36	84	70
2-Fluorobiphenyl		100	60	52	52	110	94
Terphenyl-d14		110	76	68	68	130	110

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

Table 6B Sample Results for Semi-Volatiles (ng/g)

Field ID:		7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	MDL	93-257	93-258	93-259	93-260	93-261	93-262
Target Semi-Volatiles							
2-Chlorophenol	0.6	<2	<0.6	<0.6	<0.6	<3	<3
Bis(2-chloroethyl)ether	1	<2	<1	<1	<1	<2	<4
Phenol	1	<4	<1	<1	<1	<6	<7
1,3-Dichlorobenzene	0.3	<0.4	<0.3	<0.3	<0.3	<0.3	<0.5
1,4-dichlorobenzene	0.3	<0.4	<0.3	<0.3	<0.3	<0.3	<0.5
1,2-dichlorobenzene	0.3	<0.4	<0.3	<0.3	<0.3	<0.3	<0.5
Bis(2-chloroisopropyl)ether	4	<7	<4	<4	<4	<7	<10
Hexachloroethane	2	<2	<2	<2	<2	<2	<3
N-Nitrosodi-n-propyl amine	4	<5	<4	<4	<4	<5	<7
Nitrobenzene	1	<2	<1	<1	<1	<3	<4
Isophorone	0.4	<2	1900	<0.4	<0.4	<2	<2
2-Nitrophenol	1	<2	<1	<1	<1	<2	<4
2,4-Dimethylphenol	0.7	<3	<0.7	<0.7	<0.7	<4	<4
Bis(2-chloroethoxy)methane	0.5	<0.8	<0.5	<0.5	<0.5	<0.9	<1
2,4-Dichlorophenol	0.4	<2	<0.4	<0.4	<0.4	<2	<3
1,2,4-Trichlorobenzene	0.3	<0.4	<0.3	<0.3	<0.3	<0.4	<0.5
Naphthalene	0.1	13	<0.1	<0.1	<0.1	4.8	5.6
Hexachlorobutadiene	0.6	<0.8	<0.6	<0.6	<0.6	<0.7	<1
4-Chloro-3-methylphenol	2	<7	<2	<2	<2	<9	<10
Hexachlorocyclopentadiene	0.9	<1	<0.9	<0.9	<0.9	<1	<1
2,4,6-Trichlorophenol	0.6	<0.9	<0.6	<0.6	<0.6	<0.7	<0.9
2-Chloronaphthalene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
Acenaphthylene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Dimethylphthalate	0.2	<0.3	<0.2	<0.2	<0.2	<0.3	<0.4
2,6-Dinitrotoluene	1	<2	<1	<1	<1	<3	<4
Acenaphthene	0.3	<0.4	<0.3	<0.3	<0.3	<0.3	<0.4
2,4-Dinitrophenol	PC	PC	PC	PC	PC	PC	PC
2,4-Dinitrotoluene	1	<2	<1	<1	<1	<2	<3
4-Nitrophenol	3	<5	<3	<3	<3	<6	<9
Fluorene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.4
4-chlorophenyl phenyl ether	0.4	<0.5	<0.4	<0.4	<0.4	<0.4	<0.6
Diethylphthalate	1	<1	<1	<1	<1	<1	<2
4,6-Dinitro-2-methylphenol	4	<7	<4	<4	<4	<5	<6
N-Nitrosodiphenylamine	0.5	<0.7	<0.5	<0.5	<0.5	<0.6	<0.9
4-bromophenyl phenyl ether	0.6	<0.7	<0.6	<0.6	<0.6	<0.6	<0.9
Hexachlorobenzene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6
Pentachlorophenol	4	<6	<4	<4	<4	<5	<6
Phenanthrene	0.3	<0.4	<0.3	<0.3	<0.3	<0.3	<0.4
Anthracene	0.3	<0.4	<0.3	<0.3	<0.3	<0.3	<0.4
Di-n-Butylphthalate	0.6	130	59	54	76	48	110
Fluoranthene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.5
Pyrene	0.3	<0.4	<0.3	<0.3	<0.3	<0.3	<0.4
Benzidine	2	<3	<2	<2	<2	<2	<3
Butylbenzylphthalate	1	<1	<1	<1	<1	<1	<1
Benzo[a]anthracene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chrysene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.5
3,3'-Dichlorobenzidine	2	<2	<2	<2	<2	<2	<2
Bis(2-ethylhexyl)phthalate	1	310	140	110	250	340	110
Di-n-octylphthalate	6	190	180	210	57	190	280
Benzo[b]fluoranthene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6
Benzo[k]fluoranthene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6
Benzo[a]pyrene	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.7
Indeno(1,2,3-c,d)pyrene	800	<800	<800	<800	<800	<800	<1000
Dibenzo[a,h]anthracene	1	<1	<1	<1	<1	<1	<1
Benzo[g,h,k]perylene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.6
Surrogate Recovery (%)							
2-Fluorophenol		IF	IF	IF	IF	IF	IF
Phenol-d6		17	28	20	17	16	11
2,4,6-Tribromophenol		59	65	85	68	70	54
Nitrobenzene-d5		32	60	55	35	36	24
2-Fluorobiphenyl		56	78	88	62	64	48
Terphenyl-d14		64	92	100	81	80	68

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

Table 7A Sample Results for Pesticides (ng/g)

Field ID:		1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	MDL	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target Pesticides								
a-BHC	0.6	2.7	<.6	<.6	1.6	<0.6	<.6	<0.6
b-BHC	1	<1	<1	<1	<1	<1	<1	<1
g-BHC	0.3	1.2	<.3	<.3	<.3	<.3	<.3	<0.3
d-BHC	0.9	<.9	<.9	<.9	<.9	<.9	<.9	<0.9
Heptachlor	0.3	<.3	0.7	0.9	<.3	<.3	<.3	<0.3
Aldrin	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<0.5
Heptachlor Epoxide	0.5	17	4.9	2.2	3.7	1.4	<.5	3.4
a-Endosulphan	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<0.5
Dieldrin	0.5	<.5	10	5.7	9.5	3.8	1.7	9.1
pp'-DDE	0.5	130	53	43	110	23	11	41
Endrin	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<0.5
b-Endosulphan	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<0.5
pp'-DDD	0.9	140	27	27	32	9.8	2.3	26
Endrin Aldehyde	1	<1	<1	<1	<1	<1	<1	<1
Endosulfan Sulfate	1	<1	<1	<1	<1	<1	<1	<1
pp'-DDT	1	10	7	8	51	2	<1	3
Methoxychlor	2	<2	<2	<2	<2	<2	<2	<2
g-Chlordane	1	78	30	35	14	13	<1	23
a-Chlordane	1	340	56	67	43	26	2	47
Surrogate Recovery (%)								
Tetrachloro-m-xylene		64	46	40	36	28	57	50
PCB 209		79	97	59	61	49	129	130

Field ID:		7-91	8-91	9-91	10-91	11-91	12-91	13-91
Lab ID:	MDL	92-834	92-835	92-836	92-837	92-838	92-839	92-840
Target Pesticides								
a-BHC	0.6	<.6	<.6	<.6	<.6	<0.6	<0.6	<0.6
b-BHC	1	<1	<1	<1	<1	<1	<1	<1
g-BHC	0.3	<.3	4.0	<.3	<.3	<.3	<.3	<.3
d-BHC	0.9	<.9	<.9	<.9	<.9	<.9	<.9	<.9
Heptachlor	0.3	<.3	<.3	<.3	<.3	<.3	<.3	0.7
Aldrin	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Heptachlor Epoxide	0.5	<.5	18	3.3	<.5	0.9	<.5	2.1
a-Endosulphan	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
Dieldrin	0.5	<.5	42	11	<.5	4	3.2	4.9
pp'-DDE	0.5	18	120	99	5.1	75	18	19
Endrin	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
b-Endosulphan	0.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
pp'-DDD	0.9	4.2	53	34	2.4	25	8.3	18
Endrin Aldehyde	1	<1	<1	<1	<1	<1	<1	<1
Endosulfan Sulfate	1	<1	<1	<1	<1	<1	<1	<1
pp'-DDT	1	<1	18	13	<1	<1	<1	<1
Methoxychlor	2	<2	<2	<2	<2	<2	<2	<2
g-Chlordane	1	2	41	35	<1	19	6	25
a-Chlordane	1	5	91	71	2	37	15	41
Surrogate Recovery (%)								
Tetrachloro-m-xylene		64	55	57	47	55	52	68
PCB 209		130	116	122	108	100	100	130

Table 7A Sample Results for Pesticides (ng/g)

Field ID: / Lab ID:	MDL	14–91 92–841	15–91 92–842	16–91 92–843	17–91 92–844	18–91 92–845	19–91 92–846
Target Pesticides							
a–BHC	0.6	<0.6	<.6	<.6	2.3	<0.6	<.6
b–BHC	1	<1	<1	<1	<1	<1	<1
g–BHC	0.3	<.3	<.3	<.3	<.3	<0.3	<.3
d–BHC	0.9	<.9	<.9	<.9	<.9	<0.9	<.9
Heptachlor	0.3	<.3	<.3	<.3	<.3	<0.3	<.3
Aldrin	0.5	<.5	<.5	<.5	<.5	<0.5	<.5
Heptachlor Epoxide	0.5	<.5	0.8	1.3	10	8.3	<.5
a–Endosulphan	0.5	<.5	<.5	<.5	<.5	<0.5	<.5
Dieldrin	0.5	2.2	3.4	<.5	32	21	1.6
pp'–DDE	0.5	4.7	7.2	56	130	140	9.1
Endrin	0.5	<.5	<.5	<.5	<.5	<0.5	<.5
b–Endosulphan	0.5	<.5	<.5	<.5	<.5	<0.5	<.5
pp'–DDD	0.9	2.1	6.9	17	82	76	3.4
Endrin Aldehyde	1	<1	<1	<1	<1	<1	<1
Endosulfan Sulfate	1	<1	<1	<1	<1	<1	<1
pp'–DDT	1	<1	<1	7	22	16	<1
Methoxychlor	2	<2	<2	<2	<2	<2	<2
g–Chlordane	1	1	9	9	32	84	1
a–Chlordane	1	3	14	27	100	150	4
Surrogate Recovery (%)							
Tetrachloro–m–xylene		48	55	75	55	61	49
PCB 209		109	108	138	101	140	109

Table 7B Sample Results for Pesticides (ng/g)

Field ID:		1–92	2–92	3–92	4–92	5–92	6–92
Lab ID:	MDL	93–251	93–252	93–253	93–254	93–255	93–256
Target Pesticides							
a–BHC	1	<1	<1	<1	<1	<1	<1
b–BHC	2	<2	<2	<2	<2	<2	<2
g–BHC	1	<1	<1	<1	<1	<1	<1
d–BHC	1	<1	<1	<1	<1	<1	<1
Heptachlor	0.8	<0.8	<0.8	<0.8	1.6	0.8	<0.8
Aldrin	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Heptachlor Epoxide	0.6	<0.6	<0.6	2.5	1.8	3.1	5.6
a–Endosulphan	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Dieldrin	0.6	1.6	4.0	8.8	<0.6	5.9	3.5
pp'–DDE	0.8	5.1	30	44	31	52	65
Endrin	1	<1	<1	<1	<1	<1	<1
b–Endosulphan	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
pp'–DDD	1	1	8	23	16	12	12
Endrin Aldehyde	0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Endosulfan Sulfate	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
pp'–DDT	1	9	2	6	<1	2	<1
Methoxychlor	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
g–Chlordane	1	<1	<1	6	23	23	19
a–Chlordane	1	3	2	13	43	39	33
Surrogate Recovery (%)							
Tetrachloro–m–xylene		36	76	87	68	40	50
PCB 209		47	104	104	93	52	58

Field ID:		7–92	8–92	9–92	10–92	11–92	12–92
Lab ID:	MDL	93–257	93–258	93–259	93–260	93–261	93–262
Target Pesticides							
a–BHC	1	<1	<1	<1	<1	<1	<1
b–BHC	2	<2	<2	<2	<2	<2	<2
g–BHC	1	<1	<1	<1	<1	<1	<1
d–BHC	1	<1	<1	<1	<1	<1	<1
Heptachlor	0.8	<0.8	<0.8	4.5	<0.8	<0.8	<0.8
Aldrin	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Heptachlor Epoxide	0.6	4.4	<0.6	5.1	<0.6	1.0	0.9
a–Endosulphan	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Dieldrin	0.6	16	1.5	16	2.2	3.7	4.4
pp'–DDE	0.8	91	3.7	84	23	5	12
Endrin	1	<1	<1	<1	<1	<1	<1
b–Endosulphan	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
pp'–DDD	1	22	1	45	6	2	5
Endrin Aldehyde	0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Endosulfan Sulfate	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
pp'–DDT	1	7	<1	4	<1	<1	<1
Methoxychlor	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
g–Chlordane	1	10	<1	45	10	<1	4
a–Chlordane	1	34	2	120	19	4	14
Surrogate Recovery (%)							
Tetrachloro–m–xylene		90	33	86	27	83	76
PCB 209		133	43	124	38	131	124

Table 7B Sample Results for Pesticides (ng/g)

Field ID: / Lab ID:	MDL	13–92 93–263	14–92 93–264	15–89 93–265	16–89 93–266	17–93 93–267
Target Pesticides						
a–BHC	1	<1	<2	<1	<1	<1
b–BHC	2	<2	<3	<2	<2	<2
g–BHC	1	<1	<2	<1	<1	<1
d–BHC	1	<1	<2	<1	<1	<1
Heptachlor	0.8	6.1	<1	<0.8	<0.8	<0.8
Aldrin	0.5	<0.5	<0.8	<0.5	<0.5	<0.5
Heptachlor Epoxide	0.6	5.6	15	2.2	1.2	1.2
a–Endosulphan	0.6	<0.6	<1	<0.6	<0.6	<0.6
Dieldrin	0.6	11	37	6.9	<0.6	3.1
pp'–DDE	0.8	47	59	21	30	41
Endrin	1	<1	<2	<1	<1	<1
b–Endosulphan	0.6	<0.6	<1	<0.6	<0.6	<0.6
pp'–DDD	1	30	56	18	11	6
Endrin Aldehyde	0.7	<0.7	<1	<0.7	<0.7	<0.7
Endosulfan Sulfate	0.8	<0.8	4	<0.8	<0.8	<0.8
pp'–DDT	1	<1	8	<1	<1	<1
Methoxychlor	0.4	<0.4	<1	<0.4	<0.4	<0.4
g–Chlordane	1	70	90	47	7	5
a–Chlordane	1	110	200	71	20	15
Surrogate Recovery (%)						
Tetrachloro–m–xylene		72	52	64	63	49
PCB 209		101	78	108	95	102

Table 8A Sample Results for PCBs (ng/g)

Field ID:		1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	MDL	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target PCBs								
PCB 1	0.8	<0.8	<0.8	<0.8	<0.8	2.0	<0.8	0.8
PCB 3	0.8	0.9	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 4,10	0.2	0.7	0.3	<0.2	<0.2	0.2	<0.2	0.8
PCB 7	0.2	0.6	0.3	<0.2	<0.2	0.5	<0.2	<0.2
PCB 6	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.6
PCB 8,5	0.9	3.1	1.3	<0.9	0.9	<0.9	<0.9	6.8
PCB 19	1	<1	<1	<1	16	<1	<1	<1
PCB 12,13	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 18	1	7	<1	<1	<1	2	<1	3
PCB 17	2	4	<2	<2	<2	2	<2	4
PCB 27	0.9	2.4	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 16,32	2	12	<2	<2	<2	3	<2	6
PCB 29	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2
PCB 31	1	28	2	2	2	4	<1	20
PCB 33	1	<1	1	<1	2	<1	<1	2
PCB 53	1	2	<1	1	<1	<1	<1	1
PCB 51	1	<1	<1	2	<1	2	<1	<1
PCB 22	2	7	<2	<2	<2	2	<2	4
PCB 45	1	3	<1	<1	<1	<1	<1	<1
PCB 46	2	<2	<2	<2	8	<2	<2	<2
PCB 49	1	18	3	3	<1	8	<1	7
PCB 47,48	1	19	4	7	5	12	<1	7
PCB 44	1	23	5	1	18	11	<1	8
PCB 42	0.3	0.6	<0.3	<0.3	<0.3	0.7	<0.3	<0.3
PCB 37	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 41,71,64	2	41	5	3	6	12	<2	12
PCB 40	2	5	<2	<2	5	<2	<2	<2
PCB 63	1	<1	<1	<1	4	1	<1	<1
PCB 74	1	14	<1	<1	3	1	<1	5
PCB 70,76	1	6	6	2	4	3	<1	9
PCB 66	1	41	7	4	8	14	<1	13
PCB 95	0.6	23	<0.6	4.6	4.4	14	1.1	11
PCB 91	0.6	4.7	1.7	2.4	4.8	4.6	<0.6	<0.6
PCB 92,84	1	19	3	<1	29	4	<1	5
PCB 101	0.4	29	15	11	11	28	2.8	15
PCB 99	0.4	15	5.5	3.9	8.9	11	1.3	5.6
PCB 119	0.8	2.7	0.8	1.4	2.8	2.7	<0.8	1.2
PCB 83	0.6	<0.6	<0.6	<0.6	0.8	<0.6	<0.6	0.8
PCB 97	0.4	9.7	2.8	1.5	1.6	7.2	0.6	3.2
PCB 87	0.5	18	5.1	3.1	4.8	8.8	1.3	6.1
PCB 85	0.5	7.9	2.1	1.1	3.3	3.9	0.6	2.3
PCB 136	0.7	5.7	2.5	1.5	1.2	3.0	<0.7	3.0
PCB 110	0.4	47	12	6.7	19	26	2.2	15
PCB 82	0.4	4.4	0.8	0.4	0.4	<0.4	<0.4	1.5
PCB 151	1	20	12	12	9	30	3	14
PCB 135,144	1	10	6	4	2	13	<1	7
PCB 149	1	53	32	27	55	68	5	36

Table 8A Sample Results for PCBs (ng/g)

Field ID:		1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	MDL	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target PCBs								
PCB 146	2	20	13	15	48	26	3	13
PCB 153,132	2	120	120	120	410	310	26	110
PCB 141	2	27	10	13	27	8	2	11
PCB 176	2	<2	<2	<2	<2	3	<2	<2
PCB 178	2	6	<2	6	25	14	<2	6
PCB 187,182	2	83	53	59	260	94	11	41
PCB 183	2	16	15	18	58	27	<2	12
PCB 185	2	<2	<2	<2	18	4	2	<2
PCB 174	1	19	9	9	14	10	<1	8
PCB 177	1	12	9	6	35	21	2	10
PCB 202	1	3	2	2	7	5	<1	3
PCB 171	2	11	9	11	32	19	<2	8
PCB 172	4	12	8	11	33	5	<4	6
PCB 197	4	<4	160	<4	170	<4	<4	<4
PCB 180	1	52	35	49	130	46	7	26
PCB 191	2	2	<2	2	4	2	<2	3
PCB 199	0.6	1.0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 201	2	12	8	10	24	5	2	6
PCB 202,196	2	15	11	16	35	<2	3	9
PCB 208	2	<2	<2	<2	10	<2	<2	<2
PCB 195	3	10	7	9	21	9	<3	5
PCB 194	0.9	<0.9	4.7	6.4	13	1.5	1.2	3.2
PCB 206	2	4	2	2	5	<2	<2	3
Coplanar PCB Congeners								
PCB 28	2	35	<2	<2	<2	5.3	<2	20
PCB 52	2	37	9.1	3.7	5.5	12	<2	13
PCB 60(56)	1	18	<1	<1	2	<1	<1	5
PCB 81	1	<1	<1	<1	<1	<1	<1	<1
PCB 123	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 118	0.7	65	24	14	46	56	4.1	22
PCB 114	0.8	1.8	<0 8	<0.8	0.85	0.86	<0.8	<0.8
PCB 105	0.5	20	6.2	3.3	14	11	1.4	6.1
PCB 138(163)	1	100	74	71	210	140	15	56
PCB 158	1	9.8	5.4	6.1	16	12	<1	5.6
PCB 126	0.8	2.3	2	1.8	4.4	4.2	<0.8	1.7
PCB 167	1	13	7.3	6	18	14	1.5	5.4
PCB 156	1	8.8	5.2	5.1	12	8.5	1.2	3.9
PCB 157	1	1.6	<1	10	2.2	1.5	9.7	<1
PCB 169	1	<1	<1	<1	<1	<1	<1	<1
PCB 170(190)	2	29	22	29	63	23	4.6	13
PCB 77	0.1	0.3	0.4	<0.1	<0.1	<0.1	<0.1	0.4
Total PCBs	10	1300	770	620	2000	1200	110	670
Surrogate Recovery (%)								
PCB 14		70	75	75	73	76	56	74
PCB 65		80	90	97	86	91	77	86
PCB 166		97	95	120	97	110	100	130

Table 8A Sample Results for PCBs (ng/g)

Field ID:		7-91	8-91	9-91	10-91	11-91	12-91	13-91
Lab ID:	MDL	92-834	92-835	92-836	92-837	92-838	92-839	92-840
Target PCBs								
PCB 1	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	0.8	0.97
PCB 3	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 4,10	0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	0.4
PCB 7	0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2
PCB 6	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 8,5	0.9	<0.9	<0.9	0.9	<0.9	1.9	1.1	3.6
PCB 19	1	<1	<1	<1	<1	<1	<1	<1
PCB 12,13	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 18	1	<1	<1	1	<1	4	2	6
PCB 17	2	<2	<2	<2	<2	2	<2	4
PCB 27	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 16,32	2	<2	<2	<2	<2	5	4	8
PCB 29	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 31	1	1	9	4	<1	10	8	19
PCB 33	1	<1	<1	<1	<1	2	1	2
PCB 53	1	<1	1	<1	<1	<1	<1	<1
PCB 51	1	<1	2	1	<1	<1	<1	<1
PCB 22	2	<2	<2	<2	<2	<2	<2	5
PCB 45	1	<1	<1	<1	<1	1	<1	1
PCB 46	2	<2	<2	<2	<2	<2	<2	<2
PCB 49	1	<1	9	7	<1	6	4	5
PCB 47,48	1	<1	71	10	2	5	4	5
PCB 44	1	<1	6	6	<1	7	5	8
PCB 42	0.3	<0.3	0.6	<0.3	<0.3	0.7	0.4	<0.3
PCB 37	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 41,71,64	2	<2	20	10	<2	13	9	14
PCB 40	2	<2	<2	<2	<2	<2	<2	<2
PCB 63	1	<1	2	<1	<1	<1	<1	<1
PCB 74	1	<1	8	<1	<1	6	3	5
PCB 70,76	1	1	2	2	<1	5	4	3
PCB 66	1	2	20	14	<1	13	8	10
PCB 95	0.6	2.4	13	9.2	1.1	7.0	4.1	3.9
PCB 91	0.6	0.8	8.1	3.9	<0.6	2.0	1.1	<0.6
PCB 92,84	1	<1	<1	<1	<1	<1	2	3
PCB 101	0.4	5.2	54	25	3.4	17	7.4	4.6
PCB 99	0.4	2.2	26	12	1.2	7.5	3.6	2.8
PCB 119	0.8	<0.8	9.5	2.2	<0.8	<0.8	<0.8	<0.8
PCB 83	0.6	<0.6	1.9	1.1	<0.6	1.0	<0.6	<0.6
PCB 97	0.4	0.7	4.8	5.1	0.46	4.1	2.0	1.9
PCB 87	0.5	1.8	15	9.1	<0.5	7.4	3.5	4.2
PCB 85	0.5	0.7	7.4	4.3	<0.5	3.6	1.5	1.8
PCB 136	0.7	<0.7	5.3	1.8	<0.7	1.6	<0.7	0.8
PCB 110	0.4	4.0	41	24	1.8	16	7.3	8.5
PCB 82	0.4	<0.4	0.9	0.6	<0.4	2.2	0.9	0.8
PCB 151	1	5	24	28	3	10	5	<1
PCB 135,144	1	<1	12	12	<1	6	<1	1
PCB 149	1	12	110	63	5	41	13	7

Table 8A Sample Results for PCBs (ng/g)

Field ID: / Lab ID:	MDL	7-91 92-834	8-91 92-835	9-91 92-836	10-91 92-837	11-91 92-838	12-91 92-839	13-91 92-840
Target PCBs								
PCB 146	2	6	82	31	<2	17	7	4
PCB 153,132	2	48	550	320	20	150	54	17
PCB 141	2	6	46	15	2	21	7	4
PCB 176	2	<2	3	2	<2	<2	<2	<2
PCB 178	2	<2	34	15	<2	<2	2	<2
PCB 187,182	2	20	250	110	11	89	24	11
PCB 183	2	6	66	33	<2	26	8	<2
PCB 185	2	<2	5	5	<2	<2	<2	<2
PCB 174	1	4	24	15	<1	19	4	3
PCB 177	1	3	49	20	2	11	2	2
PCB 202	1	<1	10	5	<1	2	<1	2
PCB 171	2	4	40	20	<2	14	4	<2
PCB 172	4	<4	32	11	<4	<4	5	<4
PCB 197	4	<4	10	<4	<4	5	<4	<4
PCB 180	1	15	150	70	6	84	20	8
PCB 191	2	2	<2	2	<2	2	<2	<2
PCB 199	0.6	<0.6	0.6	<0.6	<0.6	1.0	<0.6	<0.6
PCB 201	2	4	27	11	<2	<2	4	2
PCB 202,196	2	<2	43	23	<2	24	5	<2
PCB 208	2	<2	50	<2	<2	<2	<2	<2
PCB 195	3	<3	24	13	3	14	3	<3
PCB 194	0.9	1.5	13	5.2	<0.9	13	2.6	1.2
PCB 206	2	<2	5	3	<2	5	<2	<2
Coplanar PCB Congeners								
PCB 28	2	<2	5.5	5.4	<2	9	8.5	24
PCB 52	2	<2	19	9.3	<2	11	8	10
PCB 60(56)	1	<1	3	<1	<1	3.9	2.8	4.3
PCB 81	1	<1	<1	<1	<1	<1	<1	<1
PCB 123	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 118	0.7	6.2	67	52	2.7	35	12	11
PCB 114	0.8	<0.8	2.1	0.97	<0.8	1.4	0.92	<0.8
PCB 105	0.5	1.7	19	11	0.57	11	4	3.4
PCB 138(163)	1	<1	290	160	12	85	32	17
PCB 158	1	2.5	25	13	1	7.7	2.6	1.6
PCB 126	0.8	<0.8	8.6	4.1	<0.8	1.3	<0.8	<0.8
PCB 167	1	2.4	24	15	<1	9.1	3.4	2.3
PCB 156	1	1.3	17	10	<1	7.3	2.4	1.7
PCB 157	1	<1	3.6	1.7	8.6	1.4	<1	9.3
PCB 169	1	<1	<1	<1	<1	<1	<1	<1
PCB 170(190)	2	8	74	37	3.3	36	9.2	5.2
PCB 77	0.1	<0.1	0.1	<0.1	<0.1	0.2	<0.1	0.2
Total PCBs	10	180	2600	1300	90	920	340	280
Surrogate Recovery (%)								
PCB 14		68	85	62	56	69	91	71
PCB 65		96	100	78	76	80	110	75
PCB 166		130	120	87	91	110	140	92

Table 8A Sample Results for PCBs (ng/g)

Field ID:		14-91	15-91	16-91	17-91	18-91	19-91
Lab ID:	MDL	92-841	92-842	92-843	92-844	92-845	92-846
Target PCBs							
PCB 1	0.8	<0.8	<0.8	<0.8	<0.8	1.7	<0.8
PCB 3	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 4,10	0.2	<0.2	0.2	<0.2	<0.2	0.3	<0.2
PCB 7	0.2	<0.2	<0.2	<0.2	0.3	0.3	<0.2
PCB 6	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 8,5	0.9	<0.9	1.4	<0.9	<0.9	1.0	<0.9
PCB 19	1	<1	<1	<1	<1	<1	<1
PCB 12,13	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 18	1	1	3	1	1	3	<1
PCB 17	2	<2	<2	<2	<2	4	<2
PCB 27	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 16,32	2	<2	4	<2	<2	7	<2
PCB 29	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 31	1	3	9	5	11	13	1
PCB 33	1	<1	1	<1	<1	<1	<1
PCB 53	1	<1	<1	<1	1	2	<1
PCB 51	1	<1	<1	<1	<1	3	<1
PCB 22	2	<2	2	<2	<2	4	<2
PCB 45	1	<1	<1	<1	1	<1	<1
PCB 46	2	<2	<2	<2	<2	<2	<2
PCB 49	1	2	3	4	11	14	<1
PCB 47,48	1	2	2	4	21	20	<1
PCB 44	1	2	4	4	18	8	1
PCB 42	0.3	<0.3	0.3	<0.3	2.2	1.0	<0.3
PCB 37	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 41,71,64	2	3	6	6	33	17	2
PCB 40	2	<2	<2	<2	3	<2	<2
PCB 63	1	<1	<1	<1	<1	<1	<1
PCB 74	1	1	2	<1	10	<1	<1
PCB 70,76	1	2	4	4	3	4	<1
PCB 66	1	3	5	7	28	23	1
PCB 95	0.6	1.4	2.4	7.2	18	11	1.4
PCB 91	0.6	<0.6	<0.6	1.7	5.7	5.9	<0.6
PCB 92,84	1	<1	1	<1	8	3	<1
PCB 101	0.4	2.3	3.0	13	50	36	3.0
PCB 99	0.4	1.0	1.2	5.2	24	17	1.0
PCB 119	0.8	<0.8	<0.8	1	4.7	3.6	<0.8
PCB 83	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 97	0.4	0.78	0.8	2.3	9.9	5.8	0.6
PCB 87	0.5	1.5	1.7	4.3	15	10	1.5
PCB 85	0.5	<0.5	0.6	1.9	9.3	6.6	0.7
PCB 136	0.7	<0.7	<0.7	1.5	5	3.2	<0.7
PCB 110	0.4	2.4	3.2	10	51	26	2.7
PCB 82	0.4	<0.4	0.7	0.5	2.7	<0.4	<0.4
PCB 151	1	1	2	12	21	51	2
PCB 135,144	1	<1	<1	5	11	20	<1
PCB 149	1	3	5	30	96	77	5

Table 8A Sample Results for PCBs (ng/g)

Field ID:		14-91	15-91	16-91	17-91	18-91	19-91
Lab ID:	MDL	92-841	92-842	92-843	92-844	92-845	92-846
Target PCBs							
PCB 146	2	2	<2	13	55	52	3
PCB 153,132	2	10	12	120	430	560	19
PCB 141	2	<2	2	10	31	21	3
PCB 176	2	<2	<2	<2	2	4	<2
PCB 178	2	<2	<2	5	20	25	<2
PCB 187,182	2	5	6	46	150	170	10
PCB 183	2	<2	<2	14	44	50	<2
PCB 185	2	<2	<2	<2	4	8	<2
PCB 174	1	<1	2	6	15	17	<1
PCB 177	1	<1	1	5	32	20	2
PCB 202	1	<1	<1	2	7	8	<1
PCB 171	2	<2	<2	8	26	35	<2
PCB 172	4	<4	<4	7	20	13	<4
PCB 197	4	<4	<4	<4	<4	13	<4
PCB 180	1	3	5	31	93	90	7
PCB 191	2	<2	<2	<2	3	<2	<2
PCB 199	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 201	2	<2	<2	6	16	12	<2
PCB 202,196	2	<2	<2	<2	27	30	2
PCB 208	2	<2	<2	<2	80	<2	<2
PCB 195	3	<3	<3	5	15	16	<3
PCB 194	0.9	<0.9	<0.9	2.6	7.2	4.2	1
PCB 206	2	<2	<2	<2	5	4	<2
Coplanar PCB Congeners							
PCB 28	2	4	9	5.1	10	13	<2
PCB 52	2	2.8	6.1	7.2	38	15	<2
PCB 60(56)	1	1.1	2.4	2.4	6.3	6.6	<1
PCB 81	1	<1	<1	<1	<1	<1	<1
PCB 123	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 118	0.7	3.3	3.7	21	89	73	3.6
PCB 114	0.8	<0.8	<0.8	<0.8	2.2	1.8	<0.8
PCB 105	0.5	1.2	1.7	5.1	27	19	1.2
PCB 138(163)	1	6.4	7.9	67	220	230	11
PCB 158	1	<1	7.3	5.5	22	22	<1
PCB 126	0.8	<0.8	<0.8	1.5	5.2	6.6	<0.8
PCB 167	1	<1	<1	6	23	22	1.1
PCB 156	1	<1	<1	4.1	14	14	<1
PCB 157	1	9.3	<1	<1	3.1	2.9	<1
PCB 169	1	<1	<1	<1	<1	<1	<1
PCB 170(190)	2	2.2	<2	18	48	42	3.1
PCB 77	0.1	<0.1	<0.1	0.3	<0.1	0.3	<0.1
Total PCBs	10	80	130	550	2100	2000	90
Surrogate Recovery (%)							
PCB 14		49	77	70	86	66	73
PCB 65		67	92	88	100	86	92
PCB 166		86	120	110	140	120	130

Table 8B Sample Results for PCBs (ng/g)

Field ID:		1-92	2-92	3-92	4-92	5-92	6-92
Lab ID:	MDL	93-251	93-252	93-253	93-254	93-255	93-256
Target PCBs							
PCB 1	1	<1	<1	2	1	<1	<1
PCB 3	1	<1	<1	<1	<1	<1	<1
PCB 4,10	0.4	<0.4	<0.4	0.4	<0.4	<0.4	<0.4
PCB 7	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 6	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 8,5	2	<2	<2	2	3	<2	<2
PCB 19	3	<3	<3	<3	<3	<3	<3
PCB 12,13	4	<4	<4	<4	<4	<4	<4
PCB 18	3	<3	<3	<3	3	<3	<3
PCB 17	6	<6	<6	<6	<6	<6	<6
PCB 27	2	<2	<2	<2	<2	<2	<2
PCB 16,32	4	<4	<4	12	24	6	4
PCB 29	3	<3	<3	<3	<3	<3	<3
PCB 31	3	<3	<3	5	17	<3	<3
PCB 33	3	<3	<3	<3	3	<3	<3
PCB 53	0.4	<0.4	<0.4	0.6	1.6	0.4	0.4
PCB 51	0.3	<0.3	<0.3	0.9	0.8	0.7	<0.3
PCB 22	5	<5	<5	<5	<5	<5	<5
PCB 45	0.4	<0.4	<0.4	<0.4	1.1	<0.4	<0.4
PCB 46	0.4	<0.4	<0.4	<0.4	0.6	<0.4	<0.4
PCB 49	0.3	0.4	1.0	4.5	6.4	2.6	1.6
PCB 47,48	0.4	0.4	1.6	6.4	6.6	3.9	2.1
PCB 44	0.4	<0.4	0.9	4.8	8	3.1	2.0
PCB 42	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 37	0.08	<0.08	<0.08	0.16	0.14	0.32	0.15
PCB 41,71,64	0.5	0.6	1.9	8.6	14	4.4	3.1
PCB 40	0.4	<0.4	<0.4	1.0	2.4	0.6	0.6
PCB 63	0.3	<0.3	<0.3	<0.3	0.9	1.3	<0.3
PCB 74	0.3	0.3	0.7	2.3	4.1	1.2	1.4
PCB 70,76	0.3	0.6	1.2	1.7	7.3	1.5	2.7
PCB 66	0.4	0.8	2	8.3	11	5.0	3.6
PCB 95	0.8	<0.8	2.4	6.1	8.3	4.6	5.1
PCB 91	0.8	<0.8	<0.8	2.1	2.0	1.4	1.0
PCB 92,84	2	<2	<2	<2	4	<2	<2
PCB 101	0.5	1.2	4.9	13	11	8.9	8.4
PCB 99	0.5	0.6	2	5.5	4.1	3.6	3.1
PCB 119	0.7	<0.7	<0.7	0.8	<0.7	<0.7	<0.7
PCB 83	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 97	0.6	<0.6	0.9	2.9	2.5	2.1	1.7
PCB 87	0.7	<0.7	1.6	3.6	4.2	2.3	3.0
PCB 85	0.9	<0.9	0.9	2.4	2.2	1.5	1.6
PCB 136	0.3	0.4	0.7	0.9	1.6	2.1	3.1
PCB 110	0.5	1.0	3.8	10	10	6.9	7.1
PCB 82	0.7	<0.7	<0.7	<0.7	0.9	<0.7	<0.7
PCB 151	0.6	1.9	5.7	11	6.5	16	13
PCB 135,144	0.5	0.7	2.2	4.9	3.1	7.7	6.1
PCB 149	0.5	3.6	13	21	16	35	31
PCB 146	0.7	1.8	5.9	9.2	5.3	14	11
PCB 153,132	0.8	15	50	110	48	160	110

Table 8B Sample Results for PCBs (ng/g)

Field ID:		1-92	2-92	3-92	4-92	5-92	6-92
Lab ID:	MDL	93-251	93-252	93-253	93-254	93-255	93-256
Target PCBs							
PCB 141	0.8	1.7	4.0	3.2	3.7	3.3	9.9
PCB 176	0.2	0.2	0.4	1.2	0.8	2.2	1.6
PCB 178	2	<2	<2	3	2	5	5
PCB 187,182	2	9	26	43	26	67	60
PCB 183	1	3	7	12	6	17	15
PCB 185	1	<1	<1	2	<1	2	2
PCB 174	0.9	1.3	3.1	4.0	4.0	4.9	9.2
PCB 177	1	1	3	6	5	11	11
PCB 202	0.8	<0.8	1.2	2.5	1.5	4.3	2.9
PCB 171	2	<2	4	8	4	11	9
PCB 172	1	<1	1	<1	1	1	3
PCB 197	2	<2	<2	2	<2	4	3
PCB 180	0.9	5.1	15	20	13	25	37
PCB 191	1	<1	<1	<1	<1	<1	1
PCB 199	0.3	<0.3	<0.3	<0.3	<0.3	0.4	0.6
PCB 201	0.9	1.3	3.3	3.1	3.3	3.6	9.8
PCB 202,196	1	2	6	7	5	10	15
PCB 208	2	5	3	4	3	5	7
PCB 195	2	2	3	5	3	7	8
PCB 194	0.4	0.7	1.3	0.7	1.1	1.1	4.3
PCB 206	1	<1	1	1	1	2	3
Coplanar PCB Congeners							
PCB 28	3	<3	<3	5	<3	<3	<3
PCB 52	0.3	0.8	2.8	6.0	12	3.8	3.5
PCB 60(56)	0.3	0.3	1.1	2.1	4.9	1.5	1.4
PCB 81	0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2
PCB 123	0.7	2.3	10	27	17	19	14
PCB 118	0.7	<0.7	0.9	1.7	1.3	<0.7	<0.7
PCB 114	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 105	0.7	<0.7	2.6	6.3	5.2	4.0	4.0
PCB 138(163)	0.5	5.6	32	60	36	43	33
PCB 158	0.5	0.5	2.9	5.7	3.2	3.6	3.2
PCB 126	0.6	<0.6	0.8	1.8	1.0	1.6	1.0
PCB 167	0.5	0.7	3	<0.5	<0.5	4.9	2.9
PCB 156	0.4	0.4	1.9	3.6	2.6	2.5	2.6
PCB 157	0.4	11	<0.4	0.7	<0.4	<0.4	<0.4
PCB 169	0.8	<0.8	<0.8	<1	<0.8	<0.8	<0.8
PCB 170(190)	0.8	1.6	8.9	11	8.7	4.6	9.8
PCB 77	0.3	<0.3	<0.3	<0.3	1.3	<0.3	<0.3
Total PCBs	10	90	250	520	420	570	520
Surrogate Recovery (%)							
PCB 14		32	47	75	67	35	36
PCB 65		68	47	75	67	68	73
PCB 166		91	76	78	73	86	94

Table 8B Sample Results for PCBs (ng/g)

Field ID:		7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	MDL	93-257	93-258	93-259	93-260	93-261	93-262
Target PCBs							
PCB 1	1	<1	<1	6	<1	<1	<1
PCB 3	1	<1	<1	<1	<1	<1	<1
PCB 4,10	0.4	<0.4	<0.4	0.7	<0.4	<0.4	<0.4
PCB 7	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 6	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 8,5	2	<2	<2	2	<2	<2	<2
PCB 19	3	<3	<3	<3	<3	<3	<3
PCB 12,13	4	<4	<4	<4	<4	<4	<4
PCB 18	3	<3	<3	9	<3	<3	<3
PCB 17	6	<6	<6	6	<6	<6	<6
PCB 27	2	<2	<2	<2	<2	<2	<2
PCB 16,32	4	<4	<4	71	5	6	6
PCB 29	3	<3	<3	<3	<3	<3	<3
PCB 31	3	<3	<3	35	4	<3	3
PCB 33	3	<3	<3	5	<3	<3	<3
PCB 53	0.4	<0.4	<0.4	2.9	<0.4	<0.4	<0.4
PCB 51	0.3	<0.3	<0.3	1.3	<0.3	<0.3	<0.3
PCB 22	5	<5	<5	8	<5	<5	<5
PCB 45	0.4	<0.4	<0.4	2.6	<0.4	<0.4	<0.4
PCB 46	0.4	<0.4	<0.4	1.1	<0.4	<0.4	<0.4
PCB 49	0.3	0.4	0.3	14	1.8	0.8	1.0
PCB 47,48	0.4	4.1	<0.4	16	1.3	0.8	1.0
PCB 44	0.4	1.4	<0.4	18	2.1	1.0	1.3
PCB 42	0.9	<0.9	<0.9	1.7	<0.9	<0.9	<0.9
PCB 37	0.08	<0.08	<0.08	0.29	0.15	<0.08	<0.08
PCB 41,71,64	0.5	2.5	0.8	34	4.0	2.1	2.7
PCB 40	0.4	0.6	<0.4	3.5	0.7	<0.4	<0.4
PCB 63	0.3	0.7	<0.3	1.8	0.3	<0.3	<0.3
PCB 74	0.3	1.2	<0.3	9.6	1.3	0.5	0.8
PCB 70,76	0.3	<0.3	0.4	18	1.8	0.8	0.9
PCB 66	0.4	2.7	0.7	27	3.4	1.5	2.2
PCB 95	0.8	1.4	<0.8	16	2.3	<0.8	1.0
PCB 91	0.8	<0.8	<0.8	3.6	<0.8	<0.8	<0.8
PCB 92,84	2	<2	<2	<2	<2	<2	<2
PCB 101	0.5	3.4	0.8	23	4.1	1.2	1.9
PCB 99	0.5	4	<0.5	9.9	1.7	0.6	0.9
PCB 119	0.7	<0.7	<0.7	1.0	<0.7	<0.7	<0.7
PCB 83	0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 97	0.6	<0.6	<0.6	5.3	1.0	<0.6	<0.6
PCB 87	0.7	2.4	<0.7	9.6	1.7	0.8	0.9
PCB 85	0.9	1.8	<0.9	5.4	<0.9	<0.9	<0.9
PCB 136	0.3	0.4	<0.3	2.2	1.2	<0.3	<0.3
PCB 110	0.5	8.8	0.8	23	3.6	1.2	1.8
PCB 82	0.7	<0.7	<0.7	1.8	<0.7	<0.7	<0.7
PCB 151	0.6	3.2	1.3	12	4.9	0.9	0.9
PCB 135,144	0.5	<0.5	<0.5	4.9	2.4	<0.5	<0.5
PCB 149	0.5	29	2.7	28	13	1.5	2.9
PCB 146	0.7	29	1.2	11	5.2	0.7	1.4
PCB 153,132	0.8	260	9.4	87	42	5.2	12

Table 8B Sample Results for PCBs (ng/g)

Field ID:		7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	MDL	93-257	93-258	93-259	93-260	93-261	93-262
Target PCBs							
PCB 141	0.8	13	1.0	13	5.8	0.8	1.5
PCB 176	0.2	0.6	<0.2	0.8	0.6	<0.2	<0.2
PCB 178	2	<2	<2	3	2	<2	<2
PCB 187,182	2	190	6	49	31	3	7
PCB 183	1	48	2	14	8	<1	2
PCB 185	1	<1	<1	2	1	<1	<1
PCB 174	0.9	6.3	<0.9	9.0	5.5	<0.9	<0.9
PCB 177	1	29	<1	6	5	<1	<1
PCB 202	0.8	7.3	<0.8	2.0	1.5	<0.8	<0.8
PCB 171	2	28	<2	8	5	<2	<2
PCB 172	1	10	<1	4	2	<1	<1
PCB 197	2	6	<2	2	<2	<2	<2
PCB 180	0.9	91	2.9	38	23	2.1	4.4
PCB 191	1	3	<1	<1	<1	<1	<1
PCB 199	0.3	<0.3	<0.3	0.3	0.4	<0.3	<0.3
PCB 201	0.9	23	<0.9	8.9	6.7	<0.9	1.1
PCB 202,196	1	38	1	13	9	<1	1
PCB 208	2	9	3	7	5	<2	4
PCB 195	2	22	<2	7	5	<2	<2
PCB 194	0.4	11	<0.4	4.0	3.3	<0.4	0.5
PCB 206	1	4	<1	2	2	<1	<1
Coplanar PCB Congeners							
PCB 28	3	<3	<3	<3	4	3	5
PCB 52	0.3	4.0	0.8	29	2.7	1.9	<0.3
PCB 60(56)	0.3	0.6	<0.3	12	1.3	0.6	1.3
PCB 81	0.2	<0.2	<0.2	0.5	<0.2	<0.2	<0.2
PCB 123	0.7	36	1.5	41	8.3	2.2	5.3
PCB 118	0.7	<0.7	<0.7	3.1	<0.7	<0.7	<0.7
PCB 114	0.8	<0.8	<0.8	1.3	<0.8	<0.8	<0.8
PCB 105	0.7	11	<0.7	14	2.3	0.8	1.7
PCB 138(163)	0.5	150	3.3	77	17	4.3	8.9
PCB 158	0.5	15	<0.5	7.6	1.9	<0.5	0.9
PCB 126	0.6	3.7	<0.6	1.6	<0.6	<0.6	<0.6
PCB 167	0.5	10	<0.5	<0.5	1.7	<0.5	1.0
PCB 156	0.4	7.9	<0.4	6.2	1.5	<0.4	0.7
PCB 157	0.4	1.4	<0.4	1.1	<0.4	<0.4	<0.4
PCB 169	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 170(190)	0.8	52	0.8	25	6.8	1.4	2.3
PCB 77	0.3	<0.3	<0.3	3.4	<0.3	<0.3	<0.3
Total PCBs	10	1200	40	950	280	50	90
Surrogate Recovery (%)							
PCB 14		56	30	67	31	71	43
PCB 65		55	61	71	55	70	47
PCB 166		85	80	71	59	79	75

Table 8B Sample Results for PCBs (ng/g)

Field ID:		13-92	14-92	15-89	16-89	17-93
Lab ID:	MDL	93-263	93-264	93-265	93-266	93-267
Target PCBs						
PCB 1	1	2	3	2	<1	<1
PCB 3	1	<1	<2	<1	<1	<1
PCB 4,10	0.4	<0.4	<1	<0.4	<0.4	<0.4
PCB 7	0.4	<0.4	<1	<0.4	<0.4	<0.4
PCB 6	0.6	<0.6	<1	<0.6	<0.6	<0.6
PCB 8,5	2	3	<3	<2	<2	<2
PCB 19	3	<3	<5	<3	<3	<3
PCB 12,13	4	<4	<7	<4	<4	<4
PCB 18	3	11	<5	<3	<3	<3
PCB 17	6	7	<10	<6	<6	<6
PCB 27	2	<2	<3	<2	<2	<2
PCB 16,32	4	62	<7	8	<4	<4
PCB 29	3	<3	<5	<3	<3	<3
PCB 31	3	36	9	4	<3	<3
PCB 33	3	8	<5	<3	<3	<3
PCB 53	0.4	2.6	<7	<0.4	<0.4	<0.4
PCB 51	0.3	0.9	<.5	<0.3	<0.3	<0.3
PCB 22	5	9	<8	<5	<5	<5
PCB 45	0.4	2.4	<.7	<0.4	<0.4	<0.4
PCB 46	0.4	1.0	<.7	<0.4	<0.4	<0.4
PCB 49	0.3	10	6.4	1.7	0.8	0.9
PCB 47,48	0.4	10	15	1.7	1	1.0
PCB 44	0.4	15	18	2.4	1	1.2
PCB 42	0.9	1.3	<2	<0.9	<0.9	<0.9
PCB 37	0.08	0.18	0.2	<0.08	<0.08	0.08
PCB 41,71,64	0.5	26	33	4.8	1.4	1.4
PCB 40	0.4	3.3	2.5	0.6	<0.4	<0.4
PCB 63	0.3	1.2	1.9	0.3	<0.3	0.4
PCB 74	0.3	6.4	5.8	1.4	0.9	0.4
PCB 70,76	0.3	11	0.7	1.0	0.4	1.0
PCB 66	0.4	17	20	4.5	2.6	2.2
PCB 95	0.8	8.5	14	2.4	2.4	3.0
PCB 91	0.8	1.8	3	<0.8	<0.8	<0.8
PCB 92,84	2	5	<3	<2	<2	<2
PCB 101	0.5	11	18	3.2	3.6	4.0
PCB 99	0.5	4.4	11	1.6	1.6	1.7
PCB 119	0.7	<0.7	<1	<0.7	<0.7	<0.7
PCB 83	0.6	<0.6	1	<0.6	<0.6	<0.6
PCB 97	0.6	2.8	5	1.0	1.0	0.9
PCB 87	0.7	4.9	9	2.1	1.8	1.2
PCB 85	0.9	2.5	6	1.0	0.9	<0.9
PCB 136	0.3	1.6	1.9	0.8	1.4	1.9
PCB 110	0.5	11	31	4.7	4.6	3.3
PCB 82	0.7	1.0	1	<0.7	<0.7	<0.7
PCB 151	0.6	5.8	6	2.6	7.4	8.1
PCB 135,144	0.5	3.1	3.0	1.3	3.5	3.7
PCB 149	0.5	17	32	6.9	15	19
PCB 146	0.7	5.4	12	2.4	7.2	8.3
PCB 153,132	0.8	49	84	19	54	81

Table 8B Sample Results for PCBs (ng/g)

Field ID:		13-92	14-92	15-89	16-89	17-93
Lab ID:	MDL	93-263	93-264	93-265	93-266	93-267
Target PCBs						
PCB 141	0.8	7.0	8	3.7	4.7	3.4
PCB 176	0.2	0.6	0.7	0.3	1.0	1.1
PCB 178	2	2	<3	<2	3	3
PCB 187,182	2	32	110	13	42	43
PCB 183	1	7	10	3	9	10
PCB 185	1	2	<2	<1	2	1
PCB 174	0.9	5.9	6	2.9	5.8	3.7
PCB 177	1	4	9	2	8	5
PCB 202	0.8	1.3	3	<0.8	2.0	3.1
PCB 171	2	4	6	2	7	6
PCB 172	1	2	3	<1	2	2
PCB 197	2	<2	<3	<2	<2	2
PCB 180	0.9	20	23	8.4	20	21
PCB 191	1	<1	<2	<1	<1	<1
PCB 199	0.3	0.4	<0.5	<0.3	0.4	<0.3
PCB 201	0.9	5.8	11	1.9	4.4	4.8
PCB 202,196	1	8	10	3	8	10
PCB 208	2	7	6	3	4	4
PCB 195	2	4	5	<2	5	5
PCB 194	0.4	2.5	2	0.8	1.3	1.7
PCB 206	1	2	2	<1	1	2
Coplanar PCB Congeners						
PCB 28	3	57	14	6	<3	<3
PCB 52	0.3	30	62	<0.3	1.6	1.5
PCB 60(56)	0.3	10	5.9	2.6	1.0	0.7
PCB 81	0.2	<0.2	0.4	<0.2	<0.2	<0.2
PCB 123	0.7	25	61	11	14	7.4
PCB 118	0.7	<0.7	<1	0.8	1.0	<0.7
PCB 114	0.8	<0.8	2	<0.8	<0.8	<0.8
PCB 105	0.7	8.7	21	4.0	3.5	1.6
PCB 138(163)	0.5	40	120	19	44	21
PCB 158	0.5	3.8	9.9	1.9	4.5	1.8
PCB 126	0.6	1.2	2	<0.6	1.1	0.8
PCB 167	0.5	3.8	11	2.4	2.8	1.3
PCB 156	0.4	3.7	6.7	1.6	2.8	1.4
PCB 157	0.4	0.6	1.6	<0.4	<0.4	<0.4
PCB 169	0.8	<0.8	<1	<0.8	<0.8	<0.8
PCB 170(190)	0.8	11	21	5.4	12	5.4
PCB 77	0.3	<0.3	<.5	<0.3	1.3	<0.3
Total PCBs	10	690	910	180	330	320
Surrogate Recovery (%)						
PCB 14		44	58	42	48	30
PCB 65		83	59	81	49	59
PCB 166		63	120	65	77	75

Table 9A Sample Results for PCDD/PCDFs (pg/g)

Field ID: / Lab ID:	MDL	1-89 92-847	1-91 92-828	2-91 92-829	3-91 92-830	4-91 92-831	5-91 92-832	6-91 92-833
Target PCDFs								
2378-T4CDF	0.2	2.4	4.4	<0.2	<0.3	2.6	<0.1	3.8
TOTAL T4CDF	0.2	2.4 (1)	5.4 (2)	<0.2	<0.3	2.6 (1)	<0.1	4.4 (2)
12378-P5CDF	0.1	1.0	1.0	<0.1	<0.1	<0.7 *	<0.1	<0.2
23478-P5CDF	0.1	4.6	2.2	<0.1	1.1	3.2	<0.1	1.5
TOTAL P5CDF	0.1	5.6 (2)	3.2 (2)	<0.1	1.1 (1)	3.2 (1)	<0.1	1.5 (1)
123478-H6CDF	0.1	1.0	0.9	<0.1	0.3	<0.3 *	0.2	0.7
123678-H6CDF	0.1	1.0	0.9	<0.1	0.3	<0.3 *	0.3	0.8
234678-H6CDF	0.1	<0.2	0.7	<0.1	<0.1	<0.4 *	<0.1	0.9
123789-H6CDF	0.3	<0.6	0.7	<0.1	0.4	<0.4 *	<0.4	1.0
TOTAL H6CDF	0.3	9.1 (3)	4.6 (2)	<0.1	1 (3)	<0.4	0.5 (2)	3.4 (1)
1234678-H7CDF	0.1	0.9	1.0	<0.1	<0.1	0.3	0.3	1.2
1234789-H7CDF	0.2	<0.2	0.4	<0.1	<0.2	<0.1 *	<0.1	<0.2
TOTAL H7CDF	0.2	1.9 (2)	1.4 (2)	<0.1	<0.2	0.3 (1)	0.3 (1)	1.2 (1)
O8CDF	0.3	<0.5	1.3 (1)	<0.2	<0.2	<0.3	<0.3	1.7 (1)
Target PCDDs								
2378-T4CDD	0.4	2.1	1.0	0.4	<0.4	1.9	<0.4	0.9
TOTAL T4CDD	0.4	2.1 (1)	1 (1)	0.4 (1)	<0.4	1.9 (1)	<0.4	0.9 (1)
12378-P5CDD	0.2	3.9	<1.6 *	<0.2	0.7	1.4	<0.2	<0.2
TOTAL P5CDD	0.2	3.9 (1)	<1.6	<0.2	0.7 (1)	1.4 (1)	<0.2	<0.2
123478-H6CDD	0.2	1.5	1.1	<0.2	0.6	<0.5	<0.2	1.1
123678-H6CDD	0.2	4.9	1.6	<0.2	1.8	1.4	<0.2	1.4
123789-H6CDD	0.3	1.8	<.7 *	<0.2	<0.3	<0.5	<0.2	1.0
TOTAL H6CDD	0.3	9.3 (4)	2.7 (2)	<0.2	2.4 (2)	1.4 (2)	<0.2	3.5 (3)
1234678-H7CDD	0.2	6.2	4.6	0.3	2.9	2.1	<0.1	2.3
TOTAL H7CDD	0.2	7.6 (2)	5.3 (2)	0.5 (2)	2.9 (1)	2.1 (1)	<0.1	2.3 (1)
O8CDD	0.2	57.1 (1)	24 (1)	<0.2	10.4 (1)	8.1 (1)	1.8 (1)	6.3 (1)
TEQ (ppt)		7.8	3.3	0.4	1.3	4.6	0.1	2.8
Surrogate Recovery (%)								
C13-2378-T4CDF		78	70	79	57	67	82	44
C13-2378-T4CDD		80	65	81	57	66	83	49
C13-12378-P5CDF		79	67	93	71	69	87	55
C13-23478-P5CDF		82	68	93	72	70	92	56
C13-12378-P5CDD		89	66	104	74	67	94	65
C13-123478-H6CDF		80	78	105	55	79	105	68
C13-123678-H6CDF		76	74	79	44	75	76	53
C13-234678-H6CDF		81	78	89	66	83	86	61
C13-123789-H6CDF		41	74	79	64	76	41	48
C13-123478-H6CDD		85	74	117	82	74	101	77
C13-123678-H6CDD		80	73	82	60	76	77	50
C13-1234678-H7CDF		83	82	95	68	84	89	69
C13-1234789-H7CDF		80	78	99	80	82	91	75
C13-1234678-H7CDD		87	81	113	92	84	106	90
C13-O8CDD		70	81	107	105	80	74	98

* = NONE DETECTED BASED ON PEAK RATIO

Table 9A Sample Results for PCDD/PCDFs (pg/g)

Field ID:		7-91	8-91	9-91	10-91	11-91	12-91	13-91
Lab ID:	MDL	92-834	92-835	92-836	92-837	92-838	92-839	92-840
Target PCDFs								
2378-T4CDF	0.2	0.5	0.8	1.7	<0.2	<0.2	1.0	<0.3
TOTAL T4CDF	0.2	0.5 (1)	0.8 (1)	1.7 (1)	<0.2	<0.2	1 (1)	<0.3
12378-P5CDF	0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
23478-P5CDF	0.1	<0.1	1.3	3.0	<0.2	<0.1	0.4	<0.1
TOTAL P5CDF	0.1	<0.1	1.3 (1)	3 (1)	<0.2	<0.1	0.4 (1)	<0.1
123478-H6CDF	0.1	0.4	0.5	<0.1	<0.1	<0.2	<0.1	<0.1
123678-H6CDF	0.1	0.4	0.3	<0.1	0.3	0.4	0.3	0.4
234678-H6CDF	0.1	0.4	0.5	<0.1	<0.1	0.4	<0.1	0.4
123789-H6CDF	0.3	0.5	0.5	<0.3	0.5	<0.3	<0.5 *	<0.2
TOTAL H6CDF	0.3	1.7 (1)	1.8 (4)	<0.3	0.8 (2)	0.8 (2)	0.3 (1)	0.8 (2)
1234678-H7CDF	0.1	1.0	<0.4 *	0.3	<0.1	0.5	0.2	0.4
1234789-H7CDF	0.2	<0.1	<0.2	<0.2	<0.2	0.7	<0.1	<0.1
TOTAL H7CDF	0.2	1 (1)	<0.4	0.3 (1)	<0.2	1.2 (2)	0.2 (1)	0.4 (1)
O8CDF	0.3	0.7 (1)	<0.2	<0.1	<0.3	<0.3	<0.3 *	0.4 (1)
Target PCDDs								
2378-T4CDD	0.4	<0.3	0.7	1.9	<0.4	<0.2	<0.4 *	<0.3
TOTAL T4CDD	0.4	<0.3	0.7 (1)	1.9 (1)	<0.4	<0.2	<0.4	<0.3
12378-P5CDD	0.2	0.5	1.1	<0.2	<0.3	<0.1	0.5	<0.2
TOTAL P5CDD	0.2	0.5 (1)	1.1 (1)	<0.2	<0.3	<0.1	0.5 (1)	<0.2
123478-H6CDD	0.2	0.4	0.6	<0.2	<0.2	0.5	<0.2 *	0.5
123678-H6CDD	0.2	0.3	1.5	1.1	<0.2	0.8	<0.3 *	0.7
123789-H6CDD	0.3	1.0	<0.3	<0.3	<0.3	<0.2	<0.3	<0.3
TOTAL H6CDD	0.3	1.7 (3)	2.1 (2)	1.1 (1)	<0.3	1.3 (2)	<0.3	1.2 (2)
1234678-H7CDD	0.2	0.7	1.7	1.6	<0.2	2.1	<0.4 *	1.0
TOTAL H7CDD	0.2	0.7 (1)	1.7 (1)	1.6 (1)	<0.2	2.1 (1)	<0.4	1.2 (2)
O8CDD	0.2	2.7 (1)	7.6 (1)	4.1 (1)	1.2 (1)	5 (1)	1.6 (1)	3.2 (1)
TEQ (ppt)		0.7	2.4	3.7	0.1	0.3	0.6	0.2
Surrogate Recovery (%)								
C13-2378-T4CDF		73	62	49	64	75	75	74
C13-2378-T4CDD		81	57	54	64	77	68	73
C13-12378-P5CDF		95	62	61	72	73	71	72
C13-23478-P5CDF		92	59	58	73	78	72	76
C13-12378-P5CDD		102	57	66	74	81	67	80
C13-123478-H6CDF		99	68	68	78	66	80	80
C13-123678-H6CDF		76	65	48	71	60	78	76
C13-234678-H6CDF		88	68	57	78	81	86	85
C13-123789-H6CDF		74	66	41	72	80	81	73
C13-123478-H6CDD		114	67	70	80	91	80	84
C13-123678-H6CDD		75	63	50	74	79	80	80
C13-1234678-H7CDF		92	72	60	80	76	89	85
C13-1234789-H7CDF		102	71	65	79	82	90	83
C13-1234678-H7CDD		123	73	78	83	89	87	84
C13-O8CDD		128	70	74	84	89	84	86

* = NONE DETECTED BASED ON PEAK RATIO

Table 9A Sample Results for PCDD/PCDFs (pg/g)

Field ID: / Lab ID:	MDL	14-91 92-841	15-91 92-842	16-91 92-843	17-91 92-844	18-91 92-845	19-91 92-846
Target PCDFs							
2378-T4CDF	0.2	<0.3	<0.1	3.2	<0.2	2.6	<0.3
TOTAL T4CDF	0.2	<0.3	<0.1	3.2 (1)	<0.2	2.6 (1)	<0.3
12378-P5CDF	0.1	<0.2	<0.2	<0.1	<0.1	0.9	<0.1
23478-P5CDF	0.1	<0.2	<0.2	<0.1	0.7	4.5	<0.1
TOTAL P5CDF	0.1	<0.2	<0.2	<0.1	0.7 (1)	5.4 (2)	<0.1
123478-H6CDF	0.1	<0.2	0.3	<0.1	0.4	0.7	<0.1
123678-H6CDF	0.1	<0.2	0.2	0.2	0.3	0.6	<0.1
234678-H6CDF	0.1	<0.2	0.2	0.2	0.4	0.7	<0.1
123789-H6CDF	0.3	<0.3	0.5	<0.3 *	0.6	1.0	<0.2
TOTAL H6CDF	0.3	<0.3	1.2 (4)	0.4 (2)	1.7 (4)	3 (4)	<0.2
1234678-H7CDF	0.1	<0.1	0.3	<0.2	0.4	0.5	<0.1
1234789-H7CDF	0.2	<0.2	<0.1	<0.2	0.2	0.4	<0.2
TOTAL H7CDF	0.2	<0.2	0.3 (1)	<0.2	0.6 (2)	0.9 (2)	<0.2
O8CDF	0.3	<0.3	<0.3	<0.3	<0.2	0.6 (1)	<0.2
Target PCDDs							
2378-T4CDD	0.4	<0.4	<0.2	0.6	<0.2	2.3	<0.2
TOTAL T4CDD	0.4	<0.4	<0.2	0.6 (1)	<0.2	2.3 (1)	<0.2
12378-P5CDD	0.2	<0.2	<0.2	<0.4 *	1.0	1.5	<0.2
TOTAL P5CDD	0.2	<0.2	<0.2	<0.4	1 (1)	1.5 (1)	<0.2
123478-H6CDD	0.2	<0.2	0.3	<0.2	0.5	0.9	<0.2
123678-H6CDD	0.2	<0.2	<0.1	<0.2	1.6	1.8	<0.2
123789-H6CDD	0.3	<0.2	<0.1	<0.2	<0.2	0.7	<0.2
TOTAL H6CDD	0.3	<0.2	0.3 (1)	<0.2	2.1 (2)	3.4 (3)	<0.2
1234678-H7CDD	0.2	1.7	1.4	0.3	1.7	1.9	<0.3
TOTAL H7CDD	0.2	2.5 (2)	1.4 (1)	0.3 (1)	1.7 (1)	1.9 (1)	<0.3
O8CDD	0.2	11.1 (1)	3.2 (1)	1.2 (1)	6.9 (1)	5.6 (1)	<1.3
TEQ (ppt)		0.0	0.2	0.9	1.3	6.3	0.0
Surrogate Recovery (%)							
C13-2378-T4CDF		72	83	17	83	77	78
C13-2378-T4CDD		73	89	47	89	87	89
C13-12378-P5CDF		73	93	71	82	85	87
C13-23478-P5CDF		75	97	68	85	83	91
C13-12378-P5CDD		77	107	69	89	89	98
C13-123478-H6CDF		75	61	74	94	88	94
C13-123678-H6CDF		75	58	73	92	89	85
C13-234678-H6CDF		78	96	75	98	94	92
C13-123789-H6CDF		63	77	71	92	74	69
C13-123478-H6CDD		81	107	75	114	98	104
C13-123678-H6CDD		79	96	78	94	95	93
C13-1234678-H7CDF		74	86	79	101	95	96
C13-1234789-H7CDF		71	95	78	102	95	91
C13-1234678-H7CDD		88	105	80	110	104	105
C13-O8CDD		88	108	77	112	103	99

* = NONE DETECTED BASED ON PEAK RATIO

Table 9B Sample Results for PCDD/PCDFs (pg/g)

Field ID:		1-92	2-92	3-92	4-92	5-92	6-92	7-92
Lab ID:	MDL	93-251	93-252	93-253	93-254	93-255	93-256	93-257
Target PCDFs								
2378-T4CDF	0.4	<0.4	2.0	<0.3	<5.4*	1.4	<1.3	<2.5
TOTAL T4CDF	0.4	1.9 (1)	15.1 (4)	23.0 (3)	9.3 (1)	1.4 (1)	8.5 (1)	7.2 (1)
12378-P5CDF	0.2	<3.6*	<0.7 E	<8.5 E	<1.9	0.3	<4.6 E	<12.3* E
23478-P5CDF	0.2	1.5	<0.8	<0.3	<3.3	1.1	<3.1*	7.6
TOTAL P5CDF	0.2	1.5 (1)	17.3 (1)	15.4 (2)	11.9 (2)	2.0 (3)	9.8 (1)	18.2 (2)
123478-H6CDF	0.2	1.3	2.7	2.2	2.2	0.3	3.9	<12.9 E
123678-H6CDF	0.2	1.7	<0.4*	<0.3	1.4	<0.2*	1.9	7.8
234678-H6CDF	0.2	1.4	<1.0*	<0.4	<1.2	<0.3*	1.8	9.6
123789-H6CDF	0.6	<2.9 E	3.1	<2.2*	<2.4*	0.3	<4.0 E	<11.5 E
TOTAL H6CDF	0.6	4.4 (3)	7.3 (3)	4.1 (2)	3.6 (2)	0.9 (3)	7.6 (3)	17.4 (2)
1234678-H7CDF	0.2	2.5	1.4	<0.2	<6.0	0.8	<3.9*	23.2
1234789-H7CDF	0.4	<0.7	<1.5	<0.2	<7.8	<0.3	<4.7	<9.6*
TOTAL H7CDF	0.4	2.5 (1)	1.4 (1)	<0.2	<7.8	0.8 (1)	<4.7	23.2 (1)
O8CDF	0.6	26.9 (1)	36.6 (1)	16.5 (1)	20.8 (1)	54.0 (1)	30.7 (1)	70.1 (1)
Target PCDDs								
2378-T4CDD	0.8	<0.4	<0.9	<1.2*	<0.8	0.6	<0.7	3.6
TOTAL T4CDD	0.8	<0.4	<0.9	7.2 (2)	<0.8	0.6 (1)	<0.7	3.6 (1)
12378-P5CDD	0.4	<0.5	<0.8	<0.7	<1.7	<0.7*	<0.6	<1.0
TOTAL P5CDD	0.4	<0.5	<0.8	<0.7	<1.7	<0.7	<0.6	<1.0
123478-H6CDD	0.4	<1.5*	<0.9	<0.6	<1.5	<0.4*	<1.3	7.5
123678-H6CDD	0.4	1.1	<0.7	<0.6	<1.2	0.6	2.3	8.6
123789-H6CDD	0.6	1.8	<0.7	<0.6	<1.2	0.4	<1.4*	8.2
TOTAL H6CDD	0.6	2.9 (2)	5.4 (2)	31.5 (2)	<1.5	1.0 (2)	3.6 (2)	24.3 (3)
1234678-H7CDD	0.4	<0.5	<1.8	1.9	<2.2	1.3	<5.9	16.2
TOTAL H7CDD	0.4	<0.5	<1.8	1.9 (1)	<2.2	2.1 (2)	<5.9	16.2 (1)
O8CDD	0.4	7.6 (1)	65.1 (1)	9.5 (1)	<12.8*	151 (1)	32.1 (1)	104 (1)
TEQ (ppt)		1.56	0.89	0.26	0.38	1.67	1.06	12.17
Surrogate Recovery (%)								
C13-2378-T4CDF		75	79	70	41	90	64	73
C13-2378-T4CDD		90	104	84	59	116	90	107
C13-12378-P5CDF		79	92	72	45	102	78	81
C13-23478-P5CDF		81	87	76	49	106	77	82
C13-12378-P5CDD		88	81	79	46	104	90	87
C13-123478-H6CDF		85	89	79	49	102	73	85
C13-123678-H6CDF		86	94	77	50	97	71	83
C13-234678-H6CDF		90	88	75	48	101	77	86
C13-123789-H6CDF		92	98	79	56	102	78	86
C13-123478-H6CDD		91	73	88	46	100	73	92
C13-123678-H6CDD		86	90	75	52	99	73	85
C13-1234678-H7CDF		86	85	78	54	89	65	86
C13-1234789-H7CDF		94	91	89	52	95	77	90
C13-1234678-H7CDD		117	113	102	75	100	96	119
C13-O8CDD		90	86	70	43	74	49	134

* = NONE DETECTED BASED ON PEAK RATIO
E = DIPHENYL ETHER INTERFERENCES
() = TOTAL ISOMERS

Table 9B Sample Results for PCDD/PCDFs (pg/g)

Field ID:		8-92	9-92	10-92	11-92	12-92	13-92	14-92
Lab ID:	MDL	93-258	93-259	93-260	93-261	93-262	93-263	93-264
Target PCDFs								
2378-T4CDF	0.4	0.2	<0.8	<0.9	<0.8	<1.1	<1.4	<9.6
TOTAL T4CDF	0.4	0.2 (1)	31.1 (2)	18.2 (2)	<0.8	7.4 (2)	23.0 (2)	62.0 (2)
12378-P5CDF	0.2	<0.1	<6.0 E	<5.2 E	<1.4*	<1.7 E	<3.4 E	<6.8
23478-P5CDF	0.2	<0.1	<0.5	<1.4	<0.5	<1.3*	<2.1	<7.7
TOTAL P5CDF	0.2	<0.1	5.2 (1)	16.1 (2)	<1.4	6.9 (2)	14.7 (2)	<7.7
123478-H6CDF	0.2	<0.1	<5.0 E	3.7	0.8	<1.2	2.7	10.0
123678-H6CDF	0.2	0.2	<3.2 E	2.2	<0.4	<0.7	2.2	8.1
234678-H6CDF	0.2	0.2	<0.4	<0.9	<0.5	<1.9	<0.8	<9.0*
123789-H6CDF	0.6	0.3	<7.2 E	<6.4 E	1.4	<1.1	<4.4	9.5
TOTAL H6CDF	0.6	0.7 (3)	<7.2	10.1 (3)	2.2 (2)	<1.9	4.9 (2)	32.9 (4)
1234678-H7CDF	0.2	<0.2	<3.7	<3.4	<1.0	<2.9	<3.0	19.6
1234789-H7CDF	0.4	<0.3	<5.1	<3.8	<1.8	<3.1	<4.1	<4.7
TOTAL H7CDF	0.4	<0.3	<5.1	<3.8	<1.8	<3.1	<4.1	19.6 (1)
O8CDF	0.6	0.9 (1)	17.7 (1)	57.5 (1)	20.8 (1)	19.0 (1)	27.1 (1)	92.2 (1)
Target PCDDs								
2378-T4CDD	0.8	<0.1	2.8	<0.8	<0.6	<0.9	<0.6	<5.6
TOTAL T4CDD	0.8	<0.1	2.8 (1)	<0.8	<0.6	<0.9	<0.6	<5.6
12378-P5CDD	0.4	0.3	<3.2*	<0.9	<0.5	<1.1	<1.1	<1.9
TOTAL P5CDD	0.4	0.3 (1)	<3.2	<0.9	<0.5	<1.1	<1.1	<1.9
123478-H6CDD	0.4	<0.2	<1.7*	<1.1	<0.6	<2.1	<1.3	5.7
123678-H6CDD	0.4	<0.2	2.0	<1.5*	<0.5	<1.2	2.2	7.4
123789-H6CDD	0.6	<0.2	1.6	<1.7*	<0.5	<1.2	<1.3	10.3
TOTAL H6CDD	0.6	<0.2	12.2 (4)	<1.7	<0.6	<2.1	2.2 (1)	40.8 (4)
1234678-H7CDD	0.4	<0.2	<2.8	<2.9	<1.8	<1.6	<7.0*	<14.6*
TOTAL H7CDD	0.4	<0.2	<2.8	<2.9	<1.8	<1.6	<7.0	<14.6
O8CDD	0.4	2.5 (1)	7.5 (1)	14.1 (1)	3.7 (1)	5.2 (1)	48.6 (1)	54.5 (1)
TEQ (ppt)		0.21	3.22	0.66	0.25	0.02	0.78	5.44
Surrogate Recovery (%)								
C13-2378-T4CDF		88	51	49	72	81	63	47
C13-2378-T4CDD		109	67	69	99	111	87	68
C13-12378-P5CDF		97	59	55	81	93	68	57
C13-23478-P5CDF		100	59	57	89	96	76	50
C13-12378-P5CDD		100	64	60	78	93	74	61
C13-123478-H6CDF		97	66	61	85	88	75	58
C13-123678-H6CDF		99	62	59	83	124	70	53
C13-234678-H6CDF		98	62	57	83	74	74	54
C13-123789-H6CDF		99	66	60	90	120	74	60
C13-123478-H6CDD		101	67	65	88	65	76	58
C13-123678-H6CDD		96	67	61	89	101	73	57
C13-1234678-H7CDF		92	58	57	82	123	62	59
C13-1234789-H7CDF		92	64	64	94	141	70	65
C13-1234678-H7CDD		98	73	81	107	167	84	91
C13-O8CDD		73	44	47	71	108	46	61

* = NONE DETECTED BASED ON PEAK RATIO
E = DIPHENYL ETHER INTERFERENCES
() = TOTAL ISOMERS

Table 9B Sample Results for PCDD/PCDFs (pg/g)

Field ID:		15-89	16-89	17-93
Lab ID:	MDL	93-265	93-266	93-267
Target PCDFs				
2378-T4CDF	0.4	<1.4	<1.7	<3.7
TOTAL T4CDF	0.4	10.0 (2)	5.9 (1)	14.2 (2)
12378-P5CDF	0.2	<10.0	<3.4	<5.5
23478-P5CDF	0.2	<9.5	<3.0	<5.6
TOTAL P5CDF	0.2	<10.0	<3.4	<5.6
123478-H6CDF	0.2	5.5	4.5	<4.3 E
123678-H6CDF	0.2	3.4	2.2	<0.4
234678-H6CDF	0.2	5.0	<1.7	1.1
123789-H6CDF	0.6	2.4	3.7	2.5
TOTAL H6CDF	0.6	26.0(6)	12.7 (4)	3.6 (2)
1234678-H7CDF	0.2	13.5	<5.2	<1.7
1234789-H7CDF	0.4	<3.2	<6.0	<2.3
TOTAL H7CDF	0.4	13.5 (1)	<6.0	<2.3
O8CDF	0.6	31.5 (1)	27.3 (1)	37.9 (1)
Target PCDDs				
2378-T4CDD	0.8	<0.9	<3.5	<1.6
TOTAL T4CDD	0.8	<0.9	<3.5	<1.6
12378-P5CDD	0.4	<0.7	<2.8	<0.8
TOTAL P5CDD	0.4	<0.7	<2.8	<0.8
123478-H6CDD	0.4	<1.1*	<0.9	<1.5
123678-H6CDD	0.4	1.9	<0.8	<1.1
123789-H6CDD	0.6	1.7	<0.9	<1.2
TOTAL H6CDD	0.6	9.1 (3)	22.4 (2)	23.5 (2)
1234678-H7CDD	0.4	<3.8	<6.0	<8.9
TOTAL H7CDD	0.4	<3.8	<6.0	<8.9
O8CDD	0.4	15.6 (1)	<9.1	7.7 (1)
TEQ (ppt)		2.17	1.07	0.40
Surrogate Recovery (%)				
C13-2378-T4CDF		70	44	88
C13-2378-T4CDD		92	74	112
C13-12378-P5CDF		79	48	111
C13-23478-P5CDF		84	53	110
C13-12378-P5CDD		89	60	118
C13-123478-H6CDF		91	48	113
C13-123678-H6CDF		85	51	116
C13-234678-H6CDF		84	52	127
C13-123789-H6CDF		88	56	141
C13-123478-H6CDD		90	57	104
C13-123678-H6CDD		84	54	119
C13-1234678-H7CDF		84	46	132
C13-1234789-H7CDF		93	50	137
C13-1234678-H7CDD		106	72	152
C13-O8CDD		69	43	98

* = NONE DETECTED BASED ON PEAK RATIO
E = DIPHENYL ETHER INTERFERENCES
() = TOTAL ISOMERS

4 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Method Validation

The methodology described in Section 2 was validated prior to analysis of the fish by two different procedures. First, a set of four method spikes (without matrix) from the first set of analyses and one from the second set of analyses were performed for all target analytes in order to determine optimal extraction and clean-up protocols and instrumental performance. Secondly, the analysis of Standard Reference Material 1974 (*Mytilus edulis*) was performed for a select group of PCBs, pesticides, metals and PAHs. The results from this validation are presented and discussed in Appendix B and verify that the methodology used for this study was appropriate.

4.2 Blanks

Laboratory blank results are summarized in Table 10A and Table 10B (Metals), Table 11A and Table 11B (VOCs), Table 12A and Table 12B (Semi-Volatiles Organics), Table 13A and Table 13B (Pesticides), Table 14A and Table 14B (PCBs) and Table 15A and Table 15B (PCDDs/PCDFs). (Please note, all Tables referred to in the following sections are located at the end of this chapter.) The blank data indicates that no laboratory interferences were present for the analyses of trace metals, chlorinated pesticides and PCBs. However, interferences of laboratory origin were indicated by the blanks for VOCs, PCDDs/PCDFs and semi-volatiles. These are discussed in the following sections.

4.2.1 Volatile Organic Interferences

Methylene chloride, 1,1,1-trichloroethane, 1,2-dichloroethane, benzene and toluene were detected in the laboratory blanks. Methylene chloride and toluene are routinely used solvents at the Eco Logic laboratory, and although efforts are made to isolate volatile analysis preparation from laboratory solvent areas, trace interferences from these solvents persist. Breakdown of the Tenax trap material (2,6-diphenylene oxide polymer) in the purge and trap sampler contributes to background levels of benzene and toluene. This adsorbent was chosen based on the recommendation of US EPA Method 8240 and is required for the efficient trapping of the

heavier volatile compounds (eg., compounds with boiling temperatures greater than 35°C). The source of 1,1,1-trichloroethane and 1,2-dichloroethane in the blank is presently under investigation. Note, however, that the levels of toluene, benzene, 1,1,1-trichloroethane and 1,2-dichloroethane detected in the blanks were well below the practical quantitation limits set for these compounds in solids in US EPA Method 8240 (5 ng/g).

4.2.2 Semi-Volatile Organic Interferences

Di-n-butylphthalate, bis(2-ethylhexyl)phthalate and di-n-octylphthalate were detected in laboratory blanks at levels of 20-120 ng/mL. Low level sample results for these three compounds should be considered as anomalous and likely related to the hand protection worn by laboratory personnel.

4.2.3 PCDD and PCDF Interferences

The analysis of 5 laboratory blanks for the first set of set of samples and 3 for the second set indicated the absence of the toxicologically more potent tetra- and penta- chlorinated dioxins and furans. However, the blanks indicated a background of low level interferences by hexa-, hepta-, and octachlorinated dioxins and furans near the method detection limit. The higher chlorinated congeners are more ubiquitous in the environment and adsorb more readily to laboratory materials (making complete removal on washing and solvent rinsing difficult). They are thus more difficult to eliminate from the sample background. Measures are currently being taken to further reduce laboratory interferences. The levels of contamination in the blanks were all relatively low with no blank exceeding a total TEQ level of 0.65.

4.3 Surrogates

Surrogate recovery results are presented with the data in Section 3. Fish samples were spiked with surrogate compounds prior to purging or extraction to estimate recoveries of analytes throughout all phases of the procedure. Surrogate recovery control limits were calculated for all fish samples analysed and are summarized in Table 16. These control limits show the mean recovery plus or minus 3 standard deviations, as described in EPA Methods 8240 and 8270.

In some cases the calculated limits were modified to more realistically reflect an acceptable surrogate recovery. This laboratory has established (based on practical experience) a lower limit for surrogate recovery at 20% and an upper limit at 140%. This modified control limit is represented as the designated control limit. In cases where changes were made to the limits, the modified limit is more conservative. Surrogate recoveries were very generally acceptaple.

The surrogate recoveries for the analysis of organochlorine pesticides and PCBs were excellent. The recovery values fell well within the designated control limits. The surrogate recoveries for the acid semi-volatiles (2-fluorophenol and phenol-d_6) were low overall. The calculated control limits for these surrogates were below what could be considered analytically reasonable, and were therefore adjusted such that the minimum designated control limit recovery was 20%. In the first lot of fish analyses 70% (14 of 20) of the 2-fluorophenol recoveries fell below this limit. However, 2-fluorophenol showed no recovery at all in the second set of analyses due to co-elution with the solvent. In both sets of analyses, the recovery of phenol-d_6 was more consistent with only 35% (13 of 37) of the recovery values falling below 20%. This data indicates that the results for lower molecular weight acid semi-volatile target analytes should be interpreted with caution. Recovery problems were not encountered with the heavier acid surrogate 2,4,6-tribromophenol or the base-neutrals (nitrobenzene-d_5, 2-fluorobiphenyl and terphenyl-d_{14}), as the recoveries for these compounds were well within the designated control limits.

The surrogate 2-fluorophenol was recovered in Sample 3-91 at 54% which is somewhat higher than typical, and outside the predetermined limits. The recovery of phenol-d_6 in this sample was unusually high at 94%. Recalculation and reinspection of the sample, surrogates and data did not reveal a reason for the higher recoveries of these surrogates, and recoveries of the remaining four surrogates were well within normal parameters. Recovery of the internal standard perylene-d_{12}, which was used to quantitate di-n-octylphthalate (but not bis(2-ethylhexyl)phthalate, 2-fluorophenol, or phenol-d_6) had a lower recovery, which may indicate a matrix effect for this sample, but does not appear to have affected the related surrogates. However, it is recommended that the results from this sample be interpreted with caution.

Surrogate recoveries from the first set of VOC analyses indicated a problem with trichlorofluoromethane and ethylbenzene-d_{10} as evidenced by very wide range of recoveries. It

was not possible to establish realistic designated control limits for these surrogates because of matrix interferences. benzene-d_6 recoveries were good and fell within the designated control limits. The second set of fish analyses were performed using the surrogates benzene-d_6, fluorobenzene and d_8-toluene. Only 13% (2 of 15) of the samples showed recovery values exceeding the upper control limit for benzene-d_6. All the recovery values for fluorobenzene and toluene-d_8 were within the designated control limits.

The surrogate recovery values for PCDDs and PCDFs were very good overall. The recovery for ^{13}C-2,3,7,8-T_4CDF was estimated to fall below the designated value for only one sample (16-91). The recovery values for ^{13}C-1,2,3,7,8,9-H_6CDF, ^{13}C-1,2,3,4,7,8,9-H_7CDF and ^{13}C-1,2,3,4,6,7,8-H_7CDD only marginally exceeded the designated levels for the samples 17-93, 12-92 and 12-92, respectively. Surrogate recoveries for samples 5-92, 8-92, and the series duplicate were unacceptable as indicated in Section 3.7. These samples are undergoing re-analysis.

4.4 Matrix Spikes

The purpose of analysing matrix spikes and matrix spike duplicates is to determine the matrix effect on analyte recovery and to establish the reproducibility of the method. A matrix spike is prepared by spiking a sample with known amounts of representative analytes from each analyte group. The compounds spiked and the recovery control limits established by the US EPA for these compounds in matrix are summarized in Table 17. The reproducibility is reflected in the value of the relative percent difference, which is calculated according to Equation (5). One matrix spike and one matrix spike duplicate were analysed for the first and second lot of fish samples. The results are presented in Table 18A and Table 18B (Metals), Table 19A and Table 19B (VOCs), Table 20A and Table 20B (Semi-volatiles), Table 21A and Table 21B (Pesticides), Table 22A and Table 22B (PCBs) and Table 23A and Table 23B (PCDDs/PCDFs). The results for all matrix spikes and matrix spike duplicates are not recovery corrected.

$$RPD = \frac{(X_m - X_{md})}{(X_m + X_{md})/2} \times 100 \qquad (5)$$

where:

RPD = relative percent difference

X_m = % recovery of analyte from matrix spike

X_{md} = % recovery of analyte from matrix spike duplicate

The recoveries and reproducibilities for the VOCs did not indicate any major analytical problems. The matrix spikes from the first data set showed only slightly lower recoveries of toluene and trichloroethene compared to the designated recovery limits (DRL) established by the EPA. The relative percent difference (RPD) for trichloroethene was marginally higher than predicted. In the second lot of fish analyses the recoveries of 1,1-dichloroethene in both the matrix spike and matrix spike duplicate were consistently lower than expected.

In the first set of analyses the RPD for the semi-volatile phenol was estimated at 65% and well above the control limit of 35%. In the second set of analyses 4-chloro-3-methylphenol and pentachlorophenol exceeded their DRL's. However, given the inherent difficulty of EPA Method 8270 in analysing phenolic compounds, matrix spike reanalysis for these compounds is not considered necessary. The RPD of 1,4-dichlorobenzene from the first set of analyses was only slightly elevated at 27% compared to the limit of 29%. In the second set of analyses 1,2,4-trichlorobenzene, acenaphthene and pentachlorophenol exceeded their RPD's at 25%, 27% and 70%, respectively.

The pesticide matrix spike recovery results indicated that only the compound γ-BHC was found slightly outside the DRL in one spike. Otherwise, these compounds showed excellent recovery data. Control limits were not set for the metal, PCB or PCDD/PCDF matrix spikes. However in reviewing the data, it is evident that the recoveries and relative percent differences are well within accepted analytical parameters, with the exception of O_8CDF and O_8CDD. Based on the observed recovery, there appears to be an interference for O_8CDF in the matrix duplicate from the first set of analyses and O_8CDD in the duplicate in the second set of analyses. These interferences do not appear in both samples, but suggest that sample values of O_8CDF and O_8CDD should be interpreted with caution.

4.5 Duplicate Analyses

Two samples from the first twenty fish samples were analysed in duplicate to provide an indication of method reproducibility and sample homogeneity. The results are presented in Table 24A and Table 24B (metals), Table 25A and Table 25B (VOCs), Table 26A and Table 26B (semi-volatiles), Table 27A and Table 27B (pesticides), Table 28A and Table 28B (PCBs) and Table 29A and Table 29B (PCDDs/PCDFs). The reproducibility is reflected in the value of the relative percent difference, which is calculated according to Equation (6).

$$RPD = \frac{(X_1 - X_2)}{(X_1 + X_2)/2} \times 100 \qquad (6)$$

where:

RPD = relative percent difference

X_1 = concentration in sample

X_2 = concentration in sample duplicate

The reproducibility indicated by the duplicate analyses for organic analytes was excellent in all cases, with relative percents differences as low as undetectable and no greater than 150%. As expected with inorganic analyses, the duplicate analysis results were also very good, with relative percent differences ranging from 0% to 40%.

Table 10A Blank Results for Metals (μg/g)

Lab ID:	MDL	Blank #1	Blank #2
Target Metals			
As	0.1	<0.1	<0.1
Se	0.05	<0.05	<0.05
Sb	0.01	<0.01	<0.01
Hg	0.005	<0.005	<0.005
Total CN	0.05	<0.05	<0.05
Be	0.005	<0.005	<0.005
Cd	0.05	<0.05	<0.05
Cr	0.1	<0.1	<0.1
Pb	0.5	<0.5	<0.5
Ni	0.1	<0.1	<0.1
Ag	0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1

Table 10B Blank Results for Metals Analyses (μg/g)

Lab ID:	MDL	Blank #1	Blank #2
Target Metals			
As	0.1	<0.1	<0.1
Se	0.05	<0.05	<0.05
Sb	0.01	<0.05	<0.05
Hg	0.005	<0.005	<0.005
Total CN	0.05	<0.05	<0.05
Be	0.005	<0.005	<0.005
Cd	0.05	<0.05	<0.05
Cr	0.1	<0.1	<0.1
Pb	0.5	<0.5	<0.5
Ni	0.1	<0.5	<0.5
Ag	0.05	<0.05	<0.05
Tl	0.1	<0.1	<0.1

Table 11A Blank Results for VOCs (ng/g)

Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4
Target Volatiles					
1,1-Dichloroethene	0.4	<0.4	0.76	<0.4	<0.4
Methylene Chloride	0.2	3.2	2.0	2.9	3.0
Trans-1,2-Dichloroethene	0.4	<0.4	<0.4	<0.4	<0.4
1,1-Dichloroethane	0.2	<0.2	<0.2	<0.2	<0.2
Chloroform	0.2	<0.2	<0.2	<0.2	<0.2
1,1,1,Trichloroethane	0.4	0.72	0.66	0.46	<0.4
Carbon Tetrachloride	0.8	<0.8	<0.8	<0.8	<0.8
1,2-Dichloroethane	0.6	<0.6	<0.6	<0.6	<0.6
Benzene	0.2	1.1	0.68	1.4	1.3
Trichloroethene	1	<1	<1	<1	<1
1,2-Dichloropropane	0.8	<0.8	<0.8	<0.8	<0.8
Bromodichloromethane	0.6	<0.6	<0.6	<0.6	<0.6
Cis-1,3-Dichloropropene	0.6	<0.6	<0.6	<0.6	<0.6
Toluene	0.2	1.5	2.2	2.1	3.9
Trans-1,3-Dichloropropene	0.6	<0.6	<0.6	<0.6	<0.6
1,1,2-Trichloroethane	2	<2	<2	<2	<2
Tetrachloroethene	6	<6	<6	<6	<6
Dibromochloromethane	4	<4	<4	<4	<4
Chlorobenzene	2	<2	<2	<2	<2
Ethyl benzene	1	<1	<1	<1	<1
m,p-Xylene	0.6	<0.6	<0.6	<0.6	<0.6
o-Xylene	1	<1	<1	<1	<1
Bromoform	10	<10	<10	<10	<10
1,1,2,2-Tetrachloroethane	6	<6	<6	<6	<6
Surrogate Recovery (%)					
Trichlorofluoromethane		55	86	92	90
Benzene-d6		98	77	100	100
Ethylbenzene-d10		100	100	100	100

Table 11B Blank Results for VOC Analyses (ng/g)

Lab ID:	MDL	Blank #1	Blank #2
Target Volatiles			
1,1-Dichloroethene	0.2	<0.2	<0.2
Methylene Chloride	0.2	1.5	2
Trans-1,2-Dichloroethene	0.2	<0.2	<0.2
1,1-Dichloroethane	0.2	<0.2	<0.2
Chloroform	0.2	<0.2	<0.2
1,1,1,Trichloroethane	0.2	0.4	0.57
Carbon Tetrachloride	0.2	<0.2	<0.2
1,2-Dichloroethane	0.2	0.4	0.4
Benzene	0.2	0.3	0.4
Trichloroethene	0.2	<0.2	<0.2
1,2-Dichloropropane	0.2	<0.2	<0.2
Bromodichloromethane	0.2	<0.2	<0.2
Cis-1,3-Dichloropropene	0.2	<0.2	<0.2
Toluene	0.2	1.5	1.9
Trans-1,3-Dichloropropene	0.2	<0.2	<0.2
1,1,2-Trichloroethane	0.2	<0.2	<0.2
Tetrachloroethene	0.2	<0.2	<0.2
Dibromochloromethane	0.2	<0.2	<0.2
Chlorobenzene	0.2	<0.2	<0.2
Ethyl benzene	0.2	<0.2	<0.2
m,p-Xylene	0.2	<0.2	<0.2
o-Xylene	0.2	<0.2	<0.2
Bromoform	0.2	<0.2	<0.2
1,1,2,2-Tetrachloroethane	0.2	<0.2	<0.2
Surrogate Recovery (%)			
d6-Benzene		100	110
Flourobenzene		99	99
d8-Toluene		89	84

Table 12A Blank Results for Semi-Volatiles (ng/g)

Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4
Target Semi-Volatiles					
N-Nitrosodimethylamine	10	<10	<10	<10	<10
Phenol	10	<10	<10	<10	<10
bis(2-Chloroethyl)ether	3	<3	<3	<3	<3
2-Chlorophenol	5	<5	<5	<5	<5
1,3-Dichlorobenzene	2	<2	<2	<2	<2
1,4-Dichlorobenzene	2	<2	<2	<2	<2
1,2-Dichlorobenzene	2	<2	<2	<2	<2
bis(2-Chloroisopropyl)ether	10	<10	<10	<10	<10
N-Nitroso-Di-n-propylamine	30	<30	<30	<30	<30
Hexachloroethane	10	<10	<10	<10	<10
Nitrobenzene	8	<8	<8	<8	<8
Isophorone	1	<1	<1	<1	<1
2-Nitrophenol	4	<4	<4	<4	<4
2,4-Dimethylphenol	3	<3	<3	<3	<3
bis(2-Chloroethoxy)methane	2	<2	<2	<2	<2
2,4-Dichlorophenol	9	<9	<9	<9	<9
1,2,4-Trichlorobenzene	2	<2	<2	<2	<2
Naphthalene	1	<1	<1	<1	<1
Hexachlorobutadiene	4	<4	<4	<4	<4
4-Chloro-3-methylphenol	10	<10	<10	<10	<10
Hexachlorocyclopentadiene	10	<10	<10	<10	<10
2,4,6-Trichlorophenol	4	<4	<4	<4	<4
2-Chloronaphthalene	1	<1	<1	<1	<1
Dimethylphthalate	2	<2	<2	<2	<2
Acenaphthylene	0.9	<0.9	<0.9	<0.9	<0.9
2,6-Dinitrotoluene	6	<6	<6	<6	<6
Acenaphthene	2	<2	<2	<2	<2
2,4-Dinitrophenol	9	<9	<9	<9	<9
4-Nitrophenol	20	<20	<20	<20	<20
2,4-Dinitrotoluene	8	<8	<8	<8	<8
Diethylphthalate	1	<1	<1	<1	<1
4-Chlorophenyl-phenylether	2	<2	<2	<2	<2
Fluorene	2	<2	<2	<2	<2
4,6-Dinitro-2-methylphenol	10	<10	<10	<10	<10
N-Nitrosodiphenylamine	10	<10	<10	<10	<10
4-Bromophenyl-phenylether	5	<5	<5	<5	<5
Hexachlorobenzene	4	<4	<4	<4	<4
Pentachlorophenol	9	<9	<9	<9	<9
Phenanthrene	4	<4	<4	<4	<4
Anthracene	4	<4	<4	<4	<4
Di-n-butylphthalate	5	28	20	21	20
Fluoranthene	2	<2	<2	<2	<2
Benzidine	6	<6	<6	<6	<6
Pyrene	3	<3	<3	<3	<3
Butylbenzylphthalate	200	<200	<200	<200	<200
3,3'-Dichlorobenzidine	20	<20	<20	<20	<20
Benzo(a)anthracene	5	<5	<5	<5	<5
Chrysene	5	<5	<5	<5	<5
bis(2-Ethylhexyl)phthalate	9	51	28	26	18
Di-n-octylphthalate	40	<40	<40	<40	<40
Benzo(b)fluoranthene	3	<3	<3	<3	<3
Benzo(k)fluoranthene	3	<3	<3	<3	<3
Benzo(a)pyrene	2	<2	<2	<2	<2
Indeno(1,2,3-cd)pyrene	5	<5	<5	<5	<5
Dibenz(a,h)anthracene	2	<2	<2	<2	<2
Benzo(g,h,i)perylene	5	<5	<5	<5	<5
Surrogate Recovery (%)					
2-Fluorophenol		3.2	6.5	5.9	8.4
Phenol-d6		11	22	19	20
2,4,6-Tribromophenol		43	45	39	35
Nitrobenzene-d5		34	42	38	45
2-Fluorobiphenyl		56	62	54	57
Terphenyl-d14		120	75	110	82

Table 12B Blank Results for Semi-Volatiles (ng/g)

Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4	Blank #5
Target Semi-Volatiles						
2-Chlorophenol	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Bis(2-chloroethyl)ether	1	<1	<1	<1	<1	<1
Phenol	1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,4-dichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,2-dichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-chloroisopropyl)ether	4	<4	<4	<4	<4	<4
Hexachloroethane	2	<2	<2	<2	<2	<2
N-Nitrosodi-n-propyl amine	4	<4	<4	<4	<4	<4
Nitrobenzene	1	<1	<1	<1	<1	<1
Isophorone	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
2-Nitrophenol	1	<1	<1	<1	<1	<1
2,4-Dimethylphenol	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Bis(2-chloroethoxy)methane	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-Dichlorophenol	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
1,2,4-Trichlorobenzene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Naphthalene	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
4-Chloro-3-methylphenol	2	<2	<2	<2	<2	<2
Hexachlorocyclopentadiene	0.9	<0.9	<0.9	<0.9	<0.9	<0.9
2,4,6-Trichlorophenol	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
2-Chloronaphthalene	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Dimethylphthalate	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2,6-Dinitrotoluene	1	<1	<1	<1	<1	<1
Acenaphthene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrophenol	PC	PC	PC	PC	PC	PC
2,4-Dinitrotoluene	1	<1	<1	<1	<1	<1
4-Nitrophenol	3	<3	<3	<3	<3	<3
Fluorene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
4-chlorophenyl phenyl ether	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Diethylphthalate	1	<1	<1	<1	<1	<1
4,6-Dinitro-2-methylphenol	4	<4	<4	<4	<4	<4
N-Nitrosodiphenylamine	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-bromophenyl phenyl ether	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Hexachlorobenzene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	4	<4	<4	<4	<4	<4
Phenanthrene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Anthracene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Di-n-Butylphthalate	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Fluoranthene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Pyrene	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Benzidine	2	<2	<2	<2	<2	<2
Butylbenzylphthalate	1	<1	<1	<1	<1	<1
Benzo[a]anthracene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chrysene	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
3,3'-Dichlorobenzidine	2	<2	<2	<2	<2	<2
Bis(2-ethylhexyl)phthalate	1	<1	<1	<1	39	120
Di-n-octylphthalate	6	79	<6	<6	<6	59
Benzo[b]fluoranthene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo[k]fluoranthene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo[a]pyrene	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Indeno(1,2,3-c,d)pyrene	800	<800	<800	<800	<800	<800
Dibenzo[a,h]anthracene	1	<1	<1	<1	<1	<1
Benzo[g,h,k]perylene	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate Recovery (%)						
2-Fluorophenol		IF	IF	IF	IF	IF
Phenol-d6		15	2	3	2	14
2,4,6-Tribromophenol		28	22	29	20	24
Nitrobenzene-d5		36	16	24	20	74
2-Fluorobiphenyl		52	40	40	36	98
Terphenyl-d14		64	56	64	52	120

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

Table 13A Blank Results for Chlorinated Pesticides (ng/g)

Lab ID:	MDL	Blank 1	Blank 2	Blank 3	Blank 4
Target Pesticides					
a-BHC	0.6	<.6	<.6	<.6	<.6
b-BHC	1	<1	<1	<1	<1
g-BHC	0.3	<.3	<.3	<.3	<.3
d-BHC	0.9	<.9	<.9	<.9	<.9
Heptachlor	0.3	<.3	<.3	<.3	<.3
Aldrin	0.5	<.5	<.5	<.5	<.5
Heptachlor Epoxide	0.5	<.5	<.5	<.5	<.5
a-Endosulphan	0.5	<.5	<.5	<.5	<.5
Dieldrin	0.5	<.5	<.5	<.5	<.5
pp'-DDE	0.5	<.5	<.5	<.5	<.5
Endrin	0.5	<.5	<.5	<.5	<.5
b-Endosulphan	0.5	<.5	<.5	<.5	<.5
pp'-DDD	0.9	<.9	<.9	<.9	<.9
Endrin Aldehyde	1	<1	<1	<1	<1
Endosulfan Sulfate	1	<1	<1	<1	<1
pp'-DDT	1	<1	<1	<1	<1
Methoxychlor	2	<2	<2	<2	<2
g-chlordane	1	<1	<1	<1	<1
a-chlordane	1	<1	<1	<1	<1
Surrogate Recovery (%)					
Tetrachloro-m-xylene		36	40	39	45
PCB 209		126	110	125	133

Table 13B Blank Results for Chlorinated Pesticide Analyses (ng/g)

Lab ID:	MDL	Blank 1	Blank 2	Blank 3	Blank 4	Blank 5
Target Pesticides						
a-BHC	1	<1	<1	<1	<1	<1
b-BHC	2	<2	<2	<2	<2	<2
g-BHC	1	<1	<1	<1	<1	<1
d-BHC	1	<1	<1	<1	<1	<1
Heptachlor	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Aldrin	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Heptachlor Epoxide	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
a-Endosulphan	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Dieldrin	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
pp'-DDE	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Endrin	1	<1	<1	<1	<1	<1
b-Endosulphan	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
pp'-DDD	1	<1	<1	<1	<1	<1
Endrin Aldehyde	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Endosulfan Sulfate	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
pp'-DDT	1	<1	<1	<1	<1	<1
Methoxychlor	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
g-chlordane	1	<1	<1	<1	<1	<1
a-chlordane	1	<1	<1	<1	<1	<1
Surrogate Recovery (%)						
Tetrachloro-m-xylene		53	78	43	37	35
PCB 209		80	78	91	78	49

Table 14A Blank Results for PCBs (ng/g)

Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4
Target PCBs					
PCB 1	0.8	<0.8	<0.8	<0.8	<0.8
PCB 3	0.8	<0.8	<0.8	<0.8	<0.8
PCB 4,10	0.2	<0.2	<0.2	<0.2	<0.2
PCB 7	0.2	<0.2	<0.2	<0.2	<0.2
PCB 6	0.3	<0.3	<0.3	<0.3	<0.3
PCB 8,5	0.9	<0.9	<0.9	<0.9	<0.9
PCB 19	1	<1	<1	<1	<1
PCB 12,13	0.2	<0.2	<0.2	<0.2	<0.2
PCB 18	1	<1	<1	<1	<1
PCB 17	2	<2	<2	<2	<2
PCB 27	0.9	<0.9	<0.9	<0.9	<0.9
PCB 16,32	2	<2	<2	<2	<2
PCB 29	0.2	<0.2	<0.2	<0.2	<0.2
PCB 31	1	<1	<1	<1	<1
PCB 33	1	<1	<1	<1	<1
PCB 53	1	<1	<1	<1	<1
PCB 51	1	<1	<1	<1	<1
PCB 22	2	<2	<2	<2	<2
PCB 45	1	<1	<1	<1	<1
PCB 46	2	<2	<2	<2	<2
PCB 49	1	<1	<1	<1	<1
PCB 47,48	1	<1	<1	<1	<1
PCB 44	1	<1	<1	<1	<1
PCB 42	0.3	<0.3	<0.3	<0.3	<0.3
PCB 37	0.5	<0.5	<0.5	<0.5	<0.5
PCB 41,71,64	2	<2	<2	<2	<2
PCB 40	2	<2	<2	<2	<2
PCB 63	1	<1	<1	<1	<1
PCB 74	1	<1	<1	<1	<1
PCB 70,76	1	<1	<1	<1	<1
PCB 66	1	<1	<1	<1	<1
PCB 95	0.6	<0.6	<0.6	<0.6	<0.6
PCB 91	0.6	<0.6	<0.6	<0.6	<0.6
PCB 92,84	1	<1	<1	<1	<1
PCB 101	0.4	<0.4	<0.4	<0.4	<0.4
PCB 99	0.4	<0.4	<0.4	<0.4	<0.4
PCB 119	0.8	<0.8	<0.8	<0.8	<0.8
PCB 83	0.6	<0.6	<0.6	<0.6	<0.6
PCB 97	0.4	<0.4	<0.4	<0.4	<0.4
PCB 87	0.5	<0.5	<0.5	<0.5	<0.5
PCB 85	0.5	<0.5	<0.5	<0.5	<0.5
PCB 136	0.7	<0.7	<0.7	<0.7	<0.7
PCB 110	0.4	<0.4	<0.4	<0.4	<0.4
PCB 82	0.4	<0.4	<0.4	<0.4	<0.4
PCB 151	1	<1	<1	<1	<1
PCB 135,144	1	<1	<1	<1	<1
PCB 149	1	<1	<1	<1	<1
PCB 146	2	<2	<2	<2	<2
PCB 153,132	2	<2	<2	<2	<2
PCB 141	2	<2	<2	<2	<2
PCB 176	2	<2	<2	<2	<2
PCB 178	2	<2	<2	<2	<2
PCB 187,182	2	<2	<2	<2	<2
PCB 183	2	<2	<2	<2	<2
PCB 185	2	<2	<2	<2	<2
PCB 174	1	<1	<1	<1	<1
PCB 177	1	<1	<1	<1	<1
PCB 202	1	<1	<1	<1	<1
PCB 171	2	<2	<2	<2	<2
PCB 172	4	<4	<4	<4	<4
PCB 197	4	<4	<4	<4	<4
PCB 180	1	<1	<1	<1	<1

Table 14A Blank Results for PCBs (ng/g)

Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4
Target PCBs					
PCB 191	2	<2	<2	<2	<2
PCB 199	0.6	<0.6	<0.6	<0.6	<0.6
PCB 201	2	<2	<2	<2	<2
PCB 202,196	2	<2	<2	<2	<2
PCB 208	2	<2	<2	<2	<2
PCB 195	3	<3	<3	<3	<3
PCB 194	0.9	<0.9	<0.9	<0.9	<0.9
PCB 206	2	<2	<2	<2	<2
Coplanar PCB Congeners					
PCB 28	2	<2	<2	<2	<2
PCB 52	2	<2	<2	<2	<2
PCB 60(56)	1	<1	<1	<1	<1
PCB 81	1	<1	<1	<1	<1
PCB 123	0.6	<0.6	<0.6	<0.6	<0.6
PCB 118	0.7	<0.7	<0.7	<0.7	<0.7
PCB 114	0.8	<0.8	<0.8	<0.8	<0.8
PCB 105	0.5	<0.5	<0.5	<0.5	<0.5
PCB 138(163)	1	<1	<1	<1	<1
PCB 158	1	<1	<1	<1	<1
PCB 126	0.8	<0.8	<0.8	<0.8	<0.8
PCB 167	1	<1	<1	<1	<1
PCB 156	1	<1	<1	<1	<1
PCB 157	1	<1	<1	<1	<1
PCB 169	1	<1	<1	<1	<1
PCB 170(190)	2	<2	<2	<2	<2
PCB 77	0.1	<0.1	<0.1	<0.1	<0.1
Total PCBs	10	<10	<10	<10	<10
Surrogate Recovery (%)					
PCB 14		37	44	37	56
PCB 65		64	66	58	65
PCB 166		100	104	97	89

Table 14B Blank Results for PCBs (ng/g)

Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4	Blank #5
Target PCBs						
PCB 1	1	<1	<1	<1	<1	<1
PCB 3	1	<1	<1	<1	<1	<1
PCB 4,10	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 7	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 6	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 8,5	2	<2	<2	<2	<2	<2
PCB 19	3	<3	<3	<3	<3	<3
PCB 12,13	4	<4	<4	<4	<4	<4
PCB 18	3	<3	<3	<3	<3	<3
PCB 17	6	<6	<6	<6	<6	<6
PCB 27	2	<2	<2	<2	<2	<2
PCB 16,32	4	<4	<4	<4	<4	<4
PCB 29	3	<3	<3	<3	<3	<3
PCB 31 + 28	3	<3	<3	<3	<3	<3
PCB 33	3	<3	<3	<3	<3	<3
PCB 53	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 51	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 22	5	<5	<5	<5	<5	<5
PCB 45	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 46	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 49	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 47,48	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 44	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 37	0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 42	0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB 41,71,64	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 40	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 63	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 74	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 70,76	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 66	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 95	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 91	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 92,84	2	<2	<2	<2	<2	<2
PCB 101	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 99	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 119	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
PCB 83	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 97	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 87	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
PCB 85	0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 136	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 110	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 82	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
PCB 151	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 135,144	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 149	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 146	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
PCB 153,132	0.8	<0.8	<0.8	<0.8	<0.8	0.8
PCB 141	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 176	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 178	2	<2	<2	<2	<2	<2
PCB 187,182	2	<2	<2	<2	<2	<2
PCB 183	1	<1	<1	<1	<1	<1
PCB 185	1	<1	<1	<1	<1	<1
PCB 174	0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 177	1	<1	<1	<1	<1	<1
PCB 202	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 171	2	<2	<2	<2	<2	<2
PCB 172	1	<1	<1	<1	<1	<1
PCB 197	2	<2	<2	<2	<2	<2
PCB 180	0.9	<0.9	<0.9	<0.9	<0.9	<0.9

Table 14B Blank Results for PCBs (ng/g)

Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4	Blank #5
Target PCBs						
PCB 191	1	<1	<1	<1	<1	<1
PCB 199	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 201	0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 203,196	1	<1	<1	<1	<1	<1
PCB 208	2	<2	<2	<2	<2	<2
PCB 195	2	<2	<2	<2	<2	<2
PCB 194	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 206	1	<1	<1	<1	<1	<1
Coplanar PCB Congeners						
PCB 28	3	<3	<3	<3	<3	<3
PCB 52	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 60(56)	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
PCB 81	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 118	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
PCB 123	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
PCB 114	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 105	0.7	<0.7	<0.7	<0.7	<0.7	<0.7
PCB 138(163)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 158	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 126	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
PCB 167	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 156	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 157	0.4	<0.4	<0.4	<0.4	<0.4	<0.4
PCB 169	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 170(190)	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 77	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total PCBs	10	<10	<10	<10	<10	<10
Surrogate Recovery (%)						
PCB 14		47	27	30	27	27
PCB 65		51	30	32	55	61
PCB 166		71	60	69	58	84

Table 15A Blank Results for PCDD/PCDFs (pg/g)

Field ID: Lab ID:	MDL	Blank #1	Blank #2	Blank #3	Blank #4	Blank #5
Target PCDFs						
2378-T4CDF	0.2	<0.3	<0.2	<0.3	<0.2	<1.5
TOTAL T4CDF	0.2	<0.3	<0.2	<0.3	<0.2	<1.5
12378-P5CDF	0.1	<0.1	<0.1	<0.2	<0.1	<0.1
23478-P5CDF	0.1	<0.1	<0.1	<0.2	<0.1	<0.1
TOTAL P5CDF	0.1	<0.1	<0.1	<0.2	<0.1	<0.1
123478-H6CDF	0.1	0.5	0.3	0.5	0.3	<0.1
123678-H6CDF	0.1	0.7	<0.1	<0.1	0.3	<0.1
234678-H6CDF	0.1	<0.2	0.4	0.4	<0.1	<0.1
123789-H6CDF	0.3	1.6	<0.2	0.8	0.6	<0.4 *
TOTAL H6CDF	0.3	2.8 (3)	0.7 (2)	1.9 (3)	1.2 (3)	<0.4
1234678-H7CDF	0.1	2.5	0.5	0.5	0.5	<0.1
1234789-H7CDF	0.2	1	<0.1	<0.2	<0.1	<0.1
TOTAL H7CDF	0.2	3.5 (2)	0.5 (1)	0.5 (1)	0.5 (1)	<0.1
O8CDF	0.3	6.6 (1)	1.5 (1)	1.1 (1)	<0.3	<0.2
Target PCDDs						
2378-T4CDD	0.4	<0.4	<0.3	<0.4	<0.3	<0.4 **
TOTAL T4CDD	0.4	<0.4	<0.3	<0.4	<0.3	<0.4
12378-P5CDD	0.2	<0.3	<0.1	<0.2	<0.2	<0.2
TOTAL P5CDD	0.2	<0.3	<0.1	<0.2	<0.2	<0.2
123478-H6CDD	0.2	0.6	<0.1	<0.3	0.5	<0.2
123678-H6CDD	0.2	<0.2	<0.2	<0.3	<0.2	<0.2
123789-H6CDD	0.3	1.9	<0.2	<0.3	0.3	<0.2
TOTAL H6CDD	0.3	2.5 (2)	<0.2	<0.3	0.8 (2)	<0.2
1234678-H7CDD	0.2	1.9	1	0.7	0.5	<0.1
TOTAL H7CDD	0.2	1.9 (1)	1 (1)	0.7 (1)	0.7 (2)	<0.1
O8CDD	0.2	9.5 (1)	6 (1)	2.1 (1)	<0.3	<0.6 *
TEQ (ppt)		0.6	0.08	0.19	0.2	0.00
Surrogate Recovery (%)						
C13-2378-T4CDF		55	70	63	69	10
C13-2378-T4CDD		67	81	74	74	31
C13-12378-P5CDF		65	85	68	80	54
C13-23478-P5CDF		67	88	68	75	52
C13-12378-P5CDD		74	94	75	83	54
C13-123478-H6CDF		80	101	82	85	66
C13-123678-H6CDF		63	80	78	84	67
C13-234678-H6CDF		75	92	82	86	75
C13-123789-H6CDF		56	71	65	75	69
C13-123478-H6CDD		97	119	83	89	75
C13-123678-H6CDD		67	83	84	84	63
C13-1234678-H7CDF		77	100	86	87	75
C13-1234789-H7CDF		79	104	81	84	76
C13-1234678-H7CDD		96	121	90	91	80
C13-O8CDD		100	126	89	87	72

* = NONE DETECTED BASED ON PEAK RATIO
** = NONE DETECTED BASED ON PEAK SHAPE
() = TOTAL ISOMERS

Table 15B Blank Results for PCDD/PCDFs (pg/g)

Field ID: Lab ID:	MDL	Blank #1	Blank #2	Blank #5
Target PCDFs				
2378-T4CDF	0.2	<0.4	<0.5	<0.6
TOTAL T4CDF	0.2	<0.4	<0.5	<0.6
12378-P5CDF	0.1	<0.4	<4.7	<2.6
23478-P5CDF	0.1	<0.4	<5.3	<2.6
TOTAL P5CDF	0.1	<0.4	<5.3	<2.6
123478-H6CDF	0.1	3.1	<0.7**	<0.5
123678-H6CDF	0.1	2.7	<0.2	<0.4
234678-H6CDF	0.1	<0.2	<0.2	<0.5
123789-H6CDF	0.3	<2.1*	<1.0*	<1.8*
TOTAL H6CDF	0.3	9.8 (3)	2.4 (2)	1.6
1234678-H7CDF	0.1	2.6	<0.6	<0.7
1234789-H7CDF	0.2	<0.6	<0.7	<0.8
TOTAL H7CDF	0.2	2.5 (1)	<0.7	<0.8
O8CDF	0.3	34.9 (1)	24.2 (1)	29.7 (1)
Target PCDDs				
2378-T4CDD	0.4	<0.6	<0.7	<0.5
TOTAL T4CDD	0.4	<0.6	<0.7	<0.5
12378-P5CDD	0.2	<0.5	<0.6	<0.4
TOTAL P5CDD	0.2	<0.5	<0.6	<0.4
123478-H6CDD	0.2	<0.3	<0.5	<1.2
123678-H6CDD	0.2	<0.3	<0.3	<1.0
123789-H6CDD	0.3	<0.3	<0.3	<1.1
TOTAL H6CDD	0.3	<0.3	<0.5	<1.2
1234678-H7CDD	0.2	<0.9	<0.6	<1.1
TOTAL H7CDD	0.2	<0.9	<0.6	<1.1
O8CDD	0.2	3.9 (1)	19.1 (1)	6.7 (1)
TEQ (ppt)		0.65	0.04	0.04
Surrogate Recovery (%)				
C13-2378-T4CDF		57	61	64
C13-2378-T4CDD		75	85	87
C13-12378-P5CDF		74	76	72
C13-23478-P5CDF		74	67	73
C13-12378-P5CDD		80	76	77
C13-123478-H6CDF		84	75	74
C13-123678-H6CDF		89	76	80
C13-234678-H6CDF		85	73	76
C13-123789-H6CDF		90	84	79
C13-123478-H6CDD		89	65	77
C13-123678-H6CDD		88	81	76
C13-1234678-H7CDF		85	79	78
C13-1234789-H7CDF		96	87	89
C13-1234678-H7CDD		95	105	103
C13-O8CDD		73	71	74

* = NONE DETECTED BASED ON PEAK RATIO
** = NONE DETECTED BASED ON PEAK SHAPE
() = TOTAL ISOMERS

Table 16 Surrogate Recovery Control Limits (%)

Surrogates	Mean (p)	Std. dev. (s)	Calculated Control Range (p±3s)*	Range of Surrogate Recovery Data	Designated Control Limits†
Pesticides					
Tetrachloro-m-xylene	57	16	9-105	27-90	20-105
PCB 209	99	29	11-186	38-140	20-140
PCBs					
PCB 14	60	17	8-113	30-91	20-113
PCB 65	77	16	27-126	47-110	27-126
PCB 166	97	23	27-168	59-140	27-140
Semi-Volatile Organics					
2-Fluorophenol‡	17	11	D-49	5-54	20-49
Phenol-d_6	31	21	D-94	2-94	20-94
2,4,6-Tribromophenol	64	13	25-102	41-85	25-102
Nitrobenzene-d_5	49	18	D-103	31-85	20-103
2-Fluorobiphenyl	67	15	22-112	49-89	22-112
Terphenyl-d_{14}	68	21	6-130	39-84	20-130
Volatile Organics (Data Set 1)					
Trichlorofluoromethane	323	187	NA	82-890	NA
Benzene-d_6	91	8	67-114	82-110	67-114
Ethylbenzene-d_{10}	150	52	D-305	63-310	NA
Volatile Organics (Data Set 2)					
Benzene-d_6	116	13	76-155	100-150	76-140
Fluorobenzene	103	5	87-120	99-120	87-120
Toluene-d_8	81	19	24-138	65-135	24-138

Table 16 Surrogate Recovery Control Limits (Continued)					
PCDDs/PCDFs					
^{13}C-2378-T_4CDF	66	15	21-112	17-88	21-112
^{13}C-2378-T_4CDD	78	17	28-129	47-112	28-129
^{13}C-12378-P_5CDF	75	14	32-118	45-111	32-118
^{13}C-23478-P_5CDF	76	15	33-120	49-110	33-120
^{13}C-12378-P_5CDD	80	16	32-127	46-118	32-127
^{13}C-123478-H_6CDF	78	15	32-124	48-113	32-124
^{13}C-123678-H_6CDF	74	17	22-126	44-124	22-126
^{13}C-234678-H_6CDF	79	15	33-125	48-127	33-125
^{13}C-123789-H_6CDF	74	20	14-134	41-141	20-134
^{13}C-123478-H_6CDD	83	17	33-134	46-117	33-134
^{13}C-123678-H_6CDD	77	15	32-123	50-119	32-123
^{13}C-1234678-H_7CDF	80	18	28-133	46-132	28-133
^{13}C-1234789-H_7CDF	85	19	29-141	50-141	29-140
^{13}C-1234678-H_7CDD	98	21	35-160	72-167	35-140
^{13}C-O_8CDD	82	23	12-152	43-134	20-140

* Calculated as mean ± (3 x the standard deviation)

† Occasionally, the control limit range calculated results in situation where it is theoretically acceptable to have recoveries as low as the detection limit or as high as 200 or more. Based on analytical experience some control limits have been modified to a more reasonable range. In general, upper control limits should not exceed 140; and lower control limits should not fall below 20.

‡ Recovery data available from first data set only

Table 17 Matrix Spike/Matrix Spike Duplicates

Target Volatiles	Designated Recovery Limits	Relative % Difference
1,1–dichloroethene	59–172	22
benzene	66–142	21
toluene	59–139	21
1,1,2–trichloroethene	62–137	24
chlorobenzene	60–133	21

Target Semi–Volatiles	Designated Recovery Limits	Relative % Difference
Phenol	26–90	35
2–Chlorophenol	25–102	50
1,4–Dichlorobenzene	28–104	27
N–Nitroso–Di–n–propylamine	41–126	38
1,2,4–Trichlorobenzene	38–107	23
4–Chloro–3–methylphenol	26–103	33
Acenaphthene	31–137	19
4–Nitrophenol	11–114	50
2,4–Dinitrotoluene	28–89	47
Pentachlorophenol	17–109	47
Pyrene	35–142	36

Target Pesticides	Designated Recovery Limits	Relative % Difference
g–BHC	46–127	50
Heptachlor	35–130	31
Aldrin	34–132	43
Dieldrin	31–134	38
Endrin	42–139	45
pp'–DDT	23–134	50

Note: Limits taken from US EPA Test Methods for Evaluating Solid Waste (EPA SW–846, Chapter One, Revision 0, September, 1986)

Table 18A Matrix Spike Percent Recoveries for Metals

Field ID: / Lab ID:	1-91 92-828m (%)	1-91 92-828md (%)	Relative % Difference (%)	2-91 92-829m (%)	2-91 92-829md (%)	Relative % Difference (%)	Spike Amount (µg/g)
Target Metals							
As				100	100	0	0.50
Se				100	99	4	0.47
Sb				100	100	0	0.50
Hg	95	96	1				0.01
Total CN	70	73	4				2.0
Be	110	110	1				1.0
Cd	100	100	0				1.0
Cr	75	100	29				1.0
Pb	100	110	10				1.0
Ni	100	100	0				1.0
Ag	130	130	3				1.0
Tl	60	60	0				1.0

Table 18B Matrix Spike Percent Recoveries for Metals

Field ID: / Lab ID:	1-92 93-251m (%)	12-92 93-262m (%)	Spike Amount (µg/g)
Target Metals			
As	100	83	0.50
Se	98	83	0.47
Sb	87	73	0.50
Hg	99	100	0.01
Total CN	100	100	2.0
Be	110	99	1.0
Cd	99	150	1.0
Cr	140	120	1.0
Pb	120	130	1.0
Ni	160	140	1.0
Ag	98	100	1.0
Tl	100	100	1.0

Table 19A Matrix Spike Percent Recoveries for VOCs

Field ID: Lab ID:	7-91 92-834m (%)	7-91 92-834md (%)	Relative % Difference (%)	Spike Amount (µg/mL)
Target Semi-Volatiles				
Phenol	34	67	65	20
2-Chlorophenol	45	63	33	20
1,4-Dichlorobenzene	45	60	29	5
N-Nitroso-di-n-propylamine	54	73	30	5
1,2,4-Trichlorobenzene	55	63	14	5
4-Chloro-3-methylphenol	74	65	13	20
Acenaphthene	64	65	2	5
4-Nitrophenol	52	48	8	20
2,4-Dinitrotoluene	41	44	7	5
Pentachlorophenol	47	46	2	20
Pyrene	83	74	11	5
Surrogate Recovery (%)				
2-Fluorophenol	12	19	45	20
Phenol-d6	25	60	82	20
2,4,6-Tribromophenol	63	57	10	20
Nitrobenzene-d5	49	69	34	5
2-Fluorobiphenyl	65	68	5	5
Terphenyl-d14	50	46	8	5

Table 20B Matrix Spike Percent Recoveries for Semi-Volatile

Field ID: Lab ID:	3-92 93-253m (%)	3-92 93-253md (%)	Relative % Difference (%)	Spike Amount (µg/mL)
Target Semi-Volatiles				
2-Chlorophenol	62	68	7.7	20
Phenol	44	44	0	20
1,4-dichlorobenzene	60	60	0	5
N-Nitroso-di-n-propylamine	65	70	7.4	5
1,2,4-Trichlorobenzene	75	95	24	5
4-Chloro-3-methylphenol	92	120	28	20
Acenaphthene	80	100	27	5
2,4-Dinitrotoluene	65	80	20	5
4-Nitrophenol	54	61	13	20
Pentachlorophenol	96	200	70	20
Pyrene	80	110	32	5
Surrogate Recovery (%)				
2-Fluorophenol	IF	IF	NA	20
Phenol-d6	38	42	10	20
2,4,6-Tribromophenol	80	100	22	20
Nitrobenzene-d5	80	84	5	5
2-Fluorobiphenyl	100	120	18	5
Terphenyl-d14	120	150	22	5

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

able 20A Matrix Spike Percent Recoveries for Semi-Volatiles

Field ID: Lab ID:	7-91 92-834m (%)	7-91 92-834md (%)	Relative % Difference (%)	Spike Amount (µg/mL)
Target Semi-Volatiles				
Phenol	34	67	65	20
2-Chlorophenol	45	63	33	20
1,4-Dichlorobenzene	45	60	29	5
N-Nitroso-di-n-propylamine	54	73	30	5
1,2,4-Trichlorobenzene	55	63	14	5
4-Chloro-3-methylphenol	74	65	13	20
Acenaphthene	64	65	2	5
4-Nitrophenol	52	48	8	20
2,4-Dinitrotoluene	41	44	7	5
Pentachlorophenol	47	46	2	20
Pyrene	83	74	11	5
Surrogate Recovery (%)				
2-Fluorophenol	12	19	45	20
Phenol-d6	25	60	82	20
2,4,6-Tribromophenol	63	57	10	20
Nitrobenzene-d5	49	69	34	5
2-Fluorobiphenyl	65	68	5	5
Terphenyl-d14	50	46	8	5

Table 20B Matrix Spike Percent Recoveries for Semi-Volatile

Field ID: Lab ID:	3-92 93-253m (%)	3-92 93-253md (%)	Relative % Difference (%)	Spike Amount (µg/mL)
Target Semi-Volatiles				
2-Chlorophenol	62	68	7.7	20
Phenol	44	44	0	20
1,4-dichlorobenzene	60	60	0	5
N-Nitroso-di-n-propylamine	65	70	7.4	5
1,2,4-Trichlorobenzene	75	95	24	5
4-Chloro-3-methylphenol	92	120	28	20
Acenaphthene	80	100	27	5
2,4-Dinitrotoluene	65	80	20	5
4-Nitrophenol	54	61	13	20
Pentachlorophenol	96	200	70	20
Pyrene	80	110	32	5
Surrogate Recovery (%)				
2-Fluorophenol	IF	IF	NA	20
Phenol-d6	38	42	10	20
2,4,6-Tribromophenol	80	100	22	20
Nitrobenzene-d5	80	84	5	5
2-Fluorobiphenyl	100	120	18	5
Terphenyl-d14	120	150	22	5

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

Table 21A Matrix Spike Percent Recoveries for Chlorinated Pesticides

Lab ID: Field ID:	92-834m 7-91 (%)	92-834md 7-91 (%)	Relative % Difference (%)	Spike Amount (ng/mL)
Target Pesticides				
g-BHC	48	38	23	14
Heptachlor	65	59	9	14
Aldrin	49	48	3	14
Dieldrin	87	67	26	14
Endrin	61	43	35	14
pp'-DDT	73	45	49	14
Surrogate Recovery (%)				
Tetrachloro-m-xylene	50	31	47	100
PCB 209	110	99	13	100

Table 21B Matrix Spike Percent Recoveries for Chlorinated Pesticides

Lab ID: Field ID:	3-92 93-253m (%)	3-92 93-253md (%)	Relative % Difference (%)	Spike Amount (ng/mL)
Target Pesticides				
g-BHC	40	53	27	14
Heptachlor	89	81	10	14
Aldrin	85	88	3	14
Dieldrin	73	76	4	14
Endrin	51	66	25	14
pp'-DDT	130	94	30	14
Surrogate Recovery (%)				
Tetrachloro-m-xylene	41	39	5	100
PCB 209	96	110	10	100

Table 22A Matrix Spike Percent Recoveries for PCBs

Field ID: Lab ID:	Spike Amount (ng/mL)	7-91 92-834m	7-91 92-834md	Relative % Difference
Target PCBs				
PCB 1	480	47	49	4
PCB 3	330	0	0	0
PCB 4,10	32	47	47	0
PCB 7	25	48	50	3
PCB 6	48	49	50	1
PCB 8,5	580	49	48	2
PCB 19	11	61	61	0
PCB 12,13	12	40	46	13
PCB 18	140	56	56	0
PCB 17	83	60	44	31
PCB 27	9.0	59	48	21
PCB 16,32	140	57	57	0
PCB 29	2.0	67	67	0
PCB 31	410	62	60	4
PCB 33	150	58	58	0
PCB 53	28	72	72	0
PCB 51	7.5	87	87	0
PCB 22	120	60	57	5
PCB 45	29	68	68	0
PCB 46	15	66	66	0
PCB 49	91	72	72	0
PCB 47,48	92	79	71	10
PCB 44	160	69	69	0
PCB 42	15	0	6	200
PCB 37	13	74	76	3
PCB 41,71,64	270	72	72	0
PCB 40	33	79	79	0
PCB 63	8.3	79	79	0
PCB 74	86	77	77	0
PCB 70,76	200	75	73	2
PCB 66	220	74	71	4
PCB 95	53	75	62	18
PCB 91	13	73	55	27
PCB 92,84	43	68	61	12
PCB 101	51	85	59	36
PCB 99	24	104	55	61
PCB 119	2.0	140	134	5
PCB 83	3.6	100	100	0
PCB 97	19	80	70	14
PCB 87	33	75	62	19
PCB 85	17	80	65	21
PCB 136	14	69	62	11
PCB 110	57	81	64	24

Field ID: Lab ID:	Spike Amount (ng/mL)	7-91 92-834m	7-91 92-834md	Relative % Difference
Target PCBs				
PCB 82	19	70	63	11
PCB 151	82	72	56	25
PCB 135,144	33	89	70	25
PCB 149	160	75	54	32
PCB 146	22	118	44	91
PCB 153,132	320	83	41	67
PCB 141	78	72	51	34
PCB 176	16	81	81	0
PCB 178	45	95	88	8
PCB 187,182	340	87	72	20
PCB 183	90	95	70	31
PCB 185	29	92	80	13
PCB 174	130	74	74	0
PCB 177	67	74	64	14
PCB 202	40	58	58	0
PCB 171	43	91	53	53
PCB 172	35	160	151	6
PCB 197	35	57	47	18
PCB 180	270	92	72	25
PCB 191	5	0	0	0
PCB 199	19	39	34	14
PCB 201	150	60	58	4
PCB 202,196	180	75	70	8
PCB 208	110	91	60	40
PCB 195	110	61	55	11
PCB 194	91	58	54	6
PCB 206	47	71	71	0
Coplanar PCB Congeners				
PCB 28	410	64	65	3
PCB 52	120	120	120	0
PCB 60(56)	37	143	101	34
PCB 118	56	134	105	24
PCB 138(163)	140	151	100	41
PCB 170(190)	140	62	41	40
Total PCBs	7600	70	63	11
Surrogate Recovery (%)				
PCB 14		70	69	1
PCB 65		91	94	3
PCB 166		108	118	9

Table 22B Matrix Spike Percent Recoveries for PCBs

Field ID: Lab ID:	Spike Amount (ng/mL)	93-253m	93-253md	Relative % Difference
Target PCBs				
PCB 1	51	85	70	20
PCB 3	31	91	0	200
PCB 4,10	3	88	75	15
PCB 7	3	93	80	15
PCB 6	5	95	81	15
PCB 8,5	60	93	79	17
PCB 19	1	54	88	47
PCB 12,13	1	111	68	48
PCB 18	16	56	96	52
PCB 17	9	59	98	50
PCB 27	0.9	61	84	31
PCB 16,32	16	35	67	63
PCB 29	0.2	79	88	11
PCB 33	17	56	93	50
PCB 53	3	50	91	58
PCB 51	0.8	42	83	66
PCB 22	13	58	87	39
PCB 45	3	56	96	53
PCB 46	2	54	91	52
PCB 49	11	50	96	63
PCB 47,48	11	48	97	68
PCB 44	18	53	95	57
PCB 37	2	62	40	43
PCB 42	2	61	105	53
PCB 41,71,64	30	55	98	56
PCB 40	4	53	87	49
PCB 63	0.9	90	86	5
PCB 74	10	55	94	53
PCB 70,76	25	61	102	50
PCB 66	26	56	100	56
PCB 95	6	41	99	82
PCB 91	2	51	101	65
PCB 92,84	5	64	112	54
PCB 101	6	55	101	59
PCB 99	3	59	103	54
PCB 119	0.2	99	83	17
PCB 83	0.4	70	118	50
PCB 97	2	53	99	61
PCB 87	4	61	104	52
PCB 85	2	53	106	66
PCB 136	2	113	96	16
PCB 110	7	48	99	69

Field ID: Lab ID:	Spike Amount (ng/mL)	93-253md	93-253m	Relative % Difference
Target PCBs				
PCB 82	2	92	47	65
PCB 151	7	85	87	2
PCB 135,144	3	81	84	4
PCB 149	13	80	86	8
PCB 146	2	80	77	3
PCB 153,132	26	79	81	3
PCB 141	6	85	93	8
PCB 176	2	86	99	13
PCB 178	4	87	97	11
PCB 187,182	36	89	101	13
PCB 183	9	85	100	17
PCB 185	3	79	93	16
PCB 174	13	88	100	13
PCB 177	7	81	100	21
PCB 202	4	82	105	25
PCB 171	4	84	95	13
PCB 172	3	98	106	8
PCB 197	3	69	84	20
PCB 180	29	90	101	11
PCB 191	0.5	127	126	1
PCB 199	1	93	106	13
PCB 201	18	89	108	20
PCB 203,196	21	86	110	25
PCB 208	10	78	94	19
PCB 195	10	81	109	30
PCB 194	7	92	119	26
PCB 206	5	86	103	18
Coplanar PCB Congeners				
PCB 28	46	91	111	20
PCB 52	14	90	46	64
PCB 60(56)	4	83	47	56
PCB 118	4	109	91	18
PCB 138(163)	12	35	42	18
PCB 170(190)	14	87	99	13
Total PCBs	751	87	77	13
Surrogate Recovery (%)				
PCB 14		64	67	6
PCB 65		67	69	3
PCB 166		73	70	4

Table 23A Matrix Spike Percent Recoveries for PCDD/PCDFs

Field ID: Lab ID:	Spike Amount (ng/mL)	7-91 92-834m	7-91 92-834md	Relative % Difference
Target PCDFs				
2378-T4CDF	1	128	134	4
TOTAL T4CDF	1	128	134	4
12378-P5CDF	4	94	96	3
23478-P5CDF	4	96	97	1
TOTAL P5CDF	4	97	97	0
123478-H6CDF	4	99	99	0
123678-H6CDF	4	100	100	0
234678-H6CDF	4	99	98	1
123789-H6CDF	4	101	102	1
TOTAL H6CDF	4	100	100	0
1234678-H7CDF	4	109	109	0
1234789-H7CDF	4	100	101	1
TOTAL H7CDF	4	104	105	0
O8CDF	8	83	168	68
Target PCDDs				
2378-T4CDD	1	168	107	45
TOTAL T4CDD	1	168	107	45
12378-P5CDD	4	103	104	2
TOTAL P5CDD	4	104	104	0
123478-H6CDD	4	102	102	0
123678-H6CDD	4	104	107	2
123789-H6CDD	4	140	133	5
TOTAL H6CDD	4	115	114	1
1234678-H7CDD	4	98	104	6
TOTAL H7CDD	4	98	104	6
O8CDD	8	102	93	9
Surrogate Recovery (%)				
C13-2378-T4CDF	25	82	86	5
C13-2378-T4CDD	25	99	95	4
C13-12378-P5CDF	25	101	106	5
C13-23478-P5CDF	25	101	109	8
C13-12378-P5CDD	25	110	117	6
C13-123478-H6CDF	25	93	71	27
C13-123678-H6CDF	25	67	54	21
C13-234678-H6CDF	25	100	107	7
C13-123789-H6CDF	25	74	91	21
C13-123478-H6CDD	25	127	132	4
C13-123678-H6CDD	25	87	89	2
C13-1234678-H7CDF	25	101	95	6
C13-1234789-H7CDF	25	109	118	8
C13-1234678-H7CDD	25	132	133	1
C13-O8CDD	25	136	139	2

Table 23B Matrix Spike Percent Recoveries for PCDD/PCDFs

Field ID: Lab ID:	Spike Amount (ng/mL)	3-92 93-253m	3-92 93-253md	Relative % Difference
Target PCDFs				
2378-T4CDF	1	73	120	49
TOTAL T4CDF	1	73	120	49
12378-P5CDF	4	Interference	Interference	NA
23478-P5CDF	4	87	94	8
TOTAL P5CDF	4	87	94	8
123478-H6CDF	4	87	88	1
123678-H6CDF	4	82	78	5
234678-H6CDF	4	78	76	2
123789-H6CDF	4	77	79	3
TOTAL H6CDF	4	81	89	9
1234678-H7CDF	4	85	88	3
1234789-H7CDF	4	98	94	4
TOTAL H7CDF	4	91	91	0
O8CDF	8	62	70	12
Target PCDDs				
2378-T4CDD	1	71	94	28
TOTAL T4CDD	1	71	94	28
12378-P5CDD	4	63	78	21
TOTAL P5CDD	4	63	78	21
123478-H6CDD	4	81	82	1
123678-H6CDD	4	80	80	0
123789-H6CDD	4	76	78	3
TOTAL H6CDD	4	82	85	4
1234678-H7CDD	4	101	128	23
TOTAL H7CDD	4	101	128	23
O8CDD	8	154	364	81
Surrogate Recovery (%)				
C13-2378-T4CDF	25	55	72	27
C13-2378-T4CDD	25	74	93	23
C13-12378-P5CDF	25	61	78	24
C13-23478-P5CDF	25	61	77	23
C13-12378-P5CDD	25	68	66	3
C13-123478-H6CDF	25	64	84	27
C13-123678-H6CDF	25	60	81	30
C13-234678-H6CDF	25	64	79	21
C13-123789-H6CDF	25	9	87	163
C13-123478-H6CDD	25	64	77	18
C13-123678-H6CDD	25	67	84	23
C13-1234678-H7CDF	25	60	80	29
C13-1234789-H7CDF	25	68	87	25
C13-1234678-H7CDD	25	88	102	15
C13-O8CDD	25	59	64	8

Table 24A Duplicate Sample Results for Metals (μg/g)

Field ID: / Lab ID:	MDL	1-91 92-828	1-91 92-828d	Relative % Difference	2-91 92-829	2-91 92-829D	Relative % Difference
Target Metals							
As	0.1	0.3	NA	NA	0.1	0.1	0
Se	0.05	0.35	NA	NA	0.46	0.46	0
Sb	0.01	<0.01	NA	NA	<0.01	<0.01	NA
Hg	0.005	0.1	0.116	0	0.5	0.5	0
Total CN	0.05	<0.05	<0.05	NA	<0.05	<0.05	NA
Be	0.005	<0.005	<0.005	NA	<0.005	<0.005	NA
Cd	0.05	<0.05	<0.05	NA	<0.05	<0.05	NA
Cr	0.1	0.3	0.2	40	0.4	0.4	0
Pb	0.5	<0.5	<0.5	NA	<0.5	<0.5	NA
Ni	0.1	<0.1	<0.1	NA	<0.1	<0.1	NA
Ag	0.05	<0.05	<0.05	NA	<0.05	<0.05	NA
Tl	0.1	<0.1	<0.1	NA	<0.1	<0.1	NA

Field ID: / Lab ID:	MDL	3-91 92-830	3-91 92-830d	Relative % Difference
Target Metals				
As	0.1	0.1	0.1	0
Se	0.05	0.37	0.37	0
Sb	0.01	<0.01	<0.01	NA
Hg	0.005	0.221	–	NA
Total CN	0.05	0.1	–	NA
Be	0.005	<0.005	–	NA
Cd	0.05	<0.05	–	NA
Cr	0.1	<0.1	–	NA
Pb	0.5	<0.5	–	NA
Ni	0.1	<0.1	–	NA
Ag	0.05	<0.05	–	NA
Tl	0.1	<0.1	–	NA

Table B Duplicate Sample Results for Metals (μg/g)

Field ID: / Lab ID:	MDL	1-92 93-251	1-92 93-251d	Relative % Difference	12-92 93-262	12-92 93-262d	Relative % Difference
Target Metals							
As	0.1	<0.1	<0.1	NA	<0.1	0.2	NA
Se	0.05	0.22	0.22	0	0.20	0.15	29
Sb	0.01	<0.05	<0.05	NA	<0.05	<0.05	NA
Hg	0.005	0.052	0.052	0	0.069	0.074	7
Total CN	0.05	1.28	1.28	0	0.05	0.05	0
Be	0.005	<0.005	<0.005	NA	<0.005	<0.005	NA
Cd	0.05	<0.05	<0.05	NA	<0.05	<0.05	NA
Cr	0.1	<0.1	<0.1	NA	<0.1	<0.1	NA
Pb	0.5	<0.5	<0.5	NA	<0.5	<0.5	NA
Ni	0.1	<0.5	<0.5	NA	<0.5	<0.5	NA
Ag	0.05	<0.05	<0.05	NA	<0.05	<0.05	NA
Tl	0.1	<0.1	<0.1	NA	<0.1	<0.1	NA

Table 25A Duplicate Sample Results for VOCs (ng/g)

Field ID: / Lab ID:	MDL	1-89 92-847	1-89 92-847d	Relative % Difference	19-91 92-846	19-91 92-846d	Relative % Difference
Target Volatiles							
1,1-dichloroethene	0.4	<0.4	<0.4	NA	<0.4	<0.4	NA
methylene chloride	0.2	31	36	15	12	14	15
trans-1,2-dichloroethene	0.4	<0.4	<0.4	NA	<0.4	<0.4	NA
1,1-dichloroethane	0.2	<0.2	<0.2	NA	<0.2	<0.2	NA
chloroform	0.2	0.38	0.72	62	0.23	0.26	12
1,1,1,-trichloroethane	0.4	1.0	1.4	33	0.66	0.74	11
carbon tetrachloride	0.8	<0.8	<0.7	NA	<0.8	<0.8	NA
1,2-dichloroethane	0.6	<0.6	0.78	NA	<0.6	<0.6	NA
benzene	0.2	2.8	4.0	35	1.8	2.2	20
trichloroethene	1	<1	1.6	NA	<0.9	<1	NA
1,2-dichloropropane	0.8	<0.8	<0.7	NA	<0.8	<0.8	NA
bromodichloromethane	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
cis-1,3-dichloropropene	4	<4	<4	NA	<4	<4	NA
toluene	0.2	22	40	58	29	34	16
trans-1,3-dichloropropene	3	<3	<3	NA	<3	<3	NA
1,1,2-trichloroethane	2	<2	<2	NA	<2	<2	NA
tetrachloroethene	6	18	59	110	<6	<6	NA
dibromochloromethane	10	<10	42	NA	<10	<10	NA
chlorobenzene	2	<2	<2	NA	<2	<2	NA
ethylbenzene	1	<1	2.3	NA	1.4	1.3	7.1
m,p-xylene	0.6	1.1	2.5	78	1.8	2.2	20
o-xylene	1	<1	2.1	NA	1.9	2.4	23
bromoform	NR	NR	NR	NA	NR	NR	NA
1,1,2,2-tetrachloroethane	6	<6	<6	NA	<6	<6	NA
Surrogate Recovery (%)							
trichlorofluoromethane		380	600	45	400	410	2.4
benzene-d6		100	110	9.1	96	98	2.1
ethylbenzene-d10		120	130	7.7	110	110	0

NA = NOT APPLICABLE
NR = NOT RECOVERED

Table 25B Duplicate Sample Results for VOCs (ng/g)

Field ID: / Lab ID:	MDL	93-253 3-92	93-253d 3-92	Relative % Difference	93-263 13-92	93-263d 13-92	Relative % Difference
Target Volatiles							
1,1-Dichloroethene	<2	<0.2	<0.2	NA	<0.2	<0.2	NA
Methylene Chloride	<2	1700	1200	34	160	280	55
Trans-1,2-Dichloroethene	<2	<0.2	<0.2	NA	<0.2	<0.2	NA
1,1-Dichloroethane	<2	<0.2	<0.2	NA	<0.2	<0.2	NA
Chloroform	<2	1.5	1.6	6	0.9	0.6	40
1,1,1,Trichloroethane	<2	1.7	1.4	19	1.2	0.8	40
Carbon Tetrachloride	<2	<0.2	0.4	NA	<0.2	<0.2	NA
1,2-Dichloroethane	<2	0.7	0.6	15	0.9	0.5	57
Benzene	<2	11	10	10	6.6	4	49
Trichloroethene	<2	0.4	0.5	22	0.7	0.3	80
1,2-Dichloropropane	<2	<0.2	<0.2	NA	<0.2	<0.2	NA
Bromodichloromethane	<2	<0.2	1.5	NA	<0.2	<0.2	NA
Cis-1,3-Dichloropropene	<2	<0.2	<0.2	NA	0.4	<0.2	NA
Toluene	<2	38	83	74	90	45	67
Trans-1,3-dichloropropene	<2	<0.2	<0.2	NA	0.8	<0.2	NA
1,1,2-Trichloroethane	<2	<0.2	<0.2	NA	1.0	0.5	67
Tetrachloroethene	<2	3.1	3.2	3	20	5.1	119
Dibromochloromethane	<2	<0.2	<0.2	NA	<0.2	<0.2	NA
Chlorobenzene	<2	1.0	0.5	67	2.5	<0.2	NA
Ethylbenzene	<2	3.0	2.4	22	15	3.7	121
M,P-xylene	<2	5.5	4.7	16	30	7.8	117
O-xylene	<2	4.2	3.5	18	21	5.5	117
Styrene	<2	2.1	1.2	55	5.5	0.8	149
Bromoform	<2	<0.2	0.6	NA	0.8	<0.2	NA
1,1,2,2-Tetrachloroethane	<2	<0.2	<0.2	NA	<0.2	<0.2	NA
Surrogate Recovery (%)							
d6-Benzene		105	107	2	111	106	5
Flourobenzene		101	100	1	100	98	3
d8-Toluene		76	90	17	85	85	0

Table 26A Duplicate Sample Results for Semi-Volatiles (ng/g)

Field ID: / Lab ID:	MDL	4-91 92-831	92-831D	Relative % Difference	18-91 92-845	92-845D	Relative % Difference
Target Semi-Volatiles							
N-Nitrosodimethylamine	10	<10	<10	NA	<10	<10	NA
Phenol	10	<10	<10	NA	<10	<10	NA
bis(2-Chloroethyl)ether	3	<3	<3	NA	<3	<3	NA
2-Chlorophenol	5	<5	<5	NA	<5	<5	NA
1,3-Dichlorobenzene	2	<2	<2	NA	<2	<2	NA
1,4-Dichlorobenzene	2	<2	<2	NA	<2	<2	NA
1,2-Dichlorobenzene	2	<2	<2	NA	<2	<2	NA
bis(2-Chloroisopropyl)ether	10	<10	<10	NA	<10	<10	NA
N-Nitroso-di-n-propylamine	30	<30	<30	NA	<30	<30	NA
Hexachloroethane	10	<10	<10	NA	<10	<9	NA
Nitrobenzene	8	<8	<8	NA	<8	<8	NA
Isophorone	1	<1	<1	NA	<1	<1	NA
2-Nitrophenol	4	<4	<4	NA	<4	<4	NA
2,4-Dimethylphenol	3	<3	<3	NA	<3	<3	NA
bis(2-Chloroethoxy)methane	2	<2	<2	NA	<2	<2	NA
2,4-Dichlorophenol	9	<9	<9	NA	<9	<9	NA
1,2,4-Trichlorobenzene	2	<2	<2	NA	<2	<2	NA
Naphthalene	1	54	53	2	84	110	27%
Hexachlorobutadiene	4	<4	<4	NA	<4	<4	NA
4-Chloro-3-methylphenol	10	<10	<10	NA	<10	<10	NA
Hexachlorocyclopentadiene	10	<10	<10	NA	<10	<9	NA
2,4,6-Trichlorophenol	4	<4	<4	NA	<4	<4	NA
2-Chloronaphthalene	1	<1	<1	NA	<1	<1	NA
Dimethylphthalate	2	<2	<2	NA	<2	<1	NA
Acenaphthylene	0.9	<0.9	<0.9	NA	<0.9	<0.9	NA
2,6-Dinitrotoluene	6	<6	<6	NA	<6	<6	NA
Acenaphthene	2	<2	<2	NA	<2	<2	NA
2,4-Dinitrophenol	9	<9	<9	NA	<9	<8	NA
4-Nitrophenol	20	<20	<20	NA	<20	<20	NA
2,4-Dinitrotoluene	8	<8	<8	NA	<8	<8	NA
Diethylphthalate	1	26	14	60	14	8	55
4-Chlorophenyl-phenylether	2	<2	<2	NA	<2	<2	NA
Fluorene	2	<2	6	NA	<2	<2	NA
4,6-Dinitro-2-methylphenol	10	<10	<10	NA	<10	<10	NA
N-Nitrosodiphenylamine	10	<10	<10	NA	<10	<10	NA
4-Bromophenyl-phenylether	5	<4	<4	NA	<4	<4	NA
Hexachlorobenzene	4	<4	<4	NA	<4	<4	NA
Pentachlorophenol	9	<9	<9	NA	<9	<8	NA
Phenanthrene	4	<4	<4	NA	<4	<3	NA
Anthracene	4	<4	<4	NA	<4	<4	NA
Di-n-butylphthalate	5	89	100	12	69	42	49
Fluoranthene	2	<2	<2	NA	<2	<2	NA
Benzidine	6	<6	<6	NA	<6	<6	NA
Pyrene	3	<3	<3	NA	<3	<3	NA
Butylbenzylphthalate	200	<200	<200	NA	<200	<200	NA
3,3'-Dichlorobenzidine	20	<10	<20	NA	<10	<10	NA
Benzo(a)anthracene	5	<5	<5	NA	<5	<5	NA
Chrysene	5	<5	<5	NA	<5	<5	NA
bis(2-Ethylhexyl)phthalate	9	190	230	19	140	120	15
Di-n-octylphthalate	40	960	1200	22	6700	3900	53
Benzo(b)fluoranthene	3	<3	<3	NA	<3	<3	NA
Benzo(k)fluoranthene	3	<3	<3	NA	<3	<3	NA
Benzo(a)pyrene	2	<2	<2	NA	<2	<2	NA
Indeno(1,2,3-cd)pyrene	5	<5	<5	NA	<5	<5	NA
Dibenz(a,h)anthracene	2	<2	<2	NA	<2	<2	NA
Benzo(g,h,i)perylene	5	<5	<5	NA	<5	<5	NA
Surrogate Recovery (%)							
2-Fluorophenol		29	24	19	13	25	63
Phenol-d6		67	82	20	49	73	39
2,4,6-Tribromophenol		72	75	4	63	68	8
Nitrobenzene-d5		68	85	22	69	79	14
2-Fluorobiphenyl		70	88	23	81	78	4
Terphenyl-d14		52	63	19	61	63	3

Table 26B Duplicate Sample Results for Semi-Volatiles (ng/g)

Field ID:		2-92		Relative %	2-94		Relative %
Lab ID:	MDL	93-252	93-252D	Difference	93-254	93-254D	Difference
Target Semi-Volatiles							
2-Chlorophenol	5	<0.6	<0.6	NA	<0.6	<0.6	NA
bis(2-Chloroethyl)ether	3	<1	<1	NA	<1	<1	NA
Phenol	10	<1	<1	NA	<1	<1	NA
1,3-Dichlorobenzene	2	<0.3	<0.3	NA	<0.3	<0.3	NA
1,4-Dichlorobenzene	2	<0.3	<0.3	NA	<0.3	<0.3	NA
1,2-Dichlorobenzene	2	<0.3	<0.3	NA	<0.3	<0.3	NA
bis(2-Chloroisopropyl)ether	10	<4	<4	NA	<4	<4	NA
Hexachloroethane	10	<2	<2	NA	<2	<2	NA
N-Nitroso-di-n-propylamine	30	<4	<4	NA	<4	<4	NA
Nitrobenzene	8	<1	<1	NA	<1	<1	NA
Isophorone	1	<0.4	<0.4	NA	<0.4	<0.4	NA
2-Nitrophenol	4	<1	<1	NA	<1	<1	NA
2,4-Dimethylphenol	3	<0.7	<0.7	NA	<0.7	<0.7	NA
bis(2-Chloroethoxy)methane	2	<0.5	<0.5	NA	<0.5	<0.5	NA
2,4-Dichlorophenol	9	<0.4	<0.4	NA	<0.4	<0.4	NA
1,2,4-Trichlorobenzene	2	<0.3	<0.3	NA	<0.3	<0.3	NA
Naphthalene	1	3.9	<0.1	NA	3.9	<0.1	150
Hexachlorobutadiene	4	<0.6	<0.6	NA	<0.6	<0.6	NA
4-Chloro-3-methylphenol	10	<2	<2	NA	<2	<2	NA
Hexachlorocyclopentadiene	10	<0.9	<0.9	NA	<0.9	<0.9	NA
2,4,6-Trichlorophenol	4	<0.6	<0.6	NA	<0.6	<0.6	NA
2-Chloronaphthalene	1	<0.2	<0.2	NA	<0.2	<0.2	NA
Acenaphthylene	0.9	<0.4	<0.4	NA	<0.4	<0.4	NA
Dimethylphthalate	2	<0.2	<0.2	NA	<0.2	<0.2	NA
2,6-Dinitrotoluene	6	<1	<1	NA	<1	<1	NA
Acenaphthene	2	<0.3	<0.3	NA	<0.3	<0.3	NA
2,4-Dinitrophenol	9	PC	PC	NA	PC	PC	NA
2,4-Dinitrotoluene	8	<1	<1	NA	<1	<1	NA
4-Nitrophenol	20	<3	<3	NA	<3	<3	NA
Fluorene	2	<0.3	<0.3	NA	<0.3	<0.3	NA
4-Chlorophenyl-phenylether	2	<0.4	<0.4	NA	<0.4	<0.4	NA
Diethylphthalate	1	<1	<1	NA	<1	<1	NA
4,6-Dinitro-2-methylphenol	10	<4	<4	NA	<4	<4	NA
N-Nitrosodiphenylamine	10	<0.5	<0.5	NA	<0.5	<0.5	NA
4-Bromophenyl-phenylether	5	<0.6	<0.6	NA	<0.6	<0.6	NA
Hexachlorobenzene	4	<0.5	<0.5	NA	<0.5	<0.5	NA
Pentachlorophenol	9	<4	<4	NA	<4	<4	NA
Phenanthrene	4	<0.3	<0.3	NA	<0.3	<0.3	NA
Anthracene	4	<0.3	<0.3	NA	<0.3	<0.3	NA
Di-n-butylphthalate	5	39	110	95	39	75	63
Fluoranthene	2	<0.4	<0.4	NA	<0.4	<0.4	NA
Pyrene	3	<0.3	<0.3	NA	<0.3	<0.3	NA
Benzidine	6	<2	<2	NA	<2	<2	NA
Butylbenzylphthalate	200	<1	<1	NA	<1	<1	NA
Benzo(a)anthracene	5	<0.4	<0.4	NA	<0.4	<0.4	NA
Chrysene	5	<0.4	<0.4	NA	<0.4	<0.4	NA
3,3'-Dichlorobenzidine	20	<2	<2	NA	<2	<2	NA
bis(2-Ethylhexyl)phthalate	9	160	170	6	120	190	45
Di-n-octylphthalate	40	120	240	67	150	280	60
Benzo(b)fluoranthene	3	<0.5	<0.5	NA	<0.5	<0.5	NA
Benzo(k)fluoranthene	3	<0.5	<0.5	NA	<0.5	<0.5	NA
Benzo(a)pyrene	2	<0.6	<0.6	NA	<0.6	<0.6	NA
Indeno(1,2,3-cd)pyrene	5	<800	<800	NA	<800	<800	NA
Dibenz(a,h)anthracene	2	<1	<1	NA	<1	<1	NA
Benzo(g,h,i)perylene	5	<0.5	<0.5	NA	<0.5	<0.5	NA
Surrogate Recovery (%)							
2-Fluorophenol		IF	IF	NA	IF	IF	NA
Phenol-d6		11	10	10	18	33	59
2,4,6-Tribromophenol		65	80	21	60	90	40
Nitrobenzene-d5		36	48	29	36	66	59
2-Fluorobiphenyl		60	94	44	52	92	56
Terphenyl-d14		76	130	52	68	120	55

Table 27A Duplicate Sample Results for Pesticides (ng/g)

Lab ID: / Field ID:	MDL	4-91 92-831	4-91 92-831d	Relative % Difference	18-91 92-845	92-845d 18-91	Relative % Difference
Target Pesticides							
a-BHC	0.6	<0.6	<.6	NA	<0.6	<.6	NA
b-BHC	1	<1	<1	NA	<1	<1	NA
g-BHC	0.3	<.3	<.3	NA	<.3	<.3	NA
d-BHC	0.9	<.9	<.9	NA	<.9	<.9	NA
Heptachlor	0.3	<.3	<.3	NA	<.3	<.3	NA
Aldrin	0.5	<.5	<.5	NA	<.5	<.5	NA
Heptachlor Epoxide	0.5	1.4	3.4	83	8.6	11	24
a-Endosulphan	0.5	<.5	<.5	NA	<.5	<.5	NA
Dieldrin	0.5	3.8	9.3	84	22	29	27
pp'-DDE	0.5	23	40	54	120	180	40
Endrin	0.5	<.5	<.5	NA	<.5	<.5	NA
b-Endosulphan	0.5	<.5	<.5	NA	<.5	<.5	NA
pp'-DDD	0.9	9.8	23	80	91	97	6
Endrin Aldehyde	1	<1	<1	NA	<1	<1	NA
Endosulfan Sulfate	1	<1	<1	NA	<1	<1	NA
pp'-DDT	1	2	3	40	19	25	27
Methoxychlor	2	<2	<2	NA	<2	<2	NA
g-chlordane	1	13	21	47	51	87	52
a-chlordane	1	26	42	47	170	160	6
Surrogate Recovery (%)							
Tetrachloro-m-xylene		28	62	76	22	40	58
PCB 209		49	109	76	72	98	31

Table 27B Duplicate Sample Results for Chlorinated Pesticide (ng/g)

Lab ID: / Field ID:	MDL	2-92 93-252	2-92 93-252d	Relative % Difference	4-92 93-254	4-92 93-254d	Relative % Difference
Target Pesticides							
a-BHC	1	<1	<1	NA	<1	<1	NA
b-BHC	2	<2	<2	NA	<2	<2	NA
g-BHC	1	<1	<1	NA	<1	<1	NA
d-BHC	1	<1	<1	NA	<1	<1	NA
Heptachlor	0.8	<0.8	<0.8	NA	1.6	1.7	6
Aldrin	0.5	<0.5	<0.5	NA	<0.5	<0.5	NA
Heptachlor Epoxide	0.6	<0.6	<0.6	NA	1.8	2.2	20
a-Endosulphan	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
Dieldrin	0.6	4.0	4.3	7	<0.6	<0.6	NA
pp'-DDE	0.8	30	36	18	31	35	12
Endrin	1	<1	<1	NA	<1	<1	NA
b-Endosulphan	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
pp'-DDD	1	8	9	12	16	18	12
Endrin Aldehyde	0.7	<0.7	<0.7	NA	<0.7	<0.7	NA
Endosulfan Sulfate	0.8	<0.8	<0.8	NA	<0.8	<0.8	NA
pp'-DDT	1	2	1	67	<1	<1	NA
Methoxychlor	0.4	<0.4	<0.4	NA	<0.4	<0.4	NA
g-chlordane	1	<1	<1	NA	23	25	8
a-chlordane	1	2	2	0	43	47	9
Surrogate Recovery (%)							
Tetrachloro-m-xylene		76	79	5	68	78	13
PCB 209		104	123	17	93	98	5

Table 28A Duplicate Sample Results for PCBs (ng/g)

Field ID: / Lab ID:	MDL	4-91 92-831	4-91 92-831d	Relative % Difference	18-91 92-845	18-91 92-845d	Relative % Difference
Target PCBs							
PCB 1	0.8	2.0	<0.8	NA	1.7	1.5	13
PCB 3	0.8	<0.8	<0.8	NA	<0.8	<0.8	NA
PCB 4,10	0.2	0.2	<0.2	NA	0.3	0.4	29
PCB 7	0.2	0.5	<0.2	NA	0.3	0.6	67
PCB 6	0.3	<0.3	<0.3	NA	<0.3	<0.3	NA
PCB 8,5	0.9	<0.9	0.9	NA	1.0	<0.9	NA
PCB 19	1	<1	<1	NA	<1	<1	NA
PCB 12,13	0.2	<0.2	<0.2	NA	<0.2	<0.2	NA
PCB 18	1	2	2	0	3	3	0
PCB 17	2	2	<2	NA	4	4	0
PCB 27	0.9	<0.9	<0.9	NA	<0.9	1.1	NA
PCB 16,32	2	3	<2	NA	7	7	0
PCB 29	0.2	<0.2	<0.2	NA	<0.2	<0.2	NA
PCB 31	1	4	3	29	13	14	7
PCB 33	1	<1	2	NA	<1	<1	NA
PCB 53	1	<1	<1	NA	2	<1	NA
PCB 51	1	2	1	67	3	3	0
PCB 22	2	2	<2	NA	4	4	0
PCB 45	1	<1	<1	NA	<1	<1	NA
PCB 46	2	<2	<2	NA	<2	<2	NA
PCB 49	1	8	5	46	14	13	7
PCB 47,48	1	12	7	53	20	17	16
PCB 44	1	11	7	44	8	7	13
PCB 42	0.3	0.7	0.8	13	1.0	0.9	11
PCB 37	0.5	<0.5	<0.5	NA	<0.5	<0.5	NA
PCB 41,71,64	2	12	8	40	17	18	6
PCB 40	2	<2	<2	NA	<2	<2	NA
PCB 63	1	1	<1	NA	<1	2	NA
PCB 74	1	1	<1	NA	<1	<1	NA
PCB 70,76	1	3	3	0	4	5	22
PCB 66	1	14	10	33	23	24	4
PCB 95	0.6	14	10	33	11	7.4	39
PCB 91	0.6	4.6	3.2	36	5.9	4.8	21
PCB 92,84	1	4	<1	NA	3	<1	NA
PCB 101	0.4	28	20	33	36	32	12
PCB 99	0.4	11	8.1	30	17	17	0
PCB 119	0.8	2.7	1.5	57	3.6	3.7	3
PCB 83	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
PCB 97	0.4	7.2	5.0	36	5.8	5.0	15
PCB 87	0.5	8.8	6.2	35	10	8.0	22
PCB 85	0.5	3.9	2.8	33	6.6	6.5	2
PCB 136	0.7	3.0	2.1	35	3.2	1.6	67
PCB 110	0.4	26	19	31	26	20	26
PCB 82	0.4	<0.4	<0.4	NA	<0.4	<0.4	NA
PCB 151	1	30	27	11	51	45	13
PCB 135,144	1	13	12	8	20	18	11
PCB 149	1	68	60	13	77	55	33
PCB 146	2	26	23	12	52	46	12
PCB 153,132	2	310	260	18	560	510	9
PCB 141	2	8	7	13	21	19	10
PCB 176	2	3	3	0	4	3	29
PCB 178	2	14	13	7	25	25	0
PCB 187,182	2	94	88	7	170	180	6
PCB 183	2	27	25	8	50	55	10
PCB 185	2	4	<2	NA	8	7	13
PCB 174	1	10	9	11	17	18	6
PCB 177	1	21	19	10	20	11	58
PCB 202	1	5	4	22	8	7	13
PCB 171	2	19	17	11	35	35	0
PCB 172	4	5	6	18	13	13	0
PCB 197	4	<4	<4	NA	13	8	48
PCB 180	1	46	41	11	90	95	5

Table 28A Duplicate Sample Results for PCBs (ng/g)

Field ID: / Lab ID:	MDL	4-91 92-831	4-91 92-831d	Relative % Difference	18-91 92-845	18-91 92-845d	Relative % Difference
Target PCBs							
PCB 191	2	2	<2	NA	<2	4	NA
PCB 199	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
PCB 201	2	5	4	22	12	11	9
PCB 202,196	2	<2	11	NA	30	28	7
PCB 208	2	<2	30	NA	<2	40	NA
PCB 195	3	9	9	0	16	18	12
PCB 194	0.9	1.5	1.6	6	4.2	4.5	7
PCB 206	2	<2	<2	NA	4	4	0
Coplanar PCB Congeners							
PCB 28	2	5.3	3.8	33	13	<2	NA
PCB 52	2	12	9.1	27	15	15	0
PCB 60(56)	1	<1	3.3	NA	6.6	6.6	0
PCB 81	1	<1	<1	NA	<1	<1	NA
PCB 123	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
PCB 118	0.7	56	33	52	73	63	15
PCB 114	0.8	0.86	1.3	41	1.8	1.6	12
PCB 105	0.5	11	7.5	38	19	15	24
PCB 138(163)	1	140	100	33	230	190	19
PCB 158	1	12	8.3	36	22	15	38
PCB 126	0.8	4.2	2.7	43	6.6	5.1	26
PCB 167	1	14	9.2	41	22	19	15
PCB 156	1	8.5	5.4	45	14	12	15
PCB 157	1	1	<1	NA	2.9	2.1	32
PCB 169	1	<1	<1	NA	<1	<1	NA
PCB 170(190)	2	23	17	30	42	41	2
PCB 77	0.1	<0.1	<0.1	NA	0.3	0.2	40
Total PCBs	10	1200	1000	18	2000	1900	5
Surrogate Recovery (%)							
PCB 14		76	67	13	66	78	17
PCB 65		91	78	16	86	91	6
PCB 166		109	104	4	124	113	9

Table 28B Duplicate Sample Results for PCBs (ng/g)

Field ID: Lab ID:	MDL	2-92 93-252	2-92 93-252d	Relative % Difference	4-92 93-254	4-92 93-254d	Relative % Difference
Target PCBs							
PCB 1	1	<1	<1	NA	1	<1	NA
PCB 3	1	<1	<1	NA	<1	<1	NA
PCB 4,10	0.4	<0.4	<0.4	NA	<0.4	<0.4	NA
PCB 7	0.4	<0.4	<0.4	NA	<0.4	<0.4	NA
PCB 6	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
PCB 8,5	2	<2	<2	NA	3	<2	NA
PCB 19	3	<3	<3	NA	<3	<3	NA
PCB 12,13	4	<4	<4	NA	<4	<4	NA
PCB 18	3	<3	<3	NA	3	<3	NA
PCB 17	6	<6	<6	NA	<6	<6	NA
PCB 27	2	<2	<2	NA	<2	<2	NA
PCB 16,32	4	<4	<4	NA	24	19	23
PCB 29	3	<3	<3	NA	<3	<3	NA
PCB 31 + 28	3	<3	<3	NA	17	13	27
PCB 33	3	<3	<3	NA	3	<3	NA
PCB 53	0.4	<0.4	<0.4	NA	1.6	1.3	21
PCB 51	0.3	<0.3	<0.3	NA	0.8	0.7	13
PCB 22	5	<5	<5	NA	<5	<5	NA
PCB 45	0.4	<0.4	<0.4	NA	1.1	0.9	20
PCB 46	0.4	<0.4	<0.4	NA	0.6	<0.4	NA
PCB 49	0.3	1.0	1.0	0	6.4	5.3	19
PCB 47,48	0.4	1.6	1.2	29	6.6	5.7	15
PCB 44	0.4	0.9	0.8	12	8	7	13
PCB 37	0.9	<0.9	<0.9	NA	<0.9	<0.9	NA
PCB 42	0.08	<0.08	<0.08	NA	0.14	<0.08	NA
PCB 41,71,64	0.5	1.9	1.4	30	14	12	15
PCB 40	0.4	<0.4	<0.4	NA	2.4	1.6	40
PCB 63	0.3	<0.3	<0.3	NA	0.9	0.8	12
PCB 74	0.3	0.7	0.6	15	4.1	3	31
PCB 70,76	0.3	1.2	1.1	9	7.3	6	20
PCB 66	0.4	2	2	0	11	9.6	14
PCB 95	0.8	2.4	2.3	4	8.3	7	17
PCB 91	0.8	<0.8	<0.8	NA	2.0	1.5	29
PCB 92,84	2	<2	<2	NA	4	<2	NA
PCB 101	0.5	4.9	4.9	0	11	9.6	14
PCB 99	0.5	2	2	0	4.1	3.6	13
PCB 119	0.7	<0.7	<0.7	NA	<0.7	<0.7	NA
PCB 83	0.6	<0.6	<0.6	NA	<0.6	<0.6	NA
PCB 97	0.6	0.9	0.8	12	2.5	2.1	17
PCB 87	0.7	1.6	1.5	6	4.2	3.7	13
PCB 85	0.9	0.9	0.9	0	2.2	1.9	15
PCB 136	0.3	0.7	0.7	0	1.6	1.5	6
PCB 110	0.5	3.8	3.7	3	10	9.0	11
PCB 82	0.7	<0.7	<0.7	NA	0.9	0.8	12
PCB 151	0.6	5.7	5.2	9	6.5	6.0	8
PCB 135,144	0.5	2.2	2.1	5	3.1	2.9	7
PCB 149	0.5	13	13	0	16	15	6
PCB 146	0.7	5.9	6.2	5	5.3	4.9	8
PCB 153,132	0.8	50	51	2	48	43	11

Table 28B Duplicate Sample Results for PCBs (ng/g)

Field ID: / Lab ID:	MDL	2-92 93-252	2-92 93-252d	Relative % Difference	4-92 93-254	4-92 93-254d	Relative % Difference
Target PCBs							
PCB 141	0.8	4.0	3.8	5	4	4	0
PCB 176	0.2	0.4	0.4	0	0.8	0.7	13
PCB 178	2	<2	<2	NA	2	2	0
PCB 187,182	2	26	26	0	26	24	8
PCB 183	1	7	7	0	6	6	0
PCB 185	1	<1	1	NA	<1	<1	NA
PCB 174	0.9	3.1	3.1	0	4.0	3.7	8
PCB 177	1	3	3	0	5	5	0
PCB 202	0.8	1	1	0	2	1	7
PCB 171	2	4	4	0	4	4	0
PCB 172	1	1	2	67	1	1	0
PCB 197	2	<2	<2	NA	<2	<2	NA
PCB 180	0.9	15	15	0	13	12	8
PCB 191	1	<1	<1	NA	<1	<1	NA
PCB 199	0.3	<0.3	<0.3	NA	<0.3	<0.3	NA
PCB 201	0.9	3.3	3.4	3	3.3	2.9	13
PCB 203,196	1	6	5	18	5	4	22
PCB 208	2	3	5	50	3	4	29
PCB 195	2	3	3	0	3	3	0
PCB 194	0.4	1.3	1.4	7	1.1	1.1	0
PCB 206	1	1	1	0	1	<1	NA
Coplanar PCB Congeners							
PCB 28	3	<3	<3	NA	<3	<3	NA
PCB 52	0.3	2.8	2.5	11	12	11	9
PCB 60(56)	0.3	1.1	1.0	10	4.9	3.9	23
PCB 81	0.2	<0.2	<0.2	NA	<0.2	<0.2	NA
PCB 118	0.7	10	10	0	17	15	13
PCB 123	0.7	0.9	0.9	0	1.3	1.1	17
PCB 114	0.8	<0.8	<0.8	NA	<0.8	<0.8	NA
PCB 105	0.7	2.6	2.8	7	5.2	4.7	10
PCB 138(163)	0.5	32	32	0	36	33	9
PCB 158	0.5	2.9	3.1	7	3.2	2.8	13
PCB 126	0.6	0.8	<0.6	NA	1.0	0.6	50
PCB 167	0.5	3.0	2.7	11	<0.5	<0.5	NA
PCB 156	0.4	1.9	1.8	5	2.6	2.3	12
PCB 157	0.4	<0.4	<0.4	NA	<0.4	<0.4	NA
PCB 169	0.8	<0.8	<0.8	NA	<0.8	<0.8	NA
PCB 170(190)	0.8	8.9	8.5	5	8.7	7.9	10
PCB 77	0.3	<0.3	<0.3	NA	3.4	1.3	89
Total PCBs	10	250	250	0	420	370	13
Surrogate Recovery (%)							
PCB 14		47	45	2.8	67	63	5.4
PCB 65		47	46	0.22	67	63	6.8
PCB 166		76	73	4.4	73	65	12

Table 29A Duplicate Sample Results for PCDD/PCDFs (pg/g)

Field ID: Lab ID:	MDL	4-91 92-831	4-91 92-831d	Relative % Difference	18-91 92-845	18-91 92-845d	Relative % Difference
Target PCDFs							
2378-T4CDF	0.2	2.6	1.4	60	2.6	1.8	36
TOTAL T4CDF	0.2	2.6 (1)	1.4 (1)	60	2.6 (1)	1.8 (1)	36
12378-P5CDF	0.1	<0.7 *	0.4	NA	0.9	<0.5	NA
23478-P5CDF	0.1	3.2	1.9	51	4.5	4	12
TOTAL P5CDF	0.1	3.2 (1)	2.3 (2)	33	5.4 (2)	4 (1)	30
123478-H6CDF	0.1	<0.3 *	0.2	NA	0.7	0.3	80
123678-H6CDF	0.1	<0.3 *	0.2	NA	0.6	0.3	67
234678-H6CDF	0.1	<0.4 *	0.3	NA	0.7	0.5	33
123789-H6CDF	0.3	<0.4 *	<0.1	NA	1	<0.4	NA
TOTAL H6CDF	0.3	<0.4	0.7 (3)	NA	3 (4)	0.9 (3)	100
1234678-H7CDF	0.1	0.3	0.3	0	0.5	0.3	50
1234789-H7CDF	0.2	<0.1 *	<0.1	NA	0.4	<0.1	NA
TOTAL H7CDF	0.2	0.3 (1)	0.3 (1)	0%	0.9 (2)	0.3 (1)	100
O8CDF	0.3	<0.3	<0.1	NA	0.6 (1)	<0.3	NA
Target PCDDs							
2378-T4CDD	0.4	1.9	<0.3	NA	2.3	2.4	4
TOTAL T4CDD	0.4	1.9 (1)	<0.3	NA	2.3 (1)	2.4 (1)	4
12378-P5CDD	0.2	1.4	0.7	67	1.5	<1.3	NA
TOTAL P5CDD	0.2	1.4 (1)	0.7 (1)	67	1.5 (1)	<1.3	NA
123478-H6CDD	0.2	<0.5	0.4	NA	0.9	<0.6	NA
123678-H6CDD	0.2	1.4	0.9	43	1.8	1.6	12
123789-H6CDD	0.3	<0.5	<0.1	NA	0.7	0.6	15
TOTAL H6CDD	0.3	1.4 (2)	1.3 (2)	7	3.4 (3)	2.2 (2)	43
1234678-H7CDD	0.2	2.1	1.3	47	1.9	1.8	5
TOTAL H7CDD	0.2	2.1 (1)	1.3 (1)	47	1.9 (1)	1.8 (1)	5
O8CDD	0.2	8.1	3.2	87	5.6	5.5	2
TEQ (ppt)		4.59	1.67	93	6.3	4.9	25
Surrogate Recovery (%)							
C13-2378-T4CDF		67	97	37	77	81	5
C13-2378-T4CDD		66	100	41	87	85	2
C13-12378-P5CDF		69	113	48	85	85	0
C13-23478-P5CDF		70	118	51	83	87	5
C13-12378-P5CDD		67	119	56	89	92	3
C13-123478-H6CDF		79	115	37	88	85	3
C13-123678-H6CDF		75	86	14	89	79	12
C13-234678-H6CDF		83	111	29	94	92	2
C13-123789-H6CDF		76	92	19	74	65	13
C13-123478-H6CDD		74	139	61	98	105	7
C13-123678-H6CDD		76	102	29	95	90	5
C13-1234678-H7CDF		84	112	29	95	93	2
C13-1234789-H7CDF		82	120	38	95	97	2
C13-1234678-H7CDD		84	137	48	104	100	4
C13-O8CDD		80	141	55	103	106	3

* = NONE DETECTED BASED ON PEAK RATIO

APPENDIX A

SURROGATE RECOVERY

CORRECTED RESULTS

Table of Contents

List of Tables

1 Introduction

The results presented in this Appendix are calculated from the data given in Results section and corrected for recovery of surrogate compounds. In some instances (discussed below), the use of a given surrogate to perform the correction is somewhat arbitrary given structural dissimilarities. An attempt was made to select the surrogate that behaved most like the target analyte, however, a good match was not always possible. The corrected results should therefore be interpreted with caution.

Surrogate recovery-corrected data is not reported for the metals because these analyses do not use surrogates. The method used for PCDD/PCDF analysis employs an internal standard method of quantitation which uses the surrogates for quantitation. Thus analyte recovery is incorporated into the results presented in the Results section of the Final Report.

2 Volatiles

The surrogate recovery-corrected results for the analysis of volatiles in the first 20 fish samples are given in Table IA and Table IB. In the first set of analyses, the recoveries of the surrogates trichlorofluoromethane and ethylbenzene-d_{10} indicated a matrix interference for these compounds, thus only benzene-d_6 was used as a correction surrogate. For the second set of analyses, all three surrogates (benzene-d_6, toluene-d_8, and fluorobenzene) were used in the surrogate recovery correction of VOCs.

3 Semi-Volatile Organics

The surrogate recovery-corrected results for the analyses of semi-volatiles in the fish samples are given in Table IIA and Table IIB. The selection of surrogates for recovery-correction was based on the presence of similar functional groups, molecular weight, and boiling point. Thus in general, a compound was corrected by the surrogate eluting closest to it, with some exceptions due to functional group differences. The surrogates used for correction of the

semi-volatiles are indicated in Table V. Note that for semi-volatile compounds with amine or nitrosamine functional groups, analysis of a structurally analogous surrogate was not performed. Because of the polar nature of these compounds as well as their basicity, it is not appropriate to estimate their recovery based only on gas chromatographic performance or to approximate their recoveries using phenols, which are acidic. Corrected results for basic semi-volatiles should therefore be interpreted with caution. In the second set of analyses, recovery of the surrogate 2-fluorophenol was not possible, therefore the surrogate recovery correction for the second set of analyses was performed using phenol-d_6.

4 Organochlorine Pesticides

The surrogate recovery-corrected results for the analyses of pesticides for the fish samples are given in Table IVA and Table IVB. The two surrogates for this analysis, tetrachloro-m-xylene and PCB 209, elute at the beginning and the end of the organochlorine pesticide window. Many of the organochlorine pesticides are more polar than the surrogates used. Because of this they are more strongly bound to the sample matrix and the stationary phases used for clean-up. The recoveries suggested by the two surrogates used may therefore be an overestimation of the true analyte recovery. The surrogate eluting closest to the target analyte was chosen for recovery correction.

5 Polychlorinated Biphenyls

The surrogate recovery-corrected results for the analysis of PCBs in the first 20 fish samples are given in Table VA and Table VB. PCB-14, a dichloro- PCB, was used to correct all monochloro- and dichloro- PCBs. PCB-65, a tetrachloro- PCB, was used to correct all trichloro-, tetrachloro- and pentachloro- PCBs. PCB-166, a hexachloro- PCB, was used to correct the remaining congeners.

Table IA Surrogate Recovery Corrected Sample Results for VOCs (ng/g)

Field ID:	1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target Volatiles							
1,1-dichloroethene	<0.4	<0.4	<0.5	<0.4	<0.4	<0.3	<0.4
methylene chloride	31	59	3.5	36	59	22	24
trans-1,2-dichloroethene	<0.4	<0.4	<0.5	<0.4	<0.4	<0.3	<0.4
1,1-dichloroethane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
chloroform	0.38	0.6	0.43	0.56	0.43	0.4	1.4
1,1,1,-trichloroethane	1.0	<0.4	1.3	<0.4	1.1	<0.3	0.93
carbon tetrachloride	<0.8	<0.8	<1	<0.7	<0.7	<0.7	<0.8
1,2-dichloroethane	<0.6	<0.6	<0.7	<0.6	<0.5	<0.5	<0.6
benzene	2.8	6.6	4.7	4.8	2.4	4.1	6.4
trichloroethene	<1	<1	1.8	<0.9	<0.9	<0.8	<1
1,2-dichloropropane	<0.8	<0.8	<1	<0.7	<0.7	<0.7	<0.8
bromodichloromethane	<0.6	<0.6	<0.7	<0.6	<0.5	<0.5	<0.6
cis-1,3-dichloropropene	<4	<4	<4	<4	<4	<4	<4
toluene	22	35	38	19	14	30	15
trans-1,3-dichloropropene	<3	<3	<3	<3	<3	<3	<3
1,1,2-trichlorethane	<2	<2	<2	<2	<1	<1	<2
tetrachloroethene	18	<6	<7	<6	<5	<5	1.7
dibromochloromethane	<10	<10	<10	<10	<10	<10	<10
chlorobenzene	<2	<2	<2	<2	<1	<1	<2
ethylbenzene	<1	4.2	5	4.2	5.8	1.3	3.4
m,p-xylene	1.1	6	5.7	5.5	9.5	2	5
o-xylene	<1	5.3	6.4	5.3	7.4	2.5	4.8
bromoform	NR	NR	NR	NR	NR	NR	NR
1,1,2,2-tetrachloroethane	<6	<6	<7	<6	<5	<5	<6
Surrogate Recovery (%)							
trichlorofluoromethane	380	350	180	130	350	140	340
benzene-d6	100	98	85	100	100	110	96
ethylbenzene-d10	120	130	92	140	150	63	130

Field ID:	7-91	8-91	9-91	10-91	11-91	12-91	13-91
Lab ID:	92-834	92-835	92-836	92-837	92-838	92-839	92-840
Target Volatiles							
1,1-dichloroethene	<0.4	<0.5	<0.4	<0.5	<0.5	<0.4	<0.4
methylene chloride	23	26	7.6	14	35	11	12
trans-1,2-dichloroethene	<0.4	<0.5	<0.4	<0.5	<0.5	<0.4	<0.4
1,1-dichloroethane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
chloroform	0.57	5.8	1.1	0.56	0.33	0.39	<0.2
1,1,1,-trichloroethane	0.59	4.3	0.9	0.65	0.62	0.63	0.54
carbon tetrachloride	<0.7	1.6	<0.9	<0.9	<1	<0.9	<0.9
1,2-dichloroethane	<0.6	<0.7	<0.7	<0.7	<0.7	<0.6	<0.7
benzene	1.8	7.4	1.8	1.8	1.8	1.5	1.7
trichloroethene	<0.9	2.7	<1	<1	<1	<1	<1
1,2-dichloropropane	<0.7	<1	<0.9	<0.9	<1	<0.9	<0.9
bromodichloromethane	<0.6	<0.7	0.77	<0.7	<0.7	<0.6	<0.7
cis-1,3-dichloropropene	<4	<4	<4	<4	<4	<4	<4
toluene	6.5	77	11	16	18	19	46
trans-1,3-dichloropropene	<3	<3	<3	<3	<3	<3	<3
1,1,2-trichlorethane	<2	<2	<2	<2	<2	<2	<2
tetrachloroethene	<6	20	<7	<7	<7	<6	<7
dibromochloromethane	<10	<10	<10	<10	<10	<10	<10
chlorobenzene	<2	<2	<2	<2	<2	<2	<2
ethylbenzene	<0.9	18	5.6	1.9	2.6	1.7	1.7
m,p-xylene	<0.6	24	6.9	2.4	3	1.8	1.9
o-xylene	<1	23	5.3	2.8	2.6	<2	2
bromoform	NR	NR	NR	NR	NR	NR	NR
1,1,2,2-tetrachloroethane	<6	<7	<7	<7	<7	<6	<7
Surrogate Recovery (%)							
trichlorofluoromethane	82	700	280	230	250	140	270
benzene-d6	100	82	90	85	84	87	85
ethylbenzene-d10	120	100	230	160	160	150	160

NR = NOT RECOVERED

Table IA Surrogate Recovery Corrected Sample Results for VOCs (ng/g)

Field ID:	14-91	15-91	16-91	17-91	18-91	19-91
Lab ID:	92-841	92-842	92-843	92-844	92-845	92-846
Target Volatiles						
1,1-dichloroethene	<0.5	<0.4	<0.4	<0.5	<0.4	<0.4
methylene chloride	19	8	17	26	5.7	13
trans-1,2-dichloroethene	<0.5	<0.4	<0.4	<0.5	<0.4	<0.4
1,1-dichloroethane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
chloroform	<0.2	0.39	0.51	2.4	0.95	0.24
1,1,1,-trichloroethane	<0.5	0.67	0.49	2.7	0.63	0.69
carbon tetrachloride	<0.9	<0.9	<0.9	<0.9	<0.8	<0.8
1,2-dichloroethane	<0.7	<0.6	<0.7	<0.7	<0.6	<0.6
benzene	1.5	3.1	2	6.7	2.5	1.9
trichloroethene	<1	<1	<1	1.2	<1	<1
1,2-dichloropropane	<0.9	<0.9	<0.9	<0.9	<0.8	<0.8
bromodichloromethane	<0.7	<0.6	<0.7	<0.7	<0.6	<0.6
cis-1,3-dichloropropene	<4	<4	<4	<4	<4	<4
toluene	29	24	14	50	17	30
trans-1,3-dichloropropene	<3	<3	<3	<3	<3	<3
1,1,2-trichlorethane	<2	<2	<2	<2	<2	<2
tetrachloroethene	<7	<6	<7	<7	<6	<6
dibromochloromethane	<10	<10	<10	<10	<10	<10
chlorobenzene	<2	<2	<2	<2	<2	<2
ethylbenzene	1.9	2.3	1.9	19	10	1.5
m,p-xylene	2.5	2.8	2.2	22	13	1.9
o-xylene	2.3	2.5	<2	19	10	2.0
bromoform	NR	NR	NR	NR	NR	NR
1,1,2,2-tetrachloroethane	<7	<6	<7	<7	<6	<6
Surrogate Recovery (%)						
trichlorofluoromethane	170	400	290	990	190	400
benzene-d6	84	84	85	83	85	96
ethylbenzene-d10	160	160	150	210	310	110

NR = NOT RECOVERED

Table IB Surrogate Recovery Corrected Sample Results for VOCs (ng/g)

Field ID:		93-251	93-252	93-253	93-254	93-255
Lab ID:	MDL	1-92	2-92	3-92	4-92	5-92
Target Volatiles						
1,1-Dichloroethene	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2
Methylene Chloride	<0.2	19	860	1600	110	49
Trans-1,2-Dichloroethene	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2
1,1-Dichloroethane	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2
Chloroform	<0.2	0.4	0.5	1	1.5	0.5
1,1,1,Trichloroethane	<0.2	0.7	0.8	2	1	1
Carbon Tetrachloride	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2
1,2-Dichloroethane	<0.2	0.9	0.9	0.7	0.8	0.6
Benzene	<0.2	6.6	3.6	11	31	3.2
Trichloroethene	<0.2	0.4	0.5	0.4	1	0.3
1,2-Dichloropropane	<0.2	<0.2	0.3	0.2	0.5	<0.2
Bromodichloromethane	<0.2	<0.2	<0.2	0.2	<0.2	<0.2
Cis-1,3-Dichloropropene	<0.2	<0.2	<0.2	0.2	<0.2	<0.2
Toluene	<0.2	110	23	50	64	56
Trans-1,3-dichloropropene	<0.2	0.6	<0.3	<0.3	<0.2	<0.2
1,1,2-Trichloroethane	<0.2	0.6	<0.3	<0.3	<0.2	<0.2
Tetrachloroethene	<0.2	0.8	1	4.1	7.0	2
Dibromochloromethane	<0.2	<0.3	<0.3	<0.3	<0.2	<0.2
Chlorobenzene	<0.2	0.8	0.8	1	1	0.4
Ethyl benzene	<0.2	2	2	3.9	4.8	2
M,P-xylene	<0.2	2.5	3.4	7.2	6.9	2.9
O-xylene	<0.2	2.6	3	5.5	4.0	2.1
Bromoform	<0.2	1	<0.3	<0.3	<0.2	<0.2
1,1,2,2-Tetrachloroethane	<0.2	2	<0.3	<0.3	<0.2	<0.2
Surrogate Recovery (%)						
d6-Benzene		100	110	110	150	110
Fluorobenzene		100	100	100	120	100
d8-Toluene		72	65	76	120	83

Field ID:		93-256	93-258	93-259	93-260	93-261
Lab ID:	MDL	6-92	8-92	9-92	10-92	11-92
Target Volatiles						
1,1-Dichloroethene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methylene Chloride	<0.2	960	1200	54	10	1000
Trans-1,2-Dichloroethene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform	<0.2	0.4	0.7	0.5	0.5	0.7
1,1,1,Trichloroethane	<0.2	0.7	0.6	0.9	0.5	0.5
Carbon Tetrachloride	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloroethane	<0.2	0.6	0.9	0.6	0.6	0.6
Benzene	<0.2	6.0	6.8	3.0	3.2	6.2
Trichloroethene	<0.2	<0.2	0.4	0.4	<0.2	<0.2
1,2-Dichloropropane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bromodichloromethane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cis-1,3-Dichloropropene	<0.2	<0.2	<0.2	<0.2	<0.3	<0.2
Toluene	<0.2	37	58	43	33	66
Trans-1,3-dichloropropene	<0.2	<0.3	<0.3	<0.3	<0.3	<0.3
1,1,2-Trichloroethane	<0.2	<0.3	<0.3	<0.3	1	<0.3
Tetrachloroethene	<0.2	2	1	4.4	1	1
Dibromochloromethane	<0.2	<0.3	<0.3	<0.3	<0.3	<0.3
Chlorobenzene	<0.2	0.6	0.8	0.6	<0.3	0.4
Ethyl benzene	<0.2	3	2	2	0.6	5.1
M,P-xylene	<0.2	4.2	3.2	3.2	1	10
O-xylene	<0.2	3.4	3	3	0.9	8.7
Bromoform	<0.2	<0.3	<0.3	<0.3	<0.3	<0.3
1,1,2,2-Tetrachloroethane	<0.2	<0.3	<0.3	<0.3	<0.3	<0.3
Surrogate Recovery (%)						
d6-Benzene		120	110	120	110	110
Fluorobenzene		100	100	100	100	100
d8-Toluene		70	73	65	71	72

Table IB Surrogate Recovery Corrected Sample Results for VOCs (ng/g)

Field ID: / Lab ID:	MDL	93-262 12-92	93-263 13-92	93-265 15-89	93-266 16-89	93-267 17-93
Target Volatiles						
1,1-Dichloroethene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1
Methylene Chloride	<0.2	570	140	490	1200	47
Trans-1,2-Dichloroethene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1
1,1-Dichloroethane	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1
Chloroform	<0.2	0.6	0.8	1	2	0.6
1,1,1,Trichloroethane	<0.2	0.4	1	0.6	0.8	0.3
Carbon Tetrachloride	<0.2	<0.2	<0.2	<0.2	<0.2	0.3
1,2-Dichloroethane	<0.2	0.5	0.9	0.5	0.5	0.6
Benzene	<0.2	5.4	6.6	2.8	2	13
Trichloroethene	<0.2	<0.2	0.7	0.4	0.3	0.7
1,2-Dichloropropane	<0.2	<0.2	0.2	<0.2	<0.2	<0.2
Bromodichloromethane	<0.2	<0.2	0.2	0.7	0.9	<0.2
Cis-1,3-Dichloropropene	<0.2	<0.2	0.4	<0.2	<0.2	<0.2
Toluene	<0.2	48	110	45	44	70
Trans-1,3-dichloropropene	<0.2	<0.3	0.8	<0.3	<0.3	<0.2
1,1,2-Trichloroethane	<0.2	<0.3	1	<0.3	<0.3	<0.2
Tetrachloroethene	<0.2	3.3	24	6.7	0.9	2
Dibromochloromethane	<0.2	<0.3	<0.2	<0.3	<0.3	<0.2
Chlorobenzene	<0.2	0.8	2.9	<0.3	<0.3	<0.2
Ethyl benzene	<0.2	13	18	1	0.7	2
M,P-xylene	<0.2	26	35	2	1	2.7
O-xylene	<0.2	14	25	1	1	2
Bromoform	<0.2	<0.3	0.9	0.4	0.5	<0.2
1,1,2,2-Tetrachloroethane	<0.2	<0.3	<0.2	<0.3	<0.3	<0.2
Surrogate Recovery (%)						
d6-Benzene		110	110	110	110	150
Fluorobenzene		110	100	100	99	110
d8-Toluene		77	85	77	77	140

Table IIA Surrogate Recovery Corrected Sample Results for Semi-Volatiles (ng/g)

Field ID:	1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target Semi-Volatile							
N-Nitrosodimethylamine	<10	<10	<10	<10	<10	<10	<10
Phenol	160	50	<10	30	<20	<60	<20
bis(2-Chloroethyl)ether	<6	<4	<4	<3	<4	<7	<4
2-Chlorophenol	<60	<20	<20	<9	<20	<40	<40
1,3-Dichlorobenzene	<3	<2	<3	<2	<3	<4	<3
1,4-Dichlorobenzene	<3	<2	<3	<3	<3	<4	<3
1,2-Dichlorobenzene	<3	<2	<3	<2	<3	<4	<3
bis(2-Chloroisopropyl)ether	<20	<10	<10	<10	<20	<20	<10
N-Nitroso-di-n-propylamine	<40	<30	<50	<40	<40	<60	<40
Hexachloroethane	<10	<10	<10	<10	<20	<20	<10
Nitrobenzene	<20	<10	<10	<9	<10	<20	<10
Isophorone	<6	<2	<2	<1	<2	<7	<3
2-Nitrophenol	<9	<6	<6	<5	<6	<10	<6
2,4-Dimethylphenol	<10	<4	<4	<3	<4	<20	<6
bis(2-Chloroethoxy)methane	<4	<3	<3	<2	<3	<5	<3
2,4-Dichlorophenol	<100	<30	<40	<20	<30	<70	<80
1,2,4-Trichlorobenzene	<3	<2	<3	<3	<3	<4	<3
Naphthalene	10	32	22	120	100	29	52
Hexachlorobutadiene	<6	<5	<6	<5	<6	<7	<6
4-Chloro-3-methylphenol	<100	<40	<50	<20	<40	<90	<100
Hexachlorocyclopentadiene	<10	<10	<10	<10	<10	<20	<10
2,4,6-Trichlorophenol	<6	<5	<6	<5	<5	<8	<5
2-Chloronaphthalene	<1	<1	<2	<1	<2	<2	<1
Dimethylphthalate	<2	<2	<2	<2	<2	<3	<2
Acenaphthylene	<1	<1	<1	<1	<2	<2	<1
2,6-Dinitrotoluene	<10	<8	<8	<7	<9	<10	<8
Acenaphthene	<2	<3	<5	<3	<4	<5	47
2,4-Dinitrophenol	<20	<10	<10	<10	<10	<20	<10
4-Nitrophenol	<40	<20	<20	<20	<20	<40	<20
2,4-Dinitrotoluene	<20	<10	<10	<9	<10	<20	<10
Diethylphthalate	13	<1	9	8	37	9	8
4-Chlorophenyl-phenylether	<3	<2	<3	<3	<3	<4	<3
Fluorene	16	<3	<4	<2	<3	<4	33
4,6-Dinitro-2-methylphenol	<20	<20	<20	<20	<20	<30	<20
N-Nitrosodiphenylamine	<10	<10	<10	<10	<10	<20	<10
4-Bromophenyl-phenylether	<6	<5	<7	<5	<6	<8	<6
Hexachlorobenzene	<5	<7	<10	<6	<8	<10	<8
Pentachlorophenol	<10	<10	<10	<10	<10	<20	<10
Phenanthrene	65	28	<8	<5	<7	<9	36
Anthracene	<4	<6	<8	<5	<7	<9	<6
Di-n-butylphthalate	84	180	80	74	170	60	59
Fluoranthene	22	<4	<5	<3	<4	<5	<4
Benzidine	<80	<20	<20	<10	<20	<50	<50
Pyrene	40	<5	<7	<4	<6	<8	<6
Butylbenzylphthalate	<200	<400	<500	<300	<400	<600	<400
3,3'-Dichlorobenzidine	<20	<30	<30	<20	<30	<40	<30
Benzo(a)anthracene	<5	<8	<10	<7	<9	<10	<8
Chrysene	<5	<8	<10	<7	<9	<10	<9
bis(2-Ethylhexyl)phthalate	<10	2400	110	2100	370	240	240
Di-n-octylphthalate	<40	3000	1000	5200	1800	5400	3900
Benzo(b)fluoranthene	<3	<5	<7	<4	<6	<7	<5
Benzo(k)fluoranthene	<3	<5	<7	<4	<6	<7	<5
Benzo(a)pyrene	<2	<3	<5	<3	<4	<5	<4
Indeno(1,2,3-cd)pyrene	<6	<9	<10	<8	<10	<10	<9
Dibenz(a,h)anthracene	<2	<3	<4	<3	<4	<5	<3
Benzo(g,h,i)perylene	<5	<8	<10	<7	<9	<10	<8
Surrogate Recovery (%)							
2-Fluorophenol	7.6	26	25	54	29	12	12
Phenol-d6	22	65	80	94	67	18	50
2,4,6-Tribromophenol	62	79	66	77	72	46	80
Nitrobenzene-d5	42	71	69	85	68	39	71
2-Fluorobiphenyl	69	89	66	86	70	53	76
Terphenyl-d14	84	55	42	71	52	39	57

Table IIA Surrogate Recovery Corrected Sample Results for Semi-Volatiles (ng/g)

Field ID:	7-91	8-91	9-91	10-91	11-91	12-91	13-91
Lab ID:	92-834	92-835	92-836	92-837	92-838	92-839	92-840
Target Semi-Volatile							
N-Nitrosodimethylamine	<10	<10	<10	<10	<10	<10	<10
Phenol	<40	87	<20	<60	<50	<20	<30
bis(2-Chloroethyl)ether	<6	<6	<3	<6	<7	<5	<5
2-Chlorophenol	<40	<80	<20	<40	<40	<20	<30
1,3-Dichlorobenzene	<4	<3	<3	<3	<3	<3	<3
1,4-Dichlorobenzene	<4	<3	<3	<4	<4	<3	<3
1,2-Dichlorobenzene	<3	<3	<2	<3	<3	<3	<3
bis(2-Chloroisopropyl)ether	<20	<20	<10	<20	<30	<20	<20
N-Nitroso-di-n-propylamine	<50	<50	<40	<50	<50	<50	<40
Hexachloroethane	<20	<20	<20	<20	<20	<20	<10
Nitrobenzene	<20	<20	<10	<20	<20	<10	<10
Isophorone	<5	<4	<2	<6	<6	<2	<3
2-Nitrophenol	<10	<9	<5	<10	<10	<7	<7
2,4-Dimethylphenol	<10	<9	<5	<10	<10	<5	<7
bis(2-Chloroethoxy)methane	<4	<4	<2	<5	<5	<3	<3
2,4-Dichlorophenol	<80	<200	<40	<70	<80	<40	<50
1,2,4-Trichlorobenzene	<4	<4	<3	<4	<4	<4	<3
Naphthalene	7	53	42	19	18	23	35
Hexachlorobutadiene	<7	<7	<5	<7	<7	<7	<6
4-Chloro-3-methylphenol	<100	<200	<50	<100	<100	<50	<70
Hexachlorocyclopentadiene	<20	<20	<10	<20	<20	<20	<10
2,4,6-Trichlorophenol	<6	<8	<4	<7	<7	<7	<6
2-Chloronaphthalene	<2	<2	<1	<2	<2	<2	<2
Dimethylphthalate	<3	<2	<2	<2	<2	<2	<2
Acenaphthylene	<2	<1	<2	<2	<2	5	<1
2,6-Dinitrotoluene	<10	<10	<7	<10	<20	<10	<10
Acenaphthene	<4	<4	<3	<3	<4	10	<3
2,4-Dinitrophenol	<20	<20	<10	<20	<20	<10	<10
4-Nitrophenol	<40	<40	<20	<40	<40	<30	<30
2,4-Dinitrotoluene	<20	<20	<10	<20	<20	<10	<10
Diethylphthalate	11	25	15	13	13	<2	6
4-Chlorophenyl-phenylether	<4	<3	<3	<4	<4	<4	<3
Fluorene	<3	<3	<3	<3	<3	<4	<2
4,6-Dinitro-2-methylphenol	<20	<30	<20	<30	<30	<20	<20
N-Nitrosodiphenylamine	<20	<20	<10	<20	<20	<20	<10
4-Bromophenyl-phenylether	<8	<7	<5	<7	<7	<7	<6
Hexachlorobenzene	<8	<8	<7	<7	<9	<10	<7
Pentachlorophenol	<10	<20	<9	<20	<20	<20	<10
Phenanthrene	<7	<7	<6	6	<7	30	<6
Anthracene	<7	<7	<6	<6	<7	12	<6
Di-n-butylphthalate	73	110	170	51	110	160	39
Fluoranthene	<4	<4	<3	<3	<4	16	<3
Benzidine	<50	<100	<30	<50	<60	<30	<40
Pyrene	<6	<6	<5	<5	<6	12	<5
Butylbenzylphthalate	<400	<400	<400	<400	<500	<500	<400
3,3'-Dichlorobenzidine	<30	<30	<20	<20	<30	<40	<20
Benzo(a)anthracene	<9	<9	<8	<8	<9	<10	<7
Chrysene	<9	<9	<8	<8	<10	<10	<8
bis(2-Ethylhexyl)phthalate	120	230	340	190	280	530	220
Di-n-octylphthalate	2300	9500	7700	5800	3400	6400	390
Benzo(b)fluoranthene	<6	<6	<5	<5	<6	<7	<5
Benzo(k)fluoranthene	<6	<6	<5	<5	<6	<7	<5
Benzo(a)pyrene	<4	<4	<3	<3	<4	<5	<3
Indeno(1,2,3-cd)pyrene	<10	<10	<9	<9	<10	<10	<8
Dibenz(a,h)anthracene	<4	<4	<3	<3	<4	<5	<3
Benzo(g,h,i)perylene	<9	<9	<8	<8	<9	<10	<7
Surrogate Recovery (%)							
2-Fluorophenol	12	5.4	20	12	11	23	17
Phenol-d6	29	30	57	21	24	54	39
2,4,6-Tribromophenol	61	47	85	53	54	55	64
Nitrobenzene-d5	45	45	74	42	39	58	58
2-Fluorobiphenyl	59	61	76	60	62	60	72
Terphenyl-d14	53	50	56	60	51	41	63

Table IIA Surrogate Recovery Corrected Sample Results for Semi-Volatiles (ng/g)

Field ID:	14-91	15-91	16-91	17-91	18-91	19-91
Lab ID:	92-841	92-842	92-843	92-844	92-845	92-846
Target Semi-Volatile						
N-Nitrosodimethylamine	<10	<10	<10	<10	<10	<10
Phenol	<100	<40	<60	<30	<20	<40
bis(2-Chloroethyl)ether	<9	<5	<6	<5	<4	<5
2-Chlorophenol	<70	<40	<40	<20	<40	<30
1,3-Dichlorobenzene	<4	<3	<3	<3	<3	<3
1,4-Dichlorobenzene	<4	<3	<3	<3	<3	<3
1,2-Dichlorobenzene	<4	<3	<3	<3	<3	<3
bis(2-Chloroisopropyl)ether	<30	<20	<20	<20	<10	<20
N-Nitroso-di-n-propylamine	<60	<50	<50	<50	<40	<50
Hexachloroethane	<20	<20	<20	<20	<20	<20
Nitrobenzene	<30	<20	<20	<10	<10	<20
Isophorone	<10	<4	<7	<3	<3	<4
2-Nitrophenol	<10	<9	<10	<8	<6	<8
2,4-Dimethylphenol	<30	<9	<10	<6	<6	<9
bis(2-Chloroethoxy)methane	<6	<4	<4	<4	<3	<4
2,4-Dichlorophenol	<100	<80	<80	<50	<70	<50
1,2,4-Trichlorobenzene	<5	<3	<4	<4	<3	<4
Naphthalene	16	41	27	69	140	28
Hexachlorobutadiene	<8	<6	<7	<7	<5	<7
4-Chloro-3-methylphenol	<200	<100	<100	<60	<90	<60
Hexachlorocyclopentadiene	<20	<10	<20	<20	<10	<10
2,4,6-Trichlorophenol	<9	<7	<7	<9	<6	<7
2-Chloronaphthalene	<2	<2	<2	<2	<1	<2
Dimethylphthalate	<3	<2	<2	<2	<2	<2
Acenaphthylene	4	<2	<2	<2	<2	<2
2,6-Dinitrotoluene	<20	<10	<10	<10	<8	<10
Acenaphthene	7	<4	<4	<3	<3	<3
2,4-Dinitrophenol	<30	<20	<20	<20	<10	<20
4-Nitrophenol	<50	<30	<40	<30	<20	<30
2,4-Dinitrotoluene	<30	<20	<20	<10	<10	<20
Diethylphthalate	<3	11	9	12	17	9
4-Chlorophenyl-phenylether	<4	<3	<3	<4	<3	<3
Fluorene	<3	<3	<3	<3	<3	<3
4,6-Dinitro-2-methylphenol	<30	<20	<20	<30	<20	<30
N-Nitrosodiphenylamine	<20	<20	<20	<20	<10	<20
4-Bromophenyl-phenylether	<9	<7	<7	<7	<6	<7
Hexachlorobenzene	<8	<8	<8	<7	<7	<7
Pentachlorophenol	<20	<10	<10	<20	<10	<20
Phenanthrene	14	<7	<7	<6	<6	<6
Anthracene	9	<7	<7	<6	<6	<6
Di-n-butylphthalate	110	70	<10	54	110	43
Fluoranthene	12	<4	<4	<4	<3	<3
Benzidine	<90	<60	<60	<30	<50	<30
Pyrene	9	<6	<6	<5	<5	<5
Butylbenzylphthalate	<400	<400	<400	<400	<400	<400
3,3'-Dichlorobenzidine	<30	<30	<30	<30	<20	<20
Benzo(a)anthracene	<8	<9	<9	<8	<8	<8
Chrysene	<9	<9	<9	<8	<8	<8
bis(2-Ethylhexyl)phthalate	450	170	170	270	230	<10
Di-n-octylphthalate	7400	3500	4400	8500	11000	7200
Benzo(b)fluoranthene	<5	<6	<6	<5	<5	<5
Benzo(k)fluoranthene	<6	<6	<6	<5	<5	<5
Benzo(a)pyrene	<4	<4	<4	<3	<3	<3
Indeno(1,2,3-cd)pyrene	<10	<10	<10	<9	<9	<9
Dibenz(a,h)anthracene	<3	<4	<4	<3	<3	<3
Benzo(g,h,i)perylene	<9	<9	<9	<8	<8	<8
Surrogate Recovery (%)						
2-Fluorophenol	7.1	11	11	19	13	18
Phenol-d6	9.9	30	20	46	49	32
2,4,6-Tribromophenol	42	56	56	41	63	54
Nitrobenzene-d5	31	49	44	54	69	50
2-Fluorobiphenyl	51	64	60	60	81	62
Terphenyl-d14	56	52	52	57	61	58

Table IIB Surrogate Recovery Corrected Sample Results for Semi-Volatiles (ng/g)

Field ID:	1-92	2-92	3-92	4-92	5-92	6-92
Lab ID:	93-251	93-252	93-253	93-254	93-255	93-256
Target Semi-Volatile						
2-Chlorophenol	<3	<3	<1	<2	<1	<2
Bis(2-chloroethyl)ether	<2	<2	<2	<2	<2	<2
Phenol	<6	<6	<3	<6	<3	54
1,3-Dichlorobenzene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,4-dichlorobenzene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
1,2-dichlorobenzene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Bis(2-chloroisopropyl)ether	<6	<6	<5	<6	<5	<6
Hexachloroethane	<2	<2	<2	<2	<2	<2
N-Nitroso-di-n-propylamine	<4	<4	<4	<4	<4	<4
Nitrobenzene	<2	<2	<2	<2	<2	<2
Isophorone	<2	<2	<1	<1	<1	<1
2-Nitrophenol	<2	<2	<1	<2	<1	<2
2,4-Dimethylphenol	<4	<4	<2	<2	<2	<2
Bis(2-chloroethoxy)methane	<0.7	<0.7	<0.6	<0.7	<0.6	<0.7
2,4-Dichlorophenol	<2	<2	<1	<1	<1	<1
1,2,4-Trichlorobenzene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Naphthalene	<0.09	5.1	5.7	5.7	<0.08	<0.09
Hexachlorobutadiene	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
4-Chloro-3-methylphenol	<9	<9	<5	<6	<5	<6
Hexachlorocyclopentadiene	<0.9	<0.9	<0.8	<1	<0.8	<1
2,4,6-Trichlorophenol	<0.7	<0.7	<0.7	<0.8	<0.7	<0.8
2-Chloronaphthalene	<0.2	<0.2	<0.1	<0.2	<0.1	<0.2
Acenaphthylene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Dimethylphthalate	<0.2	<0.2	<0.2	<0.3	<0.2	<0.3
2,6-Dinitrotoluene	<2	<2	<2	<2	<2	<2
Acenaphthene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
2,4-Dinitrophenol	PC	PC	PC	PC	PC	PC
2,4-Dinitrotoluene	<2	<2	<1	<2	<1	<2
4-Nitrophenol	<4	<4	<4	<4	<4	<4
Fluorene	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3
4-chlorophenyl phenyl ether	<0.4	<0.4	<0.3	<0.4	<0.3	<0.4
Diethylphthalate	<1	<1	<0.9	<1	<0.9	<1
4,6-Dinitro-2-methylphenol	<5	<5	<5	<6	<5	<6
N-Nitrosodiphenylamine	<0.5	<0.5	<0.5	<0.6	<0.5	<0.6
4-bromophenyl phenyl ether	<0.6	<0.6	<0.5	<0.6	<0.5	<0.6
Hexachlorobenzene	<0.4	<0.4	<0.3	<0.4	<0.3	<0.4
Pentachlorophenol	<4	<4	<4	<5	<4	<5
Phenanthrene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Anthracene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Di-n-Butylphthalate	69	51	120	57	120	80
Fluoranthene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Pyrene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Benzidine	<2	<2	<2	<2	<2	<2
Butylbenzylphthalate	<0.9	<0.9	<0.8	<0.9	<0.8	<0.9
Benzo[a]anthracene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chrysene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
3,3'-Dichlorobenzidine	<2	<2	<1	<2	<1	<2
Bis(2-ethylhexyl)phthalate	120	210	810	180	480	190
Di-n-octylphthalate	190	160	690	220	260	160
Benzo[b]fluoranthene	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Benzo[k]fluoranthene	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Benzo[a]pyrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	<700	<700	<600	<700	<600	<700
Dibenzo[a,h]anthracene	<1	<1	<0.8	<1	<0.8	<1
Benzo[g,h,k]perylene	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Surrogate Recovery (%)						
2-Fluorophenol	IF	IF	IF	IF	IF	IF
Phenol-d6	20	11	16	18	40	33
2,4,6-Tribromophenol	90	65	63	60	90	75
Nitrobenzene-d5	70	36	32	36	84	70
2-Fluorobiphenyl	100	60	52	52	110	94
Terphenyl-d14	110	76	68	68	130	110

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

Table IIB Surrogate Recovery Corrected Sample Results for Semi-Volatiles (ng/g)

Field ID:	7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	93-257	93-258	93-259	93-260	93-261	93-262
Target Semi-Volatile						
2-Chlorophenol	<2	<2	<3	<3	<3	<3
Bis(2-chloroethyl)ether	<2	<2	<2	<4	<2	<4
Phenol	<4	<4	<6	<7	<6	<7
1,3-Dichlorobenzene	<0.4	<0.4	<0.3	<0.5	<0.3	<0.5
1,4-dichlorobenzene	<0.4	<0.4	<0.3	<0.5	<0.3	<0.5
1,2-dichlorobenzene	<0.4	<0.4	<0.3	<0.5	<0.3	<0.5
Bis(2-chloroisopropyl)ether	<7	<7	<7	<10	<7	<10
Hexachloroethane	<2	<2	<2	<3	<2	<3
N-Nitroso-di-n-propylamine	<5	<5	<5	<7	<5	<7
Nitrobenzene	<2	<2	<3	<4	<3	<4
Isophorone	<2	6900	<2	<2	<2	<2
2-Nitrophenol	<2	<2	<2	<4	<2	<4
2,4-Dimethylphenol	<3	<3	<4	<4	<4	<4
Bis(2-chloroethoxy)methane	<0.8	<0.8	<0.9	<1	<0.9	<1
2,4-Dichlorophenol	<2	<2	<2	<3	<2	<3
1,2,4-Trichlorobenzene	<0.4	<0.4	<0.4	<0.5	<0.4	<0.5
Naphthalene	13	<0.1	<0.1	<0.1	4.8	5.6
Hexachlorobutadiene	<0.8	<0.8	<0.7	<1	<0.7	<1
4-Chloro-3-methylphenol	<7	<7	<9	<10	<9	<10
Hexachlorocyclopentadiene	<1	<1	<1	<1	<1	<1
2,4,6-Trichlorophenol	<0.9	<0.9	<0.7	<0.9	<0.7	<0.9
2-Chloronaphthalene	<0.2	<0.2	<0.2	<0.3	<0.2	<0.3
Acenaphthylene	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Dimethylphthalate	<0.3	<0.3	<0.3	<0.4	<0.3	<0.4
2,6-Dinitrotoluene	<2	<2	<3	<4	<3	<4
Acenaphthene	<0.4	<0.4	<0.3	<0.4	<0.3	<0.4
2,4-Dinitrophenol	PC	PC	PC	PC	PC	PC
2,4-Dinitrotoluene	<2	<2	<2	<3	<2	<3
4-Nitrophenol	<5	<5	<6	<9	<6	<9
Fluorene	<0.3	<0.3	<0.3	<0.4	<0.3	<0.4
4-chlorophenyl phenyl ether	<0.5	<0.5	<0.4	<0.6	<0.4	<0.6
Diethylphthalate	<1	<1	<1	<2	<1	<2
4,6-Dinitro-2-methylphenol	<7	<7	<5	<6	<5	<6
N-Nitrosodiphenylamine	<0.7	<0.7	<0.6	<0.9	<0.6	<0.9
4-bromophenyl phenyl ether	<0.7	<0.7	<0.6	<0.9	<0.6	<0.9
Hexachlorobenzene	<0.5	<0.5	<0.5	<0.6	<0.5	<0.6
Pentachlorophenol	<6	<6	<5	<6	<5	<6
Phenanthrene	<0.4	<0.4	<0.3	<0.4	<0.3	<0.4
Anthracene	<0.4	<0.4	<0.3	<0.4	<0.3	<0.4
Di-n-Butylphthalate	130	64	54	94	48	110
Fluoranthene	<0.4	<0.4	<0.4	<0.5	<0.4	<0.5
Pyrene	<0.4	<0.4	<0.3	<0.4	<0.3	<0.4
Benzidine	<3	<3	<2	<3	<2	<3
Butylbenzylphthalate	<1	<1	<1	<1	<1	<1
Benzo[a]anthracene	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chrysene	<0.4	<0.4	<0.4	<0.5	<0.4	<0.5
3,3'-Dichlorobenzidine	<2	<2	<2	<2	<2	<2
Bis(2-ethylhexyl)phthalate	310	150	110	310	340	110
Di-n-octylphthalate	190	200	210	70	190	280
Benzo[b]fluoranthene	<0.5	<0.5	<0.5	<0.6	<0.5	<0.6
Benzo[k]fluoranthene	<0.5	<0.5	<0.5	<0.6	<0.5	<0.6
Benzo[a]pyrene	<0.6	<0.6	<0.6	<0.7	<0.6	<0.7
Indeno(1,2,3-c,d)pyrene	<800	<800	<800	<1000	<800	<1000
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1
Benzo[g,h,k]perylene	<0.5	<0.5	<0.5	<0.6	<0.5	<0.6
Surrogate Recovery (%)						
2-Fluorophenol	IF	IF	IF	IF	IF	IF
Phenol-d6	17	28	20	17	16	11
2,4,6-Tribromophenol	59	65	85	68	70	54
Nitrobenzene-d5	32	60	55	35	36	24
2-Fluorobiphenyl	56	78	88	62	64	48
Terphenyl-d14	64	92	100	81	80	68

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

Table IIB Surrogate Recovery Corrected Sample Results for Semi-Volatiles (ng/g)

Field ID:	13-92	14-92	15-92	16-92	17-92
Lab ID:	93-263	93-264	93-265	93-266	93-267
Target Semi-Volatile					
2-Chlorophenol	<7	<3	<7	<3	<3
Bis(2-chloroethyl)ether	<7	<3	<7	<3	<3
Phenol	<10	<5	<10	<5	<5
1,3-Dichlorobenzene	<0.7	<0.4	<0.7	<0.4	<0.5
1,4-dichlorobenzene	<0.7	<0.4	<0.7	<0.4	<0.5
1,2-dichlorobenzene	<0.7	<0.4	<0.7	<0.4	<0.5
Bis(2-chloroisopropyl)ether	<20	<10	<20	<10	<10
Hexachloroethane	<5	<3	<5	<3	<3
N-Nitroso-di-n-propylamine	<10	<6	<10	<6	<7
Nitrobenzene	<7	<4	<7	<4	<3
Isophorone	<5	<2	<5	<2	<2
2-Nitrophenol	<6	<3	<6	<3	<3
2,4-Dimethylphenol	<8	<3	<8	<3	<3
Bis(2-chloroethoxy)methane	<2	<1	<2	<1	<1
2,4-Dichlorophenol	<5	<2	<5	<2	<2
1,2,4-Trichlorobenzene	<0.8	<0.4	<0.8	<0.4	<0.5
Naphthalene	18	200	<0.1	<0.1	<0.1
Hexachlorobutadiene	<2	<0.9	<2	<0.9	<1
4-Chloro-3-methylphenol	<20	<9	<20	<9	<9
Hexachlorocyclopentadiene	<2	<1	<2	<1	<1
2,4,6-Trichlorophenol	<1	<0.9	<1	<0.9	<0.9
2-Chloronaphthalene	<0.4	<0.2	<0.4	<0.2	<0.3
Acenaphthylene	<0.8	<0.4	<0.8	<0.4	<0.5
Dimethylphthalate	<0.6	<0.3	<0.6	<0.3	<0.4
2,6-Dinitrotoluene	<7	<4	<7	<4	<3
Acenaphthene	<0.8	<0.4	<0.8	<0.4	<0.5
2,4-Dinitrophenol	PC	PC	PC	PC	PC
2,4-Dinitrotoluene	<5	<3	<5	<3	<3
4-Nitrophenol	<20	<8	<20	<8	<8
Fluorene	<0.7	<0.4	<0.7	<0.4	<0.4
4-chlorophenyl phenyl ether	<0.9	<0.5	<0.9	<0.5	<0.6
Diethylphthalate	<2	<1	<2	<1	<2
4,6-Dinitro-2-methylphenol	<10	<6	<10	<6	<7
N-Nitrosodiphenylamine	<1	<0.8	<1	<0.8	<0.9
4-bromophenyl phenyl ether	<1	<0.8	<1	<0.8	<0.9
Hexachlorobenzene	<1	<0.6	<1	<0.6	<0.6
Pentachlorophenol	<9	<6	<9	<6	<6
Phenanthrene	<0.8	<0.4	<0.8	<0.4	<0.5
Anthracene	<0.8	<0.4	<0.8	<0.4	<0.5
Di-n-Butylphthalate	130	200	95	180	84
Fluoranthene	<0.9	<0.5	<0.9	<0.5	<0.5
Pyrene	<0.8	<0.4	<0.8	<0.4	<0.5
Benzidine	<5	<3	<5	<3	<3
Butylbenzylphthalate	<2	<1	<2	<1	<1
Benzo[a]anthracene	<0.8	<0.5	<0.8	<0.5	<0.5
Chrysene	<0.8	<0.5	<0.8	<0.5	<0.5
3,3'-Dichlorobenzidine	<4	<2	<4	<2	<3
Bis(2-ethylhexyl)phthalate	130	800	140	220	810
Di-n-octylphthalate	89	240	<7	90	300
Benzo[b]fluoranthene	<1	<0.6	<1	<0.6	<0.6
Benzo[k]fluoranthene	<1	<0.6	<1	<0.6	<0.6
Benzo[a]pyrene	<1	<0.7	<1	<0.7	<0.8
Indeno(1,2,3-c,d)pyrene	<2000	<1000	<2000	<1000	<1000
Dibenzo[a,h]anthracene	<2	<1	<2	<1	<1
Benzo[g,h,k]perylene	<1	<0.6	<1	<0.6	<0.7
Surrogate Recovery (%)					
2-Fluorophenol	IF	IF	IF	IF	IF
Phenol-d6	8.5	21	12	5	21
2,4,6-Tribromophenol	42	68	70	73	65
Nitrobenzene-d5	20	40	36	4	41
2-Fluorobiphenyl	40	70	68	64	62
Terphenyl-d14	44	80	80	88	73

* NOTE: IF= interference with surrogate retention time and quantitation ion
PC= poor chromatography for this compound

Table IIIA Surrogate Recovery Designation Table

Compound Name	Surrogate Spike
N-Nitrosodimethylamine	Not corrected
Phenol	Phenol-d_6
bis(2-Chloroethyl)ether	Nitrobenzene-d_5
2-Chlorophenol	2-Fluorophenol
1,3-Dichlorobenzene	2-Fluorobiphenyl
1,4-Dichlorobenzene	2-Fluorobiphenyl
1,2-Dichlorobenzene	2-Fluorobiphenyl
bis(2-Chloroisopropyl)ether	Nitrobenzene-d_5
N-Nitroso-Di-n-propylamine	2-Fluorobiphenyl
Hexachloroethane	2-Fluorobiphenyl
Nitrobenzene	Nitrobenzene-d_5
Isophorone	Phenol-d_6
2-Nitrophenol	Nitrobenzene-d_5
2,4-Dimethylphenol	Phenol-d_6
bis(2-Chloroethoxy)methane	Nitrobenzene-d_5
2,4-Dichlorophenol	2-Fluorophenol
1,2,4-Trichlorobenzene	2-Fluorobiphenyl
Naphthalene	2-Fluorobiphenyl
Hexachlorobutadiene	2-Fluorobiphenyl
4-Chloro-3-methylphenol	2-Fluorophenol
Hexachlorocyclopentadiene	2-Fluorobiphenyl
2,4,6-Trichlorophenol	2,4,6-Tribromophenol
2-Chloronaphthalene	2-Fluorobiphenyl
Dimethylphthalate	2-Fluorobiphenyl
Acenaphthylene	2-Fluorobiphenyl
2,6-Dinitrotoluene	Nitrobenzene-d_5
Acenaphthene	Terphenyl-d_{14}
2,4-Dinitrophenol	Nitrobenzene-d_5

Table IIIB Surrogate Recovery Designation Table

Compound Name	Surrogate Spike
4-Nitrophenol	Nitrobenzene-d_5
2,4-Dinitrotoluene	Nitrobenzene-d_5
Diethylphthalate	2-Fluorobiphenyl
4-Chlorophenyl-phenylether	2-Fluorobiphenyl
Fluorene	Terphenyl-d_{14}
4,6-Dinitro-2-methylphenol	2,4,6-Tribromophenol
N-Nitrosodiphenylamine	2-Fluorobiphenyl
4-Bromophenyl-phenylether	2-Fluorobiphenyl
Hexachlorobenzene	Terphenyl-d_{14}
Pentachlorophenol	2,4,6-Tribromophenol
Phenanthrene	Terphenyl-d_{14}
Anthracene	Terphenyl-d_{14}
Di-n-butylphthalate	Terphenyl-d_{14}
Fluoranthene	Terphenyl-d_{14}
Benzidine	Terphenyl-d_{14}
Pyrene	Terphenyl-d_{14}
Butylbenzylphthalate	Terphenyl-d_{14}
3,3'-Dichlorobenzidine	Terphenyl-d_{14}
Benzo(a)anthracene	Terphenyl-d_{14}
Chrysene	Terphenyl-d_{14}
bis(2-Ethylhexyl)phthalate	Terphenyl-d_{14}
Di-n-octylphthalate	Terphenyl-d_{14}
Benzo(b)fluoranthene	Terphenyl-d_{14}
Benzo(k)fluoranthene	Terphenyl-d_{14}
Benzo(a)pyrene	Terphenyl-d_{14}
Indeno(1,2,3-cd)pyrene	Terphenyl-d_{14}
Dibenz(a,h)anthracene	Terphenyl-d_{14}
Benzo(g,h,i)perylene	Terphenyl-d_{14}

Table IVA Surrogate Recovery Corrected Sample Results for Pesticides (ng/g)

Field ID:		1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	MDL	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target Pesticides								
a-BHC	1	4.2	<1	<1	4	<2	<1	<1
b-BHC	2	<2	<2	<2	<3	<4	<2	<2
g-BHC	0.6	1.9	<0.7	<0.7	<0.8	<1	<0.5	<0.6
d-BHC	2	<1	<2	<2	<2	<3	<2	<2
Heptachlor	0.6	<0.5	1.5	2.2	<0.8	<1	<0.5	<0.6
Aldrin	1	<0.8	<1	<1	<1	<2	<0.9	<1
Heptachlor Epoxide	1	27	11	6	10	5	<0.9	7
a-Endosulphan	1	<0.8	<1	<1	<1	<2	<0.9	<1
Dieldrin	0.5	<0.6	10	9.7	16	8	1.3	7.0
pp'-DDE	0.5	160	55	73	180	47	8.5	32
Endrin	0.5	<0.6	<0.5	<0.8	<0.8	<1	<0.4	<0.4
b-Endosulphan	0.5	<0.6	<0.5	<0.8	<0.8	<1	<0.4	<0.4
pp'-DDD	0.9	180	28	48	52	20	1.8	20
Endrin Aldehyde	1	<1	<1	<2	<2	<2	<0.8	<0.8
Endosulfan Sulfate	1	<1	<1	<2	<2	<2	<0.8	<0.8
pp'-DDT	1	13	7	14	84	4	<0.8	2.3
Methoxychlor	2	<3	<2	<3	<3	<4	<2	<2
g-chlordane	1	99	31	59	23	27	<0.8	18
a-chlordane	1	430	58	110	70	53	1.6	36
Surrogate Recovery (%)								
Tetrachloro-m-xylene		64	46	40	36	28	57	50
PCB 209		79	97	59	61	49	130	130

Field ID:		7-91	8-91	9-91	10-91	11-91	12-91	13-91
Lab ID:	MDL	92-834	92-835	92-836	92-837	92-838	92-839	92-840
Target Pesticides								
a-BHC	1	<0.9	<1	<1	<1	<1	<1	<0.9
b-BHC	2	<2	<2	<2	<2	<2	<2	<1
g-BHC	0.6	<0.5	7.3	<0.5	<0.6	<0.5	<0.6	<0.4
d-BHC	2	<1	<2	<2	<2	<2	<2	<1
Heptachlor	0.6	<0.5	<0.5	<0.5	<0.6	<0.5	<0.6	1.0
Aldrin	1	<0.8	<0.9	<0.9	<1	<0.9	<1	<0.7
Heptachlor Epoxide	1	<0.8	33	5.8	<1	1.6	<1	3.1
a-Endosulphan	1	<0.8	<0.9	<0.9	<1	<0.9	<1	<0.7
Dieldrin	0.5	<0.4	36	9.0	<0.5	4.0	3.2	3.4
pp'-DDE	0.5	<0.4	100	81	4.7	75	18	15
Endrin	0.5	<0.4	<0.4	<0.4	<0.5	<0.5	<0.5	<0.4
b-Endosulphan	0.5	<0.4	<0.4	<0.4	<0.5	<0.5	<0.5	<0.4
pp'-DDD	0.9	<0.7	46	28	2.2	25	8.3	14
Endrin Aldehyde	1	<0.8	<0.9	<0.8	<0.9	<1	<1	<0.8
Endosulfan Sulfate	1	<0.8	<0.9	<0.8	<0.9	<1	<1	<0.8
pp'-DDT	1	<0.8	16	11	<0.9	<1	<1	<0.8
Methoxychlor	2	<2	<2	<2	<2	<2	<2	<2
g-chlordane	1	<0.8	35	27	<0.9	19	6	19
a-chlordane	1	<0.8	78	58	1.9	37	15	32
Surrogate Recovery (%)								
Tetrachloro-m-xylene		64	55	57	47	55	52	68
PCB 209		130	120	120	110	100	100	130

Table IVA Surrogate Recovery Corrected Sample Results for Pesticides (ng/g)

Field ID:		14-91	15-91	16-91	17-91	18-91	19-91	2-91
Lab ID:	MDL	92-841	92-842	92-843	92-844	92-845	92-846	92-829
Target Pesticides								
a-BHC	1	<1	<1	<0.8	4	<1	<1	<2
b-BHC	2	<2	<2	<1	<2	<2	<2	<3
g-BHC	0.6	<0.6	<0.5	<0.4	<0.5	<0.5	<0.6	<0.9
d-BHC	2	<2	<2	<1	<2	<1	<2	<3
Heptachlor	0.6	<0.6	<0.5	<0.4	<0.5	<0.5	<0.6	<0.9
Aldrin	1	<1	<0.9	<0.7	<0.9	<0.8	<1	<2
Heptachlor Epoxide	1	<1	1.5	1.7	18	14	<1	<2
a-Endosulphan	1	<1	<0.9	<0.7	<0.9	<0.8	<1	<2
Dieldrin	0.5	2.0	3.1	<0.4	32	15	1.1	<0.8
pp'-DDE	0.5	4.3	6.7	41	130	100	6.5	19
Endrin	0.5	<0.5	<0.5	<0.4	<0.5	<0.4	<0.5	<0.8
b-Endosulphan	0.5	<0.5	<0.5	<0.4	<0.5	<0.4	<0.5	<0.8
pp'-DDD	0.9	1.9	6.4	12	81	54	3.1	4
Endrin Aldehyde	1	<0.9	<0.9	<0.7	<1	<0.7	<0.9	<2
Endosulfan Sulfate	1	<0.9	<0.9	<0.7	<1	<0.7	<0.9	<2
pp'-DDT	1	<0.9	<0.9	5.1	22	11	<0.9	<2
Methoxychlor	2	<2	<2	<1	<2	<1	<2	<3
g-chlordane	1	0.9	8.3	6.5	32	60	0.9	<2
a-chlordane	1	2.8	13	20	99	110	3.7	6
Surrogate Recovery (%)								
Tetrachloro-m-xylene		48	55	75	55	61	49	33
PCB 209		110	110	140	100	140	110	64

Table IVB Surrogate Recovery Corrected Sample Results for Pesticides (ng/g)

Field ID:		1-92	2-92	3-92	4-92	5-92	6-92
Lab ID:	MDL	93-251	93-252	93-253	93-254	93-255	93-256
Target Pesticides							
a-BHC	2	<2	<2	<2	<2	<2	<2
b-BHC	3	<3	<3	<3	<3	<3	<3
g-BHC	2	<2	<2	<2	<2	<2	<2
d-BHC	2	<2	<2	<2	<2	<2	<2
Heptachlor	1	<1	<1	<1	2	2	<1
Aldrin	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Heptachlor Epoxide	1	<1	<1	3	3	8	11
a-Endosulphan	1	<1	<1	<1	<1	<1	<1
Dieldrin	0.7	3.4	3.9	8.4	<0.7	11	6.0
pp'-DDE	0.9	11	29	42	33	99	110
Endrin	1	<1	<1	<1	<1	<1	<1
b-Endosulphan	0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
pp'-DDD	1	2	8	22	17	23	21
Endrin Aldehyde	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Endosulfan Sulfate	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
pp'-DDT	1	19	2	6	<1	4	<1
Methoxychlor	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
g-chlordane	1	<1	<1	6	25	44	33
a-chlordane	1	6	2	12	46	74	57
Surrogate Recovery (%)							
Tetrachloro-m-xylene		36	76	87	68	40	50
PCB 209		47	100	100	93	52	58

Field ID:		7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	MDL	93-257	93-258	93-259	93-260	93-261	93-262
Target Pesticides							
a-BHC	2	<2	<2	<2	<2	<2	<2
b-BHC	3	<3	<3	<3	<3	<3	<3
g-BHC	2	<2	<2	<2	<2	<2	<2
d-BHC	2	<2	<2	<2	<2	<2	<2
Heptachlor	1	<1	<1	5	<1	<1	<1
Aldrin	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Heptachlor Epoxide	1	5	<1	6	<1	1	1
a-Endosulphan	1	<1	<1	<1	<1	<1	<1
Dieldrin	0.7	12	3.5	13	5.8	2.8	3.6
pp'-DDE	0.9	69	8.6	68	60	3.8	9.7
Endrin	1	<1	<1	<1	<1	<1	<1
b-Endosulphan	0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
pp'-DDD	1	17	2	36	16	2	4
Endrin Aldehyde	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Endosulfan Sulfate	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
pp'-DDT	1	5	<1	3	<1	<1	<1
Methoxychlor	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
g-chlordane	1	8	<1	36	26	<1	3
a-chlordane	1	26	5	97	50	3	11
Surrogate Recovery (%)							
Tetrachloro-m-xylene		90	33	86	27	83	76
PCB 209		130	43	120	38	130	120

Table IVB Surrogate Recovery Corrected Sample Results for Pesticides (ng/g)

Field ID:		13-92	14-92	15-89	16-89	17-93
Lab ID:	MDL	93-263	93-264	93-265	93-266	93-267
Target Pesticides						
a-BHC	2	<2	<4	<2	<2	<2
b-BHC	3	<3	<6	<3	<3	<3
g-BHC	2	<2	<4	<2	<2	<2
d-BHC	2	<2	<4	<2	<2	<2
Heptachlor	1	9	<2	<1	<1	<1
Aldrin	0.8	<0.8	<2	<0.8	<0.8	<0.8
Heptachlor Epoxide	1	8	29	3	2	2
a-Endosulphan	1	<1	<2	<1	<1	<1
Dieldrin	0.7	11	48	6.4	<0.7	3.1
pp'-DDE	0.9	47	76	19	32	40
Endrin	1	<1	<3	<1	<1	<1
b-Endosulphan	0.7	<0.7	<1	<0.7	<0.7	<0.7
pp'-DDD	1	30	72	17	12	6
Endrin Aldehyde	0.8	<0.8	<1	<0.8	<0.8	<0.8
Endosulfan Sulfate	0.9	<0.9	5	<0.9	<0.9	<0.9
pp'-DDT	1	<1	10	<1	<1	<1
Methoxychlor	0.4	<0.4	<1	<0.4	<0.4	<0.4
g-chlordane	1	69	120	44	7	5
a-chlordane	1	110	260	66	21	15
Surrogate Recovery (%)						
Tetrachloro-m-xylene		72	52	64	63	49
PCB 209		100	78	110	95	100

Table VA Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	MDL	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target PCBs								
PCB 1	0.8	<1	<1	<1	<1	2.6	<1	1.1
PCB 3	0.8	1.3	<1	<1	<1	<1	<1	<1
PCB 4,10	0.2	1	0.4	<0.3	<0.3	0.3	<0.4	1.1
PCB 7	0.2	0.9	0.4	<0.3	<0.3	0.7	<0.4	<0.3
PCB 6	0.3	<0.4	<0.4	<0.4	<0.4	<0.4	<0.5	0.8
PCB 8,5	0.9	4.4	1.7	<1	1.2	<1	<2	9.2
PCB 19	1	<1	<1	<2	22	<1	<2	<1
PCB 12,13	0.2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.4	<0.3
PCB 18	1	8.8	<1	<1	<1	2.2	<1	3.5
PCB 17	2	5	<2	<3	<2	<2	<3	4.6
PCB 27	0.9	3	<1	<0.9	<1	<1	<1	<1
PCB 16,32	2	15	<2	<3	<2	<2	<3	7
PCB 29	0.2	<0.3	<0.2	<0.2	<0.2	<0.2	<0.3	0.2
PCB 31	1	35	2.2	2.1	2.3	4.4	<1	23
PCB 33	1	<1	1.1	<1	2.3	<1	<1	2.3
PCB 53	1	2.5	<1	1	<1	<1	<1	1.2
PCB 51	1	<1	<1	2.1	<1	2.2	<1	<1
PCB 22	2	8.8	<2	<2	<2	2.2	<3	4.6
PCB 45	1	3.8	<1	<1	<1	<1	<1	<1
PCB 46	2	<3	<2	<2	9.3	<2	<3	<2
PCB 49	1	23	3.3	3.1	<1	8.8	<1	8.1
PCB 47,48	1	24	4.5	7.3	5.8	13	<1	8.1
PCB 44	1	29	5.6	1	21	12	<1	9.3
PCB 42	0.3	0.8	<0.3	<0.3	<0.3	0.8	<0.4	<0.3
PCB 37	0.5	<0.6	<0.6	<0.5	<0.6	<0.5	<0.6	<0.6
PCB 41,71,64	2	51	5.6	3.1	7	13	<3	14
PCB 40	2	6.3	<2	<2	5.8	<2	<3	<2
PCB 63	1	<1	<1	<1	4.7	1.1	<1	<1
PCB 74	1	18	<1	<1	3.5	1.1	<1	5.8
PCB 70,76	1	7.5	6.7	2.1	4.7	3.3	<1	10
PCB 66	1	51	7.8	4.1	9.3	15	<1	15
PCB 95	0.6	29	<0.7	4.8	5.1	15	1.4	13
PCB 91	0.6	5.9	1.9	2.5	5.6	5	<0.8	<0.7
PCB 92,84	1	24	3.3	<1	34	4.4	<1	5.8
PCB 101	0.4	36	17	11	13	31	3.6	17
PCB 99	0.4	19	6.1	4	10	12	1.7	6.5
PCB 119	0.8	3.4	0.9	1.5	3.3	3	<1	1.4
PCB 83	0.6	<0.8	<0.7	<0.6	0.9	<0.7	<0.8	0.9
PCB 97	0.4	12	3.1	1.6	1.9	7.9	0.8	3.7
PCB 87	0.5	23	5.7	3.2	5.6	9.6	1.7	7.1
PCB 85	0.5	9.9	2.3	1.1	3.8	4.3	0.8	2.7
PCB 136	0.7	5.9	2.6	1.3	1.2	2.8	<0.7	2.4
PCB 110	0.4	59	13	6.9	22	28	2.9	17
PCB 82	0.4	5.5	0.9	0.4	0.5	<0.4	<0.5	1.7
PCB 151	1	21	13	10	9.2	28	3	11
PCB 135,144	1	10	6.3	3.5	2.1	12	<1	5.6
PCB 149	1	55	34	24	57	63	5	29
PCB 146	2	21	14	13	49	24	3	10
PCB 153,132	2	120	130	100	420	290	26	87
PCB 141	2	28	11	11	28	7.4	2	8.7
PCB 176	2	<2	<2	<2	<2	2.8	<2	<2
PCB 178	2	6.2	<2	5.2	26	13	<2	4.8
PCB 187,182	2	86	56	51	270	87	11	33
PCB 183	2	16	16	16	60	25	<2	9.5
PCB 185	2	<2	<2	<2	18	3.7	2	<2
PCB 174	1	20	9.5	7.9	14	9.2	<1	6.3

Table VA Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		1-89	1-91	2-91	3-91	4-91	5-91	6-91
Lab ID:	MDL	92-847	92-828	92-829	92-830	92-831	92-832	92-833
Target PCBs								
PCB 177	1	12	9.5	5.2	36	19	2	7.9
PCB 202	1	3.1	2.1	1.7	7.2	4.6	<1	2.4
PCB 171	2	11	9.5	9.6	33	17	<2	6.3
PCB 172	4	12	8.4	9.6	34	4.6	<4	4.8
PCB 197	4	<4	170	<3	170	<4	<4	<3
PCB 180	1	54	37	43	130	42	7	21
PCB 191	2	2.1	<2	1.7	4.1	1.8	<2	2.4
PCB 199	0.6	1	<0.6	<0.5	<0.6	<0.6	<0.6	<0.5
PCB 201	2	12	8.4	8.7	25	4.6	2	4.8
PCB 202,196	2	15	12	14	36	<2	3	7.1
PCB 208	2	<2	<2	<2	10	<2	<2	<2
PCB 195	3	10	7.4	7.9	22	8.3	<3	4
PCB 194	0.9	<0.9	4.9	5.6	13	1.4	1.2	2.5
PCB 206	2	4.1	2.1	1.7	5.1	<2	<2	2.4
Coplanar PCB Congeners								
PCB 28	2	44	<2	<2	<2	5.5	<3	23
PCB 52	2	46	10	4.1	7	13	<3	15
PCB 60(56)	1	23	<1	<1	2.3	<1	<1	5.8
PCB 81	1	<1	<1	<1	<1	<1	<1	<1
PCB 123	0.6	<0.8	<0.7	<0.6	<0.7	<0.7	<0.8	<0.7
PCB 118	0.7	82	27	15	54	61	5.3	26
PCB 114	0.8	2.3	<0.9	<0.8	1	0.99	<1	<0.9
PCB 105	0.5	25	6.9	3.4	16	12	1.8	7.1
PCB 138(163)	1	100	78	62	220	130	15	44
PCB 158	1	10	5.3	5.2	16	11	<1	4.8
PCB 126	0.8	2.9	2.2	1.9	5.1	4.6	<1	2
PCB 167	1	13	7.4	5.2	18	13	2	4
PCB 156	1	9.3	5.3	4.4	12	8.3	1	3.2
PCB 157	1	2.1	<1	8.7	2.1	1.8	10	<0.8
PCB 169	1	<1	<1	<0.9	<1	<0.9	<1	<0.8
PCB 170(190)	2	30	23	25	65	21	5	10
PCB 77	0.1	0.4	0.5	<0.1	<0.1	<0.1	<0.1	0.5
Total PCBs	10	1400	820	550	2100	1200	120	620
Surrogate Recovery (%)								
PCB 14		70	75	75	73	76	56	74
PCB 65		80	90	97	86	91	77	86
PCB 166		97	95	120	97	110	100	126

Table VA Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID: / Lab ID:	MDL	7-91 92-834	8-91 92-835	9-91 92-836	10-91 92-837	11-91 92-838	12-91 92-839	13-91 92-840
Target PCBs								
PCB 1	0.8	<1	<0.9	<1	<1	<1	0.9	1.4
PCB 3	0.8	<1	<0.9	<1	<1	<1	<0.9	<1
PCB 4,10	0.2	<0.3	<0.2	<0.3	<0.4	0.3	<0.2	0.6
PCB 7	0.2	<0.3	<0.2	0.3	<0.4	<0.3	<0.2	<0.3
PCB 6	0.3	<0.4	<0.4	<0.5	<0.5	<0.4	<0.3	<0.4
PCB 8,5	0.9	<1	<1	1.5	<2	2.8	1.2	5.1
PCB 19	1	<1	<1	<2	<2	<1	<1	<1
PCB 12,13	0.2	<0.3	<0.2	<0.3	<0.4	<0.3	<0.2	<0.3
PCB 18	1	<1	<1	1.3	<1	5	1.9	8
PCB 17	2	<2	<2	<3	<3	2.5	<2	5.3
PCB 27	0.9	<0.9	<0.9	<1	<1	<1	<0.8	<1
PCB 16,32	2	<2	<2	<3	<3	6.3	3.7	11
PCB 29	0.2	<0.2	<0.2	<0.3	<0.3	<0.3	<0.2	<0.3
PCB 31	1	1	8.6	5.1	<1	13	7.4	25
PCB 33	1	<1	<1	<1	<1	2.5	0.9	2.7
PCB 53	1	<1	1	<1	<1	<1	<0.9	<1
PCB 51	1	<1	1.9	1.3	<1	<1	<0.9	<1
PCB 22	2	<2	<2	<3	<3	<3	<2	6.7
PCB 45	1	<1	<1	<1	<1	1.3	<0.9	1.3
PCB 46	2	<2	<2	<3	<3	<3	<2	<3
PCB 49	1	<1	8.6	8.9	<1	7.5	3.7	6.7
PCB 47,48	1	<1	68	13	2.6	6.3	3.7	6.7
PCB 44	1	<1	5.8	7.7	<1	8.8	4.7	11
PCB 42	0.3	<0.3	0.6	<0.4	<0.4	0.9	0.4	<0.4
PCB 37	0.5	<0.5	<0.5	<0.6	<0.7	<0.6	<0.5	<0.7
PCB 41,71,64	2	<2	19	13	<3	16	8.4	19
PCB 40	2	<2	<2	<3	<3	<3	<2	<3
PCB 63	1	<1	1.9	<1	<1	<1	<0.9	<1
PCB 74	1	<1	7.7	<1	<1	7.5	2.8	6.7
PCB 70,76	1	1	1.9	2.6	<1	6.3	3.7	4
PCB 66	1	2.1	19	18	<1	16	7.4	13
PCB 95	0.6	2.5	12	12	1.5	8.8	3.8	5.2
PCB 91	0.6	0.8	7.8	5	<0.8	2.5	1	<0.8
PCB 92,84	1	<1	<1	<1	<1	<1	1.9	4
PCB 101	0.4	5.4	52	32	4.5	21	6.9	6.1
PCB 99	0.4	2.3	25	15	1.6	9.4	3.4	3.7
PCB 119	0.8	<0.8	9.1	2.8	<1	<1	<0.7	<1
PCB 83	0.6	<0.6	1.8	1.4	<0.8	1.3	<0.6	<0.8
PCB 97	0.4	0.7	4.6	6.5	0.6	5.1	1.9	2.5
PCB 87	0.5	1.9	14	12	<0.7	9.3	3.3	5.6
PCB 85	0.5	0.7	7.1	5.5	<0.7	4.5	1.4	2.4
PCB 136	0.7	<0.5	4.4	2.1	<0.8	1.5	<0.5	0.9
PCB 110	0.4	4.1	39	31	2.4	20	6.8	11
PCB 82	0.4	<0.4	0.9	0.8	<0.5	2.8	0.8	1.1
PCB 151	1	3.7	20	32	3.3	9.4	3.3	<1
PCB 135,144	1	<0.7	9.9	14	<1	5.6	<0.7	1.1
PCB 149	1	9	91	73	5.5	38	8.7	7.6
PCB 146	2	4.5	68	36	<2	16	4.7	4.3
PCB 153,132	2	36	460	370	22	140	36	18
PCB 141	2	4.5	38	17	2.2	20	4.7	4.3
PCB 176	2	<1	2.5	2.3	<2	<2	<1	<2
PCB 178	2	<1	28	17	<2	<2	1.3	<2
PCB 187,182	2	15	210	130	12	83	16	12
PCB 183	2	4.5	55	38	<2	24	5.3	<2
PCB 185	2	<1	4.1	5.8	<2	<2	<1	<2
PCB 174	1	3	20	17	<1	18	2.7	3.3

Table VA Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID: / Lab ID:	MDL	7-91 92-834	8-91 92-835	9-91 92-836	10-91 92-837	11-91 92-838	12-91 92-839	13-91 92-840
Target PCBs								
PCB 177	1	2.2	41	23	2.2	10	1.3	2.2
PCB 202	1	<0.7	8.3	5.8	<1	1.9	<0.7	2.2
PCB 171	2	3	33	23	<2	13	2.7	<2
PCB 172	4	<3	26	13	<4	<4	3.3	<4
PCB 197	4	<3	8.3	<5	<4	4.7	<3	<4
PCB 180	1	11	120	81	6.6	79	13	8.7
PCB 191	2	1.5	<2	2.3	<2	1.9	<1	<2
PCB 199	0.6	<0.4	0.5	<0.7	<0.7	0.9	<0.4	<0.7
PCB 201	2	3	22	13	<2	<2	2.7	2.2
PCB 202,196	2	<1	36	26	<2	23	3.3	<2
PCB 208	2	<1	41	<2	<2	<2	<1	<2
PCB 195	3	<2	20	15	3.3	13	2	<3
PCB 194	0.9	1.1	11	6	<1	12	1.7	1.3
PCB 206	2	<1	4.1	3.5	<2	4.7	<1	<2
Coplanar PCB Congeners								
PCB 28	2	<2	5.8	6.4	<3	11	8.4	32
PCB 52	2	<2	18	11	<3	14	7.4	13
PCB 60(56)	1	<1	2.9	<1	<1	5	2.8	5.3
PCB 81	1	<1	<1	<1	<1	<1	<0.9	<1
PCB 123	0.6	<0.6	<0.6	<0.8	<0.8	<0.7	<0.6	<0.8
PCB 118	0.7	6.4	64	66	3.6	44	11	15
PCB 114	0.8	<0.8	2	1.3	<1	1.7	0.84	<1
PCB 105	0.5	1.8	18	14	0.79	14	3.7	4.5
PCB 138(163)	1	<0.7	240	180	13	80	21	18
PCB 158	1	2.2	21	15	1.1	7.5	2	2.2
PCB 126	0.8	<0.8	8.2	5.2	<1	1.6	<0.7	<1
PCB 167	1	1.5	20	17	<1	8.4	2	2.2
PCB 156	1	0.75	14	12	<1	6.6	1.3	2.2
PCB 157	1	<0.7	3.3	2	9.9	0.94	<0.7	9.8
PCB 169	1	<0.7	<0.8	<1	<1	<0.9	<0.7	<1
PCB 170(190)	2	6	61	43	3.3	34	6	5.4
PCB 77	0.1	<0.1	0.1	<0.1	<0.1	0.3	<0.09	0.3
Total PCBs	10	140	2200	1500	100	940	260	350
Surrogate Recovery (%)								
PCB 14		68	85	62	56	69	91	71
PCB 65		96	100	78	76	80	110	75
PCB 166		130	120	87	91	110	140	92

Table VA Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		14-91	15-91	16-91	17-91	18-91	19-91
Lab ID:	MDL	92-841	92-842	92-843	92-844	92-845	92-846
Target PCBs							
PCB 1	0.8	<2	<1	<1	<0.9	2.6	<1
PCB 3	0.8	<2	<1	<1	<0.9	<1	<1
PCB 4,10	0.2	<0.4	0.3	<0.3	<0.2	0.5	<0.3
PCB 7	0.2	<0.4	<0.3	<0.3	0.4	0.5	<0.3
PCB 6	0.3	<0.6	<0.4	<0.4	<0.4	<0.5	<0.4
PCB 8,5	0.9	<2	1.8	<1	<1	1.5	<1
PCB 19	1	<2	<1	<1	<1	<2	<1
PCB 12,13	0.2	<0.4	<0.3	<0.3	<0.2	<0.3	<0.3
PCB 18	1	1.5	3.3	1.1	1	3.5	<1
PCB 17	2	<3	<2	<2	<2	4.7	<2
PCB 27	0.9	<1	<1	<1	<0.9	<1	<1
PCB 16,32	2	<3	4.4	<2	<2	8.1	<2
PCB 29	0.2	<0.3	<0.2	<0.2	<0.2	<0.2	<0.2
PCB 31	1	4.5	9.8	5.7	11	15	1.1
PCB 33	1	<2	1.1	<1	<1	<1	<1
PCB 53	1	<2	<1	<1	1	2.3	<1
PCB 51	1	<2	<1	<1	<1	3.5	<1
PCB 22	2	<3	2.2	<2	<2	4.7	<2
PCB 45	1	<2	<1	<1	1	<1	<1
PCB 46	2	<3	<2	<2	<2	<2	<2
PCB 49	1	3	3.3	4.6	11	16	<1
PCB 47,48	1	3	2.2	4.6	21	23	<1
PCB 44	1	3	4.4	4.6	18	9.3	1.1
PCB 42	0.3	<0.5	0.3	<0.3	2.2	1.2	<0.3
PCB 37	0.5	<0.8	<0.5	<0.6	<0.5	<0.6	<0.5
PCB 41,71,64	2	4.5	6.6	6.8	33	20	2.2
PCB 40	2	<3	<2	<2	3	<2	<2
PCB 63	1	<2	<1	<1	<1	<1	<1
PCB 74	1	1.5	2.2	<1	10	<1	<1
PCB 70,76	1	3	4.4	4.6	3	4.7	<1
PCB 66	1	4.5	5.5	8.0	28	27	1.1
PCB 95	0.6	2.1	2.6	8.2	18	13	1.5
PCB 91	0.6	<0.9	<0.7	1.9	5.7	6.9	<0.6
PCB 92,84	1	<2	1.1	<1	8	3.5	<1
PCB 101	0.4	3.5	3.3	15	50	42	3.2
PCB 99	0.4	1.5	1.3	5.9	24	20	1.1
PCB 119	0.8	<1	<0.9	1.1	4.7	4.2	<0.9
PCB 83	0.6	<0.9	<0.7	<0.7	<0.6	<0.7	<0.6
PCB 97	0.4	1.2	0.9	2.6	9.9	6.7	0.7
PCB 87	0.5	2.3	1.9	4.9	15	12	1.6
PCB 85	0.5	<0.8	0.7	2.2	9.3	7.7	0.8
PCB 136	0.7	<0.8	<0.6	1.4	3.7	2.6	<0.6
PCB 110	0.4	3.6	3.5	11	51	30	2.9
PCB 82	0.4	<0.6	0.8	0.6	2.7	<0.5	<0.4
PCB 151	1	1.2	1.6	11	15	41	1.6
PCB 135,144	1	<1	<0.8	4.7	8	16	<0.8
PCB 149	1	3.5	4.1	28	70	62	4
PCB 146	2	2.3	<2	12	40	42	2.4
PCB 153,132	2	12	9.8	110	310	450	15
PCB 141	2	<2	1.6	9.5	23	17	2.4
PCB 176	2	<2	<2	<2	1.5	3.2	<2
PCB 178	2	<2	<2	4.7	15	20	<2
PCB 187,182	2	5.8	4.9	44	110	140	8
PCB 183	2	<2	<2	13	32	40	<2
PCB 185	2	<2	<2	<2	2.9	6.4	<2
PCB 174	1	<1	1.6	5.7	11	14	<0.8

Table VA Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		14-91	15-91	16-91	17-91	18-91	19-91
Lab ID:	MDL	92-841	92-842	92-843	92-844	92-845	92-846
Target PCBs							
PCB 177	1	<1	0.8	4.7	23	16	1.6
PCB 202	1	<1	<0.8	1.9	5.1	6.4	<0.8
PCB 171	2	<2	<2	7.6	19	28	<2
PCB 172	4	<5	<3	6.6	15	10	<3
PCB 197	4	<5	<3	<4	<3	10	<3
PCB 180	1	3.5	4.1	29	68	73	5.6
PCB 191	2	<2	<2	<2	2.2	<2	<2
PCB 199	0.6	<0.7	<0.5	<0.6	<0.4	<0.5	<0.5
PCB 201	2	<2	<2	5.7	12	9.7	<2
PCB 202,196	2	<2	<2	<2	20	24	1.6
PCB 208	2	<2	<2	<2	58	<2	<2
PCB 195	3	<3	<2	4.7	11	13	<2
PCB 194	0.9	<1	<0.7	2.5	5.3	3.4	0.8
PCB 206	2	<2	<2	<2	3.7	3.2	<2
Coplanar PCB Congeners							
PCB 28	2	6	9.8	5.7	10	15	<2
PCB 52	2	4.5	6.6	8	38	17	<2
PCB 60(56)	1	1.5	2.2	2.3	6	8.1	<1
PCB 81	1	<2	<1	<1	<1	<1	<1
PCB 123	0.6	<0.9	<0.7	<0.7	<0.6	<0.7	<0.6
PCB 118	0.7	5	4	24	89	85	3.9
PCB 114	0.8	<1	<0.9	<0.9	2.2	2.1	<0.9
PCB 105	0.5	1.8	1.9	5.8	27	22	1.3
PCB 138(163)	1	7	6.5	64	160	190	8.8
PCB 158	1	<1	5.7	5.7	16	18	<0.8
PCB 126	0.8	<1	<0.9	1.7	5.2	7.7	<0.9
PCB 167	1	<1	<0.8	5.7	17	18	0.8
PCB 156	1	<1	<0.8	3.8	10	11	<0.8
PCB 157	1	10	<0.8	<0.9	2.2	2.4	<0.8
PCB 169	1	<1	<0.8	<0.9	<0.7	<0.8	<0.8
PCB 170(190)	2	2.3	<2	17	35	34	2.4
PCB 77	0.1	<0.2	<0.1	0.3	<0.1	0.4	<0.1
Total PCBs	10	100	130	540	1600	1800	77
Surrogate Recovery (%)							
PCB 14		49	77	70	86	66	73
PCB 65		67	92	88	100	86	92
PCB 166		86	120	110	140	120	130

Table VB Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID: / Lab ID:	MDL	1-92 93-251	2-92 93-252	3-92 93-253	4-92 93-254	5-92 93-255	6-92 93-256
Target PCBs							
PCB 1	2	<2	<2	3	2	<2	<2
PCB 3	2	<2	<2	<2	<2	<2	<2
PCB 4,10	0.8	<0.8	<0.8	0.5	<0.8	<0.8	<0.8
PCB 7	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 6	1	<1	<1	<1	<1	<1	<1
PCB 8,5	4	<4	<4	4	5	<4	<4
PCB 19	6	<6	<6	<6	<6	<6	<6
PCB 12,13	8	<8	<8	<8	<8	<8	<8
PCB 18	6	<6	<6	6	6	<6	<6
PCB 17	10	<10	<10	<10	<10	<10	<10
PCB 27	4	<4	<4	<4	<4	<4	<4
PCB 16,32	8	<8	<8	16	36	17	11
PCB 29	6	<6	<6	<6	<6	<6	<6
PCB 31	6	<6	<6	7	26	<6	<6
PCB 33	6	<6	<6	<6	6	<6	<6
PCB 53	0.6	<0.6	<0.6	0.8	2.4	0.6	0.6
PCB 51	0.5	<0.5	<0.5	1.2	1.2	1.0	<0.5
PCB 22	10	<10	<10	<10	<10	<10	<10
PCB 45	0.6	<0.6	<0.6	<0.6	1.6	<0.6	<0.6
PCB 46	0.6	<0.6	<0.6	<0.6	0.9	<0.6	<0.6
PCB 49	0.5	0.6	2.2	6.0	9.5	3.8	2.2
PCB 47,48	0.6	0.6	3.4	8.5	9.8	5.7	2.9
PCB 44	0.6	<0.6	1.9	6.4	12	4.5	2.7
PCB 42	1	<1	<1	<1	<1	<1	<1
PCB 37	0.2	<0.2	<0.2	0.2	0.2	0.9	0.4
PCB 41,71,64	0.8	0.9	4.1	11	21	6.4	4.2
PCB 40	0.6	<0.6	<0.6	1.3	3.6	0.9	0.8
PCB 63	0.5	<0.5	<0.5	<0.5	1.3	1.9	<0.5
PCB 74	0.5	0.5	1.5	3.1	6.1	1.8	1.9
PCB 70,76	0.5	0.9	2.6	2.3	11	2.2	3.7
PCB 66	0.6	1.2	4.3	11	16	7.3	4.9
PCB 95	1	<1	5	8	12	7	7
PCB 91	1	<1	<1	3	3	2	1
PCB 92,84	3	<3	<3	<3	6	<3	<3
PCB 101	0.8	1.8	11	17	16	13	11
PCB 99	0.8	0.9	4.3	7.3	6.1	5.3	4.2
PCB 119	1	<1	<1	1	<1	<1	<1
PCB 83	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 97	0.9	<0.9	1.9	3.9	3.7	3.1	2.3
PCB 87	1	<1	3	5	6	3	4
PCB 85	1	<1	2	3	3	2	2
PCB 136	0.4	0.4	0.9	1.1	2.2	2.4	3.3
PCB 110	0.8	1.5	8.2	13	15	10	9.7
PCB 82	1	<1	<1	<1	1	<1	<1
PCB 151	0.8	2.1	7.5	14	8.9	19	14
PCB 135,144	0.7	0.8	2.9	6.3	4.2	9	6.5
PCB 149	0.7	4.0	17	27	22	41	33
PCB 146	0.9	2.0	7.7	12	7.3	16	12
PCB 153,132	1	16	65	140	66	190	120
PCB 141	1	2	5	4.1	5.1	4	11
PCB 176	0.3	0.3	0.5	1.5	1.1	2.6	1.7
PCB 178	3	<3	<3	4	3	6	5
PCB 187,182	3	10	34	55	36	78	64
PCB 183	1	3	9	15	8	20	16
PCB 185	1	<1	<1	3	<1	2	2
PCB 174	1	1	4	5	6	6	10
PCB 177	1	1	4	8	7	13	12
PCB 202	1	<1	2	3	2	5	3

Table VB Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		1-92	2-92	3-92	4-92	5-92	6-92
Lab ID:	MDL	93-251	93-252	93-253	93-254	93-255	93-256
Target PCBs							
PCB 171	3	<3	5	10	6	13	10
PCB 172	1	<1	1	<1	1	1	3
PCB 197	3	<3	<3	3	<3	5	3
PCB 180	1	6	20	26	18	29	40
PCB 191	1	<1	<1	<1	<1	<1	1
PCB 199	0.4	<0.4	<0.4	<0.4	<0.4	0.5	0.6
PCB 201	1	1	4	4	5	4	10
PCB 202,196	1	2	8	9	7	12	16
PCB 208	3	6	4	5	4	6	8
PCB 195	3	3	4	6	4	8	9
PCB 194	0.5	0.8	1.7	0.9	1.5	1.3	4.6
PCB 206	1	<1	1	1	1	2	3
Coplanar PCB Congeners							
PCB 28	6	<6	<6	7	<6	<6	<6
PCB 52	0.5	1.2	6	8	18	5.6	4.8
PCB 60(56)	0.5	0.5	2.4	2.8	7.3	2.2	1.9
PCB 81	0.3	<0.3	<0.3	0.5	<0.3	<0.3	<0.3
PCB 123	1	3	22	36	25	28	19
PCB 118	1	<1	2	2	2	<1	<1
PCB 114	1	<1	<1	<1	<1	<1	<1
PCB 105	1	<1	6	8	8	6	5
PCB 138(163)	0.7	6.2	42	77	49	50	35
PCB 158	0.7	0.7	3.8	7.3	4.4	4.2	3.4
PCB 126	0.9	<0.9	1.7	2.4	1.5	2.3	1.4
PCB 167	0.7	0.8	3.9	<0.7	<0.7	5.7	3.1
PCB 156	0.5	0.5	2.5	4.6	3.6	2.9	2.8
PCB 157	0.5	12	<0.5	0.9	<0.5	<0.5	<0.5
PCB 169	1	<1	<1	<1	<1	<1	<1
PCB 170(190)	1	2	12	14	12	5	10
PCB 77	0.5	<0.5	<0.5	<0.5	1.9	<0.5	<0.5
Total PCBs	20	97	370	680	610	710	580
Surrogate Recovery (%)							
PCB 14		32	47	75	67	35	36
PCB 65		68	47	75	67	68	73
PCB 166		91	76	78	73	86	94

Table VB Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	MDL	93-257	93-258	93-259	93-260	93-261	93-262
Target PCBs							
PCB 1	2	<2	<2	9	<2	<2	<2
PCB 3	2	<2	<2	<2	<2	<2	<2
PCB 4,10	0.8	<0.8	<0.8	1.0	<0.8	<0.8	<0.8
PCB 7	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
PCB 6	1	<1	<1	<1	<1	<1	<1
PCB 8,5	4	<4	<4	3	<4	<4	<4
PCB 19	6	<6	<6	<6	<6	<6	<6
PCB 12,13	8	<8	<8	<8	<8	<8	<8
PCB 18	6	<6	<6	13	<6	<6	<6
PCB 17	10	<10	<10	10	<10	<10	<10
PCB 27	4	<4	<4	<4	<4	<4	<4
PCB 16,32	8	<8	<8	110	16	9	14
PCB 29	6	<6	<6	<6	<6	<6	<6
PCB 31	6	<6	<6	52	13	<6	7
PCB 33	6	<6	<6	7	<6	<6	<6
PCB 53	0.6	<0.6	<0.6	4.1	<0.6	<0.6	<0.6
PCB 51	0.5	<0.5	<0.5	1.8	<0.5	<0.5	<0.5
PCB 22	10	<10	<10	10	<10	<10	<10
PCB 45	0.6	<0.6	<0.6	3.7	<0.6	<0.6	<0.6
PCB 46	0.6	<0.6	<0.6	1.5	<0.6	<0.6	<0.6
PCB 49	0.5	0.7	0.5	20	3.3	1.1	2.1
PCB 47,48	0.6	7.5	<0.6	22	2.4	1.1	2.1
PCB 44	0.6	2.5	<0.6	25	3.8	1.4	2.8
PCB 42	1	<1	<1	2	<1	<1	<1
PCB 37	0.2	<0.2	<0.2	0.4	0.5	<0.2	<0.2
PCB 41,71,64	0.8	4.5	1.3	48	7.3	3.0	5.8
PCB 40	0.6	1.1	<0.6	4.9	1.3	<0.6	<0.6
PCB 63	0.5	1.3	<0.5	2.5	0.6	<0.5	<0.5
PCB 74	0.5	2.2	<0.5	13	2.4	0.7	1.7
PCB 70,76	0.5	<0.5	0.7	25	3.3	1.1	1.9
PCB 66	0.6	4.9	1.2	38	6.2	2.1	4.7
PCB 95	1	3	<1	22	4	<1	2
PCB 91	1	<1	<1	5	<1	<1	<1
PCB 92,84	3	<3	<3	<3	<3	<3	<3
PCB 101	0.8	6.2	1.3	32	7.5	1.7	4.1
PCB 99	0.8	7.3	<0.8	14	3.1	0.9	1.9
PCB 119	1	<1	<1	1	<1	<1	<1
PCB 83	0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
PCB 97	0.9	<0.9	<0.9	7.4	1.8	<0.9	<0.9
PCB 87	1	4	<1	13	3	1	2
PCB 85	1	3	<1	8	<1	<1	<1
PCB 136	0.4	0.5	<0.4	3.1	2.1	<0.4	<0.4
PCB 110	0.8	16	1.3	32	6.6	1.7	3.8
PCB 82	1	<1	<1	3	<1	<1	<1
PCB 151	0.8	3.8	1.6	17	8.4	1.1	1.2
PCB 135,144	0.7	<0.7	<0.7	6.9	4.1	<0.7	<0.7
PCB 149	0.7	34	3.4	39	22	1.9	3.9
PCB 146	0.9	34	1.5	15	8.9	0.9	1.9
PCB 153,132	1	310	12	120	72	7	16
PCB 141	1	15	1	18	10	1	2
PCB 176	0.3	0.7	<0.3	1.1	1.0	<0.3	<0.3
PCB 178	3	<3	<3	4	3	<3	<3
PCB 187,182	3	220	8	69	53	4	9
PCB 183	1	56	3	20	14	<1	3
PCB 185	1	<1	<1	3	2	<1	<1
PCB 174	1	7	<1	13	9	<1	<1

Table VB Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		7-92	8-92	9-92	10-92	11-92	12-92
Lab ID:	MDL	93-257	93-258	93-259	93-260	93-261	93-262
Target PCBs							
PCB 177	1	34	<1	8	9	<1	<1
PCB 202	1	9	<1	3	3	<1	<1
PCB 171	3	33	<3	11	9	<3	<3
PCB 172	1	12	<1	6	3	<1	<1
PCB 197	3	7	<3	3	<3	<3	<3
PCB 180	1	110	4	53	39	3	6
PCB 191	1	4	<1	<1	<1	<1	<1
PCB 199	0.4	<0.4	<0.4	0.4	0.7	<0.4	<0.4
PCB 201	1	27	<1	12	11	<1	2
PCB 202,196	1	45	1	18	15	<1	1
PCB 208	3	11	4	10	9	<3	5
PCB 195	3	26	<3	10	9	<3	<3
PCB 194	0.5	13	<0.5	5.6	5.6	<0.5	0.7
PCB 206	1	5	<1	3	3	<1	<1
Coplanar PCB Congeners							
PCB 28	6	<6	<6	<6	13	6	12
PCB 52	0.5	7.3	1.3	41	4.9	2.7	<0.5
PCB 60(56)	0.5	1.1	<0.5	17	2.4	0.9	2.8
PCB 81	0.3	<0.3	<0.3	0.7	<0.3	<0.3	<0.3
PCB 123	1	65	3	58	15	3	11
PCB 118	1	<1	<1	4	<1	<1	<1
PCB 114	1	<1	<1	2	<1	<1	<1
PCB 105	1	20	<1	20	4	1	4
PCB 138(163)	0.7	180	4.1	110	29	5.4	12
PCB 158	0.7	18	<0.7	11	3.2	<0.7	1.2
PCB 126	0.9	6.7	<0.9	2.2	<0.9	<0.9	<0.9
PCB 167	0.7	12	<0.7	<0.7	2.9	<0.7	1.3
PCB 156	0.5	9.3	<0.5	8.7	2.6	<0.5	0.9
PCB 157	0.5	1.6	<0.5	1.5	<0.5	<0.5	<0.5
PCB 169	1	<1	<1	<1	<1	<1	<1
PCB 170(190)	1	61	1	35	12	2	3
PCB 77	0.5	<0.5	<0.5	4.8	<0.5	<0.5	<0.5
Total PCBs	20	1500	60	1400	500	65	160
Surrogate Recovery (%)							
PCB 14		56	30	67	31	71	43
PCB 65		55	61	71	55	70	47
PCB 166		85	80	71	59	79	75

Table VB Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		13-92	14-92	15-89	16-89	17-93
Lab ID:	MDL	93-263	93-264	93-265	93-266	93-267
Target PCBs						
PCB 1	2	5	5	5	<2	<2
PCB 3	2	<2	<3	<2	<2	<2
PCB 4,10	0.8	<0.8	<2	<0.8	<0.8	<0.8
PCB 7	0.8	<0.8	<2	<0.8	<0.8	<0.8
PCB 6	1	<1	<2	<1	<1	<1
PCB 8,5	4	7	<5	<4	<4	<4
PCB 19	6	<6	<8	<6	<6	<6
PCB 12,13	8	<8	<10	<8	<8	<8
PCB 18	6	25	<8	<6	<6	<6
PCB 17	10	20	<20	<10	<10	<10
PCB 27	4	<4	<5	<4	<4	<4
PCB 16,32	8	140	<10	19	<8	<8
PCB 29	6	<6	<8	<6	<6	<6
PCB 31	6	82	15	9	<6	<6
PCB 33	6	18	<8	<6	<6	<6
PCB 53	0.6	3.1	<10	<0.6	<0.6	<0.6
PCB 51	0.5	1.1	<0.8	<0.5	<0.5	<0.5
PCB 22	10	20	<10	<10	<10	<10
PCB 45	0.6	2.9	<1	<0.6	<0.6	<0.6
PCB 46	0.6	1.2	<1	<0.6	<0.6	<0.6
PCB 49	0.5	12	11	2.1	1.6	1.5
PCB 47,48	0.6	12	25	2.1	2.1	1.7
PCB 44	0.6	18	30	3.0	2.1	2.0
PCB 42	1	2	<3	<1	<1	<1
PCB 37	0.2	0.4	0.3	<0.2	<0.2	0.3
PCB 41,71,64	0.8	31	56	6.0	2.9	2.4
PCB 40	0.6	4.0	4	0.8	<0.6	<0.6
PCB 63	0.5	1.5	3.2	0.5	<0.5	0.7
PCB 74	0.5	7.7	9.8	1.7	1.9	0.7
PCB 70,76	0.5	13	1.2	1.2	0.8	1.7
PCB 66	0.6	21	34	5.6	5.3	3.7
PCB 95	1	10	24	3	5	5
PCB 91	1	2	5	<1	<1	<1
PCB 92,84	3	6	<5	<3	<3	<3
PCB 101	0.8	13	30	4.0	7.4	6.8
PCB 99	0.8	5.3	19	2.0	3.3	2.9
PCB 119	1	<1	<2	<1	<1	<1
PCB 83	0.9	<0.9	2	<0.9	<0.9	<0.9
PCB 97	0.9	3.4	9	1.2	2.1	1.5
PCB 87	1	6	15	3	4	2
PCB 85	1	3	10	1	2	<1
PCB 136	0.4	2.6	1.6	1.2	1.8	2.5
PCB 110	0.8	13	52	5.8	9.5	5.6
PCB 82	1	1	2	<1	<1	<1
PCB 151	0.8	9.3	4.9	4.0	9.6	11
PCB 135,144	0.7	4.9	2.5	2.0	4.5	4.9
PCB 149	0.7	27	26	11	19	25
PCB 146	0.9	8.6	9.8	3.7	9.4	11
PCB 153,132	1	78	69	29	70	110
PCB 141	1	11	6.5	6	6	5
PCB 176	0.3	1.0	0.6	0.5	1.3	1.5
PCB 178	3	3	<2	<3	4	4
PCB 187,182	3	51	90	20	55	57
PCB 183	1	11	8	5	12	13
PCB 185	1	3	<2	<1	3	1
PCB 174	1	9	5	5	8	5

Table VB Surrogate Recovery Corrected Sample Results for PCBs (ng/g)

Field ID:		13-92	14-92	15-89	16-89	17-93
Lab ID:	MDL	93-263	93-264	93-265	93-266	93-267
Target PCBs						
PCB 177	1	6	7	3	10	7
PCB 202	1	2	2.5	<1	3	4
PCB 171	3	6	5	3	9	8
PCB 172	1	3	3	<1	3	3
PCB 197	3	<3	<2	<3	<3	3
PCB 180	1	32	19	13	26	28
PCB 191	1	<1	<2	<1	<1	<1
PCB 199	0.4	0.6	<0.4	<0.4	0.5	<0.4
PCB 201	1	9	9	3	6	6
PCB 202,196	1	13	8	5	10	13
PCB 208	3	11	5	5	5	5
PCB 195	3	6	4	<3	7	7
PCB 194	0.5	4.0	1.6	1.2	1.7	2.3
PCB 206	1	3	2	<1	1	3
Coplanar PCB Congeners						
PCB 28	6	130	24	14	<6	<6
PCB 52	0.5	36	100	<0.5	3.3	2.5
PCB 60(56)	0.5	12	10	3.2	2.1	1.2
PCB 81	0.3	<0.3	0.7	<0.3	<0.3	<0.3
PCB 123	1	30	100	14	29	12
PCB 118	1	<1	<2	1	2	<1
PCB 114	1	<1	3	<1	<1	<1
PCB 105	1	11	36	5	7	3
PCB 138(163)	0.7	64	98	29	57	28
PCB 158	0.7	6.1	8.1	2.9	5.8	2.4
PCB 126	0.9	1.5	3	<0.9	2.3	1.4
PCB 167	0.7	6.1	9.0	3.7	3.6	1.7
PCB 156	0.5	5.9	5.5	2.5	3.6	1.9
PCB 157	0.5	1.0	1.3	<0.5	<0.5	<0.5
PCB 169	1	<1	<0.8	<1	<1	<1
PCB 170(190)	1	18	17	8	16	7
PCB 77	0.5	<0.5	<0.8	<0.5	2.7	<0.5
Total PCBs	20	1100	1100	280	470	440
Surrogate Recovery (%)						
PCB 14		44	58	42	48	30
PCB 65		83	59	81	49	59
PCB 166		63	120	65	77	75

APPENDIX B

METHOD VALIDATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1 SUMMARY

The following report summarizes the final results of method validation analyses performed as part of fish analyses for the Potomac River Basin under contract to the Interstate Commission on the Potomac River Basin. These dat show that the methodology described in the document entitled "QA/QC PROJECT PLAN: Analysis of Fish from the Potomac River for Trace Metals and Trace Organic Contaminants" is appropriate for the acquisition of meaningful results from these samples.

2 METHOD SPIKES

A method spike is an analytical blank that is spiked with all target compounds. By analyzing a set of method spikes for each class of analytes, the method is validated and a measure of the method accuracy and precision is obtained. Recoveries from the method spikes are generally better than those expected from analysis of a real samples, due to the absence of a matrix. The exception to this is the more volatile compounds such as the phenolics which exhibit poor recoveries due to losses during sample concentration. A set of 4 method spikes was analyzed with the first set of data and one for the second set of data according to the method for each group of target organic analytes except volatiles. Note that the results presented below are not corrected for surrogate recovery.

2.1 Metals

Table IA and Table IB show the method spike results for metals and cyanide for the first and second set of analyses, respectively. Recoveries are, as expected for metals analysis, very good, ranging from 80% to 140% but with averages generally around 100-110% for most analytes. Silver and thallium recoveries are somewhat high, with averages of 130%. These metals are inherently more difficult to analyze, and therefore results from the analysis of silver and thallium should be interpreted with greater caution. The reproducibility of the analysis was also very good as indicated by the standard deviations reported, with exception of silver which had a somewhat higher standard deviation of 21%.

2.2 Volatile Organics

The method used for the analysis of volatile organics is that of purge and trap sampled GC/MS. As there is no clean-up or extraction prior to introduction to the purge and trap sampler, method spikes have little meaning and are indistinguishable from the calibration standard results. However, to demonstrate the precision in the purge and sampling technique, Table IIA and Table IIB shows the results of replicate injections of standard.

2.3 Semi-Volatile Organics

The method spike results for the semi-volatiles are shown in Table IIIA and Table IIIB. The recoveries of most compounds on the parameter list range from good to excellent and are highly reproducible. However, recoveries of some phenolic compounds, as well as N-nitrosodimethylamine and benzidine, were quite low, and in the case of N-nitrosodimethylamine, not detectable. These compounds are more volatile than typical semivolatiles and therefore easily lost during the concentration steps of sample preparation. Recoveries in actual samples can often be considerably better since the sample matrices often prevent losses of the volatile compounds. Poor recoveries of polar semivolatiles can also be accounted for in part by poor chromatography. This is frequently the case when polar compounds are analyzed without derivatization on a DB-5 capillary gas chromatography column, as is the case with the method used here. Should better recoveries and chromatography be required for N-nitrosodimethylamine, benzidine, 2,4-dinitrophenol and pentachlorophenol, a derivatization method is recommended. The overall results from this method suggest that modification is not necessary.

2.4 Organochlorine Pesticides

Table IVA and Table IVB displays the method spike results for the organochlorine pesticides, which demonstrate good recoveries ranging from 44 % to 130 %. The precision ranges from excellent (Methoxychlor and Endosulfan sulfate standard deviation 3 %) to fair (α-endosulfan standard deviation 23%).

2.5 Co-planer, Congener-specific, and Total PCBs

The results from the congener-specific analysis of method spikes for PCBs is shown in Table VA and Table VB. As indicated in the tables, average recoveries were generally very good, although sometimes higher than expected (38 % - 150 %), indicating that the spiking standard may have become concentrated. The precision indicated by the method spike data was excellent, with a standard deviation for total PCBs of only 4 %.

A second set of methods spikes were analyzed to demonstrate separation of PCB 77 from PCB 110, as there was insufficient PCB 77 in the other spike solution. In this set, the standard Aroclor mix was enhanced with a mix of co-planer PCBs, and chlorinated dioxins and furans were also spiked. Analysis of these method spikes for co-planer PCBs produced excellent results. As indicated in Table VI, separation of PCB 77 away from the bulk of the PCBs was successful, thus interference problems from PCB 110 is not anticipated. The results do indicate that small amount of PCB 81 (13%) and PCB 126 (7%) are also transferred to the carbon/glass fibre fraction and thus the contribution from both fractions for these compounds will have to be evaluated when analyzing the fish samples. Excellent precision is achieved using this clean-up procedure, and based on the method spike results, no analytical problems are anticipated.

2.6 Chlorinated Dioxins and Furans

Method spike data for the chlorinated dioxins and furans is given in Table VII and Table VIII. The method spikes were analyzed using high resolution GC/low resolution MS (HRGC/LRMS). As the method spikes were within the detectable range of LRMS it was not necessary to analyze them using HRMS. The recoveries of chlorinated dioxins and furans in the method spikes were excellent (46% to 100% for the first set, 63% to 160% for the second set) and the method precision was also very good (standard deviations of 3%-9% for the first set, 11% to 20% for the second set). A method spike for the second set of analyses will follow shortly.

Table IA Method Spike Results Percent Recovery of Metals

Target Metals	Method Spike 1	Method Spike 2	Method Spike 3	Method Spike 4	Average	Standard Deviation
As	100	100	100	100	100	0
Se	100	100	100	100	100	0
Sb	100	100	100	100	100	0
Hg	100	90	110	110	100	8.3
CN	90	100	100	100	100	4.3
Be	110	110	110	110	110	0
Cd	110	110	110	110	110	0
Cr	110	90	80	100	100	11
Pb	100	130	110	110	110	11
Ni	110	100	100	100	100	4.3
Ag	140	140	130	90	130	21
Tl	130	130	120	140	130	7.1

Table IB Method Spike Results Percent Recovery of Metals

Target Metals	Method Spike % Recovery
As	80
Se	110
Sb	100
Hg	100
Total CN	100
Be	110
Cd	100
Cr	110
Pb	110
Ni	110
Ag	100
Tl	100

Table IIA Method Spike Results Percent Recovery of VOCs

Target Volatiles	Method Spike 1 (%)	Method Spike 2 (%)	Method Spike 3 (%)	Method Spike 4 (%)	Average (%)	Deviation (%)	TABLE B Method Spike % Recovery
Chloromethane	120	96	91	90	99	12	210
Vinyl chloride	140	100	110	110	120	15	340
Bromomethane	44	92	84	110	83	24	160
Chloroethane	110	110	100	100	100	5	130
1,1-dichloroethene	96	93	94	94	94	1	98
Methylene chloride	96	94	93	94	94	1	100
Trans-1,2-dichloroethene	91	92	93	94	92	1	99
1,1-dichloroethane	100	97	98	96	98	1	99
Chloroform	95	92	94	94	94	1	99
1,1,1,-trichloroethane	150	86	86	87	100	28	100
Carbon tetrachloride	97	91	93	93	93	2	0
1,2-dichloroethane-d4	120	110	110	100	110	7	100
1,2-dichloroethane	110	100	100	100	100	4	99
Benzene	100	96	97	98	98	1	97
Trichloroethene	100	91	92	94	94	4	100
1,2-dichloropropane	110	98	99	98	100	5	99
Bromodichloromethane	100	96	97	99	98	2	97
2-chloroethyl vinyl ether	120	110	110	110	110	4	97
cis-1,3-dichloropropene	97	95	98	98	97	1	100
Toluene	97	91	91	97	94	3	100
trans-1,3-dichloropropene	100	98	100	100	100	1	99
1,1,2-trichlorethane	110	100	100	100	100	4	98
Tetrachlorethene	73	69	70	70	70	2	100
Dibromochloromethane	110	99	100	100	100	5	99
Chlorobenzene	99	95	96	95	96	2	110
Ethyl benzene	98	210	94	95	120	49	93
m,p-xylene	98	93	94	94	95	2	98
o-xylene	99	93	94	94	95	3	95
Styrene	100	93	95	95	96	2	230
Bromoform	110	110	110	110	110	0	95
1,1,2,2-tetrachloroethane	110	120	120	120	120	4	95
1,3-dichlorobenzene	110	92	92	94	97	8	94
1,2-dichlorobenzene	97	96	96	98	97	1	99
1,4-dichlorobenzene	95	100	100	100	99	2	94
Surrogate Recovery (%)							
Benzene-d6	100	99	98	98	99	1	100
Ethyl benzene-d10	100	96	96	95	97	2	
Fluorobenzene							100
D8-Toluene							99

Table IIIA Method Spike Results Percent Recovery of Semi-Volatiles

Target Semi-Volatiles	Method Spike 1	Method Spike 2	Method Spike 3	Method Spike 4	Average	Standard Deviation
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND
Phenol	23	30	30	23	27	3.6
bis(2-Chloroethyl)ether	46	49	55	48	50	3.3
2-Chlorophenol	35	45	42	38	40	3.8
1,3-Dichlorobenzene	31	43	39	39	38	4.3
1,4-Dichlorobenzene	31	45	44	40	40	5.7
1,2-Dichlorobenzene	31	44	45	39	40	5.4
bis(2-Chloroisopropyl)ether	32	38	40	35	36	3.1
N-Nitroso-Di-n-propylamine	50	51	58	51	52	3.1
Hexachloroethane	33	48	47	41	42	5.8
Nitrobenzene	38	54	49	47	47	5.9
Isophorone	46	58	59	56	55	5.4
2-Nitrophenol	49	59	56	55	55	3.5
2,4-Dimethylphenol	39	40	43	42	41	1.6
bis(2-Chloroethoxy)methane	48	53	54	52	52	2.5
2,4-Dichlorophenol	56	66	63	63	62	3.5
1,2,4-Trichlorobenzene	42	53	50	52	49	4.5
Naphthalene	46	53	52	52	51	2.9
Hexachlorobutadiene	33	33	47	30	35	6.5
4-Chloro-3-methylphenol	55	63	61	59	59	2.6
Hexachlorocyclopentadiene	34	41	43	36	38	4
2,4,6-Trichlorophenol	63	63	64	59	62	1.9
2-Chloronaphthalene	51	60	61	59	58	4.1
Dimethylphthalate	75	71	71	70	72	1.8
Acenaphthylene	63	61	59	64	62	1.7
2,6-Dinitrotoluene	60	61	69	67	64	3.7
Acenaphthene	61	63	61	62	62	0.77
2,4-Dinitrophenol	0.76	ND	1.1	2.1	0.98	0.75
4-Nitrophenol	46	67	55	33	50	13
2,4-Dinitrotoluene	61	64	68	69	66	3.1
Diethylphthalate	70	65	66	68	67	2
4-Chlorophenyl-phenylether	62	59	67	66	63	3.3
Fluorene	68	67	66	67	67	0.4
4,6-Dinitro-2-methylphenol	61	62	63	60	62	1.2
N-Nitrosodiphenylamine	78	78	75	75	76	1.6
4-Bromophenyl-phenylether	65	65	61	56	62	3.6
Hexachlorobenzene	67	72	68	70	69	2
Pentachlorophenol	7.7	ND	4.9	5.2	4.4	2.8
Phenanthrene	73	73	68	71	71	2
Anthracene	69	75	69	73	71	2.6
Di-n-butylphthalate	88	88	81	85	86	2.9
Fluoranthene	74	78	68	74	73	3.6
Benzidine	13	5.1	6.4	13	9.3	3.6
Pyrene	110	82	100	110	100	12
Butylbenzylphthalate	120	88	110	110	110	11
3,3'-Dichlorobenzidine	110	100	100	92	100	5.8
Benzo(a)anthracene	110	75	100	93	95	13
Chrysene	110	70	96	86	91	15
bis(2-Ethylhexyl)phthalate	83	55	79	76	73	11
Di-n-octylphthalate	61	36	40	36	43	11
Benzo(b)fluoranthene	110	68	70	64	79	20
Benzo(k)fluoranthene	87	72	93	73	81	9
Benzo(a)pyrene	71	61	60	61	63	4.5
Indeno(1,2,3-cd)pyrene	93	78	74	73	80	7.9
Dibenz(a,h)anthracene	89	74	67	75	76	7.8
Benzo(g,h,i)perylene	18	20	22	21	20	1.4
Surrogate Recovery (%)						
2-Fluorophenol	12	17	14	11	14	2.4
Phenol-d6	18	24	24	18	21	2.9
2,4,6-Tribromophenol	67	67	64	63	65	1.8
Nitrobenzene-d5	40	52	49	46	47	4.4
2-Fluorobiphenyl	55	59	58	57	57	1.6
Terphenyl-d14	90	70	89	72	80	9.4

Table IIIB Method Spike Results Percent Recovery of Semi-Volatiles

Target Semi-Volatiles	Method Spike % Recovery
2-Chlorophenol	28
Bis(2-chloroethyl)ether	24
Phenol	14
1,3-Dichlorobenzene	27
1,4-dichlorobenzene	27
1,2-dichlorobenzene	29
Bis(2-chloroisopropyl)ether	32
Hexachloroethane	30
N-Nitrosodi-n-propyl amine	34
Nitrobenzene	32
Isophorone	42
2-Nitrophenol	43
2,4-Dimethylphenol	25
Bis(2-chloroethoxy)methane	38
2,4-Dichlorophenol	44
1,2,4-Trichlorobenzene	38
Naphthalene	38
Hexachlorobutadiene	39
4-Chloro-3-methylphenol	46
Hexachlorocyclopentadiene	40
2,4,6-Trichlorophenol	53
2-Chloronaphthalene	45
Acenaphthylene	48
Dimethylphthalate	59
2,6-Dinitrotoluene	65
Acenaphthene	49
2,4-Dinitrophenol	290
2,4-Dinitrotoluene	67
4-Nitrophenol	22
Fluorene	57
4-chlorophenyl phenyl ether	59
Diethylphthalate	64
4,6-Dinitro-2-methylphenol	160
N-Nitrosodiphenylamine	52
4-bromophenyl phenyl ether	62
Hexachlorobenzene	64
Pentachlorophenol	110
Phenanthrene	66
Anthracene	67
Di-n-Butylphthalate	70
Fluoranthene	71
Pyrene	64
Benzidine	0.2
Butylbenzylphthalate	65
Benzo[a]anthracene	69
Chrysene	69
3,3'-Dichlorobenzidine	130
Bis(2-ethylhexyl)phthalate	63
Di-n-octylphthalate	62
Benzo[b]fluoranthene	65
Benzo[k]fluoranthene	67
Benzo[a]pyrene	66
Indeno(1,2,3-c,d)pyrene	73
Dibenzo[a,h]anthracene	67
Benzo[g,h,k]perylene	63
Surrogate Recovery (%)	
2-Fluorophenol	9.2
Phenol-d6	11
2,4,6-Tribromophenol	76
Nitrobenzene-d5	32
2-Fluorobiphenyl	46
Terphenyl-d14	71

*NOTE: ND= non detected

Table IVA Method Spike Results Percent Recovery of Pesticides

Target Pesticides	Method Spike 1 (%)	Method Spike 2 (%)	Method Spike 3 (%)	Method Spike 4 (%)	Average (%)	Standard Deviation (%)
a-BHC	57	34	36	49	44	9.5
b-BHC	110	75	96	95	93	11
g-BHC	100	64	71	79	79	15
d-BHC	94	65	74	75	77	11
Heptachlor	130	110	110	100	110	9.9
Aldrin	78	64	67	63	68	6
Heptachlor Epoxide	120	86	110	99	100	12
g-Chlordane	99	74	89	85	87	9
a-Endosulphan	71	69	100	120	92	23
a-Chlordane	120	87	110	100	100	10
Dieldrin	130	110	120	100	120	12
pp'-DDE	130	110	130	130	120	9
Endrin	86	89	85	94	89	3.5
b-Endosulphan	110	86	100	91	97	9.5
pp'-DDD	120	110	120	120	120	4.7
Endrin Aldehyde	60	71	82	86	75	10
Endosulfan Sulphate	130	130	130	120	130	3.2
pp'-DDT	130	110	110	110	110	8.6
Methoxychlor	100	95	100	100	100	3.3
Surrogate Recovery (%)						
Tetrachloro-m-xyle	49	44	45	42	45	2.5
PCB 209	110	96	120	110	110	7.6

Table IVB Method Spike Results Percent Recovery of Pesticides

Target Pesticides	Method Spike % Recovery
a-BHC	51
b-BHC	44
g-BHC	57
d-BHC	48
Heptachlor	75
Aldrin	120
Heptachlor Epoxide	97
a-Endosulphan	130
Dieldrin	80
pp'-DDE	69
Endrin	63
b-Endosulphan	110
pp'-DDD	64
Endrin Aldehyde	23
Endosulfan Sulfate	89
pp'-DDT	59
Methoxychlor	64
Surrogate Recovery (%)	
Tetrachloro-m-xylene	77
PCB 209	120

Table VA Method Spike Results Percent Recovery of PCBs

Lab ID: Target PCBs	Method Spike 1 (%)	Method Spike 2 (%)	Method Spike 3 (%)	Method Spike 4 (%)	Average (%)	Standard Deviation (%)
PCB 1	92	94	85	79	87	5.8
PCB 3	72	110	100	85	93	15
PCB 4,10	110	110	96	90	100	7
PCB 7	130	140	120	110	130	10
PCB 6	110	120	100	96	110	8.4
PCB 8,5	110	110	100	97	110	6.6
PCB 19	110	110	100	110	110	2.9
PCB 12,13	38	39	26	49	38	8.1
PCB 18	120	130	110	110	110	7.6
PCB 17	110	89	100	100	100	7.9
PCB 27	110	110	100	100	100	3.6
PCB 16,32	120	120	110	100	110	5.1
PCB 29	120	130	130	130	130	2.7
PCB 33	120	120	120	120	120	2.6
PCB 53	120	120	120	120	120	2.8
PCB 51	110	120	110	110	110	3.7
PCB 22	120	120	110	110	120	3.3
PCB 45	120	120	110	120	120	1.4
PCB 46	110	100	97	100	100	3.3
PCB 49	130	130	120	120	130	5.2
PCB 47,48	120	120	120	120	120	2.8
PCB 65 surrogate	98	97	95	99	97	1.4
PCB 44	120	120	110	120	120	2.7
PCB 42	100	110	99	110	100	3.7
PCB 37	130	140	120	130	130	7.7
PCB 41,71,64	120	120	120	120	120	2
PCB 40	130	130	120	130	120	2.3
PCB 63	130	130	120	120	120	5.8
PCB 74	130	130	130	130	130	1.4
PCB 70,76	140	140	130	140	140	2.1
PCB 66	120	130	120	130	120	2.3
PCB 95	120	120	130	130	120	5.3
PCB 91	130	130	130	140	130	5.1
PCB 92,84	110	110	110	120	110	4.3
PCB 101	120	130	130	130	130	3.2
PCB 99	110	120	120	120	120	3.9
PCB 119	130	96	150	140	130	20
PCB 83	140	140	130	130	140	6.6
PCB 97	130	130	120	130	130	4.1
PCB 87	120	120	110	140	120	8.4
PCB 85	120	130	130	140	130	5.2
PCB 136	130	130	140	140	130	3.7
PCB 110	120	120	120	130	120	5
PCB 82	110	130	120	97	110	11
PCB 151	110	120	110	98	110	6.8
PCB 135,144	100	110	100	89	100	8.3
PCB 149	110	120	110	93	110	10
PCB 146	140	150	160	120	140	13
PCB 153,132	110	120	110	95	110	7.3
PCB 141	110	120	110	92	110	9.1
PCB 176	130	140	140	120	130	6.6
PCB 178	120	130	120	110	120	7.4
PCB 166 surrogate	91	99	93	85	92	5.2
PCB 187,182	130	140	130	120	130	5.7
PCB 183	130	130	130	120	130	6
PCB 185	110	110	110	110	110	2.5
PCB 174	120	130	120	120	120	3.5
PCB 177	120	130	130	120	120	4.4

Table VA Method Spike Results Percent Recovery of PCBs

Lab ID:	Method Spike 1 (%)	Method Spike 2 (%)	Method Spike 3 (%)	Method Spike 4 (%)	Average (%)	Standard Deviation (%)
Target PCBs						
PCB 202	140	150	140	110	140	12
PCB 171	110	140	130	100	120	14
PCB 172	150	150	140	150	150	3.1
PCB 197	140	150	130	120	130	12
PCB 180	130	140	130	120	130	6.1
PCB 191	140	150	130	140	140	5.3
PCB 199	90	100	85	71	88	12
PCB 201	140	150	150	140	140	4.8
PCB 202,196	140	150	150	140	140	3.9
PCB 208	130	130	140	110	130	10
PCB 195	120	130	150	110	130	16
PCB 194	140	150	130	110	130	14
PCB 206	130	130	140	120	130	5
Total PCBs	120	120	120	110	120	4.3
Surrogate Recovery (%)						
PCB 31,28	120	120	110	110	120	4.5
PCB 52	120	120	120	120	120	2.4
PCB 56,60	120	130	120	130	120	1.9
PCB 118	100	120	100	81	100	13
PCB 163,138	110	120	110	96	110	9.3
PCB 170,190	110	120	120	120	120	3.2

Table VB Method Spike Results Percent Recovery of PCBs

Lab ID:

Target PCBs	Method Spike % Recovery
PCB 1	54
PCB 3	56
PCB 4,10	64
PCB 7	62
PCB 6	65
PCB 8,5	65
PCB 19	64
PCB 12,13	67
PCB 18	69
PCB 17	71
PCB 27	70
PCB 16,32	71
PCB 29	72
PCB 33	76
PCB 53	73
PCB 51	73
PCB 22	78
PCB 45	74
PCB 46	75
PCB 49	76
PCB 47,48	80
PCB 44	79
PCB 42	71
PCB 37	5.4
PCB 41,71,64	79
PCB 40	78
PCB 63	77
PCB 74	80
PCB 70,76	81
PCB 66	78
PCB 95	81
PCB 91	78
PCB 92,84	92
PCB 101	80
PCB 99	81
PCB 119	67
PCB 83	76
PCB 97	83
PCB 87	83
PCB 85	80
PCB 136	78
PCB 110	81
PCB 82	66
PCB 151	67
PCB 135,144	68
PCB 149	67
PCB 146	66
PCB 153,132	68
PCB 141	65
PCB 176	70
PCB 178	70
PCB 187,182	70
PCB 183	69
PCB 185	63
PCB 174	70
PCB 177	67

Table VB Method Spike Results Percent Recovery of PCBs

Lab ID:	Recovery (%)
Target PCBs	
PCB 202	67
PCB 171	66
PCB 172	61
PCB 197	68
PCB 180	69
PCB 191	63
PCB 199	68
PCB 201	70
PCB 203,196	71
PCB 208	66
PCB 195	68
PCB 194	75
PCB 206	66
Coplanar PCB Congeners	
PCB 28(31)	75
PCB 52	77
PCB 60(56)	81
PCB 118	69
PCB 138(163)	68
PCB 170(190)	69
Total PCBs	70
Surrogate Recovery (%)	
PCB 14	71
PCB 65	80
PCB 166	79

Table VIA Method Spike Results Percent Recovery of Coplanar PCBs

Alumina/Si−gel Fraction A Target PCBs	Method Spike 1 (%)	Method Spike 2 (%)	Method Spike 3 (%)	Method Spike 4 (%)	Average (%)	Standard Deviation (%)
PCB 28(31)	43	70	54	49	54	9.9
PCB 52	51	80	61	57	62	11
PCB 60(56)	53	80	63	58	64	10
PCB 81	38	57	46	41	46	7.3
PCB 77	14	17	16	18	16	1.6
PCB 123	71	98	88	71	82	12
PCB 118	110	120	110	110	110	5.3
PCB 114	74	110	96	83	92	15
PCB 105	77	110	100	90	95	13
PCB 138(163)	62	83	75	72	73	7.8
PCB 158	64	74	66	65	67	4.2
PCB 126	62	89	78	71	75	9.7
PCB 167	64	89	81	73	77	9.3
PCB 156	64	90	78	72	76	9.6
PCB 157	63	92	84	75	79	11
PCB 169	64	90	80	74	77	9.4
PCB 170(190)	55	65	60	54	58	4.5
Carbon/Glass Fibre Fraction A						
Target PCBs						
PCB 81	14	13	13	11	13	1.1
PCB 77	53	67	69	53	61	7.6
PCB 126	6	9	6	5	6.5	1.5
PCB 28(31)	ND	ND	ND	ND		
PCB 52	ND	ND	ND	ND		
PCB 60(56)	ND	ND	ND	ND		
PCB 123	ND	ND	ND	ND		
PCB 118	ND	ND	ND	ND		
PCB 114	ND	ND	ND	ND		
PCB 105	ND	ND	ND	ND		
PCB 138(163)	ND	ND	ND	ND		
PCB 158	ND	ND	ND	ND		
PCB 167	ND	ND	ND	ND		
PCB 156	ND	ND	ND	ND		
PCB 157	ND	ND	ND	ND		
PCB 169	ND	ND	ND	ND		
PCB 170(190)	ND	ND	ND	ND		

Table VII Method Spike Results Percent Recovery of PCDD/PCDFs

Target PCDD/F	Method Spike 1 (%)	Method Spike 2 (%)	Method Spike 3 (%)	Method Spike 4 (%)	Average (%)	Standard Deviation (%)
2378-T4CDF	100	110	100	130	110	11
2378-T4CDD	100	110	100	130	110	11
	0	0	0	0	0	0
12378-P5CDF	100	100	100	130	110	12
23478-P5CDF	91	93	96	120	100	12
12378-P5CDD	120	120	130	160	130	15
	0	0	0	0	0	0
123478-H6CDF	87	79	92	110	93	13
123678-H6CDF	110	100	120	150	120	18
123789-H6CDF	110	94	110	130	110	15
234678-H6CDF	91	84	98	120	99	15
123478-H6CDD	100	95	100	130	110	15
123678-H6CDD	110	100	120	140	120	17
123789-H6CDD	110	100	120	140	120	14
	0	0	0	0	0	0
1234678-H7CDF	98	93	110	130	110	13
1234789-H7CDF	67	63	68	93	73	12
1234678-H7CDD	88	81	100	130	100	19
	0	0	0	0	0	0
O8CDD	85	74	92	120	93	17
O8CDF	89	73	100	130	97	20
	0	0	0	0	0	0
Surrogate Recovery (%)	0	0	0	0	0	0
13C-2378-T4CDD	92	84	84	110	92	10
13C-12378-P5CDD	93	94	91	130	100	14
13C-123478-H6CDD	82	75	82	110	86	12
13C-1234678-H7CDD	84	77	87	120	91	15
13C-O8CDD	72	68	81	110	83	17

Table VIII Method Spike Results Percent Recovery of PCDD/PCDFs

Target PCDD/F	Method Spike 1 (%)	Method Spike 2 (%)	Method Spike 3 (%)	Method Spike 4 (%)	Average (%)	Standard Deviation (%)
2378-T4CDF	92	80	73	78	81	7
2378-T4CDD	93	82	74	77	82	7
	0	0	0	0	0	0
12378-P5CDF	92	81	73	70	79	9
23478-P5CDF	73	63	63	62	65	5
12378-P5CDD	100	92	84	83	90	8
	0	0	0	0	0	0
123478-H6CDF	78	72	62	63	69	7
123678-H6CDF	89	81	80	72	81	6
123789-H6CDF	85	77	75	70	77	6
234678-H6CDF	75	68	64	62	67	5
123478-H6CDD	90	82	83	76	82	5
123678-H6CDD	85	75	72	68	75	6
123789-H6CDD	92	85	77	71	81	8
	0	0	0	0	0	0
1234678-H7CDF	85	75	72	67	75	6
1234789-H7CDF	54	48	46	47	49	3
1234678-H7CDD	80	74	69	65	72	6
	0	0	0	0	0	0
O8CDD	81	70	70	66	72	6
O8CDF	72	61	66	59	65	5
	0	0	0	0	0	0
Surrogate Recovery (%)	0	0	0	0	0	0
13C-2378-T4CDD	75	67	66	64	68	4
13C-12378-P5CDD	82	72	68	76	75	5
13C-123478-H6CDD	66	61	59	54	60	4
13C-1234678-H7CDD	67	64	61	57	62	4
13C-O8CDD	65	56	54	54	57	5

3 STANDARD REFERENCE MATERIAL

Further method validation is accomplished by the analysis of a sample of standard reference material (SRM). The material chosen is "Standard Reference Material 1974", which is mussel (*Mytilus edulis*) tissue that has been certified by the United States National Institute of Standards and Technology (NIST) for certain polynuclear aromatic hydrocarbons (PAHs). The mussel tissue has also been analyzed for selected PCBs, organochlorine pesticides, metals and other PAHs. A copy of the Certificate of Analysis is supplied in Appendix 1. The following tables summarize the results and indicate a very high degree of accuracy and precision in the analysis of the SRM.

3.1 Semi-Volatile Organics

Only certain polynuclear aromatic hydrocarbons (PAHs) have been certified in the SRM, those being the nine compounds shown in the first section of Table IX. Of the nine certified compounds, only the two highest, fluoranthene and pyrene, were detected. Perylene is not included in the requested parameter list. The remaining compounds were present in the tissue below the detection limit for this method. The values determined by Eco Logic for the detected compounds were within the quoted range in the certified material.

Table IX also indicates other non-certified PAHs expected to be found in the mussel tissue sample. Note, however that most of these compounds, specifically the methylnaphthalenes and phenanthrenes, are not included in the parameter list for the Potomac River fish analysis project. Of the compounds that were on the parameter list fluorene, benzo[a]anthracene, chrysene, benzo[k]fluoranthene and dibenzo[a,h]anthracene were all below the method detection limit for PAHs in fish. As the detection limits were approximately as quoted in the QAPP for this project, these are acceptable results.

3.2 Organochlorine Pesticides

Although not certified by NIST, some organochlorine pesticides are analyzed and reported for the SRM. The results from the Eco Logic analysis of the SRM for organochlorine

pesticides are given in Table X. Four of the nine pesticides listed are not included on the Eco Logic parameter list, those being trans-nonachlor, 2,4'-DDE, 2,4'-DDD, and 2,4'-DDT. Dieldrin and 4,4'-DDT were below the detection limit for the organochlorine pesticide method used for this project. The remaining three pesticides, alpha-Chlordane, 4,4'-DDE, and 4,4'-DDD, exhibited excellent agreement between the results generated by Eco Logic and those by NIST.

3.3 Polychlorinated Biphenyls

Some polychlorinated biphenyl congeners (PCBs) are analyzed and reported for the SRM, although not certified by NIST. The results from the Eco Logic analysis of the SRM for PCBs are given in Table XI. Results generated for most of the 17 PCB congeners (with some co-eluting) are in excellent agreement with those reported in the Certificate of Analysis and no congeners were outside $\pm$ 50% of the value reported by NIST. PCB 128 is not included on the Eco Logic parameter list and was thus not analyzed.

3.4 Metals

Certain metals are analyzed and reported for the SRM, although not certified by NIST. The results from the analysis by Barringer Laboratories for trace metals in the SRM are compared to the NIST analysis in Table XII. Overall, the Barringer results compare very well with those generated by NIST. Only silver is reported by Barringer to be somewhat higher than that reported by NIST, although in the same order of magnitude. This is to be expected when near the method detection limit as was the case here. Formation of silver chloride in the sample may also lead to analytical difficulties. The SRM results demonstrate the methods' appropriateness for the analysis of the Potomac River fish.

An additional standard reference material, also an oyster tissue sample, was also analysed by Barringer Laboratories as part of their standard QA/QC protocol. The material analysed was National Bureau of Standards Standard Reference Material 1566. A copy of the Certificate of Analysis is presented in Appendix 2. The results from the analysis of this standard reference material are presented in Table XIII. The difficulties with silver were not encountered

with this material, due to its higher levels in the sample. The SRM results confirm the methods' appropriateness for the analysis of the Potomac River fish.

Table IX Standard Reference Material Semi-Volatile Organics

All results reported in ng/g Wet Weight

% Moisture in SRM: 91%
% Lipid in SRM: 0.66%

Target Semi–Volatiles	Eco Logic Result * Corrected	NIST Certified Concentration (std. deviation)	Method Detection Limit
Phenanthrene	<4	5.6 (1.4)	4
Anthracene	<4	0.75 (0.21)	4
Fluoranthene	32	33.6 (5.8)	2
Pyrene	32	34.1 (3.7)	2
Perylene	***	1.05 (0.29)	
Benzo(b)fluoranthene	<3	6.5 (1.2)	3
Benzo(a)pyrene	<5	2.29 (0.47)	5
Benzo(g,h,i)perylene	<4	2.47 (0.28)	4
Indeno(1,2,3–cd)pyrene	<6	1.80 (0.33)	6

Target Semi–Volatiles	Eco Logic Result (Corrected)*	NIST Non–certified Concentration (std deviation)	Method Detection Limit
2–Methylnaphthalene	***	2.1 (0.5)	
1–Methylnaphthalene	***	1.1 (0.2)	
Fluorene	<2	1.5 (0.2)	2
9–Methyl– and 4 methyl phenanthrene	***	2.7 (0.6)	
1–Methylphenanthrene	***	2.3 (0.6)	
2– and 9– ethylphenanthrenes and 3,6–Dimethylphenanthrene	***	4.2 (1.0)	
2,6–Dimethylphenanthrene	***	4.6 (0.9)	
2,7–Dimethylphenanthrene	***	4.3 (1.1)	
1,3–,2,10,3,9– and 3,10–Dimethylphenanthrenes	***	11 (2)	
1,6– and 2,9– Dimethyl– phenanthrenes	***	5.8 (1.4)	
1,7–Dimethylphenanthrene	***		
Benzo(a)anthracene	<4	4.6 (0.4)	4
Chrysene and Triphenylene	<4 (Chrysene)	15.3 (1.4)	4 (Chrysene)
Benzo(a)fluoranthene	***	0.51 (0.15)	
Benzo(k)+(j)fluoranthene	***	4.3 (0.7)	
Benzo(k)fluoranthene	<3	3.0 (0.1)	5
Benzo(e)pyrene	***	10 (1)	
Indeno(1,2,3–cd)fluoranthene	***	0.48 (0.07)	
Dibenz(a,h)anthracene	<6	0.35 (0.01)	6

* corrected for blank and recovery of surrogates
*** not on Eco Logic parameter list

Table X Standard Reference Material Organochlorine Pesticides

All results reported in ng/g Wet Weight

% Moisture in SRM: 91%
% Lipid in SRM: 0.66%

Target Pesticides	Eco Logic Result (Corrected)*	NIST Non-certified Concentration (std deviation)	Method Detection Limit
Alpha-Chlordane	3.4	3.2 (0.2)	0.7
Trans-Nonachlor	***	2.6 (0.6)	
Dieldrin	<1	1.0 (0.5)	1
2,4'-DDE	***	0.72 (0.07)	
4,4'-DDE	4.5	5.9 (0.2)	0.6
2,4'-DDD	***	2.5 (0.9)	
4,4'-DDD	4.9	8.4 (0.4)	1
2,4'-DDT	***	0.4 (0.2)	
4,4'-DDT	<0.8	0.3 (0.3)	0.8

* corrected for blank and recovery of surrogates
*** not on Eco Logic parameter list

Table XI Standard Reference Material PCBs

All results reported in ng/g Wet Weight

% Moisture in SRM: 91%
% Lipid in SRM: 0.66%

Target PCBs	Eco Logic Result Corrected	NIST Non-certified Concentration	Method Detection Limit
PCB 18	1.6	3 (1)	0.8
PCB 28	5.6	7.6 (0.4)	0.9
PCB 44	6.6	8 (3)	1
PCB 52	6.3	12 (5)	0.9
PCB 66	15	13.6 (0.6)	1
PCB 101,90	7.9	13 (1)	1
PCB 105	4	5.6 (0.4)	1
PCB 118	8.2	13.6 (0.6)	0.7
PCB 128	***	1.9 (0.3)	
PCB 138,163,164	16	14 (1)	2
PCB 153	24	18 (1)	3
PCB 180	1.3	1.7 (0.2)	1
PCB 187,182	6.3	3.7 (0.1)	2

* corrected for blank and recovery of surrogates
*** not on Eco Logic parameter list

Table XII NIST Standard Reference Material Trace Metals

All results reported in μg/g Wet Weight

% Moisture in SRM: 91%
% Lipid in SRM: 0.66%

Target Metals	Barringer Laboratories Result	NIST Non-certified Concentration (std deviation)	Method Detection Limit
Arsenic	1.43	1.2 (0.04)	0.10
Selenium	0.27	0.247 (0.007)	0.10
Antimony	< 0.20	0.00324 (0.00002)	0.20
Mercury	0.023	0.024 (0.0017)	0.005
Berylium	< 0.10	1.05 (0.29)	0.10
Cadmium	0.2	0.17 (0.05)	0.2
Chromium	<0.1	0.322 (0.026)	0.1
Lead	1.6	1.2 (0.07)	0.5
Nickel	0.1	0.124 (0.010)	0.1
Silver	0.38	0.105 (0.003)	0.10
Thallium	<0.10		0.10

** Other elements that were detected by NIST in the SRM that are not on the required parameter list are aluminum, scandium, vanadium, manganese, cobalt, iron, copper, zinc, arsenic, bromine, rubidium, strontium, molybdenum, cesium, lanthium, cerium, samarium, europium, hafnium, tantalum, gold, and thorium

Table XIII NBS Standard Reference Material Trace Metals

All results reported in μg/g Wet Weight

TARGET METALS	Barringer Laboratories Result	NBS Certified Concentration (std deviation)	Method Detection Limit
Arsenic	13.2	13.4 (1.9)	0.10
Selenium	1.78	2.1 (0.5)	0.10
Antimony	< 0.20		0.20
Mercury	0.051	0.057 (0.015)	0.005
Berylium	< 0.10		0.10
Cadmium	3.1	3.5 (0.4)	0.2
Chromium	0.5	0.69 (0.27)	0.1
Lead	0.5	0.48 (0.04)	0.5
Nickel	1	1.03 (0.19)	0.1
Silver	0.8	0.89 (0.09)	0.10
Thallium	<0.10		0.10

APPENDIX 1

copy of

National Institute of Standards & Technology

Certificate of Analysis

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 1974

Organics in Mussel Tissue (Mytilus edulis)

This Standard Reference Material (SRM) is intended primarily for use in validating analytical methods for the determination of selected polycyclic aromatic hydrocarbons (PAHs) in marine bivalve tissue or materials of similar matrix. Noncertified concentrations of additional PAHs, polychlorinated biphenyls (PCBs), chlorinated pesticides, and inorganic constituents are also provided. A unit of SRM 1974 consists of three bottles, each containing approximately 15-20 g (wet weight) of frozen tissue homogenate.

CERTIFIED CONCENTRATIONS

Certified concentrations of nine PAHs, which are naturally present in the mussel tissue, are provided in Table 1. These values are based on the results obtained from the analysis of this material using two different sample preparation procedures and two different analytical techniques (gas chromatography-mass spectrometry and reversed-phase liquid chromatography with fluorescence detection). A summary of the results obtained from the two independent analytical procedures is provided in Appendix A. Noncertified concentrations for additional PAHs, PCBs, and pesticides are provided in Appendices B, C, and D, respectively. Noncertified concentrations for trace inorganic constituents are provided in Appendix E.

Table 1. Certified Concentrations of PAHs in SRM 1974[a]

Compound	Concentration ng/g wet weight[b]	ng/g dry weight[a]
Phenanthrene	5.6 ± 1.4	45 ± 11
Anthracene	0.75 ± 0.21	6.1 ± 1.7
Fluoranthene	33.6 ± 5.8	272 ± 47
Pyrene	34.1 ± 3.7	276 ± 30
Perylene	1.05 ± 0.29	8.5 ± 2.4
Benzo[b]fluoranthene	6.5 ± 1.2	52.3 ± 9.4
Benzo[a]pyrene	2.29 ± 0.47	18.6 ± 3.8
Benzo[ghi]perylene	2.47 ± 0.28	20.0 ± 2.3
Indeno[1,2,3-cd]pyrene	1.80 ± 0.33	14.6 ± 2.7

[a] Certified values were determined on a wet weight basis; concentrations were converted to a dry weight basis for user convenience.

[b] The certified values are equally weighted means of results from two analytical techniques. The uncertainty is obtained from a 95% prediction interval plus an allowance for systematic error between the methods used. In the absence of systematic error, the resulting uncertainty limits will cover the concentration of approximately 95% of samples of this SRM having a minimum sample size of 15 g (wet weight).

Gaithersburg, MD 20899
July 2, 1991
(Revision of certificate dated 10-15-90)

William P. Reed, Chief
Standard Reference Materials Program

(over)

The collection, preparation, and certification of SRM 1974 were supported in part by the Ocean Assessments Division, National Oceanic and Atmospheric Administration (NOAA); Office of the Chief of Naval Operations, Department of the Navy; Minerals Management Service, Department of the Interior; and Environmental Monitoring Systems Laboratory (Las Vegas), Environmental Protection Agency. The mussels used for SRM 1974 were collected with the assistance of S. Freitas of Battelle New England Research Laboratory, Duxbury, MA.

PREPARATION AND ANALYSIS

Sample Collection. The mussels (*Mytilus edulis*) used for the preparation of SRM 1974 were collected on December 1, 1987 from Dorchester Bay within Boston Harbor, MA (Position 42°18.25'N, 71°02.31'W). Approximately 2400 individual mussels were collected by hand at low tide. The samples were transported to the Battelle New England Laboratory (Duxbury, MA) where the mussels were rinsed in a tank supplied with pumped sea water; rocks and other debris were removed. The samples were placed in insulated, Teflon-lined wooden containers, frozen and transported to NIST on dry ice. The samples were transferred to Teflon bags and stored in a liquid nitrogen vapor freezer (-120 °C) until they were shucked.

Sample Preparation. The mussel tissue was removed from the shell using the following procedure. The mussels were allowed to warm up to about 0 °C; the tissue was removed from the shell using a titanium knife and placed in Teflon bags (approximately 1 kg per bag) and immediately returned to a liquid nitrogen freezer. Approximately 28 kg of mussel tissue were prepared for use as the SRM. The frozen mussel tissue was pulverized in batches of approximately 150 g each using a cryogenic procedure described previously [1]. The total 28 kg of pulverized material was then combined in an aluminum mixing drum. The mixing drum was designed to fit inside the liquid nitrogen vapor freezer and to rotate in the freezer thereby mixing the frozen tissue powder. After mixing for 2 h, subsamples (15-20 g) of the mussel tissue homogenate were aliquoted into pre-cooled glass bottles. The bottles of SRM 1974 have been stored at -80 °C since preparation.

Conversion to Dry Weight Basis. The moisture content of the mussel homogenate was determined by measuring the weight loss after freeze drying. Twenty bottles of SRM 1974 were selected according to a stratified randomization scheme for the drying study. The entire contents of each bottle were transferred to a Teflon jar and dried for 5 days at 1 Pa with a -10 °C shelf temperature and a -50 °C condenser temperature. Based on these studies, a 95% prediction interval for the moisture content of a new bottle of SRM 1974 is 87.65 ± 0.17%. This interval will cover the moisture content of approximately 95% of all bottles. Analytical results for the organic constituents were determined on a wet weight basis and then converted to a dry weight basis by dividing by the conversion factor of 0.1235. Inorganic constituents were determined in SRM 1974 using freeze-dried material.

Polycyclic Aromatic Hydrocarbons. The SRM was analyzed for the determination of selected PAHs using gas chromatography with mass spectrometric detection (GC-MS) and reversed-phase liquid chromatography with fluorescence detection (LC-FL). A more detailed discussion of the analysis of SRM 1974 is reported elsewhere [2].

For the GC-MS analyses, a subsample of 13-26 g (wet weight) of the mussel homogenate from 12 randomly selected bottles was mixed with approximately 100 g of sodium sulfate, an internal standard solution (see below) was added to the sodium sulfate-tissue mixture, and then the mixture was Soxhlet extracted for 18 h using 300 mL of methylene chloride. The extract was concentrated, and gel-permeation chromatography on a semipreparative divinylbenzene-polystyrene column (10 μm particle size, 100 Å pore size) was used to remove the majority of the lipid and biogenic materials. The eluant was then passed through a silica solid phase extraction (SPE) cartridge as the final cleanup step prior to GC-MS analysis. GC-MS analyses were performed using a 0.25 mm x 60 m fused silica capillary column with a 5% phenyl substituted polysiloxane phase (DB-5) (0.25μm film thickness).

For the LC-FL analyses, a subsample of 14-18 g (wet weight) of the mussel homogenate from six randomly selected bottles was mixed with approximately 100 g of sodium sulfate, an internal standard solution (see below) was added to the sodium sulfate-tissue mixture, and then the mixture was Soxhlet extracted for 18 h using 250 mL of hexane:acetone (1:1 v/v). The extract was concentrated and then passed through an aminosilane SPE cartridge to remove the lipid and more polar interferences. The eluant from the SPE cartridge was concentrated and the SPE procedure repeated a second and third time. After the third SPE cleanup, the eluant was concentrated and injected onto a semipreparative aminosilane column to isolate the PAH fraction by normal-phase LC [3]. The isolated PAH fraction was then analyzed by reversed-phase LC using a polymeric octadecylsilane (C_{18}) column (4.6 mm i.d. x 25 cm, 5-μm particle size) with wavelength programmed fluorescence detection [4-6].

[4] W. E. May and S. A. Wise, Liquid Chromatographic Determination of Polycyclic Aromatic Hydrocarbons in Air Particulate Extracts, **Anal. Chem.** 56, 225-232 (1984).

[5] S. A. Wise, B. A. Benner, G. D. Byrd, S.N. Chesler, R. E. Rebbert, and M. M. Schantz, Determination of Polycyclic Aromatic Hydrocarbons in a Coal Tar Standard Reference Material, **Anal. Chem.** 60, 887-894 (1988).

[6] M. M. Schantz, B. A. Benner, Jr., S. N. Chesler, B. J. Koster, S. F. Stone, R. Zeisler, and S. A. Wise, Preparation and Analysis of a Marine Sediment Reference Material for the Determination of Trace Organic Constituents, **Fresenius J. Anal. Chem.**, in press.

[7] R. Zeisler, S. F. Stone, and R. W. Sanders, Sequential Determination of Biological and Pollutant Elements in Marine Bivalves, **Anal. Chem.** 60, 2760-2765 (1988).

[8] P. Ostapczuk, P. Valenta, and H. W. Nürnberg, Square Wave Voltammetry - A Rapid and Reliable Determination Method for Zn, Cd, Pb, Cu, Ni, and Co in Biological and Environmental Samples, **J. Electroanal. Chem.** 214, 51-64 (1986).

[9] P. Ostapczuk, M. Froning, and M. Stoeppler, Voltammetric Determination of Heavy Metals in Environmental Samples after HPA Digestion with Nitric Acid, **Fresenius Z. Anal. Chem.** 334, 661 (1989).

[10] K. May and M. Stoeppler, Complete Wet Digestion in Partly and Completely Closed Quartz Vessels for Subsequent Trace and Ultratrace Mercury Determinations, **Fresenius Z. Anal. Chem.** 317, 248-251 (1984).

[11] K. Ballschmiter and M. Zell, Analysis of Polychlorinated Biphenyls (PCB) by Glass Capillary Gas Chromatography - Composition of Technical Aroclor- and Clophen-PCB Mixtures, **Fresenius Z. Anal. Chem.** 302, 20-31 (1980).

SUPPLEMENTAL INFORMATION

Noncertified Quantitative Values

Appendices A through D contain supplemental analytical results obtained from the analysis of SRM 1974. Appendix A contains a comparison of the analytical results for the PAHs obtained using the two analytical techniques during the certification of SRM 1974. Noncertified concentration values are listed in Appendix B for additional PAHs, in Appendix C for 13 PCB congeners, in Appendix D for nine chlorinated pesticides, and in Appendix E for 34 inorganic constituents. The values reported are the results obtained by the measurement techniques indicated and may include unrecognized bias; therefore, they are provided for information only. The uncertainties given represent only the precision of the measurement processes. NIST does not recommend that this information be used for calibration, bias evaluation, or similar purposes for which certified values are used.

APPENDIX A

Summary of Analytical Results for the Determination of PAHs in SRM 1974

Compound	Concentration (ng/g dry weight)[a] LC/Fluorescence	GC-MS
Phenanthrene	44.6 ± 2.7	45.3 ± 7.3
Anthracene	5.97 ± 0.52	6.14 ± 0.72
Fluoranthene	289 ±10	255 ± 21
Pyrene	294 ±10	259 ± 12
Perylene	8.56 ± 0.35	8.5 ± 1.7
Benzo[b]fluoranthene	55.9 ± 2.2	48.7 ± 5.2
Benzo[a]pyrene	20.1 ± 2.3	17.1 ± 2.2
Benzo[ghi]perylene	19.6 ± 1.4	20.3 ± 2.3
Indeno[1,2,3-cd]pyrene	15.6 ± 1.4	13.6 ± 1.4

a Uncertainties are one standard deviation of a single measurement.

APPENDIX C

Summary of Analytical Results and Noncertified Concentrations for Selected PCB Congeners in SRM 1974

NOTE: Although bias has not been evaluated for the procedures used, these noncertified concentrations should be useful for comparison with results obtained using similar procedures.

Analytical Results by Method (ng/g dry wt)[a]

Polychlorinated Biphenyls[b]	GC-ECD (DB-5)[c]	GC-ECD (C-18)[c]	GC-MS (DB-5)[c]	Noncertified Values[d] ng/g dry wt	ng/g wet wt
PCB 18 (2,2',5-Trichlorobiphenyl)	22 ± 5	28 ± 4	23 ± 1	24 ± 9	3 ± 1
PCB 28 (2,4,4'-Trichlorobiphenyl)	61 ± 5	62 ± 5	159	62 ± 3[e]	7.6 ± 0.4
PCB 44 (2,2',3,5'-Tetrachlorobiphenyl)	62 ± 5	58 ± 5	76 ± 3	65 ± 23	8 ± 3
PCB 52 (2,2',5,5'-Tetrachlorobiphenyl)	85 ± 7	95 ± 8	115 ± 7	98 ± 39	12 ± 5
PCB 66 (2,3',4,4'-Tetrachlorobiphenyl)	133 ± 9[f]	107 ± 8	113 ± 4	110 ± 5[f]	13.6 ± 0.6
PCB 101 (2,2',4,5,5'-Pentachlorobiphenyl) 90 (2,2',3,4',5-Pentachlorobiphenyl)	132 ± 9	105 ± 9[g]	126 ± 6	105 ± 11[g]	13 ± 1
PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)	46 ± 3	45 ± 3	44 ± 3	45 ± 3	5.6 ± 0.4
PCB 118 (2,3',4,4',5-Pentachlorobiphenyl)	110 ± 10	107 ± 9	112 ± 6	110 ± 5	13.6 ± 0.6
PCB 128 (2,2',3,3',4,4'-Hexachlorobiphenyl)	15 ± 2	12 ± 2	18 ± 5	15 ± 2	1.9 ± 0.3
PCB 138 (2,2',3,4,4',5'-Hexachlorobiphenyl) 163 (2,3,3',4',5,6-Hexachlorobiphenyl) 164 (2,3,3',4',5',6-Hexachlorobiphenyl)	124 ± 10	118 ± 9	110 ± 9[h]	110 ± 11[h]	14 ± 1
PCB 153 (2,2',4,4',5,5'-Hexachlorobiphenyl)	147 ± 12	154 ± 16	135 ± 11	145 ± 8	18 ± 1
PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl)	13 ± 2	14 ± 2	13 ± 3	13 ± 1	1.7 ± 0.2
PCB 187 (2,2',3,4',5,5',6-Heptachlorobiphenyl) 182 (2,2',3',4,4',5,6'-Heptachlorobiphenyl)	30 ± 2	29 ± 3	31 ± 2	30 ± 1	3.7 ± 0.1

[a] Results reported in dry weight may be converted to wet weight by multiplying by 0.1235.

[b] PCBs are numbered according to reference 11; PCB congener listed first is the major component; additional PCB congeners listed may be present as minor components.

[c] Uncertainties are one standard deviation of a single measurement treating all measurements as statistically independent and identically distributed. Samples from five bottles were extracted; each extract was analyzed in triplicate for the GC-ECD analyses on both columns and each extract was analyzed once for the GC-MS analyses.

[d] Noncertified concentrations are means of the values from the three methods with uncertainties expressed as 95% confidence intervals.

[e] PCB 31 (2,4',5-Trichlorobiphenyl) coeluted with PCB 28 in the GC-MS analyses; these results were not included in the noncertified value.

[f] PCB 95 (2,2',3,5',6-Pentachlorobiphenyl) coeluted with PCB 66 in the GC-ECD analyses using the DB-5 column. The GC-ECD (DB-5) results were not included in the noncertified value for PCB 66.

[g] PCB 90 was separated from PCB 101 using the C-18 column; only the results from the C-18 column were used for the noncertified value for PCB 101.

[h] PCB 138 was separated from PCB 163 in the GC-MS results; only these results were used for the noncertified value.

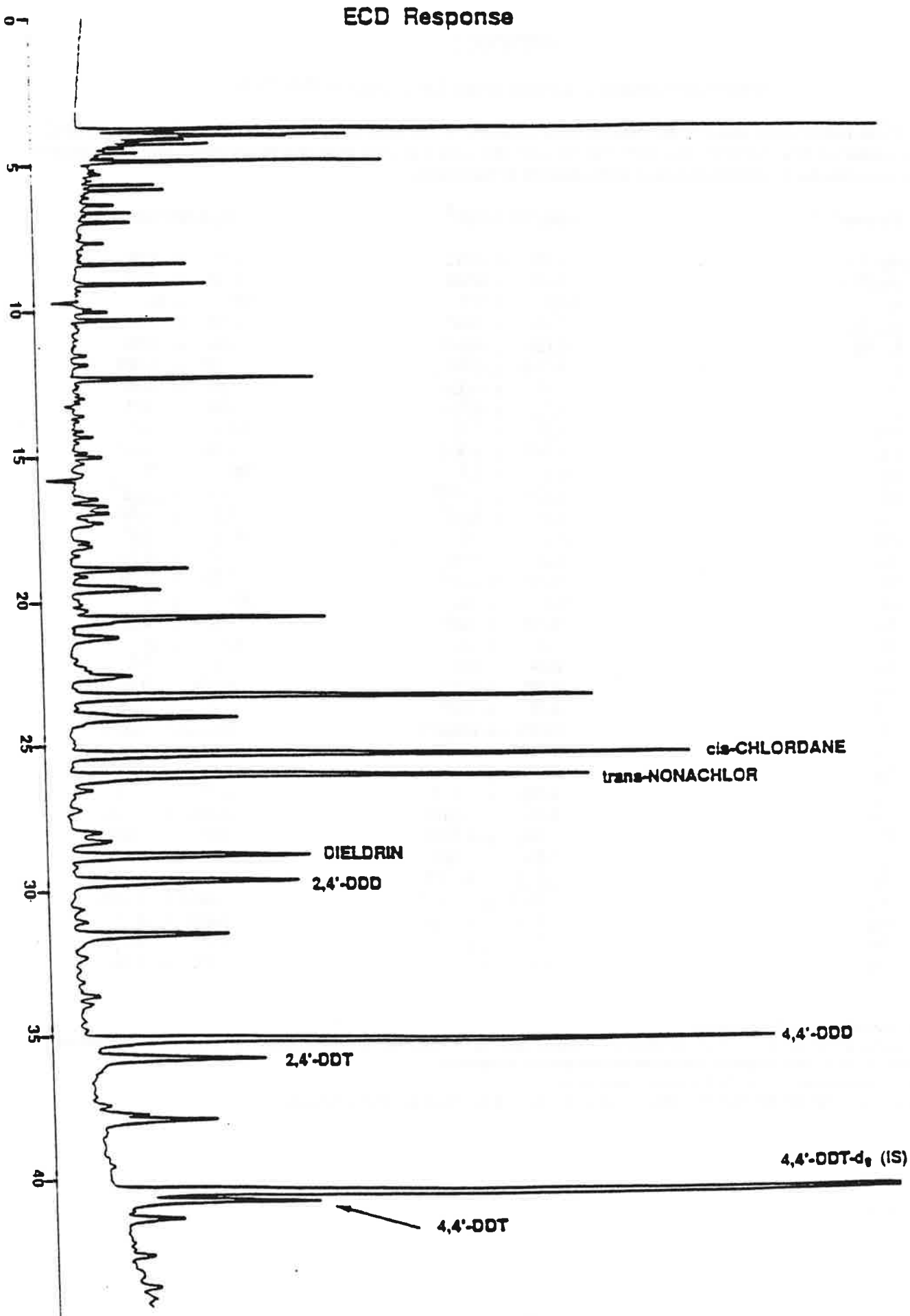


Figure 2 GC/ECD analysis on DB-5 column of the more polar chlorinated pesticide fraction isolated from SRM 1974.

APPENDIX E

Noncertified Concentrations of Inorganic Constituents in SRM 1974

NOTE: These noncertified values were obtained using procedures that have been used previously to provide certified values for similar SRM's. However, this SRM was not analyzed using a second analytical procedure; therefore, unrecognized bias may exist for the determination of some analytes in this matrix.

Element[a]	µg/g wet weight[b]	µg/g dry weight[b]
Na (%)	0.406 ± 0.011	3.29 ± 0.09
Mg (%)	0.059 ± 0.004	0.48 ± 0 .03
Al	62.1 ± 5.7	503 ± 46
Cl (%)	0.746 ± 0.021	6.04 ± 0.17
K (%)	0.136 ± 0.040	1.10 ± 0.33
Sc	0.0105 ± 0.0011	0.085 ± 0.009
V	0.191 ± 0.036	1.55 ± 0.29
Cr	0.322 ± 0.026	2.61 ± 0.21
Mn	1.26 ± 0.15	10.2 ± 1.2
Co	0.047 ± 0.001[c]	0.38 ± 0.01[c]
Fe	61.8 ± 3.3	500 ± 27
Ni	0.124 ± 0.010[d]	1.00 ± 0.08[d]
Cu	1.14 ± 0.24[d]	9.2 ± 1.9d
Zn	11.3 ± 0.5	91.6 ± 3.8[c]
As	1.20 ± 0.04	9.72 ± 0.35
Se	0.247 ± 0.007	2.00 ± 0.06
Br	46.1 ± 2.2	373 ± 18
Rb	0.700 ± 0.020	5.67 ± 0.16
Sr	7.4 ± 1.8	60 ± 14
Mo	0.24 ± 0.06	2.0 ± 0.5
Ag	0.105 ± 0.003	0.854 ± 0.021
Cd	0.17 ± 0.05[d]	1.4 ± 0.4d
Sb	0.00324 ± 0.00002	0.0262 ± 0.0002
Cs	0.0049 ± 0.0004	0.040 ± 0.003
La	0.043 ± 0.009	0.35 ± 0.08
Ce	0.065 ± 0.017	0.53 ± 0.13
Sm	0.0079 ± 0.0017	0.064 ± 0.014
Eu	0.0015 ± 0.0003	0.012 ± 0.002
Hf	0.006 ± 0.004	0.05 ± 0.03
Ta	0.0022 ± 0.0003	0.018 ± 0.003
Au	0.00589 ± 0.00013	0.0476 ± 0.0010
Hg	0.024 ± 0.0017	0.194 ± 0.014
Pb	1.20 ± 0.07[d]	9.7 ± 0.6[d]
Th	0.009 ± 0.002	0.07 ± 0.02

[a] Elements listed in order of atomic number.

[b] Uncertainties are one standard deviation of a single measurement assuming all measurements are statistically independent and identically distributed. For INAA results, samples from six bottles were analyzed in duplicate.

[c] Value is the combination of the INAA and voltammetry results.

[d] Value determined by voltammetry at KFA Jülich; three subsamples from one bottle analyzed in duplicate.

APPENDIX 2

copy of

National Bureau of Standards
Certificate of Analysis

U.S. Department of Commerce
James Baldwin Kreps
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Stand

Certificate of Analysis

Standard Reference Material

Oyster Tissue

This Standard Reference Material is intended primarily for use in calibrating ins methodology for the chemical analysis of marine animal tissue.

Certified Values of Constituent Elements: The certified values for the constituent e Certified values are based on results obtained by reference methods of known ac results obtained by two or more independent and reliable analytical methods. Nor information only in Table 2. All values are based on a minimum sample size of

NOTICE AND WARNINGS TO USERS

Expiration of Certification: This certification is invalid after 5 years from the date invalid before then, purchasers will be notified by NBS.

Storage: The material should be kept tightly closed in its original bottle and stor tures between 10-30 °C. It should not be exposed to intense sources of radiation, sunlight.

Use: A minimum sample weight of 250 mg of the *dried* material (see Instruction any certified value in Table 1 to be valid within the stated uncertainty. The bottle each use, and closed tightly immediately after use.

The statistical analysis of the data was performed by K. R. Eberhardt and H. H. ing Division.

The overall direction and coordination of the analytical chemistry measurement performed in the NBS Center for Analytical Chemistry by P. D. LaFleur.

The technical and support aspects involved in the preparation, certification, Reference Material were coordinated through the Office of Standard Referen

Washington, D.C. 20234
December 12, 1979

G
Office of

(over)

Table 1. Certified Values of Constituent Elements

Element[1]	Content[2], Wt. Percent
Calcium[b,d]	0.15 ± 0.02
Magnesium[a,d]	0.128 ± 0.009

Element[1]	Content[2], µg/g
Arsenic[a,f,g,h]	13.4 ± 1.9
Cadmium[a,d,e,f,h]	3.5 ± 0.4
Chromium[d,e,f]	0.69 ± 0.27
Copper[a,c,e,f]	63.0 ± 3.5
Iron[b,c,e,f]	195 ± 34
Lead[a,d,e,h]	0.48 ± 0.04
Manganese[a,c,f]	17.5 ± 1.2
Mercury[a,f]	0.057 ± 0.015

Element[1]	Content[2], Wt. Percent
Potassium[d]	0.969 ± 0.005
Sodium[b,f]	0.51 ± 0.03

Element[1]	Content[2], µg/g
Nickel[a,e,h]	1.03 ± 0.19
Rubidium[d,f]	4.45 ± 0.09
Selenium[a,e,f]	2.1 ± 0.5
Silver[a,f]	0.89 ± 0.09
Strontium[b,d]	10.36 ± 0.56
Uranium[d]	0.116 ± 0.006
Zinc[a,c,d,e,f,h]	852 ± 14

1. Analytical Methods:
   - [a] Atomic absorption spectroscopy
   - [b] Atomic emission spectroscopy, flame
   - [c] Atomic emission spectroscopy, inductively coupled plasma
   - [d] Isotope dilution mass spectrometry, thermal ionization
   - [e] Isotope dilution mass spectrometry, spark source
   - [f] Neutron activation
   - [g] Photon activation
   - [h] Polarography
2. Based on dry weight. (For drying instructions, see the section of this certificate on Instructions for Drying.) The estimated uncertainty is given as 95 percent tolerance limits for coverage of at least 95 percent of the measured values of all bottles of SRM 1566. For a given element, the following statement can be made at a confidence limit of 95 percent. "If the concentrations were measured for all bottles, at least 95 percent of these measured values should fall within the indicated limits." The concept of tolerance limits is discussed in Chapter 2, Experimental Statistics, NBS Handbook 91, 1966, and page 14, The Role of Standard Reference Materials in Measurement Systems, NBS Monograph 148, 1975.

Table 2. Non-certified Values of Constituent Elements

Element	Content[1] (Wt. Percent)
Chlorine	(1.0)
Sulfur	(0.76)
Phosphorous	(0.81)
	(µg/g)
Bromine	(55)
Cobalt	(0.4)
Fluorine	(5.2)
Iodine	(2.8)
Molybdenum	(≤0.2)
Thallium	(≤0.005)
Thorium	(0.1)
Vanadium	(2.8)

[1] Based on dry weight. (For drying instructions, see the section of this certificate on Instructions for Drying.)