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Monitoring Dioxin Levels in Maine Rivers with Semipermeable Membrane Devices

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MONITORING DIOXIN LEVELS IN MAINE RIVERS WITH SEMIPERMEABLE MEMBRANE DEVICES

By

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Thesis Advisor: Dr. Howard H. Patterson

An Abstract of the Thesis Presented
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The Maine Department of Environmental Protection (DEP) currently monitors river dioxin levels through the sampling and destructive analysis of fish. Recent state law mandates that by December 31, 2002, the dioxin concentrations in fish downstream of a bleached Kraft pulp and paper mill are not to exceed the concentrations in fish upstream of the mill (38 M.R.S.A. §420-A). The objective of this thesis project was to develop an alternate method for determining Kraft mill compliance to this Dioxin law. This new method that uses semipermeable membrane devices (SPMDs) circumvents many of the concerns generated by the upstream-downstream fish test. An important advantage is that the SPMDs sample current dioxin concentrations at fixed sites.

Over the course of two field seasons, we assessed the feasibility of using SPMDs to monitor dioxin concentrations in Maine rivers. The 1999 field season focused on developing viable field and laboratory SPMD methods. Field methods included design of the vertical deployment apparatus for the SPMDs and determination of which environmental conditions to monitor. In the laboratory, the final SPMD extraction and cleanup methods included extraction by dialysis of the entire SPMD into hexane followed

by two cleanup methods: acidified silica gel slurry to remove residual lipids and gel permeation chromatography to remove interference through size exclusion. The final laboratory analysis involved EPA Method 1613B and high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS).

For the 2000 field season we applied the developed methods to assess the effects of varying environmental conditions on SPMD sampling and to test two pairs of upstream-downstream sites: one on the Androscoggin River and one on the Kennebec River. A preliminary investigation of the effect of varying environmental conditions on SPMD dioxin concentrations was conducted. The positive temperature correlation and negative water velocity correlation with SPMD dioxin concentrations are significant and require further research. Investigations indicated that there was no statistical difference between upstream and downstream dioxin concentrations at both pairs of sites.

The effects of environmental conditions on SPMD dioxin concentrations need to be further studied with experimental designs that allow for additional statistical tests; otherwise, a permeability reference compound for dioxin should be identified to correct SPMD concentrations for varying environmental conditions at the sites during a deployment. Repeating the 2000 field season experimental design provides for comparisons to be made between years and all current hypotheses may be re-evaluated. This thesis identifies a potentially significant alternative to compare with the rest of the dioxin monitoring data gathered during the 2000 field season, the various sample types and species of fish as well as caged freshwater mussels. The Department of Environmental Protection's evaluation of all available data will bring the state of Maine closer to determining the most appropriate upstream-downstream test.

DEDICATION

In loving memory of my father, Michael T. Shoven (1945-1997).

The World of Possibilities

By Heather A. Shoven

Waves crashing onto the shore.
Leaves swept away by the wind.
A sense of change dominates the storm
With endless possibilities raging in my mind.

Luckily, a calm rests in my heart.
The reassurance of a father's love,
The promise that it will all be good.
This storm will leave a rainbow.

While this chapter in my life has concluded
I embrace a new beginning.
With my family and friends to guide me
I know that my learning will never end.

I dedicate this thesis to my family and friends who have supported and inspired me.

ACKNOWLEDGMENTS

I want to start by thanking my family because without their unending support and love this thesis would not have been possible. Thanks also to my friends for providing counsel, support, adventure, and fun!

Thanks to my advisory committee for their contributions to the project and for reviewing drafts of the thesis. My advisor, Howard Patterson, has been a wonderful source of support. I thank him for his counsel and for providing the opportunity to start this project. Thanks to Steve Kahl for providing political and practical counsel for the project and for making the Water Resources Option possible. Thanks to Touradj Solouki for SPMD and mass spectrometry information and advice. Although not an officially approved committee member, Therese Anderson has always been there when it came to practical logistics and laboratory methods; thanks for teaching me about the "Beast" and for answering my questions!

I would not have been able to accomplish the field work without the help of the following people: Richard Dill, Barry Mower, Sharon Sneed, Dan Kusnierz and the Penobscot Indian Nation, John Reynolds, Chuck Penney, and Rachel Keats. Special thanks to Richard Dill for his aid in field method development and for being responsible for my first Maine moose sighting!

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A special thanks to Terri Spencer and Environmental Sampling Technologies for all of their help with the SPMDs and the extraction method. The method development process was a long one and I appreciate the input from all of the scientists at the USGS Columbia Environmental Research Center in MO, especially Jim Huckins, Carl Orazio, Jon Lebo, Robert Gale, Paul Peterman, and Jimmie Petty. Also special thanks to Therese Anderson and Sharon Sneed for their help in laboratory method development. The statistical analyses in this project would not have been possible without the invaluable help of Rachel Keats and Professor Bill Halteman.

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1. INTRODUCTION

Maine's Dioxin Monitoring Program through the Department of Environmental Protection (DEP) is faced with the challenge of determining an appropriate upstream-downstream dioxin monitoring test as a result of the 1997 Dioxin Law. This law mandates that by December 31, 2002, the dioxin concentrations in fish downstream of a bleached Kraft pulp and paper mill are not to exceed dioxin concentrations in fish upstream of the mill (38 M.R.S.A. §420-A). This project investigates the feasibility of using semipermeable membrane devices (SPMDs) to perform this upstream-downstream test.

This introductory chapter begins with an examination of the problem tackled in this project. However, before dioxin-monitoring methods can be investigated, background information on dioxin must be compiled in order to understand what this pollutant is and why dioxin must be monitored. Therefore, a dioxin question and answer section in this chapter substantiates the significance of dioxin monitoring in the State of Maine.

This preliminary dioxin information provides a foundation for understanding the subsequent related research section, which discusses Maine's Dioxin Monitoring Program and the multiple approaches taken to develop an upstream-downstream test. With the alternatives presented, we probe the possibilities presented with the SPMDs by gaining an understanding of both their capabilities and their limitations. A comprehensive summary of previous SPMD experiments and how the devices compare to alternate pollutant monitoring methods completes the related research section of the introduction. Finally,

with the major project parameters discussed in the first three sections, we provide the research objectives and hypotheses in the fourth section and present the scientific and societal importance of this project in the final section.

1.1 The Problem

Polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), collectively termed as dioxin, are two classes of chemically similar and toxic compounds. Dioxin, specifically 2,3,7,8-tetrachlorodibenzo-*p*-dioxin, has been positively identified as both a human carcinogen and an endocrine disrupter (EPA 2000). A wide variety of both anthropogenic and natural processes lead to the inadvertent production of dioxin as a byproduct. These processes include incinerating of solid waste, chlorine bleaching of wood pulp, and burning of forest fires. In Maine, the various bleached Kraft pulp and paper mills are currently working with the Department of Environmental Protection to comply with the Dioxin law by December 31, 2002. This law states that the dioxin concentrations in fish downstream of a bleached Kraft pulp and paper mill are not to exceed the concentrations in fish upstream of the mill (38 M.R.S.A. §420-A). Therefore, a method is needed which can measure the compliance of mills with this mandate. The search for a sensitive, cost-effective, and accurate method of routinely monitoring dioxin levels in natural waters has begun in order to find the best test.

1.1.1. Current dioxin monitoring method

Water samples obtained from surface waters are difficult to use for determining dioxin concentrations because these compounds are typically present at concentrations below the established method detection limits. However, despite these low concentrations, dioxin may bioaccumulate in fish to levels where its toxicity becomes hazardous to consumers. Because of this process of bioaccumulation in the food chain, fish are currently used for analysis since dioxin accumulates in their lipids through respiration, dermal contact, and mostly ingestion of dioxin-containing food sources (Huckins *et al.* 1996). Although fish can be used to monitor many contaminants, there are concerns with this current method:

1. Fish are mobile and their populations are generally non-uniformly distributed.
2. Dioxin levels in fish vary with fish age. Older fish have higher levels of dioxin than younger fish.
3. Different species of fish bioaccumulate dioxin at different rates.
4. Due to bioaccumulation, fish provide historical dioxin concentrations rather than current dioxin concentrations.
5. Different species of fish metabolize and eliminate dioxin at different rates, thus introducing more potential for bias.
6. It can be difficult to produce a homogenous sample for extraction and analysis.
7. Inherent error is present. There is a need for the sampling of many fish in order to prove a statistical difference between upstream and downstream concentrations.

Therefore, in assessing the upstream-downstream legislation ramifications, it is essential to develop a method which:

- ✓ Is reliable in its sampling of a particular location.
- ✓ Involves exposure of the samples for both fixed deployment times and sampling rates that are uniform for both upstream and downstream testing sites.
- ✓ Has the sensitivity to detect small minimum significant differences in dioxin concentrations between sites.

1.1.2. Proposed upstream-downstream dioxin monitoring method

Semipermeable membrane devices (SPMDs) are exclusively manufactured in the United States by Environmental Sampling Technologies of St. Joseph, Missouri. SPMDs consist of a thin film of triolein, which is a large molecular weight, chemically neutral lipid, encased by a low-density polyethylene membrane. This configuration allows the devices to sequester trace organic contaminants from natural waters (Huckins *et al.* 1990). However, while SPMDs subvert many concerns associated with the sampling of fish, the devices are not perfect. Biofouling (which is exterior debris and periphyton that collect on the device over the sampling period), temperature, water velocity, and dissolved organic carbon (DOC) may effect SPMD uptake rates, thus presenting the need to assess these factors at each deployment site.

1.2 Dioxin: Questions and Answers

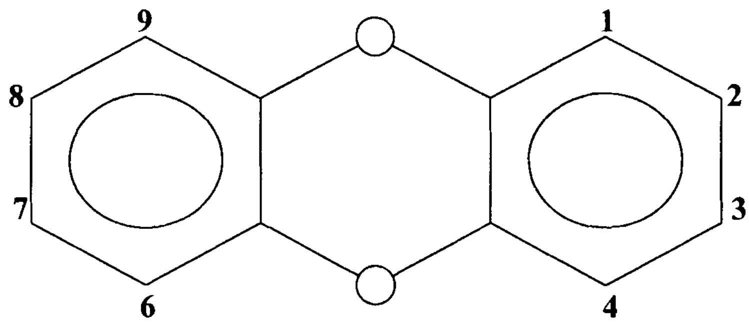
1.2.1. What is dioxin?

Dioxin is the collective term used for 75 polychlorinated dibenzo-*para*-dioxins and 135 polychlorinated dibenzofurans (PCDD/Fs) which are two classes of chemically similar compounds (Figure 1.1). The basic carbon backbone consists of two benzene rings joined by either two oxygen atoms (PCDDs) or one oxygen atom (PCDFs). The oxygen atoms in PCDD are arranged directly across from one another, adopting a *para* configuration. The numbers adjacent to each carbon in the benzene rings signify a potential site for chlorination. When one of the sites is chlorinated, a carbon-chlorine bond replaces a carbon-hydrogen bond.

PCDDs and PCDFs are two large classes of compounds; a *congener* is the general term used for each member of the PCDD and PCDF classes. Therefore, a congener has the same structural backbone (i.e. belongs to the same class such as PCDD or PCDF) but has a different number and/or positioning of chlorine atoms on the carbon backbone. There are a total of 75 PCDD and 135 PCDF congeners (EPA 2000). While the term congener generally dominates as the descriptor of dioxin, the term *isomer* is used when discussing groups of congeners. All isomers are congeners but not all congeners are isomers of one another. Structural isomers have the same molecular formula (same number of carbon, chlorine, and hydrogen atoms) yet vary in the positioning of the chlorine atoms (Carey 1996). There are eight sets each of PCDD and PCDF isomers since it is feasible to have one through eight chlorine atoms on the carbon backbones (mono- through octa- substituted dioxin). A *homologue* is the term used to represent a class of congeners, which consists of all of the isomers possible at one level of

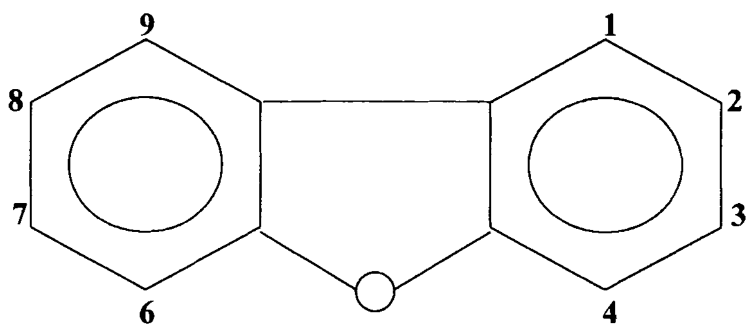
FIGURE 1.1. Seventeen Toxic Dioxin Congeners: Structures and Nomenclature

Polychlorinated Dibenzo-*p*-Dioxin (PCDD)



Toxic Congeners Studied	Abbreviation	Molecular Formula	CAS Registry
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2,3,7,8-TCDD	$C_{12}H_4O_2Cl_4$	1746-01-6
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1,2,3,7,8-PeCDD	$C_{12}H_3O_2Cl_5$	40321-76-4
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,4,7,8-HxCDD	$C_{12}H_2O_2Cl_6$	39227-28-6
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,6,7,8-HxCDD	$C_{12}H_2O_2Cl_6$	57653-85-7
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	1,2,3,7,8,9-HxCDD	$C_{12}H_2O_2Cl_6$	19408-74-3
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	1,2,3,4,6,7,8-HpCDD	$C_{12}HO_2Cl_7$	35822-46-9
Octachlorodibenzo-p-dioxin	OCDD	$C_{12}O_2Cl_8$	3268-87-9

Polychlorinated Dibenzofuran (PCDF)



Toxic Congeners Studied	Abbreviation	Molecular Formula	CAS Registry
2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-TCDF	$C_{12}H_4OCl_4$	51207-31-9
1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-PeCDF	$C_{12}H_3OCl_5$	57117-41-6
2,3,4,7,8-Pentachlorodibenzofuran	2,3,4,7,8-PeCDF	$C_{12}H_3OCl_5$	57117-31-4
1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF	$C_{12}H_2OCl_6$	70648-26-9
1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF	$C_{12}H_2OCl_6$	57117-44-9
2,3,4,6,7,8-Hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF	$C_{12}H_2OCl_6$	72918-21-9
1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-HxCDF	$C_{12}H_2OCl_6$	60851-34-5
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-HpCDF	$C_{12}HOCl_7$	67562-39-4
1,2,3,4,7,8,9-Heptachlorodibenzofuran	1,2,3,4,7,8,9-HpCDF	$C_{12}HOCl_7$	55673-89-7
Octachlorodibenzofuran	OCDF	$C_{12}OCl_8$	39001-02-0

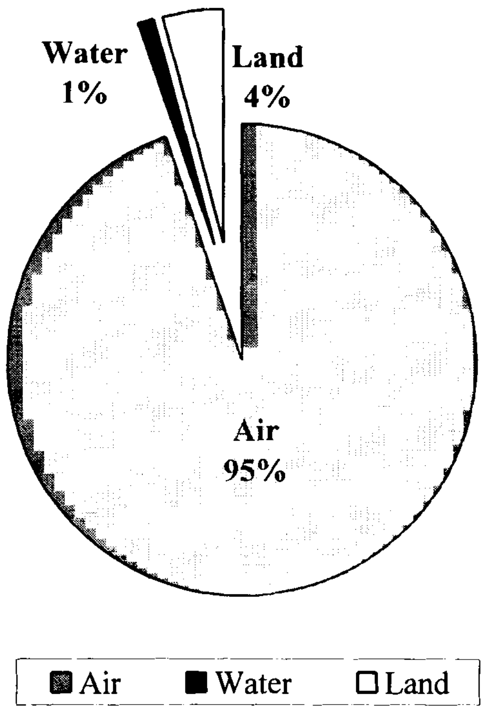
chlorination (Eitzer 1993). Therefore, all of the congeners that belong to the same homologue group are isomers of one another.

There are a total of seven toxic PCDD congeners and ten toxic PCDF congeners (EPA 1994; 2000; Van den Berg *et al.* 1998). All seventeen toxic congeners have chlorine atoms in the 2,3,7, and 8 positions (Fries 1995; EPA 2000), and are persistent in the environment.

1.2.2. What are the sources and fates of dioxin?

Widely publicized outbreaks of dioxin contamination and the resulting adverse health effects in places like Seveso, Italy in 1976 (Bertazzi *et al.* 1993), Love Canal, NY in 1979, and Times Beach, MO in 1983, have fueled the need to investigate the sources of dioxin so that emissions can be controlled and exposure reduced through government regulation (EPA 1994; 2000). The most current EPA Dioxin Reassessment draft lists five major sources of dioxin: 1. Combustion and incineration sources (both anthropogenic and natural combustion sources), 2. Metal smelting, refining, and processing, 3. Chemical manufacturing / processing (this would include the chlorine bleaching of pulp), 4. Reservoir sources including sediment, soil, and organic matter, and 5. Biological and photochemical processes (EPA 2000). This source listing illustrates the combination of anthropogenic and natural processes that lead to the unintentional existence of these toxic compounds in the environment. Human activity is believed to be the major source of dioxin (Thomas and Spiro 1996). Data from EPA's Quantitative Inventory of Environmental Releases of Dioxin in the United States was used to illustrate the distribution of dioxin releases among various media (EPA 2000).

FIGURE 1.2. % Dioxin Release Inventory for the United States, 1995. The bulk of dioxin is emitted to the air through incineration processes.



Most dioxin investigations have focused on combustion processes, with incineration being the primary source of PCDD/Fs (Czuczwa and Hites 1984, 1986; Fries 1995; Thomas and Spiro 1996; Baker and Hites 2000a,b). These processes provide ideal conditions for dioxin formation: ample organic material for forming the carbon backbone, chlorine-containing materials, and heat. Scientists have identified these sources through their investigation of what has proven to be the ultimate environmental sink of dioxin: sediments.

In the mid-1980's, Czuczwa and Hites (1984, 1986) conducted studies of Great Lake sediments and urban air particulates to examine the transport and fate of dioxin. Octachlorinated dibenzo-*p*-dioxin, OCDD, dominated the congener profiles in both sediments and urban air particulates. Furthermore, correlating the dating of sediment cores with trends in dioxin levels showed a major increase in dioxin levels in the 1940's and a decrease in dioxin levels since the 1970's. What do these landmark dates signify? The increase in the 1940's correlates with the production of chlorinated organic compounds such as chlorobenzenes and chlorophenols (Czuczwa and Hites 1984). The decrease in the 1970's correlates with the restrictions placed on particulate emissions from combustion processes due to the Clean Air Act Regulations of 1970 (Czuczwa and Hites 1986).

The congener profiles found in sediments varied from the flat congener profile of combustion samples in that sediments had less of the lower chlorinated congeners. Czuczwa and Hites (1986) attributed this finding to environmental degradation of the lower chlorinated congeners. These congeners have more carbon-hydrogen bonds than the higher chlorinated congeners thus rendering them more susceptible to atmospheric photolysis. While there are other environmental degradation pathways besides atmospheric photolysis, such as microbial degradation, Czuczwa and Hites (1986) suggested the atmospheric photolysis hypothesis because the same congener profiles were found in both sediment and urban air particulate samples. This finding minimized the likelihood that degradation was occurring in the water or sediments.

As the dioxin assessment has evolved in the United States and emissions have been reduced, scientists have been trying to balance the dioxin budget in order to identify

missing sources. Most investigations have found dioxin deposition to be greater than emissions (Baker and Hites 2000a; Baker and Hites 2000b; Wagrowski and Hites 2000). Combustion sources of OCDD and heptachlorinated dibenzo-*p*-dioxin (HpCDD) are not declining like the other congeners (Baker and Hites 2000a). Therefore, as dioxin mass balance investigations continue, insights into possible missing dioxin sources have been provided. For instance, laboratory tests have confirmed the creation of OCDD and HpCDD from pentachlorophenol (PCP), a wood preservative, by a photochemical reaction in condensed air (Baker and Hites 2000a). There are also natural sources of dioxin. For example, forest fires have been proposed as one of the major natural combustion sources of dioxin (Thomas and Spiro 1996). Furthermore, a study by Ferrario, Byrne, and Cleverly (2000) unearthed evidence of naturally occurring dioxin in mined clay products. Ball clay mined from prehistoric deposits in northwestern Mississippi was mixed in poultry feed as an anti-caking agent. The PCDD/Fs contained in the clay were ingested by the poultry. As a result, dioxin was detected in the poultry itself. The congener profile generated from the ball clay was different from all of the profiles of known dioxin sources; therefore, no anthropogenic source could be attributed to the presence of the PCDD/Fs, thus rendering the clay the probable natural dioxin source (Ferrario *et al.* 2000).

Transport of dioxin with air particulates and the deposition onto the oceans and lakes of the world remains the prevalent fate of dioxin produced from various sources. The low water solubility of dioxin directs its eventual burial in sediments. However, aerial transport leads to deposition of dioxin not only on water but also on land. Dioxin deposition on land occurs under the following scenarios: 1. Dioxin is deposited on plants

which are then consumed by animals thus entering dioxin into the food chain, 2. Dioxin is deposited on the soil where it is taken up by plants that are then eaten by animals, or 3. Dioxin is deposited on the soil and the dioxin-contaminated soil is eaten directly by the animals, transported by erosion, or removed through photodegradation, volatilization or biodegradation processes (Fries 1995).

This current investigation of dioxin in Maine has been generated by a widely investigated fate of dioxin: its introduction into the food chain. The persistence of these compounds due to their lipophilic nature allows them to be transferred from organism-to-organism up the trophic levels (Larsson *et al.* 2000). The eventual increase in dioxin concentrations, as dioxin is biomagnified in the food chain, results in fish consumption advisories issued by the Maine Bureau of Health and consequently violates Maine's water quality standards, specifically, the designated use of fishing.

1.2.3. Why is there a concern about dioxin levels in surface waters?

The concern about dioxin levels in surface waters stems from the various physical, biological, and chemical properties of dioxin that make it a threat to ecosystem health. The persistence, bioaccumulation, and low water solubility of dioxin make it difficult for organisms to metabolize these compounds. The persistence of dioxin is reflected in its estimated half-life of ten years to twelve years in both the environment and humans (Birnbaum and DeVito 1995). Moreover, due to dioxin's bioaccumulation characteristics, it affects the entire food because the predator inherits the dioxin present in the lipids of its prey. Thus 95% of human exposure to dioxin is through the consumption of animal products including meat, dairy products, and fish (Fries 1995; EPA 2000).

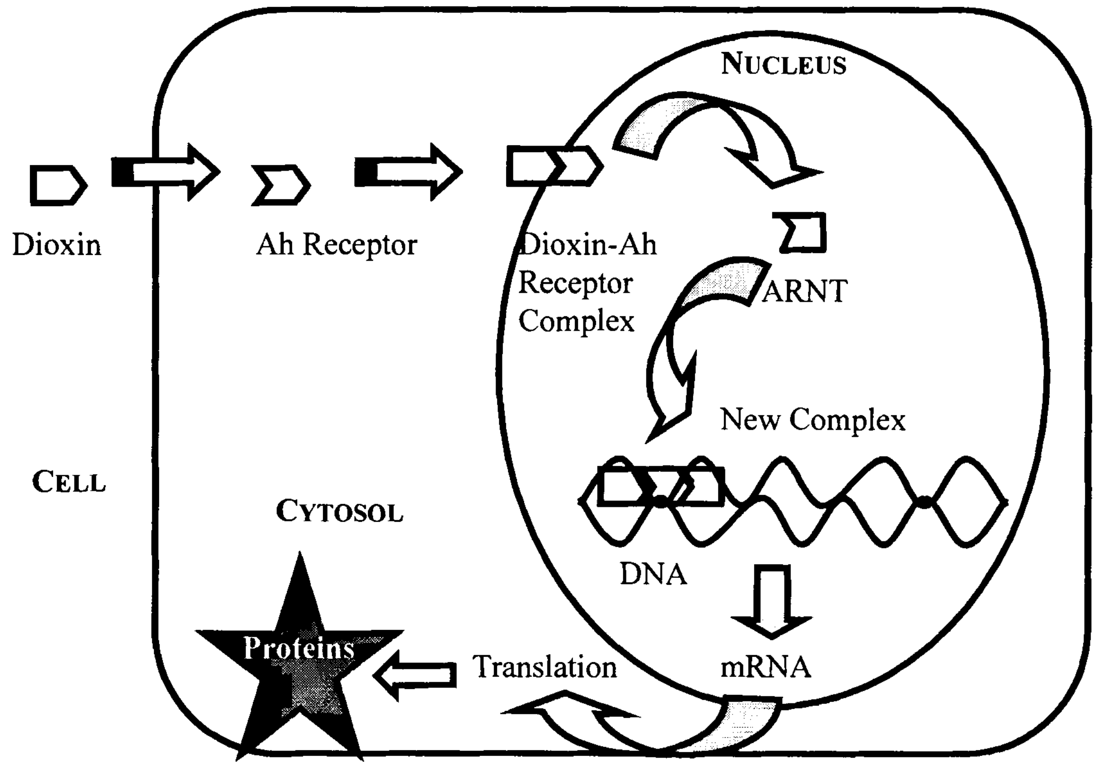
Exposure to dioxin is believed to cause adverse health effects for a variety of organisms. Chloracne, a visible skin condition, develops after exposure to high levels of dioxin and disappears when exposure ends (EPA 1994; 2000). However, not all of the adverse health effects are as visible as chloracne. 2,3,7,8-TCDD has been identified as a human carcinogen and sixteen other toxic congeners are considered likely human carcinogens (EPA 2000). In addition, dioxin in laboratory animals has been found to produce carcinogenic, immunotoxic and reproductive effects (Fries 1995; Van den Berg *et al.* 1998; Maczka *et al.* 2000).

Recently 2,3,7,8-TCDD was positively identified as an endocrine disrupter, or a hormonally active agent (Maczka *et al.* 2000). This identification raises concern because endocrine disruption carries with it many adverse health effects. First, endocrine disrupters are maternally transferred to fetuses in the womb and through breast feeding (Colborn *et al.* 1993). Hormonally active agents not only may generate reproductive and developmental effects but also may foster immune suppression and increased risk of hormone-related cancers (Maczka *et al.* 2000). Genetic dysfunction stems from the dioxin structure resembling that of a hormone (Van den Berg *et al.* 1998).

In its dioxin reassessment, the EPA describes the cascade of biochemical events triggered by dioxin, which is depicted in Figure 1.3. Dioxin diffuses into the cell and binds to the Ah (aryl hydrocarbon) receptor, a cytosolic protein. The complex is then translocated into the cell nucleus where it is joined by the nuclear protein ARNT (Ah receptor nuclear translocator). This complex acts as a transcriptional activator thus binding to DNA and signaling the beginning of messenger RNA synthesis. The mRNA is then translocated back to the cytosol where it is translated by the ribosomes to make

proteins. Depending on the genes activated, these proteins can be players in a variety of cellular events such as cell proliferation (EPA 1994; 2000).

FIGURE 1.3. Schematic of the Mechanism of Dioxin Action (UC-Davis)



1.2.4. How is risk to dioxin exposure assessed?

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) is the most toxic of the dioxin congeners and is used as the reference compound for potency comparisons (Birnbaum and DeVito 1995). Using this reference toxicity, the EPA has established a conventional hierarchy of toxicity with each dioxin congener, as well as other toxic species such as polychlorinated biphenyls, being assigned a toxic equivalency factor (TEF). The TEF represents "an order of magnitude estimate of the toxicity of a compound relative to

TCDD" (Van den Berg *et al.* 1998, p.776). With each of the seventeen toxic dioxin congeners being assigned a TEF by the World Health Organization (WHO) (Table 1.1), the risk assessment of a given environmental sample is provided by summing all of the congener concentrations multiplied by their respective TEF values. This summation of products is termed the toxic equivalency (TEQ) of the mixture. The TEQ value obtained for complex environmental sample mixtures is used to estimate environmental risk assessment (Birnbaum and DeVito 1995). It is important to note that the TEF values and the TEQ system are based on the observed Ah receptor-mediated responses (Van den Berg *et al.* 1998).

TABLE 1.1. WHO TEF Mammal Values for the Seventeen Toxic Dioxin Congeners

PCDD Congener	WHO TEF	PCDF Congener	WHO TEF
2,3,7,8-TCDD	1.0	2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDD	1.0	1,2,3,7,8-PeCDF	0.05
1,2,3,4,7,8-HxCDD	0.1	2,3,4,7,8-PeCDF	0.5
1,2,3,6,7,8-HxCDD	0.1	1,2,3,4,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDD	0.1	1,2,3,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDD	0.01	2,3,4,6,7,8-HxCDF	0.1
OCDD	0.0001	1,2,3,7,8,9-HxCDF	0.1
		1,2,3,4,6,7,8-HpCDF	0.01
		1,2,3,4,7,8,9-HpCDF	0.01
		OCDF	0.0001

1.2.5. How is dioxin analyzed?

1.2.5.1. Laboratory cleanup methods

Due to the low levels of dioxin in environmental samples, dioxin analysis starts with extraction and cleanup procedures outlined in EPA Method 1613B: Tetra-Through-

Octa-chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS (Telliard 1994). To ensure that sample contamination does not occur, dioxin extraction and cleanup procedures are carried out in a regulation M3.5, Class 100, clean room environment with Tyvek frocks, safety glasses, and gloves required (nitrile and viton) as personal protective equipment. Since the procedures used in this project will be discussed in further detail in chapter two, only a brief overview will be presented.

The first step when working with an environmental sample is the addition of surrogates in order to monitor recovery. Dioxin extraction and cleanup procedures involve many analytical transfers so it is necessary to determine the amount of sample lost throughout the entire procedure. By adding a known amount of $^{13}C_{12}$ -labeled analogs of the seventeen toxic dioxin congeners under investigation, one can correct the quantified amounts of native, unlabeled dioxin for possible losses during the extraction and cleanup processes. This cocktail of surrogates is purchased commercially from Cambridge Isotope Laboratories (CIL) of Andover, Massachussetts. After the appropriate surrogates are added, the dioxin is extracted from the sample matrix. Extraction is achieved through dialysis for the SPMDs and through hot solvent extraction for other sample matrices.

Extraction procedures remove more than just dioxin from the sample matrices; therefore cleanup steps must be followed to remove potential interferences prior to analysis. A cleanup standard of an alternate dioxin congener is added at this stage to enable quantification of the amount of sample lost during the cleanup procedures. The congener chosen as a cleanup standard for the method is $^{37}Cl_4$-2,3,7,8-TCDD (all four chlorine atoms are ^{37}Cl substituted) and this standard is also purchased from CIL.

Reactive steps such as acidified silica gel slurry are helpful in hydrolyzing and removing the lipids present in many of the samples. Finally, size exclusion procedures, like gel permeation chromatography, help remove non-reactive, interfering constituents of the samples.

1.2.5.2. Final analysis by HRGC / HRMS

As dioxin analysis has evolved, detection limits have been lowered using high-resolution gas chromatography / high-resolution mass spectrometry (HRGC/HRMS). These lower detection limits are vital due to the decreasing environmental levels of dioxin over the past decades linked to regulatory measures and awareness. The standard operating procedures for the HRGC/HRMS used in dioxin analyses are provided in EPA Method 1613B (Telliard 1994).

The fundamental principle behind a mass spectrometer is the creation of parent and fragment ions from sample analytes and the subsequent identification of these compounds through positive classification of the parent and fragment ions. The fragments are identified through their signature mass-to-charge ratios.

What is the mass-to-charge ratio? In mass spectrometry, the basic mass unit used in describing the various isotopes is called the atomic mass unit (amu), also termed the dalton. With high-resolution mass spectrometers, we look to the exact mass of the elemental isotopes, m (Skoog and Leary 1992). Identification involves looking at the mass-to-charge ratio of the ion fragments which "is obtained by dividing the molecular mass of an ion m (in amu) by the number of charges z that the ion bears" (Skoog and

Leary 1992, p. 422). It is important to note that most of the ions observed have a charge of one so that mass is the determining variable.

With mass vocabulary established, what defines high-resolution? Resolution, R, refers to the mass spectrometer's ability to differentiate between the ions (Skoog and Leary 1992):

$$R = \bar{m} / |m_1 - m_2| \tag{1.1}$$

where:

R = resolution

$\bar{m}$ = mean mass of two adjacent peaks

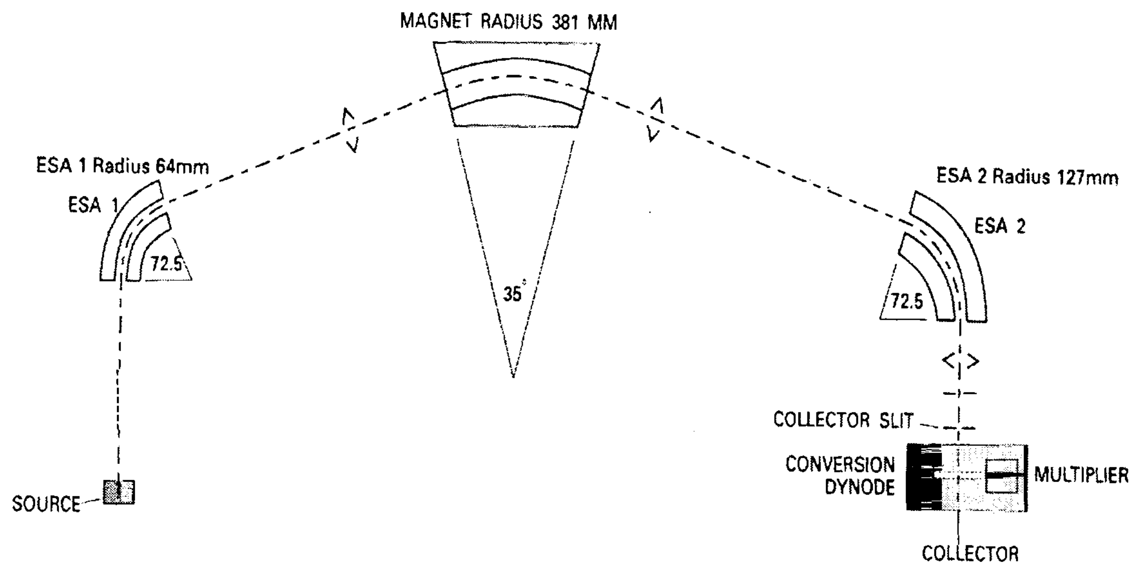
$|m_1 - m_2|$ = mass difference between the two peaks

The mass-resolution power of the MS for this project is approximately 10,000. Therefore, the instrument can resolve peaks at *m/z* values of 300.00 and 300.03 (Skoog and Leary 1992). Since the ions for not only the dioxin congeners but also interfering analytes are all over 300 *m/z*, a high-resolution MS is needed to distinguish between *m/z* values of various ions to the hundredths place.

How does the instrument work? The gas chromatograph (GC) component of HRGC/HRMS has the task of separating the mixture in the environmental sample into individual components. The GC is composed of a DB-5, fused silica, open-tubular capillary column. Compounds migrate through the sixty-meter column at different rates depending on size and structure. Thus for dioxin, the congeners elute from smallest (tetra-substituted) to largest (octa-substituted). This separation is vital before mass spectrometry because the MS is incapable of dealing with complex mixtures present in an environmental sample (Bierbaum *et al.* 1995).

One end of the GC capillary column is introduced into the ion source of the mass spectrometer. In our current study, we use a Micromass Autospec-UltimaE Mass Spectrometer, Manchester, U.K.. This instrument uses electron impact ionization in the source and has double-focusing electric and magnetic sector analyzers (Figure 1.4). The system is under ultra-high vacuum (analyzer pressure approximately 6 x 10E-6 mbar).

FIGURE 1.4. Autospec Geometry (Micromass). Schematic of the major MS components.



Once the compounds elute from the GC capillary column into the MS, they are introduced directly into the source. In the source, a potential between a heated tungsten filament and an electrode is maintained and a constant electron beam of approximately 29 eV is emitted. The GC column terminates at the center of the source. This configuration leads to collision of the compounds with the electron beam. The collision triggers ionization and since the electron beam removes electrons from compounds by electrostatic repulsion, positive molecular ion fragments ($M^{\cdot +}$) are produced (Skoog and

Leary 1992). A potential difference within the source forces positively charged ions out through the source slit and into the instrument flight tube where the ions are sorted by both electric and magnetic fields according to the mass-to-charge ratios of the ions (Bierbaum *et al.* 1995).

The Autospec is configured with two electrostatic analyzers (ESAs) and a magnetic sector analyzer. Differential voltages are applied to each ESA and the resulting potential defines a range of kinetic energies for ions of the same *m/z* value that can be filtered and focused onto the magnetic sector analyzer, in the case of ESA 1, and onto the collector slit, in the case of ESA 2 (Skoog and Leary 1992). The analyst, who sets these potential differences when specifying *m/z* ratios for single ion monitoring, controls this filtering process. The reference compound perfluorokerosene (PFK) is used in EPA's dioxin method; PFK is fragmented into ion fragments that cover the full range of ion fragment sizes of the dioxin congeners. Therefore, the analyzer always identifies the PFK fragments as lock masses and can use the location of these fragments to "find" the dioxin ions targeted and direct these desired ions to the collector (Telliard 1994; T. Anderson. personal communication).

With the magnetic field established by the ions selected for monitoring (PFK lock masses as well as targeted dioxin ions), the magnetic sector analyzer bends the path of the charged particles into different radii. The length of the bending radius is related to the *m/z* value of the ion. Only those ions with the desired *m/z* values will be directed by the magnetic sector to the second ESA (Bierbaum *et al.* 1995). This electrostatic analyzer focuses the beam of selected ions onto the collector slit where the signals are continuously collected and detected to generate a mass spectrum. Therefore, one can

detect a range of *m/z* values through manipulating magnetic field strength and changing the course of the ion trajectories (Bierbaum *et al.* 1995). The fate of the ions that do not have the desired *m/z* ratios is collision into the flight tube. Therefore, periodic baking of the flight tube is needed to purge instrument of these ions (T. Anderson, personal communication).

The general specifications of the HRGC / HRMS used in this project are given in Tables 1.2 and 1.3.

TABLE 1.2. HRMS Specifications

Mass Spectrometry Conditions		Commercial Source of Product	
Type	Autospec UltimaE sector instrument with EBE geometry	Micromass	Manchester, U.K.
Resolution	10,000		
Mode	Selective ion monitoring (SIM)		
Source type	Electron ionization under positive conditions		
Ion source temperature	260°C		
Electron impact ionization energy	29 eV		
Filament trap current	400 μA		
Ion acceleration voltage	8000 eV		
Source vacuum pressure	6×10^{-6} mbar		
Analyzer vacuum pressure	1×10^{-7} mbar		
Detector	350		
Tuning compound	Perfluorokerosene = PFK		

TABLE 1.3. HRGC Specifications

Gas Chromatography Conditions		Commercial Source of Product	
Type	CarloErba 8000	Micromass	Manchester, U.K.
Autosampler	CTC 200S	Micromass	Manchester, U.K.
Injection Volume	2 µL of 10µl sample + 0.5 µL of air		
Injection mode	Splitless with injector purge valve activated 2 minutes after sample injection		
Injector port temperature	290°C		
Column type	DB-5 fused silica open tubular capillary column	J&W Scientific	Folsom, CA
Column Specifications	60-m long with 0.32 mm inner diameter and 0.25 µm film thickness of bonded-phase fused-silica		
Carrier gas	UHP He at constant 30 PSI head pressure		
Direct GC/MS interface temperature	290°C	Micromass	Manchester, U.K.
GC Temperature Program	**Temperature**	**Time**	
	150°C	Initial, 1 minute after injection	
	2°C / minute increase ramp to 200°C		
	200°C	25 minutes	
	6°C / minute increase ramp to 300°C		
	300°C	4 minutes	

1.3 Related Research

1.3.1. The Maine Dioxin Monitoring Program

1.3.1.1. History of the program

The inception of the chlorine bleaching of pulp in the 1960's led to the release of PCDD/Fs into surface waters through pulp and paper mill effluent (MacDonald *et al.* 1992). This inadvertent dioxin production contributes about 5% of the total dioxin emissions in the United States (Thomas and Spiro 1996). Even though the concentration of dioxin in water is in the part-per-trillion to part-per-quadrillion range downstream from these effluent outlets, fish bioaccumulate these compounds to levels that exceed recommended consumption limits.

The Dioxin Monitoring Program (DMP) was established in 1988 by the Maine Legislature to determine the levels of dioxin contamination in waters and fisheries of the state. Fish are sampled annually below no more than twelve selected point sources of dioxin as part of the DMP in order to determine dioxin concentrations in the fish (Mower 2000).

The main point source monitored by the DEP consists of Kraft pulp and paper mills. While levels in Maine rivers have decreased over the past decade, detectable levels are still present. Therefore, the Maine DEP is working to find a less variable method than fish sampling for routinely monitoring dioxin concentrations both upstream and downstream of the mills in order to measure mill compliance to the law. An ideal monitoring method would:

1. Be reliable in its sampling of a particular location, i.e. upstream or downstream

2. Involve uniform exposure time and sampling rates for both upstream and downstream testing sites
3. Have the sensitivity to detect relatively small differences between sites.

The fish test is a possible candidate for the upstream-downstream test. In this project we are assessing the feasibility of using SPMDs as an alternate upstream-downstream dioxin test.

1.3.1.2. Maine's multiple approaches to upstream-downstream testing

In addition to the SPMDs, the Dioxin Monitoring Program (DMP) incorporated other approaches in the quest for the appropriate upstream-downstream test. Normally, the DMP collects benthic white suckers and pelagic small mouth bass. The whole suckers are ground and portions are analyzed while the small mouth bass fillets are ground and analyzed. However, the 1999 DMP field season marked the beginning of investigating sucker fillets as well as fish livers. Smaller bass, in addition to the larger size range, were also added for analysis (Mower 2000).

Besides fish, caged freshwater mussels were deployed at a pair of upstream-downstream sites along the Kennebec River. The mussels circumvent the problems presented with the mobility of fish; however, they are still biotic indicators, which make them susceptible to other pitfalls such as purging of the contaminants and dying during the sampling period as a response to environmental stressors (Rantalainen *et al.* 2000). With these approaches presented, SPMDs remain the only abiotic indicators tested in the program. The DMP yearly report is available on the DEP website and provides the entire data set of dioxin concentrations (http://janus.state.me.us/dep/home.htm).

This project was designed to provide the Maine DEP with SPMD data from sites where other dioxin monitoring data were collected. It will be the task of the Maine Dioxin Monitoring Program staff to compare the results from the various methods and determine an appropriate upstream-downstream test.

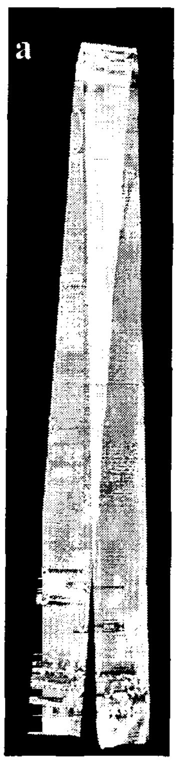
1.3.2. Semipermeable membrane devices

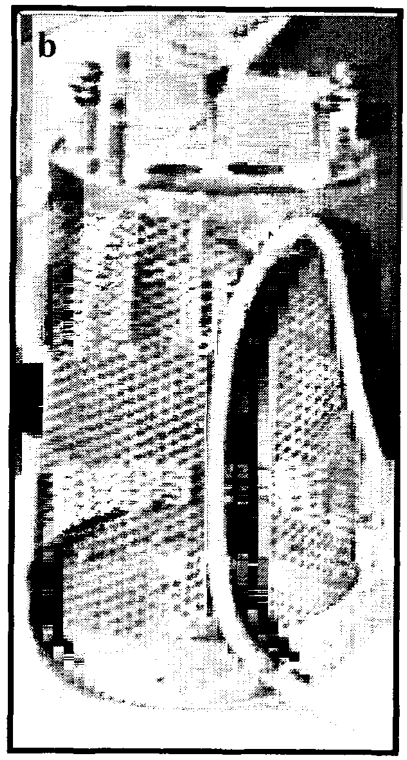
1.3.2.1. What is a semipermeable membrane device?

FIGURE 1.5. Photos of a Semipermeable Membrane Device

(a) from the manufacturer (Huckins *et al.* 1999a)

(b) on deployment rack being loaded into deployment canister (up to five per canister)





A standard semipermeable membrane device consists of two components: the neutral lipid triolein, which is found in many aquatic organisms and serves as the

sequestering phase, and a semipermeable polyethylene membrane, which encases the triolein. The membrane is approximately 2.5 cm wide and 91.4 cm long with a 75 μm to 95 μm wall thickness and a 450 cm^2 surface area. The thin film of triolein inside the membrane, 1,2,3-tri[(*cis*)-9-octadecenoyl] glycerol (95% purity), consists of one milliliter of the lipid, or 0.915 grams (Huckins *et al.* 1999a).

1.3.2.2. How does the device work?

The composition of the SPMD permits small (< 600 amu), dissolved organic pollutants to diffuse through the transport cavities of the polyethylene membrane to the triolein. Dioxin congeners are small lipophilic pollutants (306 amu to 460 amu), thus allowing them to be physisorbed and concentrated by these devices in natural waters. The semipermeable nature of the membrane stems from its exclusion of the entrance of more polar, hydrophilic ionic species and its inclusion of lipophilic compounds. The dual composition of the device permits uptake of contaminants in an aqueous environment and recovery of the compounds in the laboratory through organic solvent dialysis (Huckins *et al.* 1999a).

1.3.2.3. Who is working with SPMDs?

The devices have been developed by a group of scientists led by James N. Huckins at the USGS Columbia Environmental Research Center in Columbia, MO, USA. These scientists obtained two U.S Government-owned patents for this technology, #5,098,573 and #5,395,426, and sold an exclusive license for commercial sale of both the devices and the dialytic recovery methods to Environmental Sampling Technologies of

St. Joseph, MO, USA (Huckins *et al.* 1999a). There have been many studies comparing results of the devices with both biotic and abiotic indicators of environmental contaminants such as caged fish and mussels, sediments, and ultrafiltered water samples, all of which will be discussed in later sections. However, these devices have yet to be used in a regulatory situation such as the upstream-downstream test in Maine.

In addition to the USGS scientists, Kees Booij of the Netherlands and colleagues (1998) have been focusing on the uptake kinetics of the devices, realizing the important effects of flow conditions on uptake kinetics and the need for laboratory calibrations. Adding permeability reference compounds (PRCs) to the membranes before deployment allows comparisons to be made between SPMDs at different sites. Since there is a correlation between diffusion of the substance into the membrane and release of the PRC from the membrane, the differences in sampling rates among sites due to environmental differences can be determined by quantifying the remaining PRC levels in the triolein (Huckins *et al.* 1999a). With permeability reference compounds, the technology is evolving to where the environmental factors of biofouling, temperature, and flow can be eliminated from affecting the ability of the SPMDs to be used in estimating water concentrations of the pollutants investigated.

1.3.3. How does one connect SPMD pollutant concentrations to water concentrations?

1.3.3.1. Factors affecting SPMD sampling

The amount of dioxin sampled by an SPMD for a given deployment period depends on many factors:

1. SPMD sampling rate for the dioxin congener
2. octanol-water partition coefficient for the compound
3. concentration of dioxin in the river
4. temperature in the river
5. flow of the river
6. extent of SPMD biofouling
7. length of deployment (Huckins *et al.* 1999a).

The importance of site selection is evident. In choosing sites, we sought to have comparable temperature and flow conditions. Water velocity measurements at the deployment locations were used as indicators of flow. Water samples were collected to quantify total and dissolved organic carbon levels (TOC and DOC). The TOC and DOC levels affect the amount of dissolved, bioavailable dioxin in the river. For example, if all conditions were the same between two sites except that one site had a higher TOC than the other, the SPMDs would collect less dioxin at the higher TOC site because dioxin's low water solubility fosters its affinity to attach to particulates rather than to exist in the dissolved phase (J.N. Huckins, personal communication).

1.3.3.2. Mechanism of SPMD pollutant sequestration

In developing equations for converting SPMD-sampled concentrations to water concentrations, the seven factors listed above were considered. The mechanism of SPMD pollutant sequestration was also taken into account. Robert Gale (1998) investigated the possibility that there is more to SPMD kinetics than a one-compartment model that involves diffusion of the dissolved hydrophobic compounds through the aqueous and

polymer films with partitioning only in the encased lipid. Gale developed a three-compartment model of the SPMD sampling mechanism. The three compartments include the aqueous film layer, the polyethylene membrane, and the triolein. This design implies that dissolved hydrophobic pollutants are sequestered not only by the triolein, but also by the membrane itself (Gale 1998). Studies have shown that as much as 50% of the compounds recovered from whole SPMD dialysis resided in the membrane (Huckins *et al.* 1990; 1993; 1996; Gale 1998).

In light of these previous studies, Gale developed the three-compartment model to include significant sequestering capability of the membrane. Two major mass transfer terms are involved, which include the aqueous film and the polymer film that can either separately or collectively control the SPMD accumulation process. The process begins with a minor mass transfer step where a dissolved hydrophobic organic compound establishes contact with the aqueous film surrounding the polyethylene membrane because of turbulence in the water. The contact brings the possibility of the first major mass transfer step involving diffusion through the aqueous film layer to the polyethylene where the compound partitions onto the SPMD surface. The second major mass transfer through the polyethylene membrane then occurs if the compound is the right size, leading to sequestration in the triolein (Gale 1998).

Although biofouling is not taken into account in this three-compartment model, biofouling increases the thickness of the aqueous film and thus slows the diffusion of compounds through this layer (Gale 1998). SPMD transport kinetics are controlled by the aqueous layer around the polyethylene membrane (Gale 1998; Booij *et al.* 1998; Huckins *et al.* 1999b; Rantalainen *et al.* 2000).

1.3.3.3. Modeling the SPMD capacity for chemical uptake

Formulating equations for SPMD uptake involves not only the mechanism but also the capacity of the SPMD for the chemical under investigation. One must determine whether the uptake is linear during a deployment period or equilibrium has been reached. When does saturation of the SPMD occur and thus no more of the chemical can be sequestered? The answer to this question was used to calculate applicable deployment lengths for SPMD research. The linear uptake duration ends at one half-time ($t_{1/2}$) and equilibrium concentrations are reached to greater than 95% after four $t_{1/2}$ (Huckins *et al.* 1999a).

$$t_{1/2} = [-\ln(0.5)*K_{SPMD}*V_{SPMD}]/R_s \qquad (1.2)$$

where:

K_{SPMD} = the compound-SPMD partition coefficient = $0.3*K_{OW} = 7.9 \times 10^5$ for 2,3,7,8-TCDD (Huckins *et al.* 1999a)

K_{OW} = octanol-water partition coefficient for the compound

V_{SPMD} = the volume of entire SPMD in liters = 5.2×10^{-3} L

R_S = SPMD sampling rate for the compound, which is the volume of water sampled by the SPMD each day = 3.2 L/day for 2,3,7,8-TCDD at 19°C

Applying this equation to 2,3,7,8-TCDD, we obtain a half-time of about 889 days. Thus the standard SPMD 28-day deployments are well within the linear uptake phase.

1.3.3.4. Equation for calculating water concentrations from SPMD concentrations in the linear uptake region

Huckins *et al.* (1999a) model the linear region of SPMD pollutant uptake in equation 1.3:

$$C_W = (C_{SPMD} * V_{SPMD}) / (R_S * t) \tag{1.3}$$

where:

C_W = the concentration of the pollutant in the water

C_{SPMD} = the concentration of the pollutant in the SPMD

V_{SPMD} and R_S same as equation 1.2

t = the deployment duration in days

The need for the SPMD sampling rate for the compound of interest in equation 1.3 reinforces the importance of determining R_s values for different environmental pollutants. In subsequent sections, calibration experiments focusing on SPMD sampling rates will be discussed. Calibration studies were done using the standard SPMD specifications that include a fractional lipid content of 20%, a 75 μm to 90 μm membrane thickness, and low-density polyethylene layflat tubing manufactured without additives (Huckins *et al.* 1999a). Keeping the SPMDs standardized permits direct applicability of laboratory calibration results to field results.

The SPMD sampling rate is influenced by biofouling, temperature, and water velocity-turbulence. The sampling rate is independent of the environmental concentration of the contaminant. No matter how much of the pollutant is present, the amount of water sampled by the SPMD each day does not change. The laboratory calibration studies can provide R_S at different temperatures and flows, but do not account for biofouling.

Therefore, scientists have proposed the use of permeability reference compounds, PRCs, to provide the sampling rate correction factors for field studies (Huckins *et al.* 1999a).

PRCs are added to the encased triolein in the SPMD just prior to deployment (Huckins *et al.* 1999a). The principle is that the SPMD sampling rate is proportional to the loss rate of the PRC regardless of environmental conditions (Booij *et al.* 1998; Huckins *et al.* 1999a).

1.3.4. Advantages in applying SPMDs to dioxin monitoring

Using SPMDs for upstream-downstream test offers several potential advantages (Huckins *et al.* 1999a):

1. SPMDs are deployed at a fixed location.
2. SPMDs can provide estimates of dioxin concentrations in the water during a fixed sampling period.
3. SPMDs withstand heavy pollution and can be deployed in toxic environments that could stress and kill biotic samplers (Rohr *et al.* 1996; Rantalainen *et al.* 2000).
4. Accumulated pollutants are sequestered in the SPMD (Rantalainen *et al.* 2000) while fish simultaneously sequester and metabolize pollutants.
5. SPMDs provide reproducible homogeneous substrates.
6. They are commercially available.

The usefulness of the SPMD monitoring method has been substantiated by previous scientific investigations (Prest *et al.* 1992; Ellis *et al.* 1995; Herve *et al.* 1995; Lebo *et al.* 1995; Prest *et al.* 1995a; Gale *et al.* 1997; Hofelt and Shea 1997; Meadows *et al.* 1998;

Rantalainen *et al.* 1998; McCarthy and Gale 1999; Echols *et al.* 2000; and Granmo *et al.* 2000). Not only have SPMDs been used to monitor dioxin but also other pollutants, such as polychlorinated biphenyls, polyaromatic hydrocarbons, and pesticides. A comprehensive summary of the laboratory and field SPMD studies for various environmental contaminants will be discussed in the following sections. Most helpful in this investigation is the examination of SPMD performance in previous comparative studies that included caged mussels, fish, clams, ultrafilter water permeates, and sediments.

1.3.5. SPMD experiments focusing on environmental contaminants other than dioxin

1.3.5.1. Laboratory investigations

SPMD calibration studies began with Huckins *et al.* (1993) when they developed the mathematical models for linking SPMD concentrations to water concentrations. Flow-through exposures and dissipation experiments were done for 2,2',5,5'-tetrachlorobiphenyl (TCB) and phenanthrene, a polyaromatic hydrocarbon (PAH). The focus of the investigation was to test the model for measuring the water concentrations of the studied pollutants from SPMD concentrations. They found that the model estimates of average contaminant concentrations differed by less than two-fold from the actual average measured water concentrations (Huckins *et al.* 1993).

Further studies with TCB calculated the half-life of the chemical to be 82.5 days in the SPMD. Comparing that with fish half-lives of the compound at 14.4 and 48.1 days for different species, the utility of the SPMDs in contaminant monitoring was

substantiated (Huckins *et al.* 1996). The longer SPMD half-life for TCB demonstrates a greater tendency to retain the contaminant, making the device a better tool for monitoring periodic contaminant releases (Huckins *et al.* 1996).

Kees Booij *et al.* (1998) calculated the uptake rates of selected chlorobenzenes, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) using exposure standards. They investigated both high and low turbulence conditions in the water and found that decreased turbulence lowers uptake rates. The data supported the conclusion that flow conditions are an important factor in the uptake rates of contaminants. In order to compare SPMDs among sites, the devices either must be exposed to the same flow conditions or PRCs must be added to the triolein before deployment to account for flow differences (Booij *et al.* 1998).

Huckins *et al.* (1999b) examined the aqueous sampling rates of fifteen PAHs at various temperatures and concentrations for standard SPMDs. While the values for the sampling rates ranged from approximately 1.0 to 8.0 liters/day for the compounds, these values were affected by the environmental conditions of temperature, biofouling, and current velocity-turbulence (Huckins *et al.* 1999b). This study found that the water concentrations of the PAHs did not affect SPMD uptake (Huckins *et al.* 1999b).

A study monitoring organochlorine contaminants in the upper Mississippi River designed laboratory experiments to determine the effects of biofouling on SPMD sampling rates since the scientists had to laboriously dip the SPMDs in a biocide each week to minimize biofouling (Ellis *et al.* 1995). They exposed SPMDs in the field for 56 days and then brought the SPMDs back to the laboratory for a seven-day concurrent exposure to radiolabeled phenanthrene along with fresh SPMDs. Comparing the SPMD

sampling rates of the phenanthrene between fresh SPMDs and biofouled, deployed SPMDs revealed a decrease of 26 to 39% in biofouled SPMD sampling rates (Ellis *et al.* 1995).

1.3.5.2. Field investigations

The multi-ringed, organochlorine properties of dioxin are shared by a host of other environmental contaminants. The field studies using SPMDs to monitor other dissolved hydrophobic compounds in aqueous environments are growing larger in number each year as the devices become more established as an abiotic monitoring alternative. By examining past comparative studies of pollutants other than dioxin, useful information on general SPMD sampling trends can be gained. Finding an organized way to discuss the most applicable of these studies is the challenge. The best way is division by principle biotic monitoring method used in the study along with SPMDs. Just as in our current investigation in Maine, bivalves and fish are the major biotic indicators of pollutant levels in aquatic systems used in these comparative studies. The studies will be discussed chronologically and are summarized in Tables 1.4 and 1.5.

TABLE 1.4. Summary of Bivalve/SPMD Comparative Studies

Study	Other Monitoring Methods Examined	Pollutants Analyzed	Deployment Length	Deployment Location	Analytical Instrument Used
Prest *et al.* 1992	Freshwater clams (*Corbicula fluminea*)	Pesticides and PCBs, PCDD/Fs and PCBs	2 months	Sacramento and San Joaquin Rivers	GC/ECD HRGC/ HRMS
Herve *et al.* 1995	Caged Lake Mussels (Anodonta piscinalis)	OCs including CHCs, PCPs, PCAs, and PCVs	28 days	Four lake watercourse sites in central Finland	Not discussed
Prest *et al.* 1995a	Mussels (Mytilus edulis)	PCBs and pesticides	60 days	Corio Bay, Victoria, Australia	GC-ECD
Hofelt and Shea 1997	Mussels (Mytilus edulis) and water samples	OC pesticides and PCBs	30 days	New Bedford Harbor	GC-ECD
Granmo *et al.* 2000	Mussels (Mytilus edulis) and sediment	Organo-chlorine marine pollutants	30 days	Swedish bay	GC-ECD

1.3.5.2.1. Bivalve/SPMD comparative studies

Prest *et al.* (1992; 1995a; 1995b) determined that the concentrations of PCBs in congener distributions differed between clams and SPMDs: bivalves had larger concentrations of the higher chlorinated PCB congeners than SPMDs while SPMDs had larger concentrations of the lower chlorinated PCBs than bivalves. Since the higher chlorinated PCBs have lower water solubilities, they are less likely to be in the dissolved phase. Therefore, while SPMDs sample the lower chlorinated PCBs at slower rates, these congeners have higher levels in the SPMDs because of their greater availability in the dissolved phase.

One of the few SPMD lake studies was carried out by Herve *et al.* (1995) in order to compare caged lake mussels with SPMDs for monitoring organochlorine compounds. Another complementary result occurred and it was concluded that SPMDs preferentially absorb smaller lipophilic contaminants. These smaller contaminants are usually undetected in biota because they are eliminated through metabolic processes. The study concluded that by simultaneously deploying SPMDs and mussels, one could develop a clearer picture of contaminant distribution in the water body (Herve *et al.* 1995).

Hofelt and Shea's (1997) comparative study in New Bedford Harbor found that the concentrations of PCBs in mussels were two times the concentrations found in SPMDs. Each site had significant ($p<0.01$) correlation between PCB concentrations in SPMDs and mussels. Hofelt and Shea (1997) investigated the mathematical model of SPMD sampling and proposed that changes in the standard SPMD configuration could prove to be helpful in future experiments.

In another marine setting, Granmo *et al.* (2000) analyzed organochlorines in sediments, caged mussels, and SPMDs. The goal of the study was to determine if pollutant levels in the sediment in an industrial area were a result of current or past discharges. Calculations were done on all organochlorine concentrations found in the three sampling matrices to determine the water concentrations of the pollutants. The calculated water concentrations of the organochlorines from the sediment data were higher than the mussel and SPMD water concentrations, leading to the conclusion that the sediments sequestered past discharge organochlorines (Granmo *et al.* 2000). Again, mussels and SPMDs sampled complementary pollutants.

1.3.5.2.2. Fish/SPMD comparative studies

TABLE 1.5. Summary of Fish/SPMD Comparative Studies

Study	Other Monitoring Methods Examined	Pollutants Analyzed	Deployment Length	Deployment Location	Analytical Instrument Used
Ellis *et al.* 1995	Ultrafilter water permeates, caged fish, and feral fish	OCs	28 days	Upper Mississippi River	GC-NCI-MS
Meadows *et al.* 1998	Brown Trout (*Salmo trutta*) and water samples	PCBs	28 days	Groundwater spring	GC-ECD
Echols *et al.* 2000	Sediment, caged fish	PCBs	28 days	Saginaw River, MI	GC-ECD

Ellis *et al.* (1995) conducted the first large river monitoring study of organochlorine contaminants (OCs) with SPMDs. The scientists had difficulty comparing SPMD data with ultrafilter permeate water data because there were not enough contaminants detected in the water samples. SPMDs were found to have nine detectable OCs while caged and feral fish only had five of those nine organochlorine compounds. This discrepancy is attributed to fish metabolism (Ellis *et al.* 1995).

The caged brown trout in the study by Meadows *et al.* (1998) involved the deprivation of food for the fish in order to have them sample only dissolved PCBs through their gills. During the 28-day exposure process, SPMD PCB concentrations rose from 0.03 to 203.4 μg/g and brown trout PCB concentrations rose from 0.06 to 118.3 μg/g. The time-deployment experimental design allowed for the calculation of PCB uptake rates for the two matrices. This investigation yielded similar PCB uptake rates for caged brown trout and SPMDs.

The fish/SPMD comparative study conducted by Echols *et al.* (2000) found lower chlorinated PCBs in SPMDs that are easily metabolized and thus absent from fish. Fish and sediment concentrations had ratios between one and two for the PCBs studied. Again it was concluded that sediments and SPMDs provide complementary information: sampling period trends can be determined with SPMDs and historical trends can be determined with sediments (Echols *et al.* 2000).

1.3.6. SPMD experiments focusing on dioxin

1.3.6.1. Laboratory investigations

No laboratory calibration study had been done for PCDD/Fs with SPMDs until recently with the work of Anna-Lea Rantalainen and her colleagues (2000). Before their experiments, calculations from dioxin levels in SPMDs to dioxin levels in water were carried out using PCB experimental sampling rates (R_S) (Lebo *et al.* 1995; Gale *et al.* 1997; and McCarthy and Gale 1999). Rantalainen *et al.* measured uptake rates for sixteen of the seventeen toxic PCDD/F congeners and seven PCB congeners in both bulk water and sediment at two different temperatures, 11°C and 19°C, under controlled laboratory conditions (2000). They compared dioxin levels in the lipid, membrane, and whole SPMD and found that both the lipid and the membrane sequester dioxin. They presented their sampling rate data in liters per square meter per day. By multiplying these rates by the area of one SPMD in square meters, the sampling rate in liters per day can be obtained. These values are presented in Table 1.6 on the next page. As predicted, the SPMDs sample at a slower rate as the temperature decreases.

TABLE 1.6. SPMD Uptake Rates in Water (11°C and 19°C). The uptake rates are presented for both lipid only and for the whole SPMD. The data from Rantalainen *et al.* (2000) were manipulated to provide uptake rates in liters per day per SPMD.

Dioxin Congener	**$R_{S(L)}$ in 11°C Water Lipid (L/day)**	**R_S in 11°C Water Lipid + Membrane (L/day)**	**$R_{S(L)}$ in 19°C Water Lipid (L/day)**	**R_S in 19°C Water Lipid + membrane (L/day)**
2378-TCDD	1.4	2.1	2.0	3.2
12378-PeCDD	0.9	1.5	1.8	2.9
123478-HxCDD	0.9	1.2	2.1	3.4
123678-HxCDD	0.7	1.2	1.6	2.7
123789-HxCDD	0.6	1.1	1.2	2.4
1234678-HpCDD	0.3	0.6	0.9	1.9
OCDD	0.4	1.1	0.6	2.6
2378-TCDF	1.4	2.1	2.2	3.1
12378-PeCDF	1.1	1.7	1.9	3.2
23478-PeCDF	1.0	1.6	2.3	3.6
123478-HxCDF	0.6	1.1	1.2	2.3
123678-HxCDF	0.6	1.1	1.3	2.5
234678-HxCDF	0.6	1.0	1.4	2.5
123789-HxCDF	0.4	0.8	0.9	1.9
1234678-HpCDF	0.3	0.6	1.0	2.3
OCDF	0.2	0.4	0.6	1.5

The SPMD uptake rates have been provided for both lipid only and whole SPMD to illustrate that not only are the compounds sequestered in the lipid, but also in the polyethylene membrane. Therefore, in our present study, the entire SPMD was dialyzed and the whole SPMD mass was used in concentration calculations.

As described in the SPMD sampling rate section, the octanol-water partition coefficient, log K_{OW} value, is an important parameter for each of these compounds. The octanol-water partition coefficient has an inverse relationship with SPMD uptake rates: as log K_{OW} values increase, SPMD uptake rates decrease (Gale *et al.* 1997). The log K_{OW} values for the seventeen toxic dioxin congeners are provided in Table 1.7.

TABLE 1.7. Log K_{OW} Values for the Toxic Dioxin Congeners. These values are presented by Rantalainen *et al.* (2000) with the following sources cited: [a]Sijm *et al.* 1989, [b]Shiu *et al.* 1988, [d]Mackay *et al.* 1992, and [e]Doucette and Andren, 1988. [c]Denotes an estimation of the value using Log K_{OW} of 1,2,3,4,7,8-HxCDD.

Dioxin Congener	Log K_{OW}
2378-TCDD	6.42[a]
12378-PeCDD	6.64[a]
123478-HxCDD	7.80[b]
123678-HxCDD	7.80[c]
123789-HxCDD	7.80[c]
1234678-HpCDD	8.00[b]
OCDD	8.20[b]
2378-TCDF	6.53[a]
12378-PeCDF	6.79[a]
23478-PeCDF	6.92[a]
123478-HxCDF	7.00[d]
123678-HxCDF	7.00[d]
234678-HxCDF	7.00[d]
123789-HxCDF	7.00[d]
1234678-HpCDF	7.92[a]
OCDF	7.97[e]

The work by Rantalainen *et al.* (2000) provides the Maine DEP with the needed calibration data for PCDD/Fs in order to calculate dioxin water concentrations from the SPMD data. Now water dioxin concentrations can be better estimated using actual PCDD/F SPMD uptake rates rather than PCB uptake rates.

1.3.6.2. Field investigations

While the above study (Rantalainen *et al.* 2000) has been the only one to focus on dioxin in laboratory conditions, there have been a few previous studies on monitoring dioxin levels in aquatic field systems (Prest *et al.* 1992; Lebo *et al.* 1995; Gale *et al.* 1997; Rantalainen *et al.* 1998; and McCarthy and Gale 1999). Most studies with SPMDs are of a comparative nature due to the small database of SPMD information as compared to other monitoring systems such as bivalves, sediments, and fish. Table 1.8 contains a chronological summary of the dioxin studies involving SPMDs that will be discussed in this section.

TABLE 1.8. Summary of SPMD Dioxin Field Studies

Study	Other Monitoring Methods Examined	Pollutants Analyzed	Deployment Length	Deployment Location	Analytical Instrument Used
Prest *et al.* 1992	Freshwater clams	Pesticides and PCBs, PCDD/Fs and PCBs	2 months	Sacramento and San Joaquin Rivers, California	GC/ECD HRGC/ HRMS
Lebo *et al.* 1995	None	PCDD/Fs	28 days	Bayou Meto, Arkansas	GC/ quadrupole MS and H4IIE bioassay
Gale *et al.* 1997	Caged Channel Catfish and sediments	PCDD/Fs and PCBs	28 days	Saginaw River, Michigan	GC/ECD for m-PCBs and HRGC/ HRMS
Rantalainen *et al.* 1998	Infiltrex water sampler and benthic-feeding fish	PCDD/Fs and PCBs	62 days	Lower Fraser River, Vancouver, BC	HRGC / HRMS
McCarthy and Gale 1999	sediments	PCDD/Fs, PCBs, PAHs and OC pesticides	35 days	Lower Columbia River	HRGC / HRMS

Harry Prest (1992) led a study that deployed SPMDs side-by-side with freshwater clams (*Corbicula fluminea*). The major finding was the presence in the SPMDs of significantly higher levels of 2,3,7,8-TCDD and 2,3,7,8-TCDF than in the clams. However both matrices did contain the full congener profile of all seventeen toxic PCDD/F congeners (Prest *et al.* 1992).

Bayou Meto, Arkansas, was the site of a study by Lebo *et al.* (1995) that focused on upstream and downstream sites from a tributary confluence that had been a known source of dioxins and furans (PCDD/Fs). The focus of the study was to demonstrate the ability of SPMDs to target these compounds. Replicate samples were analyzed by either GC/quadrupole MS or H4IIE bioassay and the resulting data confirmed the agreement of these two analytical methods and the success of using SPMDs in bioassay procedures. Discussion of determining estimated aqueous concentrations from SPMD concentrations was provided and the early study used PCB SPMD sampling rates in the calculations due to the absence of PCDD/F calibration data (Lebo *et al.* 1995).

A study led by Robert Gale (1997) compared the uptake of PCDD/Fs by caged channel catfish, sediments, and SPMDs in the Saginaw River, Michigan, in order to assess the bioavailability of the pollutants. Scientists calculated the water concentrations of the compounds from the SPMD data by estimating the PCDD/F SPMD sampling rates using the PCB SPMD sampling rates from previous laboratory calibration studies. Sediment-based and caged fish-based water concentration determinations were also calculated and all of the results were compared. The following conclusions were drawn:

1. Sediments and SPMDs provide complementary information with respect to concentration. They have similar congener profiles but

differed in absolute concentrations. The sediments tend to have higher levels of the higher chlorinated congeners while the SPMDs tend to have more of the lower chlorinated congeners. The investigators attributed this occurrence to the fact that as the number of chlorine atoms increases, the water solubility decreases. Therefore, the higher chlorinated compounds are more likely to fall down the water column to the sediment and experience difficulty in diffusing across the membranes (Gale *et al.* 1997).

2. Metabolism of the congeners is a factor in fish. Most of the congeners present in fish are difficult to metabolize, e.g. the 2,3,7,8-substituted isomers. (Gale *et al.* 1997)

Rantalainen *et al.* (1998) conducted a field study in the Lower Fraser River, Vancouver, BC, where they deployed SPMDs both in the water column and in the sediments. They compared congener profiles obtained from these SPMDs with those from an Infiltrex resin column water sampler as well as benthic fish. All of the samples produced similar congener profiles with the resulting Infiltrex water sampler concentrations similar to SPMD concentrations. Moreover, they conducted a time series study of SPMD sampling of PCDD/Fs and PCBs and found that the concentration of these compounds in SPMDs does increase with exposure time over a sixty-day deployment period.

Finally, a recent study by McCarthy and Gale (1999) involved a large-scale investigation of organochlorine and polycyclic aromatic hydrocarbon compounds with PCDD/Fs included in the Lower Columbia River. Streambed sediment samples were

compared with SPMDs and it was found that sediments sampled more of the higher chlorinated PCDD/F congeners than SPMDs.

The study yielded many helpful conclusions from the data including:

1. Volatilization, dilution, and sedimentation of particulates reduce pollutant concentrations in river flow path.
2. High discharge periods lead to dilution of high pollutant levels.
3. "The distribution of hydrophobic organic compounds in streambed sediment is not necessarily indicative of their distribution in the dissolved-phase" (McCarthy and Gale 1999, p.1).
4. SPMDs succeed in detecting environmentally significant pollutant levels where water-sampling techniques fail.

Creating composite samples of fifteen SPMDs, McCarthy and Gale (1999) were able to bring the detection limits for the devices down to the low parts-per-quintillion level.

1.4 Research Objectives and Hypotheses

Objectives (1-6):

1. To develop field and laboratory methods for the SPMDs.
2. To determine the effectiveness of semipermeable membrane devices for dioxin sampling in Maine rivers.
3. To examine SPMD biofouling and dioxin concentrations during high flow (June) and low flow (July) periods in a deployment time study.

   Hypotheses (a-e):

   (a) As deployment time increases, dioxin concentrations increase.

(b) As biofouling increases on the SPMDs, the uptake of dioxin decreases. The extent of biofouling on the membrane increases as temperature increases.

(c) As water velocity increases, the dilution of water dioxin concentrations increases and less dioxin is sequestered by the SPMDs during the deployment period.

(d) As temperature increases, SPMD dioxin sampling rates increase and the devices sequester more dioxin.

(e) As ambient TOC and DOC concentrations increase, dioxin concentrations in the SPMD decrease.

4. To deploy SPMDs at selected upstream-downstream sites and determine if there is a statistical difference between upstream and downstream dioxin levels.

5. To investigate how the SPMDs sample over an entire field season at a given site. This examination will allow us to determine the optimal times for SPMD deployments.

Hypotheses (f and g):

(f) There is a difference in the SPMD dioxin concentrations among the deployment months.

(g) The varying environmental conditions of water velocity, temperature, TOC, and DOC among the deployment months influence this difference in SPMD dioxin concentrations.

6. To determine how SPMD method detection limits (MDLs) are influenced by the number of SPMDs combined to make one sample.

Hypothesis (h):

(h) As the number of SPMDs combined to make one sample in a MDL study increases, the detection limits decrease and the sensitivity of the method increases.

1.5 Scientific and Societal Importance

The goal of this project is to determine whether or not SPMDs are effective in routinely monitoring surface waters for dioxin exposure. In Maine, developing a cost-effective and reliable method to monitor dioxin in our waterways, which can replace the destructive sampling of fish, will aid in determining compliance of the Kraft paper mills to the upstream-downstream legislation. If SPMDs are selected to be this alternate method, the positive impact on similar monitoring programs will be widespread. Since dioxin is introduced into our environment from both natural and anthropogenic processes, many surface waters throughout the world are potential sinks of dioxin sources. The toxicity of dioxin cannot be ignored and the successful use of SPMDs will improve our ability to monitor dioxin levels from potential point sources. Moreover, since SPMDs can physisorb and concentrate many different organochlorine compounds, other pollutants such as polychlorinated biphenyls and polyaromatic hydrocarbons can be examined. These multiple application possibilities make the use of SPMDs for monitoring our waterways potentially far-reaching and relevant.

2. EXPERIMENTAL METHODS

2.1 Experimental Design for Objectives 1 and 2: The 1999 Field Season

2.1.1. Site descriptions

The 1999 field samples were used in the development of suitable field and laboratory techniques for the SPMDs (Objective 1). SPMDs were placed at nine different sites on the Penobscot River (Figures 2.1 and 2.2) in order to assess the dioxin monitoring potential of the SPMDs in a Maine river (Objective 2). These sites were chosen based on their range of environmental conditions and because many of these sites were the same as those used by DEP personnel for DMP fish collection.

TABLE 2.1. Summary of 1999 Deployments: Penobscot River

Deployment Number	Deployment Date	Retrieval Date	Sites
1	6/18/99	7/16/99	1,2, and 3
2	7/21/99	8/18/99	3,4, and 5
3	8/20/99	9/16/99	3,5,6, and 7
4	9/28/99	10/28/99	3,5,8, and 9

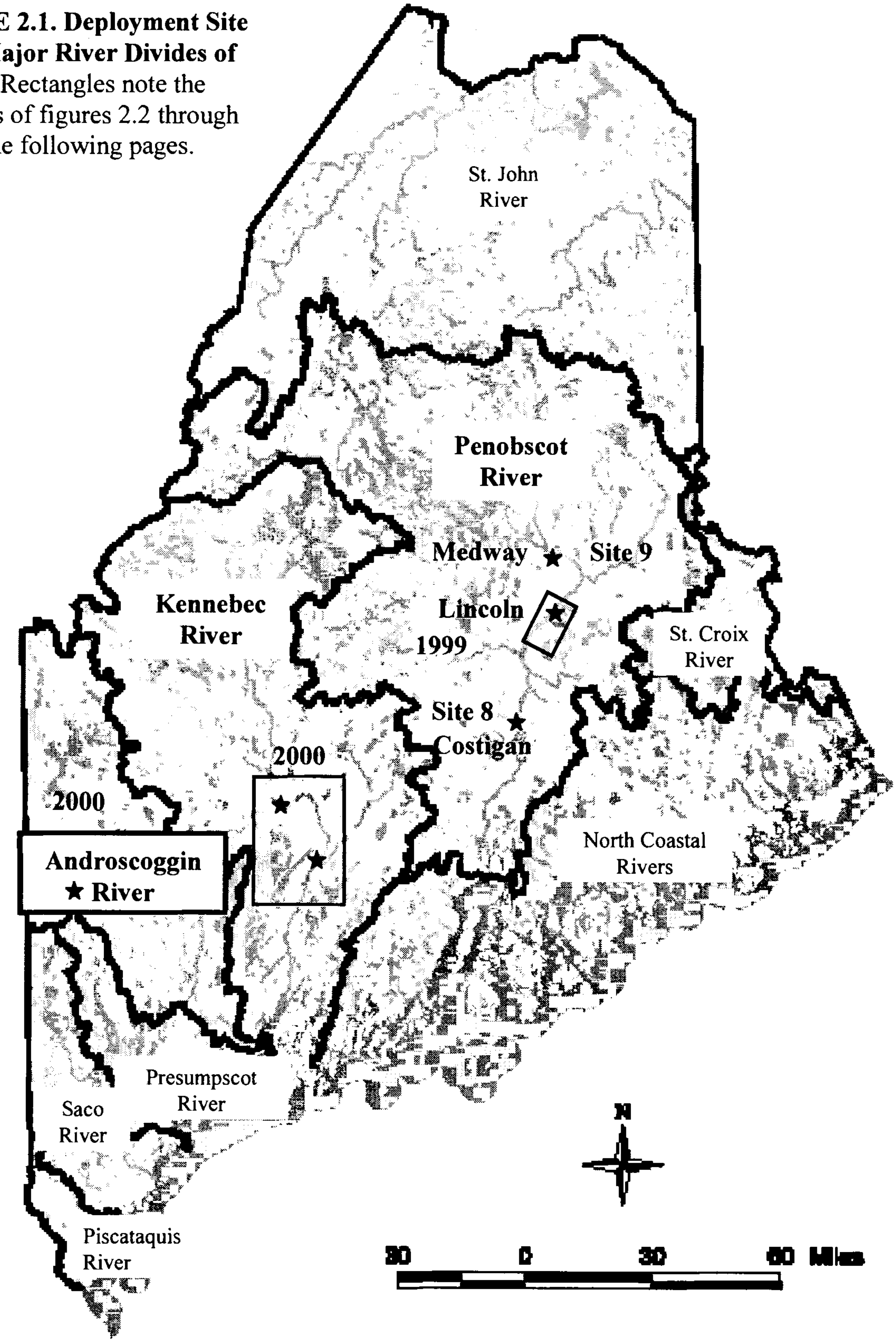
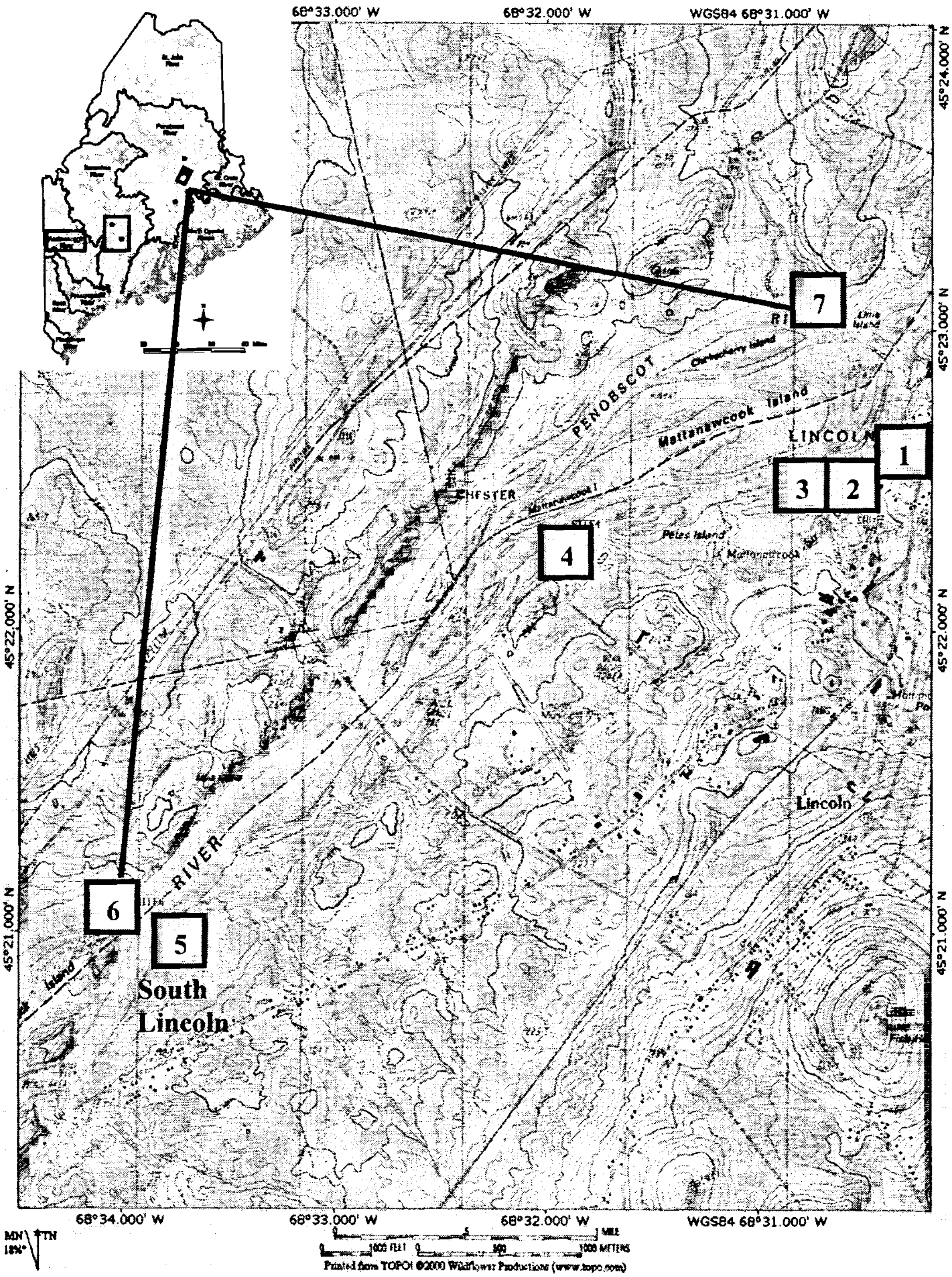


FIGURE 2.1. Deployment Site Map: Major River Divides of Maine. Rectangles note the locations of figures 2.2 through 2.4 on the following pages.

FIGURE 2.2. U.S.G.S. Topographical Map of the Penobscot River Sites around Lincoln, ME. Sites 1 through 7 were between South Lincoln and Lincoln Proper for the 1999 field season. Sites 8 and 9 are noted in Figure 2.1 (TOPO! 2000)



2.1.2. Water quality data

Each site was assessed for a suite of water quality parameters at both the beginning and end of the deployment period. Appendix A contains all of the water quality and field data collected for both the 1999 and 2000 field seasons. The following water quality data were collected:

- ✓ Field data, which included temperature, water velocity, and specific conductance measurements, were used for site selection in the field. Temperature measured by a field thermometer aided in determining uniformity between sites since temperature affects SPMD uptake of pollutants. Water velocity was measured with a field flow meter for the same reason as temperature. Specific conductance measured by a field conductivity probe allowed for assurance that downstream sites were chosen within a wastewater plume.
- ✓ Water samples were collected in order to measure the following: Total organic carbon (TOC), total suspended solids (TSS), dissolved organic carbon (DOC), total phosphorus, chlorophyll a, apparent color, turbidity, and specific conductance. These data provided a comparison of the sites for a given deployment. Onset temperature loggers recorded hourly temperatures.

2.1.3. Objective assessment

The field and laboratory methods employed will be discussed after all of the experimental designs are described. The successful investigations of objectives 1 and 2 were determined qualitatively from laboratory results. The method development section in this chapter explains the evolution of the SPMD cleanup methods and how objective 1 was not met until the 2000 field season. Objective 2 was completed using the 1999 field season data. The dioxin congeners were detected in the environmental samples from the Penobscot River but could not be quantified due to excessive triolein interference (triolein dialyzed out of the membrane along with the dioxin). Objective 6 is addressed in the concluding sections of this chapter. Objectives 3, 4, and 5 were investigated through specific field experimental designs during the 2000 field season and will be discussed in the next sections.

2.2 Objectives 3, 4, and 5: The 2000 Field Season

TABLE 2.2. Objectives of the 2000 Field Season

Objective	Deployment # Month	Sites	# of SPMDs
➢ #3: Deployment Time Study: To examine SPMD dioxin concentrations and biofouling over the 28-day deployment period. Compare high flow vs. low flow deployment environmental conditions. *Location: Androscoggin River at Dixfield*	1 and 2 June and July	10-A and 10-B	20 SPMDs per deployment with 5 retrieved each week for 4 weeks
➢ #4: Upstream/Downstream Study: To test the applicability of using SPMDs to monitor dioxin for the upstream/ downstream law. *Locations: Androscoggin River at Rumford (13) and Dixfield (10)*	4 September-October	10 and 13	20 SPMDs per site with all retrieved after 28 days
➢ #4: Upstream/Downstream Study: To test the applicability of using SPMDs to monitor dioxin for the upstream/ downstream law. *Locations: Kennebec River at Norridgewock (11) and Fairfield (12)*	3 August-September	11 and 12	10 SPMDs per site with all retrieved after the 54 days
➢ #5: Deployment Month Comparison: To investigate how the SPMDs sample over an entire field season at a given site during 28-day deployment periods. *Location: Androscoggin River at Dixfield*	1,2, and 4 June, July, and September-October	10	5 SPMDs for deployments 1 and 2 and 10 SPMDs for deployment 4

2.2.1. Site descriptions

We used the SPMDs to monitor dioxin at four sites during the 2000 field season: two sites on the Androscoggin River and two sites on the Kennebec River (Table 2.2; Figures 2.3 and 2.4).

FIGURE 2.3. U.S.G.S. Topographical Map of the 2000 Androscoggin River Sites.

The site numbers indicate their locations (TOPO! 2000)

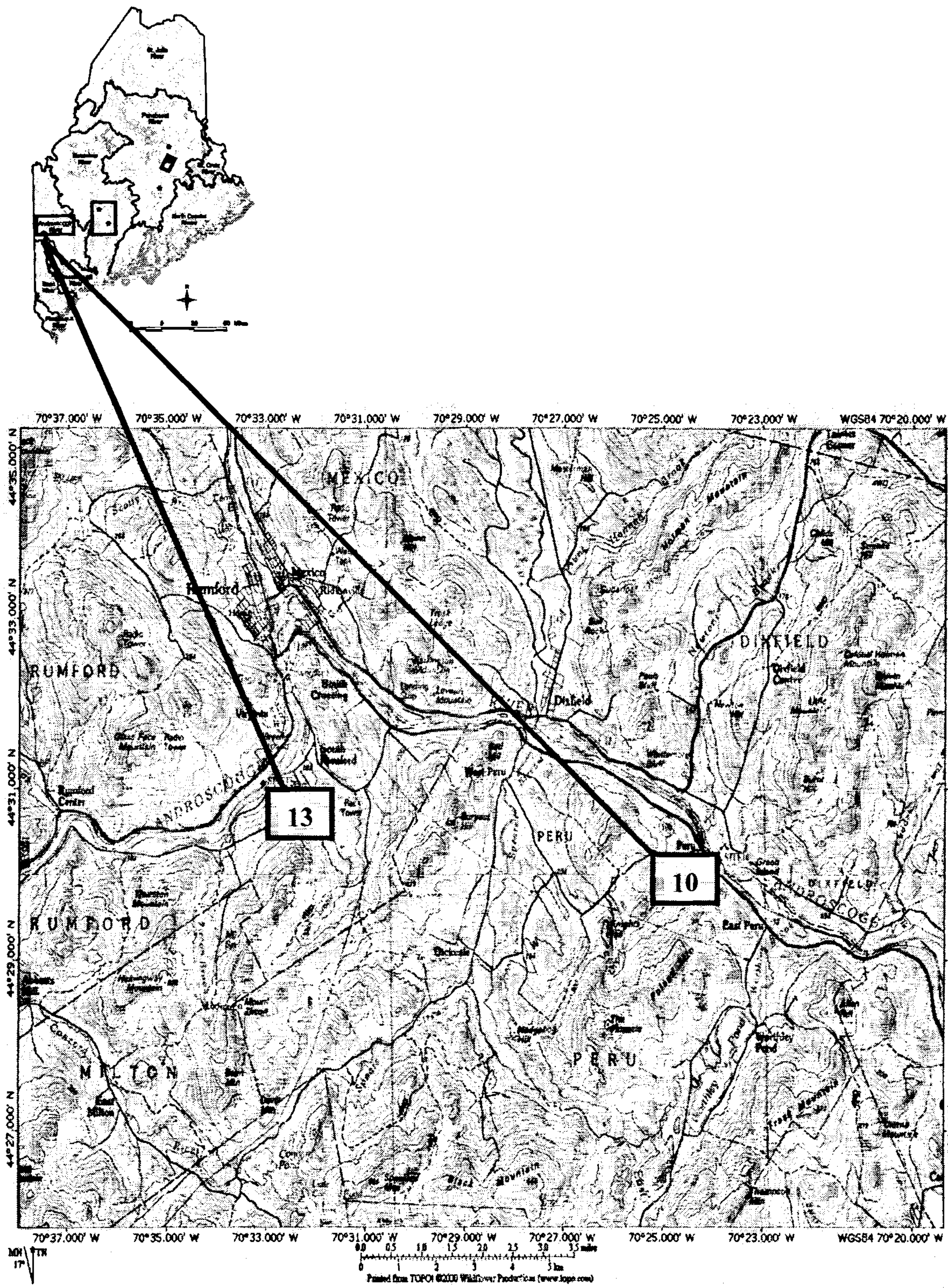


FIGURE 2.4. U.S.G.S. Topographical Map of the 2000 Kennebec River Sites. The site numbers indicate their locations (TOPO! 2000).

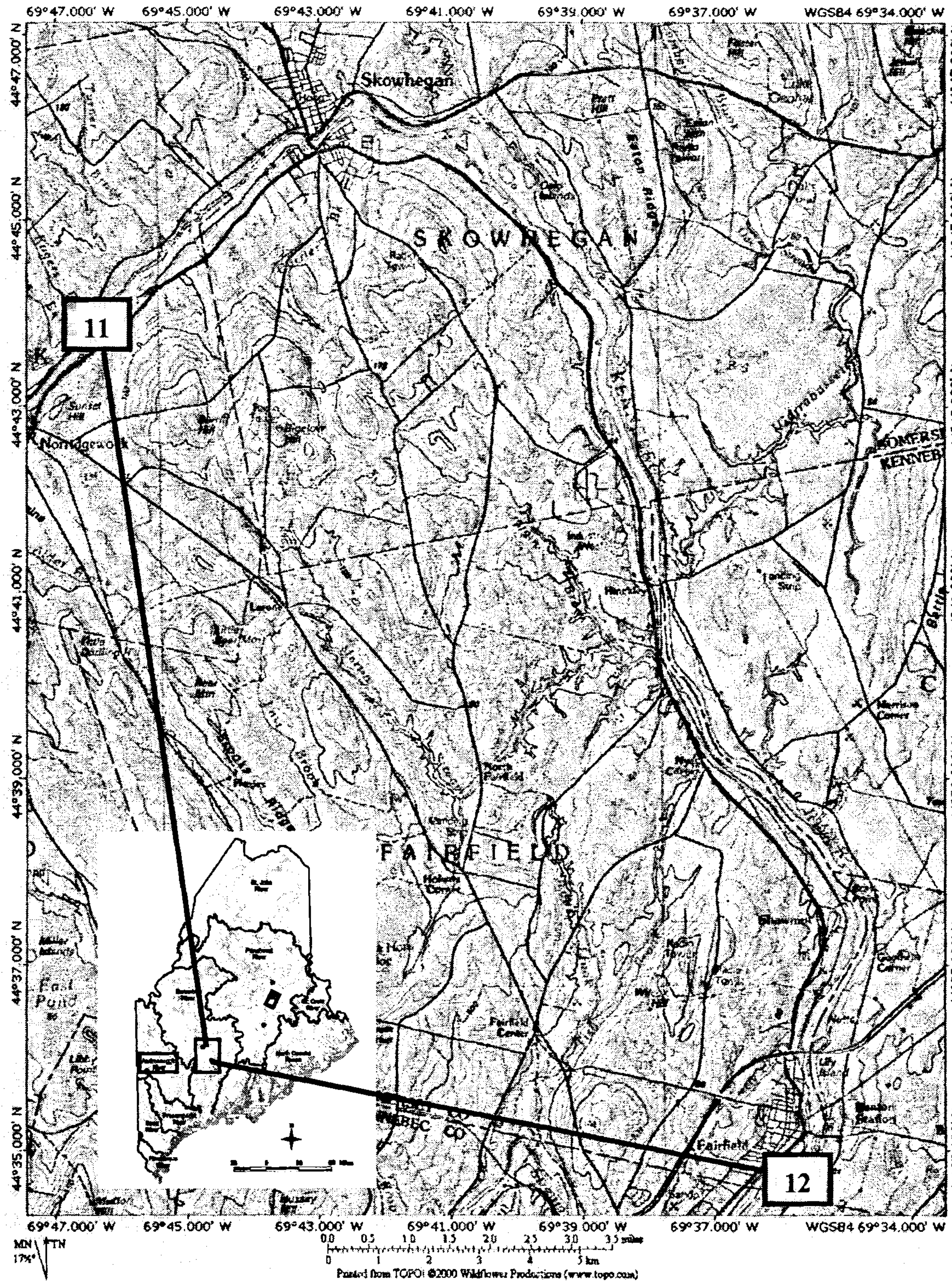


TABLE 2.3. Global Positioning Satellite (GPS) Positions for the Thirteen Sites of the Project: 1999 and 2000. Presented in TOPO! GPS Data Format: DegMinSec, NAD83.

Site	Latitude (DegMinSec)	Longitude (DegMinSec)	Elevation (ft)
1*	N45°22'37"	W68°30'27"	161
2*	N45°22'33"	W68°30'37"	164
3*	N45°22'32"	W68°30'51"	161
4*	N45°22'21"	W68°31'55"	159
5*	N45°21'01"	W68°33'50"	157
6*	N45°21'05"	W68°33'58"	164
7*	N45°23'04"	W68°30'50"	163
8*	N45°00'47"	W68°38'33"	98
9*	N45°35'38"	W68°29'47"	239
10	N44°30'10"	W70°23'53"	NA
11	N44°43'49"	W69°46'26"	NA
12	N44°34'53"	W69°35'48"	596
13	N44°31'04"	W70°33'05"	NA

*Denotes a GPS waypoint estimation of the site.

NA = Not Available

2.2.2. Water quality data

Not all of the water quality parameters tested in the 1999 field season were quantified in the 2000 field season. It was determined that the investigation be limited to only those water quality parameters that influence SPMD sampling: temperature, water velocity, total organic carbon (TOC), and dissolved organic carbon (DOC).

2.2.3. Experimental design for objective 3: Deployment time studies

2.2.3.1. Experiment description

The 2000 field season consisted of three objectives (Table 2.2). The first experiment, which targeted objective 3, involved a deployment time study that was performed on the Androscoggin River over two 28-day deployment periods. For each deployment period, twenty SPMDs were placed three feet below the river surface at Dixfield, site 10, located approximately eight miles downstream from a bleached Kraft pulp and paper mill (Figure 2.3). Each week for four weeks, five of the SPMDs were retrieved. As a result of the small amounts of dioxin, the five SPMDs from each of the first three weeks were combined to make one sample. The retrieval from the fourth week consisted of five replicate, single SPMDs for statistical analyses.

The goal of the study was to see not only how biofouling increased through time but also if SPMD dioxin levels increased linearly through time. We wanted to assess the validity of our five hypotheses, a through e, and thus determine the relationships existing between environmental conditions and SPMD dioxin concentrations.

2.2.3.2. Statistical methods

While graphical comparisons of the SPMD dioxin concentrations and deployment environmental conditions illustrate relationships between high flow (June) and low flow (July) deployment periods, statistical methods were employed to reinforce qualitative observations. It is important to note that the experimental design did not allow for a rigorous test of predictive relationships between environmental conditions and dioxin concentrations. To perform that type of analysis, natural environmental conditions would

have to be manipulated. Each parameter would need to be tested individually for its effects on dioxin concentrations while all other variables remain constant. However, the design did allow for the preliminary investigation of correlative relationships between environmental conditions and SPMD dioxin concentrations.

Three descriptive measures of linear regression were used to examine possible associations between each environmental condition (X) and SPMD dioxin concentration (Y). First, the coefficient of correlation, r, is a value between –1 and 1. The higher the absolute value, the more X and Y are linearly correlated. Negative values of r indicate an inverse relationship between the variables: as X increases, Y decreases and vice versa, therefore the slope of the regression line would be negative. Positive values of r indicate a positive slope for the linear regression model and a direct relationship: as X increases, so does Y and vice versa.

The coefficient of determination, r^2, has a value between 0 and 1. It is a measure of the reduction in variation of Y when X is used as a predictor variable. "Thus, the larger r^2 is, the more the total variation of Y is reduced by introducing the predictor variable X" (Neter *et al.* 1996, p.81). It follows that the closer the r^2 value is to 1, the greater the linear association between X and Y.

The third helpful parameter to use in the investigation of possible linear relationships is the P-value, termed the observed level of significance. In designing an experiment one chooses a level of significance, alpha (α), which is compared to the observed level of significance, P-value. If $\alpha > P$, one concludes that there is a linear relationship between X and Y. For this preliminary study, we chose an alpha value of 0.1 (Neter *et al.* 1996). All of the comparisons between SPMD dioxin concentrations and

environmental conditions during the June and July deployments were made using a Pearson Correlation Matrix.

2.2.4. Experimental design for objective 4: Upstream-downstream deployments

2.2.4.1. The Androscoggin River

While the deployment time studies sought to investigate how the SPMDs sample a particular site over the 28-day deployment period, our second set of studies sought to investigate how the devices could be applied for the upstream-downstream test. This test involved the determination of whether a statistical difference between SPMD dioxin concentrations was present between upstream and downstream sites. A pair of sites was chosen on the Androscoggin River in western Maine. The downstream site, Site 10, was located in Dixfield and was the same site used in the deployment time studies. The upstream site, 13, was located in Rumford (Figure 2.3). At each of these two sites, twenty SPMDs were deployed for a 28-day deployment period. These twenty SPMDs became ten composite replicate samples with two SPMDs per sample.

2.2.4.2. The Kennebec River

The second upstream-downstream test was conducted on the Kennebec River. The upstream site, 11, was in Norridgewock and the downstream site, 12, was in Fairfield (Figure 2.4). Similar field and water data were collected in the Kennebec River as the Androscoggin River. Ten SPMDs were deployed at each of these two sites for a 54-day deployment period. These ten SPMDs became five composite replicate samples with two SPMDs per sample.

2.2.4.3. Statistical methods

Statistically, the presence of any potential difference between upstream and downstream mean values can be detected using the F-test through analysis of variance (ANOVA) to test the null hypothesis that the sample means are equal between the two treatments of upstream and downstream. For the test to be valid, the data must follow these assumptions: 1. Residuals are randomly, independently, and normally distributed, sum to zero, and have constant variance; 2. The data are normally distributed; and 3. Treatment and environmental effects are additive (Neter *et al.* 1996).

The F Test for equality of factor level means was used to evaluate the upstream-downstream data (Neter *et al.* 1996). Basically there are two alternative conclusions possible from the test:

H_0 : upstream and downstream means are the same

H_a : upstream and downstream means are different

The test statistic that investigates which alternative is appropriate is deemed the F statistic, F*, which is the ratio of the treatment mean square to the error mean square (Neter *et al.* 1996 p.690). A large calculated F* statistic supports the alternate hypothesis H_a. The decision rule of this test involves a tabulated F value at a controlled level of significance, α, which has been set at 0.05.

If F^* is less than or equal to $F(1-\alpha; r-1, n_T-r)$, conclude H_0

If F^* is greater than $F(1-\alpha; r-1, n_T-r)$, conclude H_a

$F(1-\alpha; r-1, n_T-r)$ is a value obtained from the $(1-\alpha)$ 100 percentile F distribution chart. The value for r relates to the number of treatments, which would be 2 in our case for

upstream and downstream, and n_T indicates the total sample size. Using the statistical program SYSTAT, ANOVA was performed on the deployment four and three data sets.

2.2.5. Experimental design for objective 5: SPMD sampling over the 2000 Field Season

2.2.5.1. Experiment description

The Dixfield site on the Androscoggin River was monitored during three separate, 28-day deployment periods: June, July, and September-October. This experimental design allowed for comparisons to be made to assess whether there was a difference in dioxin concentrations between the three months and to determine the optimal SPMD field conditions by investigating the relationships between environmental conditions and SPMD dioxin concentrations.

2.2.5.2. Statistical methods

2.2.5.2.1. Hypothesis f: Is there a difference between the months?

As described in the upstream-downstream test statistics section, the F-Test under ANOVA was used to determine if there was a statistical difference between SPMD dioxin concentration means among the different deployment months.

2.2.5.2.2. Hypothesis g: How are environmental conditions related to SPMD dioxin concentrations?

While graphical comparisons of the different environmental conditions for June, July, and September-October can reveal potential relationships, statistical tools were used

to substantiate them. To statistically compare environmental conditions and SPMD dioxin concentrations, we used the coefficient of correlation [r], the coefficient of determination [r^2], and the observed level of significance [P-value]. These statistical parameters were described earlier in the deployment time study section. Since this investigation was preliminary, an alpha value of 0.1 was used (Neter *et al.* 1996).

2.2.6. Tabular summary of the 2000 Field Season deployments

TABLE 2.4. Deployment Descriptions for the 2000 Field Season

Deployment #	Deployment Date	Retrieval Date	Deployment Time (days)	Sites	SPMDs per site	SPMDs /sample	# Reps
1	6/2/00	6/9/00	7	10-A	5	5	1
		6/16/00	14	10-B	5	5	1
		6/23/00	21	10-A	5	5	1
		6/30/00	28	10-B	5	1	5
2	7/7/00	7/14/00	7	10-A	5	5	1
	6/30/00	7/14/00	14	10-B	5	5	1
	7/7/00	7/28/00	21	10-A	5	5	1
	6/30/00	7/28/00	28	10-B	5	1	5
3	8/3/00	9/26/00	54	11	10	2	5
				12	10	2	5
4	9/19/00	10/17/00	28	10	20	2	10
				13	20	2	10

2.2.7. Manipulating SPMD dioxin concentrations for statistical analyses

Many of the experiments described above involved replicate SPMD samples. In order to perform the statistics described above on the data it was necessary to assign concentrations to the less than detection limit (<DL) congeners when replicates had detectable peaks. Less than detection limit means that peaks were not identified or could not be quantified. These <DL quantities affect the calculation of the Toxic Equivalency

(TEQ). The TEQ is calculated by multiplying each congener concentration by its corresponding TEF. The State of Maine has adopted calculating the TEQ in three different ways: 1. Assigning <DL congeners a concentration of zero, TEQ (<DL = 0); 2. Assigning <DL congeners a concentration of one-half the detection limit, TEQ (<DL = 0.5*DL); and 3. Assigning <DL congeners a concentration of the detection limit.

We added three more TEQ calculations that assign those three values discussed above for <DL congeners. However, we removed the hexa- through octa- substituted congeners and focused only on tetra- and penta- substituted dioxin congeners. The quotient has been designated as TEQ_{TP}. When looking at the raw SPMD field data in Appendix B, many of the contamination-based data flags exist for the heavier substituted congeners, which are more prevalent than the lighter (less chlorinated) congeners.

We chose to use the TEQ (<DL = 0) values in the statistical analyses. This decision was made because the method detection limits (MDLs) for the SPMDs have not been validated by multiple MDL studies. Moreover, most of the congeners with high TEF values, tetra- and penta- substituted dioxin were <DL and so the concentration values assigned to those congeners would dominate the TEQ value.

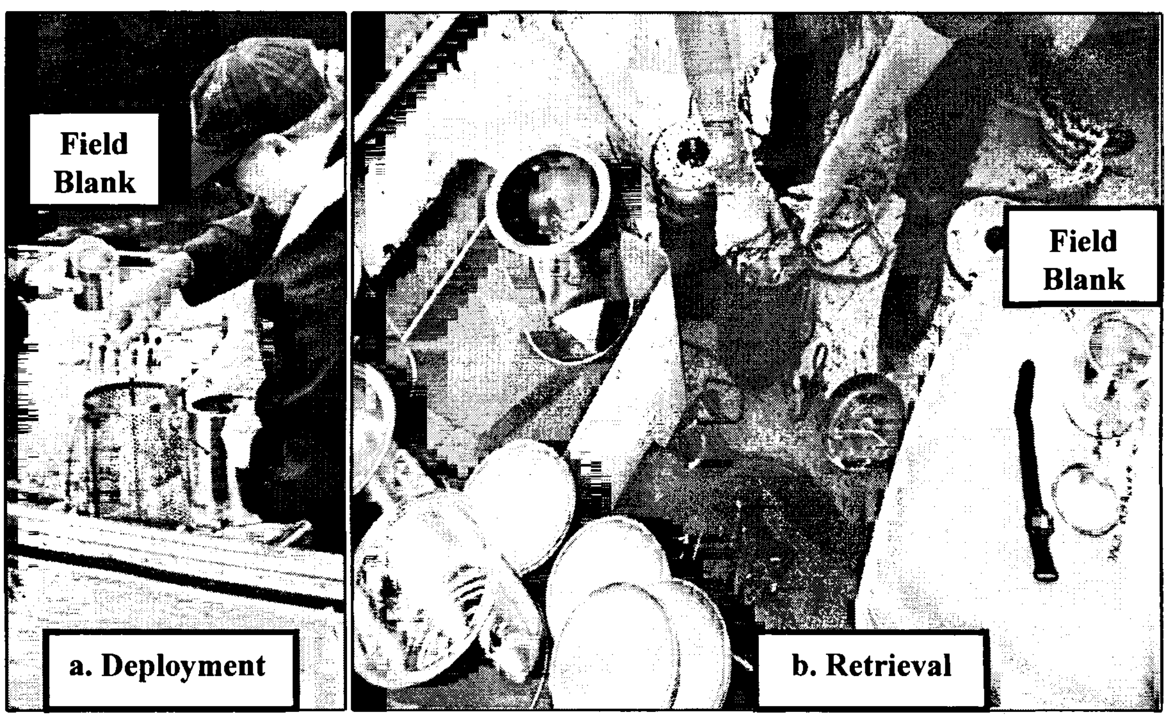
2.3 Field Methods

The standard SPMDs were purchased from Environmental Sampling Technologies of St. Joseph, MO. They were mounted on deployment racks in a regulatory level M-3.5 clean room environment and sealed in 1-gallon metal cans one day prior to deployment. SPMDs were kept in the freezer until use and transported to the field on ice. In the field, the loaded mounting racks were placed in the canisters—up to

five SPMDs per canister. For field quality control, a field blank SPMD can was opened at selected sites while the SPMDs were open to air and placed in the deployment canisters until submersion of the canisters into the river.

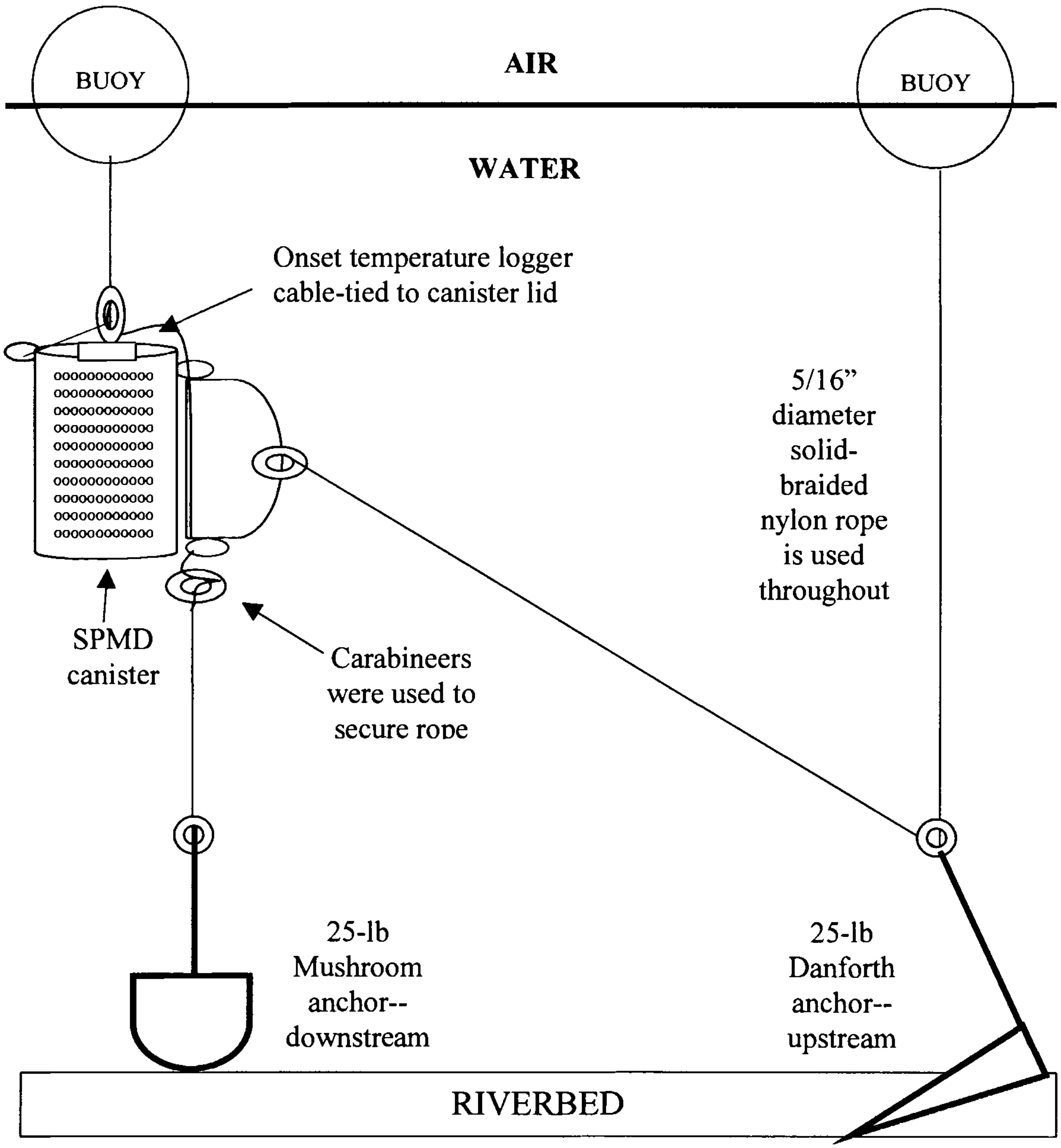
Upon retrieval of the SPMDs, the same field blank was again exposed to the atmosphere while the deployed SPMDs were exposed. This field blank was necessary since SPMDs are excellent passive air samplers (Petty *et al.* 1993). Total air exposure time for the SPMDs was less than fifteen minutes for deployment and retrieval combined. At retrieval, the SPMDs on their mounting racks were returned to their original gallon metal cans, transported to the laboratory on ice, and stored in a -20°C freezer until extraction and cleanup. These processes are illustrated in Figure 2.5.

FIGURE 2.5. Photos from the Deployment (a) and Retrieval (b) Processes. Field blanks are in pint-sized cans while deployed SPMDs are in gallon-sized cans.



The SPMDs were deployed in the river within a deployment apparatus developed for this project by Richard Dill and Heather Shoven (Figure 2.6). This apparatus could vertically deploy one to four canisters of SPMDs. The assembly of anchors and buoys provides a vertical deployment and places the canisters at a fixed depth below the water's surface. Because sediment sequesters dioxins and furans, the SPMD deployment apparatus prevented the canisters from touching the riverbed.

FIGURE 2.6. Vertical Deployment Apparatus for SPMDs



2.4 Laboratory Methods

2.4.1. Water samples

The standard operating procedures (SOPs) of the Mitchell Center were used to measure a suite of characteristics for the collected water samples from each deployment and retrieval. The parameters quantified during the two field seasons are discussed below with both summaries of the method of quantification and the reported units of measure provided: (Data presented in Appendix A.)

- ✓ Dissolved Organic Carbon (DOC): The water sample was first filtered through a 0.4 micron filter in order to measure only the dissolved organic carbon present in the sample. After filtering, the sample was acidified with two drops of 1:1 H_2O:H_2SO_4 per 60 ml sample. An OI Model 700 Total Organic Carbon Analyzer was used in the analysis of water samples for DOC. The DOC was determined by the measurement of carbon dioxide released by persulfate oxidation of the organic carbon in the acidified sample. [mg/L]
- ✓ Total Organic Carbon (TOC): This was measured with the same method as DOC except the sample was not filtered. [mg/L]
- ✓ Specific Conductance (SC): It is a measure of the total dissolved, electrically-charged species in a water sample. It was quantified with a Yellow Springs Instrument (YSI) Model Number 35 digital conductivity meter and YSI probe 3401 at 25°C. [µS/cm]

In addition to DOC, TOC, and SC, total suspended solids (TSS), total phosphorus, chlorophyll a, apparent color, and turbidity levels were measured during the 1999 field season.

2.4.2. Final SPMD method

2.4.2.1. Extraction of dioxin from SPMDs

Biofouling, which consists of exterior debris and periphyton, was removed from the SPMDs before extraction by scrubbing the membrane with a toothbrush (Huckins *et al.* 1999a). After this initial cleanup, the devices were then spiked with a cocktail of surrogates consisting of ^{13}C-labeled analogs of the toxic native dioxin congeners in order to monitor recovery. The surrogate cocktail, made exclusively for EPA Method 1613B, was purchased from Cambridge Isotope Laboratories (CIL) of Andover, MA. These surrogates were necessary for providing validity to high-resolution gas chromatography / high-resolution mass spectrometry (HRGC/HRMS) findings because the preparation of the SPMDs for analysis on the HRGC/HRMS involved many analytical transfers and cleanups, which always result in the loss of some sample. The surrogates provided a way to determine how much sample was lost throughout the process (Telliard 1994). Moreover, these compounds were essential in peak detection and in assuring that lab blanks were in fact blank. The surrogates were added with a microsyringe injection and the resulting hole was repaired with a heat sealer. The SPMD was then exposed to a 1 N HCl solution for thirty seconds.

After surrogate addition and exterior cleaning, individual SPMDs were dialyzed into hexane. The dialysis process consisted of two consecutive 24 hour incubation periods. Each SPMD was dialyzed separately in a solvent-rinsed, pint-sized Mason jar with 125 mL of hexane. The jars were covered with solvent-rinsed aluminum foil and with the screw caps placed over the foil, rubber side of the lid facing outwards. After 24 hours, the dialysate was transferred to another hexane-rinsed, pint-sized Mason jar and

another 125 mL of fresh solvent was added to the jar with the SPMD (Huckins *et al.* 1999a). After this second 24 hour dialysis period the two dialysates were combined and concentrated with Kuderna-Danish (K-D) apparatus to a ten-milliliter volume. The K-D is a standard evaporation/concentration technique for solvents like hexane and methylene chloride and involves boiling off of the solvent in a hot water bath. A condensation system is used to recover the evaporated solvent for appropriate disposal.

2.4.2.2. Cleanup of the SPMD extracts

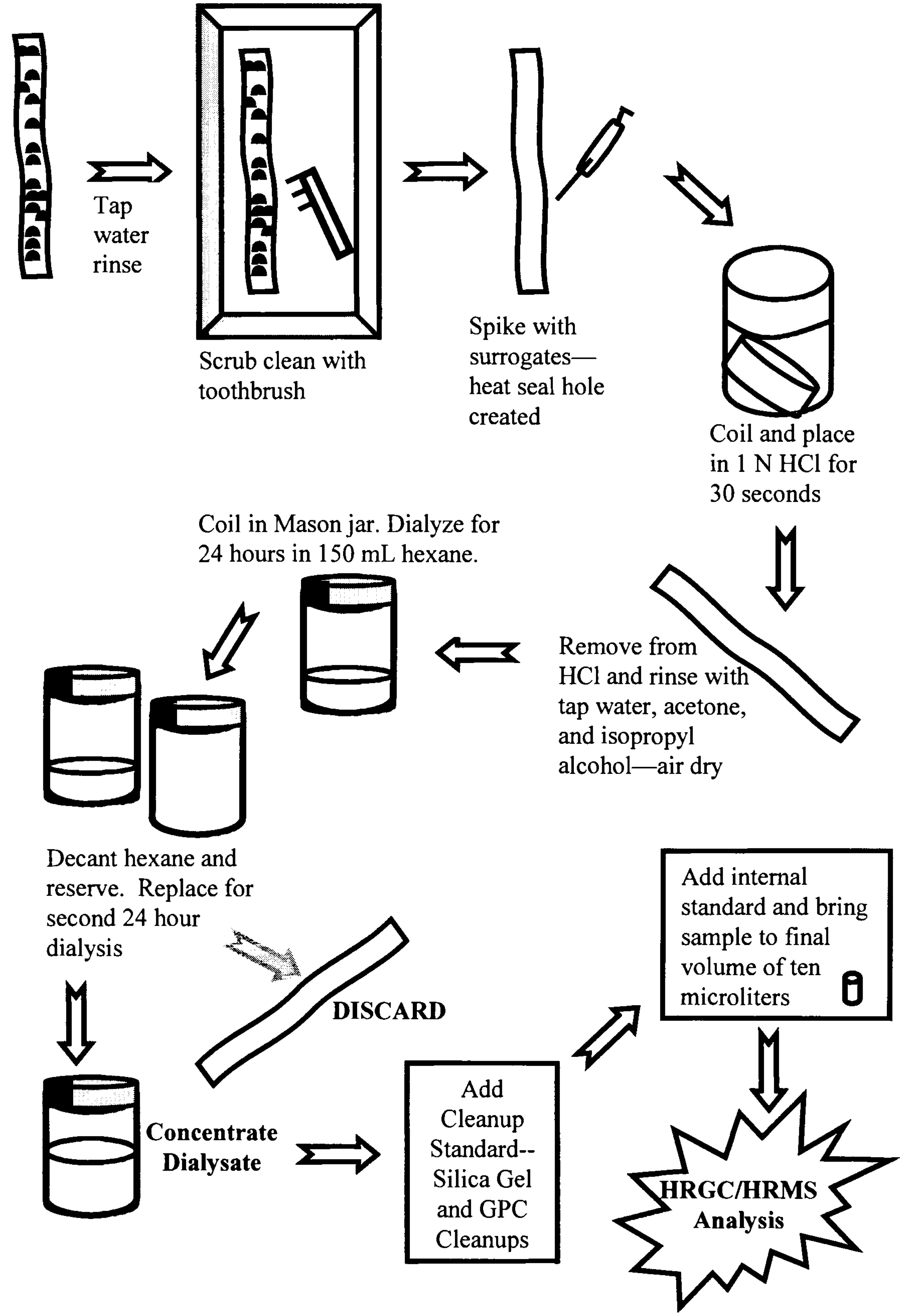
If the SPMDs were to be made into composite samples, they were combined after extraction. The resulting extract samples were then cleaned by acidified silica gel slurry. The extract was added to 100 mL of hexane and 500 μL of dioxin cleanup standard. The cleanup standard was obtained from CIL and it is $^{37}Cl_{all}$ labeled 2,3,7,8-TCDD (all four chlorine atoms are ^{37}Cl labeled). As described in the introduction, the cleanup standard allowed us to monitor sample lost during the cleanup steps while surrogates allowed us to monitor sample lost throughout the entire sample manipulation process. A stirbar was added to the beaker and when uniform mixing was established about 10 grams of acidified silica gel was added. The mixing continued for approximately one hour. This process hydrolyzed and removed residual triolein from solution.

The sample was then filtered through crystallized, anhydrous sodium sulfate and concentrated by a Kuderna-Danish apparatus. In preparation for gel permeation chromatography, the sample was filtered through a Whatman Puradisc™ 25 TF disposable filter device using dichloromethane. The filter removed any particles that could clog the valves of the instrument. For gel permeation chromatography, an

automated Autoprep 500 GPC using a 70 gram Biobeads SX-3 column was used (O.I. Analytical, ABC Instruments, Columbia, MO). The GPC is a size exclusion chromatographic method that targets dioxin-sized particles for recovery (Telliard 1994). The samples were recovered from the GPC in 150 mL Erlenmeyer flasks. Each sample was then concentrated to 10 μL in a GC autosampler vial and stored at –20°C until HRGC / HRMS analysis.

For laboratory quality assurance and quality control (QA/QC) of the extraction and cleanup procedures, three controls were run through the laboratory methods concurrently with deployed samples and field blanks. These controls included: (1) a process blank to determine the possible background concentrations in the solvents, glassware, and equipment used in the procedures, (2) a dialysis blank to determine the background in a fresh SPMD, and (3) a matrix spike to determine the efficiency of the sample preparation and analysis (McCarthy and Gale 1999).

FIGURE 2.7. Flow Diagram of SPMD Extraction and Cleanup Processes



2.4.2.3. HRGC / HRMS dioxin analysis

With the theory of the instrument established in the introduction we can now describe the fundamentals of the standard operating procedure used for analyzing the seventeen toxic dioxin congeners established by our dioxin laboratory as outlined by the EPA (Telliard 1994). The basis of the process lies in the continual introduction of perfluorokerosene (PFK) to the source. PFK is a compound that fragments into known ions that provide lock masses for the mass analyzer. These lock masses provide for mass-drift corrections that are needed due to the demands of the high-resolution process. There are five PFK lock masses involved in the single ion monitoring process, one for each homologue group investigated. PFK ion at *m/z* 304.9824 was used to tune the instrument prior to every run or every twelve hours of operation. Adjusting the various lenses and electric and magnetic fields involved in the instrument to optimally detect this ion allowed us to adjust the resolving power of the instrument up to the minimum of 10,000 resolution (Telliard 1994).

The calibration standards were purchased from CIL and consisted of a mixture of the native and $^{13}C_{12}$ labeled dioxin congeners at known concentrations. A run began with the injection of 2 μL of calibration standard into the GC column injector port. Tables 2.5 through 2.9 show the exact *m/z's* monitored during a run (* indicates $^{13}C_{12}$ labeled). The GC retention times for each descriptor scan were predetermined by running a retention time check standard that was a window-defining mixture. This standard contained all of the congeners and allowed the analyst to determine the window times for each descriptor group. Whenever the GC column was clipped or replaced for maintenance, the retention times changed and the retention time check standard was re-run. Thus the times offered

in the following tables were only good for the GC column under certain conditions and are included to provide estimated ranges of the gas chromatography column retention times.

TABLE 2.5. Descriptor One Ions: scanned between GC retention times 31:00 and 51:45

Ion Exact *m/z*	Substance Identity (*m/z* type)
303.9016	TCDF (M)
305.8987	TCDF (M+2)
315.9419	TCDF* (M)
316.9824	PFK Lock Mass
317.9389	TCDF* (M+2)
319.8965	TCDD (M)
321.8936	TCDD (M+2)
327.8847	Cl-37 TCDD
331.9368	TCDD* (M)
333.9339	TCDD* (M+2)
375.8364	HxCDPE = hexachlorodiphenylether

TABLE 2.6. Descriptor Two Ions: scanned between GC retention times 51:45 and 61:45

Ion Exact *m/z*	Substance Identity (*m/z* type)
339.8597	PeCDF (M+2)
341.8568	PeCDF (M+4)
351.9000	PeCDF* (M+2)
353.8970	PeCDF* (M+4)
355.8546	PeCDD
357.8521	PeCDD
366.9792	PFK Lock Mass
367.8948	PeCDD*
369.8919	PeCDD*
409.7974	HpCDPE = heptachlorodiphenylether

TABLE 2.7. Descriptor Three Ions: scanned between GC retention times 61:45 and 66:30

Ion Exact *m/z*	**Substance Identity (*m/z* type)**
373.8207	HxCDF (M+2)
375.8178	HxCDF (M+4)
380.9760	PFK Lock Mass
383.8639	HxCDF* (M)
385.8610	HxCDF* (M+2)
389.8156	HxCDD (M+2)
391.8127	HxCDD (M+4)
401.8559	HxCDD* (M+2)
403.8530	HxCDD (M+4)
445.7555	OCDPE = octachlorodiphenylether

TABLE 2.8. Descriptor Four Ions: scanned between GC retention times 66:30 and 71:00

Ion Exact *m/z*	**Substance Identity (*m/z* type)**
407.7818	HpCDF (M+2)
409.7788	HpCDF (M+4)
417.8253	HpCDF* (M)
419.8220	HpCDF* (M+2)
423.7767	HpCDD
425.7737	HpCDD
430.9728	PFK Lock Mass
435.8169	HpCDD* (M+2)
437.8140	HpCDD* (M+4)
479.7165	NCDPE = nonachlorodiphenylether

TABLE 2.9. Descriptor Five Ions: scanned between GC retention times 71:00 and 75:00

Ion Exact *m/z*	**Substance Identity (*m/z* type)**
441.7428	OCDF (M+2)
443.7398	OCDF (M+4)
454.9728	PFK Lock Mass
457.7377	OCDD (M+2)
459.7348	OCDD (M+4)
469.7780	OCDD* (M+2)

Ion Exact *m/z*	Substance Identity (*m/z* type)
471.7750	OCDD* (M+4)
513.6775	DCDPE = decachlorodiphenylether

Descriptor is the term used for the group of ions scanned for a given period of time in relation to the GC retention time. There are five descriptors, established by the five homologue group windows, involved in dioxin analyses as outlined in tables 2.5 through 2.9. During the allotted times of GC retention these ions in each descriptor were continuously scanned and directed by the analyzers to the detector for quantification. The resulting peaks detected started at zero abundance, reached a maximum, and then returned to a value of zero abundance (Skoog and Leary 1992). The diphenylether ions were included in the scans because they each have ion fragments that interfere with the furan ions. Therefore, one could examine the diphenylether ion scans and if there was a distinguishable peak, then the furan peaks in the descriptor group were flagged (Telliard 1994).

As described in this section, the quantification process involved a few equations and the EPA provides guidelines for identification of peaks (Telliard 1994). These processes were the same for both the calibration standards and the actual environmental samples run. The detector generates a mass spectrum of the collected data for each ion specified. The spectra are presented as ion abundance versus time. For each set of ions (M and M+2 or M+2 and M+4), ion abundance ratios are compared and must fall within the parameters listed in Table 2.10.

TABLE 2.10. Theoretical Ion Abundance Ratios and QC Limits (Telliard 1994)

CDD/CDF Type	*M/z* ratio	Theoretical ratio	QC Limits Lower	Upper
TCDD/F and $^{13}C_{12}$-TCDD/F	M / (M+2)	0.77	0.65	0.89
PeCDD/F and $^{13}C_{12}$-PeCDD/F	(M+2) / (M+4)	1.55	1.32	1.78
HxCDD/F and $^{13}C_{12}$-HxCDD	(M+2) / (M+4)	1.24	1.05	1.43
$^{13}C_{12}$-HxCDF	M / (M+2)	0.51	0.43	0.59
HpCDD/F and $^{13}C_{12}$-HpCDD	(M+2) / (M+4)	1.05	0.88	1.20
$^{13}C_{12}$-HpCDF	M / (M+2)	0.44	0.37	0.51
OCDD/F and $^{13}C_{12}$-OCDD	(M+2) / (M+4)	0.89	0.76	1.02

Not only must the above QC limits be met but also the signals for the two *m/z* types for a congener must maximize within the same two seconds of GC retention time. Moreover the signal-to-noise ratio must be ≥ 2.5 for each compound and ≥ 10 for each standard. Finally, qualitative determination of MS peaks involves the Relative Retention Time (RRT) falling within the limits set in Table 2.11.

TABLE 2.11. Retention and Quantitative Standards and Relative Retention Times

(RRT) outlined in EPA Method 1613B

Congener	Retention Time / Quantification Standard	RRT
Compounds using $^{13}C_{12}$-1,2,3,4-TCDD as the injection internal standard		
2,3,7,8-TCDF	$^{13}C_{12}$-2,3,7,8-TCDF	.999 - 1.003
2,3,7,8-TCDD	$^{13}C_{12}$-2,3,7,8-TCDD	.999 – 1.002
1,2,3,7,8-PeCDF	$^{13}C_{12}$-1,2,3,7,8-PeCDF	.999 – 1.002
2,3,4,7,8-PeCDF	$^{13}C_{12}$-2,3,4,7,8-PeCDF	.999 – 1.002
1,2,3,7,8-PeCDD	$^{13}C_{12}$-1,2,3,7,8-PeCDD	.999 – 1.002
$^{13}C_{12}$-2,3,7,8-TCDF	$^{13}C_{12}$-1,2,3,4-TCDD	.923 – 1.103
$^{13}C_{12}$-2,3,7,8-TCDD	$^{13}C_{12}$-1,2,3,4-TCDD	.976 – 1.043
$^{37}Cl_4$-2,3,7,8-TCDD	$^{13}C_{12}$-1,2,3,4-TCDD	.989 – 1.052
$^{13}C_{12}$-1,2,3,7,8-PeCDF	$^{13}C_{12}$-1,2,3,4-TCDD	1.000 – 1.425
$^{13}C_{12}$-2,3,4,7,8-PeCDF	$^{13}C_{12}$-1,2,3,4-TCDD	1.011 – 1.526
$^{13}C_{12}$-1,2,3,7,8-PeCDD	$^{13}C_{12}$-1,2,3,4-TCDD	1.000 – 1.567
Compounds using $^{13}C_{12}$-1,2,3,7,8,9HxCDD as the injection internal standard		
1,2,3,4,7,8-HxCDF	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	.999 – 1.001
1,2,3,6,7,8-HxCDF	$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	.997 – 1.005
2,3,4,6,7,8-HxCDF	$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	.999 – 1.001
1,2,3,7,8,9-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	.999 – 1.001
1,2,3,4,7,8-HxCDD	$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	.999 – 1.001
1,2,3,6,7,8-HxCDD	$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	.998 – 1.004
1,2,3,7,8,9-HxCDD	Avg. $^{13}C_{12}$-1,2,3,4,7,8-HxCDD and $^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.000 – 1.019
1,2,3,4,6,7,8-HpCDF	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	.999 – 1.001
1,2,3,4,7,8,9-HpCDF	$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	.999 – 1.001
1,2,3,4,6,7,8-HpCDD	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	.999 – 1.001
OCDF	$^{13}C_{12}$-OCDD	.999 – 1.008
OCDD	$^{13}C_{12}$-OCDD	.999 – 1.001
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	.944 - .970
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	.949 - .975
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	.977 – 1.047
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	.959 – 1.021
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	.977 – 1.000
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	.981 – 1.003
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	1.043 – 1.085
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	1.057 – 1.151
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	1.086 – 1.110
$^{13}C_{12}$-OCDD	$^{13}C_{12}$-1,2,3,7,8,9HxCDD	1.032 – 1.311

What are the internal standards in table 2.11? An internal standard is a C-13 labeled dioxin congener that is not present in the surrogate cocktail. There were two internal standard compounds, $^{13}C_{12}$-1,2,3,4-TCDD and $^{13}C_{12}$-1,2,3,7,8,9-HxCDD, present in a mixture of known concentrations added just prior to sample analysis on the HRGC / HRMS. The ion abundance values obtained from the internal standards allowed for the determination of surrogate recoveries and the subsequent quantification of the native congener concentrations (Telliard 1994).

Quantification of native dioxin congener concentrations involves mastery of some important vocabulary. The raw data spreadsheets in Appendices B and C present all of the parameters discussed below which were needed to calculate the SPMD dioxin concentrations. Calibration by isotope dilution was the method used for native congener quantification. The first sample of every run contained both a window-defining mixture and a midpoint calibration standard which was a mixture of the native compounds, labeled surrogates, cleanup standards, and labeled internal standards. The retention times were recorded in a spreadsheet along with ion abundance values (M and M+). The ion abundance values were then manipulated to find the relative response (RR) of each native compound relative to its labeled analog. (Telliard 1994)

$$RR = (A1_n + A2_n) * (C_l) / (A1_l + A2_l) * (C_n) \qquad (2.1)$$

where:

$A1_n$ and $A2_n$ = the areas of the primary and secondary *m/z's* for the dioxin congener

$A1_l$ and $A2_l$ = the areas of the primary and secondary *m/z's* for the labeled analog

C_l = the concentration of the labeled analog in the calibration standard (Table 2.12)

C_n = the concentration of the native compound in the calibration standard (Table 2.12)

TABLE 2.12. Concentration of CDD/Fs in the Midpoint Calibration Standard

Native CDD/F	Concentration (ng/mL)	Labeled CDD/F Analog	Concentration (ng/mL)
2,3,7,8-TCDF	10	$^{13}C_{12}$-2,3,7,8-TCDF	100
2,3,7,8-TCDD	10	$^{13}C_{12}$-1,2,3,4-TCDD(is)	100
1,2,3,7,8-PeCDF	50	$^{13}C_{12}$-2,3,7,8-TCDD	100
2,3,4,7,8-PeCDF	50	$^{37}Cl_{4}$-2,3,7,8-TCDD(cu)	10
1,2,3,7,8-PeCDD	50	$^{13}C_{12}$-1,2,3,7,8-PeCDF	100
1,2,3,4,7,8-HxCDF	50	$^{13}C_{12}$-2,3,4,7,8-PeCDF	100
1,2,3,6,7,8-HxCDF	50	$^{13}C_{12}$-1,2,3,7,8-PeCDD	100
2,3,4,6,7,8-HxCDF	50	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100
1,2,3,7,8,9-HxCDF	50	$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100
1,2,3,4,7,8-HxCDD	50	$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100
1,2,3,6,7,8-HxCDD	50	$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100
1,2,3,7,8,9-HxCDD	50	$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100
1,2,3,4,6,7,8-HpCDF	50	$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100
1,2,3,4,7,8,9-HpCDF	50	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD(is)	100
1,2,3,4,6,7,8-HpCDD	50	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100
OCDF	100	$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100
OCDD	100	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100
		$^{13}C_{12}$-OCDD	200

is = internal standard cu = cleanup standard

The RR values calculated in the calibration standard were then used to quantify the native dioxin congener concentrations in the extract for the subsequent samples in the run.

$$C_{ex}\ (ng/mL) = (A1_n + A2_n) * (C_l) / (A1_l + A2_l) * RR \quad (2.2)$$

where:

C_{ex} = concentration of compound in extract

$A1_n$ and $A2_n$ = areas of primary and secondary *m/z's* for the native dioxin congener

$A1_l$ and $A2_l$ = areas of primary and secondary *m/z's* for the labeled analog

RR = relative response

C_l = concentration of the labeled analog (surrogate)

The surrogate concentrations recovered in a sample were quantified by calibration by an internal standard. The equations closely resemble those used to quantify the native dioxin congener concentrations. Instead of calculating a relative response (RR) with the calibration run data, we calculated a response factor (RF) defined by the following equation:

$$RF = [(A1_s + A2_s) * C_{is}] / [(A1_{is} + A2_{is}) * C_s] \quad (2.3)$$

where:

$A1_s$ and $A2_s$ = areas of the primary and secondary *m/z's* for the labeled analog and cleanup standard congeners

$A1_{is}$ and $A2_{is}$ = areas of the primary and secondary *m/z's* for the appropriate internal standard (Table 2.11 provides the pairing of the labeled analogs with the appropriate internal standard)

C_{is} = concentration of the internal standard (Table 2.12)

C_s = concentration of the compound in the calibration standard (Table 2.12)

With these calculated response factors, the concentrations of the surrogates recovered in each sample extract were calculated with the following equation:

$$C_{ex}\ (\text{ng/mL}) = [(A1_s + A2_s) * C_{is}] / [(A1_{is} + A2_{is}) * RF] \qquad (2.4)$$

With the extract concentrations of the surrogates and cleanup standards calculated, the percent recovery was determined. For all of the surrogates except OCDD, the percent surrogate recovery was identical to the concentration in the extract. However, for OCDD the percent surrogate recovery was calculated by dividing the concentration in the extract by two. For the cleanup standard, the percent recovery was calculated by multiplying the concentration in the extract by two.

The final calculation in dioxin analysis was used to relate the amount of dioxin present in the extract to the original environmental matrix: in our study, the SPMD.

$$C_{SPMD} = (C_{ex} * V_{ex}) / W_{SPMD} \qquad (2.5)$$

where:

C_{SPMD} = Concentration in SPMD (ng/kg)

C_{ex} = ng dioxin per mL of extract

V_{ex} = 10 μl = 0.01 mL = total volume of extract

W_{SPMD} = weight of the SPMD in kg = membrane + lipid

All of the parameters involved in HRGC / HRMS dioxin congener quantification have now been discussed. The process was rigorous and involved the need for quality assurance and quality control (QA/QC) measures. After each calibration standard and window defining mixture sample began a twelve-hour run, a solvent blank of dichloromethane was run as the next sample to check for possible sample carry-over. The

solvent blank was then followed by the day's samples. The time following a given calibration and tuning of the instrument was no longer than twelve hours in order to assure the quality of the results.

2.4.3. SPMD method development phases

Figure 2.7 outlines the final SPMD method developed in this study. However, that method was only adopted after several others were attempted. While the extraction method remained constant throughout the process, the cleanup steps changed. This section documents the evolution of the SPMD cleanup method.

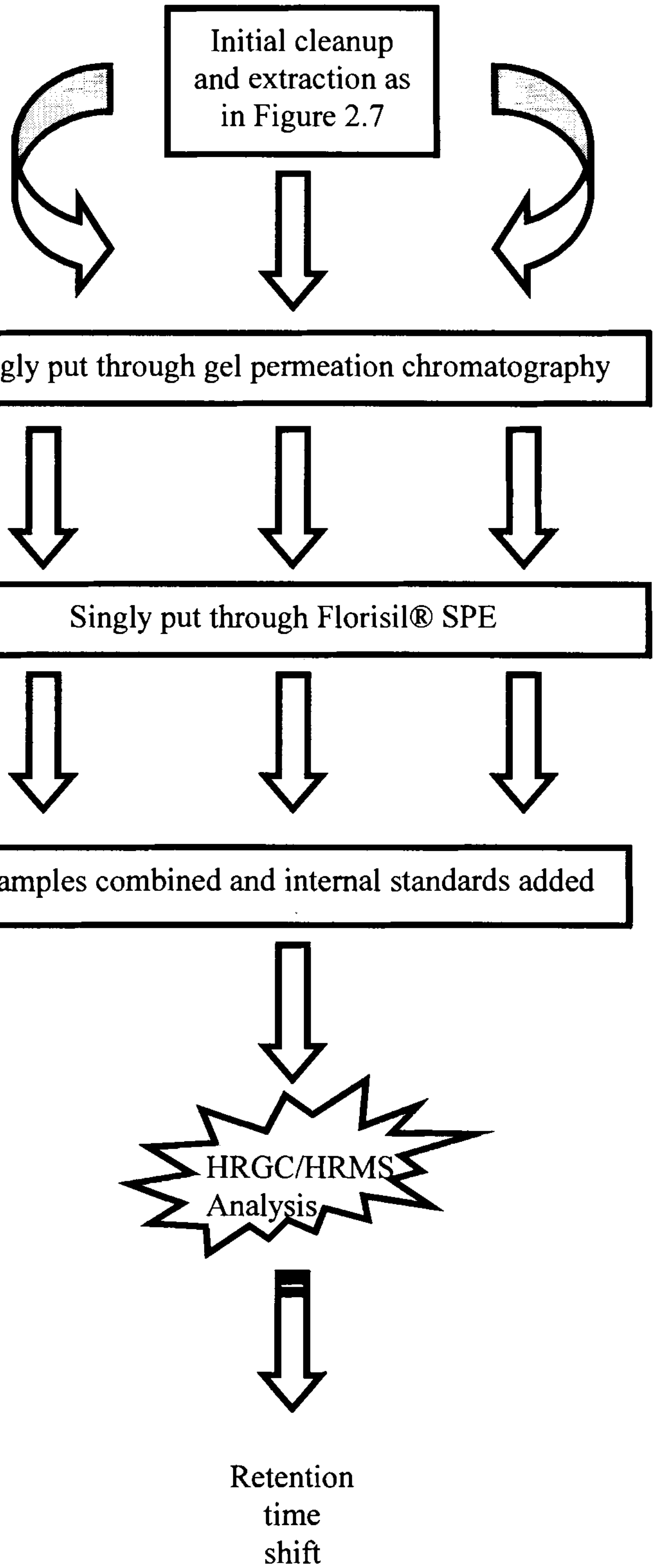
When this project began, high-performance gel permeation chromatography (GPC) was assumed to be an appropriate cleanup step. GPC has been successfully used with the fish samples in the Dioxin Monitoring Program and it had been used in previous SPMD studies for its size exclusion abilities (Ellis *et al.* 1995; Gale *et al.* 1997; Meadows *et al.* 1998; and Echols *et al.* 2000). It was determined that GPC alone was not sufficient for removing interferences and resulted in lengthy retention time shifts of the dioxin peaks. These retention time shifts were most likely caused by the presence of residual triolein in the sample that sequestered the dioxin molecules in the GC column, thus lengthening the retention times.

This retention time shift produced the need for more cleanup of the SPMD dialysates. We did not adopt the rest of the fish method, which consisted of an acidified silica gel slurry, because we were hoping to develop a less time-consuming method with the SPMDs. Therefore, we explored the possibility of adding a solid-phase extraction procedure by using pre-packed Bakerbond spe™ Glass Florisil® columns from J.T.

Baker of Phillipsburg, NJ. The columns are available with 500 mg of Florisil packed in the column to 2 g. The SPMD study conducted by Prest *et al.* (1995) used Florisil fractionation and also the Florisil method is outlined in EPA Method 1613-B.

We found that when using 500-mg Florisil® spe columns in conjunction with GPC, it is best to keep each SPMD as a single sample and then composite the samples as needed after cleanup. This cleanup step is illustrated in Figure 2.8.

FIGURE 2.8. Intermediate Cleanup Methods: GPC and Florisil®



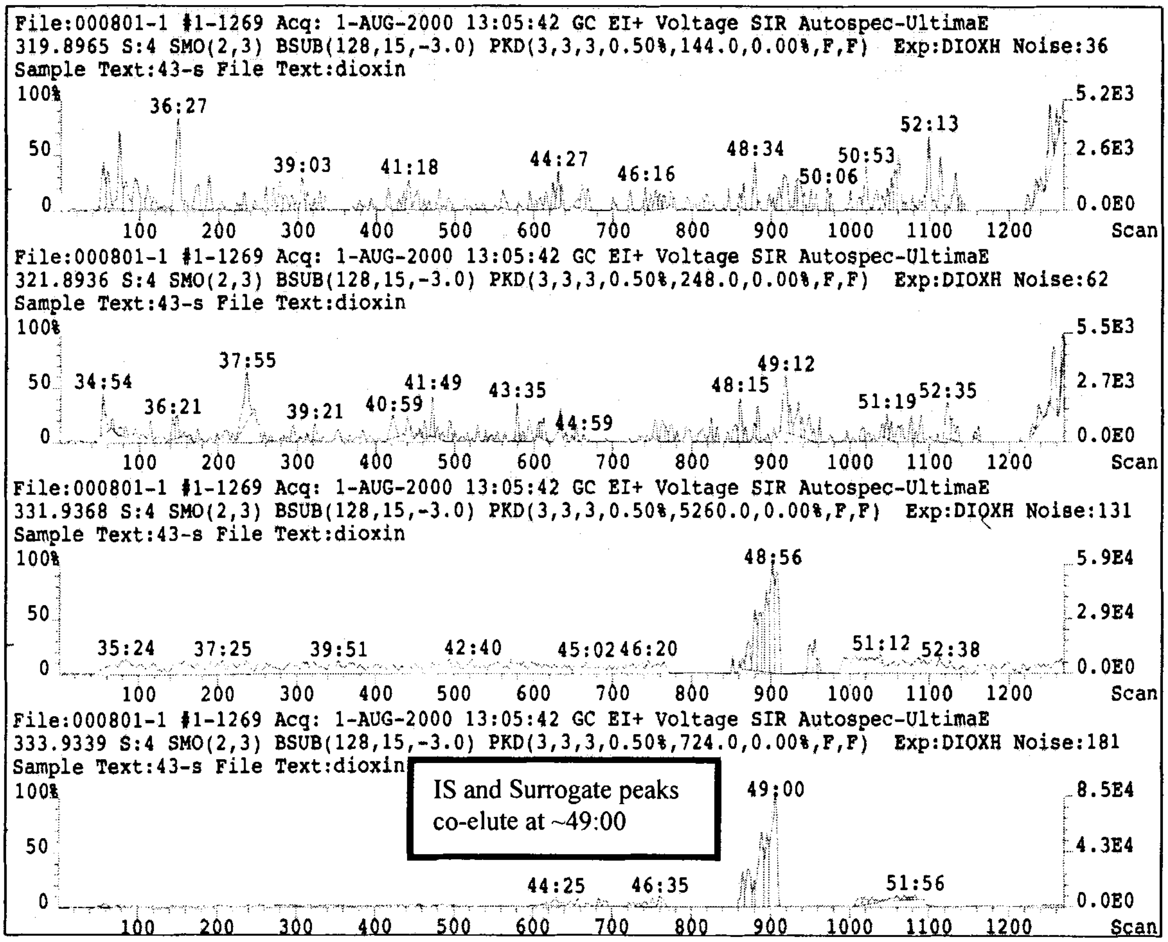
The lingering retention time shift even with the addition of the Florisil cleanup step fostered the need to alter the chromatographic techniques in order to quantify the SPMD results. Therese Anderson developed a set of two runs that could scan for the tetra-substituted through hexa-substituted dioxin congeners. These HRGC/HRMS runs were set up to scan for the desired ion fragments for longer periods of time, lengthening the windows for selective ion monitoring. This altered method did detect the peaks; however, only one lock mass was used and only one of the two masses, M, for each surrogate was monitored, compromising the integrity of peak identification as outlined in EPA Method 1613-B. For this reason, none of the 1999 field season data were quantifiable.

Process blanks from the Fig. 2.8 cleanup method, which were scanned by EPA methods on the HRGC/HRMS due to lack of triolein, revealed a substantial loss of the C-13 labeled OCDD surrogate: 50% to 70% less than the other surrogates in the cocktail. This occurrence was discussed with scientists at the Columbia Environmental Research Center in MO. It is possible that OCDD becomes sequestered in the Florisil SPE®, which would explain lower surrogate recoveries. This lower surrogate yield coupled with the still present retention time shift steered us back to the basics of the fish method used at the Mitchell Center. The SPMD symposium talks focused on the need to remove triolein reactively. The acidified silica gel column could replace Florisil®. However, we decided to try the acidified silica gel slurry since that was the method already used with fish sample cleanup (Figure 2.7). The trial was a success (Figure 2.9).

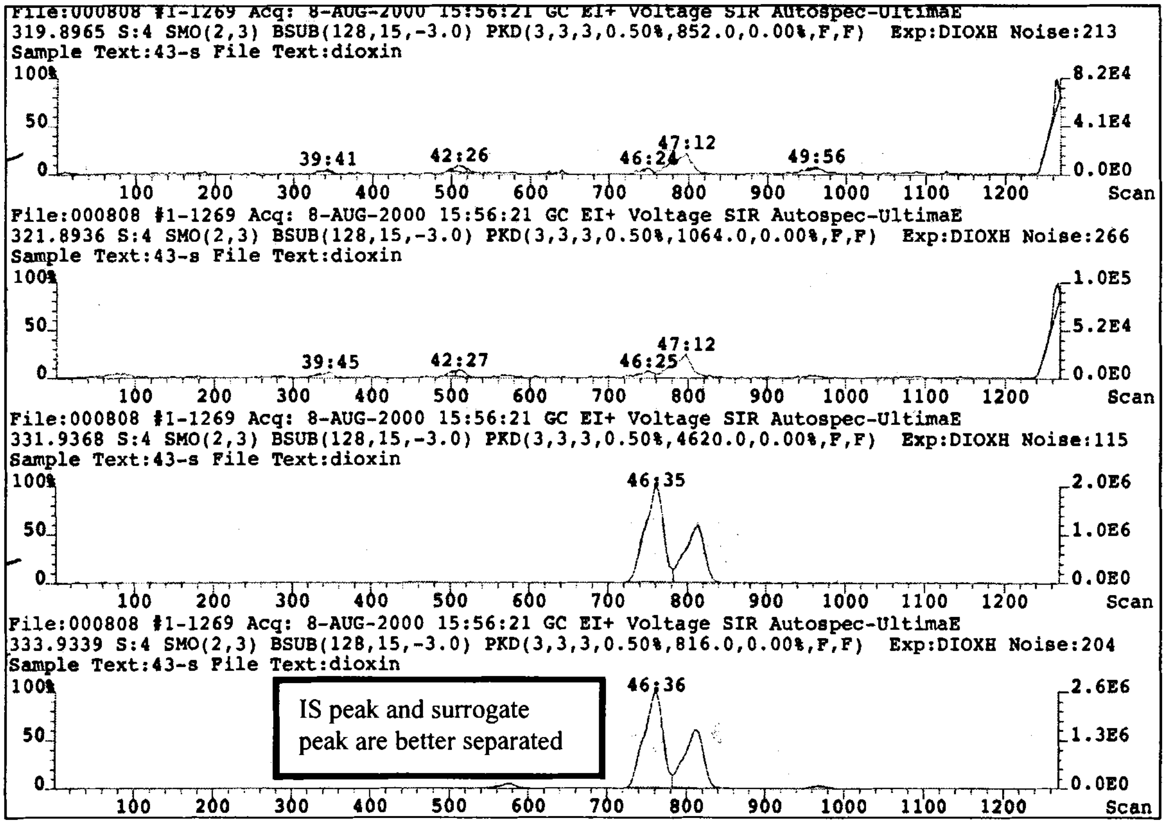
FIGURE 2.9. Before and After Chromatograms for the Acidified Silica Gel Slurry.

The two sets of chromatograms presented here each contain the four ions selected for 2,3,7,8-TCDD and C-13 labeled 2,3,7,8-TCDD. 319.8965 and 321.8936 are the two major ions for 2,3,7,8-TCDD while 331.9368 and 333.9339 are the two major ions for the internal standard C-13 1,2,3,4-TCDD internal standard and C-13 2,3,7,8-TCDD surrogate. The (b) chromatogram has less interference and smoother peaks.

(a) The TCDD window of a deployed SPMD sample run before silica gel cleanup



(b) The TCDD window of a deployed SPMD sample run after silica gel cleanup



*The chromatograms represent % abundance on left y-axis, abundance height on the right y-axis, and the x-axis goes by scan number which is smaller divisions of retention time. The retention times are indicated above the peaks.

Therefore, extraction followed by acidified silica gel slurry and high performance gel permeation chromatography cleanup achieved elimination of the retention time shift. However, diphenylether interferences still persist and may be addressed in further SPMD studies. These interferences were scanned and identified through EPA method 1613-B, allowing the actual dioxin peaks to be distinguished from the interferences in the furan windows.

Because the Gel Permeation Chromatograph malfunctioned before deployment two and four samples could be cleaned by this method, the chromatograms indicate the return of a retention time shift due to residual lipid. However, the target peaks remained in the defined chromatographic windows and positive identification of the compounds could still be made. Samples that visibly had a great deal of lipid after the silica gel slurry were put through a subsequent, small-scale silica gel cleanup in a test-tube.

2.4.4. Experimental design for objective 6: Method detection limit studies

2.4.4.1. Study one: Single SPMDs

Method detection limits (MDLs) vary among different environmental matrices used to sample dioxin. An important factor in determining an appropriate upstream-downstream test will be the varying MDLs among the methods. Our first study involved spiking seven SPMDs with surrogates and the seventeen native toxic dioxin congeners at concentrations equal to about three times the estimated detection limit of the instrument.

These SPMDs then went through the same processing steps as deployed SPMDs and the resulting dioxin concentrations recovered from the devices were quantified. Basic statistical parameters were calculated for the seven replicates including the mean,

standard deviation, and percent relative statistical difference (%RSD also known as coefficient of variation). The %RSD value is equal to the standard deviation divided by the mean then multiplied by 100. Statistically, the MDL for each congener is calculated by examining the reproducibility among the seven replicates. The 99% t-value is multiplied by the standard deviation of the replicates to calculate the MDL of the congener (40 CFR part 136).

2.4.4.2. Study two: Composites of two SPMDs

The MDL study was repeated with two SPMDs combined to form one sample. The same amount of dioxin was spiked in each composite as the first study. This study was initiated because many of the samples from the 2000 field season consisted of composites of two SPMDs in order to aid in detection and increase the sensitivity of the method. We wanted to test our hypothesis that as more SPMDs are combined to form one sample, the method detection limits decrease for all of the congeners.

3. RESULTS

The following sections of this chapter focus on each of the deployments of the 2000 field season. The concentrations of the seventeen toxic dioxin congeners were calculated for each sample and are provided in both graphical and tabular format. The results of the statistical analyses are also presented.

3.1 Research Objective 6: Method Detection Limit Studies

3.1.1. Study one: Single SPMDs

This method detection limit (MDL) study is the basis for the detection limits (DLs) presented in each of the dioxin concentration data tables. The MDLs and basic statistical parameters of mean, standard deviation, and percent relative statistical difference (%RSD also known as coefficient of variation) are provided for this MDL study in Table 3.1 on the following page.

TABLE 3.1. Method Detection Limit Study One: SPMD Concentrations (ng congener/kg SPMD)

One SPMD per sample												
Type of QC	**MDL**	**MDL**	**MDL**	**MDL**	**MDL**	**MDL**	**MDL**	**Mean**	**std. Dev**	**%RSD**	**MDL (ng/kg)**	**Rejected Pts.**
congener/sample ID	11-S	12-S	13-S	14-S	15-S	16-S	17-S	xbar	s	s/xbar	99% t *s	95% Q Test*
2,3,7,8-TCDF	2.34	2.35	1.78	2.06	1.93	2.30	0.90	2.13	0.24	11.25	0.80	17-S
1,2,3,7,8-PeCDF	11.42	9.21	8.32	9.30	8.32	7.79	8.06	8.50	0.62	7.27	2.08	11-S
2,3,4,7,8-PeCDF	10.51	9.47	10.03	8.63	7.81	8.29	8.44	9.03	1.00	11.03	3.13	
1,2,3,4,7,8-HxCDF	10.51	10.08	10.93	9.72	8.71	8.91	9.28	9.74	0.82	8.46	2.59	
1,2,3,6,7,8-HxCDF	10.81	9.94	10.01	9.52	9.38	8.37	8.98	9.57	0.78	8.19	2.46	
2,3,4,6,7,8-HxCDF	11.16	11.19	9.94	9.56	9.22	8.81	9.76	9.95	0.92	9.20	2.88	
1,2,3,7,8,9-HxCDF	10.42	10.56	10.91	10.58	9.57	9.50	10.43	10.28	0.54	5.22	1.68	
1,2,3,4,6,7,8-HpCDF	10.17	9.75	10.51	9.89	8.86	8.33	8.59	9.44	0.84	8.92	2.65	
1,2,3,4,7,8,9-HpCDF	9.85	10.38	9.36	9.44	9.52	9.01	8.94	9.50	0.50	5.24	1.56	
OCDF	27.51	20.13	18.59	15.43	15.86	20.62	18.12	18.13	2.14	11.79	7.18	11-S
2,3,7,8-TCDD	1.97	2.99	1.48	2.81	1.78	1.21	2.40	2.09	0.67	31.98	2.10	
1,2,3,7,8-PeCDD	10.94	9.72	10.28	8.84	10.00	9.38	10.27	9.92	0.68	6.88	2.14	
1,2,3,4,7,8-HxCDD	8.77	10.35	11.34	10.70	9.00	9.04	9.61	9.83	0.98	9.98	3.08	
1,2,3,6,7,8-HxCDD	11.07	10.50	11.20	10.33	10.40	8.96	10.78	10.71	0.36	3.40	1.22	16-S
1,2,3,7,8,9-HxCDD	12.92	13.40	14.19	10.11	12.96	12.86	14.94	13.54	0.85	6.25	2.84	14-S
1,2,3,4,6,7,8-HpCDD	10.61	9.80	9.69	9.99	9.20	8.24	9.74	9.61	0.74	7.66	2.31	
OCDD	21.63	24.98	23.69	23.49	20.90	19.62	25.29	22.80	2.13	9.36	6.70	
TEQ (<DL = 0)	26.85	26.06	25.52	23.98	23.50	22.26	25.04	24.82	2.45	9.88	7.74	
TEQ_{TP} (<DL = 0)	18.97	18.15	17.37	16.63	16.30	15.35	17.38	17.16	1.90	11.10	5.99	

*Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.

3.1.2. Study two: Composites of two SPMDs

The results of this study are provided in Table 3.2. It is important to note that this study was done when the gel permeation chromatograph was not operating and thus these samples did not go through the appropriate, full cleanup procedure. This is why these MDLs are not applied to the field sample results. Gel permeation chromatography eliminates many of the diphenyl ether interference that can hinder peak identification. It is recommended that this study be repeated in order to test the theory further.

TABLE 3.2. Method Detection Limit Study Two: SPMD Concentrations (ng congener/kg SPMD)

Two SPMDs per sample												
Type of QC	MDL	MDL	MDL	MDL	MDL	MDL	MDL	Mean	std. Dev	%RSD	MDL (ng/kg)	Rejected Pts.
congener/sample ID	110-S	111-S	112-S	113-S	114-S	115-S	116-S	xbar	s	s/xbar	99% t * s	95% Q Test*
2,3,7,8-TCDF	0.88	1.81	1.64	4.40	1.38	2.06	0.59	1.39	0.56	40.34	1.89	113-S
1,2,3,7,8-PeCDF	6.10	6.04	6.52	12.17	6.15	11.20	6.76	6.31	0.31	4.96	1.18	113-S, 115-S
2,3,4,7,8-PeCDF	9.37	6.81	6.25	9.73	9.60	12.45	7.54	8.82	2.13	24.15	6.69	
1,2,3,4,7,8-HxCDF	5.67	5.56	6.89	7.17	12.09	11.40	7.34	6.53	0.84	12.94	3.17	114-S, 115-S
1,2,3,6,7,8-HxCDF	6.91	5.94	5.83	7.40	11.24	12.69	6.72	6.56	0.67	10.18	2.50	114-S, 115-S
2,3,4,6,7,8-HxCDF	7.93	6.38	6.58	13.38	15.26	13.22	7.15	7.01	0.69	9.88	3.14	113-S, 114-S, 115-S
1,2,3,7,8,9-HxCDF	10.29	6.49	8.46	18.47	17.00	18.13	10.36	8.90	1.83	20.56	8.31	113-S, 114-S, 115-S
1,2,3,4,6,7,8-HpCDF	6.87	6.42	6.92	13.58	17.95	12.84	8.00	7.05	0.67	9.45	3.03	113-S, 114-S, 115-S
1,2,3,4,7,8,9-HpCDF	8.10	8.45	7.19	19.34	10.11	13.78	7.02	7.69	0.70	9.05	3.16	113-S, 114-S, 115-S
OCDF	15.40	20.33	13.01	61.34	25.27	27.01	14.21	15.74	3.21	20.41	14.58	113-S, 114-S, 115-S
2,3,7,8-TCDD	1.77	0.96	1.61	5.25	2.97	2.32	0.25	1.65	0.96	58.54	3.24	113-S
1,2,3,7,8-PeCDD	7.96	4.21	5.17	34.99	20.29	10.74	6.65	6.94	2.56	36.84	9.59	113-S, 114-S
1,2,3,4,7,8-HxCDD	13.13	18.10	7.43	73.92	25.35	11.95	12.58	14.76	6.20	42.03	20.84	113-S
1,2,3,6,7,8-HxCDD	6.80	8.27	5.80	14.05	14.04	13.16	5.66	6.63	1.21	18.18	5.47	113-S, 114-S, 115-S
1,2,3,7,8,9-HxCDD	11.45	6.89	8.39	43.51	15.05	14.74	7.45	8.54	2.03	23.78	9.22	113-S, 114-S, 115-S
1,2,3,4,6,7,8-HpCDD	13.99	25.47	6.78	65.21	31.83	12.43	9.49	10.67	3.20	29.95	14.51	111-S, 113-S, 114-S
OCDD	12.21	45.97	13.33	71.96	28.95	22.75	22.99	20.05	7.10	35.42	26.63	111-S, 113-S
TEQ (<DL = 0)	21.32	15.22	15.54	64.94	40.11	29.98	17.04	19.61	6.05	30.87	21.90	
TEQ_{TP} (<DL = 0)	14.81	9.05	10.39	46.16	28.50	20.06	11.07	13.46	4.66	34.63	16.43	

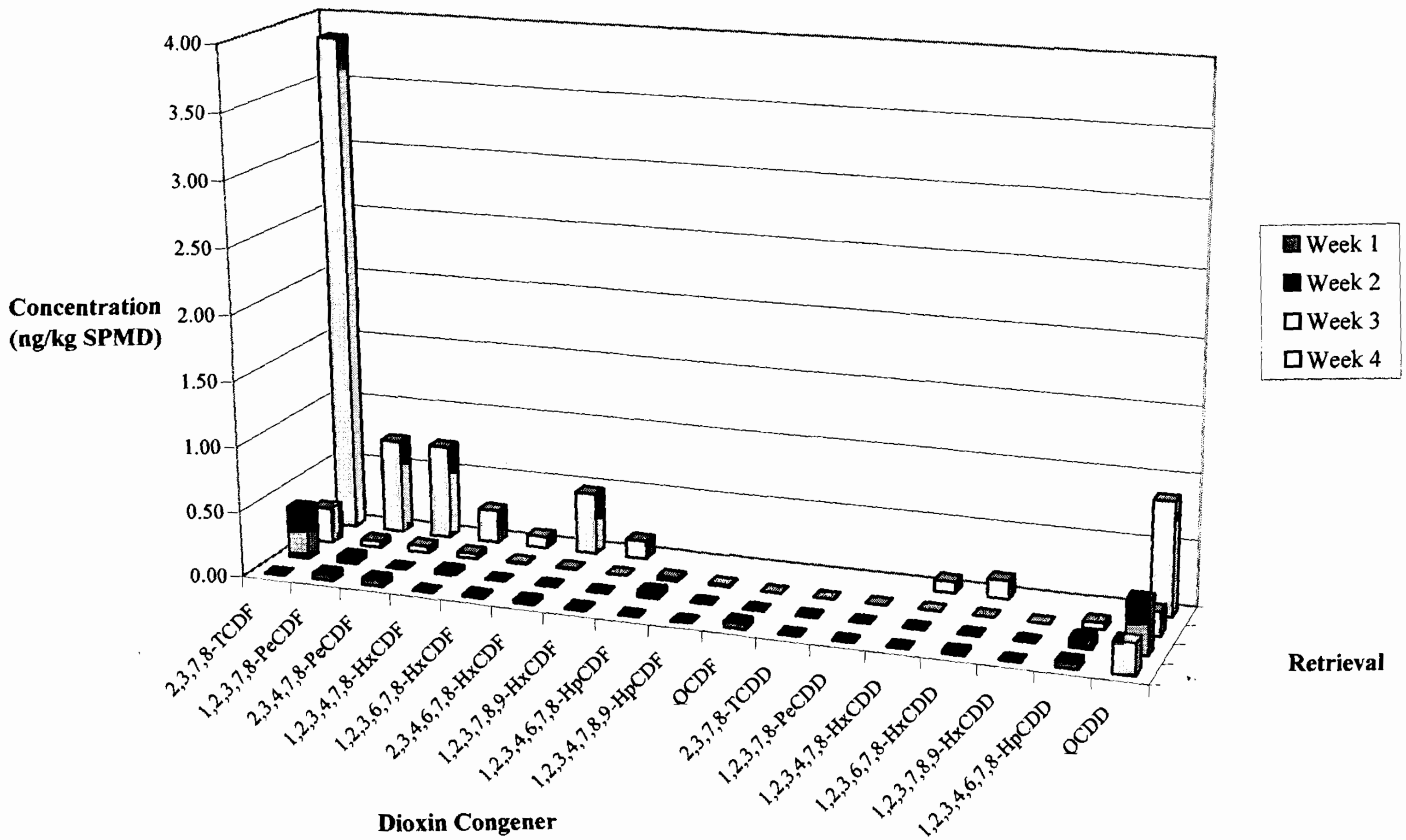
*Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.

3.2 Research Objective 3: Deployment Time Studies

3.2.1. Deployment one: June 2 to June 30, 2000

The data are presented in Figure 3.1. The x-axis features each of the seventeen toxic dioxin congeners, the y-axis features each retrieval week, and the z-axis features the concentration of the dioxin congener in nanograms per kilogram of whole SPMD. A general increase in dioxin levels is demonstrated by the figure. The fluctuations between weeks two and three could be generated by the small sample size of n=1 and a general increasing trend can be discerned since the week four data points are reinforced with an n=5. Figure 3.1 was created by assuming that those congeners not detected were at a concentration of zero.

Figure 3.1. SPMD Concentrations from the Four Weeks of Deployment One, Androscoggin River, ME. Concentrations are provided as nanograms per kilogram of SPMD to create uniformity among the weeks. The absence of a bar on the graph indicates that the congener was not detected. The mean concentrations are provided for week 4 (n=5) and the mean was calculated under the assumption that those congeners present at less than the detection limit were a concentration of zero.



There are three different ways to treat the data for each deployment. Tables 3.3 through 3.5 each provide all six TEQ values described in the methods chapter and the SPMD concentrations for all seventeen toxic congeners. Their differences lie in the way the <DL congeners were used in the statistical analyses: Table 3.3 assigns the <DL congeners with zero concentrations; Table 3.4 assigns them half the detection limit concentration; and Table 3.5 assigns them the detection limit concentration. In tables 3.3 to 3.5, several parameters are presented for week 4 replicates: 1. The standard deviation, 2. The 95% confidence intervals using the student t-value along with the standard deviation (Harris 1995), and 3. The percent relative statistical difference (%RSD) which provides the ratio of the standard deviation to the mean. EPA methods call for the %RSD among replicates to generally be less than 25 to 30%.

TABLE 3.3. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment One: <DL = 0 for Statistics

	DL	Week 1	Week 2	Week 3	Week 4, N=5									Data Flags
congener/sample ID	(ng/kg)	19-S	27-S	34-S	42-S	43-S	44-S	45-S	46-S	Mean	Std Dev	95% CI	% RSD	
2,3,7,8-TCDF	0.80	<DL	0.39	0.27	2.65	1.93	4.81	5.41	4.40	3.84	1.48	1.84	38.65	S
1,2,3,7,8-PeCDF	2.08	0.05	0.05	0.05	<DL	0.73	0.80	1.26	0.84	0.73	0.24	0.30	32.82	S
2,3,4,7,8-PeCDF	3.13	0.05	<DL	0.05	0.43	0.82	0.77	0.92	0.65	0.72	0.19	0.23	26.07	S
1,2,3,4,7,8-HxCDF	2.59	<DL	0.03	0.04	0.25	<DL	0.36	0.65	<DL	0.25	0.21	0.26	81.92	
1,2,3,6,7,8-HxCDF	2.46	0.02	<DL	0.01	<DL	0.25	0.19	<DL	<DL	0.09	0.04	0.05	47.42	
2,3,4,6,7,8-HxCDF	2.88	0.02	<DL	0.01	<DL	0.63	0.76	0.67	0.27	0.47	0.21	0.27	45.71	
1,2,3,7,8,9-HxCDF	1.68	0.01	<DL	<DL	<DL	<DL	<DL	0.50	0.19	0.14	0.22	0.27	158.29	
1,2,3,4,6,7,8-HpCDF	2.65	<DL	0.05	0.02	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	0.01	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	S
OCDF	7.18	0.05	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	S
1,2,3,4,7,8-HxCDD	3.08	<DL	<DL	<DL	<DL	<DL	<DL	0.43	<DL	0.09	NA	NA	NA	
1,2,3,6,7,8-HxCDD	1.22	0.02	<DL	<DL	<DL	<DL	<DL	0.70	<DL	0.14	NA	NA	NA	
1,2,3,7,8,9-HxCDD	2.84	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	
1,2,3,4,6,7,8-HpCDD	2.31	0.04	0.07	0.05	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	
OCDD	6.70	0.24	0.40	0.18	<DL	2.19	<DL	<DL	2.13	0.86	0.04	0.05	4.87	S
TEQ (<DL = 0)	NA	0.03	0.05	0.06	0.51	0.73	1.04	1.36	0.85	0.90	0.32	0.40	35.99	
TEQ (<DL = 0.5DL)	NA	2.64	3.66	2.62	3.42	3.45	3.63	3.78	3.62	3.58	0.15	0.18	4.08	
TEQ (<DL = DL)	NA	5.25	7.29	5.19	6.34	6.18	6.23	6.20	6.38	6.27	0.09	0.11	1.42	
TEQ_{TP} (<DL = 0)	NA	0.03	0.04	0.05	0.48	0.64	0.91	1.06	0.81	0.78	0.23	0.28	29.12	
TEQ_{TP} (<DL = 0.5DL)	NA	2.19	2.94	2.17	2.65	2.76	3.03	3.18	2.93	2.91	0.21	0.26	7.23	
TEQ_{TP} (<DL = DL)	NA	4.35	5.85	4.30	4.83	4.89	5.15	5.31	5.05	5.05	0.20	0.24	3.87	

NOTES

NA = Not Applicable
DL = Detection Limits
S = surrogate levels above or below EPA Method 1613B recovery range
Means are calculated with <DL having a zero concentration.
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid).
Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.
Values less than the MDLs are to be considered estimated values.

TABLE 3.4. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment One: <DL = 0.5*DL for Statistics

	DL	Week 1	Week 2	Week 3	Week 4, N=5								
congener/sample ID	(ng/Kg)	19-S	27-S	34-S	42-S	43-S	44-S	45-S	46-S	Mean	Std Dev	95% CI	% RSD
2,3,7,8-TCDF	0.80	0.40	0.39	0.27	2.65	1.93	4.81	5.41	4.40	3.84	1.48	1.84	38.65
1,2,3,7,8-PeCDF	2.08	0.05	0.05	0.05	1.04	0.73	0.80	1.26	0.84	0.94	0.21	0.27	22.96
2,3,4,7,8-PeCDF	3.13	0.05	1.56	0.05	0.43	0.82	0.77	0.92	0.65	0.72	0.19	0.23	26.07
1,2,3,4,7,8-HxCDF	2.59	1.29	0.03	0.04	0.25	1.29	0.36	0.65	1.29	0.77	0.50	0.62	65.04
1,2,3,6,7,8-HxCDF	2.46	0.02	1.23	0.01	1.23	0.25	0.19	1.23	1.23	0.83	0.55	0.69	67.25
2,3,4,6,7,8-HxCDF	2.88	0.02	1.44	0.01	1.44	0.63	0.76	0.67	0.27	0.76	0.42	0.53	56.16
1,2,3,7,8,9-HxCDF	1.68	0.01	0.84	0.84	0.84	0.84	0.84	0.50	0.19	0.64	0.29	0.36	45.55
1,2,3,4,6,7,8-HpCDF	2.65	1.32	0.05	0.02	1.32	1.32	1.32	1.32	1.32	1.32	0.00	0.00	0.00
1,2,3,4,7,8,9-HpCDF	1.56	0.78	0.78	0.01	0.78	0.78	0.78	0.78	0.78	0.78	0.00	0.00	0.00
OCDF	7.18	0.05	3.59	3.59	3.59	3.59	3.59	3.59	3.59	3.59	0.00	0.00	0.00
2,3,7,8-TCDD	2.10	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.00	0.00	0.00
1,2,3,7,8-PeCDD	2.14	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	0.00	0.00	0.00
1,2,3,4,7,8-HxCDD	3.08	1.54	1.54	1.54	1.54	1.54	1.54	0.43	1.54	1.32	0.49	0.61	37.48
1,2,3,6,7,8-HxCDD	1.22	0.02	0.61	0.61	0.61	0.61	0.61	0.70	0.61	0.63	0.04	0.05	6.40
1,2,3,7,8,9-HxCDD	2.84	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	0.00	0.00	0.00
1,2,3,4,6,7,8-HpCDD	2.31	0.04	0.07	0.05	1.16	1.16	1.16	1.16	1.16	1.16	0.00	0.00	0.00
OCDD	6.70	0.24	0.40	0.18	3.35	2.19	3.35	3.35	2.13	2.87	0.65	0.81	22.66
TEQ (<DL = 0)	NA	0.03	0.05	0.06	0.51	0.73	1.04	1.36	0.85	0.90	0.32	0.40	35.99
TEQ (<DL = 0.5DL)	NA	2.64	3.66	2.62	3.42	3.45	3.63	3.78	3.62	3.58	0.15	0.18	4.08
TEQ (<DL = DL)	NA	5.25	7.29	5.19	6.34	6.18	6.23	6.20	6.38	6.27	0.09	0.11	1.42
TEQ_{TP} (<DL = 0)	NA	0.03	0.04	0.05	0.48	0.64	0.91	1.06	0.81	0.78	0.23	0.28	29.12
TEQ_{TP} (<DL = 0.5DL)	NA	2.19	2.94	2.17	2.65	2.76	3.03	3.18	2.93	2.91	0.21	0.26	7.23
TEQ_{TP} (<DL = DL)	NA	4.35	5.85	4.30	4.83	4.89	5.15	5.31	5.05	5.05	0.20	0.24	3.87

NOTES

NA = Not Applicable

DL = Detection Limits

Means are calculated with <DL having 0.5*DL concentrations.

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.

Values less than the MDLs are to be considered estimated values.

TABLE 3.5. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment One: <DL = DL for Statistics

	DL	Week 1	Week 2	Week 3	Week 4, N=5								
congener/sample ID	(ng/kg)	19-S	27-S	34-S	42-S	43-S	44-S	45-S	46-S	Mean	Std Dev	95% CI	% RSD
2,3,7,8-TCDF	0.80	0.80	0.39	0.27	2.65	1.93	4.81	5.41	4.40	3.84	1.48	1.84	38.65
1,2,3,7,8-PeCDF	2.08	0.05	0.05	0.05	2.08	0.73	0.80	1.26	0.84	1.14	0.56	0.70	49.15
2,3,4,7,8-PeCDF	3.13	0.05	3.13	0.05	0.43	0.82	0.77	0.92	0.65	0.72	0.19	0.23	26.07
1,2,3,4,7,8-HxCDF	2.59	2.59	0.03	0.04	0.25	2.59	0.36	0.65	2.59	1.29	1.20	1.48	92.96
1,2,3,6,7,8-HxCDF	2.46	0.02	2.46	0.01	2.46	0.25	0.19	2.46	2.46	1.56	1.23	1.53	78.59
2,3,4,6,7,8-HxCDF	2.88	0.02	2.88	0.01	2.88	0.63	0.76	0.67	0.27	1.04	1.04	1.29	99.75
1,2,3,7,8,9-HxCDF	1.68	0.01	1.68	1.68	1.68	1.68	1.68	0.50	0.19	1.15	0.74	0.92	64.53
1,2,3,4,6,7,8-HpCDF	2.65	2.65	0.05	0.02	2.65	2.65	2.65	2.65	2.65	2.65	0.00	0.00	0.00
1,2,3,4,7,8,9-HpCDF	1.56	1.56	1.56	0.01	1.56	1.56	1.56	1.56	1.56	1.56	0.00	0.00	0.00
OCDF	7.18	0.05	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	0.00	0.00	0.00
2,3,7,8-TCDD	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00
1,2,3,7,8-PeCDD	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	0.00	0.00	0.00
1,2,3,4,7,8-HxCDD	3.08	3.08	3.08	3.08	3.08	3.08	3.08	0.43	3.08	2.55	1.18	1.47	46.38
1,2,3,6,7,8-HxCDD	1.22	0.02	1.22	1.22	1.22	1.22	1.22	0.70	1.22	1.12	0.23	0.29	20.92
1,2,3,7,8,9-HxCDD	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	0.00	0.00	0.00
1,2,3,4,6,7,8-HpCDD	2.31	0.04	0.07	0.05	2.31	2.31	2.31	2.31	2.31	2.31	0.00	0.00	0.00
OCDD	6.70	0.24	0.40	0.18	6.70	2.19	6.70	6.70	2.13	4.88	2.49	3.09	50.89
TEQ (<DL = 0)	NA	0.03	0.05	0.06	0.51	0.73	1.04	1.36	0.85	0.90	0.32	0.40	35.99
TEQ (<DL = 0.5DL)	NA	2.64	3.66	2.62	3.42	3.45	3.63	3.78	3.62	3.58	0.15	0.18	4.08
TEQ (<DL = DL)	NA	5.25	7.29	5.19	6.34	6.18	6.23	6.20	6.38	6.27	0.09	0.11	1.42
TEQ_{TP} (<DL = 0)	NA	0.03	0.04	0.05	0.48	0.64	0.91	1.06	0.81	0.78	0.23	0.28	29.12
TEQ_{TP} (<DL = 0.5DL)	NA	2.19	2.94	2.17	2.65	2.76	3.03	3.18	2.93	2.91	0.21	0.26	7.23
TEQ_{TP} (<DL = DL)	NA	4.35	5.85	4.30	4.83	4.89	5.15	5.31	5.05	5.05	0.20	0.24	3.87

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having DL concentrations.**

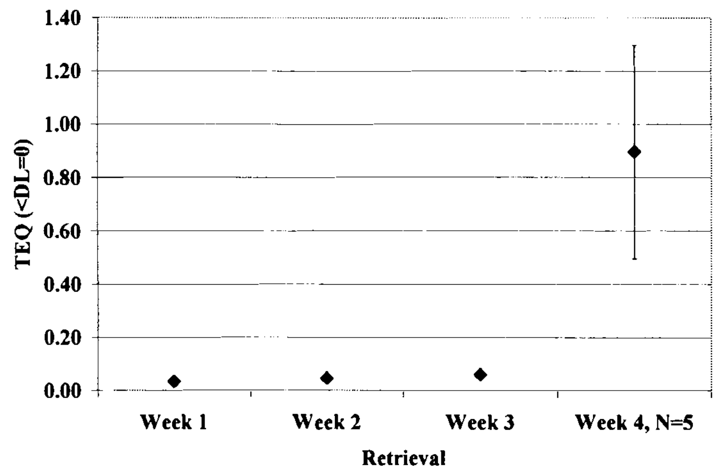
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.

Values less than the MDLs are to be considered estimated values.

The trends in Figure 3.1 are not uniform among all of the seventeen congeners. Therefore, in order to compare the dioxin concentrations in the field sample mixtures, the toxic equivalency (TEQ) is used. A general increase in TEQ levels over the four week period with the TEQ (<DL=0) on the y-axis and the retrieval on the x-axis (Figure 3.2). The y-axis error bar on week 4 indicates the 95% confidence interval for the five replicates.

FIGURE 3.2. TEQ (<DL=0) over the 4-Week Deployment One Period. With exception to the TEQ_{TP} (<DL=0), this was the only TEQ method where an increase occurred over the 28-day deployment period.



3.2.2. Deployment two: June 30 to July 28, 2000

Figure 3.3 has been assembled just as Figure 3.1 for comparative purposes. The only difference is that the scale of the z-axis, dioxin concentration, is from 0 to 4 in Figure 3.1 while it ranges from 0 to 20 in Figure 3.2. Thus, it is important to note the jump in dioxin concentrations detected by the devices: July levels more than doubling the June levels in 2,3,7,8-TCDF. Just as for the first deployment, Tables 3.6 through 3.8 provide the data from this deployment. Figure 3.3 was generated from Table 3.6 data (<DL = 0).

Figure 3.3. SPMD Concentrations from the Four Weeks of Deployment Two, Androscoggin River, ME. Concentrations are provided as nanograms per kilogram of SPMD to create uniformity among the weeks. The absence of a bar on the graph indicates that the congener was not detected. The mean concentrations are provided for week 4 (n=5) and the mean was calculated under the assumption that those congeners present at less than the detection limit were a concentration of zero.

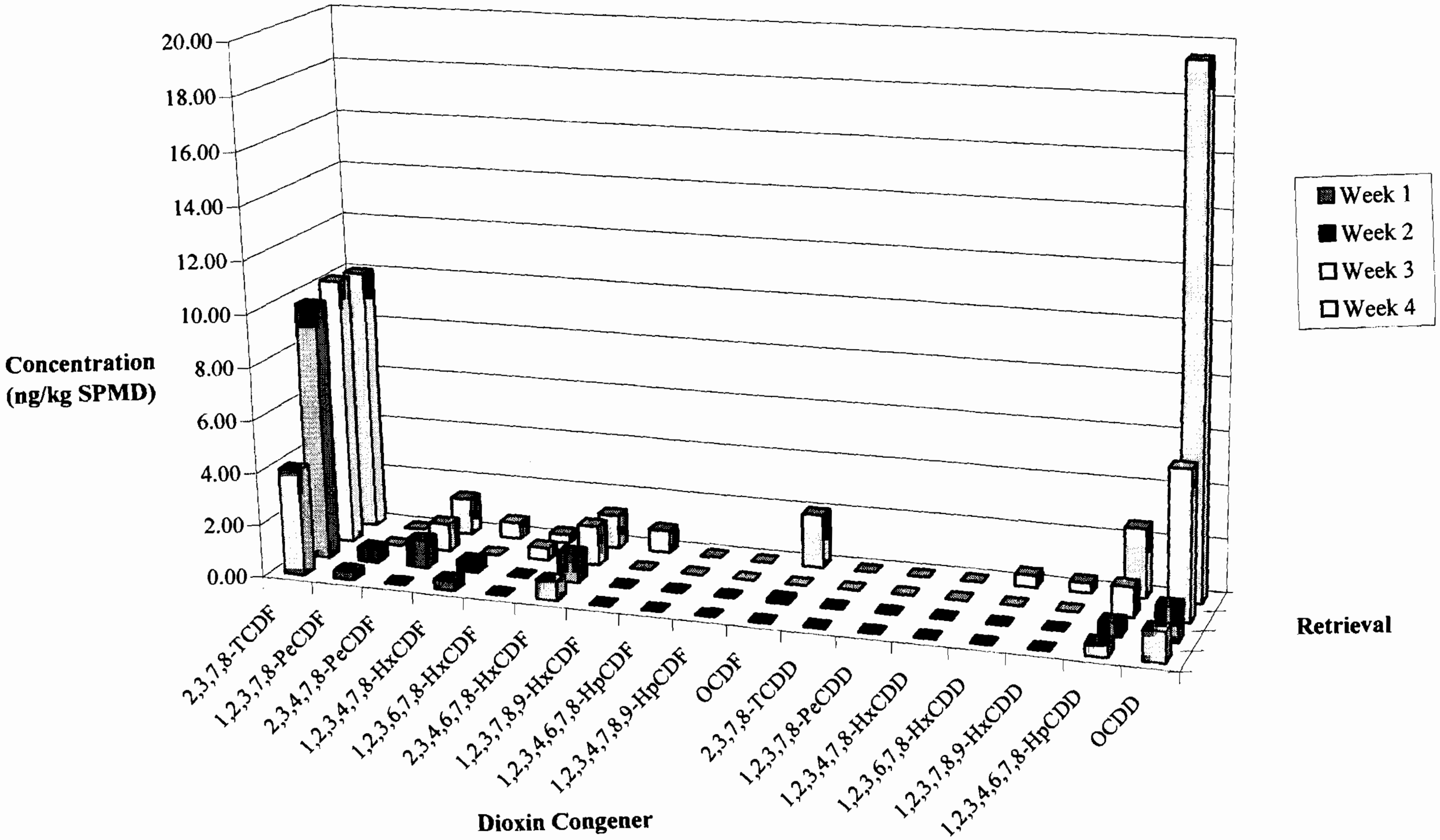


TABLE 3.6. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Two: <DL = 0 for Statistics

	DL	Week 1	Week 2	Week 3	Week 4, N=5										Data Flags
congener/sample ID	(ng/kg)	49-S	52-S	56-S	60-S	61-S	62-S	63-S	64-S	Mean	Std Dev	95% CI	% RSD	Rejected*	
2,3,7,8-TCDF	0.80	4.04	9.79	10.20	9.75	10.42	7.30	12.37	10.01	9.97	1.81	2.25	18.20		
1,2,3,7,8-PeCDF	2.08	0.31	0.53	<DL	<DL	1.81	<DL	<DL	<DL	0.36	NA	NA	NA		
2,3,4,7,8-PeCDF	3.13	<DL	1.05	1.04	1.15	<DL	<DL	4.36	1.38	0.63	0.16	0.20	25.93	63-S	
1,2,3,4,7,8-HxCDF	2.59	0.37	0.42	<DL	0.63	0.82	0.51	<DL	0.61	0.65	NA	NA	NA		S
1,2,3,6,7,8-HxCDF	2.46	<DL	<DL	0.46	<DL	<DL	<DL	<DL	0.32	0.32	NA	NA	NA		
2,3,4,6,7,8-HxCDF	2.88	0.72	1.09	1.49	1.13	1.44	1.42	3.87	1.27	1.31	0.14	0.18	10.93	63-S	S
1,2,3,7,8,9-HxCDF	1.68	<DL	<DL	<DL	0.45	<DL	0.66	4.52	0.84	0.49	0.20	0.25	40.72	63-S	
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		S
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	<DL	0.29	<DL	<DL	4.77	<DL	0.07	NA	NA	NA	63-S	
OCDF	7.18	<DL	0.14	<DL	1.10	<DL	1.73	5.41	2.02	1.21	0.47	0.59	39.01	63-S	
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,4,7,8-HxCDD	3.08	<DL	<DL	<DL	<DL	0.49	0.31	1.95	<DL	0.20	0.12	0.15	60.44	63-S	S
1,2,3,6,7,8-HxCDD	1.22	<DL	<DL	<DL	<DL	0.84	<DL	3.49	0.45	0.32	0.28	0.34	85.82	63-S	S
1,2,3,7,8,9-HxCDD	2.84	<DL	<DL	<DL	<DL	0.79	0.51	3.14	0.38	0.42	0.21	0.26	50.16	63-S	
1,2,3,4,6,7,8-HpCDD	2.31	0.45	0.51	1.12	1.63	2.28	3.25	5.31	2.59	3.01	1.41	1.75	46.84		S
OCDD	6.70	1.13	1.29	5.60	9.17	11.53	19.35	14.41	19.49	14.79	4.62	5.73	31.21		S
TEQ (<DL = 0)	NA	0.53	1.69	1.75	1.79	1.59	1.11	1.29	2.11	1.58	0.40	0.49	25.20		
TEQ (<DL = 0.5DL)	NA	4.02	4.39	4.51	4.46	4.72	4.27	7.65	4.46	5.11	1.43	1.78	27.99		
TEQ (<DL = DL)	NA	7.51	7.10	7.28	7.13	7.86	7.43	6.17	6.81	7.08	0.64	0.79	9.03		
TEQ_{TP} (<DL = 0)	NA	0.42	1.53	1.54	1.55	1.13	0.73	1.24	1.69	1.27	0.38	0.47	29.73		
TEQ_{TP} (<DL = 0.5DL)	NA	3.32	3.65	3.71	3.72	4.04	3.68	5.59	3.86	4.18	0.80	0.99	19.14		
TEQ_{TP} (<DL = DL)	NA	6.23	5.78	5.89	5.90	6.94	6.64	5.59	6.04	6.22	0.56	0.69	8.94		

NOTES

NA = Not Applicable
DL = Detection Limits.
S = surrogate levels above or below EPA Method 1613B recovery range
Means are calculated with <DL having a zero concentration.
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)
***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**
Values less than the MDLs are to be considered estimated values.

TABLE 3.7. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Two: <DL = 0.5*DL for Statistics

	DL	Week 1	Week 2	Week 3	Week 4, N=5									
congener/sample ID	(ng/Kg)	49-S	52-S	56-S	60-S	61-S	62-S	63-S	64-S	Mean	Std Dev	95% CI	% RSD	Rejected*
2,3,7,8-TCDF	0.80	4.04	9.79	10.20	9.75	10.42	7.30	12.37	10.01	9.97	1.81	2.25	18.20	
1,2,3,7,8-PeCDF	2.08	0.31	0.53	1.04	1.04	1.81	1.04	1.04	1.04	1.19	0.35	0.43	29.03	
2,3,4,7,8-PeCDF	3.13	1.56	1.05	1.04	1.15	1.56	1.56	4.36	1.38	1.42	0.20	0.24	13.85	63-S
1,2,3,4,7,8-HxCDF	2.59	0.37	0.42	1.29	0.63	0.82	0.51	1.29	0.61	0.78	0.31	0.39	40.12	
1,2,3,6,7,8-HxCDF	2.46	1.23	1.23	0.46	1.23	1.23	1.23	1.23	0.32	1.05	0.41	0.50	38.77	
2,3,4,6,7,8-HxCDF	2.88	0.72	1.09	1.49	1.13	1.44	1.42	3.87	1.27	1.31	0.14	0.18	10.93	63-S
1,2,3,7,8,9-HxCDF	1.68	0.84	0.84	0.84	0.45	0.84	0.66	4.52	0.84	0.70	0.19	0.23	26.98	63-S
1,2,3,4,6,7,8-HpCDF	2.65	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	0.78	0.78	0.78	0.29	0.78	0.78	4.77	0.78	0.66	0.25	0.31	37.49	63-S
OCDF	7.18	3.59	0.14	3.59	1.10	3.59	1.73	5.41	2.02	2.11	1.06	1.31	50.18	63-S
2,3,7,8-TCDD	2.10	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDD	3.08	1.54	1.54	1.54	1.54	0.49	0.31	1.95	1.54	0.97	0.66	0.82	68.21	63-S
1,2,3,6,7,8-HxCDD	1.22	0.61	0.61	0.61	0.61	0.84	0.61	3.49	0.45	0.63	0.16	0.20	25.60	63-S
1,2,3,7,8,9-HxCDD	2.84	1.42	1.42	1.42	1.42	0.79	0.51	3.14	0.38	0.77	0.46	0.58	60.08	63-S
1,2,3,4,6,7,8-HpCDD	2.31	0.45	0.51	1.12	1.63	2.28	3.25	5.31	2.59	3.01	1.41	1.75	46.84	
OCDD	6.70	1.13	1.29	5.60	9.17	11.53	19.35	14.41	19.49	14.79	4.62	5.73	31.21	
TEQ (<DL = 0)	NA	0.53	1.69	1.75	1.79	1.59	1.11	1.29	2.11	1.58	0.40	0.49	25.20	
TEQ (<DL = 0.5DL)	NA	4.02	4.39	4.51	4.46	4.72	4.27	7.65	4.46	5.11	1.43	1.78	27.99	
TEQ (<DL = DL)	NA	7.51	7.10	7.28	7.13	7.86	7.43	6.17	6.81	7.08	0.64	0.79	9.03	
TEQ_{TP} (<DL = 0)	NA	0.42	1.53	1.54	1.55	1.13	0.73	1.24	1.69	1.27	0.38	0.47	29.73	
TEQ_{TP} (<DL = 0.5DL)	NA	3.32	3.65	3.71	3.72	4.04	3.68	5.59	3.86	4.18	0.80	0.99	19.14	
TEQ_{TP} (<DL = DL)	NA	6.23	5.78	5.89	5.90	6.94	6.64	5.59	6.04	6.22	0.56	0.69	8.94	

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having 0.5*DL concentrations.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

TABLE 3.8. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Two: <DL = DL for Statistics

	DL	Week 1	Week 2	Week 3	Week 4, N=5									
congener/sample ID	(ng/kg)	49-S	52-S	56-S	60-S	61-S	62-S	63-S	64-S	Mean	Std Dev	95% CI	% RSD	Rejected*
2,3,7,8-TCDF	0.80	4.04	9.79	10.20	9.75	10.42	7.30	12.37	10.01	9.97	1.81	2.25	18.20	
1,2,3,7,8-PeCDF	2.08	0.31	0.53	2.08	2.08	1.81	2.08	2.08	2.08	2.02	0.12	0.15	5.83	
2,3,4,7,8-PeCDF	3.13	3.13	1.05	1.04	1.15	3.13	3.13	4.36	1.38	2.20	1.34	1.67	61.15	63-S
1,2,3,4,7,8-HxCDF	2.59	0.37	0.42	2.59	0.63	0.82	0.51	2.59	0.61	1.03	0.88	1.09	84.65	
1,2,3,6,7,8-HxCDF	2.46	2.46	2.46	0.46	2.46	2.46	2.46	2.46	0.32	2.03	0.96	1.19	47.07	
2,3,4,6,7,8-HxCDF	2.88	0.72	1.09	1.49	1.13	1.44	1.42	3.87	1.27	1.31	1.15	1.43	87.50	63-S
1,2,3,7,8,9-HxCDF	1.68	1.68	1.68	1.68	0.45	1.68	0.66	4.52	0.84	0.91	1.68	2.09	185.07	63-S
1,2,3,4,6,7,8-HpCDF	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	1.56	1.56	1.56	0.29	1.56	1.56	4.77	1.56	1.24	1.67	2.08	134.45	63-S
OCDF	7.18	7.18	0.14	7.18	1.10	7.18	1.73	5.41	2.02	3.01	2.66	3.30	88.39	63-S
2,3,7,8-TCDD	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDD	3.08	3.08	3.08	3.08	3.08	0.49	0.31	1.95	3.08	1.74	1.35	1.67	77.27	63-S
1,2,3,6,7,8-HxCDD	1.22	1.22	1.22	1.22	1.22	0.84	1.22	3.49	0.45	0.93	1.19	1.48	127.48	63-S
1,2,3,7,8,9-HxCDD	2.84	2.84	2.84	2.84	2.84	0.79	0.51	3.14	0.38	1.13	1.34	1.67	119.16	63-S
1,2,3,4,6,7,8-HpCDD	2.31	0.45	0.51	1.12	1.63	2.28	3.25	5.31	2.59	3.01	1.41	1.75	46.84	
OCDD	6.70	1.13	1.29	5.60	9.17	11.53	19.35	14.41	19.49	14.79	4.62	5.73	31.21	
TEQ (<DL = 0)	NA	0.53	1.69	1.75	1.79	1.59	1.11	1.29	2.11	1.58	0.40	0.49	25.20	
TEQ (<DL = 0.5DL)	NA	4.02	4.39	4.51	4.46	4.72	4.27	7.65	4.46	5.11	1.43	1.78	27.99	
TEQ (<DL = DL)	NA	7.51	7.10	7.28	7.13	7.86	7.43	6.17	6.81	7.08	0.64	0.79	9.03	
TEQ_{TP} (<DL = 0)	NA	0.42	1.53	1.54	1.55	1.13	0.73	1.24	1.69	1.27	0.38	0.47	29.73	
TEQ_{TP} (<DL = 0.5DL)	NA	3.32	3.65	3.71	3.72	4.04	3.68	5.59	3.86	4.18	0.80	0.99	19.14	
TEQ_{TP} (<DL = DL)	NA	6.23	5.78	5.89	5.90	6.94	6.64	5.59	6.04	6.22	0.56	0.69	8.94	

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having DL concentrations.**

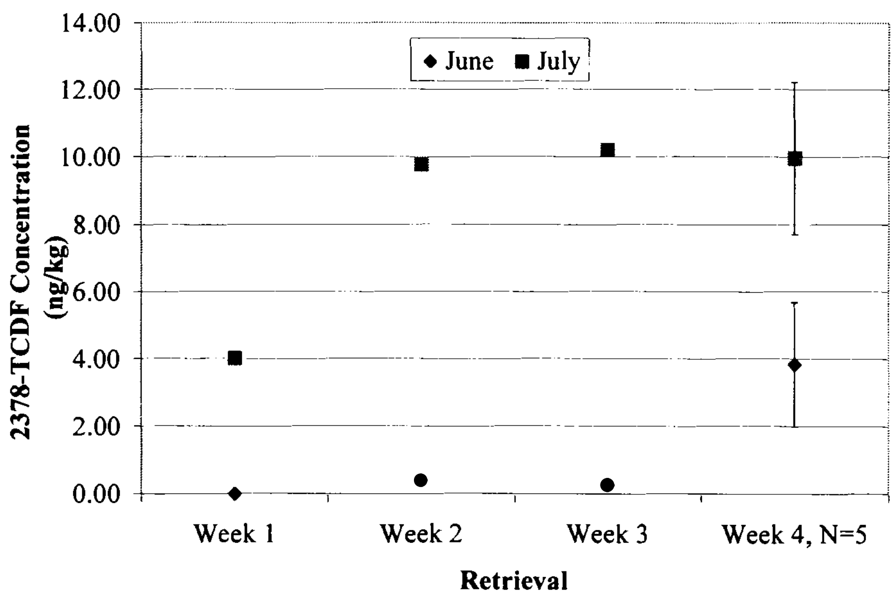
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

Figure 3.3 does not exhibit a significant linear increase throughout the deployment period for the tetra- through penta- substituted congeners as Figure 3.1. A comparison of the TCDF concentrations between the two deployment time studies is useful since 2,3,7,8-TCDF is a congener most likely to originate from a water point source. Figure 3.4 below presents these concentrations for each week of the June and July deployments. The 2,3,7,8-TCDF concentrations are provided on the y-axis in ng per kg of SPMD while the retrievals are provided chronologically on the x-axis. The error bars for the week 4 data points represent the 95% confidence interval among the five replicate samples collected that week.

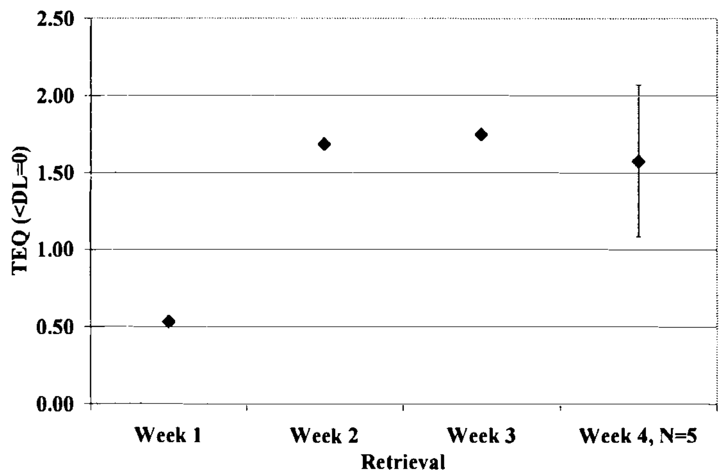
FIGURE 3.4. Comparison of TCDF Concentrations Sampled during June and July.



Again, July levels of TCDF are at least twice as high as June levels. The trends are different between the two months. June has a slow liner increase while July has the opposite: a quick linear increase followed by a possible plateau by week four. This trend

for July is also evident when we examine the TEQ values over the July deployment period. Figure 3.5 is set up just as Figure 3.2 and it illustrates the TEQ values over each deployment week in July. On the y-axis is the TEQ (<DL=0) and on the x-axis is the retrieval week chronologically. Again the y-axis error bar on the week 4 data point represents the 95% confidence interval among the replicates.

FIGURE 3.5. TEQ (<DL=0) over the 4-Week Deployment Two Period. The other TEQ indices provided in tables 3.6 to 3.8 demonstrate the same closeness in week 2,3, and 4 TEQ values.



These TEQ values are together than the June deployment values. However, when taking into account the upper error bar on the fourth data point, an increasing trend can be indicated.

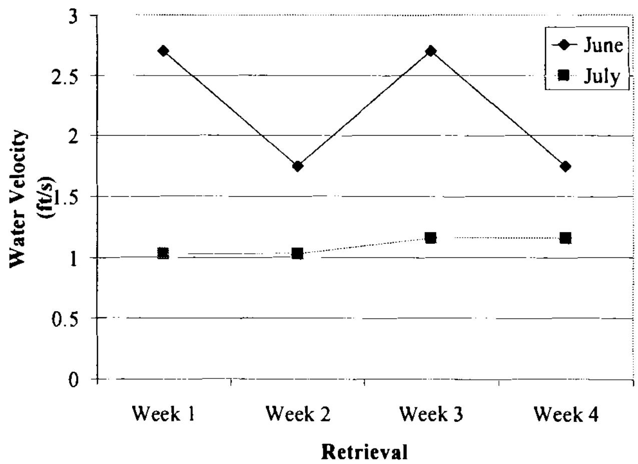
3.2.3. A comparative look at the two deployment time studies

3.2.3.1. Graphical comparisons of environmental conditions

Appendix A contains the water quality data collected from these two deployment periods. While it would have been ideal to monitor water velocity conditions continuously, we collected water velocity data during deployment and retrievals (Figure

3.6). Mean water velocity during the indicated week deployment period is on the y-axis in feet per second while the retrieval is on the x-axis.

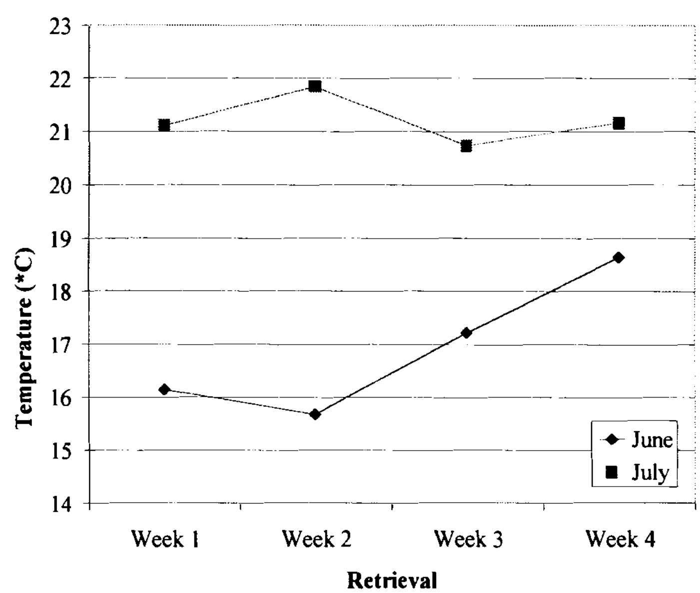
FIGURE 3.6. Water Velocity vs. Time for June and July SPMD Deployments.



As demonstrated by the graph, the water velocity was higher in June than July.

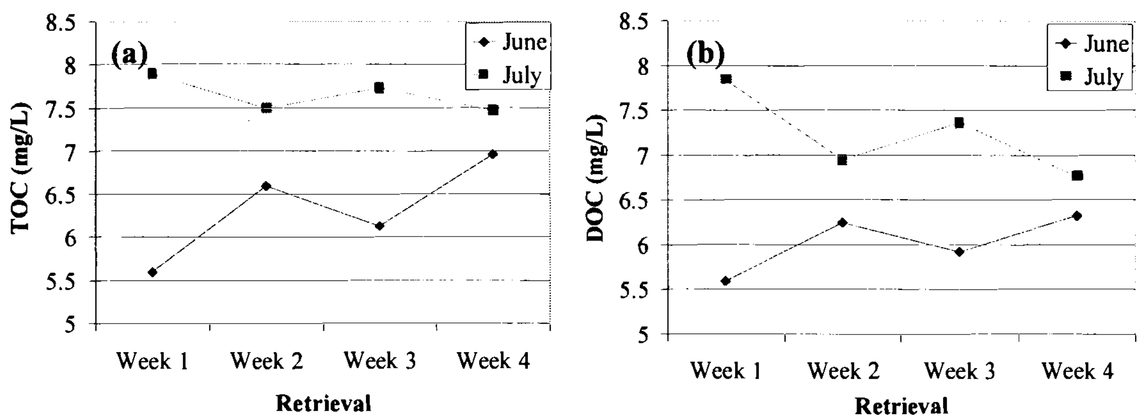
Another environmental variable to examine is temperature (hypothesis d), (Figure 3.7). The temperature values represent the mean temperatures to which the SPMDs were exposed during each deployment period length (weeks 1, 2, 3, and 4) as measured by the deployed temperature loggers.

FIGURE 3.7. Temperature vs. Time for June and July Deployments.



In addition to water velocity and temperature, dissolved organic carbon (DOC) and total organic carbon (TOC) levels are important environmental conditions during SPMD dioxin sampling (Hypothesis e), (Figures 3.8a and b). The TOC and DOC concentrations are provided on the y-axis in mg/L and the retrieval week is provided on the x-axis.

FIGURE 3.8. (a) TOC / (b) DOC vs. Time for June and July Deployments



Both TOC and DOC concentrations were higher in July than June even though there were higher dioxin concentrations in July.

3.2.3.2. Statistical comparisons of environmental conditions

All of the environmental conditions were correlated with their corresponding TEQ (<DL=0) values for the June and July data in a Pearson Correlation Matrix provided (Table 3.9). The Coefficient of Correlation, r, between each parameter is provided in the cell where the parameters intersect. There is only one dependent variable, Y, in our study which is TEQ (<DL-0) and there are five predictor variables (X) which are month, water velocity, TOC, DOC, and temperature. However, it is helpful to see the possible linear

relationships between each pair of variables to determine possible interactions between terms.

TABLE 3.9. r Values for June and July Deployment Data Set.

Parameter	TEQ (<DL=0)	Month	Water Velocity	TOC	DOC	Temperature
TEQ (<DL=0)	1.000					
Month	0.789	1.000				
Water Velocity	-0.766	-0.857	1.000			
TOC	0.748	0.861	-0.960	1.000		
DOC	0.581	0.860	-0.884	0.946	1.000	
Temperature	0.852	0.929	-0.839	0.881	0.820	1.000

It is important to note that we only have an n=8 and that we are making 15 different comparisons. The table illustrates that in June and July, many of the variables are correlated with each other. What the r tells us that r^2 does not is the type of relationship between the variables. Water velocity has an inverse relationship with all of the parameters in the study. The r^2 values and P-values are in the following Tables 3.10 and 3.11.

TABLE 3.10. r^2 Values for June and July Deployment Data Set. The Coefficient of Determination, r^2, between each parameter is provided in the cell where the parameters intersect.

Parameter	TEQ (<DL=0)	Month	Water Velocity	TOC	DOC	Temperature
TEQ (<DL=0)	1.000					
Month	0.663	1.000				
Water Velocity	0.587	0.734	1.000			
TOC	0.560	0.741	0.922	1.000		
DOC	0.338	0.740	0.781	0.895	1.000	
Temperature	0.726	0.863	0.704	0.777	0.672	1.000

TABLE 3.11. P-Values for June and July Deployment Data Set. The Observed Level of Significance, P-value, between each parameter is provided in the cell where the parameters intersect.

Parameter	TEQ (<DL=0)	Month	Water Velocity	TOC	DOC	Temperature
TEQ (<DL=0)	0.000					
Month	0.020	0.000				
Water Velocity	0.027	0.006	0.000			
TOC	0.033	0.006	0.000	0.000		
DOC	0.131	0.006	0.004	0.000	0.000	
Temperature	0.007	0.001	0.009	0.004	0.013	0.000

We have set the alpha level at 0.1 since these are preliminary investigations (Neter *et al.* 1996). Due to the small sample size and lack of a statistical design for testing each parameter separately, a linear regression model for SPMD dioxin concentrations taking all of these environmental condition parameters into account is not possible.

3.3 Research Objective 4: Upstream-Downstream Studies

3.3.1. Androscoggin River: Deployment Four, September 19 to October 17, 2000

The comparison data between upstream and downstream are presented in Figure 3.9 while Tables 3.12 through 3.17 provide the dioxin concentrations for all seventeen toxic dioxin congeners along with all six TEQ values. Tables 3.12 through 3.14 provide the upstream data while Tables 3.15 through 3.17 provide the downstream data. Again there are three different ways to treat the tabular data. Their differences lie in the way the <DL congeners were used in the statistical analyses (calculating the mean, standard deviation and percent relative statistical difference): 1. Tables 3.12 and 3.15 assign the <DL congeners with zero concentrations; 2. Tables 3.13 and 3.16 assign them half the detection limit concentrations; and 3. Tables 3.14 and 3.17 assign them the detection

limit concentration. Figure 3.9 presents the mean concentrations for all seventeen congeners with the <DL congeners given a concentration of zero for statistical purposes (Tables 3.12 and 3.15 data). Concentrations are provided on the y-axis in nanograms per kilogram of whole SPMD while the seventeen dioxin congeners quantified are provided on the x-axis. The y-axis error bars represent the 95% confidence interval for the mean concentrations with an n=10.

FIGURE 3.9. Upstream-Downstream Dioxin Concentrations on the Androscoggin River

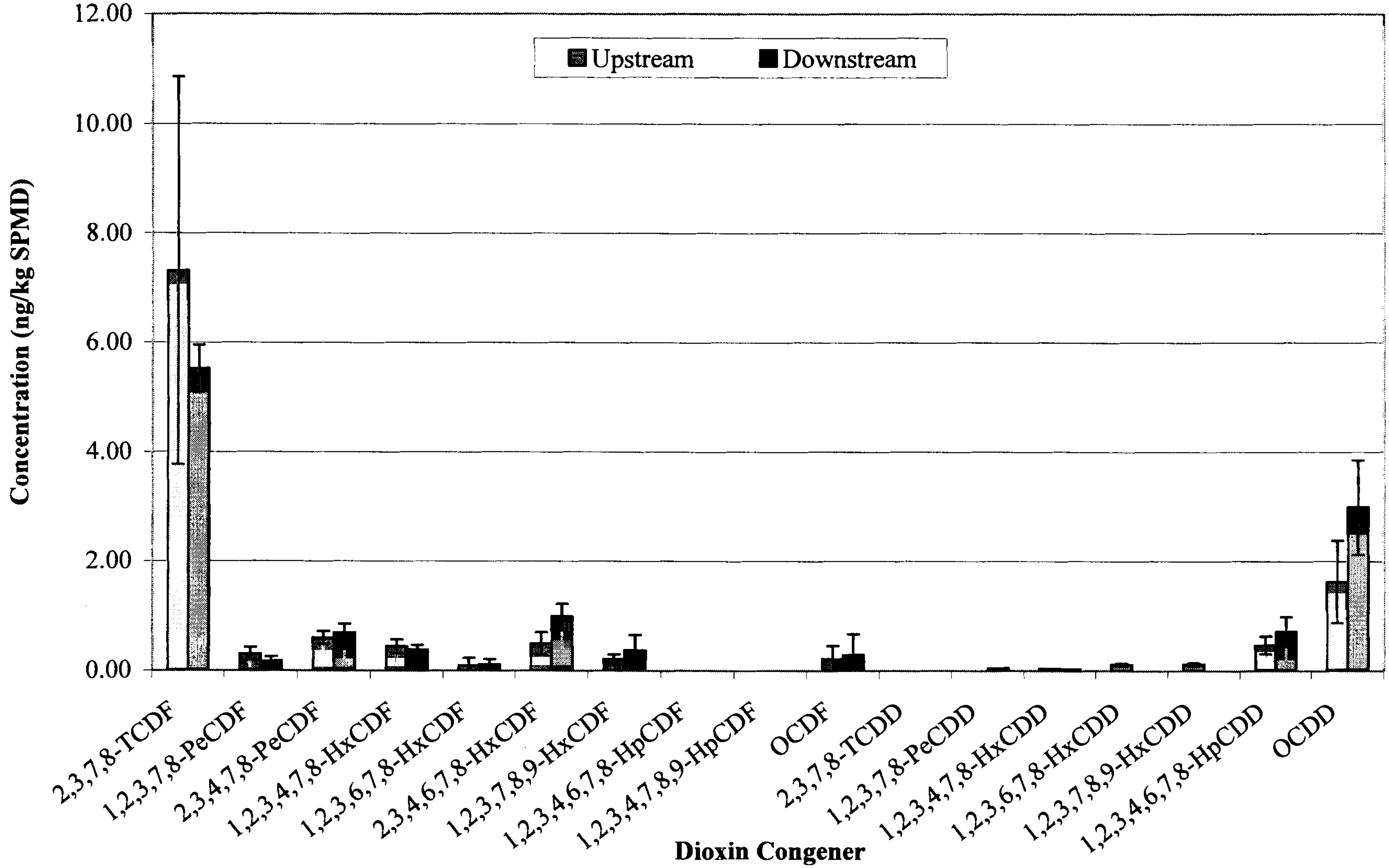


TABLE 3.12. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Four Upstream: <DL = 0 for Statistics

	DL	Rumford--Upstream, N=10														Data
congener/sample ID	(ng/kg)	83-S	84-S	85-S	86-S	87-S	90-S	91-S	92-S	93-S	94-S	Mean	Std Dev	95% CI	% RSD	Flags
2,3,7,8-TCDF	0.80	1.26	11.55	0.92	2.05	11.69	2.11	11.03	10.13	11.29	11.07	7.31	4.96	3.54	67.79	S
1,2,3,7,8-PeCDF	2.08	<DL	<DL	<DL	<DL	<DL	<DL	0.56	0.94	0.84	0.73	0.31	0.17	0.12	53.76	S
2,3,4,7,8-PeCDF	3.13	<DL	<DL	0.92	<DL	<DL	<DL	1.17	1.22	1.36	1.27	0.59	0.17	0.12	27.92	
1,2,3,4,7,8-HxCDF	2.59	0.24	0.80	0.26	0.54	0.62	0.52	<DL	0.57	0.46	0.40	0.44	0.18	0.13	40.05	
1,2,3,6,7,8-HxCDF	2.46	<DL	0.58	<DL	<DL	0.31	<DL	<DL	<DL	<DL	<DL	0.09	0.19	0.14	216.23	
2,3,4,6,7,8-HxCDF	2.88	<DL	<DL	0.25	<DL	1.02	<DL	0.87	0.99	0.87	0.90	0.49	0.29	0.20	58.29	
1,2,3,7,8,9-HxCDF	1.68	<DL	0.57	0.39	<DL	<DL	<DL	<DL	0.67	0.45	<DL	0.21	0.12	0.09	59.53	
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	S
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	
OCDF	7.18	<DL	1.05	<DL	<DL	0.39	<DL	<DL	<DL	0.72	<DL	0.22	0.33	0.23	151.16	
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA	S, C
1,2,3,4,7,8-HxCDD	3.08	<DL	0.44	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.04	NA	NA	NA	
1,2,3,6,7,8-HxCDD	1.22	<DL	0.55	<DL	<DL	<DL	<DL	<DL	0.59	<DL	<DL	0.11	0.03	0.02	22.34	
1,2,3,7,8,9-HxCDD	2.84	<DL	0.62	<DL	<DL	<DL	<DL	<DL	<DL	0.58	<DL	0.12	0.03	0.02	27.31	
1,2,3,4,6,7,8-HpCDD	2.31	<DL	1.02	<DL	<DL	0.59	<DL	0.55	0.87	1.05	0.62	0.47	0.22	0.16	47.80	
OCDD	6.70	<DL	3.25	<DL	<DL	1.24	<DL	1.57	3.27	3.87	3.04	1.62	1.05	0.75	64.79	
TEQ (<DL = 0)	NA	0.15	1.52	0.64	0.26	1.37	0.26	1.81	1.96	2.10	1.92	1.20	0.79	0.56	65.66	
TEQ (<DL = 0.5DL)	NA	3.85	4.64	3.33	3.96	4.79	3.96	4.64	4.52	4.58	4.62	4.29	0.48	0.34	11.23	
TEQ (<DL = DL)	NA	7.55	7.76	6.02	7.66	8.21	7.66	7.49	7.09	7.06	7.34	7.38	0.58	0.42	7.91	
TEQ_{TP} (<DL = 0)	NA	0.13	1.16	0.55	0.21	1.17	0.21	1.72	1.67	1.85	1.78	1.04	0.71	0.51	68.10	
TEQ_{TP} (<DL = 0.5DL)	NA	3.08	4.11	2.72	3.16	4.12	3.17	3.84	3.79	3.97	3.90	3.59	0.50	0.36	14.01	
TEQ_{TP} (<DL = DL)	NA	6.04	7.07	4.90	6.12	7.08	6.12	5.96	5.92	6.10	6.03	6.13	0.61	0.44	10.01	

NOTES

S = surrogate levels above or below EPA Method 1613B recovery range C = interfering, co-eluting peak present
DL = Detection Limits NA = Not Applicable Means are calculated with <DL having a zero concentration.
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)
Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.
Values less than the MDLs are to be considered estimated values.

TABLE 3.13. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Four Upstream: <DL = 0.5*DL for Statistics

	DL	Rumford--Upstream, N=10													
congener/sample ID	(ng/Kg)	83-S	84-S	85-S	86-S	87-S	90-S	91-S	92-S	93-S	94-S	**Mean**	**Std Dev**	**95% CI**	**% RSD**
2,3,7,8-TCDF	0.80	1.26	11.55	0.92	2.05	11.69	2.11	11.03	10.13	11.29	11.07	7.31	4.96	3.54	67.79
1,2,3,7,8-PeCDF	2.08	1.04	1.04	1.04	1.04	1.04	1.04	0.56	0.94	0.84	0.73	0.93	0.17	0.12	18.25
2,3,4,7,8-PeCDF	3.13	1.56	1.56	0.92	1.56	1.56	1.56	1.17	1.22	1.36	1.27	1.38	0.23	0.16	16.43
1,2,3,4,7,8-HxCDF	2.59	0.24	0.80	0.26	0.54	0.62	0.52	1.29	0.57	0.46	0.40	0.57	0.30	0.22	53.42
1,2,3,6,7,8-HxCDF	2.46	1.23	0.58	1.23	1.23	0.31	1.23	1.23	1.23	1.23	1.23	1.07	0.34	0.24	31.38
2,3,4,6,7,8-HxCDF	2.88	1.44	1.44	0.25	1.44	1.02	1.44	0.87	0.99	0.87	0.90	1.07	0.39	0.28	36.18
1,2,3,7,8,9-HxCDF	1.68	0.84	0.57	0.39	0.84	0.84	0.84	0.84	0.67	0.45	0.84	0.71	0.18	0.13	25.47
1,2,3,4,6,7,8-HpCDF	2.65	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	0.00	0.00	0.00	0.00
1,2,3,4,7,8,9-HpCDF	1.56	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.00	0.00	0.00	0.00
OCDF	7.18	3.59	1.05	3.59	3.59	0.39	3.59	3.59	3.59	0.72	3.59	2.73	1.39	1.00	51.04
2,3,7,8-TCDD	2.10	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.00	0.00	0.00	0.00
1,2,3,7,8-PeCDD	2.14	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	0.00	0.00	0.00	0.00
1,2,3,4,7,8-HxCDD	3.08	1.54	0.44	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.43	0.00	0.00	0.00
1,2,3,6,7,8-HxCDD	1.22	0.61	0.55	0.61	0.61	0.61	0.61	0.61	0.59	0.61	0.61	0.60	0.02	0.01	3.17
1,2,3,7,8,9-HxCDD	2.84	1.42	0.62	1.42	1.42	1.42	1.42	1.42	1.42	0.58	1.42	1.26	0.35	0.25	27.54
1,2,3,4,6,7,8-HpCDD	2.31	1.16	1.02	1.16	1.16	0.59	1.16	0.55	0.87	1.05	0.62	0.93	0.26	0.18	27.43
OCDD	6.70	3.35	3.25	3.35	3.35	1.24	3.35	1.57	3.27	3.87	3.04	2.96	0.85	0.61	28.73
TEQ (<DL = 0)	NA	0.15	1.52	0.64	0.26	1.37	0.26	1.81	1.96	2.10	1.92	1.20	0.79	0.56	65.66
TEQ (<DL = 0.5DL)	NA	3.85	4.64	3.33	3.96	4.79	3.96	4.64	4.52	4.58	4.62	4.29	0.48	0.34	11.23
TEQ (<DL = DL)	NA	7.55	7.76	6.02	7.66	8.21	7.66	7.49	7.09	7.06	7.34	7.38	0.58	0.42	7.91
TEQ_{TP} (<DL = 0)	NA	0.13	1.16	0.55	0.21	1.17	0.21	1.72	1.67	1.85	1.78	1.04	0.71	0.51	68.10
TEQ_{TP} (<DL = 0.5DL)	NA	3.08	4.11	2.72	3.16	4.12	3.17	3.84	3.79	3.97	3.90	3.59	0.50	0.36	14.01
TEQ_{TP} (<DL = DL)	NA	6.04	7.07	4.90	6.12	7.08	6.12	5.96	5.92	6.10	6.03	6.13	0.61	0.44	10.01

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having 0.5*DL concentrations.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.

Values less than the MDLs are to be considered estimated values.

TABLE 3.14. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Four Upstream: <DL = DL for Statistics

	DL	Rumford--Upstream, N=10													
congener/sample ID	(ng/kg)	83-S	84-S	85-S	86-S	87-S	90-S	91-S	92-S	93-S	94-S	**Mean**	**Std Dev**	**95% CI**	**% RSD**
2,3,7,8-TCDF	0.80	1.26	11.55	0.92	2.05	11.69	2.11	11.03	10.13	11.29	11.07	7.31	4.96	3.54	67.79
1,2,3,7,8-PeCDF	2.08	2.08	2.08	2.08	2.08	2.08	2.08	0.56	0.94	0.84	0.73	1.55	0.68	0.49	43.97
2,3,4,7,8-PeCDF	3.13	3.13	3.13	0.92	3.13	3.13	3.13	1.17	1.22	1.36	1.27	2.16	1.03	0.73	47.60
1,2,3,4,7,8-HxCDF	2.59	0.24	0.80	0.26	0.54	0.62	0.52	2.59	0.57	0.46	0.40	0.70	0.68	0.49	98.17
1,2,3,6,7,8-HxCDF	2.46	2.46	0.58	2.46	2.46	0.31	2.46	2.46	2.46	2.46	2.46	2.06	0.85	0.61	41.40
2,3,4,6,7,8-HxCDF	2.88	2.88	2.88	0.25	2.88	1.02	2.88	0.87	0.99	0.87	0.90	1.64	1.08	0.78	66.08
1,2,3,7,8,9-HxCDF	1.68	1.68	0.57	0.39	1.68	1.68	1.68	1.68	0.67	0.45	1.68	1.22	0.61	0.43	49.76
1,2,3,4,6,7,8-HpCDF	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	0.00	0.00	0.00
1,2,3,4,7,8,9-HpCDF	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	0.00	0.00	0.00
OCDF	7.18	7.18	1.05	7.18	7.18	0.39	7.18	7.18	7.18	0.72	7.18	5.24	3.12	2.23	59.56
2,3,7,8-TCDD	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00
1,2,3,7,8-PeCDD	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	0.00	0.00	0.00
1,2,3,4,7,8-HxCDD	3.08	3.08	0.44	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	2.82	0.84	0.60	29.68
1,2,3,6,7,8-HxCDD	1.22	1.22	0.55	1.22	1.22	1.22	1.22	1.22	0.59	1.22	1.22	1.09	0.28	0.20	25.24
1,2,3,7,8,9-HxCDD	2.84	2.84	0.62	2.84	2.84	2.84	2.84	2.84	2.84	0.58	2.84	2.39	0.95	0.68	39.48
1,2,3,4,6,7,8-HpCDD	2.31	2.31	1.02	2.31	2.31	0.59	2.31	0.55	0.87	1.05	0.62	1.39	0.81	0.58	57.95
OCDD	6.70	6.70	3.25	6.70	6.70	1.24	6.70	1.57	3.27	3.87	3.04	4.30	2.21	1.58	51.26
TEQ (<DL = 0)	NA	0.15	1.52	0.64	0.26	1.37	0.26	1.81	1.96	2.10	1.92	1.20	0.79	0.56	65.66
TEQ (<DL = 0.5DL)	NA	3.85	4.64	3.33	3.96	4.79	3.96	4.64	4.52	4.58	4.62	4.29	0.48	0.34	11.23
TEQ (<DL = DL)	NA	7.55	7.76	6.02	7.66	8.21	7.66	7.49	7.09	7.06	7.34	7.38	0.58	0.42	7.91
TEQ_{TP} (<DL = 0)	NA	0.13	1.16	0.55	0.21	1.17	0.21	1.72	1.67	1.85	1.78	1.04	0.71	0.51	68.10
TEQ_{TP} (<DL = 0.5DL)	NA	3.08	4.11	2.72	3.16	4.12	3.17	3.84	3.79	3.97	3.90	3.59	0.50	0.36	14.01
TEQ_{TP} (<DL = DL)	NA	6.04	7.07	4.90	6.12	7.08	6.12	5.96	5.92	6.10	6.03	6.13	0.61	0.44	10.01

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having DL concentrations.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.

Values less than the MDLs are to be considered estimated values.

TABLE 3.15. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Four Downstream: <DL = 0 for Statistics

	DL	Dixfield--Downstream, N=10															Data
congener/sample ID	(ng/kg)	97-S	98-S	99-S	100-S	101-S	104-S	105-S	106-S	107-S	108-S	Mean	Std Dev	95% CI	% RSD	Rej.*	Flags
2,3,7,8-TCDF	0.80	1.59	4.58	6.33	4.68	5.39	5.71	5.46	5.95	6.19	5.36	5.52	0.61	0.44	11.05	97-S	
1,2,3,7,8-PeCDF	2.08	<DL	0.26	<DL	0.55	<DL	<DL	0.48	<DL	0.41	<DL	0.17	0.12	0.09	71.64		
2,3,4,7,8-PeCDF	3.13	<DL	0.62	<DL	1.36	0.92	0.92	0.79	0.81	0.79	0.71	0.69	0.22	0.16	32.41		
1,2,3,4,7,8-HxCDF	2.59	0.39	0.32	0.17	1.03	0.24	<DL	0.55	0.46	0.36	0.27	0.38	0.12	0.09	32.11		S
1,2,3,6,7,8-HxCDF	2.46	<DL	0.33	<DL	<DL	<DL	<DL	0.44	<DL	0.14	0.19	0.11	0.14	0.10	122.04		
2,3,4,6,7,8-HxCDF	2.88	0.15	0.42	0.77	3.81	0.92	0.64	1.05	1.09	0.56	0.44	0.98	0.32	0.23	32.02		
1,2,3,7,8,9-HxCDF	1.68	<DL	0.24	<DL	1.30	0.38	<DL	0.86	<DL	0.46	0.44	0.37	0.40	0.28	107.69		
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		S
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		S
OCDF	7.18	<DL	<DL	0.33	<DL	<DL	<DL	<DL	1.28	1.25	<DL	0.29	0.54	0.39	189.49		
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	0.52	<DL	<DL	<DL	<DL	<DL	<DL	0.05	NA	NA	NA		S, C
1,2,3,4,7,8-HxCDD	3.08	0.32	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.03	NA	NA	NA		
1,2,3,6,7,8-HxCDD	1.22	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,7,8,9-HxCDD	2.84	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,4,6,7,8-HpCDD	2.31	1.06	<DL	0.98	1.65	<DL	<DL	0.99	1.24	0.65	0.51	0.71	0.38	0.27	53.12		S
OCDD	6.70	2.32	1.96	1.86	4.91	5.05	2.68	2.63	3.46	3.36	1.64	2.99	1.21	0.86	40.45		S
TEQ (<DL = 0)	NA	0.26	0.91	0.74	2.33	1.15	1.10	1.27	1.17	1.20	1.03	1.21	0.45	0.32	37.18	100-S	
TEQ (<DL = 0.5DL)	NA	3.64	3.42	4.28	3.88	3.84	3.99	3.76	3.92	3.69	3.58	3.82	0.25	0.18	6.46		
TEQ (<DL = DL)	NA	7.03	5.94	7.82	5.43	6.53	6.90	6.27	6.69	6.20	6.14	6.43	0.67	0.48	10.47		
TEQ_{TP} (<DL = 0)	NA	0.16	0.78	0.63	1.70	1.00	1.03	0.96	1.00	1.04	0.89	1.00	0.29	0.21	29.13		
TEQ_{TP} (<DL = 0.5DL)	NA	3.11	2.90	3.59	2.75	3.17	3.20	3.08	3.17	3.16	3.06	3.12	0.23	0.16	7.37		
TEQ_{TP} (<DL = DL)	NA	6.07	5.03	6.55	3.80	5.35	5.38	5.21	5.35	5.28	5.24	5.24	0.70	0.50	13.28		

NOTES

S = surrogate levels above or below EPA Method 1613B recovery range   C = interfering, co-eluting peak present
DL = Detection Limits   Means are calculated with <DL having a zero concentration.   NA = Not Applicable
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)
***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**
Values less than the MDLs are to be considered estimated values.

TABLE 3.16. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Four Downstream: <DL = 0.5*DL for Statistics

	DL	Dixfield--Downstream, N=10														
congener/sample ID	(ng/Kg)	97-S	98-S	99-S	100-S	101-S	104-S	105-S	106-S	107-S	108-S	Mean	Std Dev	95% CI	% RSD	Rejected*
2,3,7,8-TCDF	0.80	1.59	4.58	6.33	4.68	5.39	5.71	5.46	5.95	6.19	5.36	5.52	0.61	0.44	11.05	97-S
1,2,3,7,8-PeCDF	2.08	1.04	0.26	1.04	0.55	1.04	1.04	0.48	1.04	0.41	1.04	0.79	0.33	0.23	41.06	
2,3,4,7,8-PeCDF	3.13	1.56	0.62	1.56	1.36	0.92	0.92	0.79	0.81	0.79	0.71	1.00	0.35	0.25	35.31	
1,2,3,4,7,8-HxCDF	2.59	0.39	0.32	0.17	1.03	0.24	1.29	0.55	0.46	0.36	0.27	0.51	0.33	0.24	65.73	
1,2,3,6,7,8-HxCDF	2.46	1.23	0.33	1.23	1.23	1.23	1.23	0.44	1.23	0.14	0.19	0.85	0.50	0.36	58.66	
2,3,4,6,7,8-HxCDF	2.88	0.15	0.42	0.77	3.81	0.92	0.64	1.05	1.09	0.56	0.44	0.98	0.32	0.23	32.02	
1,2,3,7,8,9-HxCDF	1.68	0.84	0.24	0.84	1.30	0.38	0.84	0.86	0.84	0.46	0.44	0.70	0.32	0.23	45.14	
1,2,3,4,6,7,8-HpCDF	2.65	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.00	0.00	0.00	
OCDF	7.18	3.59	3.59	0.33	3.59	3.59	3.59	3.59	1.28	1.25	3.59	2.80	1.30	0.93	46.42	
2,3,7,8-TCDD	2.10	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	1.07	1.07	1.07	0.52	1.07	1.07	1.07	1.07	1.07	1.07	1.01	0.17	0.12	17.14	
1,2,3,4,7,8-HxCDD	3.08	0.32	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.42	0.39	0.28	27.25	
1,2,3,6,7,8-HxCDD	1.22	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.00	0.00	0.00	
1,2,3,7,8,9-HxCDD	2.84	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	0.00	0.00	0.00	
1,2,3,4,6,7,8-HpCDD	2.31	1.06	1.16	0.98	1.65	1.16	1.16	0.99	1.24	0.65	0.51	1.06	0.32	0.23	29.85	
OCDD	6.70	2.32	1.96	1.86	4.91	5.05	2.68	2.63	3.46	3.36	1.64	2.99	1.21	0.86	40.45	
TEQ (<DL = 0)	NA	0.26	0.91	0.74	2.33	1.15	1.10	1.27	1.17	1.20	1.03	1.21	0.45	0.32	37.18	
TEQ (<DL = 0.5DL)	NA	3.64	3.42	4.28	3.88	3.84	3.99	3.76	3.92	3.69	3.58	3.82	0.25	0.18	6.46	
TEQ (<DL = DL)	NA	7.03	5.94	7.82	5.43	6.53	6.90	6.27	6.69	6.20	6.14	6.43	0.67	0.48	10.47	
TEQ_{TP} (<DL = 0)	NA	0.16	0.78	0.63	1.70	1.00	1.03	0.96	1.00	1.04	0.89	1.00	0.29	0.21	29.13	
TEQ_{TP} (<DL = 0.5DL)	NA	3.11	2.90	3.59	2.75	3.17	3.20	3.08	3.17	3.16	3.06	3.12	0.23	0.16	7.37	
TEQ_{TP} (<DL = DL)	NA	6.07	5.03	6.55	3.80	5.35	5.38	5.21	5.35	5.28	5.24	5.24	0.70	0.50	13.28	

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having 0.5*DL concentrations.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

TABLE 3.17. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Four Downstream: <DL = DL for Statistics

	DL	Dixfield--Downstream, N=10														
congener/sample ID	(ng/kg)	97-S	98-S	99-S	100-S	101-S	104-S	105-S	106-S	107-S	108-S	**Mean**	**Std Dev**	**95% CI**	**% RSD**	**Rejected***
2,3,7,8-TCDF	0.80	1.59	4.58	6.33	4.68	5.39	5.71	5.46	5.95	6.19	5.36	5.52	0.61	0.44	11.05	97-S
1,2,3,7,8-PeCDF	2.08	2.08	0.26	2.08	0.55	2.08	2.08	0.48	2.08	0.41	2.08	1.42	0.86	0.61	60.50	
2,3,4,7,8-PeCDF	3.13	3.13	0.62	3.13	1.36	0.92	0.92	0.79	0.81	0.79	0.71	1.32	0.97	0.70	73.94	
1,2,3,4,7,8-HxCDF	2.59	0.39	0.32	0.17	1.03	0.24	2.59	0.55	0.46	0.36	0.27	0.64	0.76	0.54	118.26	
1,2,3,6,7,8-HxCDF	2.46	2.46	0.33	2.46	2.46	2.46	2.46	0.44	2.46	0.14	0.19	1.59	1.13	0.81	71.19	
2,3,4,6,7,8-HxCDF	2.88	0.15	0.42	0.77	3.81	0.92	0.64	1.05	1.09	0.56	0.44	0.98	0.32	0.23	32.02	
1,2,3,7,8,9-HxCDF	1.68	1.68	0.24	1.68	1.30	0.38	1.68	0.86	1.68	0.46	0.44	1.04	0.63	0.45	60.20	
1,2,3,4,6,7,8-HpCDF	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	0.00	0.00	0.00	
OCDF	7.18	7.18	7.18	0.33	7.18	7.18	7.18	7.18	1.28	1.25	7.18	5.31	3.02	2.16	56.83	
2,3,7,8-TCDD	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	2.14	2.14	2.14	0.52	2.14	2.14	2.14	2.14	2.14	2.14	1.98	0.51	0.37	25.92	
1,2,3,4,7,8-HxCDD	3.08	0.32	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	3.08	2.81	0.87	0.63	31.15	
1,2,3,6,7,8-HxCDD	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.00	0.00	0.00	
1,2,3,7,8,9-HxCDD	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	0.00	0.00	0.00	
1,2,3,4,6,7,8-HpCDD	2.31	1.06	2.31	0.98	1.65	2.31	2.31	0.99	1.24	0.65	0.51	1.40	0.70	0.50	49.81	
OCDD	6.70	2.32	1.96	1.86	4.91	5.05	2.68	2.63	3.46	3.36	1.64	2.99	1.21	0.86	40.45	
TEQ (<DL = 0)	NA	0.26	0.91	0.74	2.33	1.15	1.10	1.27	1.17	1.20	1.03	1.21	0.45	0.32	37.18	
TEQ (<DL = 0.5DL)	NA	3.64	3.42	4.28	3.88	3.84	3.99	3.76	3.92	3.69	3.58	3.82	0.25	0.18	6.46	
TEQ (<DL = DL)	NA	7.03	5.94	7.82	5.43	6.53	6.90	6.27	6.69	6.20	6.14	6.43	0.67	0.48	10.47	
TEQ_{TP} (<DL = 0)	NA	0.16	0.78	0.63	1.70	1.00	1.03	0.96	1.00	1.04	0.89	1.00	0.29	0.21	29.13	
TEQ_{TP} (<DL = 0.5DL)	NA	3.11	2.90	3.59	2.75	3.17	3.20	3.08	3.17	3.16	3.06	3.12	0.23	0.16	7.37	
TEQ_{TP} (<DL = DL)	NA	6.07	5.03	6.55	3.80	5.35	5.38	5.21	5.35	5.28	5.24	5.24	0.70	0.50	13.28	

NOTES **NA = Not Applicable**

DL = Detection Limits **Means are calculated with <DL having DL concentrations.**

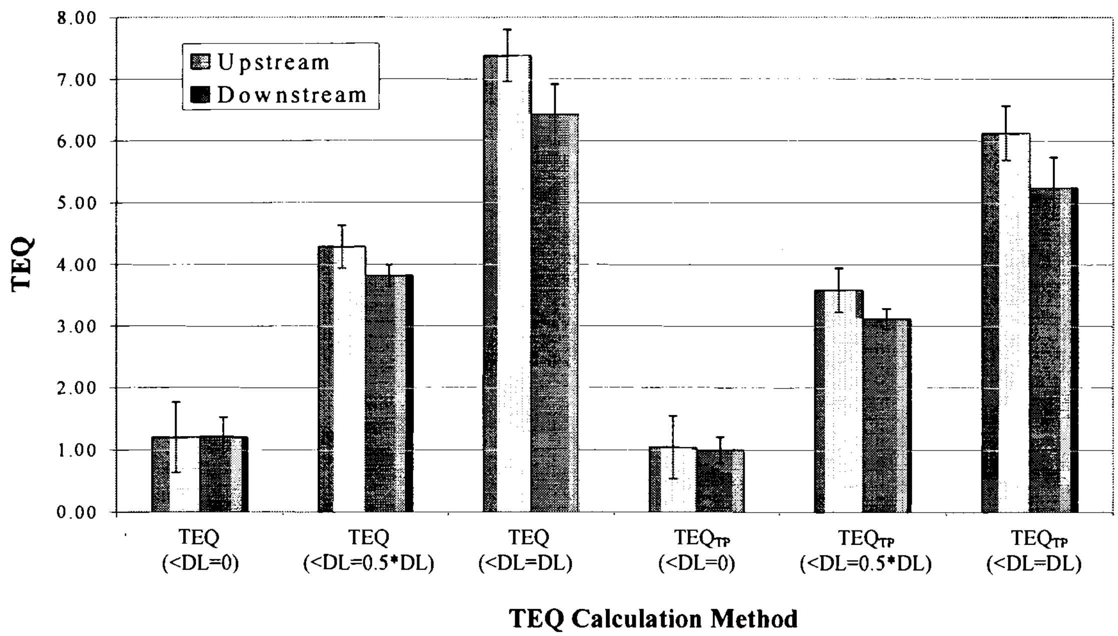
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

Figure 3.9 does not offer any evidence that there is a difference between upstream and downstream dioxin concentrations. The toxic equivalency (TEQ) becomes an important tool that allows us to compare all the dioxin congeners concentrations in one value for upstream and one value for downstream. The TEQ values are available in Tables 3.12 to 3.17 and the mean TEQ values are illustrated in the Figure 3.10 bar graph below. The TEQ value is on the y-axis while the x-axis provides the TEQ calculation method. The y-axis error bars represent the 95% confidence intervals for the mean TEQ values with an n=10.

FIGURE 3.10. Upstream-Downstream TEQ Values for Androscoggin River Deployment Four



For each of the TEQ methods shown, the error bars overlap for upstream and downstream, demonstrating no differences between the sites.

ANOVA was performed on the deployment four data set. The TEQ (<DL=0) was chosen to be the dependent variable in the ANOVA and the independent variable was upstream or downstream. The F* value of 0.077 is below the cutoff of 4.42 (F (0.95; 1, 18) = 4.42), thus supporting the null hypothesis that there is no difference between upstream and downstream dioxin levels for this deployment period. All of the criteria were met to substantiate the ANOVA F test conclusion: There was constancy of variance, a normal probability distribution of residuals, and no outliers were present. The P-value is 0.784, which is well above the alpha of 0.05.

3.3.2. Kennebec River: Deployment Three, August 3 to September 26, 2000

The comparison data between upstream and downstream are presented in Figure 3.11 while Tables 3.18 through 3.23 provide the dioxin concentrations for all seventeen toxic dioxin congeners along with all six TEQ values. Tables 3.18 through 3.20 provide the upstream data while Tables 3.21 through 3.23 provide the downstream data. Again there are three different ways to treat the tabular data. Their differences lie in the way the <DL congeners were used in the statistical analyses (calculating the mean, standard deviation and percent relative statistical difference): 1. Tables 3.18 and 3.21 assign the <DL congeners with zero concentrations; 2. Tables 3.19 and 3.22 assign them half the detection limit concentrations; and 3. Tables 3.20 and 3.23 assign them the detection limit concentration. Figure 3.11 presents the mean concentrations for all seventeen congeners with the <DL congeners given a concentration of zero for statistical purposes

(Tables 3.18 and 3.21 data). Concentrations are provided on the y-axis in nanograms per kilogram of whole SPMD while the seventeen dioxin congeners quantified are provided on the x-axis. The y-axis error bars represent the 95% confidence interval for the mean concentrations with an n=5.

FIGURE 3.11. Upstream-Downstream Dioxin Concentrations on the Kennebec River

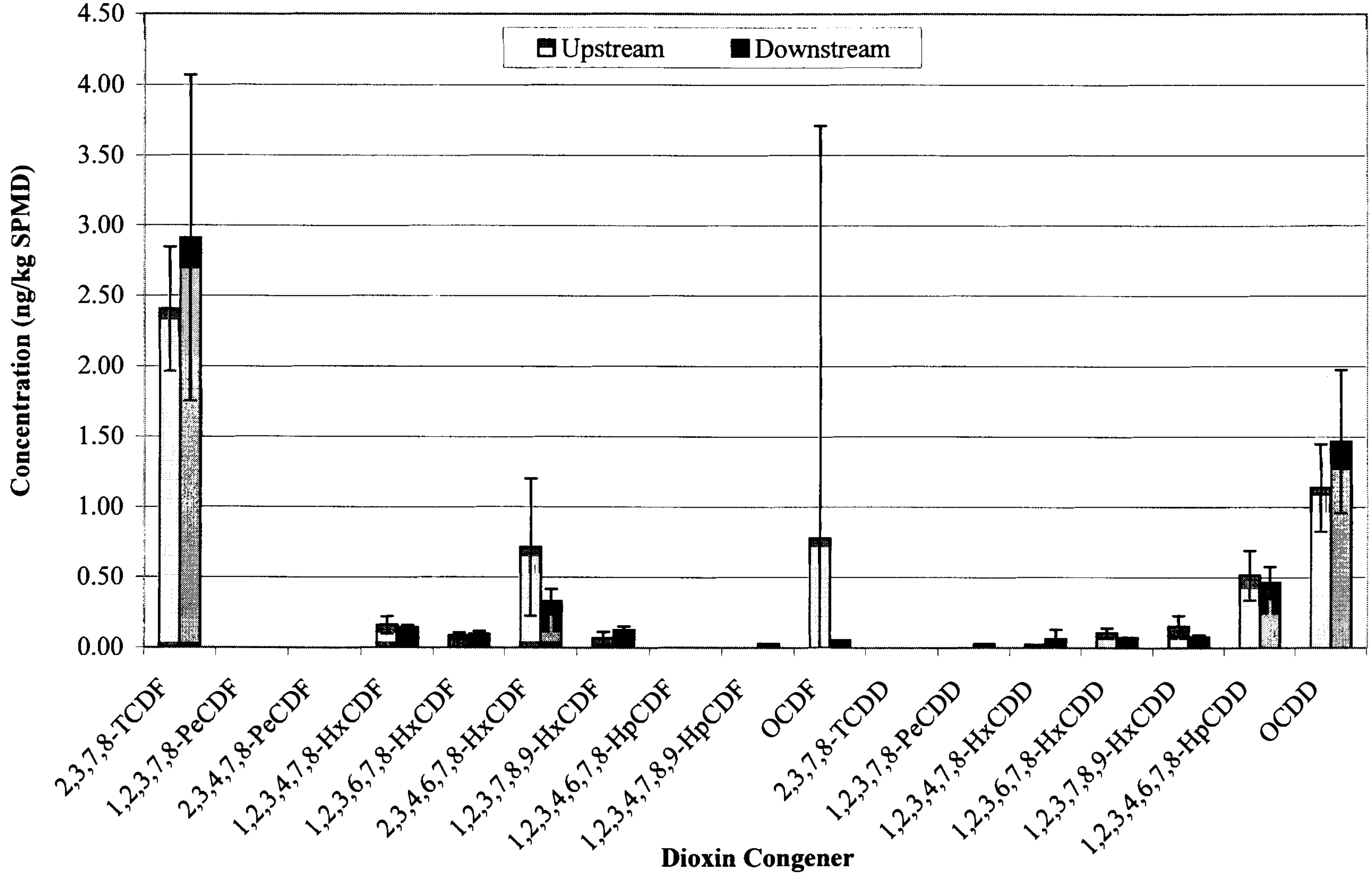


TABLE 3.18. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Three Upstream: <DL = 0 for Statistics

	DL	Norridgewock--Upstream, N=5										Data
congener/sample ID	(ng/kg)	68-S	69-S	70-S	71-S	72-S	Mean	Std Dev	95% CI	% RSD	Rejected*	Flags
2,3,7,8-TCDF	0.80	2.27	2.02	2.47	2.28	2.97	2.40	0.36	0.44	14.83		
1,2,3,7,8-PeCDF	2.08	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
2,3,4,7,8-PeCDF	3.13	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,4,7,8-HxCDF	2.59	0.13	0.11	0.16	0.15	0.24	0.16	0.05	0.06	31.56		
1,2,3,6,7,8-HxCDF	2.46	0.12	<DL	0.16	0.14	<DL	0.08	0.02	0.02	21.62		
2,3,4,6,7,8-HxCDF	2.88	0.43	0.53	1.37	0.45	0.77	0.71	0.39	0.49	55.24		
1,2,3,7,8,9-HxCDF	1.68	0.14	<DL	<DL	<DL	0.19	0.07	0.04	0.04	54.90		
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
OCDF	7.18	0.27	<DL	3.61	<DL	<DL	0.78	2.36	2.93	304.66		
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,4,7,8-HxCDD	3.08	<DL	0.11	<DL	<DL	<DL	0.02	NA	NA	NA		
1,2,3,6,7,8-HxCDD	1.22	0.17	0.15	<DL	0.21	<DL	0.11	0.03	0.03	25.64		
1,2,3,7,8,9-HxCDD	2.84	0.14	0.28	<DL	0.17	0.18	0.15	0.06	0.07	39.04		
1,2,3,4,6,7,8-HpCDD	2.31	0.47	0.38	5.32	0.49	0.71	0.51	0.14	0.18	27.71	70-S	
OCDD	6.70	1.76	1.26	5.84	1.52	<DL	1.14	0.25	0.31	22.00	70-S	
TEQ (<DL = 0)	NA	0.35	0.32	0.43	0.35	0.44	0.38	0.05	0.07	14.51		
TEQ (<DL = 0.5DL)	NA	3.47	3.51	3.89	3.56	3.76	3.64	0.18	0.22	4.89		
TEQ (<DL = DL)	NA	6.61	6.69	7.10	6.78	7.08	6.85	0.22	0.28	3.28		
TEQ_{TP} (<DL = 0)	NA	0.23	0.20	0.25	0.23	0.30	0.24	0.04	0.04	14.83		
TEQ_{TP} (<DL = 0.5DL)	NA	3.18	3.16	3.20	3.18	3.25	3.19	0.04	0.04	1.12		
TEQ_{TP} (<DL = DL)	NA	6.14	6.11	6.16	6.14	6.21	6.15	0.04	0.04	0.58		

NOTES

NA = Not Applicable

DL = Detection Limits. **Means are calculated with <DL having a zero concentration.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

TABLE 3.19. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Three Upstream: <DL = 0.5*DL for Statistics

	DL	Norridgewock--Upstream, N=5									
congener/sample ID	(ng/Kg)	68-S	69-S	70-S	71-S	72-S	**Mean**	**Std Dev**	**95% CI**	**% RSD**	**Rejected***
2,3,7,8-TCDF	0.80	2.27	2.02	2.47	2.28	2.97	2.40	0.36	0.44	14.83	
1,2,3,7,8-PeCDF	2.08	1.04	1.04	1.04	1.04	1.04	1.04	0.00	0.00	0.00	
2,3,4,7,8-PeCDF	3.13	1.56	1.56	1.56	1.56	1.56	1.56	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDF	2.59	0.13	0.11	0.16	0.15	0.24	0.16	0.05	0.06	31.56	
1,2,3,6,7,8-HxCDF	2.46	0.12	1.23	0.16	0.14	1.23	0.58	0.60	0.74	103.68	
2,3,4,6,7,8-HxCDF	2.88	0.43	0.53	1.37	0.45	0.77	0.71	0.39	0.49	55.24	
1,2,3,7,8,9-HxCDF	1.68	0.14	0.84	0.84	0.84	0.19	0.57	0.37	0.46	65.05	
1,2,3,4,6,7,8-HpCDF	2.65	1.32	1.32	1.32	1.32	1.32	1.32	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	0.78	0.78	0.78	0.78	0.78	0.78	0.00	0.00	0.00	
OCDF	7.18	0.27	3.59	3.61	3.59	3.59	2.93	1.49	1.85	50.79	
2,3,7,8-TCDD	2.10	1.05	1.05	1.05	1.05	1.05	1.05	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	1.07	1.07	1.07	1.07	1.07	1.07	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDD	3.08	1.54	0.11	1.54	1.54	1.54	1.25	0.64	0.79	50.97	
1,2,3,6,7,8-HxCDD	1.22	0.17	0.15	0.61	0.21	0.61	0.35	0.24	0.30	68.33	
1,2,3,7,8,9-HxCDD	2.84	0.14	0.28	1.42	0.17	0.18	0.44	0.55	0.69	126.27	
1,2,3,4,6,7,8-HpCDD	2.31	0.47	0.38	5.32	0.49	0.71	0.51	0.14	0.18	27.71	70-S
OCDD	6.70	1.76	1.26	5.84	1.52	3.35	1.97	0.94	1.17	47.59	70-S
TEQ (<DL = 0)	NA	0.35	0.32	0.43	0.35	0.44	0.38	0.05	0.07	14.51	
TEQ (<DL = 0.5DL)	NA	3.47	3.51	3.89	3.56	3.76	3.64	0.18	0.22	4.89	
TEQ (<DL = DL)	NA	6.61	6.69	7.10	6.78	7.08	6.85	0.22	0.28	3.28	
TEQ$_{TP}$ (<DL = 0)	NA	0.23	0.20	0.25	0.23	0.30	0.24	0.04	0.04	14.83	
TEQ$_{TP}$ (<DL = 0.5DL)	NA	3.18	3.16	3.20	3.18	3.25	3.19	0.04	0.04	1.12	
TEQ$_{TP}$ (<DL = DL)	NA	6.14	6.11	6.16	6.14	6.21	6.15	0.04	0.04	0.58	

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having 0.5*DL concentrations.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

TABLE 3.20. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Three Upstream: <DL = DL for Statistics

	DL	Norridgewock--Upstream, N=5									
congener/sample ID	(ng/kg)	68-S	69-S	70-S	71-S	72-S	Mean	Std Dev	95% CI	% RSD	Rejected*
2,3,7,8-TCDF	0.80	2.27	2.02	2.47	2.28	2.97	2.40	0.36	0.44	14.83	
1,2,3,7,8-PeCDF	2.08	2.08	2.08	2.08	2.08	2.08	2.08	0.00	0.00	0.00	
2,3,4,7,8-PeCDF	3.13	3.13	3.13	3.13	3.13	3.13	3.13	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDF	2.59	0.13	0.11	0.16	0.15	0.24	0.16	0.05	0.06	31.56	
1,2,3,6,7,8-HxCDF	2.46	0.12	2.46	0.16	0.14	2.46	1.07	1.27	1.58	119.00	
2,3,4,6,7,8-HxCDF	2.88	0.43	0.53	1.37	0.45	0.77	0.71	0.39	0.49	55.24	
1,2,3,7,8,9-HxCDF	1.68	0.14	1.68	1.68	1.68	0.19	1.08	0.83	1.03	77.38	
1,2,3,4,6,7,8-HpCDF	2.65	2.65	2.65	2.65	2.65	2.65	2.65	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	1.56	1.56	1.56	1.56	1.56	1.56	0.00	0.00	0.00	
OCDF	7.18	0.27	7.18	3.61	7.18	7.18	5.08	3.10	3.85	61.06	
2,3,7,8-TCDD	2.10	2.10	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	2.14	2.14	2.14	2.14	2.14	2.14	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDD	3.08	3.08	0.11	3.08	3.08	3.08	2.49	1.33	1.65	53.41	
1,2,3,6,7,8-HxCDD	1.22	0.17	0.15	1.22	0.21	1.22	0.59	0.57	0.71	96.55	
1,2,3,7,8,9-HxCDD	2.84	0.14	0.28	2.84	0.17	0.18	0.72	1.19	1.47	164.46	
1,2,3,4,6,7,8-HpCDD	2.31	0.47	0.38	5.32	0.49	0.71	0.51	0.14	0.18	27.71	70-S
OCDD	6.70	1.76	1.26	5.84	1.52	6.70	2.81	2.60	3.23	92.47	70-S
TEQ (<DL = 0)	NA	0.35	0.32	0.43	0.35	0.44	0.38	0.05	0.07	14.51	
TEQ (<DL = 0.5DL)	NA	3.47	3.51	3.89	3.56	3.76	3.64	0.18	0.22	4.89	
TEQ (<DL = DL)	NA	6.61	6.69	7.10	6.78	7.08	6.85	0.22	0.28	3.28	
TEQ_{TP} (<DL = 0)	NA	0.23	0.20	0.25	0.23	0.30	0.24	0.04	0.04	14.83	
TEQ_{TP} (<DL = 0.5DL)	NA	3.18	3.16	3.20	3.18	3.25	3.19	0.04	0.04	1.12	
TEQ_{TP} (<DL = DL)	NA	6.14	6.11	6.16	6.14	6.21	6.15	0.04	0.04	0.58	

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having DL concentrations.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

TABLE 3.21. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Three Downstream: <DL = 0 for Statistics

	DL	Fairfield--Downstream, N=5										Data
congener/sample ID	(ng/kg)	76-S	77-S	78-S	79-S	80-S	Mean	Std Dev	95% CI	% RSD	Rejected*	Flags
2,3,7,8-TCDF	0.80	1.99	2.43	4.46	2.77	2.91	2.91	0.93	1.16	32.09		
1,2,3,7,8-PeCDF	2.08	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
2,3,4,7,8-PeCDF	3.13	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,4,7,8-HxCDF	2.59	0.18	0.17	0.17	<DL	0.19	0.14	0.01	0.01	7.85		
1,2,3,6,7,8-HxCDF	2.46	0.14	<DL	0.15	0.18	<DL	0.10	0.02	0.02	18.98		
2,3,4,6,7,8-HxCDF	2.88	0.41	0.33	<DL	0.50	0.39	0.33	0.07	0.09	21.44		
1,2,3,7,8,9-HxCDF	1.68	0.17	0.16	0.12	<DL	0.16	0.12	0.02	0.03	17.16		
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	0.14	<DL	<DL	0.03	NA	NA	NA		
OCDF	7.18	0.26	<DL	<DL	<DL	<DL	0.05	NA	NA	NA		
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	NA	NA	NA	NA		
1,2,3,7,8-PeCDD	2.14	0.13	<DL	<DL	<DL	<DL	0.03	NA	NA	NA		
1,2,3,4,7,8-HxCDD	3.08	<DL	<DL	0.12	<DL	0.20	0.06	0.05	0.07	83.38		
1,2,3,6,7,8-HxCDD	1.22	0.18	<DL	0.18	<DL	<DL	0.07	0.00	0.00	2.54		
1,2,3,7,8,9-HxCDD	2.84	0.19	<DL	0.20	<DL	<DL	0.08	0.01	0.02	16.05		
1,2,3,4,6,7,8-HpCDD	2.31	0.42	0.41	0.42	0.62	0.44	0.46	0.09	0.11	19.73		
OCDD	6.70	1.99	<DL	1.34	2.30	1.69	1.46	0.41	0.51	27.99		
TEQ (<DL = 0)	NA	0.46	0.31	0.55	0.35	0.39	0.41	0.09	0.11	22.48		
TEQ (<DL = 0.5DL)	NA	2.52	3.77	3.66	3.90	3.69	3.51	0.56	0.70	15.98		
TEQ (<DL = DL)	NA	4.58	7.23	6.77	7.45	7.00	6.61	1.16	1.44	17.58		
TEQ_{TP} (<DL = 0)	NA	0.33	0.24	0.45	0.28	0.29	0.32	0.08	0.10	24.72		
TEQ_{TP} (<DL = 0.5DL)	NA	2.21	3.20	3.40	3.23	3.24	3.06	0.48	0.59	15.66		
TEQ_{TP} (<DL = DL)	NA	4.10	6.16	6.36	6.19	6.20	5.80	0.96	1.19	16.48		

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having a zero concentration.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

TABLE 3.22. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Three Downstream: <DL = 0.5*DL for Statisti

	DL	Fairfield--Downstream, N=5									
congener/sample ID	(ng/kg)	76-S	77-S	78-S	79-S	80-S	Mean	Std Dev	95% CI	% RSD	Rejected*
2,3,7,8-TCDF	0.80	1.99	2.43	4.46	2.77	2.91	2.91	0.93	1.16	32.09	
1,2,3,7,8-PeCDF	2.08	1.04	1.04	1.04	1.04	1.04	1.04	0.00	0.00	0.00	
2,3,4,7,8-PeCDF	3.13	1.56	1.56	1.56	1.56	1.56	1.56	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDF	2.59	0.18	0.17	0.17	1.29	0.19	0.40	0.50	0.62	124.42	
1,2,3,6,7,8-HxCDF	2.46	0.14	1.23	0.15	0.18	1.23	0.59	0.59	0.73	100.02	
2,3,4,6,7,8-HxCDF	2.88	0.41	0.33	1.44	0.50	0.39	0.62	0.47	0.58	75.59	
1,2,3,7,8,9-HxCDF	1.68	0.17	0.16	0.12	0.84	0.16	0.29	0.31	0.38	105.22	
1,2,3,4,6,7,8-HpCDF	2.65	1.32	1.32	1.32	1.32	1.32	1.32	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	0.78	0.78	0.14	0.78	0.78	0.65	0.29	0.36	43.92	
OCDF	7.18	0.26	3.59	3.59	3.59	3.59	2.92	1.49	1.85	50.90	
2,3,7,8-TCDD	2.10	1.05	1.05	1.05	1.05	1.05	1.05	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	0.13	1.07	1.07	1.07	1.07	0.88	0.42	0.52	47.76	
1,2,3,4,7,8-HxCDD	3.08	1.54	1.54	0.12	1.54	0.20	0.99	0.76	0.94	76.73	
1,2,3,6,7,8-HxCDD	1.22	0.18	0.61	0.18	0.61	0.61	0.44	0.24	0.29	53.84	
1,2,3,7,8,9-HxCDD	2.84	0.19	1.42	0.20	1.42	1.42	0.93	0.67	0.83	72.21	
1,2,3,4,6,7,8-HpCDD	2.31	0.42	0.41	0.42	0.62	0.44	0.46	0.09	0.11	19.73	
OCDD	6.70	1.99	3.35	1.34	2.30	1.69	2.13	0.77	0.95	35.91	
TEQ (<DL = 0)	NA	0.46	0.31	0.55	0.35	0.39	0.41	0.09	0.11	22.48	
TEQ (<DL = 0.5DL)	NA	2.52	3.77	3.66	3.90	3.69	3.51	0.56	0.70	15.98	
TEQ (<DL = DL)	NA	4.58	7.23	6.77	7.45	7.00	6.61	1.16	1.44	17.58	
TEQ_{TP} (<DL = 0)	NA	0.33	0.24	0.45	0.28	0.29	0.32	0.08	0.10	24.72	
TEQ_{TP} (<DL = 0.5DL)	NA	2.21	3.20	3.40	3.23	3.24	3.06	0.48	0.59	15.66	
TEQ_{TP} (<DL = DL)	NA	4.10	6.16	6.36	6.19	6.20	5.80	0.96	1.19	16.48	

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having 0.5*DL concentrations.**

All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

TABLE 3.23. SPMD Dioxin Concentrations (ng/kg SPMD) for Deployment Three Downstream: <DL = DL for Statistics

	DL	**Fairfield--Downstream, N=5**									
congener/sample ID	**(ng/kg)**	76-S	77-S	78-S	79-S	80-S	**Mean**	**Std Dev**	**95% CI**	**% RSD**	**Rejected***
2,3,7,8-TCDF	0.80	1.99	2.43	4.46	2.77	2.91	2.91	0.93	1.16	32.09	
1,2,3,7,8-PeCDF	2.08	2.08	2.08	2.08	2.08	2.08	2.08	0.00	0.00	0.00	
2,3,4,7,8-PeCDF	3.13	3.13	3.13	3.13	3.13	3.13	3.13	0.00	0.00	0.00	
1,2,3,4,7,8-HxCDF	2.59	0.18	0.17	0.17	2.59	0.19	0.66	1.08	1.34	163.31	
1,2,3,6,7,8-HxCDF	2.46	0.14	2.46	0.15	0.18	2.46	1.08	1.26	1.57	116.85	
2,3,4,6,7,8-HxCDF	2.88	0.41	0.33	2.88	0.50	0.39	0.90	1.10	1.37	122.43	
1,2,3,7,8,9-HxCDF	1.68	0.17	0.16	0.12	1.68	0.16	0.46	0.68	0.85	148.55	
1,2,3,4,6,7,8-HpCDF	2.65	2.65	2.65	2.65	2.65	2.65	2.65	0.00	0.00	0.00	
1,2,3,4,7,8,9-HpCDF	1.56	1.56	1.56	0.14	1.56	1.56	1.28	0.64	0.79	49.78	
OCDF	7.18	0.26	7.18	7.18	7.18	7.18	5.80	3.09	3.84	53.38	
2,3,7,8-TCDD	2.10	2.10	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	
1,2,3,7,8-PeCDD	2.14	0.13	2.14	2.14	2.14	2.14	1.74	0.90	1.12	51.78	
1,2,3,4,7,8-HxCDD	3.08	3.08	3.08	0.12	3.08	0.20	1.91	1.60	1.99	83.76	
1,2,3,6,7,8-HxCDD	1.22	0.18	1.22	0.18	1.22	1.22	0.81	0.57	0.71	70.94	
1,2,3,7,8,9-HxCDD	2.84	0.19	2.84	0.20	2.84	2.84	1.78	1.45	1.80	81.34	
1,2,3,4,6,7,8-HpCDD	2.31	0.42	0.41	0.42	0.62	0.44	0.46	0.09	0.11	19.73	
OCDD	6.70	1.99	6.70	1.34	2.30	1.69	2.80	2.21	2.74	78.66	
TEQ (<DL = 0)	NA	0.46	0.31	0.55	0.35	0.39	0.41	0.09	0.11	22.48	
TEQ (<DL = 0.5DL)	NA	2.52	3.77	3.66	3.90	3.69	3.51	0.56	0.70	15.98	
TEQ (<DL = DL)	NA	4.58	7.23	6.77	7.45	7.00	6.61	1.16	1.44	17.58	
TEQ_{TP} (<DL = 0)	NA	0.33	0.24	0.45	0.28	0.29	0.32	0.08	0.10	24.72	
TEQ_{TP} (<DL = 0.5DL)	NA	2.21	3.20	3.40	3.23	3.24	3.06	0.48	0.59	15.66	
TEQ_{TP} (<DL = DL)	NA	4.10	6.16	6.36	6.19	6.20	5.80	0.96	1.19	16.48	

NOTES

NA = Not Applicable

DL = Detection Limits **Means are calculated with <DL having DL concentrations.**

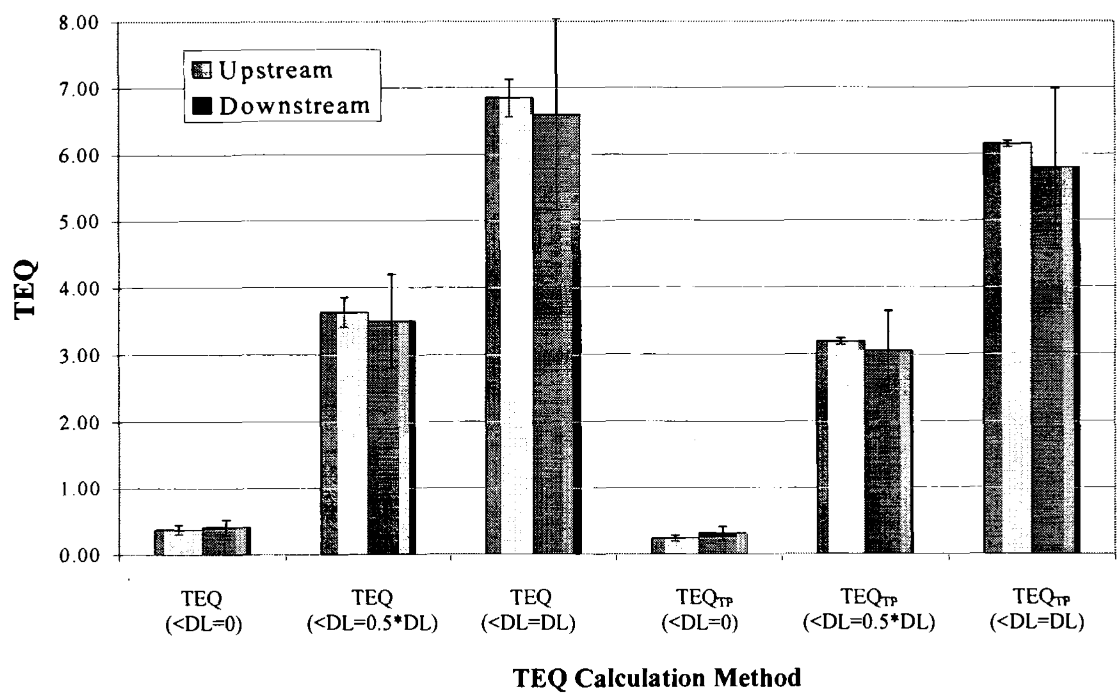
All concentrations are given in parts per trillion as ng of the congener per kg of whole SPMD (membrane + lipid)

***Data points are only rejected if they are proven to be outliers by the Q Test for Bad Data with 95% Confidence.**

Values less than the MDLs are to be considered estimated values.

The graphical and tabular results indicate that there is no difference between the upstream-downstream dioxin concentrations. Figure 3.12 provides a graphical presentation of the various TEQs calculated for both upstream and downstream. The mean TEQ is provided on the y-axis and the TEQ calculation method is provided on the x-axis. The bars represent the mean TEQ value among the five replicates for each site. The y-axis error bars represent the 95% confidence interval for the mean TEQs.

FIGURE 3.12. Upstream-Downstream TEQ Values for Kennebec River



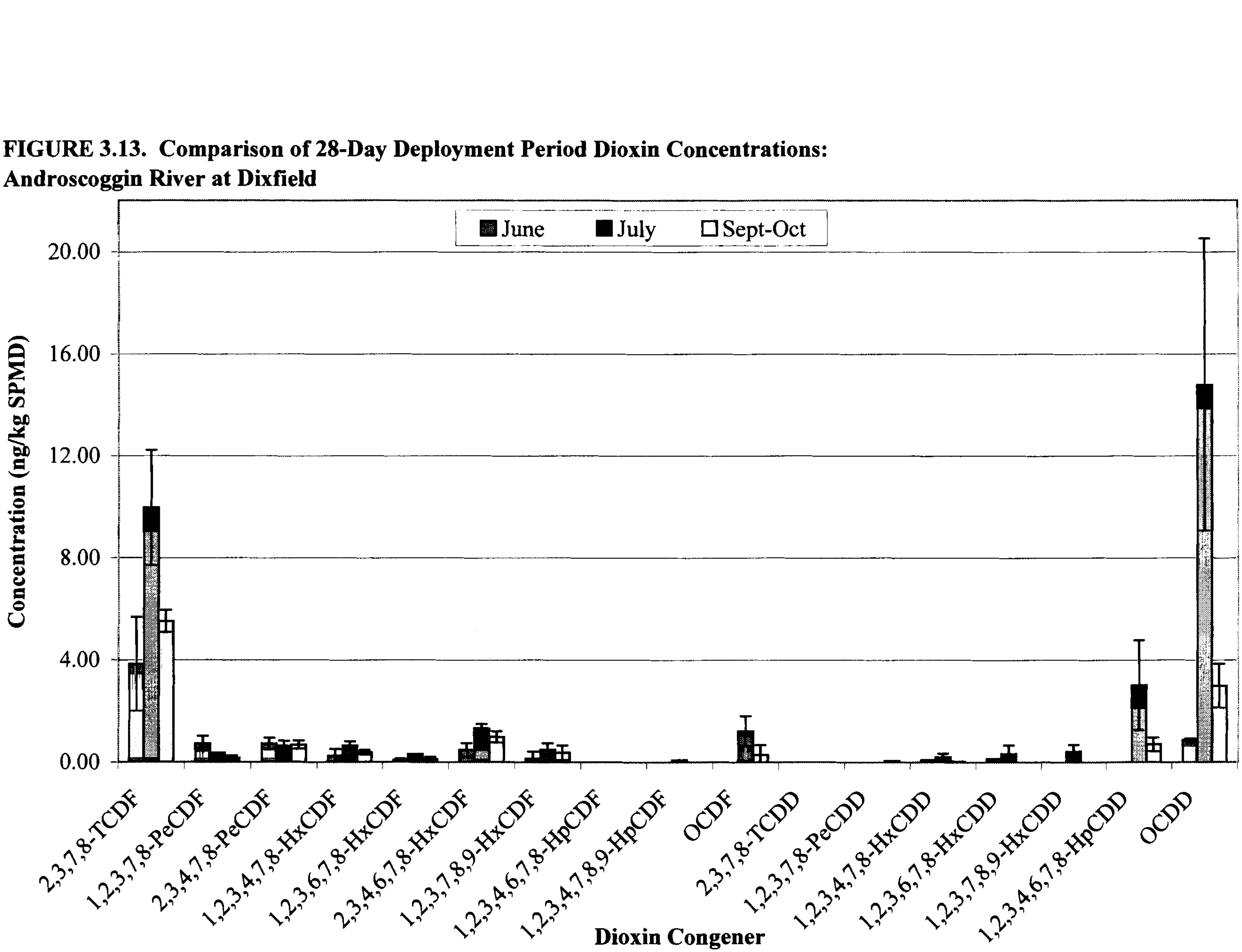
There is no difference between upstream and downstream dioxin concentration means (Figure 3.12). Statistically, the analysis of variance (ANOVA) F-test supports the null hypothesis that there is no statistical difference between upstream and downstream treatments at a level of significance, $\alpha = 0.05$ with a P-value of 0.505.

3.4 Research Objective 5: Investigation of the Dixfield, ME Site

3.4.1. Deployment month

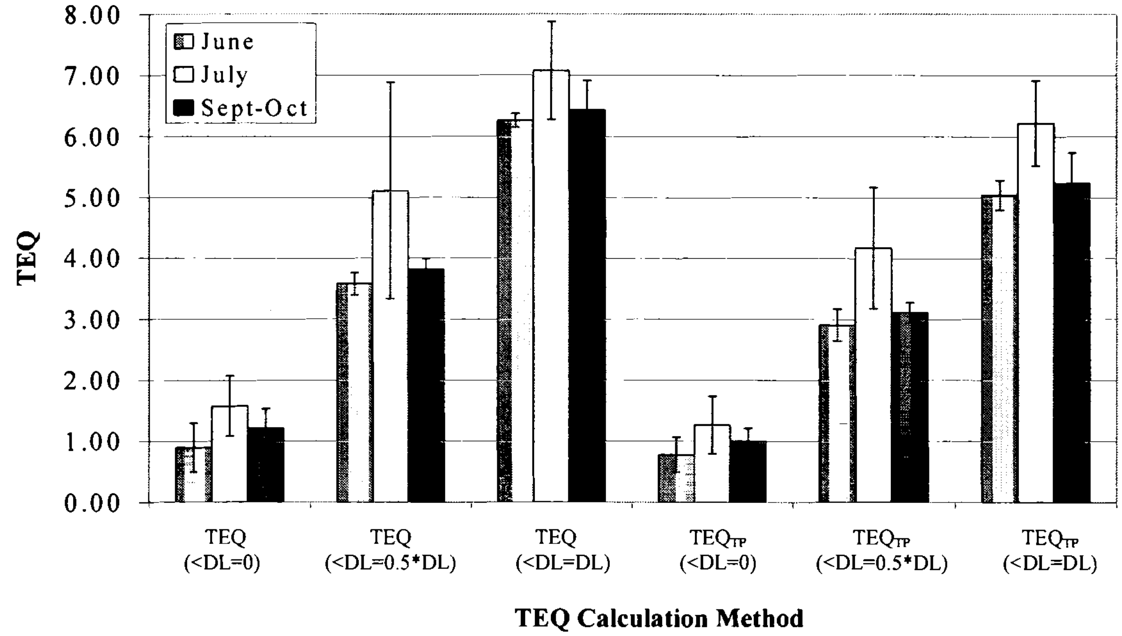
Figure 3.13 on the following page presents the dioxin concentrations for all three Androscoggin River deployment months. The concentrations in nanograms of the dioxin congener per kilogram of whole SPMD are provided on the y-axis while the seventeen dioxin congeners are provided on the x-axis. The y-axis error bars represent the 95% confidence intervals for the concentration means: for June and July, n=5 and for September-October, n=10.

FIGURE 3.13. Comparison of 28-Day Deployment Period Dioxin Concentrations: Androscoggin River at Dixfield



For most of the congeners, the concentrations are highest in July, followed by September-October, and then June (Figure 3.13; Figure 3.14).

FIGURE 3.14. Comparison of 28-Day Deployment Period TEQ Values: Androscoggin River at Dixfield



The statistical difference in SPMD dioxin concentrations between months was proven through ANOVA. The dependent variable used was TEQ (<DL=0) and the predictor variable was month with three different treatments of June, July, and September-October, n_T=18. The F* value was 7.647 compared to a critical F value of 3.68. Therefore, we conclude H_a, that there is a statistical difference between dioxin concentrations among the three treatments. It is important to note that there were two outliers removed from the September-October data set, thus n=8 (97-S and 100-S). They are noted as outliers on the data sheet by the 95% Q test for Bad Data (Harris 1995). This

ANOVA test is conclusive because all criteria for ANOVA were met. The P-value for the test was 0.005, which is well below the alpha of 0.05.

3.4.2. Environmental conditions

3.4.2.1. Graphical comparisons

Figures 3.15 to 3.17 graphically present the data in the Appendix A for these water quality parameters.

FIGURE 3.15. Water Velocity vs. Deployment Month for the Dixfield Site. The water velocity is an average for each deployment period.

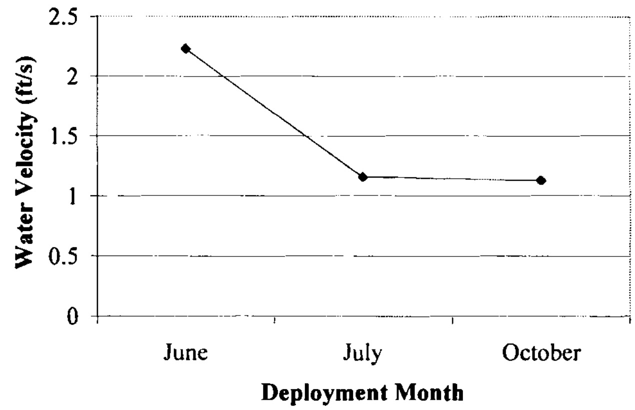


FIGURE 3.16. Temperature vs. Deployment Month for the Dixfield Site. The temperature is an average of the hourly temperature logger data for each deployment period.

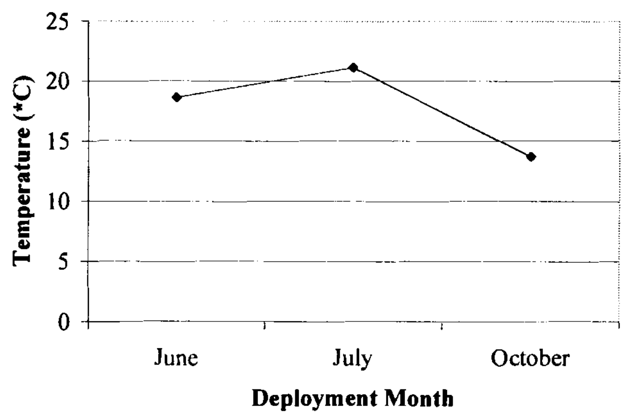
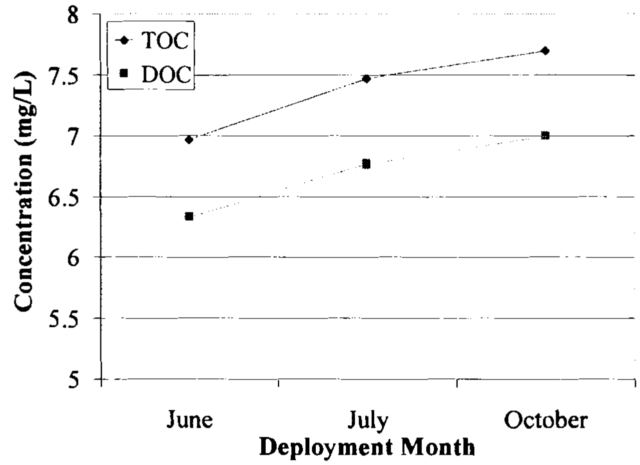


FIGURE 3.17. TOC and DOC Concentrations vs. Deployment Month for the Dixfield Site. Each data point represents the mean concentration for the deployment period.



3.4.2.2. Statistical comparisons

To statistically compare environmental conditions and dioxin concentrations, we used the coefficient of correlation [r], the coefficient of determination [r^2], and the observed level of significance [P-value] (Tables 3.24 to 3.26). The number of observations is equal to 18. There is only one dependent variable, Y, in our study which is TEQ (<DL-0) and there are four predictor variables, X, which are water velocity, TOC, DOC, and temperature.

TABLE 3.24. r Values for the Dixfield Data Set. The Coefficient of Correlation, r, between each parameter is provided in the cell where the parameters intersect.

Parameter	TEQ (<DL=0)	Water Velocity	TOC	DOC	Temperature
TEQ (<DL=0)	1.000				
Water Velocity	-0.425	1.000			
TOC	0.242	-0.957	1.000		
DOC	0.221	-0.948	1.000	1.000	
Temperature	0.408	0.312	-0.574	-0.599	1.000

TABLE 3.25. r^2 Values for the Dixfield Data Set. The Coefficient of Determination, r^2, between each parameter is provided in the cell where the parameters intersect.

Parameter	TEQ (<DL=0)	Water Velocity	TOC	DOC	Temperature
TEQ (<DL=0)	1.000				
Water Velocity	0.181	1.000			
TOC	0.059	0.916	1.000		
DOC	0.049	0.899	1.000	1.000	
Temperature	0.166	0.097	0.329	0.359	1.000

TABLE 3.26. P-Values for the Dixfield Data Set. The Observed Level of Significance, P-value, between each parameter is provided in the cell where the parameters intersect.

Parameter	TEQ (<DL=0)	Water Velocity	TOC	DOC	Temperature
TEQ (<DL=0)	0.000				
Water Velocity	0.079	0.000			
TOC	0.334	0.000	0.000		
DOC	0.377	0.000	0.000	0.000	
Temperature	0.092	0.208	0.013	0.009	0.000

Compared with the deployment time study statistical parameters, these data differ for some of the variables. Not only will these current correlations be discussed, but also they will be compared with the deployment time study correlations in our discussion chapter.

4. DISCUSSION

This chapter will examine each of our objectives and hypotheses and apply the results from the last chapter to each of them. This chapter will also discuss the questions for future work.

4.1 Objective 1: Method Development

To develop field and laboratory methods for the SPMDs.

The sample data presented in the results chapter coupled with the quality control data spreadsheets in the appendices demonstrate the effectiveness of the final SPMD extraction and cleanup methods developed in this project. Retention time shifts were eliminated with the combined cleanup steps of silica gel slurry and gel permeation chromatography. The significance of the GPC was reinforced when the instrument malfunctioned and the samples from deployments two and four of the 2000 field season could not be cleaned with the final method. Samples from these two deployments had more diphenylether (DPE) interference than samples from the other deployments. This interference is noted in the data flag column of each spreadsheet.

It is helpful at this point to discuss the causes of some of the other data flags in the quality control data in Appendices C and D: dioxin detected in laboratory blanks (B), syringe contamination (Y), and carryover from the HRGC / HRMS calibration standard (O). Mostly the dioxin detected in the laboratory blanks, B, was associated with diphenylether interference. One isolated incident involved the contamination of an internal standard syringe with the performance and recovery standard (Y-flag). This

contamination was found in some of the QC blanks but the pattern of contamination was not exhibited in the accompanying field SPMD samples; therefore, those field samples were not flagged. The HRGC / HRMS calibration standard contamination was a difficult source of contamination because it only affected the first sample of each of the SPMD runs. The first sample was usually a process blank and that is why most of these samples are flagged. The sample order in the run was always calibration standard, fresh solvent blank, and then process blank. The contamination was attributed to the syringe because the same peaks were found in the fresh solvent blank run prior to the process blank.

While analytical problems occurred, noted by the data flags, the final SPMD extraction and cleanup method was successful and is ready to be used in future SPMD work. The analytical issues have subsequently been eliminated by the HRGC /HRMS analyst.

4.2 Objective 2: SPMD Performance

To determine the effectiveness of semipermeable membrane devices for sampling dioxin in Maine rivers.

While this objective was met with preliminary results from the 1999 field season data, it was reinforced by the quantitative data from the 2000 field season. For all of the 2000 field season deployments, the tetra- through hexa-chlorinated dibenzofurans (TCDFs, PeCDFS, and HxCDFs) and the hepta- and octa-chlorinated dibenzo-*p*-dioxins (HpCDD and OCDD) were detected by the SPMDs. The detection of HpCDD and OCDD in all of the samples substantiates the discussion of Czuczwa and Hites (1986)

about the atmospheric abundance of these two congeners produced by the reactions of the wood preservative pentachlorophenol.

A key unrelated issue is whether the SPMDs are able to sample TCDD. Previous dioxin studies using the SPMDs have been able to detect TCDD (Prest *et al.* 1992; Lebo *et al.* 1995; Gale *et al.* 1997; and Rantalainen *et al.* 1998), so it is unlikely that an inability to sample TCDD is a shortfall of the devices. Most likely, the compound was not present during the deployment periods in a dissolved form. Another interesting trend is for only the lower chlorinated PCDFs to be sampled by the SPMDs. This occurrence was noted in many previous SPMD studies with polychlorinated biphenyls and dioxin: the SPMDs sampled more of the lower chlorinated congeners than the higher chlorinated ones (Prest *et al.* 1995; Gale *et al.* 1997; McCarthy and Gale 1999; and Echols *et al.* 2000). Our SPMD data follow the trends exhibited in previous studies.

4.3 Objective 3: Deployment Time Studies

Examine the effects of environmental conditions on SPMD dioxin concentrations during June and July deployment time studies

The SPMD deployment parameters and environmental conditions scrutinized under this objective are identified with each of the hypotheses provided in the following subsections.

4.3.1. Hypothesis a: Deployment time

As deployment time increases, dioxin concentrations increase.

We developed this hypothesis, which was reinforced by the deployment time studies executed by Rantalainen *et al.* (1998), to determine if SPMD saturation occurred during our deployment periods. While we performed the calculations and found that we were well within the linear sampling period for dioxin, we wanted to substantiate the calculation with experimental data as well as investigate the biofouling of the membranes throughout the deployment time period. A quick review of the results presented in chapter three reveals that our two deployment time studies validated hypothesis a. For both June and July, there was a general trend of increasing dioxin levels as deployment time increased. However, the lack of a substantial increase in dioxin concentrations in the fourth week of the July deployment indicates the presence of other factors influencing dioxin concentrations: the factor of increased biofouling.

4.3.2. Hypothesis b: Biofouling

As biofouling increases on the SPMDs, the uptake of dioxin decreases.

The extent of biofouling on the membrane increases as temperature increases.

Scientists working with SPMDs have long recognized that biofouling on the device slows the SPMD sampling rate of pollutants (Gale 1998; Huckins *et al.* 1999a). The environmental condition of temperature influences biofouling because as temperature increases, so does biological activity and thus biofouling. Biofouling could not quantified; however, it was qualitatively observed. More growth was noted in July than in June. For July, tiny periphyton was observed on the SPMDs in the first week,

leaving no stain when cleaned during processing. However, the growth on the membrane surface became darker and larger with increased exposure and brown staining of the membranes occurred. Perhaps this increase in biofouling slowed the SPMD sampling rate in July, validating hypothesis b. The June deployment TEQ and TCDF concentrations (Figures 3.2 and 3.4) do not indicate a plateau in the concentrations over the four-week period while the July deployment values do (Figures 3.4 and 3.5). This plateau may be nonexistent or not be attributed to biofouling. However, these observations reflect the need for more research on the effects of biofouling on SPMD performance.

4.3.3. Hypothesis c: Water velocity

As water velocity increases, the dilution of water dioxin concentrations increases and less dioxin is sequestered by the SPMDs during the deployment period.

While Booij *et al.* (1998) found that increased water velocity-turbulence causes an increase in SPMD sampling rate, our water velocity hypothesis focused on what occurs in the river during high velocity periods. Even though SPMD sampling rate increases during high water velocity conditions, the water being sampled would contain less dioxin than during low water velocity conditions due to the presence of more water and thus dilution. Was this hypothesis validated by our deployment time studies?

Water velocity was higher in June than in July and dioxin concentrations were higher in July than in June. Is this inverse relationship real? Statistically, the relationship between water velocity and TEQ (<DL=0) in the Pearson Correlation Matrix had an r of –0.766 and a P-value of 0.027. With an alpha value set at 0.1 for preliminary

investigations, the inverse relationship between water velocity and dioxin concentrations for the two deployment time studies was validated statistically. However, the small sample size and lack of a statistical design for testing water velocity separate from the other environmental conditions. Therefore, these results warrant the need for further investigations into this hypothesis.

4.3.4. Hypothesis d: Temperature

As temperature increases SPMD dioxin sampling rates increase and the devices sequester more dioxin.

Previous calibration studies with the SPMDs have validated this hypothesis in the laboratory (Huckins *et al.* 1999a and Rantalainen *et al.* 2000). We wanted to see if this direct relationship between temperature and dioxin concentrations occurred in the field during our deployment time studies. Temperatures in the water were three to five degrees Celsius higher in July than in June and dioxin concentrations were higher in July than in June as well. Was a direct relationship between temperature and dioxin concentrations statistically significant? The coefficient of correlation, r, was 0.852 between temperature and TEQ (<DL=0) and the P-value was 0.007 which is well below an alpha of 0.1. Therefore, the relationship was proven to be statistically significant and warrants further study.

4.3.5. Hypothesis e: Total organic carbon and dissolved organic carbon

As TOC and DOC concentrations in the water sampled increase,

dioxin concentrations in the SPMD decrease.

In addition to biofouling, water velocity, and temperature, TOC and DOC concentrations influence the SPMD dioxin concentrations (J.N. Huckins, personal communication; McCarthy and Gale 1999). Dioxin is highly hydrophobic and prefers to be bound to particulate matter. TOC and DOC chelate dioxin and reduce the availability of the dioxin for the sequestered by the SPMDs during deployment. High levels of TOC and DOC theoretically suggest lower levels of dioxin sampled by the devices. TOC and DOC levels were higher in July than in June (Figure 3.8). Therefore, in July both TOC/DOC and dioxin concentrations were higher; thus instead of the hypothesized inverse relationship, a direct one is presented. Does this disprove our original hypothesis? Statistically, a correlation between TOC/DOC concentrations and dioxin concentrations was not evident, especially DOC with a P-value of 0.131. There are many interactions occurring between the environmental conditions, making it difficult to adequately test all of these hypotheses. Further studies will need to be done that isolate these conditions.

4.4 Objective 4: Upstream-Downstream Test

To deploy SPMDs at selected upstream-downstream sites and determine

if there is a statistical difference between upstream and downstream dioxin levels.

This objective was the main focus of our project. The sample sizes were bigger for this investigation than for the environmental condition investigations. We wanted to

see if these devices could be used for the upstream-downstream test. The larger sample size allowed for statistical analyses to be done on the results. Through graphical and statistical analyses we found that there was no difference between upstream and downstream dioxin concentrations at both pairs of sites tested.

A great deal of information was provided by these two deployments. The statistical parameter of percent relative statistical difference (%RSD), also known as the coefficient of variation, relates the standard deviation and mean of a set of replicate deployment samples. In determining the presence of a statistical difference between upstream and downstream it is important to have the least amount of variability among the replicate SPMD samples as possible. An important factor that must be worked out by the Maine DEP is the determination of what value to assign for <DL because it affects the %RSD. While the %RSD values presented in the previous chapter are promising, subsequent SPMD studies should focus on investigating multiple replicates at each site to further assess method variability. The Maine DEP has been evaluating fish variability so it would be beneficial to look at SPMD performance for the same sites over multiple field seasons since environmental conditions are variable from year to year.

4.5 Objective 5: SPMD Field Season

To investigate how the SPMDs sample over an entire field season at a given site. This examination will allow us to determine the optimal times for SPMD deployments.

4.5.1. Hypothesis f: Deployment month

There is a difference in the SPMD dioxin concentrations among the deployment months.

As we planned the 2000 field season we expected that deployment month would be significant because environmental conditions vary from month to month (Figure 3.13). Through ANOVA, the hypothesis was statistically validated: Dioxin concentrations in the SPMDs vary by deployment month, with the highest dioxin concentrations in July. Therefore, it is helpful to characterize a given deployment site throughout a given field season in order to gain understanding of how the varying monthly conditions influence SPMD dioxin concentrations. For example, the environmental condition trends found in the 2000 field season are most likely going to be different from previous and subsequent field seasons. As far as an optimal deployment month, that is hard to assess. For the 2000 field season, July looked to be the best month for deployment because one could have shorter deployment periods due to less dilution of the pollutant examined.

4.5.2. Hypothesis g: Environmental conditions

The varying environmental conditions of water velocity, temperature, TOC, and DOC among the deployment months influence this difference in SPMD dioxin concentrations.

While each environmental condition will be briefly discussed, it is evident that all of these conditions influence the SPMD dioxin concentrations through an interactive

effort: no one parameter controls the SPMD sampling. For this reason, it is difficult to establish the presence of statistical relationships without a set experimental design that can hold the other environmental conditions constant while the investigated parameter is varied. These designs cannot be achieved in the field, which is why they were not pursued in this current study.

4.5.2.1. Water velocity

For dioxin concentrations, July had the highest followed by September-October and then June. For water velocity, June had the highest, followed by July then September-October. Therefore, an inverse relationship is possible between dioxin concentrations and water velocity. However, statistically, the coefficient of correlation between water velocity and TEQ (<DL=0) was -0.425 with a P-value of 0.079 which is just under an alpha of 0.1, indicating the presence of a possible negative correlation.

4.5.2.2. Temperature

The relationship in the deployment time study between temperature and SPMD dioxin concentrations is reinforced by this deployment month investigation. July had both the highest temperatures and the highest dioxin concentrations. The coefficient of correlation between the two variables was 0.408 and the P-value of 0.092 is below an alpha of 0.1, indicating the presence of a possible positive correlation.

4.5.2.3. TOC and DOC

A linear association between TOC/DOC and TEQ was not significant with this data set. The P-values were 0.334 and 0.377 for TOC and DOC respectively when each was correlated with TEQ (<DL=0).

4.6 Objective 6, Hypothesis h: Method Detection Limits

To determine if SPMD method detection limits (MDLs) are influenced by the number of SPMDs combined to make one sample.

Hypothesis (h):

As the number of SPMDs that are combined to make one sample in a MDL study increases, the detection limits decrease and the sensitivity of the method increases.

Tables 3.1 and 3.2 in the previous chapter do not validate this hypothesis. Most of the MDLs for the different dioxin congeners increased as we went from one SPMD to two. Why did the experimental results diverge from the hypothesis?

It is important to note that the second MDL study was done when the gel permeation chromatograph was not operating and thus these samples did not go through the appropriate, full cleanup procedure. This is the reason why these MDLs are not applied to the field sample results. Gel permeation chromatography eliminates many of the diphenyl ether interference that can hinder peak identification. Therefore, the peaks in the second MDL study were not as defined as in the first study. It is recommended that this study be repeated in order to test the theory further.

5. CONCLUSION

5.1 Summary

This thesis project evaluated an alternate method for determining Kraft pulp and paper mill compliance to the upstream-downstream test of the 1997 Dioxin Law. This new method that utilizes semipermeable membrane devices (SPMDs) circumvents many of the problems present with the current upstream-downstream fish test.

Over the course of two field seasons, we assessed the feasibility of using SPMDs to monitor dioxin concentrations in Maine rivers. First, the 1999 field season focused on developing viable field and laboratory SPMD methods. Field methods included design of the vertical deployment apparatus for the SPMDs and determination of which environmental conditions to monitor: biofouling, temperature, water velocity, dissolved organic carbon, total organic carbon, and specific conductance. In the laboratory, the final SPMD extraction and cleanup methods included extraction by dialysis of the entire SPMD in hexane followed by two cleanup methods: acidified silica gel slurry to remove residual lipids and gel permeation chromatography to remove interferences through size exclusion. The laboratory analysis involved EPA Method 1613B and high resolution gas chromatography / high resolution mass spectrometry (HRGC/HRMS).

Second, for the 2000 field season we applied the developed methods to assess the effects of varying environmental conditions on SPMD sampling and to test two pairs of upstream-downstream sites: one pair on the Androscoggin River and one pair on the Kennebec River. A pair of deployment time studies allowed for us to investigate the

effects of biofouling on SPMD sampling and to determine if SPMD dioxin concentrations increase linearly over the 28-day deployment period.

5.2 Conclusions

We developed viable field and laboratory methods for using semipermeable membrane devices to monitor dioxin levels in Maine rivers. Over the past two field seasons, we have demonstrated the ability of the devices to monitor dioxin. Moreover, we have provided the Maine Department of Environmental Protection with SPMD upstream-downstream data from two Maine Rivers with replicate SPMD samples. These data will be compared by DEP staff with data from the other dioxin monitoring methods.

Since laboratory investigations were not part of this project, the relationships between environmental conditions, such as water velocity, temperature, total organic carbon, and dissolved organic carbon, and SPMD dioxin concentrations could not be examined. The Pearson Correlation Matrices demonstrated the existence of relationships that need to be validated in further studies: a negative correlation between water velocity and dioxin concentration and a positive correlation between temperature and dioxin concentration. While there are many advantages in using the SPMDs, the varying environmental conditions and their effects on SPMD dioxin concentrations do present the fundamental limitation of the devices: the SPMD sampling rate depends on water velocity, temperature, and biofouling. Scientists are working hard to circumvent this limitation (Booij *et al.* 1998; Huckins *et al.* 1999a). Our earlier discussion about permeability reference compounds (PRCs) addresses this issue. Adding a PRC to the SPMD before deployment will allow for corrections to be made between sites for these

varying environmental conditions. Using these PRCs, we will not need to investigate complex experimental designs to establish the statistical relationships between each environmental variable and dioxin concentrations.

The method detection limit (MDL) studies presented in this thesis illustrate the reproducibility of the SPMD results. The questionable MDL study involving the two SPMDs per sample warrants the need for further composite studies to test our hypothesis.

5.3 Proposed Future Work

Since this is the first attempt to use SPMDs in the State of Maine in a possible regulatory situation, there are many areas that need to be further investigated.

1. More SPMDs should be processed to test the effectiveness of the extraction and cleanup methods.
2. A permeability reference compound (PRC) should be developed for SPMD dioxin monitoring. In a possible regulatory situation, we need to be assured that upstream and downstream sites can be directly compared; therefore, environmental conditions must be identical or corrections must be made through use of the PRCs. Our studies controlled site selection for water velocity and temperature, however TOC and DOC concentration analyses must be performed in the laboratory and thus are not good screening data.
3. If a PRC is not used, laboratory experiments should be performed where other environmental conditions are held constant and each parameter is tested separately on how it affects SPMD dioxin concentrations. It would be difficult to perform these tests in the field.

4. Repeat the deployment time studies with more replicates in the first three weeks to refine the recommendations for optimal time of deployment.
5. Repeat the upstream-downstream tests at the same sites as the 2000 deployments so that we can begin to establish a historical record of SPMD concentrations. Adding more replicates will allow for a fuller examination of upstream-downstream differences and variability.
6. Compare SPMD data with the other dioxin monitoring methods from the 2000 field season for the same sites and deployment periods to determine how our SPMD test measures up to the alternatives: How does the variability of our samples compare with fish and mussel variability?

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APPENDICES

Appendix A

WATER QUALITY DATA FROM 1999 AND 2000 FIELD SEASONS

TABLE A.1. Field and Laboratory Water Quality Data from the 1999 Field Season

a. Deployment One

Penobscot River — **9 SPMDs deployed, 3 per site: 6/18/99 to 7/16/99**

	Deployment: 6/18			Retrieval: 7/16		
Field Data:	**Site 1**	**Site 2**	**Site 3**	**Site 1**	**Site 2**	**Site 3**
GPS Location	N45*22'37" W68*30'27"	N45*22'33" W68*30'37"	N45*22'32" W68*30'51"			
Water Temperature (*C)	19	19.5	21	22	22.5	24
Temperature Logger (*C)	20.96	20.96	21.48	22.96	23.3	23.32
Avg. Temp Logger for Deployment (*C)	23.47	23.46	23.75			
Air Temperature (*C)	17.5	14.5	17	28.5	26	28.5
Depth (feet)	6	6	6	5	4	5
Water Velocity (ft/s)	0.9	0.78	0.56	2.43	1.57	1.4
Conductivity (ms/cm)	47	47	212			28
Air Exposure Time (minutes)	4:57	3:00	3:19	3:32	3:52	3:27
Laboratory Data:						
Closed-cell pH	7	7.1	7.2	NA	NA	NA
Total Organic Carbon (mg/L)	6.8	6.8	10	6.5	6.5	15
Dissolved Organic Carbon (mg/L)	NA	NA	NA	NA	NA	NA
Total Suspended Solids (mg/L)	0.22	3.8	2.2	1.2	1	2.9
Apparent Color (PCU)	NA	NA	NA	45	44	130
Chlorophyll a (ppb)	NA	NA	NA	3	3.2	4.3
Specific Conductance (ms/cm)	NA	NA	NA	51	54	280
Total Phosphorus (ppb)	NA	NA	NA	14	56	140
Turbidity (NTU)	NA	NA	NA	0.63	0.66	1.5

NA = Not Available

TABLE A.1 continued
b. Deployment Two
Penobscot River

Field Data:	Site 3	Site 4	Site 5	Site 3	Site 4	Site 5
	12 SPMDs 6 at site 3, 3 at sites 4 and 5: 7/21/99 to 8/18/99					
	Deployment: 7/21			Retrieval: 8/18		
GPS Location	N45*22'32" W68*30'51"	N45*22'21" W68*31'55"	N45*21'01" W68*33'50"			
Water Temperature (*C)	24	23.5	24.5	22	22	22
Temp Logger (*C)	24.67		24.88	22.45		22.96
Avg. Temp Logger for Deployment (*C)	23.82		23.73			
Air Temperature (*C)	26	28.5	27.5	21	22	21
Depth (feet)	5	5	5	6	6	6
Water Velocity (ft/s)	NA	NA	NA	1.8	2.3	2.8
Conductivity (ms/cm)	200-225	85	~100	NA	NA	NA
Air Exposure Time (minutes)	7:12	2:34	1:57	6:55	2:45	2:53
Laboratory Data:						
Closed-cell pH	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/L)	14	8.1	7.6	14	7.8	8.3
Dissolved Organic Carbon (mg/L)	NA	NA	NA	13	7.4	7.6
Total Suspended Solids (mg/L)	4	0.61	1	2.2	0.6	1.2
Apparent Color (PCU)	NA	NA	NA	150	48	53
Chlorophyll a (ppb)	3.1	2.1	2.6	2.1	2.3	2
Specific Conductance (ms/cm)	300	100	89	260	63	83
Total Phosphorus (ppb)	140	36	32	79	23	26
Turbidity (NTU)	1.7	0.6	0.55	1.5	1.2	1.2

NA = Not Available

TABLE A.1 continued
c. Deployment Three
Penobscot River

12 SPMDs deployed, 3 per site: 8/20/99 to 9/16/99

Field Data:	Deployment: 8/20				Retrieval: 9/16			
	Site 3	**Site 5**	**Site 6**	**Site 7**	**Site 3**	**Site 5**	**Site 6**	**Site 7**
GPS Location	N45*22'32" W68*30'51"	N45*21'01" W68*33'50"	N45*21'05" W68*33'58"	N45*23'04" W68*30'50"				
Water Temperature (*C)	21	22	20	20	20	20	20	20
Temp Logger (*C)	21.29			20.97	21.12			20.64
Avg. Temp Logger for Deployment (*C)	23.16			22.94				
Air Temperature (*C)	20	22	20	17.5	15	14	14	14
Depth (feet)	6	6	7	6	6	6	6	6
Water Velocity (ft/s)	2.2	4.5	4	4.1	NA	NA	NA	NA
Conductivity (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA
Air Exposure Time (minutes)	2:15	2:21	2:20	2:15	4:00	5:00	3:00	3:00
Laboratory Data:								
Closed-cell pH	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/L)	12	9.2	8	7.9	14	11	9	8.7
Dissolved Organic Carbon (mg/L)	11	8.6	6.6	7.7	14	11	9.4	9.5
Total Suspended Solids (mg/L)	2.4	0.67	0.22	0.44	4	1.4	2.2	2.1
Apparent Color (PCU)	100	57	46	47	180	82	63	62
Chlorophyll a (ppb)	2.5	2.4	2	2.7	4.8	4.1	5.6	6.1
Specific Conductance (ms/cm)	160	88	48	47	200	85	48	45
Total Phosphorus (ppb)	120	29	14	14	75	29	23	21
Turbidity (NTU)	1.8	1	0.85	0.48	0.98	0.65	0.67	0.59

NA = Not Available

TABLE A.1 continued

d. Deployment Four

Penobscot River

	12 SPMDs deployed, 3 per site: 9/28/99 to 10/28/99							
	Deployment: 9/28				Retrieval: 10/28			
Field Data:	**Site 3**	**Site 5**	**Site 8**	**Site 9**	**Site 3**	**Site 5**	**Site 8**	**Site 9**
GPS Location	N45*22'32" W68*30'51"	N45*21'01" W68*33'50"	N45*00'47" W68*38'33"	N45*35'38" W68*29'47"				
Water Temperature (*C)	15	14	15	15	4	4	5	5
Temp Logger (*C)	16.13			16.93	5.74			6.67
Avg. Temp Logger for Deployment (*C)	10.91			11.15				
Air Temperature (*C)	13	12	12	15	5	4	6	-1
Depth (feet)	10	8	8	10	9	9	8	9
Water Velocity (ft/s)	1.5	1.9	1.3	0.42	1.1	1.4	1.4	0.9
Conductivity (ms/cm)	NA	NA	NA	NA	NA	NA	NA	NA
Air Exposure Time (minutes)	2:38	1:45	2:00	1:47	2:00	2:05	1:30	2:00
Laboratory Data:								
Closed-cell pH	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon (mg/L)	16	14	15	7	11	12	12	7
Dissolved Organic Carbon (mg/L)	15	14	15	6.9	11	12	13	7.3
Total Suspended Solids (mg/L)	1.7	1.2	1.7	0.9	1.3	0.9	1.4	0.3
Apparent Color (PCU)	120	100	120	54	79	87	97	47
Chlorophyll a (ppb)	2.3	2.6	2.6	3.4	1.4	1.8	1.5	1.6
Specific Conductance (ms/cm)	87	64	46	38	44	62	44	39
Total Phosphorus (ppb)	28	27	21	18	29	31	22	42
Turbidity (NTU)	0.72	0.62	0.73	0.54	1	1.1	1.1	1

NA = Not Available

TABLE A.2. Field and Laboratory Water Quality Data from the 2000 Field Season
a. Deployment One
Androscoggin River **20 SPMDs deployed at Site 10, 4 Weekly Retrievals: 6/2/00 to 6/30/00**

	Deployment: 6/2	Deployment: 6/2	Retrieval 1: 6/9	Retrieval 2: 6/16	Retrieval 3: 6/23	Retrieval 4: 6/30
Field Data:	**Site 10-A**	**Site 10-B**	**Site 10-A**	**Site 10-B**	**Site 10-A**	**Site 10-B**
GPS Location	N44*30'10" W70*23'53"	same as A				
Water Temperature (*C)	16		14	15	20	23
Temp Logger (*C)	17.09	17.08	16.29	17.08	20.64	23.46
Avg. Temp Logger for Deployment (*C)	17.23	18.64	16.15	15.68	17.23	18.64
Air Temperature (*C)	21.5		18.5	19	18	24
Depth (feet)	12.5		12.5	12	11	13
Water Velocity (ft/s)	2.7		NA	1.75	NA	NA
Air Exposure Time (min:sec)	3:45	4:15	5:00	3:00	3:54	3:00
Laboratory Data:						
Total Organic Carbon (mg/L)	5.5	5.5	5.6	7.7	7.3	7.7
Dissolved Organic Carbon (mg/L)	5.6	5.5	5.6	7	6.6	6.5
Specific Conductance (ms/cm)	73.7	73.2	65.3	77.5	101	106

NA = Not Available

TABLE A.2 continued
b. Deployment Two
Androscoggin River

Field Data:	20 SPMDs deployed at Site 10, 4 Weekly Retrievals: 6/30/00 to 7/28/00					
	Deployment:6/30	Deployment: 7/7	Retrieval 1: 7/14	Retrieval 2: 7/14	Retrieval 3: 7/28	Retrieval 4: 7/28
	Site 10-B	**Site 10-A**	**Site 10-A**	**Site 10-B**	**Site 10-A**	**Site 10-B**
GPS Location	N44*30'10" W70*23'53"					
Water Temperature (*C)	23	20	21	21	21	21
Temp Logger (*C)	23.63	21.29	22.63	22.62	21.13	21.12
Avg. Temp Logger for Deployment (*C)			21.12	21.84	20.74	21.16
Air Temperature (*C)	24	19	21	21	19	19
Depth (feet)	13	11	10.3	10.3	10.7	10.7
Water Velocity (ft/s)	NA	0.86	1.19	1.19	1.43	1.43
Air Exposure Time (min:sec)	3:54	5:00	2:05	0:30	2:50	2:20
Laboratory Data:						
Total Organic Carbon (mg/L)	7.7	8.5	7.3	7.3	7.4	7.4
Dissolved Organic Carbon (mg/L)	6.5	8.3	7.4	7.4	6.4	6.4
Specific Conductance (ms/cm)	106	110	112	112	110	110

NA = Not Available

TABLE A.2 continued
c. Deployment Three
Kennebec River

20 SPMDs deployed, 10 per site, 1 Retrieval after 54 days: 8/3/00 to 9/26/00

	Deployment: 8/3		Retrieval: 9/26	
Field Data:	**Site 11-Upstream**	**Site 12-Downstream**	**Site 11-Upstream**	**Site 12-Downstream**
GPS Location	N44*43'48.3" W69*46'26.6"	N44*34'53.1" W69*35'48.1"		
Water Temperature (*C)	21	22	15	15
Temp Logger (*C)	21.46	22.96	16.29	16.61
Avg. Temp Logger for Deployment (*C)			20.35	22.96
Air Temperature (*C)	24	29	8	9
Depth (feet)	12	12	6.8	13.6
Water Velocity (ft/s)	NA	NA	0.45	1.17
Air Exposure Time (min:sec)	9:28	3:00	4:10	4:15
Laboratory Data:				
Total Organic Carbon (mg/L)	4.9	6.4	4.5	6
Dissolved Organic Carbon (mg/L)	4.6	5.8	4.5	6.5
Specific Conductance (ms/cm)	35.6	67.9	36	72.5

NA = Not Available

TABLE A.2 continued
d. Deployment Four
Androscoggin River

Field Data:	Deployment: 9/19 **Site 10-Downstream**	 **Site 13-Upstream**	Retrieval: 10/17 **Site 10-Downstream**	 **Site 13-Upstream**
	40 SPMDs deployed, 20 per site, 1 retrieval after 28 days: 9/19/00 to 10/17/00			
GPS Location	N44*33'10.4" W70*23'52.9"	N44*31'4.1" W70*33'5.3"		
Water Temperature (*C)	15	18	9	8
Temp Logger (*C)	16.59	16.44	NA	9.59
Avg. Temp Logger for Deployment (*C)			13.71	13.22
Air Temperature (*C)	18	22	5	10
Depth (feet)	14	11.5	11.7	11.8
Water Velocity (ft/s)	1.15	1.1	1.1	1.1
Air Exposure Time (min:sec)	12:10	10:10	13:00	8:07
Laboratory Data:				
Total Organic Carbon (mg/L)	7.4	6.8	8	6.2
Dissolved Organic Carbon (mg/L)	6.6	6.1	7.4	5.6
Specific Conductance (ms/cm)	102	53	117.7	71.3

NA = Not Available

FIGURE A.1. Hourly Temperature Logger Data from the 1999 Field Season
a. Deployment One

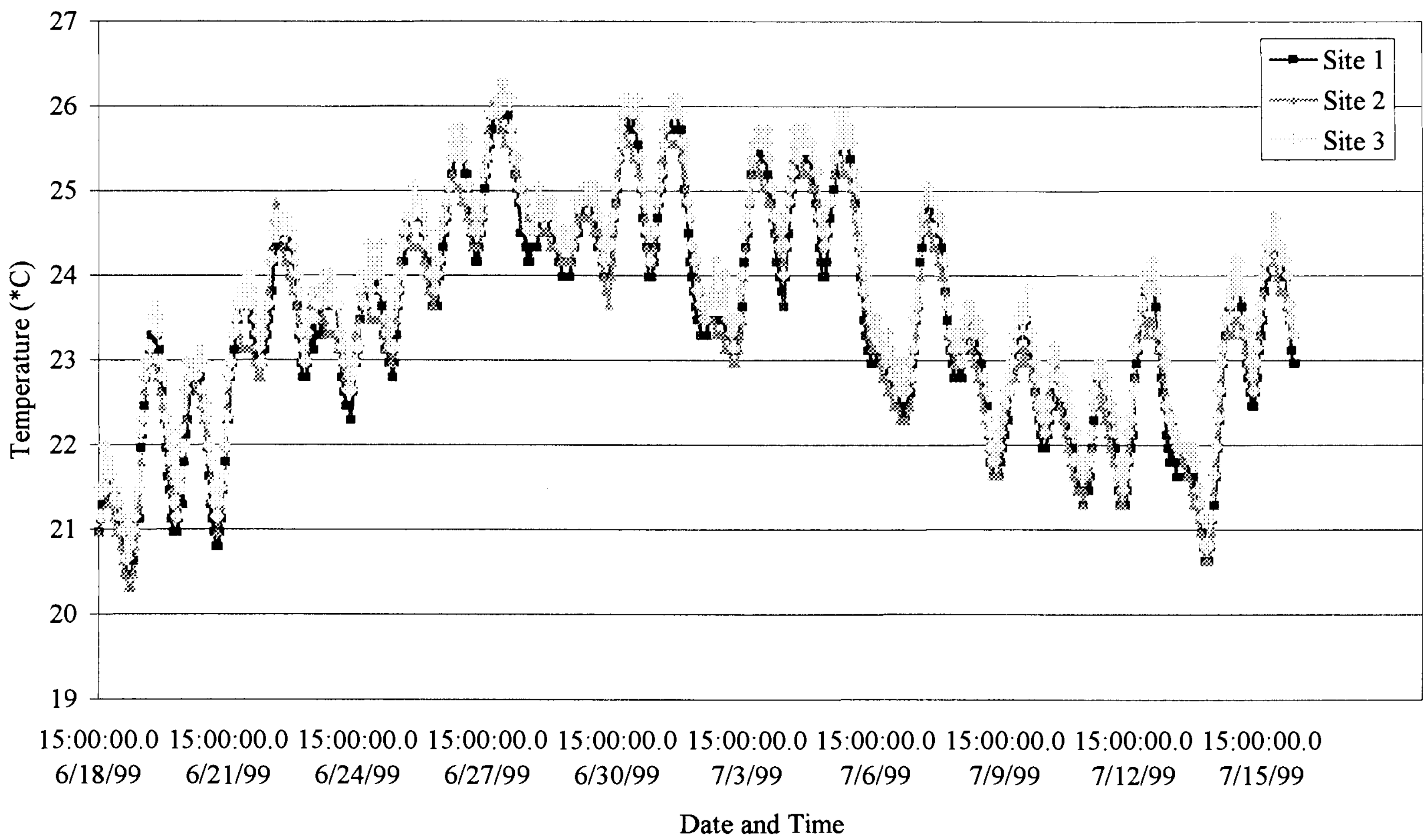


FIGURE A.1 continued
b. Deployment Two

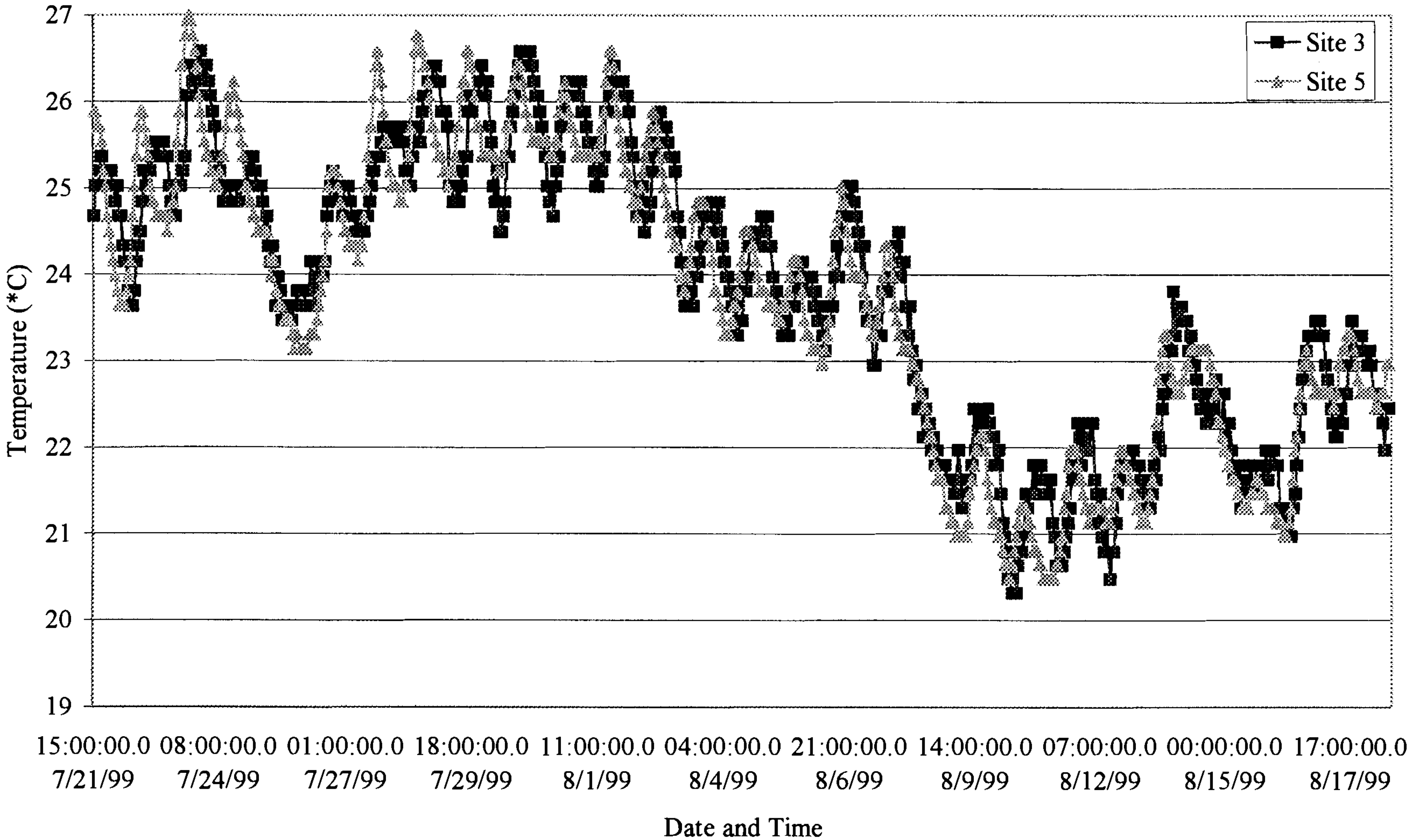


FIGURE A.1 continued
c. Deployment Three

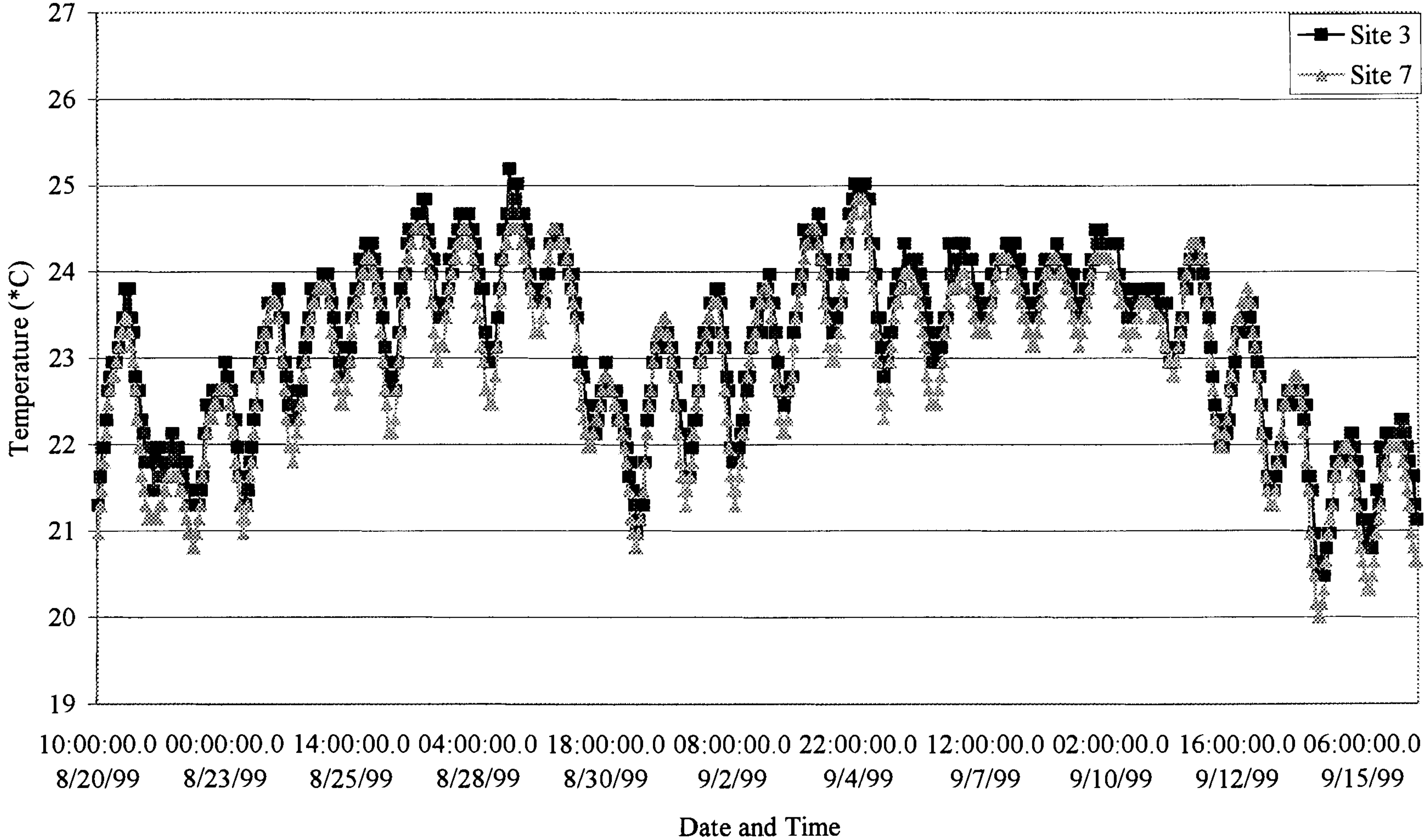


FIGURE A.1 continued
d. Deployment Four

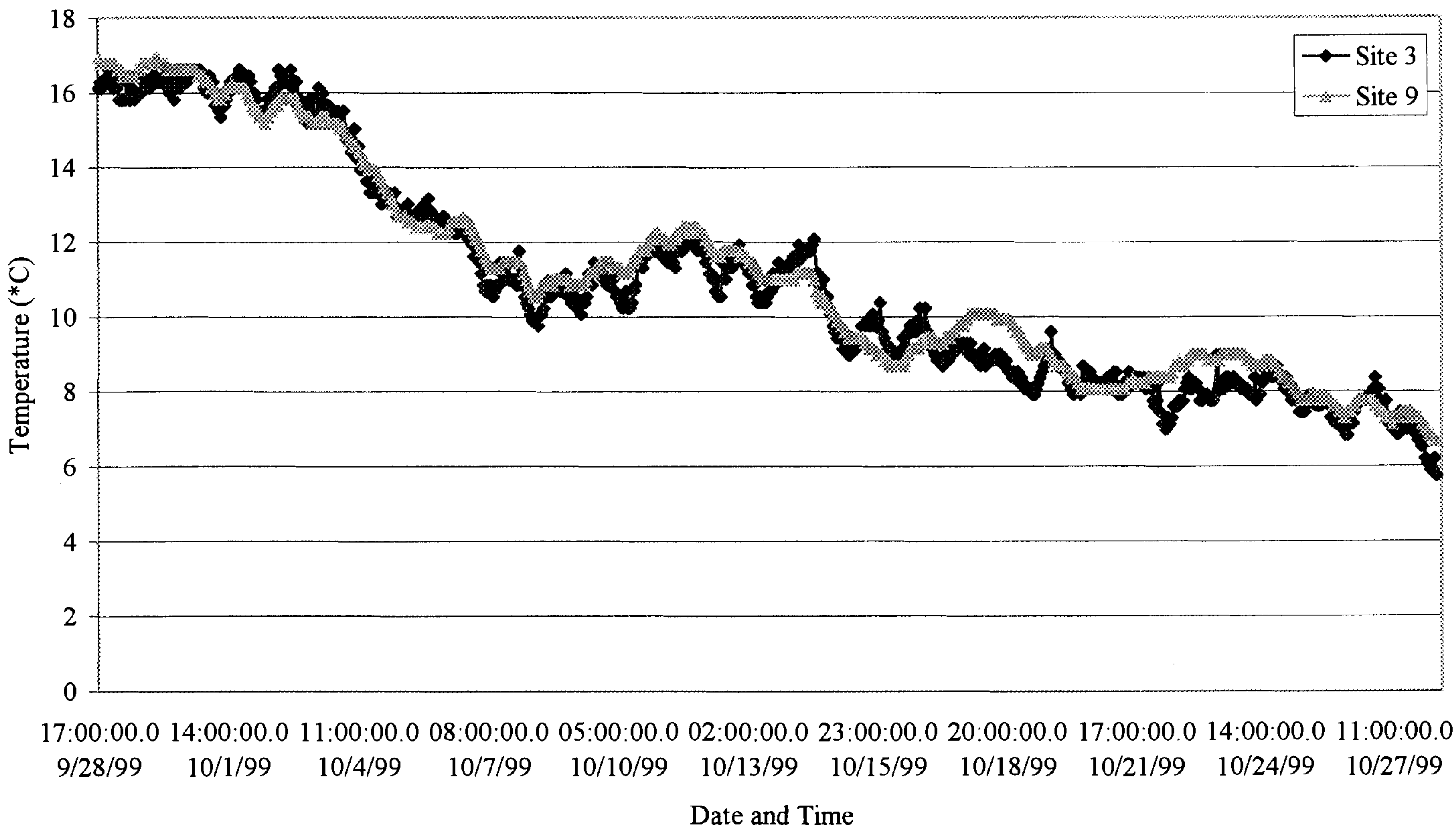


FIGURE A.2. Hourly Temperature Logger Data from the 2000 Field Season
a. Deployment One

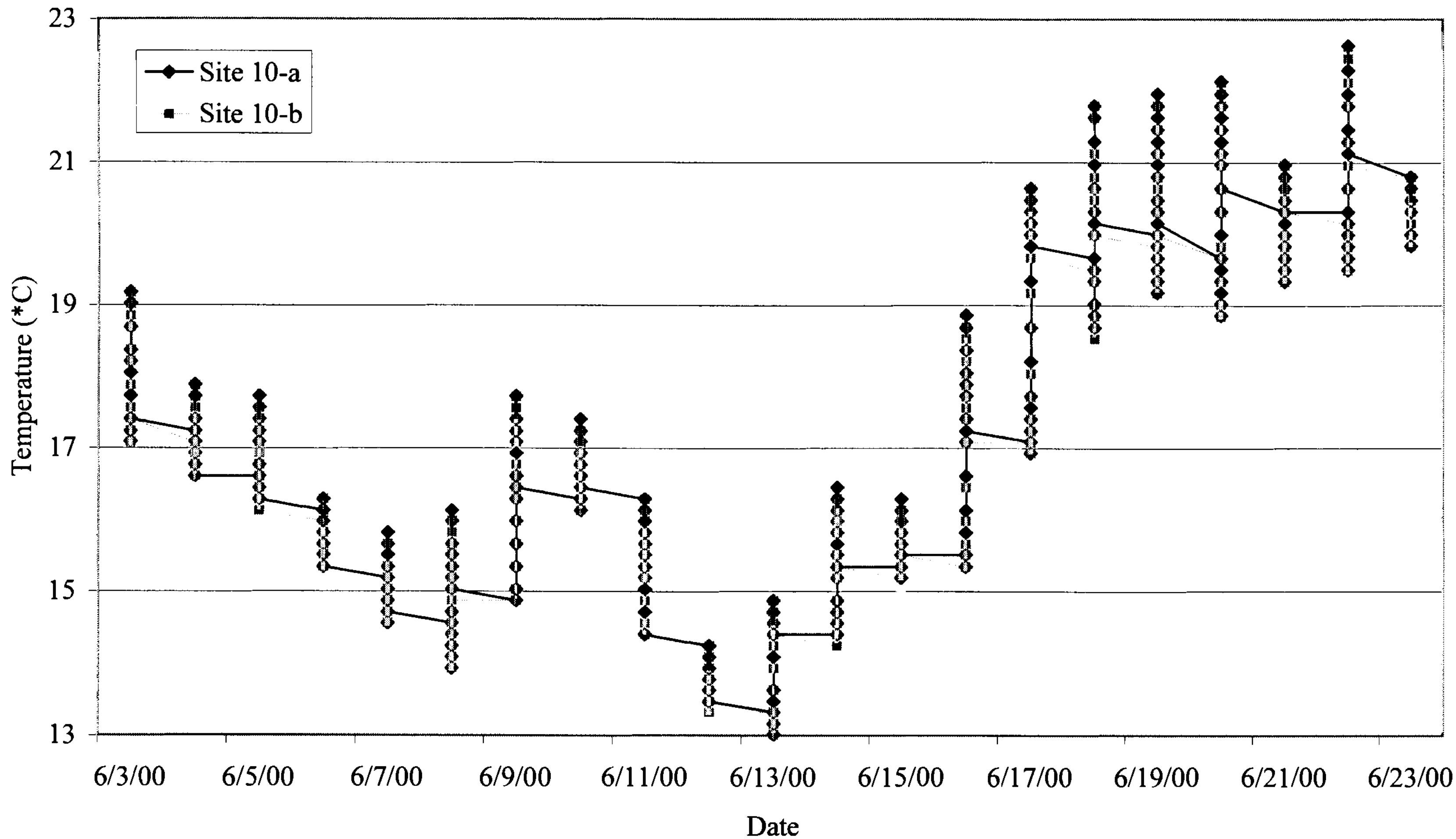


FIGURE A.2 continued
b. Deployment Two

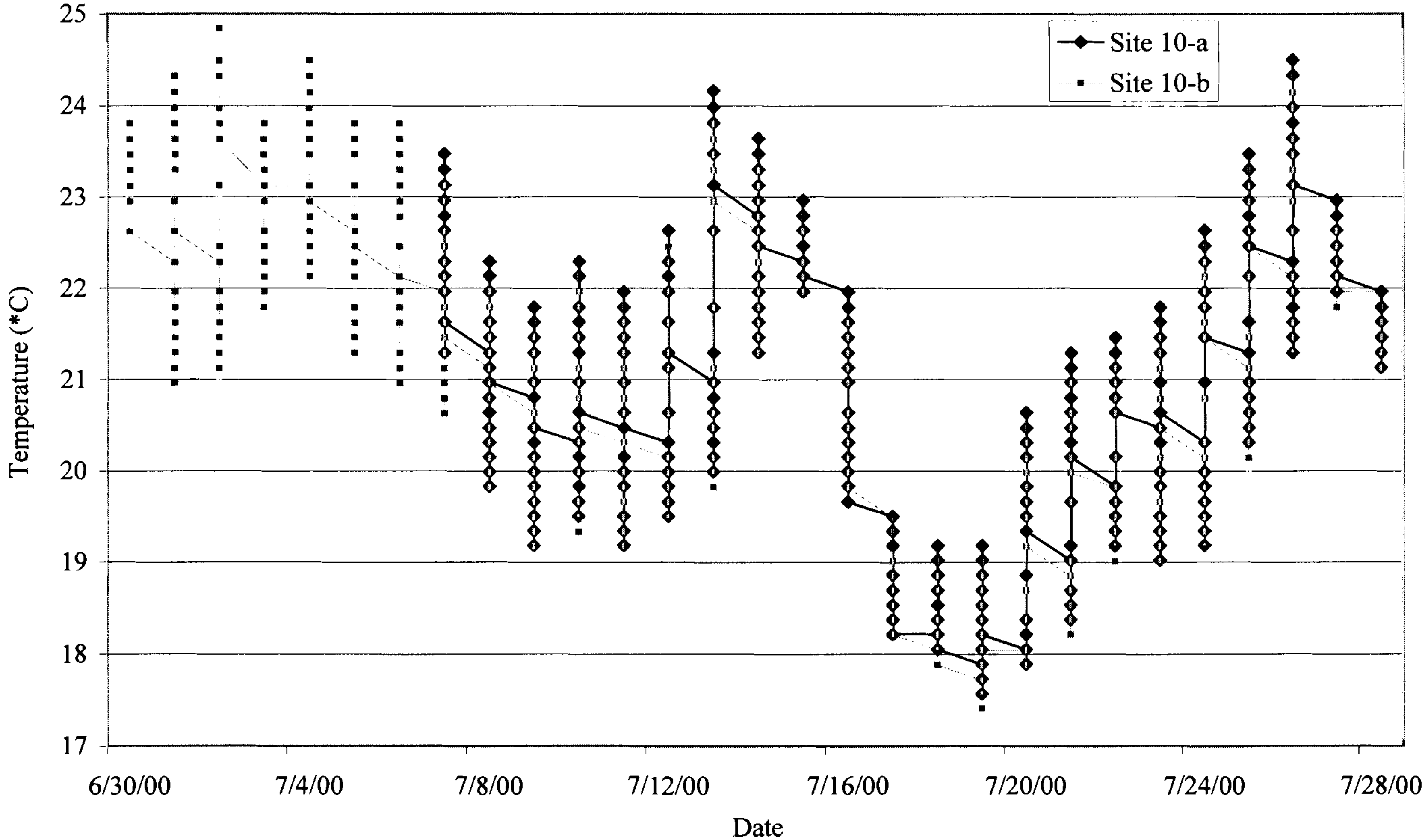


FIGURE A.2 continued
c. Deployment Three

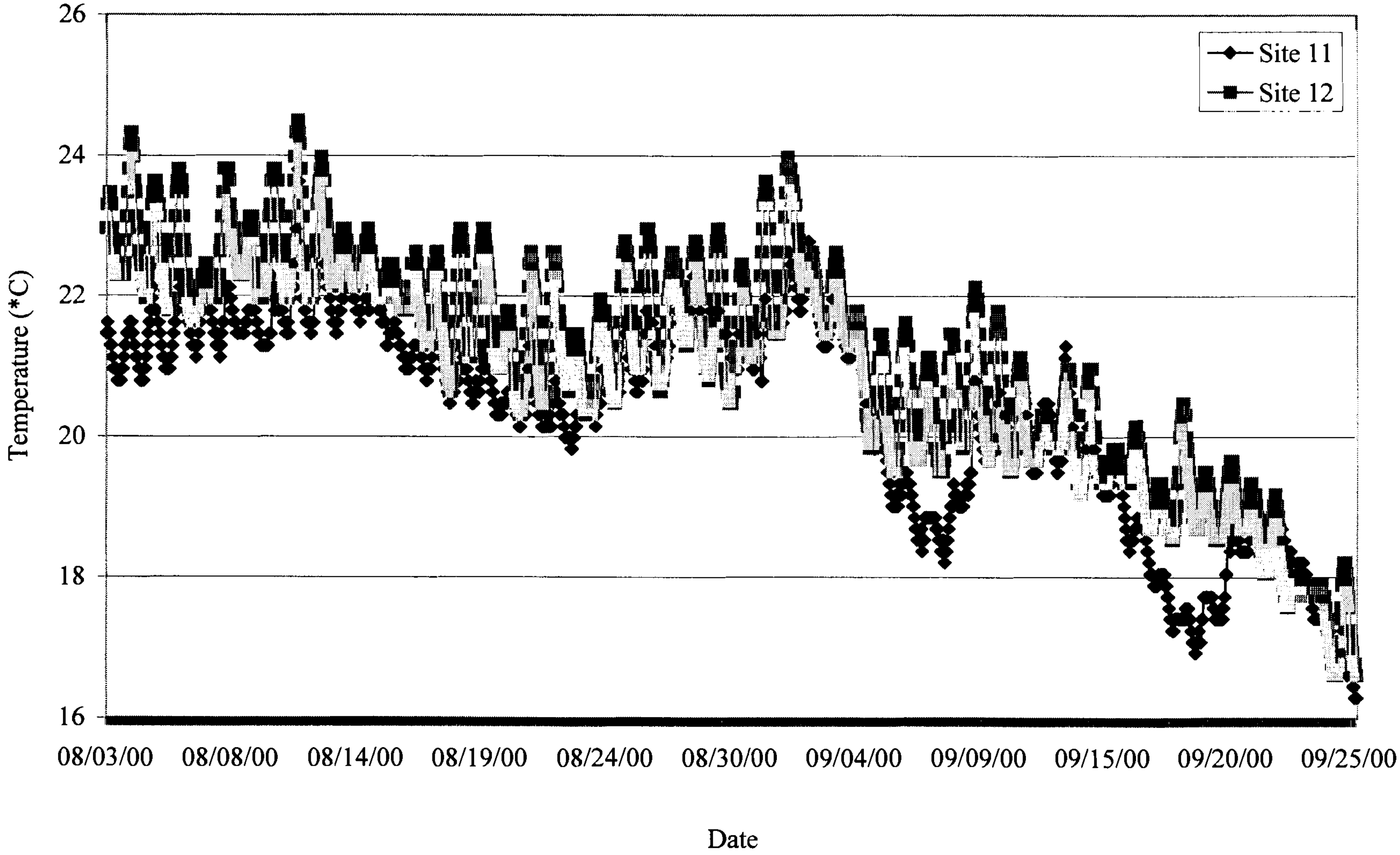
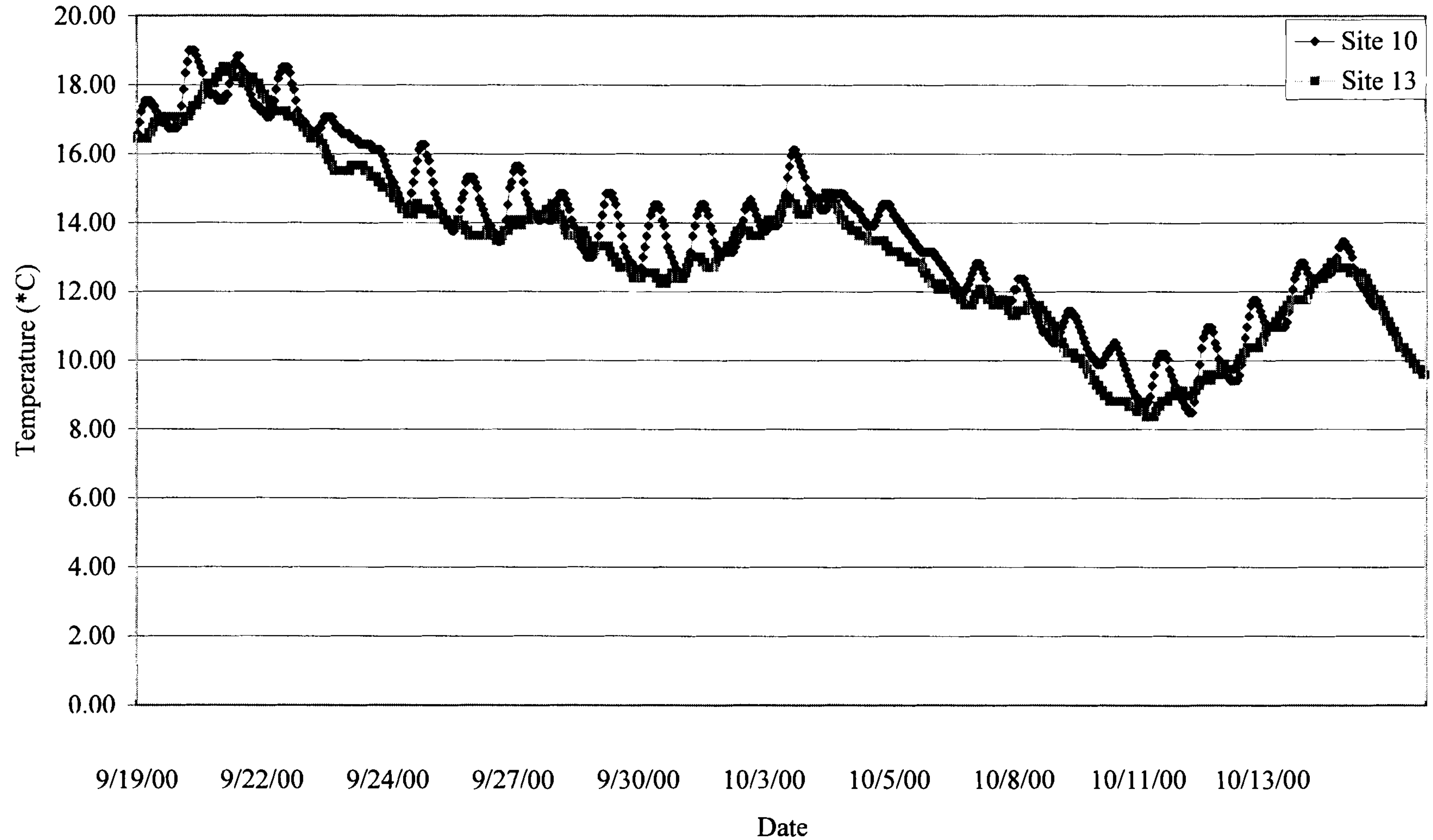


FIGURE A.2 continued
d. Deployment Four



Appendix B

SPMD FIELD SAMPLE INFORMATION AND RAW DATA SPREADSHEETS FROM THE 2000 FIELD SEASON

Table B.1	SPMD Field Sample Information Log, 2000
Table B.2	SPMD Raw Data Calculation Spreadsheets for Deployment One Field Samples
Table B.3	SPMD Raw Data Calculation Spreadsheets for Deployment Two Field Samples
Table B.4	SPMD Raw Data Calculation Spreadsheets for Deployment Three Field Samples
Table B.5	SPMD Raw Data Calculation Spreadsheets for Deployment Four Field Samples

ND Peak was not detected

Data Flag Information Key:

C Co-eluting peak

DPE Diphenyl ether interference with the dioxin peak

S Percent surrogate recoveries were either above or below the established limits set by the EPA in method 1613-B (Telliard 1994)

APPENDIX B.1. SPMD Field Sample Information Log, 2000

Deployment One: Androscoggin River at Dixfield, ME Site 10

Retrieval 1 Samples: 6/2/00 to 6/9/00 10-A Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
19-S	10-A Composite	5	1

Retrieval 2 Samples: 6/2/00 to 6/16/00 10-B Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
27-S	10-B Composite	5	1

Retrieval 3 Samples: 6/2/00 to 6/23/00 10-A Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
34-S	10-A 1	5	1

Retrieval 4 Samples: 6/2/00 to 6/30/00 10-B Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
42-S	10-B 1	1	5
43-S	2	1	
44-S	3	1	
45-S	4	1	
46-S	5	1	

Deployment Two: Androscoggin River at Dixfield, ME Site 10

Retrieval 1 Samples: 7/7/00 to 7/14/00 10-A Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
49-S	10-A Composite	5	1

Retrieval 2 Samples: 6/30/00 to 7/14/00 10-B Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
52-S	10-B Composite	5	1

Retrieval 3 Samples: 7/7/00 to 7/28/00 10-A Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
56-S	10-A Composite	5	1

Retrieval 4 Samples: 6/30/00 to 7/28/00 10-B Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
60-S	10-B 1	1	5
61-S	2	1	
62-S	3	1	
63-S	4	1	
64-S	5	1	

Deployment Three: Upstream-Downstream on the Kennebec River

Upstream Site 11 in Norridgewock, ME: 8/3/00 to 9/26/00

Sample ID#	Descriptor	SPMDs per Sample	# replicates
68-S	Deployed 11 1	2	5
69-S	Deployed 11 2	2	
70-S	Deployed 11 3	2	
71-S	Deployed 11 4	2	
72-S	Deployed 11 5	2	

Deployment Three: Upstream-Downstream on the Kennebec River

Downstream Site 12 in Fairfield, ME: 8/3/00 to 9/26/00

Sample ID#	Descriptor	SPMDs per Sample	# replicates
76-S	Deployed 12 1	2	5
77-S	Deployed 12 2	2	
78-S	Deployed 12 3	2	
79-S	Deployed 12 4	2	
80-S	Deployed 12 5	2	

Deployment Four: Upstream-Downstream on the Androscoggin River

Upstream Site 13 in Rumford, ME: 9/19/00 to 10/17/00

Sample ID#	Descriptor	SPMDs per Sample	# replicates
83-S	Deployed 13 1	2	10
84-S	2	2	
85-S	3	2	
86-S	4	2	
87-S	5	2	
90-S	6	2	
91-S	7	2	
92-S	8	2	
93-S	9	2	
94-S	10	2	

Deployment Four: Upstream-Downstream on the Androscoggin River

Downstream Site 10 in Dixfield, ME: 9/19/00 to 10/17/00

Sample ID#	Descriptor	SPMDs per Sample	# replicates
97-S	Deployed 10 1	2	10
98-S	2	2	
99-S	3	2	
100-S	4	2	
101-S	5	2	
104-S	6	2	
105-S	7	2	
106-S	8	2	
107-S	9	2	
108-S	10	2	

TABLE B.2. SPMD Raw Data Calculation Spreadsheets for Deployment One Field Samples

a. Sample 19-S

Deployment 1, Retrieval 1	010402-1 Run	SAMPLE 1	Composite	5 SPMDs--5*IS and 5*Surr					
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		
13C-2,3,7,8-TCDF	41.52	222836000	284372000	21.99	21.99		1.56	0.78	S
IS-13C-1,2,3,4-TCDD	43.43	644447000	838405000					0.77	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	44.32	204999000	265033000	30.58	30.58		1.04	0.77	
37Cl-TCDD	44.35	99252600		6.35	63.50		2.42		
1,2,3,7,8-PeCDF	56.13	673772	440821	0.12		0.05	0.94	1.53	
2,3,4,7,8-PeCDF	58.02	690952	468783	0.12		0.05	1.01	1.47	
13C-1,2,3,7,8-PeCDF	56.12	635619000	395933000	39.21	39.21		1.77	1.61	
13C-2,3,4,7,8-PeCDF	58.00	593562000	371347000	33.17	33.17		1.96	1.60	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	58.48	556953000	355328000	37.20	37.20		1.65	1.57	
1,2,3,4,7,8-HxCDF	ND						1.20		
1,2,3,6,7,8-HxCDF	63.03	319247	251308	0.04		0.02	1.25	1.27	
2,3,4,6,7,8-HxCDF	63.52	454467	319123	0.05		0.02	1.12	1.42	
1,2,3,7,8,9-HxCDF	64.45	198746	186683	0.03		0.01	1.24	1.06	
13C-1,2,3,4,7,8-HxCDF	62.53	398989000	760897000	81.49	81.49		0.73	0.52	
13C-1,2,3,6,7,8-HxCDF	63.01	419466000	789469000	84.70	84.70		0.73	0.53	
13C-2,3,4,6,7,8-HxCDF	63.50	436120000	827156000	115.28	115.28		0.56	0.53	
13C-1,2,3,7,8,9-HxCDF	64.43	376335000	718721000	60.01	60.01		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	64.12	244092	203907	0.04		0.02	0.95	1.20	
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.05	532430000	427028000	108.35	108.35		0.45	1.25	
13C-1,2,3,6,7,8-HxCDD	64.12	603089000	481581000	146.06	146.06		0.38	1.25	S
IS-13C-1,2,3,7,8,9-HxCDD	64.33	1083390000	872761000					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.47	284767000	626238000	59.94	59.94		0.78	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.19	245301000	545780000	63.70	63.70		0.63	0.45	
1,2,3,4,6,7,8-HpCDD	67.57	522485	585406	0.11		0.04	0.95	0.89	
13C-1,2,3,4,6,7,8-HpCDD	67.56	552862000	532558000	72.37	72.37		0.77	1.04	
OCDD	71.26	2113600	2491680	0.57		0.24	1.04	0.85	
13C-OCDD	71.25	718384000	837443000	137.18	68.59		0.58	0.86	
OCDF	71.32	429964	510581	0.11		0.05	1.11	0.84	

TABLE B.2 continued
b. Sample 27-S

Deployment 1, Retrieval 2 | 000821 run | SAMPLE 6 | Deployed Sample Composite of 5 SPMDs

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.33	123842	154027	0.94		0.39	0.918439986	0.80	
13C-2,3,7,8-TCDF	44.28	13918600	18177200	48.23	48.23		1.441030096	0.77	
IS-13C-1,2,3,4-TCDD	46.26	20376700	25807000					0.79	
2,3,7,8-TCDD	ND						1.077109761		
13C-2,3,7,8-TCDD	47.19	10675800	14453200	53.14	53.14		1.023857862	0.74	
37Cl-TCDD	47.23	3810210		39.55	79.10		2.364085374		
1,2,3,7,8-PeCDF	57.38	24223	18367.6	0.12		0.05	0.927874023	1.32	
2,3,4,7,8-PeCDF	ND						0.969709158		
13C-1,2,3,7,8-PeCDF	57.38	22891600	14371000	47.82	47.82		1.687362997	1.59	
13C-2,3,4,7,8-PeCDF	56.14	22883100	14693000	39.74	39.74		2.047482477	1.56	
1,2,3,7,8-PeCDD							1.025891246		
13C-1,2,3,7,8-PeCDD	59.56	21465100	13592600	46.33	46.33		1.638485797	1.58	
1,2,3,4,7,8-HxCDF	63.46	29088.5	21186.1	0.07		0.03	1.219966561	1.37	
1,2,3,6,7,8-HxCDF	ND						1.192602772		
2,3,4,6,7,8-HxCDF	ND						1.113743836		
1,2,3,7,8,9-HxCDF	ND						1.232706056		
13C-1,2,3,4,7,8-HxCDF	63.45	18736000	37044300	65.99	65.99		1.169972968	0.51	
13C-1,2,3,6,7,8-HxCDF	63.54	19564600	38041700	66.21	66.21		1.204344463	0.51	
13C-2,3,4,6,7,8-HxCDF	64.41	21281100	41465200	77.03	77.03		1.127538571	0.51	
13C-1,2,3,7,8,9-HxCDF	65.33	18633600	36154200	81.18	81.18		0.934144448	0.52	
1,2,3,4,7,8-HxCDD	ND						1.079402111		
1,2,3,6,7,8-HxCDD	ND						0.931942117		
1,2,3,7,8,9-HxCDD	ND						1.012454733		
13C-1,2,3,4,7,8-HxCDD	64.54	23047300	18268600	66.32	66.32		0.86229618	1.26	
13C-1,2,3,6,7,8-HxCDD	65.00	24917400	19534100	60.59	60.59		1.015565858	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	65.21	40413300	31831100					1.27	
1,2,3,4,6,7,8-HpCDF	67.32	36460.3	30727.2	0.12		0.05	1.507118302	1.19	
1,2,3,4,7,8,9-HpCDF	ND						1.468323939		
13C-1,2,3,4,6,7,8-HpCDF	67.32	11454600	25334500	65.58	65.58		0.776561886	0.45	
13C-1,2,3,4,7,8,9-HpCDF	69.08	8587410	20223200	59.09	59.09		0.674918165	0.42	
1,2,3,4,6,7,8-HpCDD	68.44	45674.3	41709	0.17		0.07	0.905840161	1.10	
13C-1,2,3,4,6,7,8-HpCDD	68.42	28823000	27783400	90.83	90.83		0.862603199	1.04	
OCDD	72.26	15080.5	15411	0.96		0.40	0.992801567	0.98	
13C-OCDD	72.24	3042820	3370080	11.94	5.97		0.743342442	0.90	S
OCDF	ND						1.16695644		

TABLE B.2 continued

c. Sample 34-S

Deployment 1, Retrieval 3 | 000821 run | SAMPLE 8 | Composite of 5 deployed SPMDs

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.30	115023	158740	0.65		0.27	0.92	0.72	
13C-2,3,7,8-TCDF	44.26	20317500	25883800	34.46	34.46		1.44	0.78	
IS-13C-1,2,3,4-TCDD	46.24	41429000	51611500					0.80	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.17	18707100	23904500	44.73	44.73		1.02	0.78	
37Cl-TCDD	47.19	4961110		5.07	50.70		2.36		
1,2,3,7,8-PeCDF	57.40	50819.8	35041	0.11		0.05	0.93	1.45	
2,3,4,7,8-PeCDF	59.16	52328.8	36364.1	0.12		0.05	0.97	1.44	
13C-1,2,3,7,8-PeCDF	57.38	49833200	31017400	51.50	51.50		1.69	1.61	
13C-2,3,4,7,8-PeCDF	59.14	46197700	28982500	39.46	39.46		2.05	1.59	
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.56	47620300	29994500	50.91	50.91		1.64	1.59	
1,2,3,4,7,8-HxCDF	63.46	74763.1	69753.1	0.09		0.04	1.22	1.07	
1,2,3,6,7,8-HxCDF	63.55	13860.5	11875.4	0.02		0.01	1.19	1.17	
2,3,4,6,7,8-HxCDF	64.42	14334.6	10107.5	0.02		0.01	1.11	1.42	
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.44	43537300	85933100	80.81	80.81		1.17	0.51	
13C-1,2,3,6,7,8-HxCDF	63.53	38263600	74613600	68.44	68.44		1.20	0.51	
13C-2,3,4,6,7,8-HxCDF	64.41	45325900	88050700	86.38	86.38		1.13	0.51	
13C-1,2,3,7,8,9-HxCDF	65.32	35547000	68747100	81.53	81.53		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.53	44246200	35061200	67.16	67.16		0.86	1.26	
13C-1,2,3,6,7,8-HxCDD	65.00	54120100	43511000	70.20	70.20		1.02	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	65.20	76181200	60761500					1.25	
1,2,3,4,6,7,8-HpCDF	67.33	33442.9	38102.5	0.06		0.02	1.51	0.88	
1,2,3,4,7,8,9-HpCDF	69.09	10995.6	11310	0.03		0.01	1.47	0.97	
13C-1,2,3,4,6,7,8-HpCDF	67.32	24842700	57659500	77.58	77.58		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	69.06	14690800	34590800	53.32	53.32		0.67	0.42	
1,2,3,4,6,7,8-HpCDD	68.42	69701.3	64873.6	0.12		0.05	0.91	1.07	
13C-1,2,3,4,6,7,8-HpCDD	68.41	61725800	59953300	103.01	103.01		0.86	1.03	
OCDD	72.24	14826.1	16464.1	0.43		0.18	0.99	0.90	
13C-OCDD	72.23	6798980	7722140	14.27	7.13		0.74	0.88	S
OCDF	ND						1.17		

TABLE B.2 continued

d. Sample 42-S

Deployment 1, Retrieval 4 000808 run SAMPLE 3 1 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.10	349049	410346	1.26		2.65	0.92	0.85	
13C-2,3,7,8-TCDF	44.05	28485400	36904300	275.25	275.25		1.44	0.77	S
IS-13C-1,2,3,4-TCDD	46.05	7343340	9142330					0.80	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	46.56	7944500	10342500	108.34	108.34		1.02	0.77	
37Cl-TCDD	46.59	20087400		115.71	231.42		2.36		S
1,2,3,7,8-PeCDF	ND						0.93		
2,3,4,7,8-PeCDF	59.02	88962.9	63954.8	0.21		0.43	0.97	1.39	
13C-1,2,3,7,8-PeCDF	57.25	48508700	30653300	284.58	284.58		1.69	1.58	S
13C-2,3,4,7,8-PeCDF	59.02	46561800	29849900	226.38	226.38		2.05	1.56	S
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.46	37255000	25308000	231.62	231.62		1.64	1.47	S
1,2,3,4,7,8-HxCDF	63.38	53473	39407.4	0.12		0.25	1.22	1.36	
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	ND						1.11		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.36	20998600	42209200	123.96	123.96		1.17	0.50	
13C-1,2,3,6,7,8-HxCDF	63.45	19588200	38843600	111.32	111.32		1.20	0.50	
13C-2,3,4,6,7,8-HxCDF	64.33	20019600	40329700	122.81	122.81		1.13	0.50	
13C-1,2,3,7,8,9-HxCDF	65.23	13354500	27011600	99.15	99.15		0.93	0.49	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.45	29985000	23561500	142.48	142.48		0.86	1.27	S
13C-1,2,3,6,7,8-HxCDD	64.52	29294400	22380400	116.75	116.75		1.02	1.31	
IS-13C-1,2,3,7,8,9-HxCDD	65.13	24346400	19236700					1.27	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.24	12288200	28524300	120.59	120.59		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	68.57	5635800	13371000	64.62	64.62		0.67	0.42	
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.34	27506700	25690600	141.50	141.50		0.86	1.07	S
OCDD	ND						0.99		
13C-OCDD	72.12	36398000	40432100	237.15	118.58		0.74	0.90	
OCDF	ND						1.17		

TABLE B.2 continued

e. Sample 43-S

Deployment 1, Retrieval 4 | 000808 run | SAMPLE 4 | 1 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.39	353726	389146	0.92		1.93	0.92	0.91	
13C-2,3,7,8-TCDF	44.34	38077200	49779100	49.98	49.98		1.44	0.76	
IS-13C-1,2,3,4-TCDD	46.36	53813400	68165600					0.79	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.26	33676600	43547200	61.83	61.83		1.02	0.77	
37Cl-TCDD	47.30	53359600		41.94	83.89		2.36		
1,2,3,7,8-PeCDF	57.40	189542	117884	0.35		0.73	0.93	1.61	
2,3,4,7,8-PeCDF	59.19	213102	148349	0.39		0.82	0.97	1.44	
13C-1,2,3,7,8-PeCDF	57.41	58158000	37060300	46.26	46.26		1.69	1.57	
13C-2,3,4,7,8-PeCDF	59.16	57866500	37027600	38.00	38.00		2.05	1.56	
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.58	40337400	27804100	34.09	34.09		1.64	1.45	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	63.56	50154.1	42156.6	0.12		0.25	1.19	1.19	
2,3,4,6,7,8-HxCDF	64.40	128310	114195	0.30		0.63	1.11	1.12	
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.46	27790100	56691900	86.66	86.66		1.17	0.49	
13C-1,2,3,6,7,8-HxCDF	63.54	21950900	43653300	65.38	65.38		1.20	0.50	
13C-2,3,4,6,7,8-HxCDF	64.42	23877300	48287800	76.81	76.81		1.13	0.49	
13C-1,2,3,7,8,9-HxCDF	65.32	10941100	21442400	41.61	41.61		0.93	0.51	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.54	38451600	30077700	95.38	95.38		0.86	1.28	
13C-1,2,3,6,7,8-HxCDD	65.00	33068700	25926200	69.72	69.72		1.02	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	65.22	46490500	36832000					1.26	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.31	7057130	16728300	36.76	36.76		0.78	0.42	
13C-1,2,3,4,7,8,9-HpCDF	69.03	658027	1366730	3.60	3.60		0.67	0.48	S
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.40	6370250	6125620	17.39	17.39		0.86	1.04	S
OCDD	62.18	209905	241522	1.05		2.19	0.99	0.87	
13C-OCDD	62.17	40708300	46139100	140.22	70.11		0.74	0.88	
OCDF	ND						1.17		

TABLE B.2 continued

f. Sample 44-S

Deployment 1, Retrieval 4	000808 run	SAMPLE 5	1 Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.42	369857	565873	2.30		4.81	0.918439986	0.65	
13C-2,3,7,8-TCDF	44.36	19211600	25131100	49.05	49.05		1.441030096	0.76	
IS-13C-1,2,3,4-TCDD	46.36	27494800	35239600					0.78	
2,3,7,8-TCDD	ND						1.077109761		
13C-2,3,7,8-TCDD	47.27	17359000	22592700	62.20	62.20		1.023857862	0.77	
37Cl-TCDD	47.32	26261400		40.40	80.80		2.364085374		
1,2,3,7,8-PeCDF	57.43	150678	109937	0.38		0.80	0.927874023	1.37	
2,3,4,7,8-PeCDF	59.18	150468	106262	0.37		0.77	0.969709158	1.42	
13C-1,2,3,7,8-PeCDF	57.43	44576600	28521900	69.05	69.05		1.687362997	1.56	
13C-2,3,4,7,8-PeCDF	59.16	43766800	27999700	55.87	55.87		2.047482477	1.56	
1,2,3,7,8-PeCDD	ND						1.025891246		
13C-1,2,3,7,8-PeCDD	59.59	35314100	24357600	58.05	58.05		1.638485797	1.45	
1,2,3,4,7,8-HxCDF	63.47	59518.7	48164.1	0.17		0.36	1.219966561	1.24	
1,2,3,6,7,8-HxCDF	63.56	29435.1	22020.8	0.09		0.19	1.192602772	1.34	
2,3,4,6,7,8-HxCDF	64.40	107127	91994.6	0.36		0.76	1.113743836	1.16	
1,2,3,7,8,9-HxCDF	ND						1.232706056		
13C-1,2,3,4,7,8-HxCDF	63.46	16876700	34862100	71.97	71.97		1.169972968	0.48	
13C-1,2,3,6,7,8-HxCDF	63.54	15777200	32121300	64.72	64.72		1.204344463	0.49	
13C-2,3,4,6,7,8-HxCDF	64.42	16316100	32839800	70.95	70.95		1.127538571	0.50	
13C-1,2,3,7,8,9-HxCDF	65.32	9866040	20163100	52.32	52.32		0.934144448	0.49	
1,2,3,4,7,8-HxCDD	ND						1.079402111		
1,2,3,6,7,8-HxCDD	ND						0.931942117		
1,2,3,7,8,9-HxCDD	ND						1.012454733		
13C-1,2,3,4,7,8-HxCDD	64.55	23557000	18260700	78.92	78.92		0.86229618	1.29	
13C-1,2,3,6,7,8-HxCDD	65.01	25213600	19737700	72.03	72.03		1.015565858	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	65.22	34329400	27117700					1.27	
1,2,3,4,6,7,8-HpCDF	ND						1.507118302		
1,2,3,4,7,8,9-HpCDF	ND						1.468323939		
13C-1,2,3,4,6,7,8-HpCDF	67.31	7567890	18089500	53.77	53.77		0.776561886	0.42	
13C-1,2,3,4,7,8,9-HpCDF	69.04	685263	1589610	5.49	5.49		0.674918165	0.43	S
1,2,3,4,6,7,8-HpCDD	ND						0.905840161		
13C-1,2,3,4,6,7,8-HpCDD	68.40	4514030	4392210	16.80	16.80		0.862603199	1.03	S
OCDD	ND						0.992801567		
13C-OCDD	72.15	1210700	1268150	5.43	2.71		0.743342442	0.95	S
OCDF	ND						1.16695644		

TABLE B.2 continued

g. Sample 45-S

Deployment 1, Retrieval 4 | 000808 run | SAMPLE 6 | 1 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.29	279564	329427	2.59		5.41	0.92	0.85	
13C-2,3,7,8-TCDF	44.25	11151300	14499000	50.17	50.17		1.44	0.77	
IS-13C-1,2,3,4-TCDD	46.25	15615900	19864600					0.79	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.15	9706330	12634700	61.50	61.50		1.02	0.77	
37Cl-TCDD	47.19	11165500		30.24	60.49		2.36		
1,2,3,7,8-PeCDF	57.38	113888	86391.3	0.60		1.26	0.93	1.32	
2,3,4,7,8-PeCDF	59.13	86435.1	60889	0.44		0.92	0.97	1.42	
13C-1,2,3,7,8-PeCDF	57.36	21773100	14076900	59.88	59.88		1.69	1.55	
13C-2,3,4,7,8-PeCDF	59.11	20995400	13656300	47.70	47.70		2.05	1.54	
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.54	19292900	13314400	56.09	56.09		1.64	1.45	
1,2,3,4,7,8-HxCDF	63.43	82156	63079.8	0.31		0.65	1.22	1.30	
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	64.39	71749.8	60103.5	0.32		0.67	1.11	1.19	
1,2,3,7,8,9-HxCDF	65.30	31603.3	28693.5	0.24		0.50	1.23	1.10	
13C-1,2,3,4,7,8-HxCDF	63.42	12635900	25684100	67.73	67.73		1.17	0.49	
13C-1,2,3,6,7,8-HxCDF	63.50	13047800	26026100	67.09	67.09		1.20	0.50	
13C-2,3,4,6,7,8-HxCDF	64.38	11985200	24733600	67.34	67.34		1.13	0.48	
13C-1,2,3,7,8,9-HxCDF	65.28	6734950	13718400	45.28	45.28		0.93	0.49	
1,2,3,4,7,8-HxCDD	64.53	41842.5	29717.5	0.21		0.43	1.08	1.41	
1,2,3,6,7,8-HxCDD	64.58	58548.3	46336.7	0.33		0.70	0.93	1.26	
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.51	17887300	14021300	76.52	76.52		0.86	1.28	
13C-1,2,3,6,7,8-HxCDD	64.57	18942100	14708500	68.52	68.52		1.02	1.29	
IS-13C-1,2,3,7,8,9-HxCDD	65.18	26976500	21381300					1.26	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.29	7030650	16592200	62.91	62.91		0.78	0.42	
13C-1,2,3,4,7,8,9-HpCDF	69.01	686953	1544690	6.84	6.84		0.67	0.44	S
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.37	5093150	4787580	23.69	23.69		0.86	1.06	
OCDD	ND						0.99		
13C-OCDD	72.12	954094	1025130	5.51	2.75		0.74	0.93	S
OCDF	ND						1.17		

TABLE B.2 continued

h. Sample 46-S

Deployment 1, Retrieval 4 000808 run SAMPLE 7 1 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.32	381545	568099	2.10		4.40	0.92	0.67	
13C-2,3,7,8-TCDF	44.27	21610000	27571300	45.61	45.61		1.44	0.78	
IS-13C-1,2,3,4-TCDD	46.27	32665000	42156000					0.77	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.18	18363700	24495100	55.95	55.95		1.02	0.75	
37Cl-TCDD	47.23	24122000		31.24	62.47		2.36		
1,2,3,7,8-PeCDF	57.38	154834	109067	0.40		0.84	0.93	1.42	
2,3,4,7,8-PeCDF	59.11	133279	78055.4	0.31		0.65	0.97	1.71	
13C-1,2,3,7,8-PeCDF	57.36	42823700	27624000	55.80	55.80		1.69	1.55	
13C-2,3,4,7,8-PeCDF	59.11	42646100	27686200	45.91	45.91		2.05	1.54	
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.54	38567000	26269200	52.89	52.89		1.64	1.47	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	64.36	51346.8	41802.3	0.13		0.27	1.11	1.23	
1,2,3,7,8,9-HxCDF	65.30	20311.5	16891	0.09		0.19	1.23	1.20	
13C-1,2,3,4,7,8-HxCDF	63.42	23407300	48076500	66.09	66.09		1.17	0.49	
13C-1,2,3,6,7,8-HxCDF	63.50	19674600	39939400	53.54	53.54		1.20	0.49	
13C-2,3,4,6,7,8-HxCDF	64.39	21036400	42676500	61.12	61.12		1.13	0.49	
13C-1,2,3,7,8,9-HxCDF	65.28	10899900	22180300	38.30	38.30		0.93	0.49	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.51	32989900	25762500	73.70	73.70		0.86	1.28	
13C-1,2,3,6,7,8-HxCDD	64.57	31622500	24634500	59.92	59.92		1.02	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	65.18	51916400	40535600					1.28	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.28	10055100	23518300	46.76	46.76		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	69.11	1104370	2421110	5.65	5.65		0.67	0.46	S
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.37	8422980	8001850	20.60	20.60		0.86	1.05	S
OCDD	72.14	247100	320036	1.02		2.13	0.99	0.77	
13C-OCDD	72.14	53007000	59147100	163.20	81.60		0.74	0.90	
OCDF	ND						1.17		

TABLE B.3. SPMD Raw Data Calculation Spreadsheets for Deployment Two Field Samples

a. Sample 49-S

Deployment 2, Retrieval 1 010402-1 Run SAMPLE 7 Composite of 5 Deployed SPMDs 1*Surr and IS

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.27	15313100	19400100	9.65		4.04	0.93	0.79	
13C-2,3,7,8-TCDF	42.24	167153000	218783000	71.44	71.44		1.56	0.76	
IS-13C-1,2,3,4-TCDD	44.16	151852000	195362000					0.78	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	45.09	148933000	196331000	95.92	95.92		1.04	0.76	
37Cl-TCDD	45.12	159226000		43.25	86.49		2.42		
1,2,3,7,8-PeCDF	56.36	1415180	1046100	0.74		0.31	0.94	1.35	
2,3,4,7,8-PeCDF	ND						1.01		
13C-1,2,3,7,8-PeCDF	56.33	218549000	136905000	57.70	57.70		1.77	1.60	
13C-2,3,4,7,8-PeCDF	58.17	173652000	107444000	41.26	41.26		1.96	1.62	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	59.08	125716000	92883300	38.07	38.07		1.65	1.35	
1,2,3,4,7,8-HxCDF	63.06	878683	702518	0.89		0.37	1.20	1.25	
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	64.00	1037270	831996	1.71		0.72	1.12	1.25	
1,2,3,7,8,9-HxCDF	ND						1.24		
13C-1,2,3,4,7,8-HxCDF	63.05	51060200	97303200	244.10	244.10		0.73	0.52	S
13C-1,2,3,6,7,8-HxCDF	63.13	27450700	52216300	130.71	130.71		0.73	0.53	
13C-2,3,4,6,7,8-HxCDF	64.00	33942800	64004100	209.31	209.31		0.56	0.53	S
13C-1,2,3,7,8,9-HxCDF	64.54	21801000	41810000	81.64	81.64		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.15	38342200	29709700	179.97	179.97		0.45	1.29	S
13C-1,2,3,6,7,8-HxCDD	64.23	44545700	34337800	248.75	248.75		0.38	1.30	S
IS-13C-1,2,3,7,8,9-HxCDD	64.42	46225000	37304600					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.55	33563300	73687900	165.24	165.24		0.78	0.46	S
13C-1,2,3,4,7,8,9-HpCDF	68.27	32944200	73707100	201.12	201.12		0.63	0.45	S
1,2,3,4,6,7,8-HpCDD	68.05	599394	594068	1.07		0.45	0.95	1.01	
13C-1,2,3,4,6,7,8-HpCDD	68.04	60063900	56960500	182.73	182.73		0.77	1.05	S
OCDD	71.35	1447580	1486590	2.71		1.13	1.04	0.97	
13C-OCDD	71.34	97815500	109565000	428.22	214.11		0.58	0.89	S
OCDF	ND						1.11		

TABLE B.3 continued

b. Sample 52-S

Deployment 2, Retrieval 2	010402-1 Run	SAMPLE 8	Composite of 5 Deployed SPMDs 1*Surr and IS						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.27	34895400	45120100	23.38		9.79	0.93	0.77	
13C-2,3,7,8-TCDF	42.25	167858000	199318000	72.85	72.85		1.56	0.84	
IS-13C-1,2,3,4-TCDD	44.15	145110000	178846000					0.81	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	45.09	154177000	191719000	103.00	103.00		1.04	0.80	
37Cl-TCDD	45.12	160078000		45.50	90.99		2.42		
1,2,3,7,8-PeCDF	56.35	2766600	1587480	1.26		0.53	0.94	1.74	
2,3,4,7,8-PeCDF	58.17	4823710	3244610	2.51		1.05	1.01	1.49	
13C-1,2,3,7,8-PeCDF	56.32	226768000	140771000	63.95	63.95		1.77	1.61	
13C-2,3,4,7,8-PeCDF	58.17	194722000	122721000	49.94	49.94		1.96	1.59	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	59.05	144872000	103044000	46.27	46.27		1.65	1.41	
1,2,3,4,7,8-HxCDF	63.06	1556440	1273980	1.01		0.42	1.20	1.22	
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	63.59	3681100	2815040	2.62		1.09	1.12	1.31	
1,2,3,7,8,9-HxCDF	ND						1.24		
13C-1,2,3,4,7,8-HxCDF	63.04	79356200	153134000	165.95	165.95		0.73	0.52	S
13C-1,2,3,6,7,8-HxCDF	63.13	51149600	97637000	105.91	105.91		0.73	0.52	
13C-2,3,4,6,7,8-HxCDF	64.00	77071000	145559000	206.40	206.40		0.56	0.53	S
13C-1,2,3,7,8,9-HxCDF	64.54	58569200	112015000	94.98	94.98		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.16	89876400	72522800	186.33	186.33		0.45	1.24	S
13C-1,2,3,6,7,8-HxCDD	64.23	102356000	81164000	251.07	251.07		0.38	1.26	S
IS-13C-1,2,3,7,8,9-HxCDD	64.42	107857000	84682900					1.27	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.56	34785100	77818300	75.27	75.27		0.78	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.28	32132000	71885200	85.10	85.10		0.63	0.45	
1,2,3,4,6,7,8-HpCDD	68.05	780603	743701	1.21		0.51	0.95	1.05	
13C-1,2,3,4,6,7,8-HpCDD	68.04	67936000	64358200	89.62	89.62		0.77	1.06	
OCDD	71.35	1545200	1693110	3.09		1.29	1.04	0.91	
13C-OCDD	71.34	93564200	107010000	179.68	89.84		0.58	0.87	
OCDF	71.43	170791	208814	0.34		0.14	1.11	0.82	

TABLE B.3 continued

c. Sample 56-S

Deployment 2, Retrieval 3 010402-1 Run SAMPLE 6 Composite of 5 Deployed SPMDs 1*Surr and IS

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.06	5484860	6808160	24.37		10.20	0.93	0.81	
13C-2,3,7,8-TCDF	42.01	23856600	30278200	72.35	72.35		1.56	0.79	
IS-13C-1,2,3,4-TCDD	43.52	21864500	26226600					0.83	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	44.43	21789100	27035900	97.94	97.94		1.04	0.81	
37Cl-TCDD	44.46	17601100		33.20	66.40		2.42		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.05	730158	485392	2.49		1.04	1.01	1.50	
13C-1,2,3,7,8-PeCDF	56.16	34674500	21440800	65.77	65.77		1.77	1.62	
13C-2,3,4,7,8-PeCDF	58.04	29407800	18857600	51.15	51.15		1.96	1.56	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	58.51	24003500	15940800	50.22	50.22		1.65	1.51	
1,2,3,4,7,8-HxCDF							1.20		
1,2,3,6,7,8-HxCDF	63.05	157520	118532	1.11		0.46	1.25	1.33	
2,3,4,6,7,8-HxCDF	63.52	307232	263070	3.56		1.49	1.12	1.17	
1,2,3,7,8,9-HxCDF	ND						1.24		
13C-1,2,3,4,7,8-HxCDF	62.54	7070730	12941000	93.24	93.24		0.73	0.55	
13C-1,2,3,6,7,8-HxCDF	63.03	6618250	13310800	92.60	92.60		0.73	0.50	
13C-2,3,4,6,7,8-HxCDF	63.50	5025900	9329010	86.87	86.87		0.56	0.54	
13C-1,2,3,7,8,9-HxCDF	64.44	9530850	17951800	99.89	99.89		0.93	0.53	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.06	6072920	4757440	81.11	81.11		0.45	1.28	
13C-1,2,3,6,7,8-HxCDD	64.12	6524070	5004520	102.95	102.95		0.38	1.30	
IS-13C-1,2,3,7,8,9-HxCDD	64.33	16203500	13292900					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.48	7009580	15200800	96.91	96.91		0.78	0.46	
13C-1,2,3,4,7,8,9-HpCDF	68.19	4728980	9809010	77.64	77.64		0.63	0.48	
1,2,3,4,6,7,8-HpCDD	67.58	271490	267989	2.68		1.12	0.95	1.01	
13C-1,2,3,4,6,7,8-HpCDD	67.57	11079700	10116700	93.73	93.73		0.77	1.10	
OCDD	71.26	806341	940043	13.37		5.60	1.04	0.86	
13C-OCDD	71.25	11740100	13279500	146.30	73.15		0.58	0.88	
OCDF	ND						1.11		

TABLE B.3 continued

d. Sample 60-S

Deployment 2, Retrieval 4   020101 Run   SAMPLE 4   Deployed SPMD at Site 10-B

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	38.46	3212410	4210830	4.66		9.75	0.93	0.76	
13C-2,3,7,8-TCDF	38.44	75098000	96282800	52.44	52.44		1.37	0.78	
IS-13C-1,2,3,4-TCDD	40.21	104014000	135253000					0.77	
2,3,7,8-TCDD	ND			0.00			0.99		
13C-2,3,7,8-TCDD	41.04	67711600	86719900	60.79	60.79		1.06	0.78	
37Cl-TCDD	41.06	57055800		24.30	48.60		2.26		
1,2,3,7,8-PeCDF	ND			0.00			0.95		
2,3,4,7,8-PeCDF	56.11	540495	342215	0.55		1.15	1.02	1.58	
13C-1,2,3,7,8-PeCDF	53.46	95765900	60281000	55.24	55.24		1.18	1.59	
13C-2,3,4,7,8-PeCDF	56.07	96152200	61480300	55.63	55.63		1.18	1.56	
1,2,3,7,8-PeCDD	ND			0.00			1.02		
13C-1,2,3,7,8-PeCDD	57.04	88835300	54798700	62.52	62.52		0.96	1.62	
1,2,3,4,7,8-HxCDF	71.36	264719	250703	0.30		0.63	1.31	1.06	
1,2,3,6,7,8-HxCDF	ND			0.00			1.21		
2,3,4,6,7,8-HxCDF	62.39	509604	387257	0.54		1.13	1.18	1.32	
1,2,3,7,8,9-HxCDF	63.34	155640	125946	0.21		0.45	1.03	1.24	
13C-1,2,3,4,7,8-HxCDF	61.34	43505500	86376200	55.06	55.06		0.92	0.50	
13C-1,2,3,6,7,8-HxCDF	61.44	51092600	102520000	47.47	47.47		1.26	0.50	
13C-2,3,4,6,7,8-HxCDF	62.39	47362200	93688000	52.96	52.96		1.03	0.51	
13C-1,2,3,7,8,9-HxCDF	63.32	43450100	84974500	54.00	54.00		0.92	0.51	
1,2,3,4,7,8-HxCDD	ND			0.00			1.14		
1,2,3,6,7,8-HxCDD	ND			0.00			1.01		
1,2,3,7,8,9-HxCDD	ND			0.00			1.07		
13C-1,2,3,4,7,8-HxCDD	62.53	72576200	58612300	69.11	69.11		0.74	1.24	
13C-1,2,3,6,7,8-HxCDD	63.01	94908100	77484800	61.24	61.24		1.09	1.22	
IS-13C-1,2,3,7,8,9-HxCDD	63.22	141775000	116019000					1.22	
1,2,3,4,6,7,8-HpCDF	ND			0.00			1.40		
1,2,3,4,7,8,9-HpCDF	67.17	79281.8	76527.9	0.14		0.29	1.38	1.04	
13C-1,2,3,4,6,7,8-HpCDF	65.42	26404200	61044100	43.58	43.58		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	67.16	24271200	57490800	47.88	47.88		0.66	0.42	
1,2,3,4,6,7,8-HpCDD	66.56	515856	487451	0.78		1.63	0.95	1.06	
13C-1,2,3,4,6,7,8-HpCDD	66.55	68038500	67962600	57.39	57.39		0.92	1.00	
OCDD	70.11	2284530	2631890	4.38		9.17	1.01	0.87	
13C-OCDD	70.10	102818000	119204000	112.32	56.16		0.77	0.86	
OCDF	70.16	293402	350193	0.52		1.10	1.11	0.84	

TABLE B.3 continued

e. Sample 61-S

Deployment 2, Retrieval 4 | 010202 Run | SAMPLE 7 | Deployed SPMD at Site 10-B

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	38.48	1907580	2556340	4.98		10.42	1.08	0.75	
13C-2,3,7,8-TCDF	38.45	36485900	46472400	40.46	40.46		1.38	0.79	
IS-13C-1,2,3,4-TCDD	40.22	64356800	84692600					0.76	
2,3,7,8-TCDD	ND						0.91		
13C-2,3,7,8-TCDD	41.05	36060200	47754800	57.02	57.02		0.99	0.76	
37Cl-TCDD	41.06	82525000		22.14	44.26		2.50		
1,2,3,7,8-PeCDF	53.46	370860	282248	0.87		1.81	1.00	1.31	
2,3,4,7,8-PeCDF	ND						1.03		
13C-1,2,3,7,8-PeCDF	53.46	46339800	29000600	42.37	42.37		1.19	1.60	
13C-2,3,4,7,8-PeCDF	56.08	49020600	30499200	44.35	44.35		1.20	1.61	
1,2,3,7,8-PeCDD	ND						0.98		
13C-1,2,3,7,8-PeCDD	57.04	46155900	28410300	50.00	50.00		1.00	1.62	
1,2,3,4,7,8-HxCDF	61.36	191061	184060	0.39		0.82	1.40	1.04	
1,2,3,6,7,8-HxCDF	ND						1.27		
2,3,4,6,7,8-HxCDF	62.40	352012	304581	0.69		1.44	1.27	1.16	
1,2,3,7,8,9-HxCDF	ND						1.14		
13C-1,2,3,4,7,8-HxCDF	61.35	22485600	45475300	59.73	59.73		0.69	0.49	
13C-1,2,3,6,7,8-HxCDF	61.44	26786900	52935400	56.42	56.42		0.86	0.51	
13C-2,3,4,6,7,8-HxCDF	62.39	25252600	49829800	55.46	55.46		0.82	0.51	
13C-1,2,3,7,8,9-HxCDF	63.33	22162600	44347400	41.71	41.71		0.97	0.50	
1,2,3,4,7,8-HxCDD	62.55	103862	85679	0.23		0.49	1.19	1.21	
1,2,3,6,7,8-HxCDD	63.02	195757	176003	0.40		0.84	1.00	1.11	
1,2,3,7,8,9-HxCDD	63.24	175340	152797	0.38		0.79	1.08	1.15	
13C-1,2,3,4,7,8-HxCDD	62.53	38255400	30304400	65.48	65.48		0.63	1.26	
13C-1,2,3,6,7,8-HxCDD	63.01	51194300	41545800	61.95	61.95		0.91	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	63.23	90245200	74828500					1.21	
1,2,3,4,6,7,8-HpCDF	ND						1.43		
1,2,3,4,7,8,9-HpCDF	ND						1.44		
13C-1,2,3,4,6,7,8-HpCDF	65.42	13754000	32759000	36.14	36.14		0.78	0.42	
13C-1,2,3,4,7,8,9-HpCDF	67.16	10830700	26110300	31.10	31.10		0.72	0.41	
1,2,3,4,6,7,8-HpCDD	66.56	375824	377722	1.09		2.28	1.00	0.99	
13C-1,2,3,4,6,7,8-HpCDD	66.55	34875400	34701000	46.27	46.27		0.91	1.01	
OCDD	70.11	1685610	1833330	5.51		11.53	1.04	0.92	
13C-OCDD	70.10	56173000	66952300	80.41	40.21		0.93	0.84	
OCDF	ND						1.20		

TABLE B.3 continued

f. Sample 62-S

Deployment 2, Retrieval 4 | 020101 Run | SAMPLE 6 | Deployed SPMD at Site 10-B

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	38.43	966712	1190010	3.49		7.30	0.93	0.81	
13C-2,3,7,8-TCDF	38.41	29249700	37265100	78.18	78.18		1.37	0.78	
IS-13C-1,2,3,4-TCDD	40.19	26993300	35292300					0.76	
2,3,7,8-TCDD	ND						0.99		
13C-2,3,7,8-TCDD	41.00	32282900	42989300	113.83	113.83		1.06	0.75	
37Cl-TCDD	41.03	12827200		21.05	42.10		2.26		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	53.42	36605000	23389600	81.59	81.59		1.18	1.57	
13C-2,3,4,7,8-PeCDF	56.05	39980400	25357000	88.58	88.58		1.18	1.58	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	57.02	40634800	31073300	119.90	119.90		0.96	1.31	
1,2,3,4,7,8-HxCDF	61.34	104019	87641	0.24		0.51	1.31	1.19	
1,2,3,6,7,8-HxCDF	ND						1.21		
2,3,4,6,7,8-HxCDF	62.39	274911	234823	0.68		1.42	1.18	1.17	
1,2,3,7,8,9-HxCDF	63.34	105844	83506.9	0.32		0.66	1.03	1.27	
13C-1,2,3,4,7,8-HxCDF	61.33	20046100	40140500	97.66	97.66		0.92	0.50	
13C-1,2,3,6,7,8-HxCDF	61.43	23519800	47120400	83.55	83.55		1.26	0.50	
13C-2,3,4,6,7,8-HxCDF	62.38	21265100	42589600	91.77	91.77		1.03	0.50	
13C-1,2,3,7,8,9-HxCDF	63.31	19557300	38867400	94.04	94.04		0.92	0.50	
1,2,3,4,7,8-HxCDD	62.52	58117.2	50860.6	0.15		0.31	1.14	1.14	
1,2,3,6,7,8-HxCDD	ND						1.01		
1,2,3,7,8,9-HxCDD	63.22	97844.8	95917.1	0.24		0.51	1.07	1.02	
13C-1,2,3,4,7,8-HxCDD	62.52	34725600	28703300	127.89	127.89		0.74	1.21	
13C-1,2,3,6,7,8-HxCDD	62.59	47479900	38875100	117.42	117.42		1.09	1.22	
IS-13C-1,2,3,7,8,9-HxCDD	63.21	36729000	30621600					1.20	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	65.41	12169600	28705900	77.98	77.98		0.78	0.42	
13C-1,2,3,4,7,8,9-HpCDF	67.15	11217800	26055600	83.55	83.55		0.66	0.43	
1,2,3,4,6,7,8-HpCDD	66.55	431742	462302	1.55		3.25	0.95	0.93	
13C-1,2,3,4,6,7,8-HpCDD	66.54	30318100	30523200	98.28	98.28		0.92	0.99	
OCDD	70.09	2450620	2941280	9.25		19.35	1.01	0.83	
13C-OCDD	70.09	53139800	62254500	223.45	111.73		0.77	0.85	
OCDF	70.15	235262	293690	0.83		1.73	1.11	0.80	

TABLE B.3 continued

g. Sample 63-S

Deployment 2, Retrieval 4 020101 Run SAMPLE 7 Deployed SPMD at Site 10-B

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	38.41	753706	1002040	5.91		12.37	0.93	0.75	
13C-2,3,7,8-TCDF	38.38	14081500	17852200	45.83	45.83		1.37	0.79	
IS-13C-1,2,3,4-TCDD	40.16	22324800	28684500					0.78	
2,3,7,8-TCDD	ND						0.99		
13C-2,3,7,8-TCDD	40.58	14056800	19952200	62.80	62.80		1.06	0.70	
37Cl-TCDD	41.01	12380400		24.56	49.12		2.26		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	56.05	342586	234462	2.08		4.36	1.02	1.46	
13C-1,2,3,7,8-PeCDF	53.40	15884000	10471300	43.77	43.77		1.18	1.52	
13C-2,3,4,7,8-PeCDF	56.03	16737100	10477800	45.05	45.05		1.18	1.60	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	57.00	16797600	11253700	57.27	57.27		0.96	1.49	
1,2,3,4,7,8-HxCDF	ND						1.31		
1,2,3,6,7,8-HxCDF	ND						1.21		
2,3,4,6,7,8-HxCDF	62.38	330966	237422	1.85		3.87	1.18	1.39	
1,2,3,7,8,9-HxCDF	63.32	273163	240126	2.16		4.52	1.03	1.14	
13C-1,2,3,4,7,8-HxCDF	61.32	8317130	16249900	53.32	53.32		0.92	0.51	
13C-1,2,3,6,7,8-HxCDF	61.42	9392040	18299800	43.81	43.81		1.26	0.51	
13C-2,3,4,6,7,8-HxCDF	62.36	8925880	17192900	50.21	50.21		1.03	0.52	
13C-1,2,3,7,8,9-HxCDF	63.30	7786470	15352600	49.81	49.81		0.92	0.51	
1,2,3,4,7,8-HxCDD	62.53	155117	141180	0.93		1.95	1.14	1.10	
1,2,3,6,7,8-HxCDD	62.59	317171	260978	1.67		3.49	1.01	1.22	
1,2,3,7,8,9-HxCDD	63.21	291925	204382	1.50		3.14	1.07	1.43	
13C-1,2,3,4,7,8-HxCDD	62.51	15284400	12563600	75.10	75.10		0.74	1.22	
13C-1,2,3,6,7,8-HxCDD	62.58	18693900	15480200	62.15	62.15		1.09	1.21	
IS-13C-1,2,3,7,8,9-HxCDD	63.21	27381600	22972500					1.19	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	67.14	238436	201212	2.28		4.77	1.38	1.18	
13C-1,2,3,4,6,7,8-HpCDF	65.41	4829740	11401600	41.41	41.41		0.78	0.42	
13C-1,2,3,4,7,8,9-HpCDF	67.14	4334880	9578160	41.71	41.71		0.66	0.45	
1,2,3,4,6,7,8-HpCDD	66.53	286467	282550	2.54		5.31	0.95	1.01	
13C-1,2,3,4,6,7,8-HpCDD	66.52	11752900	11952200	51.22	51.22		0.92	0.98	
OCDD	70.08	637452	780269	6.88		14.41	1.01	0.82	
13C-OCDD	70.07	18747100	22001400	105.54	52.77		0.77	0.85	
OCDF	ND	223092	359794	2.59		5.41	1.11	0.62	

TABLE B.3 continued

h. Sample 64-S

Deployment 2, Retrieval 4 020101 Run SAMPLE 8 Deployed SPMD at Site 10-B

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	38.42	2041680	2676630	4.78		10.01	0.93	0.76	
13C-2,3,7,8-TCDF	38.40	46105300	60019200	44.86	44.86		1.37	0.77	
IS-13C-1,2,3,4-TCDD	40.19	74483600	98711400					0.75	
2,3,7,8-TCDD	ND						0.99		
13C-2,3,7,8-TCDD	41.00	49431600	66602300	63.10	63.10		1.06	0.74	
37Cl-TCDD	41.04	40589700		24.14	48.28		2.26		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	56.08	397578	255171	0.66		1.38	1.02	1.56	
13C-1,2,3,7,8-PeCDF	53.42	57814700	36483100	46.12	46.12		1.18	1.58	
13C-2,3,4,7,8-PeCDF	56.05	59240500	37749100	47.29	47.29		1.18	1.57	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	57.02	59769900	41268900	60.76	60.76		0.96	1.45	
1,2,3,4,7,8-HxCDF	61.35	171682	152582	0.29		0.61	1.31	1.13	
1,2,3,6,7,8-HxCDF	61.44	105642	85056.9	0.15		0.32	1.21	1.24	
2,3,4,6,7,8-HxCDF	62.39	374133	303257	0.61		1.27	1.18	1.23	
1,2,3,7,8,9-HxCDF	ND	137634	217047	0.40		0.84	1.03	0.63	
13C-1,2,3,4,7,8-HxCDF	61.33	28365900	56005300	48.82	48.82		0.92	0.51	
13C-1,2,3,6,7,8-HxCDF	61.43	34798900	68203700	43.45	43.45		1.26	0.51	
13C-2,3,4,6,7,8-HxCDF	62.38	31837400	63102000	48.66	48.66		1.03	0.50	
13C-1,2,3,7,8,9-HxCDF	63.31	28744700	56928500	49.18	49.18		0.92	0.50	
1,2,3,4,7,8-HxCDD	ND						1.14		
1,2,3,6,7,8-HxCDD	63.01	143542	133164	0.21		0.45	1.01	1.08	
1,2,3,7,8,9-HxCDD	63.23	111735	105264	0.18		0.38	1.07	1.06	
13C-1,2,3,4,7,8-HxCDD	62.53	56490200	41537500	70.49	70.49		0.74	1.36	
13C-1,2,3,6,7,8-HxCDD	62.59	67706100	59902700	61.88	61.88		1.09	1.13	
IS-13C-1,2,3,7,8,9-HxCDD	63.21	103131000	85720400					1.20	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	65.41	18768400	44052400	42.74	42.74		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	67.15	16895800	39836700	45.35	45.35		0.66	0.42	
1,2,3,4,6,7,8-HpCDD	66.55	519507	612010	1.24		2.59	0.95	0.85	
13C-1,2,3,4,6,7,8-HpCDD	66.54	48352800	48227000	55.64	55.64		0.92	1.00	
OCDD	70.09	3692310	4579140	9.31		19.49	1.01	0.81	
13C-OCDD	70.09	80410800	95362800	121.39	60.69		0.77	0.84	
OCDF	70.15	371065	567964	0.97		2.02	1.11	0.65	

TABLE B.4. SPMD Raw Data Calculation Spreadsheets for Deployment Three Field Samples

a. Sample 68-S

Deployment 3, Upstream	010210 Run	SAMPLE 7	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.45	3918430	5481810	2.17		2.27	0.86	0.71	
13C-2,3,7,8-TCDF	36.41	220940000	282583000	72.42	72.42		1.32	0.78	
IS-13C-1,2,3,4-TCDD	38.11	230622000	294941000					0.78	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.50	185542000	243274000	75.72	75.72		1.08	0.76	
37Cl-TCDD	38.53	141124000		26.75	53.50		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.24	268430000	166890000	73.03	73.03		1.13	1.61	
13C-2,3,4,7,8-PeCDF	54.30	268010000	165861000	71.72	71.72		1.15	1.62	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.40	229651000	145027000	74.14	74.14		0.96	1.58	
1,2,3,4,7,8-HxCDF	60.40	313908	277272	0.12		0.13	1.25	1.13	
1,2,3,6,7,8-HxCDF	60.51	329734	265300	0.12		0.12	1.19	1.24	
2,3,4,6,7,8-HxCDF	61.49	1019870	829535	0.41		0.43	1.13	1.23	
1,2,3,7,8,9-HxCDF	62.43	308992	267487	0.13		0.14	1.19	1.16	
13C-1,2,3,4,7,8-HxCDF	60.39	130406000	249572000	73.06	73.06		1.09	0.52	
13C-1,2,3,6,7,8-HxCDF	60.50	146716000	276901000	75.28	75.28		1.18	0.53	
13C-2,3,4,6,7,8-HxCDF	61.46	135042000	260430000	75.62	75.62		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	62.42	126165000	240090000	78.56	78.56		0.98	0.53	
1,2,3,4,7,8-HxCDD	ND						1.12		
1,2,3,6,7,8-HxCDD	62.12	318799	260090	0.16		0.17	0.99	1.23	
1,2,3,7,8,9-HxCDD	62.35	267254	204404	0.13		0.14	1.05	1.31	
13C-1,2,3,4,7,8-HxCDD	62.03	179969000	144577000	76.58	76.58		0.89	1.24	
13C-1,2,3,6,7,8-HxCDD	62.11	204131000	163178000	77.21	77.21		1.00	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	62.33	262903000	213365000					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.40		
13C-1,2,3,4,6,7,8-HpCDF	64.57	85407600	193883000	69.88	69.88		0.84	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.33	68793300	158657000	59.47	59.47		0.80	0.43	
1,2,3,4,6,7,8-HpCDD	66.13	694990	684639	0.45		0.47	0.92	1.02	
13C-1,2,3,4,6,7,8-HpCDD	66.12	168814000	161368000	73.72	73.72		0.94	1.05	
OCDD	69.21	878495	1093900	1.69		1.76	0.98	0.80	
13C-OCDD	69.21	112300000	125754000	72.59	36.30		0.69	0.89	
OCDF	69.26	199576	196305	0.26		0.27	1.30	1.02	

TABLE B.4 continued

b. Sample 69-S

Deployment 3, Upstream | 010210 Run | SAMPLE 8 | Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.48	4661690	6159340	1.93		2.02	0.86	0.76	
13C-2,3,7,8-TCDF	36.45	287267000	366404000	105.29	105.29		1.32	0.78	
IS-13C-1,2,3,4-TCDD	38.16	205542000	263728000					0.78	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.56	241245000	316701000	110.35	110.35		1.08	0.76	
37Cl-TCDD	38.59	131784000		28.03	56.05		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.30	347011000	216938000	105.97	105.97		1.13	1.60	
13C-2,3,4,7,8-PeCDF	54.34	327286000	205289000	98.60	98.60		1.15	1.59	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.43	288399000	199228000	108.07	108.07		0.96	1.45	
1,2,3,4,7,8-HxCDF	60.44	363435	283851	0.11		0.11	1.25	1.28	
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	61.49	1570300	1237450	0.51		0.53	1.13	1.27	
1,2,3,7,8,9-HxCDF	ND						1.19		
13C-1,2,3,4,7,8-HxCDF	60.43	165874000	321596000	109.10	109.10		1.09	0.52	
13C-1,2,3,6,7,8-HxCDF	60.53	175932000	336321000	105.95	105.95		1.18	0.52	
13C-2,3,4,6,7,8-HxCDF	61.50	166877000	321999000	108.80	108.80		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	62.45	156777000	302765000	114.72	114.72		0.98	0.52	
1,2,3,4,7,8-HxCDD	62.08	253127	215548	0.11		0.11	1.12	1.17	
1,2,3,6,7,8-HxCDD	62.15	381989	308084	0.15		0.15	0.99	1.24	
1,2,3,7,8,9-HxCDD	62.37	646528	557851	0.26		0.28	1.05	1.16	
13C-1,2,3,4,7,8-HxCDD	62.07	219294000	176464000	108.69	108.69		0.89	1.24	
13C-1,2,3,6,7,8-HxCDD	62.13	264450000	210753000	116.26	116.26		1.00	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	62.36	226940000	182261000					1.25	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.40		
13C-1,2,3,4,6,7,8-HpCDF	65.00	101337000	228850000	96.15	96.15		0.84	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.35	79002300	182551000	79.60	79.60		0.80	0.43	
1,2,3,4,6,7,8-HpCDD	66.15	683566	606796	0.36		0.38	0.92	1.13	
13C-1,2,3,4,6,7,8-HpCDD	66.14	197687000	188220000	100.29	100.29		0.94	1.05	
OCDD	69.24	729988	754001	1.21		1.26	0.98	0.97	
13C-OCDD	69.22	117999000	132011000	88.73	44.37		0.69	0.89	
OCDF	ND						1.30		

TABLE B.4 continued

c. Sample 70-S

Deployment 3, Upstream	010210 Run	SAMPLE 9	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.48	2008440	2721060	2.36		2.47	0.86	0.74	
13C-2,3,7,8-TCDF	36.45	102694000	130200000	76.81	76.81		1.32	0.79	
IS-13C-1,2,3,4-TCDD	38.15	99877000	129301000					0.77	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.55	83296800	109157000	77.94	77.94		1.08	0.76	
37Cl-TCDD	38.58	65560700		28.69	57.39		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.28	119663000	74133600	74.56	74.56		1.13	1.61	
13C-2,3,4,7,8-PeCDF	54.34	126945000	77911700	77.66	77.66		1.15	1.63	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.43	107097000	66593300	78.82	78.82		0.96	1.61	
1,2,3,4,7,8-HxCDF	60.43	185643	167349	0.15		0.16	1.25	1.11	
1,2,3,6,7,8-HxCDF	60.54	207320	158100	0.15		0.16	1.19	1.31	
2,3,4,6,7,8-HxCDF	61.52	1599690	1223480	1.31		1.37	1.13	1.31	
1,2,3,7,8,9-HxCDF	62.46	139981	131553	0.13		0.14	1.19	1.06	
13C-1,2,3,4,7,8-HxCDF	60.42	64264500	120928000	77.01	77.01		1.09	0.53	
13C-1,2,3,6,7,8-HxCDF	60.52	66942300	134850000	77.54	77.54		1.18	0.50	
13C-2,3,4,6,7,8-HxCDF	61.49	64842200	125719000	78.80	78.80		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	65.45	58800100	113518000	79.93	79.93		0.98	0.52	
1,2,3,4,7,8-HxCDD	ND						1.12		DPE
1,2,3,6,7,8-HxCDD	ND						0.99		
1,2,3,7,8,9-HxCDD	ND						1.05		
13C-1,2,3,4,7,8-HxCDD	62.06	87437800	69973500	80.32	80.32		0.89	1.25	
13C-1,2,3,6,7,8-HxCDD	62.14	99748100	80152400	81.78	81.78		1.00	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	62.36	122161000	98075800					1.25	
1,2,3,4,6,7,8-HpCDF	ND						1.40		DPE
1,2,3,4,7,8,9-HpCDF	ND						1.40		
13C-1,2,3,4,6,7,8-HpCDF	65.01	41521400	93340100	72.97	72.97		0.84	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.35	33920900	79648900	64.22	64.22		0.80	0.43	
1,2,3,4,6,7,8-HpCDD	66.16	3523380	3559820	5.09		5.32	0.92	0.99	
13C-1,2,3,4,6,7,8-HpCDD	66.15	76742400	73801000	72.69	72.69		0.94	1.04	
OCDD	69.24	1545500	1697410	5.58		5.84	0.98	0.91	
13C-OCDD	69.23	55674700	62638800	78.02	39.01		0.69	0.89	
OCDF	69.28	1196560	1452410	3.45		3.61	1.30	0.82	

TABLE B.4 continued

d. Sample 71-S

Deployment 3, Upstream	010210 Run	SAMPLE 10	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.50	3734690	4884720	2.18		2.28	0.86	0.76	
13C-2,3,7,8-TCDF	36.47	201435000	258118000	72.79	72.79		1.32	0.78	
IS-13C-1,2,3,4-TCDD	38.17	207979000	269201000					0.77	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.57	170505000	219082000	75.77	75.77		1.08	0.78	
37Cl-TCDD	39.00	131746000		27.69	55.38		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.32	239718000	151747000	72.34	72.34		1.13	1.58	
13C-2,3,4,7,8-PeCDF	54.36	239852000	152024000	71.35	71.35		1.15	1.58	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.45	209886000	132476000	74.62	74.62		0.96	1.58	
1,2,3,4,7,8-HxCDF	60.45	331179	281206	0.14		0.15	1.25	1.18	
1,2,3,6,7,8-HxCDF	61.55	314813	241750	0.13		0.14	1.19	1.30	
2,3,4,6,7,8-HxCDF	61.53	962773	779556	0.43		0.45	1.13	1.24	
1,2,3,7,8,9-HxCDF	ND						1.19		DPE
13C-1,2,3,4,7,8-HxCDF	60.43	116975000	228154000	73.36	73.36		1.09	0.51	
13C-1,2,3,6,7,8-HxCDF	60.53	122624000	236798000	70.60	70.60		1.18	0.52	
13C-2,3,4,6,7,8-HxCDF	61.50	122358000	236185000	75.79	75.79		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	62.46	112317000	216084000	77.86	77.86		0.98	0.52	
1,2,3,4,7,8-HxCDD	ND						1.12		DPE
1,2,3,6,7,8-HxCDD	62.16	394279	284244	0.20		0.21	0.99	1.39	
1,2,3,7,8,9-HxCDD	62.38	304299	255822	0.17		0.17	1.05	1.19	
13C-1,2,3,4,7,8-HxCDD	62.08	162177000	129836000	76.17	76.17		0.89	1.25	
13C-1,2,3,6,7,8-HxCDD	62.14	194302000	155017000	81.17	81.17		1.00	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	62.37	239510000	191336000					1.25	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.40		
13C-1,2,3,4,6,7,8-HpCDF	65.01	72525200	164587000	65.58	65.58		0.84	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.36	55943700	128079000	53.19	53.19		0.80	0.44	
1,2,3,4,6,7,8-HpCDD	66.17	558680	495560	0.47		0.49	0.92	1.13	
13C-1,2,3,4,6,7,8-HpCDD	66.16	124538000	118319000	59.94	59.94		0.94	1.05	
OCDD	69.25	642904	765849	1.45		1.52	0.98	0.84	
13C-OCDD	69.24	93013600	104335000	66.52	33.26		0.69	0.89	
OCDF	ND						1.30		

TABLE B.4 continued

e. Sample 72-S

Deployment 3, Upstream	010210 Run	SAMPLE 11	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.51	2642750	3693170	2.84		2.97	0.86	0.72	
13C-2,3,7,8-TCDF	36.48	113500000	146180000	75.73	75.73		1.32	0.78	
IS-13C-1,2,3,4-TCDD	38.18	113010000	146181000					0.77	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.59	91964600	122859000	76.92	76.92		1.08	0.75	
37Cl-TCDD	39.02	74618800		28.86	57.73		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.34	134765000	82857400	74.03	74.03		1.13	1.63	
13C-2,3,4,7,8-PeCDF	54.37	134613000	84640300	73.49	73.49		1.15	1.59	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.46	118001000	72854500	76.58	76.58		0.96	1.62	
1,2,3,4,7,8-HxCDF	60.46	311192	249691	0.23		0.24	1.25	1.25	
1,2,3,6,7,8-HxCDF	ND						1.19		DPE
2,3,4,6,7,8-HxCDF	61.54	883174	731848	0.74		0.77	1.13	1.21	
1,2,3,7,8,9-HxCDF	62.48	215604	193722	0.18		0.19	1.19	1.11	
13C-1,2,3,4,7,8-HxCDF	60.44	66177900	128568000	72.57	72.57		1.09	0.51	
13C-1,2,3,6,7,8-HxCDF	60.54	73766400	142339000	74.42	74.42		1.18	0.52	
13C-2,3,4,6,7,8-HxCDF	61.51	66187300	127826000	71.90	71.90		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	62.46	64999000	125145000	79.04	79.04		0.98	0.52	
1,2,3,4,7,8-HxCDD	ND						1.12		DPE
1,2,3,6,7,8-HxCDD	ND						0.99		DPE
1,2,3,7,8,9-HxCDD	62.40	184559	142582	0.17		0.18	1.05	1.29	
13C-1,2,3,4,7,8-HxCDD	62.08	97410400	77909800	80.17	80.17		0.89	1.25	
13C-1,2,3,6,7,8-HxCDD	62.15	106512000	84817300	77.94	77.94		1.00	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	62.38	135993000	109757000					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.40		DPE
13C-1,2,3,4,6,7,8-HpCDF	65.02	43359800	99083700	69.07	69.07		0.84	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.36	34666500	80324500	58.27	58.27		0.80	0.43	
1,2,3,4,6,7,8-HpCDD	66.17	527671	476515	0.68		0.71	0.92	1.11	
13C-1,2,3,4,6,7,8-HpCDD	66.16	81567100	77392100	68.79	68.79		0.94	1.05	
OCDD	ND						0.98		
13C-OCDD	69.24	45852000	51893700	57.77	28.88		0.69	0.88	
OCDF	ND						1.30		

TABLE B.4 continued

f. Sample 76-S

Deployment 3, Downstream | 010211 Run | SAMPLE 7 | Deployed SPMD | Site 12: Fairfield, ME

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.40	1725770	2243690	1.90		1.99	0.89	0.77	
13C-2,3,7,8-TCDF	36.37	105421000	129560000	83.82	83.82		1.44	0.81	
IS-13C-1,2,3,4-TCDD	38.07	85918900	108848000					0.79	
2,3,7,8-TCDD	ND						0.98		
13C-2,3,7,8-TCDD	38.48	78419600	100206000	85.35	85.35		1.07	0.78	
37Cl-TCDD	38.50	50755400		25.50	51.01		2.32		
1,2,3,7,8-PeCDF	ND						0.97		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	51.15	114226000	64985500	77.14	77.14		1.19	1.76	
13C-2,3,4,7,8-PeCDF	54.26	107590000	62440800	63.47	63.47		1.38	1.72	
1,2,3,7,8-PeCDD	55.38	91549	62154.5	0.12		0.13	0.95	1.47	
13C-1,2,3,7,8-PeCDD	55.36	81773500	50478500	61.25	61.25		1.11	1.62	
1,2,3,4,7,8-HxCDF	60.39	193288	146975	0.17		0.18	1.27	1.32	
1,2,3,6,7,8-HxCDF	60.50	162291	128155	0.14		0.14	1.27	1.27	
2,3,4,6,7,8-HxCDF	61.48	420336	339090	0.39		0.41	1.16	1.24	
1,2,3,7,8,9-HxCDF	62.42	179949	162552	0.16		0.17	1.28	1.11	
13C-1,2,3,4,7,8-HxCDF	60.38	52462400	102143000	79.74	79.74		1.10	0.51	
13C-1,2,3,6,7,8-HxCDF	60.48	56966200	110394000	80.85	80.85		1.18	0.52	
13C-2,3,4,6,7,8-HxCDF	61.45	56838700	111603000	87.63	87.63		1.09	0.51	
13C-1,2,3,7,8,9-HxCDF	62.40	55023300	108341000	97.52	97.52		0.95	0.51	
1,2,3,4,7,8-HxCDD	ND						1.08		DPE
1,2,3,6,7,8-HxCDD	62.11	125699	107303	0.17		0.18	0.96	1.17	
1,2,3,7,8,9-HxCDD	62.34	133620	103690	0.18		0.19	1.01	1.29	
13C-1,2,3,4,7,8-HxCDD	62.02	70187800	53681300	78.33	78.33		0.90	1.31	
13C-1,2,3,6,7,8-HxCDD	62.09	79643600	60756500	76.20	76.20		1.05	1.31	
IS-13C-1,2,3,7,8,9-HxCDD	62.32	99953700	75719700					1.32	
1,2,3,4,6,7,8-HpCDF	ND						1.48		DPE
1,2,3,4,7,8,9-HpCDF	ND						1.44		DPE
13C-1,2,3,4,6,7,8-HpCDF	64.56	42303300	94356400	90.18	90.18		0.86	0.45	
13C-1,2,3,4,7,8,9-HpCDF	66.32	37183800	84511200	94.25	94.25		0.73	0.44	
1,2,3,4,6,7,8-HpCDD	66.12	300188	302216	0.40		0.42	0.94	0.99	
13C-1,2,3,4,6,7,8-HpCDD	66.11	82449200	78482300	101.47	101.47		0.90	1.05	
OCDD	69.20	888968	1112730	1.90		1.99	1.01	0.80	
13C-OCDD	69.19	98042100	109741000	180.79	90.39		0.65	0.89	
OCDF	69.25	171202	179361	0.25		0.26	1.35	0.95	

TABLE B.4 continued

g. Sample 77-S

Deployment 3, Downstream	010211 Run	SAMPLE 8	Deployed SPMD		Site 12: Fairfield, ME				
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.34	806233	1026250	2.32		2.43	0.89	0.79	
13C-2,3,7,8-TCDF	36.30	40094700	48907900	79.93	79.93		1.44	0.82	
IS-13C-1,2,3,4-TCDD	38.00	34069800	43298500					0.79	
2,3,7,8-TCDD	ND						0.98		
13C-2,3,7,8-TCDD	38.39	27502000	36637400	77.15	77.15		1.07	0.75	
37Cl-TCDD	38.43	20654100		26.17	52.35		2.32		
1,2,3,7,8-PeCDF	ND						0.97		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	51.05	43598000	24934000	74.26	74.26		1.19	1.75	
13C-2,3,4,7,8-PeCDF	54.20	42310300	24228200	62.53	62.53		1.38	1.75	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	55.32	28899000	18241800	54.96	54.96		1.11	1.58	
1,2,3,4,7,8-HxCDF	60.36	60249.7	55709.6	0.16		0.17	1.27	1.08	
1,2,3,6,7,8-HxCDF	ND						1.27		DPE
2,3,4,6,7,8-HxCDF	61.46	122996	105592	0.32		0.33	1.16	1.16	
1,2,3,7,8,9-HxCDF	62.40	69871	49716.7	0.16		0.16	1.28	1.41	
13C-1,2,3,4,7,8-HxCDF	60.34	19234300	38230400	75.56	75.56		1.10	0.50	
13C-1,2,3,6,7,8-HxCDF	60.46	20745900	40925800	75.95	75.95		1.18	0.51	
13C-2,3,4,6,7,8-HxCDF	61.42	20677600	41004200	81.81	81.81		1.09	0.50	
13C-1,2,3,7,8,9-HxCDF	62.38	20244200	39925200	91.57	91.57		0.95	0.51	
1,2,3,4,7,8-HxCDD	ND						1.08		DPE
1,2,3,6,7,8-HxCDD	ND						0.96		DPE
1,2,3,7,8,9-HxCDD	ND						1.01		DPE
13C-1,2,3,4,7,8-HxCDD	61.59	26043200	20050000	74.31	74.31		0.90	1.30	
13C-1,2,3,6,7,8-HxCDD	62.07	31396000	23830600	76.41	76.41		1.05	1.32	
IS-13C-1,2,3,7,8,9-HxCDD	62.29	39684800	29221000					1.36	
1,2,3,4,6,7,8-HpCDF	ND						1.48		DPE
1,2,3,4,7,8,9-HpCDF	ND						1.44		DPE
13C-1,2,3,4,6,7,8-HpCDF	64.54	17925700	41203700	99.48	99.48		0.86	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.30	16718000	39035200	110.09	110.09		0.73	0.43	
1,2,3,4,6,7,8-HpCDD	66.09	136233	116687	0.39		0.41	0.94	1.17	
13C-1,2,3,4,6,7,8-HpCDD	66.09	35025400	33832200	110.69	110.69		0.90	1.04	
OCDD	ND						1.01		
13C-OCDD	69.17	46926900	52882000	221.40	110.70		0.65	0.89	
OCDF	ND						1.35		DPE

TABLE B.4 continued

h. Sample 78-S

Deployment 3, Downstream | 010211 Run | SAMPLE 9 | Deployed SPMD | Site 12: Fairfield, ME

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.34	1042960	1462780	4.26		4.46	0.89	0.71	
13C-2,3,7,8-TCDF	36.29	29920600	36385100	69.07	69.07		1.44	0.82	
IS-13C-1,2,3,4-TCDD	38.00	29221200	37480300					0.78	
2,3,7,8-TCDD	ND						0.98		
13C-2,3,7,8-TCDD	38.38	20509200	27333700	66.75	66.75		1.07	0.75	
37Cl-TCDD	38.41	19905300		29.41	58.82		2.32		
1,2,3,7,8-PeCDF	ND						0.97		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	51.03	33288400	19200400	65.97	65.97		1.19	1.73	
13C-2,3,4,7,8-PeCDF	54.20	33176800	18750700	56.60	56.60		1.38	1.77	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	55.30	22955500	14085200	50.09	50.09		1.11	1.63	
1,2,3,4,7,8-HxCDF	60.36	57224.5	44496.1	0.16		0.17	1.27	1.29	
1,2,3,6,7,8-HxCDF	60.46	52568.3	49250.6	0.15		0.15	1.27	1.07	
2,3,4,6,7,8-HxCDF	ND						1.16		DPE
1,2,3,7,8,9-HxCDF	62.39	41822.9	36791.1	0.12		0.12	1.28	1.14	
13C-1,2,3,4,7,8-HxCDF	60.34	16596600	32143700	59.30	59.30		1.10	0.52	
13C-1,2,3,6,7,8-HxCDF	60.45	18303500	35759000	61.60	61.60		1.18	0.51	
13C-2,3,4,6,7,8-HxCDF	61.42	18539600	36477500	67.51	67.51		1.09	0.51	
13C-1,2,3,7,8,9-HxCDF	62.37	17508200	34512300	73.25	73.25		0.95	0.51	
1,2,3,4,7,8-HxCDD	62.00	26229.6	24516	0.12		0.12	1.08	1.07	
1,2,3,6,7,8-HxCDD	62.07	43297.7	37997.3	0.17		0.18	0.96	1.14	
1,2,3,7,8,9-HxCDD	62.30	48053.3	40881	0.19		0.20	1.01	1.18	
13C-1,2,3,4,7,8-HxCDD	61.58	23376000	17365300	60.77	60.77		0.90	1.35	
13C-1,2,3,6,7,8-HxCDD	62.07	28485000	21210000	63.62	63.62		1.05	1.34	
IS-13C-1,2,3,7,8,9-HxCDD	62.29	42537500	31936800					1.33	
1,2,3,4,6,7,8-HpCDF	ND						1.48		DPE
1,2,3,4,7,8,9-HpCDF	66.32	48395.8	43684.7	0.13		0.14	1.44	1.11	
13C-1,2,3,4,6,7,8-HpCDF	64.54	15373500	34386400	77.46	77.46		0.86	0.45	
13C-1,2,3,4,7,8,9-HpCDF	66.29	14518000	33311900	87.38	87.38		0.73	0.44	
1,2,3,4,6,7,8-HpCDD	66.09	108378	114636	0.40		0.42	0.94	0.95	
13C-1,2,3,4,6,7,8-HpCDD	66.08	30530500	29085800	88.67	88.67		0.90	1.05	
OCDD	69.17	264284	290717	1.28		1.34	1.01	0.91	
13C-OCDD	69.16	40455300	44898600	175.18	87.59		0.65	0.90	
OCDF	ND						1.35		DPE

TABLE B.4 continued

i. Sample 79-S

Deployment 3, Downstream	010211 Run	SAMPLE 10	Deployed SPMD		Site 12: Fairfield, ME				
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.30	382892	481314	2.64		2.77	0.89	0.80	
13C-2,3,7,8-TCDF	36.27	16846000	19991800	73.90	73.90		1.44	0.84	
IS-13C-1,2,3,4-TCDD	37.56	15174100	19457000					0.78	
2,3,7,8-TCDD	ND						0.98		
13C-2,3,7,8-TCDD	38.36	11524800	14864200	70.92	70.92		1.07	0.78	
37Cl-TCDD	38.39	8814640		25.08	50.16		2.32		
1,2,3,7,8-PeCDF	ND						0.97		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	50.58	17804700	10111200	67.58	67.58		1.19	1.76	
13C-2,3,4,7,8-PeCDF	54.17	17972900	9860280	58.43	58.43		1.38	1.82	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	55.28	11915700	7093590	49.51	49.51		1.11	1.68	
1,2,3,4,7,8-HxCDF	ND						1.27		DPE
1,2,3,6,7,8-HxCDF	60.45	29121.8	22162.6	0.17		0.18	1.27	1.31	
2,3,4,6,7,8-HxCDF	61.44	65715.4	59981.5	0.48		0.50	1.16	1.10	
1,2,3,7,8,9-HxCDF	ND						1.28		DPE
13C-1,2,3,4,7,8-HxCDF	60.32	7445400	13908300	70.85	70.85		1.10	0.54	
13C-1,2,3,6,7,8-HxCDF	60.43	7828500	15829300	73.52	73.52		1.18	0.49	
13C-2,3,4,6,7,8-HxCDF	61.41	7703710	14770400	75.21	75.21		1.09	0.52	
13C-1,2,3,7,8,9-HxCDF	62.36	7448900	14823400	85.53	85.53		0.95	0.50	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.96		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	61.57	9360880	6427010	64.22	64.22		0.90	1.46	
13C-1,2,3,6,7,8-HxCDD	62.05	11183000	8887850	70.07	70.07		1.05	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	62.27	15698400	11609800					1.35	
1,2,3,4,6,7,8-HpCDF	ND						1.48		
1,2,3,4,7,8,9-HpCDF	ND						1.44		
13C-1,2,3,4,6,7,8-HpCDF	64.53	7229220	16538300	100.90	100.90		0.86	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.27	6958380	15980300	114.29	114.29		0.73	0.44	
1,2,3,4,6,7,8-HpCDD	66.09	78934	75102.2	0.60		0.62	0.94	1.05	
13C-1,2,3,4,6,7,8-HpCDD	66.07	13907100	13618000	111.64	111.64		0.90	1.02	
OCDD	69.15	205910	232790	2.20		2.30	1.01	0.88	
13C-OCDD	69.14	18387500	20944900	220.15	110.08		0.65	0.88	
OCDF	ND						1.35		

TABLE B.4 continued

j. Sample 80-S

Deployment 3, Downstream	010211 Run	SAMPLE 11	Deployed SPMD		Site 12: Fairfield, ME				
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.30	844125	1053180	2.78		2.91	0.89	0.80	
13C-2,3,7,8-TCDF	36.26	34835600	42182100	76.48	76.48		1.44	0.83	
IS-13C-1,2,3,4-TCDD	37.56	31085600	38881100					0.80	
2,3,7,8-TCDD	ND						0.98		
13C-2,3,7,8-TCDD	38.35	23558800	30751800	72.24	72.24		1.07	0.77	
37Cl-TCDD	38.38	19785200		27.48	54.96		2.32		
1,2,3,7,8-PeCDF	ND						0.97		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	50.58	36419800	21542500	69.45	69.45		1.19	1.69	
13C-2,3,4,7,8-PeCDF	54.16	37499900	20705400	60.48	60.48		1.38	1.81	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	55.28	24823900	15054300	51.41	51.41		1.11	1.65	
1,2,3,4,7,8-HxCDF	60.33	60934.1	55941.8	0.18		0.19	1.27	1.09	
1,2,3,6,7,8-HxCDF	ND						1.27		DPE
2,3,4,6,7,8-HxCDF	61.44	133601	103694	0.38		0.39	1.16	1.29	
1,2,3,7,8,9-HxCDF	62.38	56781.2	48673.4	0.15		0.16	1.28	1.17	
13C-1,2,3,4,7,8-HxCDF	60.32	16946700	33279700	68.72	68.72		1.10	0.51	
13C-1,2,3,6,7,8-HxCDF	60.43	17777400	34478900	66.97	66.97		1.18	0.52	
13C-2,3,4,6,7,8-HxCDF	61.41	18262800	35759600	74.56	74.56		1.09	0.51	
13C-1,2,3,7,8,9-HxCDF	62.36	17935400	35541000	84.68	84.68		0.95	0.50	
1,2,3,4,7,8-HxCDD	61.58	46640.9	35619.1	0.19		0.20	1.08	1.31	
1,2,3,6,7,8-HxCDD	ND						0.96		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	61.57	23354300	17481900	68.50	68.50		0.90	1.34	
13C-1,2,3,6,7,8-HxCDD	62.05	27850300	20212200	69.20	69.20		1.05	1.38	
IS-13C-1,2,3,7,8,9-HxCDD	62.27	37705700	28516400					1.32	
1,2,3,4,6,7,8-HpCDF	ND						1.48		DPE
1,2,3,4,7,8,9-HpCDF	ND						1.44		DPE
13C-1,2,3,4,6,7,8-HpCDF	64.53	16568400	38215900	95.91	95.91		0.86	0.43	
13C-1,2,3,4,7,8,9-HpCDF	66.28	15990700	36893500	108.66	108.66		0.73	0.43	
1,2,3,4,6,7,8-HpCDD	66.08	127696	130178	0.42		0.44	0.94	0.98	
13C-1,2,3,4,6,7,8-HpCDD	66.07	33260200	31435800	108.21	108.21		0.90	1.06	
OCDD	69.16	379282	436707	1.62		1.69	1.01	0.87	
13C-OCDD	69.15	47379400	52066800	229.54	114.77		0.65	0.91	
OCDF	ND						1.35		DPE

TABLE B.5. SPMD Raw Data Calculation Spreadsheets for Deployment Four Field Samples

a. Sample 83-S

Deployment 4, Upstream	010222 Run	SAMPLE 4	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	37.22	2371340	2723680	1.20		1.26	0.92	0.87	
13C-2,3,7,8-TCDF	37.20	204955000	256796000	189.30	189.30		1.43	0.80	S
IS-13C-1,2,3,4-TCDD	38.44	78040500	92457200					0.84	
2,3,7,8-TCDD	ND						1.01		
13C-2,3,7,8-TCDD	39.31	23968000	29443400	30.67	30.67		1.02	0.81	
37Cl-TCDD	39.33	66767900		35.47	70.94		2.41		
1,2,3,7,8-PeCDF	ND	646719					0.95		DPE
2,3,4,7,8-PeCDF	ND	1054580					1.02		DPE
13C-1,2,3,7,8-PeCDF	52.18	260022000	165686000	216.00	216.00		1.16	1.57	S
13C-2,3,4,7,8-PeCDF	55.11	157980000	89914300	122.72	122.72		1.18	1.76	
1,2,3,7,8-PeCDD	ND						0.97		
13C-1,2,3,7,8-PeCDD	56.12&56.19	188865000	288013000	344.19	344.19		0.81	0.66	S,C
1,2,3,4,7,8-HxCDF	60.58	386935	292751	0.23		0.24	1.20	1.32	
1,2,3,6,7,8-HxCDF	ND						1.27		
2,3,4,6,7,8-HxCDF	ND						1.15		
1,2,3,7,8,9-HxCDF	ND						0.82		
13C-1,2,3,4,7,8-HxCDF	60.59	84497000	165766000	131.27	131.27		1.03	0.51	
13C-1,2,3,6,7,8-HxCDF	61.07	53088300	101693000	65.46	65.46		1.27	0.52	
13C-2,3,4,6,7,8-HxCDF	62.07	71420300	139499000	102.53	102.53		1.11	0.51	
13C-1,2,3,7,8,9-HxCDF	62.59	61399800	120912000	100.91	100.91		0.97	0.51	
1,2,3,4,7,8-HxCDD	ND						1.10		
1,2,3,6,7,8-HxCDD	ND						0.99		
1,2,3,7,8,9-HxCDD	ND						1.04		
13C-1,2,3,4,7,8-HxCDD	62.20	101621000	81229400	144.00	144.00		0.68	1.25	S
13C-1,2,3,6,7,8-HxCDD	62.26	103715000	82453600	84.08	84.08		1.19	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	62.49	103991000	81823900					1.27	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.42		
13C-1,2,3,4,6,7,8-HpCDF	65.12	31774100	71194300	70.11	70.11		0.79	0.45	
13C-1,2,3,4,7,8,9-HpCDF	66.46	27540400	63320800	86.77	86.77		0.56	0.43	
1,2,3,4,6,7,8-HpCDD	ND						0.96		
13C-1,2,3,4,6,7,8-HpCDD	66.23	67424800	64746800	103.54	103.54		0.69	1.04	
OCDD	ND						1.10		
13C-OCDD	69.32	48182900	54274600	93.10	46.55		0.59	0.89	
OCDF	ND						1.19		

TABLE B.5 continued

b. Sample 84-S

Deployment 4, Upstream	010404 Run	SAMPLE 10	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.26	34587400	43935300	11.04		11.55	0.93	0.79	
13C-2,3,7,8-TCDF	42.24	342193000	421354000	99.89	99.89		1.46	0.81	
IS-13C-1,2,3,4-TCDD	44.14	230042000	292452000					0.79	
2,3,7,8-TCDD	ND						1.06		
13C-2,3,7,8-TCDD	45.09	253282000	323340000	103.17	103.17		1.07	0.78	
37Cl-TCDD	45.13	253873000		45.97	91.94		2.40		
1,2,3,7,8-PeCDF	56.35	3842140	2461980				0.92		
2,3,4,7,8-PeCDF	58.18	6734040	4724990				1.00		
13C-1,2,3,7,8-PeCDF	56.33	466275000	292042000	114.05	114.05		1.27	1.60	
13C-2,3,4,7,8-PeCDF	58.18	410352000	255723000	111.50	111.50		1.14	1.60	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	59.07	270201000	185018000	98.79	98.79		0.88	1.46	
1,2,3,4,7,8-HxCDF	63.06	1415460	1023130	0.76		0.80	1.19	1.38	
1,2,3,6,7,8-HxCDF	63.15	656568	528110	0.56		0.58	1.21	1.24	
2,3,4,6,7,8-HxCDF	ND						1.12		
1,2,3,7,8,9-HxCDF	64.54	1183270	1058080	0.54		0.57	1.23	1.12	
13C-1,2,3,4,7,8-HxCDF	63.04	93140000	176833000	72.68	72.68		1.09	0.53	
13C-1,2,3,6,7,8-HxCDF	63.13	61138100	114371000	47.73	47.73		1.08	0.53	
13C-2,3,4,6,7,8-HxCDF	63.59	63803900	117884000	49.42	49.42		1.08	0.54	
13C-1,2,3,7,8,9-HxCDF	64.54	118296000	219394000	110.65	110.65		0.90	0.54	
1,2,3,4,7,8-HxCDD	64.17	649626	616887	0.42		0.44	1.06	1.05	
1,2,3,6,7,8-HxCDD	64.24	880171	726554	0.53		0.55	0.92	1.21	
1,2,3,7,8,9-HxCDD	64.43	952283	852119	0.60		0.62	0.98	1.12	
13C-1,2,3,4,7,8-HxCDD	64.16	157147000	128149000	94.72	94.72		0.88	1.23	
13C-1,2,3,6,7,8-HxCDD	64.22	182461000	148646000	101.36	101.36		0.96	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	64.42	187533000	152822000					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.55	70687600	152800000	94.03	94.03		0.70	0.46	
13C-1,2,3,4,7,8,9-HpCDF	68.27	66036100	147267000	107.71	107.71		0.58	0.45	
1,2,3,4,6,7,8-HpCDD	68.05	1248560	1216070	0.97		1.02	0.94	1.03	
13C-1,2,3,4,6,7,8-HpCDD	68.04	138833000	132354000	117.53	117.53		0.68	1.05	
OCDD	71.35	2755340	3134330	3.10		3.25	0.99	0.88	
13C-OCDD	71.34	180085000	205067000	187.33	93.66		0.60	0.88	
OCDF	71.43	973994	1095930	1.00		1.05	1.07	0.89	

TABLE B.5 continued

c. Sample 85-S

Deployment 4, Upstream   010227-1- Run   SAMPLE 2   Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	37.20	1110890	1429870	0.88		0.92	0.87	0.78	
13C-2,3,7,8-TCDF	37.17	150419000	183494000	145.70	145.70		1.38	0.82	
IS-13C-1,2,3,4-TCDD	38.39	147571000	18227100					8.10	
2,3,7,8-TCDD	ND						0.84		
13C-2,3,7,8-TCDD	39.27	139923000	170791000	182.83	182.83		1.03	0.82	S
37Cl-TCDD	39.31	136505000		41.32	82.65		2.24		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	55.12	1612310	949673	0.88		0.92	0.99	1.70	
13C-1,2,3,7,8-PeCDF	52.16	203638000	123930000	190.91	190.91		1.03	1.64	S
13C-2,3,4,7,8-PeCDF	55.11	181237000	113023000	145.14	145.14		1.22	1.60	
1,2,3,7,8-PeCDD	ND						0.96		
13C-1,2,3,7,8-PeCDD	56.12&56.17	137282000		80.34	80.34		1.03		C
1,2,3,4,7,8-HxCDF	61.01	353058	300410	0.25		0.26	1.29	1.18	
1,2,3,6,7,8-HxCDF	ND						1.22		
2,3,4,6,7,8-HxCDF	62.09	276093	229754	0.24		0.25	1.15	1.20	
1,2,3,7,8,9-HxCDF	63.01	382978	339185	0.38		0.39	1.18	1.13	
13C-1,2,3,4,7,8-HxCDF	61.01	71224300	134792000	116.79	116.79		0.88	0.53	
13C-1,2,3,6,7,8-HxCDF	61.08	49401600	110255000	59.62	59.62		1.34	0.45	
13C-2,3,4,6,7,8-HxCDF	62.08	60973400	123869000	86.73	86.73		1.07	0.49	
13C-1,2,3,7,8,9-HxCDF	62.59	53136400	109208000	87.48	87.48		0.93	0.49	
1,2,3,4,7,8-HxCDD	ND						1.05		
1,2,3,6,7,8-HxCDD	ND						1.00		
1,2,3,7,8,9-HxCDD	ND						1.02		
13C-1,2,3,4,7,8-HxCDD	62.21	78581000	61977900	115.27	115.27		0.61	1.27	
13C-1,2,3,6,7,8-HxCDD	62.26	115748000	88337300	80.71	80.71		1.26	1.31	
IS-13C-1,2,3,7,8,9-HxCDD	62.50	112224000	87797000					1.28	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.42		
13C-1,2,3,4,6,7,8-HpCDF	65.16	25641600	59325500	55.90	55.90		0.76	0.43	
13C-1,2,3,4,7,8,9-HpCDF	66.49	21282100	49576600	56.51	56.51		0.63	0.43	
1,2,3,4,6,7,8-HpCDD	66.29						0.95		
13C-1,2,3,4,6,7,8-HpCDD	66.29	50423900	48468600	61.26	61.26		0.81	1.04	
OCDD	ND						1.01		
13C-OCDD	69.42	36693000	41003300	59.69	29.85		0.65	0.89	
OCDF	ND						1.15		

TABLE B.5 continued

d. Sample 86-S

Deployment 4, Upstream   010227-1- Run   SAMPLE 3   Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	37.02	1832710	2413260	1.96		2.05	0.87	0.76	
13C-2,3,7,8-TCDF	37.00	113114000	135809000	79.40	79.40		1.38	0.83	
IS-13C-1,2,3,4-TCDD	38.24	104822000	121972000					0.86	
2,3,7,8-TCDD	ND						0.84		
13C-2,3,7,8-TCDD	39.11	104628000	125902000	99.17	99.17		1.03	0.83	
37Cl-TCDD	39.14	105835000		45.10	90.21		2.24		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.59	136920000	83935600	94.10	94.10		1.03	1.63	
13C-2,3,4,7,8-PeCDF	55.00	92476300	58291100	54.36	54.36		1.22	1.59	
1,2,3,7,8-PeCDD	ND						0.96		
13C-1,2,3,7,8-PeCDD	56.02&56.08	103224000	65511000	72.19	72.19		1.03	1.58	C
1,2,3,4,7,8-HxCDF	60.57	517773	362080	0.52		0.54	1.29	1.43	
1,2,3,6,7,8-HxCDF	ND						1.22		
2,3,4,6,7,8-HxCDF	ND						1.15		
1,2,3,7,8,9-HxCDF	ND						1.18		
13C-1,2,3,4,7,8-HxCDF	60.56	42920300	88670900	110.23	110.23		0.88	0.48	
13C-1,2,3,6,7,8-HxCDF	61.03	47607700	95558700	79.00	79.00		1.34	0.50	
13C-2,3,4,6,7,8-HxCDF	62.05	46828900	95814900	98.90	98.90		1.07	0.49	
13C-1,2,3,7,8,9-HxCDF	62.57	38421700	78746800	93.30	93.30		0.93	0.49	
1,2,3,4,7,8-HxCDD	ND						1.05		
1,2,3,6,7,8-HxCDD	ND						1.00		
1,2,3,7,8,9-HxCDD	ND						1.02		
13C-1,2,3,4,7,8-HxCDD	62.18	54320100	41957700	116.67	116.67		0.61	1.29	
13C-1,2,3,6,7,8-HxCDD	62.23	90424200	68838700	93.07	93.07		1.26	1.31	
IS-13C-1,2,3,7,8,9-HxCDD	62.48	76450600	58911900					1.30	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.42		
13C-1,2,3,4,6,7,8-HpCDF	65.14	20607800	47693900	66.40	66.40		0.76	0.43	
13C-1,2,3,4,7,8,9-HpCDF	66.46	16085600	36746600	62.26	62.26		0.63	0.44	
1,2,3,4,6,7,8-HpCDD	ND						0.95		
13C-1,2,3,4,6,7,8-HpCDD	66.25	41099800	38622000	72.97	72.97		0.81	1.06	
OCDD	ND						1.01		
13C-OCDD	69.33	27676900	30742200	66.32	33.16		0.65	0.90	
OCDF	ND						1.15		

TABLE B.5 continued

e. Sample 87-S

Deployment 4, Upstream | 010404 Run | SAMPLE 11 | Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.39	38833600	49309900	11.18		11.69	0.93	0.79	
13C-2,3,7,8-TCDF	42.40	378972000	467990000	84.16	84.16		1.46	0.81	
IS-13C-1,2,3,4-TCDD	44.30	306374000	381536000					0.80	
2,3,7,8-TCDD	ND						1.06		
13C-2,3,7,8-TCDD	45.28	301579000	386265000	93.48	93.48		1.07	0.78	
37Cl-TCDD	45.30	283560000		38.55	77.10		2.40		
1,2,3,7,8-PeCDF	56.45	3848340	2321350				0.92		
2,3,4,7,8-PeCDF	58.27	5596510	3995500				1.00		
13C-1,2,3,7,8-PeCDF	56.44	519567000	322969000	96.25	96.25		1.27	1.61	
13C-2,3,4,7,8-PeCDF	58.27	445441000	277543000	91.92	91.92		1.14	1.60	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	59.15	253042000	180980000	71.54	71.54		0.88	1.40	C
1,2,3,4,7,8-HxCDF	63.12	1863660	1480420	0.59		0.62	1.19	1.26	
1,2,3,6,7,8-HxCDF	63.22	586495	440371	0.30		0.31	1.21	1.33	
2,3,4,6,7,8-HxCDF	64.04	3031190	2150180	0.97		1.02	1.12	1.41	
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.11	166524000	312153000	113.53	113.53		1.09	0.53	
13C-1,2,3,6,7,8-HxCDF	63.20	99684700	186469000	68.56	68.56		1.08	0.53	
13C-2,3,4,6,7,8-HxCDF	64.06	165385000	310158000	113.96	113.96		1.08	0.53	
13C-1,2,3,7,8,9-HxCDF	64.59	120063000	224964000	99.59	99.59		0.90	0.53	
1,2,3,4,7,8-HxCDD	ND						1.06		
1,2,3,6,7,8-HxCDD	ND						0.92		
1,2,3,7,8,9-HxCDD	ND						0.98		
13C-1,2,3,4,7,8-HxCDD	64.22	188095000	151718000	99.39	99.39		0.88	1.24	
13C-1,2,3,6,7,8-HxCDD	64.28	205148000	165601000	99.99	99.99		0.96	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	64.48	213796000	172551000					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	67.00	60393900	133416000	71.83	71.83		0.70	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.33	69386300	155978000	100.26	100.26		0.58	0.44	
1,2,3,4,6,7,8-HpCDD	68.10	804780	733211	0.56		0.59	0.94	1.10	
13C-1,2,3,4,6,7,8-HpCDD	68.09	150375000	143018000	112.02	112.02		0.68	1.05	
OCDD	71.41	1301950	1279480	1.18		1.24	0.99	1.02	
13C-OCDD	71.40	207270000	235756000	189.83	94.91		0.60	0.88	
OCDF	71.48	443245	451601	0.38		0.39	1.07	0.98	

TABLE B.5 continued
f. Sample 90-S

Deployment 4, Upstream	010228-1- Run	SAMPLE 3	Deployed SPMD							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.51	3187830	4069440	2.02		2.11	0.90	0.78	
13C-2,3,7,8-TCDF	36.50	184503000	213533000	89.55	89.55		1.49	0.86	
IS-13C-1,2,3,4-TCDD	38.11	136522000	161117000					0.85	
2,3,7,8-TCDD	ND						0.71		
13C-2,3,7,8-TCDD	39.00	148379000	179848000	107.99	107.99		1.02	0.83	
37Cl-TCDD	39.04	121013000		39.70	79.40		2.23		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	51.48	256019000	154835000	117.85	117.85		1.17	1.65	
13C-2,3,4,7,8-PeCDF	54.49	214006000	135119000	79.18	79.18		1.48	1.58	
1,2,3,7,8-PeCDD	ND						0.99		
13C-1,2,3,7,8-PeCDD	*55.54&55.57	166702000	120908000	81.18	81.18		1.19	1.38	C
1,2,3,4,7,8-HxCDF	60.52	743985	531712	0.49		0.52	1.24	1.40	
1,2,3,6,7,8-HxCDF	ND						1.32		
2,3,4,6,7,8-HxCDF	ND						1.19		
1,2,3,7,8,9-HxCDF	ND						2.56		
13C-1,2,3,4,7,8-HxCDF	60.52	69791500	138390000	115.07	115.07		0.91	0.50	
13C-1,2,3,6,7,8-HxCDF	60.58	84195600	164246000	78.70	78.70		1.58	0.51	
13C-2,3,4,6,7,8-HxCDF	61.59	84061500	165517000	109.46	109.46		1.14	0.51	
13C-1,2,3,7,8,9-HxCDF	62.52	69773100	137183000	108.14	108.14		0.96	0.51	
1,2,3,4,7,8-HxCDD	ND						0.94		
1,2,3,6,7,8-HxCDD	ND						1.11		
1,2,3,7,8,9-HxCDD	ND						1.05		
13C-1,2,3,4,7,8-HxCDD	?	76836600	59083300	111.40	111.40		0.61	1.30	
13C-1,2,3,6,7,8-HxCDD	62.19	155384000	115575000	109.02	109.02		1.25	1.34	
IS-13C-1,2,3,7,8,9-HxCDD	62.44	112674000	86677600					1.30	
1,2,3,4,6,7,8-HpCDF	ND						1.50		
1,2,3,4,7,8,9-HpCDF	ND						1.48		
13C-1,2,3,4,6,7,8-HpCDF	65.10	39203700	88593600	85.68	85.68		0.75	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.43	33195000	77708300	95.85	95.85		0.58	0.43	
1,2,3,4,6,7,8-HpCDD	ND						0.98		
13C-1,2,3,4,6,7,8-HpCDD	66.22	74849200	69536400	101.63	101.63		0.71	1.08	
OCDD	ND						1.10		
13C-OCDD	69.33	40659500	45898300	81.52	40.76		0.53	0.89	
OCDF	ND						1.25		

TABLE B.5 continued

g. Sample 91-S

Deployment 4, Upstream 010401 Run SAMPLE 7 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.21	25158400	32221400	10.54		11.03	0.93	0.78	
13C-2,3,7,8-TCDF	42.17	261085000	323823000	99.88	99.88		1.40	0.81	
IS-13C-1,2,3,4-TCDD	44.09	182714000	236263000					0.77	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	44.59	209544000	273354000	112.11	112.11		1.03	0.77	
37Cl-TCDD	45.03	181642000		42.25	84.51		2.35		
1,2,3,7,8-PeCDF	56.30	1678470	1101040	0.53		0.56	0.94	1.52	
2,3,4,7,8-PeCDF	58.14	3451550	2029080	1.12		1.17	1.00	1.70	
13C-1,2,3,7,8-PeCDF	56.28	343625000	212600000	89.37	89.37		1.49	1.62	
13C-2,3,4,7,8-PeCDF	58.12	301957000	185227000	80.16	80.16		1.45	1.63	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	59.01	226398000	167433000	82.69	82.69		1.14	1.35	
1,2,3,4,7,8-HxCDF							1.27		
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	63.57	725181	595618	0.83		0.87	1.18	1.22	
1,2,3,7,8,9-HxCDF	ND						1.31		
13C-1,2,3,4,7,8-HxCDF	63.01	64140500	120670000	96.81	96.81		2.03	0.53	
13C-1,2,3,6,7,8-HxCDF	63.09	56272800	102381000	89.48	89.48		1.89	0.55	
13C-2,3,4,6,7,8-HxCDF	63.57	47316800	87351400	88.61	88.61		1.62	0.54	
13C-1,2,3,7,8,9-HxCDF	64.49	30581600	57344600	103.99	103.99		0.90	0.53	
1,2,3,4,7,8-HxCDD	ND						1.13		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.00		
13C-1,2,3,4,7,8-HxCDD	64.12	53504300	44365000	87.35	87.35		1.19	1.21	
13C-1,2,3,6,7,8-HxCDD	64.18	58225300	47234800	95.55	95.55		1.18	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	64.39	51257100	42661400					1.20	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	66.51	13457400	29244600	110.34	110.34		0.41	0.46	
13C-1,2,3,4,7,8,9-HpCDF	68.22	47206300	106392000	88.99	88.99		1.84	0.44	
1,2,3,4,6,7,8-HpCDD	78.00	527157	494074	0.53		0.55	0.92	1.07	
13C-1,2,3,4,6,7,8-HpCDD	77.59	105539000	103580000	94.47	94.47		2.36	1.02	
OCDD	71.30	1317280	1310430	1.50		1.57	0.97	1.01	
13C-OCDD	71.29	169731000	193063000	149.46	74.73		2.58	0.88	
OCDF	ND						1.06		

TABLE B.5 continued

h. Sample 92-S

Deployment 4, Upstream	010401 Run	SAMPLE 8	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.01	9056070	11642300	9.68		10.13	0.93	0.78	
13C-2,3,7,8-TCDF	41.56	102745000	127009000	54.84	54.84		1.40	0.81	
IS-13C-1,2,3,4-TCDD	43.49	130583000	169149000					0.77	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	44.38	79509200	103000000	59.23	59.23		1.03	0.77	
37Cl-TCDD	44.41	136601000		44.46	88.93		2.35		
1,2,3,7,8-PeCDF	56.16	1104500	820246	0.90		0.94	0.94	1.35	
2,3,4,7,8-PeCDF	58.04	1523840	1010540	1.17		1.22	1.00	1.51	
13C-1,2,3,7,8-PeCDF	56.15	141123000	86021100	51.02	51.02		1.49	1.64	
13C-2,3,4,7,8-PeCDF	58.02	132688000	83860000	49.80	49.80		1.45	1.58	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	58.51	97995700	67699600	48.63	48.63		1.14	1.45	C
1,2,3,4,7,8-HxCDF	62.54	309957	266743	0.54		0.57	1.27	1.16	
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	63.51	410933	328131	0.95		0.99	1.18	1.25	
1,2,3,7,8,9-HxCDF	64.43	173631	148372	0.64		0.67	1.31	1.17	
13C-1,2,3,4,7,8-HxCDF	62.53	29111600	54492600	58.56	58.56		2.03	0.53	
13C-1,2,3,6,7,8-HxCDF	63.02	26446300	48577000	56.58	56.58		1.89	0.54	
13C-2,3,4,6,7,8-HxCDF	63.49	23144000	43135000	58.31	58.31		1.62	0.54	
13C-1,2,3,7,8,9-HxCDF	64.42	13612200	24857000	60.84	60.84		0.90	0.55	
1,2,3,4,7,8-HxCDD	ND						1.13		
1,2,3,6,7,8-HxCDD	64.12	110050	100938	0.56		0.59	0.95	1.09	
1,2,3,7,8,9-HxCDD	ND						1.00		
13C-1,2,3,4,7,8-HxCDD	64.05	26939000	22012400	58.42	58.42		1.19	1.22	
13C-1,2,3,6,7,8-HxCDD	64.12	21786200	17910400	48.09	48.09		1.18	1.22	
IS-13C-1,2,3,7,8,9-HxCDD	64.32	38558600	31677100					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	66.47	26453300	58212300	292.53	292.53		0.41	0.45	S
13C-1,2,3,4,7,8,9-HpCDF	68.18	20629300	45308000	51.08	51.08		1.84	0.46	
1,2,3,4,6,7,8-HpCDD	67.56	383940	352733	0.83		0.87	0.92	1.09	
13C-1,2,3,4,6,7,8-HpCDD	67.55	48812600	47363400	58.10	58.10		2.36	1.03	
OCDD	71.24	1025080	1100390	3.13		3.27	0.97	0.93	
13C-OCDD	71.24	65774500	75025400	77.57	38.78		2.58	0.88	
OCDF	ND						1.06		

TABLE B.5 continued

i. Sample 93-S

Deployment 4, Upstream	010401 Run	SAMPLE 9	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	41.55	7879500	10299200	10.79		11.29	0.93	0.77	
13C-2,3,7,8-TCDF	41.50	80157900	100922000	92.50	92.50		1.40	0.79	
IS-13C-1,2,3,4-TCDD	43.42	61200700	78852200					0.78	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	44.29	62724300	83701400	101.70	101.70		1.03	0.75	
37Cl-TCDD	44.32	57182600		39.71	79.43		2.35		
1,2,3,7,8-PeCDF	56.13	831315	563428	0.80		0.84	0.94	1.48	
2,3,4,7,8-PeCDF	57.59	1323310	903679	1.30		1.36	1.00	1.46	
13C-1,2,3,7,8-PeCDF	56.09	114847000	70515800	89.10	89.10		1.49	1.63	
13C-2,3,4,7,8-PeCDF	57.57	105416000	65029000	83.89	83.89		1.45	1.62	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	58.46	83139600	56381200	87.63	87.63		1.14	1.47	C
1,2,3,4,7,8-HxCDF	62.51	263299	186486	0.44		0.46	1.27	1.41	
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	63.48	306573	258372	0.83		0.87	1.18	1.19	
1,2,3,7,8,9-HxCDF	64.41	327839	286219	0.43		0.45	1.31	1.15	
13C-1,2,3,4,7,8-HxCDF	62.50	28840600	52338200	33.96	33.96		2.03	0.55	
13C-1,2,3,6,7,8-HxCDF	62.59	23513700	45001900	30.86	30.86		1.89	0.52	
13C-2,3,4,6,7,8-HxCDF	63.46	20484100	37650800	30.54	30.54		1.62	0.54	
13C-1,2,3,7,8,9-HxCDF	64.40	38486500	71853400	104.21	104.21		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.13		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	64.31	310222	268915	0.55		0.58	1.00	1.15	
13C-1,2,3,4,7,8-HxCDD	64.02	54812500	45033500	71.16	71.16		1.19	1.22	
13C-1,2,3,6,7,8-HxCDD	64.10	60394500	49948200	79.83	79.83		1.18	1.21	
IS-13C-1,2,3,7,8,9-HxCDD	64.30	64583000	53035100					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	66.44	25112100	54530400	164.32	164.32		0.41	0.46	S
13C-1,2,3,4,7,8,9-HpCDF	68.16	20481800	45642400	30.59	30.59		1.84	0.45	
1,2,3,4,6,7,8-HpCDD	67.54	344420	305088	1.00		1.05	0.92	1.13	
13C-1,2,3,4,6,7,8-HpCDD	67.53	35914000	34344600	25.34	25.34		2.36	1.05	
OCDD	71.22	1026640	1222840	3.70		3.87	0.97	0.84	
13C-OCDD	71.21	58254000	67667600	41.42	20.71		2.58	0.86	
OCDF	71.29	210830	250500	0.69		0.72	1.06	0.84	

TABLE B.5 continued

j. Sample 94-S

Deployment 4, Upstream 010401 Run SAMPLE 10 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	41.57	13679900	17400900	10.58		11.07	0.93	0.79	
13C-2,3,7,8-TCDF	41.51	140711000	174999000	99.02	99.02		1.40	0.80	
IS-13C-1,2,3,4-TCDD	43.45	99455300	128653000					0.77	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	44.32	108390000	141325000	106.48	106.48		1.03	0.77	
37Cl-TCDD	44.36	107482000		45.93	91.87		2.35		
1,2,3,7,8-PeCDF	56.14	1190380	867414	0.70		0.73	0.94	1.37	
2,3,4,7,8-PeCDF	58.02	2099350	1462490	1.22		1.27	1.00	1.44	
13C-1,2,3,7,8-PeCDF	56.12	194393000	118444000	92.33	92.33		1.49	1.64	
13C-2,3,4,7,8-PeCDF	57.59	180229000	110787000	87.95	87.95		1.45	1.63	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	58.48	141390000	97843700	92.26	92.26		1.14	1.45	C
1,2,3,4,7,8-HxCDF	62.53	326468	270773	0.38		0.40	1.27	1.21	
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	63.49	1264690	900133	0.86		0.90	1.18	1.41	
1,2,3,7,8,9-HxCDF							1.31		
13C-1,2,3,4,7,8-HxCDF	62.51	42754100	80621600	29.07	29.07		2.03	0.53	
13C-1,2,3,6,7,8-HxCDF	63.01	34260600	64943400	25.17	25.17		1.89	0.53	
13C-2,3,4,6,7,8-HxCDF	63.48	74702800	138521000	63.10	63.10		1.62	0.54	
13C-1,2,3,7,8,9-HxCDF	64.41	62391500	115793000	94.79	94.79		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.13		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.00		
13C-1,2,3,4,7,8-HxCDD	64.04	95887200	78720800	70.09	70.09		1.19	1.22	
13C-1,2,3,6,7,8-HxCDD	64.11	112375000	91012200	82.88	82.88		1.18	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	64.31	115338000	93478100					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	66.46	38221700	84221000	142.30	142.30		0.41	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.17	33854600	73738900	28.04	28.04		1.84	0.46	
1,2,3,4,6,7,8-HpCDD	67.56	392307	340333	0.59		0.62	0.92	1.15	
13C-1,2,3,4,6,7,8-HpCDD	67.54	68311100	66546100	27.40	27.40		2.36	1.03	
OCDD	71.23	1458120	1497360	2.91		3.04	0.97	0.97	
13C-OCDD	71.22	98222700	112538000	39.05	19.53		2.58	0.87	
OCDF	ND						1.06		

TABLE B.5 continued

k. Sample 97-S

Deployment 4, Downstream | 010327-1 Run | SAMPLE 6 | Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	41.14	2634200	2948100	1.52		1.59	1.04	0.89	
13C-2,3,7,8-TCDF	41.12	160592000	194439000	48.07	48.07		2.43	0.83	
IS-13C-1,2,3,4-TCDD	42.49	137017000	166343000					0.82	
2,3,7,8-TCDD	ND						1.19		
13C-2,3,7,8-TCDD	43.40	102273000	136533000	36.06	36.06		2.18	0.75	
37Cl-TCDD	43.43	84098000		25.46	50.93		2.41		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	55.47	170477000	113851000	28.76	28.76		3.26	1.50	
13C-2,3,4,7,8-PeCDF	57.43	163142000	103649000	26.23	26.23		3.35	1.57	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	58.28	102104000	102092000	23.59	23.59		2.85	1.00	S,C
1,2,3,4,7,8-HxCDF	62.36	416498	361433	0.37		0.39	1.27	1.15	
1,2,3,6,7,8-HxCDF	ND						1.29		
2,3,4,6,7,8-HxCDF	63.35	132380	92867	0.14		0.15	1.19	1.43	
1,2,3,7,8,9-HxCDF	ND						1.06		
13C-1,2,3,4,7,8-HxCDF	62.35	56266300	107657000	120.94	120.94		0.96	0.52	
13C-1,2,3,6,7,8-HxCDF	62.42	40609900	76359600	67.74	67.74		1.22	0.53	
13C-2,3,4,6,7,8-HxCDF	63.34	46310600	87901500	89.35	89.35		1.06	0.53	
13C-1,2,3,7,8,9-HxCDF	64.26	39963400	73652000	85.13	85.13		0.94	0.54	
1,2,3,4,7,8-HxCDD	63.49	266988	192069	0.30		0.32	1.15	1.39	
1,2,3,6,7,8-HxCDD	ND						1.03		
1,2,3,7,8,9-HxCDD	ND						1.07		
13C-1,2,3,4,7,8-HxCDD	63.47	71295600	59649500	129.71	129.71		0.71	1.20	
13C-1,2,3,6,7,8-HxCDD	63.51	63421000	50924900	75.58	75.58		1.07	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	64.14	77309300	64340800					1.20	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.46		
13C-1,2,3,4,6,7,8-HpCDF	66.30	42238200	92069600	102.65	102.65		0.92	0.46	
13C-1,2,3,4,7,8,9-HpCDF	68.01	35289900	74566500	88.63	88.63		0.88	0.47	
1,2,3,4,6,7,8-HpCDD	67.38	743850	673994	1.01		1.06	0.99	1.10	
13C-1,2,3,4,6,7,8-HpCDD	67.38	72807600	69338800	94.95	94.95		1.06	1.05	
OCDD	71.02	929260	1216600	2.22		2.32	1.06	0.76	
13C-OCDD	71.01	84502400	97077600	142.07	71.03		0.90	0.87	
OCDF	ND						1.15		

TABLE B.5 continued

I. Sample 98-S

Deployment 4, Downstream	010331 Run	SAMPLE 4	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.03	11452800	15045800	4.37		4.58	0.96	0.76	
13C-2,3,7,8-TCDF	41.58	278311000	351475000	80.52	80.52		1.34	0.79	
IS-13C-1,2,3,4-TCDD	43.51	256704000	327316000					0.78	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	44.38	235152000	303584000	90.84	90.84		1.02	0.77	
37Cl-TCDD	44.40	211193000		32.73	65.46		2.51		
1,2,3,7,8-PeCDF	56.18	768693	559873	0.25		0.26	0.94	1.37	
2,3,4,7,8-PeCDF	58.06	1801230	1201670	0.59		0.62	1.00	1.50	
13C-1,2,3,7,8-PeCDF	56.17	348689000	211527000	51.58	51.58		1.86	1.65	
13C-2,3,4,7,8-PeCDF	58.04	315837000	188968000	37.01	37.01		2.34	1.67	
1,2,3,7,8-PeCDD	ND						0.88		
13C-1,2,3,7,8-PeCDD	58.52	296081000	225979000	40.25	40.25		2.22	1.31	C
1,2,3,4,7,8-HxCDF	62.57	920558	662212	0.31		0.32	1.23	1.39	
1,2,3,6,7,8-HxCDF	63.04	480221	456163	0.31		0.33	1.14	1.05	
2,3,4,6,7,8-HxCDF	63.53	974621	700816	0.40		0.42	1.12	1.39	
1,2,3,7,8,9-HxCDF	64.45	450290	391728	0.23		0.24	1.25	1.15	
13C-1,2,3,4,7,8-HxCDF	62.55	147172000	274703000	109.13	109.13		1.09	0.54	
13C-1,2,3,6,7,8-HxCDF	63.04	92380600	169713000	65.36	65.36		1.13	0.54	
13C-2,3,4,6,7,8-HxCDF	63.53	131543000	243635000	99.20	99.20		1.07	0.54	
13C-1,2,3,7,8,9-HxCDF	64.44	104000000	193161000	93.43	93.43		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.07	199789000	160288000	107.37	107.37		0.95	1.25	
13C-1,2,3,6,7,8-HxCDD	64.14	147950000	117800000	79.09	79.09		0.95	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	64.34	195481000	158630000					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.49	56745200	125459000	87.54	87.54		0.59	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.20	59163200	135458000	114.37	114.37		0.48	0.44	
1,2,3,4,6,7,8-HpCDD	ND						0.97		
13C-1,2,3,4,6,7,8-HpCDD	67.57	134226000	127419000	119.74	119.74		0.62	1.05	
OCDD	71.27	2176940	2473140	1.87		1.96	1.19	0.88	
13C-OCDD	71.25	195239000	223885000	194.94	97.47		0.61	0.87	
OCDF	ND						1.16		

TABLE B.5 continued

m. Sample 99-S

Deployment 4, Downstream	010331 Run	SAMPLE 5	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.43	13648300	17868400	6.05		6.33	0.96	0.76	
13C-2,3,7,8-TCDF	42.40	240307000	301610000	68.76	68.76		1.34	0.80	
IS-13C-1,2,3,4-TCDD	44.32	263396000	325069000					0.81	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	45.21	242381000	292911000	89.57	89.57		1.02	0.83	
37Cl-TCDD	45.25	240737000		36.36	72.72		2.51		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	ND						1.00	DPE	
13C-1,2,3,7,8-PeCDF	56.42	349711000	210078000	51.15	51.15		1.86	1.66	
13C-2,3,4,7,8-PeCDF	58.26	289324000	176652000	33.90	33.90		2.34	1.64	
1,2,3,7,8-PeCDD							0.88		
13C-1,2,3,7,8-PeCDD	59.12	223270000	184674000	31.21	31.21		2.22	1.21	C
1,2,3,4,7,8-HxCDF	63.11	324289	258681	0.17		0.17	1.23	1.25	
1,2,3,6,7,8-HxCDF	ND						1.14		
2,3,4,6,7,8-HxCDF	64.05	922074	745286	0.74		0.77	1.12	1.24	
1,2,3,7,8,9-HxCDF	ND						1.25		DPE
13C-1,2,3,4,7,8-HxCDF	63.10	99935100	186963000	94.61	94.61		1.09	0.53	
13C-1,2,3,6,7,8-HxCDF	63.18	47261000	87822200	42.94	42.94		1.13	0.54	
13C-2,3,4,6,7,8-HxCDF	64.06	70586300	131239000	68.03	68.03		1.07	0.54	
13C-1,2,3,7,8,9-HxCDF	64.56	91192500	168882000	104.24	104.24		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.20	98533500	77095900	66.76	66.76		0.95	1.28	
13C-1,2,3,6,7,8-HxCDD	64.27	68792700	54236000	46.68	46.68		0.95	1.27	
IS-13C-1,2,3,7,8,9-HxCDD	64.47	153260000	124517000					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.38		DPE
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.59	49217400	107514000	95.99	95.99		0.59	0.46	
13C-1,2,3,4,7,8,9-HpCDF	68.31	51068400	114261000	123.85	123.85		0.48	0.45	
1,2,3,4,6,7,8-HpCDD	68.09	1128460	985055	0.94		0.98	0.97	1.15	
13C-1,2,3,4,6,7,8-HpCDD	68.08	119942000	113676000	136.29	136.29		0.62	1.06	
OCDD	71.41	1908700	1919250	1.78		1.86	1.19	0.99	
13C-OCDD	71.40	168835000	194213000	215.27	107.63		0.61	0.87	
OCDF	71.48	311801	349940	0.31		0.33	1.16	0.89	

TABLE B.5 continued

n. Sample 100-S

Deployment 4, Downstream 010331 Run SAMPLE 6 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.29	3108580	3646930	4.47		4.68	0.96	0.85	
13C-2,3,7,8-TCDF	42.25	70582500	86562200	100.48	100.48		1.34	0.82	
IS-13C-1,2,3,4-TCDD	44.16	51811700	64959600					0.80	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	45.04	61426700	78380800	117.90	117.90		1.02	0.78	
37Cl-TCDD	45.08	48989200		37.62	75.23		2.51		
1,2,3,7,8-PeCDF	56.33	409256	291282	0.53		0.55	0.94	1.41	
2,3,4,7,8-PeCDF	58.18	962758	699333	1.30		1.36	1.00	1.38	
13C-1,2,3,7,8-PeCDF	56.32	87691600	54500200	65.48	65.48		1.86	1.61	
13C-2,3,4,7,8-PeCDF	58.17	78789000	48176300	46.55	46.55		2.34	1.64	
1,2,3,7,8-PeCDD	59.04	241177	230816	0.50		0.52	0.88		
13C-1,2,3,7,8-PeCDD	59.03	64458500	43933500	41.79	41.79		2.22	1.47	C
1,2,3,4,7,8-HxCDF	63.04	380298	271086	0.99		1.03	1.23	1.40	
1,2,3,6,7,8-HxCDF	ND						1.14		
2,3,4,6,7,8-HxCDF	63.59	912528	705192	3.64		3.81	1.12	1.29	
1,2,3,7,8,9-HxCDF	64.51	248152	191621	1.24		1.30	1.25	1.30	
13C-1,2,3,4,7,8-HxCDF	63.02	18933000	34741300	171.25	171.25		1.09	0.54	
13C-1,2,3,6,7,8-HxCDF	63.10	17396000	32538900	153.59	153.59		1.13	0.53	S
13C-2,3,4,6,7,8-HxCDF	63.59	14215000	25421700	129.26	129.26		1.07	0.56	
13C-1,2,3,7,8,9-HxCDF	64.50	9758050	18425400	109.29	109.29		0.90	0.53	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.13	17129800	13937500	114.25	114.25		0.95	1.23	
13C-1,2,3,6,7,8-HxCDD	64.20	18030300	14076800	117.85	117.85		0.95	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	64.41	16070000	12640500					1.27	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.51	3919130	9042560	76.80	76.80		0.59	0.43	
13C-1,2,3,4,7,8,9-HpCDF	68.22	12835300	28467900	299.36	299.36		0.48	0.45	S
1,2,3,4,6,7,8-HpCDD	68.00	381150	385027	1.58		1.65	0.97	0.99	
13C-1,2,3,4,6,7,8-HpCDD	67.59	26103800	24121400	283.49	283.49		0.62	1.08	S
OCDD	71.30	1179680	1325580	4.69		4.91	1.19	0.89	
13C-OCDD	71.30	41388800	48715800	516.91	258.45		0.61	0.85	S
OCDF	ND						1.16		

TABLE B.5 continued

o. Sample 101-S

Deployment 4, Downstream   010331 Run   SAMPLE 7   Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.11	6318330	8262270	5.15		5.39	0.96	0.76	
13C-2,3,7,8-TCDF	42.08	130726000	163546000	96.20	96.20		1.34	0.80	
IS-13C-1,2,3,4-TCDD	43.59	102562000	125856000					0.81	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	44.48	112567000	143416000	110.35	110.35		1.02	0.78	
37Cl-TCDD	44.52	99708400		38.68	77.36		2.51		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.09	1154380	850253	0.88		0.92	1.00	1.36	
13C-1,2,3,7,8-PeCDF	56.21	164647000	99389200	62.16	62.16		1.86	1.66	
13C-2,3,4,7,8-PeCDF	58.07	140541000	87074400	42.67	42.67		2.34	1.61	
1,2,3,7,8-PeCDD	ND						0.88		
13C-1,2,3,7,8-PeCDD	58.55	120894000	95269800	42.61	42.61		2.22	1.27	C
1,2,3,4,7,8-HxCDF	62.57	170494	151343	0.23		0.24	1.23	1.13	
1,2,3,6,7,8-HxCDF	ND						1.14		
2,3,4,6,7,8-HxCDF	63.53	459244	332455	0.88		0.92	1.12	1.38	
1,2,3,7,8,9-HxCDF	64.43	137278	114236	0.37		0.38	1.25	1.20	
13C-1,2,3,4,7,8-HxCDF	62.56	41062200	72372800	180.05	180.05		1.09	0.57	S
13C-1,2,3,6,7,8-HxCDF	63.04	25346000	50518300	116.09	116.09		1.13	0.50	
13C-2,3,4,6,7,8-HxCDF	63.52	27802800	52645300	130.52	130.52		1.07	0.53	
13C-1,2,3,7,8,9-HxCDF	64.44	19143800	35775600	105.95	105.95		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.07	38526800	30670900	126.60	126.60		0.95	1.26	
13C-1,2,3,6,7,8-HxCDD	64.13	27971500	21599500	90.52	90.52		0.95	1.30	
IS-13C-1,2,3,7,8,9-HxCDD	64.34	31958500	25753100					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.46	7782160	16647700	72.01	72.01		0.59	0.47	
13C-1,2,3,4,7,8,9-HpCDF	68.16	17344100	38907700	202.82	202.82		0.48	0.45	S
1,2,3,4,6,7,8-HpCDD	ND						0.97		
13C-1,2,3,4,6,7,8-HpCDD	67.54	11921200	10757000	63.68	63.68		0.62	1.11	
OCDD	71.22	2069170	2301930	4.83		5.05	1.19	0.90	
13C-OCDD	71.22	71430700	81339100	436.00	218.00		0.61	0.88	S
OCDF	ND						1.16		

TABLE B.5 continued

p. Sample 104-S

Deployment 4, Downstream 010331 Run SAMPLE 8 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.07	6832240	9212710	5.46		5.71	0.96	0.74	
13C-2,3,7,8-TCDF	42.02	136074000	169554000	90.49	90.49		1.34	0.80	
IS-13C-1,2,3,4-TCDD	43.54	113237000	138966000					0.81	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	44.42	122435000	155061000	108.35	108.35		1.02	0.79	
37Cl-TCDD	44.45	103965000		36.53	73.05		2.51		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.07	1178910	858026	0.88		0.92	1.00	1.37	
13C-1,2,3,7,8-PeCDF	56.20	171264000	106162000	59.15	59.15		1.86	1.61	
13C-2,3,4,7,8-PeCDF	58.06	143287000	87040500	39.10	39.10		2.34	1.65	
1,2,3,7,8-PeCDD	ND						0.88		
13C-1,2,3,7,8-PeCDD	58.54	130600000	95576000	40.38	40.38		2.22	1.37	C
1,2,3,4,7,8-HxCDF	ND						1.23		DPE
1,2,3,6,7,8-HxCDF	ND						1.14		
2,3,4,6,7,8-HxCDF	63.53	288017	225064	0.61		0.64	1.12	1.28	
1,2,3,7,8,9-HxCDF	ND						1.25		
13C-1,2,3,4,7,8-HxCDF	62.56	38005900	70327200	187.48	187.48		1.09	0.54	S
13C-1,2,3,6,7,8-HxCDF	63.04	24414000	44382000	114.77	114.77		1.13	0.55	
13C-2,3,4,6,7,8-HxCDF	63.53	26899700	48575700	133.51	133.51		1.07	0.55	
13C-1,2,3,7,8,9-HxCDF	64.44	17904400	32962300	106.99	106.99		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.08	36031500	29274000	130.27	130.27		0.95	1.23	
13C-1,2,3,6,7,8-HxCDD	64.14	31009200	24928400	111.37	111.37		0.95	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	64.35	29299800	23632200					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.49	24133200	53541800	249.65	249.65		0.59	0.45	S
13C-1,2,3,4,7,8,9-HpCDF	68.21	23086000	52481500	297.07	297.07		0.48	0.44	S
1,2,3,4,6,7,8-HpCDD	ND						0.97		
13C-1,2,3,4,6,7,8-HpCDD	67.58	51264500	47376700	301.99	301.99		0.62	1.08	S
OCDD	71.28	1124940	1128030	2.56		2.68	1.19	1.00	
13C-OCDD	71.27	69153600	79481900	462.50	231.25		0.61	0.87	S
OCDF	ND						1.16		

TABLE B.5 continued

q. Sample 105-S

Deployment 4, Downstream 010331 Run SAMPLE 9 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.12	8287950	10681400	5.22		5.46	0.96	0.78	
13C-2,3,7,8-TCDF	42.06	170956000	207181000	88.05	88.05		1.34	0.83	
IS-13C-1,2,3,4-TCDD	43.58	144022000	176644000					0.82	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	44.46	147741000	185660000	102.38	102.38		1.02	0.80	
37Cl-TCDD	44.50	133568000		36.90	73.79		2.51		
1,2,3,7,8-PeCDF	56.24	889815	562758	0.46		0.48	0.94	1.58	
2,3,4,7,8-PeCDF	58.11	1411610	922607	0.76		0.79	1.00	1.53	
13C-1,2,3,7,8-PeCDF	56.22	212194000	127705000	57.00	57.00		1.86	1.66	
13C-2,3,4,7,8-PeCDF	58.08	190706000	116985000	41.08	41.08		2.34	1.63	
1,2,3,7,8-PeCDD	ND						0.88		
13C-1,2,3,7,8-PeCDD	58.56	153733000	108679000	36.84	36.84		2.22	1.41	C
1,2,3,4,7,8-HxCDF	62.59	459616	362121	0.53		0.55	1.23	1.27	
1,2,3,6,7,8-HxCDF	63.08	279095	228235	0.42		0.44	1.14	1.22	
2,3,4,6,7,8-HxCDF	63.55	581190	502261	1.00		1.05	1.12	1.16	
1,2,3,7,8,9-HxCDF	64.48	360215	319590	0.82		0.86	1.25	1.13	
13C-1,2,3,4,7,8-HxCDF	62.58	44116200	82870600	173.58	173.58		1.09	0.53	S
13C-1,2,3,6,7,8-HxCDF	63.06	36488100	68173200	137.92	137.92		1.13	0.54	
13C-2,3,4,6,7,8-HxCDF	63.55	33798400	62689500	134.81	134.81		1.07	0.54	
13C-1,2,3,7,8,9-HxCDF	64.47	22795500	43066000	109.42	109.42		0.90	0.53	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.10	41349600	33469400	117.88	117.88		0.95	1.24	
13C-1,2,3,6,7,8-HxCDD	64.16	39440400	31382000	111.37	111.37		0.95	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	64.37	37097200	29917600					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.50	30578700	69045700	252.91	252.91		0.59	0.44	S
13C-1,2,3,4,7,8,9-HpCDF	68.22	26065200	57698400	260.09	260.09		0.48	0.45	S
1,2,3,4,6,7,8-HpCDD	68.00	577813	515012	0.95		0.99	0.97	1.12	
13C-1,2,3,4,6,7,8-HpCDD	67.59	62075000	57020800	287.99	287.99		0.62	1.09	S
OCDD	71.30	1365330	1548160	2.51		2.63	1.19	0.88	
13C-OCDD	71.29	90600000	105129000	481.05	240.53		0.61	0.86	S
OCDF	ND						1.16		

TABLE B.5 continued

r. Sample 106-S

Deployment 4, Downstream 010331 Run SAMPLE 10 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.10	10305000	13250900	5.69		5.95	0.96	0.78	
13C-2,3,7,8-TCDF	42.05	190985000	239792000	82.05	82.05		1.34	0.80	
IS-13C-1,2,3,4-TCDD	43.57	176612000	215386000					0.82	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	44.45	168188000	209571000	94.89	94.89		1.02	0.80	
37Cl-TCDD	44.49	140118000		31.56	63.13		2.51		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.10	1547350	1046930	0.77		0.81	1.00	1.48	
13C-1,2,3,7,8-PeCDF	56.22	239079000	146928000	52.95	52.95		1.86	1.63	
13C-2,3,4,7,8-PeCDF	58.07	209274000	126227000	36.65	36.65		2.34	1.66	
1,2,3,7,8-PeCDD	ND						0.88		
13C-1,2,3,7,8-PeCDD	58.55	171192000	123597000	33.86	33.86		2.22	1.39	C
1,2,3,4,7,8-HxCDF	62.59	412079	318490	0.44		0.46	1.23	1.29	
1,2,3,6,7,8-HxCDF	ND						1.14		
2,3,4,6,7,8-HxCDF	63.54	701720	553443	1.04		1.09	1.12	1.27	
1,2,3,7,8,9-HxCDF	ND						1.25		
13C-1,2,3,4,7,8-HxCDF	62.58	46742100	88475300	154.30	154.30		1.09	0.53	S
13C-1,2,3,6,7,8-HxCDF	63.06	39253400	72203600	122.61	122.61		1.13	0.54	
13C-2,3,4,6,7,8-HxCDF	63.54	37851200	69664500	125.40	125.40		1.07	0.54	
13C-1,2,3,7,8,9-HxCDF	64.46	25309800	47110200	100.44	100.44		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.09	43967900	37299400	106.89	106.89		0.95	1.18	
13C-1,2,3,6,7,8-HxCDD	64.15	42628400	33394800	99.80	99.80		0.95	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	64.36	44804000	35471400					1.26	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.49	33412900	73969200	227.57	227.57		0.59	0.45	S
13C-1,2,3,4,7,8,9-HpCDF	68.21	31998700	69912000	264.17	264.17		0.48	0.46	S
1,2,3,4,6,7,8-HpCDD	67.59	730409	690750	1.19		1.24	0.97	1.06	
13C-1,2,3,4,6,7,8-HpCDD	67.58	63865300	59829900	249.71	249.71		0.62	1.07	S
OCDD	71.29	1893080	2003740	3.31		3.46	1.19	0.94	
13C-OCDD	71.27	91814000	106843000	407.60	203.80		0.61	0.86	S
OCDF	71.35	645094	773252	1.23		1.28	1.16	0.83	

TABLE B.5 continued

s. Sample 107-S

Deployment 4, Downstream 010331 Run SAMPLE11 Deployed SPMD

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.33	26701400	33687700	5.92		6.19	0.96	0.79	
13C-2,3,7,8-TCDF	42.29	472576000	587777000	72.57	72.57		1.34	0.80	
IS-13C-1,2,3,4-TCDD	44.21	483224000	607761000					0.80	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	45.10	424329000	538684000	86.92	86.92		1.02	0.79	
37Cl-TCDD	45.14	344032000		28.32	56.65		2.51		
1,2,3,7,8-PeCDF	56.39	1706940	1275560	0.39		0.41	0.94	1.34	
2,3,4,7,8-PeCDF	58.22	3006750	2059540	0.76		0.79	1.00	1.46	
13C-1,2,3,7,8-PeCDF	56.37	509753000	310596000	40.43	40.43		1.86	1.64	
13C-2,3,4,7,8-PeCDF	58.20	413127000	251424000	26.08	26.08		2.34	1.64	
1,2,3,7,8-PeCDD	ND						0.88		
13C-1,2,3,7,8-PeCDD	59.08	308641000	234878000	22.43	22.43		2.22	1.31	S,C
1,2,3,4,7,8-HxCDF	63.07	732047	608602	0.34		0.36	1.23	1.20	
1,2,3,6,7,8-HxCDF	63.16	163610	154269	0.14		0.14	1.14	1.06	
2,3,4,6,7,8-HxCDF	64.00	750819	693642	0.54		0.56	1.12	1.08	
1,2,3,7,8,9-HxCDF	64.53	456848	373054	0.44		0.46	1.25	1.22	
13C-1,2,3,4,7,8-HxCDF	63.05	111533000	207360000	136.85	136.85		1.09	0.54	
13C-1,2,3,6,7,8-HxCDF	63.14	70844300	130452000	83.28	83.28		1.13	0.54	
13C-2,3,4,6,7,8-HxCDF	64.01	84890300	155451000	105.42	105.42		1.07	0.55	
13C-1,2,3,7,8,9-HxCDF	64.54	52448100	98744700	78.86	78.86		0.90	0.53	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	64.16	102074000	80758200	90.44	90.44		0.95	1.26	
13C-1,2,3,6,7,8-HxCDD	64.23	98321300	79536100	87.81	87.81		0.95	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	64.42	117234000	96226500					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.55	62930100	143136000	164.23	164.23		0.59	0.44	S
13C-1,2,3,4,7,8,9-HpCDF	68.27	63285800	142992000	201.09	201.09		0.48	0.44	S
1,2,3,4,6,7,8-HpCDD	68.06	744756	744993	0.62		0.65	0.97	1.00	
13C-1,2,3,4,6,7,8-HpCDD	68.04	128448000	120308000	188.85	188.85		0.62	1.07	S
OCDD	71.35	4044780	4082900	3.21		3.36	1.19	0.99	
13C-OCDD	71.34	199774000	227558000	329.73	164.86		0.61	0.88	S
OCDF	71.43	1415780	1548050	1.19		1.25	1.16	0.91	

TABLE B.5 continued

t. Sample 108-S

Deployment 4, Downstream	010401 Run	SAMPLE 6	Deployed SPMD						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.26	20855400	26033000	5.13		5.36	0.93	0.80	
13C-2,3,7,8-TCDF	42.22	435961000	546754000	90.35	90.35		1.40	0.80	
IS-13C-1,2,3,4-TCDD	44.14	338351000	439805000					0.77	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	45.05	333646000	440556000	96.78	96.78		1.03	0.76	
37Cl-TCDD	45.07	274817000		34.52	69.05		2.35		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.18	2753560	1892220	0.68		0.71	1.00	1.46	
13C-1,2,3,7,8-PeCDF	56.33	509467000	318909000	71.66	71.66		1.49	1.60	
13C-2,3,4,7,8-PeCDF	58.17	419531000	260887000	60.28	60.28		1.45	1.61	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	59.04	306156000	220002000	59.48	59.48		1.14	1.39	C
1,2,3,4,7,8-HxCDF	63.05	408783	357903	0.26		0.27	1.27	1.14	
1,2,3,6,7,8-HxCDF	63.13	241999	176297	0.18		0.19	1.25	1.37	
2,3,4,6,7,8-HxCDF	63.59	485929	429738	0.42		0.44	1.18	1.13	
1,2,3,7,8,9-HxCDF	64.53	351250	323204	0.42		0.44	1.31	1.09	
13C-1,2,3,4,7,8-HxCDF	63.03	80796200	150818000	73.03	73.03		2.03	0.54	
13C-1,2,3,6,7,8-HxCDF	63.12	63806200	117910000	61.69	61.69		1.89	0.54	
13C-2,3,4,6,7,8-HxCDF	63.59	65364500	119517000	73.22	73.22		1.62	0.55	
13C-1,2,3,7,8,9-HxCDF	64.52	42131300	80451000	87.27	87.27		0.90	0.52	
1,2,3,4,7,8-HxCDD	ND						1.13		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.00		
13C-1,2,3,4,7,8-HxCDD	64.14	78562400	62455700	75.76	75.76		1.19	1.26	
13C-1,2,3,6,7,8-HxCDD	64.22	78835100	65477900	78.70	78.70		1.18	1.20	
IS-13C-1,2,3,7,8,9-HxCDD	64.41	86163800	69867300					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	66.55	62743700	138887000	313.59	313.59		0.41	0.45	S
13C-1,2,3,4,7,8,9-HpCDF	68.27	61989000	138665000	69.97	69.97		1.84	0.45	
1,2,3,4,6,7,8-HpCDD	68.05	543452	606877	0.49		0.51	0.92	0.90	
13C-1,2,3,4,6,7,8-HpCDD	68.04	130639000	124572000	69.39	69.39		2.36	1.05	
OCDD	71.36	1633330	1678110	1.56		1.64	0.97	0.97	
13C-OCDD	71.35	205479000	233296000	108.81	54.40		2.58	0.88	
OCDF	ND						1.06		

Appendix C

SPMD QUALITY CONTROL SAMPLE INFORMATION AND RAW DATA SPREADSHEETS FROM THE 2000 FIELD SEASON

ND Peak was not detected

Data Flag Information Key:

B Positive peak identification for a blank

C Co-eluting peak present

DPE Diphenyl ether interference with the dioxin peak

S Percent surrogate recoveries were either above or below the established limits set by the EPA in method 1613-B (Telliard 1994)

APPENDIX C.1. SPMD Quality Control Sample Information Log, 2000

Method Detection Limit (MDL) Study One

Sample ID#	Descriptor	SPMDs per sample	# replicates
11-S	Dialysis Blank	1	7
12-S	"	1	
13-S	"	1	
14-S	"	1	
15-S	"	1	
16-S	"	1	
17-S	"	1	

Deployment One: Androscoggin River at Dixfield, ME Site 10

Retrieval 1 Samples: 6/2/00 to 6/9/00 10-A Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
18-S	Field Blank 10-A	1	1
24-S	Process Blank	0	1
Retrieval 2 Samples: 6/2/00 to 6/16/00 10-B Site			
25-S	Field Blank 10-B	1	1
26-S	Dialysis Blank	1	1
32-S	Process Blank	0	1
Retrieval 3 Samples: 6/2/00 to 6/23/00 10-A Site			
33-S	Field Blank 10-A	1	1
39-S	Process Blank	0	1
Retrieval 4 Samples: 6/2/00 to 6/30/00 10-B Site			
40-S	Field Blank 10-B	1	1
41-S	Matrix Spike	1	1
47-S	Process Blank	0	1

Deployment Two: Androscoggin River at Dixfield, ME Site 10

Retrieval 1 Samples: 7/7/00 to 7/14/00 10-A Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
48-S	Field Blank 10-A	1	1
50-S	Process Blank	0	1
Retrieval 2 Samples: 6/30/00 to 7/14/00 10-B Site			
51-S	Field Blank 10-B	1	1
Retrieval 3 Samples: 7/7/00 to 7/28/00 10-A Site			
54-S	Dialysis Blank	1	1
55-S	Field Blank 10-A	1	1
57-S	Process Blank	0	1

Deployment Two Androscoggin River at Dixfield, ME Site 10 (cont.)

Retrieval 4 Samples: 6/30/00 to 7/28/00 10-B Site

Sample ID#	Descriptor	SPMDs per Sample	# replicates
58-S	Field Blank 10-B	1	1
59-S	Matrix Spike	1	1
65-S	Process Blank	0	1

Deployment Three: Upstream-Downstream on the Kennebec River

Upstream Site 11 in Norridgewock, ME: 8/3/00 to 9/26/00

Sample ID#	Descriptor	SPMDs per Sample	# replicates
66-S	Field Blank	1	1
67-S	Dialysis Blank	1	1
73-S	Process Blank	0	1
Downstream Site 12 in Fairfield, ME: 8/3/00 to 9/26/00			
74-S	Field Blank 12	1	1
75-S	Matrix Spike	1	1
81-S	Process Blank	0	1

Deployment Four: Upstream-Downstream on the Androscoggin River

Upstream Site 13 in Rumford, ME: 9/19/00 to 10/17/00

Sample ID#	Descriptor	SPMDs per Sample	# replicates
82-S	Field Blank 13	2	1
88-S	Process Blank	0	1
89-S	Dialysis Blank	2	1
95-S	Process Blank	0	1
Downstream Site 10 in Dixfield, ME: 9/19/00 to 10/17/00			
96-S	Field Blank 10	2	1
102-S	Process Blank	0	1
103-S	Matrix Spike	2	1
109-S	Process Blank	0	1

Method Detection Limit (MDL) Study Two

Sample ID#	Descriptor	SPMDs per Sample	# replicates
110-S	MDL sample	2	7
111-S	spiked with PAR	2	
112-S	"	2	
113-S	"	2	
114-S	"	2	
115-S	"	2	
116-S	"	2	

TABLE C.2. SPMD Raw Data Calculation Spreadsheets for Method Detection Limit Study One Samples

a. Sample 11-S

MDL Experiment 000818 run SAMPLE 3

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.26	18938.9	26746.2	1.12		2.34	0.95	0.71	
13C-2,3,7,8-TCDF	44.20	1787020	2530690	28.69	28.69		1.39	0.71	
IS-13C-1,2,3,4-TCDD	46.19	4745800	6086530					0.78	
2,3,7,8-TCDD	47.16	20701.9	25165.3	0.94		1.97	1.10	0.82	
13C-2,3,7,8-TCDD	47.10	1979550	2426190	42.32	42.32		0.96	0.82	
37Cl-TCDD	47.13	5173660		45.68	91.36		2.39		
1,2,3,7,8-PeCDF	57.38	203114	164639	5.46		11.42	0.92	1.23	
2,3,4,7,8-PeCDF	59.13	187479	128095	5.02		10.51	0.98	1.46	
13C-1,2,3,7,8-PeCDF	57.34	4397000	2942210	40.96	40.96		1.65	1.49	
13C-2,3,4,7,8-PeCDF	59.11	3874650	2524180	31.07	31.07		1.90	1.54	
1,2,3,7,8-PeCDD	59.55	189441	168046	5.23		10.94	1.06	1.13	
13C-1,2,3,7,8-PeCDD	59.52	3498190	2982570	40.64	40.64		1.47	1.17	
1,2,3,4,7,8-HxCDF	63.44	300703	241827	5.02		10.51	1.23	1.24	
1,2,3,6,7,8-HxCDF	63.52	305275	259918	5.17		10.81	1.22	1.17	
2,3,4,6,7,8-HxCDF	64.40	281378	232691	5.33		11.16	1.13	1.21	
1,2,3,7,8,9-HxCDF	65.31	230824	194689	4.98		10.42	1.15	1.19	
13C-1,2,3,4,7,8-HxCDF	63.43	2865890	5931710	56.43	56.43		1.36	0.48	
13C-1,2,3,6,7,8-HxCDF	63.51	3121440	5861730	55.94	55.94		1.40	0.53	
13C-2,3,4,6,7,8-HxCDF	64.39	2860950	5659290	61.35	61.35		1.21	0.51	
13C-1,2,3,7,8,9-HxCDF	65.30	2399630	5033020	70.85	70.85		0.92	0.48	
1,2,3,4,7,8-HxCDD	64.52	164963	129788	4.19		8.77	1.09	1.27	
1,2,3,6,7,8-HxCDD	64.58	179099	156296	5.29		11.07	0.95	1.15	
1,2,3,7,8,9-HxCDD	65.20	232310	166972	6.18		12.92	0.99	1.39	
13C-1,2,3,4,7,8-HxCDD	64.51	3573530	2874270	54.99	54.99		1.02	1.24	
13C-1,2,3,6,7,8-HxCDD	64.58	3638820	3000160	55.23	55.23		1.05	1.21	
IS-13C-1,2,3,7,8,9-HxCDD	65.19	6411370	5033710					1.27	
1,2,3,4,6,7,8-HpCDF	67.31	430740	408506	4.86		10.17	1.51	1.05	
1,2,3,4,7,8,9-HpCDF	69.05	275984	286196	4.71		9.85	1.44	0.96	
13C-1,2,3,4,6,7,8-HpCDF	67.30	3473130	7965220	123.89	123.89		0.81	0.44	
13C-1,2,3,4,7,8,9-HpCDF	69.04	2506350	5758450	119.02	119.02		0.61	0.44	
1,2,3,4,6,7,8-HpCDD	68.40	240096	206717	5.07		10.61	0.97	1.16	
13C-1,2,3,4,6,7,8-HpCDD	68.40	4631950	4486230	102.84	102.84		0.77	1.03	
OCDD	72.22	289916	312667	10.34		21.63	1.05	0.93	
13C-OCDD	72.22	5308620	5823760	180.55	90.28		0.54	0.91	
OCDF	72.30	407247	436352	13.15		27.51	1.15	0.93	

TABLE C.2 continued
b. Sample 12-S

MDL Experiment	000818 run	SAMPLE 4							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.32	23399.8	32304	1.12		2.35	0.95	0.72	
13C-2,3,7,8-TCDF	44.28	2258610	2988570	28.38	28.38		1.39	0.76	
IS-13C-1,2,3,4-TCDD	46.25	6056470	7254640					0.83	
2,3,7,8-TCDD	47.17	35967.3	50983.8	1.43		2.99	1.10	0.71	
13C-2,3,7,8-TCDD	47.16	2571860	2932160	43.02	43.02		0.96	0.88	
37Cl-TCDD	47.21	7690950		53.21	106.42		2.39		
1,2,3,7,8-PeCDF	57.39	222843	138191	4.40		9.21	0.92	1.61	
2,3,4,7,8-PeCDF	59.16	218040	139579	4.53		9.47	0.98	1.56	
13C-1,2,3,7,8-PeCDF	57.38	5458620	3479310	40.59	40.59		1.65	1.57	
13C-2,3,4,7,8-PeCDF	59.14	4756860	3290320	31.80	31.80		1.90	1.45	
1,2,3,7,8-PeCDD	59.57	284482	163589	4.65		9.72	1.06	1.74	
13C-1,2,3,7,8-PeCDD	59.56	4995850	4140970	46.63	46.63		1.47	1.21	
1,2,3,4,7,8-HxCDF	63.46	486612	400109	4.82		10.08	1.23	1.22	
1,2,3,6,7,8-HxCDF	63.55	410893	324033	4.75		9.94	1.22	1.27	
2,3,4,6,7,8-HxCDF	64.41	440622	325499	5.35		11.19	1.13	1.35	
1,2,3,7,8,9-HxCDF	65.33	375126	301060	5.05		10.56	1.15	1.25	
13C-1,2,3,4,7,8-HxCDF	63.45	4992970	9995320	65.22	65.22		1.36	0.50	
13C-1,2,3,6,7,8-HxCDF	63.53	4309010	8402090	53.69	53.69		1.40	0.51	
13C-2,3,4,6,7,8-HxCDF	64.41	4263290	8396850	61.84	61.84		1.21	0.51	
13C-1,2,3,7,8,9-HxCDF	65.32	3918040	7741520	75.39	75.39		0.92	0.51	
1,2,3,4,7,8-HxCDD	64.55	278430	211943	4.95		10.35	1.09	1.31	
1,2,3,6,7,8-HxCDD	65.01	270168	230515	5.02		10.50	0.95	1.17	
1,2,3,7,8,9-HxCDD	65.23	355418	263082	6.41		13.40	0.99	1.35	
13C-1,2,3,4,7,8-HxCDD	64.54	5022210	4068140	52.59	52.59		1.02	1.23	
13C-1,2,3,6,7,8-HxCDD	65.00	5894480	4556510	58.98	58.98		1.05	1.29	
IS-13C-1,2,3,7,8,9-HxCDD	65.21	9365850	7505860					1.25	
1,2,3,4,6,7,8-HpCDF	67.32	443092	472331	4.66		9.75	1.51	0.94	
1,2,3,4,7,8,9-HpCDF	69.08	341512	355086	4.96		10.38	1.44	0.96	
13C-1,2,3,4,6,7,8-HpCDF	67.31	3965150	9057200	95.68	95.68		0.81	0.44	
13C-1,2,3,4,7,8,9-HpCDF	69.06	3000550	6716970	94.93	94.93		0.61	0.45	
1,2,3,4,6,7,8-HpCDD	68.43	381703	317993	4.68		9.80	0.97	1.20	
13C-1,2,3,4,6,7,8-HpCDD	68.41	8017280	7443810	118.29	118.29		0.77	1.08	
OCDD	72.24	103680	101518	11.94		24.98	1.05	1.02	
13C-OCDD	72.23	1542330	1740190	36.11	18.06		0.54	0.89	
OCDF	72.31	90968.5	91070.6	9.62		20.13	1.15	1.00	

TABLE C.2 continued

c. Sample 13-S

MDL Experiment 000818 run SAMPLE 5

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.24	8500.06	12710.5	0.85		1.78	0.95	0.67	
13C-2,3,7,8-TCDF	44.26	1093660	1536670	24.75	24.75		1.39	0.71	S
IS-13C-1,2,3,4-TCDD	46.25	3397330	4253510					0.80	
2,3,7,8-TCDD	47.20	9073.58	13387.7	0.71		1.48	1.10	0.68	
13C-2,3,7,8-TCDD	47.17	1206610	1673390	39.17	39.17		0.96	0.72	
37Cl-TCDD	47.21	4567200		56.33	112.66		2.39		
1,2,3,7,8-PeCDF	57.40	102233	77027.4	3.98		8.32	0.92	1.33	
2,3,4,7,8-PeCDF	59.15	124066	76802.2	4.79		10.03	0.98	1.62	
13C-1,2,3,7,8-PeCDF	57.37	3036730	1873500	38.80	38.80		1.65	1.62	
13C-2,3,4,7,8-PeCDF	59.14	2546080	1722110	29.34	29.34		1.90	1.48	
1,2,3,7,8-PeCDD	59.57	141994	110004	4.91		10.28	1.06	1.29	
13C-1,2,3,7,8-PeCDD	59.56	2707090	2152490	43.15	43.15		1.47	1.26	
1,2,3,4,7,8-HxCDF	63.46	223984	175064	5.22		10.93	1.23	1.28	
1,2,3,6,7,8-HxCDF	63.54	193727	173697	4.79		10.01	1.22	1.12	
2,3,4,6,7,8-HxCDF	64.42	196125	173506	4.75		9.94	1.13	1.13	
1,2,3,7,8,9-HxCDF	65.33	173202	145464	5.21		10.91	1.15	1.19	
13C-1,2,3,4,7,8-HxCDF	63.45	2150330	4072600	57.30	57.30		1.36	0.53	
13C-1,2,3,6,7,8-HxCDF	63.53	2159130	4145180	56.35	56.35		1.40	0.52	
13C-2,3,4,6,7,8-HxCDF	64.41	2379090	4499380	71.09	71.09		1.21	0.53	
13C-1,2,3,7,8,9-HxCDF	65.31	1793330	3526520	72.79	72.79		0.92	0.51	
1,2,3,4,7,8-HxCDD	64.54	125685	111964	5.42		11.34	1.09	1.12	
1,2,3,6,7,8-HxCDD	65.00	133934	132799	5.35		11.20	0.95	1.01	
1,2,3,7,8,9-HxCDD	65.22	153560	156021	6.78		14.19	0.99	0.98	
13C-1,2,3,4,7,8-HxCDD	64.53	2202930	1818010	49.22	49.22		1.02	1.21	
13C-1,2,3,6,7,8-HxCDD	64.59	2851200	2369060	62.34	62.34		1.05	1.20	
IS-13C-1,2,3,7,8,9-HxCDD	65.21	4381740	3591610					1.22	
1,2,3,4,6,7,8-HpCDF	67.32	305479	301194	5.02		10.51	1.51	1.01	
1,2,3,4,7,8,9-HpCDF	69.07	217698	206220	4.47		9.36	1.44	1.06	
13C-1,2,3,4,6,7,8-HpCDF	67.31	2475140	5525460	124.39	124.39		0.81	0.45	
13C-1,2,3,4,7,8,9-HpCDF	69.06	1938130	4624590	135.66	135.66		0.61	0.42	
1,2,3,4,6,7,8-HpCDD	68.42	164553	151112	4.63		9.69	0.97	1.09	
13C-1,2,3,4,6,7,8-HpCDD	68.41	3713160	3339620	114.18	114.18		0.77	1.11	
OCDD	72.24	53025.5	71666.6	11.32		23.69	1.05	0.74	
13C-OCDD	72.23	996784	1106470	48.96	24.48		0.54	0.90	
OCDF	72.31	47623.6	60106.8	8.89		18.59	1.15	0.79	

TABLE C.2 continued

d. Sample 14-S

MDL Experiment	000818 run	SAMPLE 6							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.26	19524.5	26642.4	0.99		2.06	0.95	0.73	
13C-2,3,7,8-TCDF	44.24	2146330	2805200	24.59	24.59		1.39	0.77	S
IS-13C-1,2,3,4-TCDD	46.23	6517790	7975350					0.82	
2,3,7,8-TCDD	47.17	31530.8	49545.2	1.34		2.81	1.10	0.64	
13C-2,3,7,8-TCDD	47.14	2381980	3088720	39.28	39.28		0.96	0.77	
37Cl-TCDD	47.19	7017970		45.12	90.23		2.39		
1,2,3,7,8-PeCDF	57.38	209964	156364	4.45		9.30	0.92	1.34	
2,3,4,7,8-PeCDF	59.14	207818	131109	4.12		8.63	0.98	1.59	
13C-1,2,3,7,8-PeCDF	57.37	5335930	3640750	37.44	37.44		1.65	1.47	
13C-2,3,4,7,8-PeCDF	59.13	5004390	3371560	30.40	30.40		1.90	1.48	
1,2,3,7,8-PeCDD	59.58	247718	147027	4.22		8.84	1.06	1.68	
13C-1,2,3,7,8-PeCDD	59.55	4771760	4083480	41.50	41.50		1.47	1.17	
1,2,3,4,7,8-HxCDF	63.46	536859	427729	4.65		9.72	1.23	1.26	
1,2,3,6,7,8-HxCDF	63.54	493497	381199	4.55		9.52	1.22	1.29	
2,3,4,6,7,8-HxCDF	64.41	538481	445031	4.57		9.56	1.13	1.21	
1,2,3,7,8,9-HxCDF	65.32	331380	279362	5.05		10.58	1.15	1.19	
13C-1,2,3,4,7,8-HxCDF	63.44	5567640	11339700	78.09	78.09		1.36	0.49	
13C-1,2,3,6,7,8-HxCDF	63.52	5282930	10504700	70.79	70.79		1.40	0.50	
13C-2,3,4,6,7,8-HxCDF	64.40	6310930	12716500	98.65	98.65		1.21	0.50	
13C-1,2,3,7,8,9-HxCDF	65.31	3483680	7029670	72.16	72.16		0.92	0.50	
1,2,3,4,7,8-HxCDD	64.54	323472	262501	5.11		10.70	1.09	1.23	
1,2,3,6,7,8-HxCDD	65.00	291230	237240	4.94		10.33	0.95	1.23	
1,2,3,7,8,9-HxCDD	65.22	253421	265040	4.83		10.11	0.99	0.96	
13C-1,2,3,4,7,8-HxCDD	64.53	5837600	4672790	64.54	64.54		1.02	1.25	
13C-1,2,3,6,7,8-HxCDD	64.58	6405970	4808980	67.19	67.19		1.05	1.33	
IS-13C-1,2,3,7,8,9-HxCDD	65.20	8744370	7149700					1.22	
1,2,3,4,6,7,8-HpCDF	67.32	538207	551065	4.73		9.89	1.51	0.98	
1,2,3,4,7,8,9-HpCDF	69.07	421925	364788	4.51		9.44	1.44	1.16	
13C-1,2,3,4,6,7,8-HpCDF	67.31	4659170	10605600	119.06	119.06		0.81	0.44	
13C-1,2,3,4,7,8,9-HpCDF	69.05	3573480	8498380	125.18	125.18		0.61	0.42	
1,2,3,4,6,7,8-HpCDD	68.42	346920	323997	4.78		9.99	0.97	1.07	
13C-1,2,3,4,6,7,8-HpCDD	68.41	7475580	7062760	118.07	118.07		0.77	1.06	
OCDD	72.24	131358	129985	11.22		23.49	1.05	1.01	
13C-OCDD	72.22	2066310	2379590	51.92	25.96		0.54	0.87	
OCDF	72.30	77920.3	111103	7.38		15.43	1.15	0.70	

TABLE C.2 continued

e. Sample 15-S

MDL Experiment 000818 run SAMPLE 7

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.38	32326.5	46867.3	0.92		1.93	0.95	0.69	
13C-2,3,7,8-TCDF	44.33	3908330	5189140	23.25	23.25		1.39	0.75	S
IS-13C-1,2,3,4-TCDD	46.32	12487900	15674400					0.80	
2,3,7,8-TCDD	47.28	42829	50972.4	0.85		1.78	1.10	0.84	
13C-2,3,7,8-TCDD	47.24	4646110	5328850	36.85	36.85		0.96	0.87	
37Cl-TCDD	47.28	12531200		42.05	84.09		2.39		
1,2,3,7,8-PeCDF	57.43	428051	253446	3.97		8.32	0.92	1.69	
2,3,4,7,8-PeCDF	59.18	347720	250512	3.73		7.81	0.98	1.39	
13C-1,2,3,7,8-PeCDF	57.41	11550400	7126090	40.09	40.09		1.65	1.62	
13C-2,3,4,7,8-PeCDF	59.16	9929290	6399160	30.49	30.49		1.90	1.55	
1,2,3,7,8-PeCDD	60.01	578837	461030	4.78		10.00	1.06	1.26	
13C-1,2,3,7,8-PeCDD	59.58	11494700	9124170	49.73	49.73		1.47	1.26	
1,2,3,4,7,8-HxCDF	63.48	1274000	1028950	4.16		8.71	1.23	1.24	
1,2,3,6,7,8-HxCDF	63.57	1236710	974171	4.48		9.38	1.22	1.27	
2,3,4,6,7,8-HxCDF	64.44	1192890	993631	4.41		9.22	1.13	1.20	
1,2,3,7,8,9-HxCDF	65.36	863581	668086	4.57		9.57	1.15	1.29	
13C-1,2,3,4,7,8-HxCDF	63.48	14746400	30311700	74.38	74.38		1.36	0.49	
13C-1,2,3,6,7,8-HxCDF	63.56	13538400	26950200	64.89	64.89		1.40	0.50	
13C-2,3,4,6,7,8-HxCDF	64.44	14436800	29430500	81.29	81.29		1.21	0.49	
13C-1,2,3,7,8,9-HxCDF	65.34	9674860	19479000	71.52	71.52		0.92	0.50	
1,2,3,4,7,8-HxCDD	64.57	737954	567945	4.30		9.00	1.09	1.30	
1,2,3,6,7,8-HxCDD	65.03	605703	555091	4.97		10.40	0.95	1.09	
1,2,3,7,8,9-HxCDD	65.25	887215	712693	6.19		12.96	0.99	1.24	
13C-1,2,3,4,7,8-HxCDD	64.56	15499800	12333200	61.09	61.09		1.02	1.26	
13C-1,2,3,6,7,8-HxCDD	65.02	13606100	10863100	52.39	52.39		1.05	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	65.24	24630500	19838300					1.24	
1,2,3,4,6,7,8-HpCDF	67.34	793511	823455	4.24		8.86	1.51	0.96	
1,2,3,4,7,8,9-HpCDF	69.09	593013	553352	4.55		9.52	1.44	1.07	
13C-1,2,3,4,6,7,8-HpCDF	67.33	7474150	17818500	70.51	70.51		0.81	0.42	
13C-1,2,3,4,7,8,9-HpCDF	69.08	5045210	12390300	64.62	64.62		0.61	0.41	
1,2,3,4,6,7,8-HpCDD	68.44	801538	760372	4.40		9.20	0.97	1.05	
13C-1,2,3,4,6,7,8-HpCDD	68.43	18803900	17958900	106.72	106.72		0.77	1.05	
OCDD	72.25	183061	203368	9.99		20.90	1.05	0.90	
13C-OCDD	72.25	3526460	3860960	30.84	15.42		0.54	0.91	S
OCDF	72.33	161040	161791	7.58		15.86	1.15	1.00	

TABLE C.2 continued

f. Sample 16-S

MDL Experiment 000818 run SAMPLE 8

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.39	32485.1	38581.5	1.10		2.30	0.95	0.84	
13C-2,3,7,8-TCDF	44.37	2908170	3932400	24.52	24.52		1.39	0.74	S
IS-13C-1,2,3,4-TCDD	46.37	8648300	11434300					0.76	
2,3,7,8-TCDD	47.30	16706.9	26136.1	0.58		1.21	1.10	0.64	
13C-2,3,7,8-TCDD	47.32	3063540	3642380	34.74	34.74		0.96	0.84	
37Cl-TCDD	47.35	9912290		48.02	96.05		2.39		
1,2,3,7,8-PeCDF	57.47	255487	169540	3.72		7.79	0.92	1.51	
2,3,4,7,8-PeCDF	59.22	241874	201998	3.96		8.29	0.98	1.20	
13C-1,2,3,7,8-PeCDF	57.44	7572370	4870890	37.46	37.46		1.65	1.55	
13C-2,3,4,7,8-PeCDF	59.20	6856130	4556520	29.89	29.89		1.90	1.50	
1,2,3,7,8-PeCDD	60.03	384087	300494	4.48		9.38	1.06	1.28	
13C-1,2,3,7,8-PeCDD	60.02	8030290	6446550	48.97	48.97		1.47	1.25	
1,2,3,4,7,8-HxCDF	63.50	777497	600078	4.26		8.91	1.23	1.30	
1,2,3,6,7,8-HxCDF	63.59	629532	495033	4.00		8.37	1.22	1.27	
2,3,4,6,7,8-HxCDF	64.46	676177	561199	4.21		8.81	1.13	1.20	
1,2,3,7,8,9-HxCDF	65.37	683034	496647	4.54		9.50	1.15	1.38	
13C-1,2,3,4,7,8-HxCDF	63.49	8628120	17708500	61.94	61.94		1.36	0.49	
13C-1,2,3,6,7,8-HxCDF	63.58	7781700	15296500	52.69	52.69		1.40	0.51	
13C-2,3,4,6,7,8-HxCDF	64.44	8742640	17238100	68.59	68.59		1.21	0.51	
13C-1,2,3,7,8,9-HxCDF	65.36	7498770	15120300	79.05	79.05		0.92	0.50	
1,2,3,4,7,8-HxCDD	64.57	434712	316396	4.32		9.04	1.09	1.37	
1,2,3,6,7,8-HxCDD	65.04	376021	364943	4.28		8.96	0.95	1.03	
1,2,3,7,8,9-HxCDD	65.25	616628	417688	6.14		12.86	0.99	1.48	
13C-1,2,3,4,7,8-HxCDD	64.57	8926850	7011100	49.83	49.83		1.02	1.27	
13C-1,2,3,6,7,8-HxCDD	65.04	10030700	8101920	55.31	55.31		1.05	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	65.24	17142700	14073200					1.22	
1,2,3,4,6,7,8-HpCDF	67.36	718896	723008	3.98		8.33	1.51	0.99	
1,2,3,4,7,8,9-HpCDF	69.12	583414	602036	4.31		9.01	1.44	0.97	
13C-1,2,3,4,6,7,8-HpCDF	67.35	7146120	16840000	95.26	95.26		0.81	0.42	
13C-1,2,3,4,7,8,9-HpCDF	69.10	5396230	13654500	100.59	100.59		0.61	0.40	
1,2,3,4,6,7,8-HpCDD	68.46	616881	559232	3.94		8.24	0.97	1.10	
13C-1,2,3,4,6,7,8-HpCDD	68.46	15766300	15134600	127.78	127.78		0.77	1.04	
OCDD	72.27	141843	143078	9.38		19.62	1.05	0.99	
13C-OCDD	72.27	2656680	3145350	34.50	17.25		0.54	0.84	
OCDF	72.35	151151	178435	9.85		20.62	1.15	0.85	

TABLE C.2 continued

g. Sample 17-S

MDL Experiment	000818 run	SAMPLE 9							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	44.37	13366.1	21030.3	0.43		0.90	0.95	0.64	
13C-2,3,7,8-TCDF	44.38	3702420	4750750	24.55	24.55		1.39	0.78	S
IS-13C-1,2,3,4-TCDD	46.38	11006300	13784400					0.80	
2,3,7,8-TCDD	47.36	53167.9	61070.2	1.15		2.40	1.10	0.87	
13C-2,3,7,8-TCDD	47.30	3962620	5048930	37.82	37.82		0.96	0.78	
37Cl-TCDD	47.33	11726100		44.64	89.28		2.39		
1,2,3,7,8-PeCDF	57.44	322794	235243	3.85		8.06	0.92	1.37	
2,3,4,7,8-PeCDF	59.20	360202	237940	4.03		8.44	0.98	1.51	
13C-1,2,3,7,8-PeCDF	57.44	9578610	6199710	38.48	38.48		1.65	1.55	
13C-2,3,4,7,8-PeCDF	59.18	9096320	6018980	32.07	32.07		1.90	1.51	
1,2,3,7,8-PeCDD	60.02	483986	403297	4.91		10.27	1.06	1.20	
13C-1,2,3,7,8-PeCDD	60.00	9459520	7672130	46.94	46.94		1.47	1.23	
1,2,3,4,7,8-HxCDF	63.49	852275	723346	4.44		9.28	1.23	1.18	
1,2,3,6,7,8-HxCDF	63.58	777941	625993	4.29		8.98	1.22	1.24	
2,3,4,6,7,8-HxCDF	64.45	892170	745048	4.66		9.76	1.13	1.20	
1,2,3,7,8,9-HxCDF	65.37	737759	621508	4.98		10.43	1.15	1.19	
13C-1,2,3,4,7,8-HxCDF	63.48	9490970	19434600	58.62	58.62		1.36	0.49	
13C-1,2,3,6,7,8-HxCDF	63.57	8915070	17939200	52.84	52.84		1.40	0.50	
13C-2,3,4,6,7,8-HxCDF	64.43	10369200	20656900	70.59	70.59		1.21	0.50	
13C-1,2,3,7,8,9-HxCDF	65.35	8020220	15712500	71.48	71.48		0.92	0.51	
1,2,3,4,7,8-HxCDD	64.57	484739	415978	4.59		9.61	1.09	1.17	
1,2,3,6,7,8-HxCDD	65.04	577543	421053	5.15		10.78	0.95	1.37	
1,2,3,7,8,9-HxCDD	65.25	748763	601596	7.14		14.94	0.99	1.24	
13C-1,2,3,4,7,8-HxCDD	64.56	9988770	7989510	48.44	48.44		1.02	1.25	
13C-1,2,3,6,7,8-HxCDD	65.03	11310600	9000810	53.39	53.39		1.05	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	65.24	20128400	16094600					1.25	
1,2,3,4,6,7,8-HpCDF	67.36	860746	842088	4.11		8.59	1.51	1.02	
1,2,3,4,7,8,9-HpCDF	69.10	646359	616327	4.27		8.94	1.44	1.05	
13C-1,2,3,4,6,7,8-HpCDF	67.35	8043990	19434300	94.04	94.04		0.81	0.41	
13C-1,2,3,4,7,8,9-HpCDF	69.09	6081690	14388700	93.14	93.14		0.61	0.42	
1,2,3,4,6,7,8-HpCDD	68.46	786669	757695	4.66		9.74	0.97	1.04	
13C-1,2,3,4,6,7,8-HpCDD	68.45	17494700	16823100	122.30	122.30		0.77	1.04	
OCDD	72.28	270768	303358	12.09		25.29	1.05	0.89	
13C-OCDD	72.27	4217420	4851390	46.47	23.24		0.54	0.87	
OCDF	72.35	232152	220581	8.66		18.12	1.15	1.05	

TABLE C.3. SPMD Raw Data Calculation Spreadsheets for Deployment One Quality Control Samples

a. Sample 18-S

Deployment 1, Retrieval 1	010404 Run	SAMPLE 9	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		
13C-2,3,7,8-TCDF	41.57	20476100	25771800	18.17	18.17		1.46	0.79	S
IS-13C-1,2,3,4-TCDD	43.48	76583100	97349700					0.79	
2,3,7,8-TCDD	ND						1.06		
13C-2,3,7,8-TCDD	44.38	19669400	24133000	23.54	23.54		1.07	0.82	S
37Cl-TCDD	44.41	66349200		36.09	72.18		2.40		
1,2,3,7,8-PeCDF	ND						0.92		
2,3,4,7,8-PeCDF	ND						1.00		
13C-1,2,3,7,8-PeCDF	56.15	89320700	56355100	65.82	65.82		1.27	1.58	
13C-2,3,4,7,8-PeCDF	58.02	83898300	52581900	68.63	68.63		1.14	1.60	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	58.51	83748600	52908700	89.09	89.09		0.88	1.58	
1,2,3,4,7,8-HxCDF	ND						1.19		
1,2,3,6,7,8-HxCDF	ND						1.21		
2,3,4,6,7,8-HxCDF	ND						1.12		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	62.53	40474700	75902900	119.01	119.01		1.09	0.53	
13C-1,2,3,6,7,8-HxCDF	63.03	45184600	83571300	133.01	133.01		1.08	0.54	
13C-2,3,4,6,7,8-HxCDF	63.50	35607800	66295800	105.30	105.30		1.08	0.54	
13C-1,2,3,7,8,9-HxCDF	64.44	51155300	95572600	182.61	182.61		0.90	0.54	S
1,2,3,4,7,8-HxCDD	ND						1.06		
1,2,3,6,7,8-HxCDD	ND						0.92		
1,2,3,7,8,9-HxCDD	ND						0.98		
13C-1,2,3,4,7,8-HxCDD	64.06	33105600	27046700	75.86	75.86		0.88	1.22	
13C-1,2,3,6,7,8-HxCDD	64.13	33050700	27487200	70.39	70.39		0.96	1.20	
IS-13C-1,2,3,7,8,9-HxCDD	64.33	48909200	40695300					1.20	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.48	38958800	84648500	197.54	197.54		0.70	0.46	S
13C-1,2,3,4,7,8,9-HpCDF	68.20	27609300	61612000	171.14	171.14		0.58	0.45	S
1,2,3,4,6,7,8-HpCDD	ND						0.94		
13C-1,2,3,4,6,7,8-HpCDD	67.57	69327700	65940500	222.68	222.68		0.68	1.05	S
OCDD	ND						0.99		
13C-OCDD	71.25	80072300	92532000	318.88	159.44		0.60	0.87	S
OCDF	ND						1.07		

TABLE C.3 continued

b. Sample 24-S

Deployment 1, Retrieval 1	010402 Run	SAMPLE 3	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		
13C-2,3,7,8-TCDF	41.42	117626000	146830000	54.81	54.81		1.56	0.80	
IS-13C-1,2,3,4-TCDD	43.35	134098000	176012000					0.76	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	44.22	85282200	114695000	62.21	62.21		1.04	0.74	
37Cl-TCDD	44.25	145410000		44.72	89.44		2.42		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	ND						1.01		
13C-1,2,3,7,8-PeCDF	56.06	198265000	123761000	58.53	58.53		1.77	1.60	
13C-2,3,4,7,8-PeCDF	57.54	201864000	125512000	53.81	53.81		1.96	1.61	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	58.43	150890000	95650500	48.07	48.07		1.65	1.58	
1,2,3,4,7,8-HxCDF	ND						1.20		
1,2,3,6,7,8-HxCDF	62.59	126167	104987	0.06		0.02	1.25	1.20	B
2,3,4,6,7,8-HxCDF	63.46	310875	224071	0.16		0.07	1.12	1.39	B
1,2,3,7,8,9-HxCDF	64.41	207234	162156	0.11		0.05	1.24	1.28	B
13C-1,2,3,4,7,8-HxCDF	62.49	103286000	191793000	93.44	93.44		0.73	0.54	
13C-1,2,3,6,7,8-HxCDF	62.57	103987000	205879000	97.85	97.85		0.73	0.51	
13C-2,3,4,6,7,8-HxCDF	63.46	102386000	195224000	122.40	122.40		0.56	0.52	
13C-1,2,3,7,8,9-HxCDF	64.39	90569800	175024000	65.60	65.60		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	64.30	113970	103541	0.08		0.03	1.01	1.10	B
13C-1,2,3,4,7,8-HxCDD	64.00	140061000	110515000	127.54	127.54		0.45	1.27	
13C-1,2,3,6,7,8-HxCDD	64.08	154052000	123490000	168.44	168.44		0.38	1.25	S
IS-13C-1,2,3,7,8,9-HxCDD	64.28	239854000	194158000					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.44	69050700	155608000	66.62	66.62		0.78	0.44	
13C-1,2,3,4,7,8,9-HpCDF	68.15	58803700	129396000	68.30	68.30		0.63	0.45	
1,2,3,4,6,7,8-HpCDD	67.53	191756	173924	0.15		0.06	0.95	1.10	B
13C-1,2,3,4,6,7,8-HpCDD	67.53	126278000	123262000	74.99	74.99		0.77	1.02	
OCDD	71.21	598868	621488	0.68		0.28	1.04	0.96	B
13C-OCDD	71.20	159070000	184571000	136.57	68.28		0.58	0.86	
OCDF	71.28	179380	198002	0.20		0.08	1.11	0.91	B

TABLE C.3 continued

c. Sample 25-S

Deployment 1, Retrieval 2	000821 run	Sample 5	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.92		
13C-2,3,7,8-TCDF	44.26	1384000	1818640	18.55	18.55		1.44	0.76	S
IS-13C-1,2,3,4-TCDD	46.24	5393850	6589460					0.82	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.24	1419570	1681190	25.27	25.27		1.02	0.84	
37Cl-TCDD	47.22	4623480		36.26	72.52		2.36		
1,2,3,7,8-PeCDF	ND						0.93		
2,3,4,7,8-PeCDF	ND						0.97		
13C-1,2,3,7,8-PeCDF	57.38	3433920	2131000	27.52	27.52		1.69	1.61	
13C-2,3,4,7,8-PeCDF	59.15	3123910	2004020	20.90	20.90		2.05	1.56	S
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.56	3177870	2135250	27.06	27.06		1.64	1.49	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	ND						1.11		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.45	2586240	5057130	49.14	49.14		1.17	0.51	
13C-1,2,3,6,7,8-HxCDF	63.53	2831700	5406560	51.46	51.46		1.20	0.52	
13C-2,3,4,6,7,8-HxCDF	64.41	3532570	6917740	69.72	69.72		1.13	0.51	
13C-1,2,3,7,8,9-HxCDF	65.32	2748090	5288760	64.72	64.72		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.54	2900310	2277340	45.17	45.17		0.86	1.27	
13C-1,2,3,6,7,8-HxCDD	65.00	3563410	2951240	48.25	48.25		1.02	1.21	
IS-13C-1,2,3,7,8,9-HxCDD	65.22	7327900	5965890					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.32	3034570	6781630	95.09	95.09		0.78	0.45	
13C-1,2,3,4,7,8,9-HpCDF	69.06	2100010	5022970	79.39	79.39		0.67	0.42	
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.42	4123760	3840180	69.45	69.45		0.86	1.07	
OCDD	ND						0.99		
13C-OCDD	72.24	617540	741785	13.76	6.88		0.74	0.83	S
OCDF	ND						1.17		

TABLE C.3 continued

d. Sample 26-S

Deployment 1, Retrieval 2	000821 run	Sample 3	Dialysis Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.92		
13C-2,3,7,8-TCDF	46.52	2720070	3837090	10.21	10.21		1.44	0.71	S
IS-13C-1,2,3,4-TCDD	48.21	19725100	24849600					0.79	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	49.06	3045230	3720780	14.83	14.83		1.02	0.82	S
37Cl-TCDD	49.10	21946700		47.06	94.13		2.36		
1,2,3,7,8-PeCDF	ND						0.93		
2,3,4,7,8-PeCDF	ND						0.97		
13C-1,2,3,7,8-PeCDF	58.01	11417100	7314700	24.90	24.90		1.69	1.56	S
13C-2,3,4,7,8-PeCDF	59.30	6704180	4243470	12.00	12.00		2.05	1.58	S
1,2,3,7,8-PeCDD	60.09	34491.7	21116.1	0.41		0.86	1.03	1.63	B
13C-1,2,3,7,8-PeCDD	60.08	8066140	5186030	18.14	18.14		1.64	1.56	S
1,2,3,4,7,8-HxCDF	63.52	26271.2	18348.4	0.23		0.48	1.22	1.43	B
1,2,3,6,7,8-HxCDF	63.59	28230.6	21099.5	0.19		0.40	1.19	1.34	B
2,3,4,6,7,8-HxCDF	ND						1.11		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.51	5691670	10108000	55.67	55.67		1.17	0.56	
13C-1,2,3,6,7,8-HxCDF	63.58	6893480	14699700	73.91	73.91		1.20	0.47	
13C-2,3,4,6,7,8-HxCDF	64.45	8479220	16738100	92.20	92.20		1.13	0.51	
13C-1,2,3,7,8,9-HxCDF	65.36	6084400	11824300	79.03	79.03		0.93	0.51	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.57	6998860	5922670	61.78	61.78		0.86	1.18	
13C-1,2,3,6,7,8-HxCDD	65.04	10181400	8165660	74.48	74.48		1.02	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	65.26	13526400	10730900					1.26	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.35	2951150	6608020	50.75	50.75		0.78	0.45	
13C-1,2,3,4,7,8,9-HpCDF	ND						0.67		
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.48	298051	196684	2.36	2.36		0.86	1.52	S
OCDD	ND						0.99		
13C-OCDD	72.28	12995400	14818400	154.25	77.13		0.74	0.88	
OCDF	ND						1.17		

TABLE C.3 continued

e. Sample 32-S

Deployment 1, Retrieval 2	000821 run	Sample 4	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.92		
13C-2,3,7,8-TCDF	44.38	2718940	3349950	65.48	65.48		1.44	0.81	
IS-13C-1,2,3,4-TCDD	46.36	2799970	3632070					0.77	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.28	2128370	2781840	74.56	74.56		1.02	0.77	
37Cl-TCDD	47.32	3406820		51.47	102.93		2.36		
1,2,3,7,8-PeCDF	ND						0.93		
2,3,4,7,8-PeCDF	ND						0.97		
13C-1,2,3,7,8-PeCDF	57.43	4402590	2868180	66.99	66.99		1.69	1.53	
13C-2,3,4,7,8-PeCDF	59.20	4442260	2833410	55.25	55.25		2.05	1.57	
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	60.01	3716070	2446840	58.48	58.48		1.64	1.52	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	ND						1.11		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.48	4041980	8213030	111.80	111.80		1.17	0.49	
13C-1,2,3,6,7,8-HxCDF	63.57	3007770	6016080	79.97	79.97		1.20	0.50	
13C-2,3,4,6,7,8-HxCDF	64.44	2860010	5678120	80.82	80.82		1.13	0.50	
13C-1,2,3,7,8,9-HxCDF	65.36	2355940	4802220	81.79	81.79		0.93	0.49	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.56	3661290	3082560	83.47	83.47		0.86	1.19	
13C-1,2,3,6,7,8-HxCDD	65.03	3826420	3059760	72.37	72.37		1.02	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	65.24	5155770	4213330					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.34	2057900	4756020	93.65	93.65		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	69.10	2066600	4536140	104.42	104.42		0.67	0.46	
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.45	5200270	4690200	122.38	122.38		0.86	1.11	
OCDD	ND						0.99		
13C-OCDD	72.28	4870100	4826790	139.23	69.62		0.74	1.01	
OCDF	ND						1.17		

TABLE C.3 continued

f. Sample 33-S

Deployment 1, Retrieval 3	000821 run	Sample 7	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.92		
13C-2,3,7,8-TCDF	44.20	779313	919130	13.37	13.37		1.44	0.85	S
IS-13C-1,2,3,4-TCDD	46.21	3948220	4868220					0.81	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.12	809000	944416	19.42	19.42		1.02	0.86	S
37Cl-TCDD	47.14	2210670		23.68	47.37		2.36		
1,2,3,7,8-PeCDF	ND						0.93		
2,3,4,7,8-PeCDF	ND						0.97		
13C-1,2,3,7,8-PeCDF	57.35	2415970	1518080	26.44	26.44		1.69	1.59	
13C-2,3,4,7,8-PeCDF	59.11	2332470	1406000	20.71	20.71		2.05	1.66	S
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.53	2373300	1590500	27.44	27.44		1.64	1.49	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	ND						1.11		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.43	1957620	3642130	44.02	44.02		1.17	0.54	
13C-1,2,3,6,7,8-HxCDF	63.51	2137470	4332370	49.41	49.41		1.20	0.49	
13C-2,3,4,6,7,8-HxCDF	64.39	2609930	4921290	61.44	61.44		1.13	0.53	
13C-1,2,3,7,8,9-HxCDF	65.30	2162790	4259100	63.23	63.23		0.93	0.51	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.52	2406730	1783080	44.69	44.69		0.86	1.35	
13C-1,2,3,6,7,8-HxCDD	64.57	3047670	2243630	47.92	47.92		1.02	1.36	
IS-13C-1,2,3,7,8,9-HxCDD	65.20	6048400	4823400					1.25	
1,2,3,4,6,7,8-HpCDF	67.31	15875.8	14805.6	0.23		0.48	1.51	1.07	B
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.31	2758830	6179600	105.87	105.87		0.78	0.45	
13C-1,2,3,4,7,8,9-HpCDF	69.04	2124910	4805830	94.46	94.46		0.67	0.44	
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.40	3862080	3594340	79.51	79.51		0.86	1.07	
OCDD	ND						0.99		
13C-OCDD	72.20	760778	891764	20.45	10.22		0.74	0.85	S
OCDF	ND						1.17		

TABLE C.3 continued

g. Sample 39-S

Deployment 1, Retrieval 3	000821 run	Sample 9	Process blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.92		
13C-2,3,7,8-TCDF	44.25	2191760	2744280	52.79	52.79		1.44	0.80	
IS-13C-1,2,3,4-TCDD	46.21	2889110	3599510					0.80	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	47.13	1604100	2276970	58.42	58.42		1.02	0.70	
37Cl-TCDD	47.16	1811260		26.52	53.04		2.36		
1,2,3,7,8-PeCDF	ND						0.93		
2,3,4,7,8-PeCDF	ND						0.97		
13C-1,2,3,7,8-PeCDF	57.36	3797810	2383860	56.46	56.46		1.69	1.59	
13C-2,3,4,7,8-PeCDF	59.13	3768730	2335570	45.95	45.95		2.05	1.61	
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.55	3325860	2125520	51.28	51.28		1.64	1.56	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	ND						1.11		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.44	2078860	4118650	69.03	69.03		1.17	0.50	
13C-1,2,3,6,7,8-HxCDF	63.53	2208550	4247950	69.86	69.86		1.20	0.52	
13C-2,3,4,6,7,8-HxCDF	64.40	2020730	4152360	71.35	71.35		1.13	0.49	
13C-1,2,3,7,8,9-HxCDF	65.32	1769150	3358980	71.54	71.54		0.93	0.53	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.52	2556630	1827220	66.25	66.25		0.86	1.40	
13C-1,2,3,6,7,8-HxCDD	64.59	2780920	2440950	67.01	67.01		1.02	1.14	
IS-13C-1,2,3,7,8,9-HxCDD	65.20	4207590	3466070					1.21	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.32	2226520	5186550	124.40	124.40		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	69.06	1359420	3245750	88.92	88.92		0.67	0.42	
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.41	2791720	2670910	82.53	82.53		0.86	1.05	
OCDD	ND						0.99		
13C-OCDD	72.23	4695770	5270460	174.72	87.36		0.74	0.89	
OCDF	ND						1.17		

TABLE C.3 continued

h. Sample 40-S

Deployment 1, Retrieval 4	000811 run	SAMPLE 7	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						1.02		
13C-2,3,7,8-TCDF	44.10	461020	576885	19.18	19.18		1.44	0.80	S
IS-13C-1,2,3,4-TCDD	46.13	1689680	2056250					0.82	
2,3,7,8-TCDD	ND						1.17		
13C-2,3,7,8-TCDD	47.03	393539	507750	24.22	24.22		0.99	0.78	S
37Cl-TCDD	47.06	1287220		31.15	62.30		2.45		
1,2,3,7,8-PeCDF	ND						1.06		
2,3,4,7,8-PeCDF	ND						1.06		
13C-1,2,3,7,8-PeCDF	57.32	948648	553099	28.73	28.73		1.40	1.72	
13C-2,3,4,7,8-PeCDF	59.06	811952	525778	19.60	19.60		1.82	1.54	S
1,2,3,7,8-PeCDD	ND						1.04		
13C-1,2,3,7,8-PeCDD	59.49	959400	995045	35.59	35.59		1.47	0.96	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	ND						1.22		
2,3,4,6,7,8-HxCDF	ND						1.16		
1,2,3,7,8,9-HxCDF	65.29	22275.1	17096	0.55		1.14	1.25	1.30	B
13C-1,2,3,4,7,8-HxCDF	63.40	1602620	3222760	31.90	31.90		1.19	0.50	
13C-1,2,3,6,7,8-HxCDF	63.48	2039240	4190200	39.39	39.39		1.24	0.49	
13C-2,3,4,6,7,8-HxCDF	64.36	1880720	3894110	39.41	39.41		1.15	0.48	
13C-1,2,3,7,8,9-HxCDF	65.27	1874000	3877160	46.60	46.60		0.97	0.48	
1,2,3,4,7,8-HxCDD	ND						1.15		
1,2,3,6,7,8-HxCDD	ND						0.97		
1,2,3,7,8,9-HxCDD	ND						1.07		
13C-1,2,3,4,7,8-HxCDD	64.49	1428850	1010760	22.76	22.76		0.84	1.41	S
13C-1,2,3,6,7,8-HxCDD	64.55	2362770	1742650	31.46	31.46		1.02	1.36	
IS-13C-1,2,3,7,8,9-HxCDD	65.16	7200660	5536760					1.30	
1,2,3,4,6,7,8-HpCDF	ND						1.46		
1,2,3,4,7,8,9-HpCDF	ND								M
13C-1,2,3,4,6,7,8-HpCDF	67.27	2392620	5393730	67.02	67.02		0.91	0.44	
13C-1,2,3,4,7,8,9-HpCDF	ND						0.00		M
1,2,3,4,6,7,8-HpCDD	ND						0.96		
13C-1,2,3,4,6,7,8-HpCDD	68.37	3647780	3423430	58.24	58.24		0.95	1.07	
OCDD	ND						1.07		
13C-OCDD	72.17	4104020	4732390	81.57	40.78		0.85	0.87	
OCDF	ND						1.16		

TABLE C.3 continued

i. Sample 41-S

Deployment 1, Retrieval 4	000808 run	Matrix Spike		SAMPLE 9					
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	43.55	213095	238316	20.95	52.37	43.83	0.92	0.89	
13C-2,3,7,8-TCDF	43.50	1001330	1344960	19.25	48.11		1.44	0.74	
IS-13C-1,2,3,4-TCDD	45.52	3801440	4658810					0.82	
2,3,7,8-TCDD	46.44	252447	327597	21.90	54.75	45.83	1.08	0.77	
13C-2,3,7,8-TCDD	46.40	1082760	1376050	28.39	28.39		1.02	0.79	
37Cl-TCDD	46.42	2934350		32.65	65.30		2.36		
1,2,3,7,8-PeCDF	57.23	2607350	1725190	107.12	53.56	224.14	0.93	1.51	
2,3,4,7,8-PeCDF	58.59	2562970	1762110	107.93	53.96	225.83	0.97	1.45	
13C-1,2,3,7,8-PeCDF	57.21	2617240	1741910	30.54	30.54		1.69	1.50	
13C-2,3,4,7,8-PeCDF	58.58	2505640	1627010	23.86	23.86		2.05	1.54	S
1,2,3,7,8-PeCDD	59.42	2964360	2560610	120.13	60.06	251.37	1.03	1.16	
13C-1,2,3,7,8-PeCDD	59.40	2589080	1894050	32.34	32.34		1.64	1.37	
1,2,3,4,7,8-HxCDF	63.32	4978500	4084270	118.45	59.23	247.86	1.22	1.22	
1,2,3,6,7,8-HxCDF	63.41	5851470	4785160	110.30	55.15	230.81	1.19	1.22	
2,3,4,6,7,8-HxCDF	64.28	6270760	5241500	123.20	61.60	257.79	1.11	1.20	
1,2,3,7,8,9-HxCDF	65.21	7399090	6036350	112.33	56.17	235.06	1.23	1.23	
13C-1,2,3,4,7,8-HxCDF	63.32	2104480	4167030	29.43	29.43		1.17	0.51	
13C-1,2,3,6,7,8-HxCDF	63.40	2719260	5366360	36.87	36.87		1.20	0.51	
13C-2,3,4,6,7,8-HxCDF	64.28	2814760	5575290	40.86	40.86		1.13	0.50	
13C-1,2,3,7,8,9-HxCDF	65.20	3276590	6425770	57.03	57.03		0.93	0.51	
1,2,3,4,7,8-HxCDD	64.42	3834530	3061130	112.75	56.38	235.93	1.08	1.25	
1,2,3,6,7,8-HxCDD	64.49	4360560	3596960	121.77	60.88	254.79	0.93	1.21	
1,2,3,7,8,9-HxCDD	65.09	7567130	6290880	215.92	107.96	451.81	1.01	1.20	
13C-1,2,3,4,7,8-HxCDD	64.41	3173590	2492340	36.08	36.08		0.86	1.27	
13C-1,2,3,6,7,8-HxCDD	64.48	3911040	3101300	37.92	37.92		1.02	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	65.09	10218200	7992840					1.28	
1,2,3,4,6,7,8-HpCDF	67.21	6586150	6390400	120.44	60.22	252.03	1.51	1.03	
1,2,3,4,7,8,9-HpCDF	68.54	4391130	4255000	123.55	61.78	258.53	1.47	1.03	
13C-1,2,3,4,6,7,8-HpCDF	67.20	2202400	4946250	50.55	50.55		0.78	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.53	1434700	3331250	38.78	38.78		0.67	0.43	
1,2,3,4,6,7,8-HpCDD	68.30	4316970	4108870	112.05	56.02	234.45	0.91	1.05	
13C-1,2,3,4,6,7,8-HpCDD	68.29	4262370	4039370	52.85	52.85		0.86	1.06	
OCDD	72.07	7663870	8742890	235.03	58.76	491.79	0.99	0.88	
13C-OCDD	72.07	6682190	7380610	103.88	51.94		0.74	0.91	
OCDF	72.15	7174600	7872060	183.38	45.84	383.71	1.17	0.91	

TABLE C.3 continued
j. Sample 47-S

Deployment 1, Retrieval 4	000808 run	SAMPLE 10	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.92		
13C-2,3,7,8-TCDF	43.51	1107430	1415760	70.35	70.35		1.44	0.78	
IS-13C-1,2,3,4-TCDD	45.53	1121280	1367610					0.82	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	46.42	866722	1092290	76.88	76.88		1.02	0.79	
37Cl-TCDD	46.45	1260830		47.56	95.13		2.36		
1,2,3,7,8-PeCDF	ND						0.93		
2,3,4,7,8-PeCDF	ND						0.97		
13C-1,2,3,7,8-PeCDF	57.20	1343550	915316	53.79	53.79		1.69	1.47	
13C-2,3,4,7,8-PeCDF	58.58	1444640	946511	46.92	46.92		2.05	1.53	
1,2,3,7,8-PeCDD	ND						1.03		
13C-1,2,3,7,8-PeCDD	59.41	1094990	817131	46.89	46.89		1.64	1.34	
1,2,3,4,7,8-HxCDF	ND						1.22		
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	ND						1.11		
1,2,3,7,8,9-HxCDF	ND						1.23		
13C-1,2,3,4,7,8-HxCDF	63.32	802700	1583540	58.68	58.68		1.17	0.51	
13C-1,2,3,6,7,8-HxCDF	63.41	905397	1759330	63.66	63.66		1.20	0.51	
13C-2,3,4,6,7,8-HxCDF	64.28	856174	1609270	62.91	62.91		1.13	0.53	
13C-1,2,3,7,8,9-HxCDF	65.20	808296	1565660	73.11	73.11		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.93		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.41	1179680	900366	69.40	69.40		0.86	1.31	
13C-1,2,3,6,7,8-HxCDD	64.48	1208970	1138170	66.49	66.49		1.02	1.06	
IS-13C-1,2,3,7,8,9-HxCDD	65.09	1910620	1565270					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.51		
1,2,3,4,7,8,9-HpCDF	ND						1.47		
13C-1,2,3,4,6,7,8-HpCDF	67.20	617674	1311080	71.46	71.46		0.78	0.47	
13C-1,2,3,4,7,8,9-HpCDF	68.53	234728	540466	33.04	33.04		0.67	0.43	
1,2,3,4,6,7,8-HpCDD	ND						0.91		
13C-1,2,3,4,6,7,8-HpCDD	68.29	1622420	1482610	103.56	103.56		0.86	1.09	
OCDD	ND						0.99		
13C-OCDD	72.07	1592440	1858460	133.56	66.78		0.74	0.86	
OCDF	ND						1.17		

TABLE C.4. SPMD Raw Data Calculation Spreadsheets for Deployment Two Quality Control Samples

a. Sample 48-S

Deployment 2, Retrieval 1	010402-1 Run	SAMPLE 2	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.10	3205440	4329640	0.69		1.45	0.93	0.74	DPE, B
13C-2,3,7,8-TCDF	42.08	513392000	655723000	102.22	102.22		1.56	0.78	
IS-13C-1,2,3,4-TCDD	43.58	320199000	414972000					0.77	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	44.48	387237000	510595000	117.81	117.81		1.04	0.76	
37Cl-TCDD	44.52	370415000		47.71	95.42		2.42		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.07	1981340	1348590	0.33		0.69	1.01	1.47	DPE, B
13C-1,2,3,7,8-PeCDF	56.19	635242000	402814000	79.59	79.59		1.77	1.58	
13C-2,3,4,7,8-PeCDF	58.05	604649000	385634000	68.65	68.65		1.96	1.57	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	58.54	499826000	300702000	65.84	65.84		1.65	1.66	C
1,2,3,4,7,8-HxCDF	62.57	204493	147995	0.07		0.15	1.20	1.38	DPE, B
1,2,3,6,7,8-HxCDF	ND						1.25		DPE
2,3,4,6,7,8-HxCDF	63.53	1847840	1527900	0.90		1.88	1.12	1.21	DPE, B
1,2,3,7,8,9-HxCDF	ND						1.24		DPE
13C-1,2,3,4,7,8-HxCDF	62.56	145883000	276582000	96.03	96.03		0.73	0.53	
13C-1,2,3,6,7,8-HxCDF	63.04	129888000	244050000	84.76	84.76		0.73	0.53	
13C-2,3,4,6,7,8-HxCDF	63.52	117063000	219069000	99.24	99.24		0.56	0.53	
13C-1,2,3,7,8,9-HxCDF	64.45	220338000	420433000	113.62	113.62		0.93	0.52	
1,2,3,4,7,8-HxCDD	64.05	72409.5	67039.3	0.05		0.11	1.08	1.08	B
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.07	140242000	111753000	92.07	92.07		0.45	1.25	
13C-1,2,3,6,7,8-HxCDD	64.14	131471000	105612000	103.29	103.29		0.38	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	64.34	334428000	270197000					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.49						0.78		DPE, C
13C-1,2,3,4,7,8,9-HpCDF	68.20						0.63		DPE, C
1,2,3,4,6,7,8-HpCDD	ND						0.95		
13C-1,2,3,4,6,7,8-HpCDD	67.57	255567000	250003000	109.06	109.06		0.77	1.02	
OCDD	71.27	590193	736683	0.35		0.72	1.04	0.80	B
13C-OCDD	71.27	342482000	394248000	210.17	105.08		0.58	0.87	
OCDF	71.36	312563	387100	0.17		0.36	1.11	0.81	DPE, B

TABLE C.4 continued

b. Sample 50-S

Deployment 2, Retrieval 1	010401 Run	SAMPLE 3	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		
13C-2,3,7,8-TCDF	41.54	1841230000	2314120000	103.92	103.92		1.40	0.80	
IS-13C-1,2,3,4-TCDD	43.44	1244040000	1616690000					0.77	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	44.32	1357070000	1784180000	106.81	106.81		1.03	0.76	
37Cl-TCDD	44.36	1196620000		40.88	81.77		2.35		
1,2,3,7,8-PeCDF	56.14	3073790	1846150	0.14		0.06	0.94	1.66	DPE, B
2,3,4,7,8-PeCDF	58.02	7518190	4698880	0.33		0.14	1.00	1.60	DPE, B
13C-1,2,3,7,8-PeCDF	56.13	2299300000	1434490000	87.87	87.87		1.49	1.60	
13C-2,3,4,7,8-PeCDF	58.00	2274230000	1424690000	89.13	89.13		1.45	1.60	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	58.48	1851380000	1317110000	97.43	97.43		1.14	1.41	C
1,2,3,4,7,8-HxCDF	62.55	1987020	1647610	0.12		0.05	1.27	1.21	DPE,B
1,2,3,6,7,8-HxCDF	63.04	1893970	1483610	0.12		0.05	1.25	1.28	DPE, B
2,3,4,6,7,8-HxCDF	63.51	9705920	7568240	0.67		0.28	1.18	1.28	DPE, B
1,2,3,7,8,9-HxCDF	64.44	2362010	1889140	0.16		0.07	1.31	1.25	DPE, B
13C-1,2,3,4,7,8-HxCDF	62.54	847652000	1522440000	65.94	65.94		2.03	0.56	
13C-1,2,3,6,7,8-HxCDF	63.03	769062000	1493340000	67.77	67.77		1.89	0.51	
13C-2,3,4,6,7,8-HxCDF	63.50	763188000	1428290000	76.58	76.58		1.62	0.53	
13C-1,2,3,7,8,9-HxCDF	64.43	727978000	1358170000	131.05	131.05		0.90	0.54	
1,2,3,4,7,8-HxCDD	64.07	1524740	1112180	0.12		0.05	1.13	1.37	B
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.00		
13C-1,2,3,4,7,8-HxCDD	64.06	1100560000	908078000	95.21	95.21		1.19	1.21	
13C-1,2,3,6,7,8-HxCDD	64.13	1179230000	958657000	102.87	102.87		1.18	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	64.33	966246000	802057000					1.20	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	68.18	1011500	886914	0.12		0.05	1.38	1.14	DPE, B
13C-1,2,3,4,6,7,8-HpCDF	66.46	400300000	882873000	176.10	176.10		0.41	0.45	S
13C-1,2,3,4,7,8,9-HpCDF	68.17	347619000	767434000	34.31	34.31		1.84	0.45	
1,2,3,4,6,7,8-HpCDD	ND						0.92		
13C-1,2,3,4,6,7,8-HpCDD	67.55	756968000	731530000	35.71	35.71		2.36	1.03	
OCDD	71.23	2633250	2719190	0.43		0.18	0.97	0.97	B
13C-OCDD	71.22	1206180000	1371320000	56.40	28.20		2.58	0.88	
OCDF	71.30	1686190	1883130	0.26		0.11	1.06	0.90	DPE, B

TABLE C.4 continued

c. Sample 51-S

Deployment 2, Retrieval 2	010402-1 Run	SAMPLE 3	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.58	4109110	5178090	0.35		0.74	0.93	0.79	DPE, B
13C-2,3,7,8-TCDF	42.58	1242540000	1566690000	82.64	82.64		1.56	0.79	
IS-13C-1,2,3,4-TCDD	44.46	955625000	1229410000					0.78	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	45.39	882454000	1140420000	89.30	89.30		1.04	0.77	
37Cl-TCDD	45.42	1063530000		45.90	91.80		2.42		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.27	8709490	5871990	0.85		1.79	1.01	1.48	DPE, B
13C-1,2,3,7,8-PeCDF	56.46	1285740000	811720000	54.11	54.11		1.77	1.58	
13C-2,3,4,7,8-PeCDF	58.29	1029210000	656416000	39.32	39.32		1.96	1.57	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	59.15	678469000	471190000	31.81	31.81		1.65	1.44	C
1,2,3,4,7,8-HxCDF	ND						1.20		
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	64.06	15481900	11957500	2.32		4.85	1.12	1.29	DPE, B
1,2,3,7,8,9-HxCDF	ND						1.24		
13C-1,2,3,4,7,8-HxCDF	63.13	336559000	638762000	151.75	151.75		0.73	0.53	S
13C-1,2,3,6,7,8-HxCDF	63.21	217888000	410570000	97.51	97.51		0.73	0.53	
13C-2,3,4,6,7,8-HxCDF	64.08	367514000	694164000	214.55	214.55		0.56	0.53	S
13C-1,2,3,7,8,9-HxCDF	65.01	236799000	451393000	83.53	83.53		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.24	358725000	289675000	162.16	162.16		0.45	1.24	S
13C-1,2,3,6,7,8-HxCDD	64.30	585953000	466965000	313.99	313.99		0.38	1.25	S
IS-13C-1,2,3,7,8,9-HxCDD	64.50	491465000	391833000					1.25	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	67.01	159036000	335975000	72.12	72.12		0.78	0.47	
13C-1,2,3,4,7,8,9-HpCDF	68.33	163009000	372760000	95.54	95.54		0.63	0.44	
1,2,3,4,6,7,8-HpCDD	67.11						0.95		
13C-1,2,3,4,6,7,8-HpCDD	68.10	317449000	299613000	91.12	91.12		0.77	1.06	
OCDD	71.41	2046580	2186800	0.71		1.48	1.04	0.94	B
13C-OCDD	71.40	538492000	607773000	223.83	111.91		0.58	0.89	
OCDF	ND						1.11		

TABLE C.4 continued

d. Sample 54-S

Deployment 2, Retrieval 3	010402-1 Run	SAMPLE 5	Dialysis Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		DPE, C
13C-2,3,7,8-TCDF	42.23	803808000	1020580000	107.29	107.29		1.56	0.79	
IS-13C-1,2,3,4-TCDD	44.12	480352000	612564000					0.78	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	45.05	608854000	781590000	122.72	122.72		1.04	0.78	
37Cl-TCDD	45.08	522132000		44.83	89.66		2.42		
1,2,3,7,8-PeCDF	56.32	425460	242813	0.04		0.09	0.94	1.75	DPE, B
2,3,4,7,8-PeCDF							1.01		
13C-1,2,3,7,8-PeCDF	56.30	987520000	617370000	82.77	82.77		1.77	1.60	
13C-2,3,4,7,8-PeCDF	58.16	866056000	545890000	65.85	65.85		1.96	1.59	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	59.04	622264000	488471000	61.45	61.45		1.65	1.27	C
1,2,3,4,7,8-HxCDF	ND						1.20		
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	ND						1.12		
1,2,3,7,8,9-HxCDF	ND						1.24		
13C-1,2,3,4,7,8-HxCDF	63.02	187038000	357439000	279.90	279.90		0.73	0.52	S
13C-1,2,3,6,7,8-HxCDF	63.10	156946000	293720000	231.03	231.03		0.73	0.53	S
13C-2,3,4,6,7,8-HxCDF	63.58	135645000	258814000	263.38	263.38		0.56	0.52	S
13C-1,2,3,7,8,9-HxCDF	64.50	96225500	182683000	111.85	111.85		0.93	0.53	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.13	168741000	133185000	249.49	249.49		0.45	1.27	S
13C-1,2,3,6,7,8-HxCDD	64.19	169646000	134624000	299.80	299.80		0.38	1.26	S
IS-13C-1,2,3,7,8,9-HxCDD	64.40	147477000	119856000					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.52	42394500	95173800	66.23	66.23		0.78	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.23	152260000	341836000	291.13	291.13		0.63	0.45	S
1,2,3,4,6,7,8-HpCDD	68.02	210006	226307	0.08		0.16	0.95	0.93	B
13C-1,2,3,4,6,7,8-HpCDD	68.00	313185000	298236000	298.31	298.31		0.77	1.05	S
OCDD	71.31	942283	1151640	0.42		0.88	1.04	0.82	B
13C-OCDD	71.30	446341000	505980000	614.43	307.21		0.58	0.88	S
OCDF	71.38	394603	455956	0.16		0.34	1.11	0.87	DPE, B

TABLE C.4 continued

e. Sample 55-S

Deployment 2, Retrieval 3	010402-1 Run	SAMPLE 4	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.32	1361480	1726020	0.26		0.54	0.93	0.79	DPE, B
13C-2,3,7,8-TCDF	42.30	572225000	722042000	94.98	94.98		1.56	0.79	
IS-13C-1,2,3,4-TCDD	44.21	387173000	488714000					0.79	
2,3,7,8-TCDD	ND						1.07		
13C-2,3,7,8-TCDD	45.12	424661000	554900000	107.88	107.88		1.04	0.77	
37Cl-TCDD	45.16	383347000		40.84	81.67		2.42		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.17	642233	484994	0.12		0.26	1.01	1.32	DPE, B
13C-1,2,3,7,8-PeCDF	56.32	689733000	437752000	72.56	72.56		1.77	1.58	
13C-2,3,4,7,8-PeCDF	58.17	555586000	351511000	52.78	52.78		1.96	1.58	
1,2,3,7,8-PeCDD	ND						0.94		
13C-1,2,3,7,8-PeCDD	59.05	413175000	303471000	49.47	49.47		1.65	1.36	C
1,2,3,4,7,8-HxCDF	ND						1.20		
1,2,3,6,7,8-HxCDF	63.13	156184	112344	0.06		0.13	1.25	1.39	DPE, B
2,3,4,6,7,8-HxCDF	64.00	502804	363728	0.28		0.59	1.12	1.38	DPE, B
1,2,3,7,8,9-HxCDF	ND						1.24		
13C-1,2,3,4,7,8-HxCDF	63.04	132711000	252206000	267.52	267.52		0.73	0.53	S
13C-1,2,3,6,7,8-HxCDF	63.12	122935000	233297000	246.90	246.90		0.73	0.53	S
13C-2,3,4,6,7,8-HxCDF	64.00	94682600	181352000	249.18	249.18		0.56	0.52	S
13C-1,2,3,7,8,9-HxCDF	64.52	67212600	128637000	106.18	106.18		0.93	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.01		
13C-1,2,3,4,7,8-HxCDD	64.14	104664000	83229300	209.91	209.91		0.45	1.26	S
13C-1,2,3,6,7,8-HxCDD	64.21	121739000	96131300	290.23	290.23		0.38	1.27	S
IS-13C-1,2,3,7,8,9-HxCDD	64.41	109460000	88275900					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.42		
1,2,3,4,7,8,9-HpCDF	ND						1.39		
13C-1,2,3,4,6,7,8-HpCDF	66.55	127060000	282150000	266.33	266.33		0.78	0.45	S
13C-1,2,3,4,7,8,9-HpCDF	68.26	104973000	235329000	271.09	271.09		0.63	0.45	S
1,2,3,4,6,7,8-HpCDD	ND						0.95		
13C-1,2,3,4,6,7,8-HpCDD	68.03	203425000	192844000	261.39	261.39		0.77	1.05	S
OCDD	71.36	589704	661443	0.37		0.77	1.04	0.89	B
13C-OCDD	71.35	305542000	345765000	568.12	284.06		0.58	0.88	S
OCDF	ND						1.11		

TABLE C.4 continued

f. Sample 57-S

Deployment 2, Retrieval 3	010401 Run	SAMPLE 4	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.01	612400	744541	0.12		0.05	0.93	0.82	DPE, B
13C-2,3,7,8-TCDF	41.55	551850000	688969000	105.01	105.01		1.40	0.80	
IS-13C-1,2,3,4-TCDD	43.47	367691000	477681000					0.77	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	44.35	405660000	534425000	108.17	108.17		1.03	0.76	
37Cl-TCDD	44.38	358409000		41.43	82.86		2.35		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	58.05	537105	302495	0.07		0.03	1.00	1.78	DPE, B
13C-1,2,3,7,8-PeCDF	56.15	795161000	498856000	103.05	103.05		1.49	1.59	
13C-2,3,4,7,8-PeCDF	58.03	775480000	487236000	102.97	102.97		1.45	1.59	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	58.51	639520000	395363000	107.69	107.69		1.14	1.62	
1,2,3,4,7,8-HxCDF	ND						1.27		
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	ND						1.18		
1,2,3,7,8,9-HxCDF	ND						1.31		
13C-1,2,3,4,7,8-HxCDF	62.54	367051000	658203000	59.91	59.91		2.03	0.56	
13C-1,2,3,6,7,8-HxCDF	63.03	359852000	692867000	66.23	66.23		1.89	0.52	
13C-2,3,4,6,7,8-HxCDF	63.52	345742000	640629000	72.39	72.39		1.62	0.54	
13C-1,2,3,7,8,9-HxCDF	64.44	316345000	588867000	119.42	119.42		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.13		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.00		
13C-1,2,3,4,7,8-HxCDD	64.06	472906000	386840000	85.59	85.59		1.19	1.22	
13C-1,2,3,6,7,8-HxCDD	64.13	499998000	404889000	91.44	91.44		1.18	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	64.34	460942000	381051000					1.21	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	66.48	200056000	442399000	185.16	185.16		0.41	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.19	155407000	344733000	32.32	32.32		1.84	0.45	
1,2,3,4,6,7,8-HpCDD	ND						0.92		
13C-1,2,3,4,6,7,8-HpCDD	67.57	327656000	319503000	32.61	32.61		2.36	1.03	
OCDD	ND						0.97		
13C-OCDD	71.26	528819000	600322000	51.89	25.94		2.58	0.88	
OCDF	ND						1.06		

TABLE C.4 continued

g. Sample 58-S

Deployment 2, Retrieval 4	020101 Run	SAMPLE 9	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		
13C-2,3,7,8-TCDF	38.42	13936300	18031800	38.91	38.91		1.37	0.77	
IS-13C-1,2,3,4-TCDD	40.20	25701000	34451600					0.75	
2,3,7,8-TCDD	ND						0.99		
13C-2,3,7,8-TCDD	41.01	16042700	22143700	59.79	59.79		1.06	0.72	
37Cl-TCDD	41.05	12047100		20.76	41.52		2.26		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	53.43	16926700	11264400	39.70	39.70		1.18	1.50	
13C-2,3,4,7,8-PeCDF	56.05	15629400	10272100	36.36	36.36		1.18	1.52	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	57.02	17276400	15454600	56.67	56.67		0.96	1.12	
1,2,3,4,7,8-HxCDF	ND						1.31		
1,2,3,6,7,8-HxCDF	ND						1.21		
2,3,4,6,7,8-HxCDF	62.39	76767.7	57534.2	0.53		1.10	1.18	1.33	DPE, B
1,2,3,7,8,9-HxCDF	63.33	55144.6	45014.5	0.51		1.06	1.03	1.23	DPE, B
13C-1,2,3,4,7,8-HxCDF	61.33	6025000	13392900	46.87	46.87		0.92	0.45	
13C-1,2,3,6,7,8-HxCDF	61.43	8459180	16390700	43.72	43.72		1.26	0.52	
13C-2,3,4,6,7,8-HxCDF	62.38	7471970	14228900	46.39	46.39		1.03	0.53	
13C-1,2,3,7,8,9-HxCDF	63.31	6484180	12690600	45.91	45.91		0.92	0.51	
1,2,3,4,7,8-HxCDD	ND						1.14		
1,2,3,6,7,8-HxCDD	ND						1.01		
1,2,3,7,8,9-HxCDD	ND						1.07		
13C-1,2,3,4,7,8-HxCDD	62.52	13073400	11049100	72.35	72.35		0.74	1.18	
13C-1,2,3,6,7,8-HxCDD	62.59	16910500	14060300	62.64	62.64		1.09	1.20	
IS-13C-1,2,3,7,8,9-HxCDD	63.21	24706400	20569300					1.20	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	65.41	3760560	8711860	35.39	35.39		0.78	0.43	
13C-1,2,3,4,7,8,9-HpCDF	67.15	3955980	9343380	44.35	44.35		0.66	0.42	
1,2,3,4,6,7,8-HpCDD	ND						0.95		
13C-1,2,3,4,6,7,8-HpCDD	66.54	9652490	10272500	47.88	47.88		0.92	0.94	
OCDD	70.09	481409	577543	5.70		11.94	1.01	0.83	B
13C-OCDD	70.08	16595300	20141700	105.82	52.91		0.77	0.82	
OCDF	ND						1.11		

TABLE C.4 continued

h. Sample 59-S

Deployment 2, Retrieval 4	020101 Run	SAMPLE 10	Matrix Spike						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	38.41	5897170	7584670	11.43	28.56	23.91	0.93		
13C-2,3,7,8-TCDF	38.39	55362300	71553800	67.56	168.91		1.37	0.77	
IS-13C-1,2,3,4-TCDD	40.16	59146900	78373700					0.75	
2,3,7,8-TCDD	41.02	7154490	9433940	11.51	28.77	24.08	0.99		
13C-2,3,7,8-TCDD	40.58	61368300	83808900	99.43	99.43		1.06	0.73	
37Cl-TCDD	41.01	31726700		23.76	47.52		2.26		
1,2,3,7,8-PeCDF	53.43	38741200	24238000	56.44	28.22	118.11	0.95		
2,3,4,7,8-PeCDF	56.05	39868300	25090000	57.81	28.91	120.98	1.02		
13C-1,2,3,7,8-PeCDF	53.40	71305100	45563600	71.99	71.99		1.18	1.56	
13C-2,3,4,7,8-PeCDF	56.04	66877800	43459100	67.75	67.75		1.18	1.54	
1,2,3,7,8-PeCDD	57.03	45134200	25982900	51.40	25.70	107.56	1.02		
13C-1,2,3,7,8-PeCDD	57.00	74692300	61370400	103.04	103.04		0.96	1.22	
1,2,3,4,7,8-HxCDF	61.34	40091800	31740500	58.55	29.28	122.52	1.31		
1,2,3,6,7,8-HxCDF	61.44	45745300	36171600	61.99	31.00	129.72	1.21		
2,3,4,6,7,8-HxCDF	62.38	41245700	32821000	64.23	32.12	134.41	1.18		
1,2,3,7,8,9-HxCDF	63.32	38921500	30234800	73.88	36.94	154.60	1.03		
13C-1,2,3,4,7,8-HxCDF	61.32	32518800	61273300	80.76	80.76		0.92	0.53	
13C-1,2,3,6,7,8-HxCDF	61.43	35940800	73659400	68.79	68.79		1.26	0.49	
13C-2,3,4,6,7,8-HxCDF	62.37	32937800	65082100	74.76	74.76		1.03	0.51	
13C-1,2,3,7,8,9-HxCDF	63.30	30691200	60451400	77.85	77.85		0.92	0.51	
1,2,3,4,7,8-HxCDD	62.53	38823800	29034600	58.62	29.31	122.66	1.14		
1,2,3,6,7,8-HxCDD	62.59	42088000	38035000	55.61	27.80	116.36	1.01		
1,2,3,7,8,9-HxCDD	63.21	42565800	35622200	60.13	30.06	125.81	1.07		
13C-1,2,3,4,7,8-HxCDD	62.52	55197900	46152000	108.45	108.45		0.74	1.20	
13C-1,2,3,6,7,8-HxCDD	62.58	78025700	64173900	102.61	102.61		1.09	1.22	
IS-13C-1,2,3,7,8,9-HxCDD	63.21	68844400	58065900					1.19	
1,2,3,4,6,7,8-HpCDF	65.41	31682600	30695600	68.89	34.44	144.14	1.40	1.03	
1,2,3,4,7,8,9-HpCDF	67.15	28924200	27613100	70.60	35.30	147.74	1.38	1.05	
13C-1,2,3,4,6,7,8-HpCDF	65.41	19110600	45463300	65.37	65.37		0.78	0.42	
13C-1,2,3,4,7,8,9-HpCDF	67.14	16903300	40921200	68.79	68.79		0.66	0.41	
1,2,3,4,6,7,8-HpCDD	66.54	30165600	31179500	63.22	31.61	132.28	0.95	0.97	
13C-1,2,3,4,6,7,8-HpCDD	66.53	50889800	51789500	88.02	88.02		0.92	0.98	
OCDD	70.09	66655100	78930100	140.92	35.23	294.88	1.01	0.84	
13C-OCDD	70.08	93679000	110758000	210.09	105.04		0.77	0.85	
OCDF	70.14	61062400	68792600	114.86	28.72	240.34	1.11	0.89	

TABLE C.4 continued

i. Sample 65-S

Deployment 2, Retrieval 4	020101 Run	SAMPLE 3	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		
13C-2,3,7,8-TCDF	38.37	57507000	70708000	54.89	54.89		1.37	0.81	
IS-13C-1,2,3,4-TCDD	40.15	74942100	96065800					0.78	
2,3,7,8-TCDD	ND						0.99		
13C-2,3,7,8-TCDD	40.56	52268200	66563900	65.45	65.45		1.06	0.79	
37Cl-TCDD	40.58	41091900		24.29	49.58		2.26		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	53.39	64830000	40611300	52.23	52.23		1.18	1.60	
13C-2,3,4,7,8-PeCDF	56.02	67871900	41799700	54.16	54.16		1.18	1.62	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	56.59	60358300	34741200	57.92	57.92		0.96	1.74	
1,2,3,4,7,8-HxCDF	ND						1.31		
1,2,3,6,7,8-HxCDF	ND						1.21		
2,3,4,6,7,8-HxCDF	62.36	322207	263997	0.45		0.95	1.18	1.22	DPE, B
1,2,3,7,8,9-HxCDF	63.31	251733	202060	0.41		0.87	1.03	1.25	DPE, B
13C-1,2,3,4,7,8-HxCDF	61.31	33641400	65789800	61.05	61.05		0.92	0.51	
13C-1,2,3,6,7,8-HxCDF	61.41	44503400	86422100	58.60	58.60		1.26	0.51	
13C-2,3,4,6,7,8-HxCDF	62.36	37316900	72648500	59.80	59.80		1.03	0.51	
13C-1,2,3,7,8,9-HxCDF	63.29	36214400	70520700	65.01	65.01		0.92	0.51	
1,2,3,4,7,8-HxCDD	ND						1.14		
1,2,3,6,7,8-HxCDD	ND						1.01		
1,2,3,7,8,9-HxCDD	ND						1.07		
13C-1,2,3,4,7,8-HxCDD	62.50	49318900	39371000	67.67	67.67		0.74	1.25	
13C-1,2,3,6,7,8-HxCDD	62.58	76002400	59621100	69.78	69.78		1.09	1.27	
IS-13C-1,2,3,7,8,9-HxCDD	63.20	99248700	78737300					1.26	
1,2,3,4,6,7,8-HpCDF	65.41	182012	174119	0.33		0.68	1.40	1.05	DPE, B
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	65.40	23940500	53956800	56.23	56.23		0.78	0.44	
13C-1,2,3,4,7,8,9-HpCDF	67.14	21682000	51239800	61.85	61.85		0.66	0.42	
1,2,3,4,6,7,8-HpCDD	66.55	247527	215154	0.44		0.93	0.95	1.15	B
13C-1,2,3,4,6,7,8-HpCDD	66.52	56185300	54540000	67.68	67.68		0.92	1.03	
OCDD	70.08	2241600	2661860	5.10		10.67	1.01	0.84	B
13C-OCDD	70.07	88647700	101643000	139.44	69.72		0.77	0.87	
OCDF	70.13	567046	614177	1.12		2.35	1.11	0.92	DPE, B

TABLE C.5. SPMD Raw Data Calculation Spreadsheets for Deployment Three Quality Control Samples

a. Sample 66-S

Deployment 3	010210 Run	SAMPLE 6	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.86		
13C-2,3,7,8-TCDF	36.43	188472000	239594000	69.04	69.04		1.32	0.79	
IS-13C-1,2,3,4-TCDD	38.12	205716000	262944000					0.78	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.52	153950000	201731000	70.43	70.43		1.08	0.76	
37Cl-TCDD	38.55	129654000		27.55	55.10		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.21	216191000	136909000	66.43	66.43		1.13	1.58	
13C-2,3,4,7,8-PeCDF	54.28	218015000	135893000	65.60	65.60		1.15	1.60	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.38	185050000	111242000	65.75	65.75		0.96	1.66	
1,2,3,4,7,8-HxCDF	ND						1.25		
1,2,3,6,7,8-HxCDF	ND						1.19		
2,3,4,6,7,8-HxCDF	61.48	457127	396957	0.24		0.51	1.13	1.15	DPE, B
1,2,3,7,8,9-HxCDF	ND						1.19		
13C-1,2,3,4,7,8-HxCDF	60.38	107990000	199726000	66.65	66.65		1.09	0.54	
13C-1,2,3,6,7,8-HxCDF	60.49	113675000	225476000	67.89	67.89		1.18	0.50	
13C-2,3,4,6,7,8-HxCDF	61.46	107250000	205363000	67.34	67.34		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	62.42	96791600	185093000	68.11	68.11		0.98	0.52	
1,2,3,4,7,8-HxCDD	62.04	212335	159237	0.13		0.27	1.12	1.33	B
1,2,3,6,7,8-HxCDD	62.11	200301	176326	0.13		0.26	0.99	1.14	B
1,2,3,7,8,9-HxCDD	ND						1.05		
13C-1,2,3,4,7,8-HxCDD	62.02	142799000	114097000	68.28	68.28		0.89	1.25	
13C-1,2,3,6,7,8-HxCDD	62.10	168906000	133257000	71.55	71.55		1.00	1.27	
IS-13C-1,2,3,7,8,9-HxCDD	62.32	233729000	189069000					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.40		
13C-1,2,3,4,6,7,8-HpCDF	64.56	74196100	166897000	67.95	67.95		0.84	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.32	64200100	146776000	62.14	62.14		0.80	0.44	
1,2,3,4,6,7,8-HpCDD	66.12	293176	279263	0.22		0.46	0.92	1.05	B
13C-1,2,3,4,6,7,8-HpCDD	66.11	144209000	137831000	70.94	70.94		0.94	1.05	
OCDD	69.20	1316130	1485480	1.80		3.76	0.98	0.89	B
13C-OCDD	69.19	149658000	167206000	108.84	54.42		0.69	0.90	
OCDF	ND						1.30		

TABLE C.5 continued

b. Sample 67-S

Deployment 3	010210 Run	SAMPLE 12	Dialysis Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.86		
13C-2,3,7,8-TCDF	36.44	19490000	25009400	69.01	69.01		1.32	0.78	
IS-13C-1,2,3,4-TCDD	38.14	21289900	27448500					0.78	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.54	14929500	19934000	66.39	66.39		1.08	0.75	
37Cl-TCDD	38.56	13620800		27.97	55.93		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.24	18225900	11636000	54.02	54.02		1.13	1.57	
13C-2,3,4,7,8-PeCDF	54.32	20666100	12548600	59.21	59.21		1.15	1.65	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.41	16401300	10159000	56.68	56.68		0.96	1.61	
1,2,3,4,7,8-HxCDF	60.42	26518.6	21705.4	0.15		0.31	1.25	1.22	DPE, B
1,2,3,6,7,8-HxCDF	ND						1.19		DPE
2,3,4,6,7,8-HxCDF	ND						1.13		DPE
1,2,3,7,8,9-HxCDF	62.44	46446.4	38539.3	0.31		0.65	1.19	1.21	DPE, B
13C-1,2,3,4,7,8-HxCDF	60.40	8987700	17492100	71.47	71.47		1.09	0.51	
13C-1,2,3,6,7,8-HxCDF	60.51	9918220	19452600	73.26	73.26		1.18	0.51	
13C-2,3,4,6,7,8-HxCDF	61.47	8905980	16983600	69.49	69.49		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	62.42	8035130	15168500	69.86	69.86		0.98	0.53	
1,2,3,4,7,8-HxCDD	ND						1.12		
1,2,3,6,7,8-HxCDD	ND						0.99		
1,2,3,7,8,9-HxCDD	ND						1.05		
13C-1,2,3,4,7,8-HxCDD	62.04	11035700	8740060	65.50	65.50		0.89	1.26	
13C-1,2,3,6,7,8-HxCDD	62.12	14065500	11671000	75.94	75.94		1.00	1.21	
IS-13C-1,2,3,7,8,9-HxCDD	62.34	18886200	15042900					1.26	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	ND						1.40		
13C-1,2,3,4,6,7,8-HpCDF	64.58	5135350	11831500	59.59	59.59		0.84	0.43	
13C-1,2,3,4,7,8,9-HpCDF	66.34	4202930	9352120	49.75	49.75		0.80	0.45	
1,2,3,4,6,7,8-HpCDD	ND						0.92		
13C-1,2,3,4,6,7,8-HpCDD	66.12	8453440	7925410	51.34	51.34		0.94	1.07	
OCDD	ND						0.98		
13C-OCDD	69.20	4916870	5593280	44.99	44.99		0.69	0.88	
OCDF	ND						1.30		

TABLE C.5 continued

c. Sample 73-S

Deployment 3	010210 Run	SAMPLE 5	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.86		DPE
13C-2,3,7,8-TCDF	36.34	91927700	115867000	66.28	66.28		1.32	0.79	
IS-13C-1,2,3,4-TCDD	38.04	102955000	134002000					0.77	
2,3,7,8-TCDD	ND						0.97		
13C-2,3,7,8-TCDD	38.43	69389500	90758300	62.72	62.72		1.08	0.76	
37Cl-TCDD	38.46	58885000		25.00	50.00		2.29		
1,2,3,7,8-PeCDF	ND						0.91		
2,3,4,7,8-PeCDF	ND						0.99		
13C-1,2,3,7,8-PeCDF	51.07	90231200	56119000	54.46	54.46		1.13	1.61	
13C-2,3,4,7,8-PeCDF	54.22	102572000	62167300	60.40	60.40		1.15	1.65	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	55.32	75628100	43762700	52.40	52.40		0.96	1.73	
1,2,3,4,7,8-HxCDF	60.37	126797	97722.1	0.14		0.15	1.25	1.30	DPE, B
1,2,3,6,7,8-HxCDF	60.47	114504	105664	0.13		0.13	1.19	1.08	DPE, B
2,3,4,6,7,8-HxCDF	61.45	180119	137978	0.23		0.24	1.13	1.31	DPE, B
1,2,3,7,8,9-HxCDF	62.40	89936.8	81123.5	0.14		0.14	1.19	1.11	DPE, B
13C-1,2,3,4,7,8-HxCDF	60.35	43210700	83122900	73.68	73.68		1.09	0.52	
13C-1,2,3,6,7,8-HxCDF	60.45	49927500	94431900	77.81	77.81		1.18	0.53	
13C-2,3,4,6,7,8-HxCDF	61.43	42116900	80225800	70.96	70.96		1.10	0.52	
13C-1,2,3,7,8,9-HxCDF	62.39	36222100	69734200	68.93	68.93		0.98	0.52	
1,2,3,4,7,8-HxCDD	ND						1.12		
1,2,3,6,7,8-HxCDD	ND						0.99		
1,2,3,7,8,9-HxCDD	ND						1.05		
13C-1,2,3,4,7,8-HxCDD	61.59	49079000	40016200	63.76	63.76		0.89	1.23	
13C-1,2,3,6,7,8-HxCDD	62.07	70873200	57121400	81.60	81.60		1.00	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	62.29	86441400	70583800					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.40		
1,2,3,4,7,8,9-HpCDF	66.31	103128	96441	0.18		0.19	1.40	1.07	DPE, B
13C-1,2,3,4,6,7,8-HpCDF	64.55	28366700	64882400	70.76	70.76		0.84	0.44	
13C-1,2,3,4,7,8,9-HpCDF	66.29	23691600	54196200	61.77	61.77		0.80	0.44	
1,2,3,4,6,7,8-HpCDD	66.10	151255	150880	0.32		0.34	0.92	1.00	B
13C-1,2,3,4,6,7,8-HpCDD	66.09	52387000	49223400	68.81	68.81		0.94	1.06	
OCDD	69.18	739138	860663	1.90		1.99	0.98	0.86	B
13C-OCDD	69.17	80751700	90382700	158.28	79.14		0.69	0.89	
OCDF	ND						1.30		

TABLE C.5 continued

d. Sample 74-S

Deployment 3	010211 Run	SAMPLE 6	Field Blank	Site 12: Fairfield, ME					
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.37	149069	179058	0.11		0.11	0.89	0.83	DPE, B
13C-2,3,7,8-TCDF	36.34	151376000	189847000	75.44	75.44		1.44	0.80	
IS-13C-1,2,3,4-TCDD	38.03	138616000	175649000					0.79	
2,3,7,8-TCDD	ND						0.98		
13C-2,3,7,8-TCDD	38.43	112687000	146403000	76.73	76.73		1.07	0.77	
37Cl-TCDD	38.45	84946800		26.46	52.92		2.32		
1,2,3,7,8-PeCDF	ND						0.97		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	51.06	157641000	90185200	66.11	66.11		1.19	1.75	
13C-2,3,4,7,8-PeCDF	54.20	151254000	86972500	55.11	55.11		1.38	1.74	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	55.31	114701000	77553600	55.18	55.18		1.11	1.48	
1,2,3,4,7,8-HxCDF	60.37	157810	136735	0.11		0.12	1.27	1.15	DPE, B
1,2,3,6,7,8-HxCDF	60.47	122343	109580	0.09		0.09	1.27	1.12	DPE, B
2,3,4,6,7,8-HxCDF	61.44	230299	186743	0.17		0.18	1.16	1.23	DPE, B
1,2,3,7,8,9-HxCDF	62.39	163288	131258	0.11		0.12	1.28	1.24	DPE, B
13C-1,2,3,4,7,8-HxCDF	60.34	70285200	136485000	70.40	70.40		1.10	0.51	
13C-1,2,3,6,7,8-HxCDF	60.45	73306800	139575000	67.88	67.88		1.18	0.53	
13C-2,3,4,6,7,8-HxCDF	61.42	71686300	138622000	72.22	72.22		1.09	0.52	
13C-1,2,3,7,8,9-HxCDF	62.38	70675800	134920000	81.01	81.01		0.95	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	ND						0.96		
1,2,3,7,8,9-HxCDD	62.30	127057	111925	0.13		0.13	1.01	1.14	B
13C-1,2,3,4,7,8-HxCDD	61.59	99584600	78196900	74.21	74.21		0.90	1.27	
13C-1,2,3,6,7,8-HxCDD	62.07	110307000	84031100	69.62	69.62		1.05	1.31	
IS-13C-1,2,3,7,8,9-HxCDD	62.29	150357000	115766000					1.30	
1,2,3,4,6,7,8-HpCDF	ND						1.48		
1,2,3,4,7,8,9-HpCDF	ND						1.44		
13C-1,2,3,4,6,7,8-HpCDF	64.54	55112800	122950000	77.57	77.57		0.86	0.45	
13C-1,2,3,4,7,8,9-HpCDF	66.29	49471300	113215000	83.18	83.18		0.73	0.44	
1,2,3,4,6,7,8-HpCDD	ND						0.94		
13C-1,2,3,4,6,7,8-HpCDD	66.09	110180000	106106000	90.02	90.02		0.90	1.04	
OCDD	69.17	376458	393190	0.57		0.60	1.01	0.96	B
13C-OCDD	69.16	124987000	140584000	152.53	76.27		0.65	0.89	
OCDF	69.22	114428	150596	0.15		0.15	1.35	0.76	DPE, B

TABLE C.5 continued

e. Sample 75-S

Deployment 3	010211 Run	SAMPLE 12	Matrix Spike						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	36.35	12138100	14888700	25.37	63.43	26.54	0.89	0.82	
13C-2,3,7,8-TCDF	36.33	54442100	65632800	89.67	89.67		1.44	0.83	
IS-13C-1,2,3,4-TCDD	38.02	41146900	51893600					0.79	
2,3,7,8-TCDD	38.44	9367290	12096700	25.60	64.01	26.79	0.98	0.77	
13C-2,3,7,8-TCDD	38.42	37929700	47965700	85.92	85.92		1.07	0.79	
37Cl-TCDD	38.44	26929500		28.26	56.51		2.32		
1,2,3,7,8-PeCDF	51.11	66565200	40203900	122.02	61.01	127.66	0.97	1.66	
2,3,4,7,8-PeCDF	54.24	69498400	41555700	120.18	60.09	125.73	1.04	1.67	
13C-1,2,3,7,8-PeCDF	51.09	57944800	32482300	81.48	81.48		1.19	1.78	
13C-2,3,4,7,8-PeCDF	54.21	56531800	32664200	69.70	69.70		1.38	1.73	
1,2,3,7,8-PeCDD	55.35	49755100	29323800	129.15	64.58	135.13	0.95	1.70	
13C-1,2,3,7,8-PeCDD	55.32	40424200	24265300	62.71	62.71		1.11	1.67	
1,2,3,4,7,8-HxCDF	60.37	71326500	55018200	118.06	59.03	123.52	1.27	1.30	
1,2,3,6,7,8-HxCDF	60.47	77187300	59503600	123.31	61.66	129.02	1.27	1.30	
2,3,4,6,7,8-HxCDF	61.44	72493400	56717200	130.28	65.14	136.30	1.16	1.28	
1,2,3,7,8,9-HxCDF	62.40	71022700	53782400	118.59	59.30	124.07	1.28	1.32	
13C-1,2,3,4,7,8-HxCDF	60.35	28340100	55989200	85.62	85.62		1.10	0.51	
13C-1,2,3,6,7,8-HxCDF	60.46	29459400	57515200	82.71	82.71		1.18	0.51	
13C-2,3,4,6,7,8-HxCDF	61.43	28678700	56546100	87.28	87.28		1.09	0.51	
13C-1,2,3,7,8,9-HxCDF	62.38	27787600	54480000	96.67	96.67		0.95	0.51	
1,2,3,4,7,8-HxCDD	62.01	48090200	37701100	120.00	60.00	125.55	1.08	1.28	
1,2,3,6,7,8-HxCDD	62.09	49517600	39034500	122.72	61.36	128.40	0.96	1.27	
1,2,3,7,8,9-HxCDD	62.31	54178600	43089500	135.81	67.90	142.09	1.01	1.26	
13C-1,2,3,4,7,8-HxCDD	62.00	37988700	28201700	82.39	82.39		0.90	1.35	
13C-1,2,3,6,7,8-HxCDD	62.08	42545600	32642600	80.33	80.33		1.05	1.30	
IS-13C-1,2,3,7,8,9-HxCDD	62.30	51020800	38220500					1.33	
1,2,3,4,6,7,8-HpCDF	64.55	67577400	62515900	120.17	60.08	125.72	1.48	1.08	
1,2,3,4,7,8,9-HpCDF	66.31	59815200	55796000	119.40	59.70	124.92	1.44	1.07	
13C-1,2,3,4,6,7,8-HpCDF	64.54	22622700	50687300	95.23	95.23		0.86	0.45	
13C-1,2,3,4,7,8,9-HpCDF	66.30	20471800	46844400	102.63	102.63		0.73	0.44	
1,2,3,4,6,7,8-HpCDD	66.10	50889400	49414000	121.73	60.87	127.36	0.94	1.03	
13C-1,2,3,4,6,7,8-HpCDD	66.09	45393100	42222200	108.75	108.75		0.90	1.08	
OCDD	69.18	75522100	87366200	238.96	59.74	250.01	1.01	0.86	
13C-OCDD	69.17	63742700	70684400	230.24	115.12		0.65	0.90	
OCDF	69.22	84339600	92233900	194.79	48.70	203.79	1.35	0.91	

TABLE C.5 continued

f. Sample 81-S

Deployment 3 Congener	010211 Run Retention Time	SAMPLE 5 M ion area	Process Blank M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.89		
13C-2,3,7,8-TCDF	36.18	84293600	103828000	65.34	65.34		1.44	0.81	
IS-13C-1,2,3,4-TCDD	37.49	87300700	112721000					0.77	
2,3,7,8-TCDD	ND						0.98		
13C-2,3,7,8-TCDD	38.26	60096700	77606800	64.07	64.07		1.07	0.77	
37Cl-TCDD	38.29	58227800		28.80	57.59		2.32		
1,2,3,7,8-PeCDF	ND						0.97		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	50.44	90895300	54282800	60.85	60.85		1.19	1.67	
13C-2,3,4,7,8-PeCDF	54.09	106222000	64044200	61.89	61.89		1.38	1.66	
1,2,3,7,8-PeCDD	ND						0.95		
13C-1,2,3,7,8-PeCDD	55.20	74537700	43542100	53.25	53.25		1.11	1.71	
1,2,3,4,7,8-HxCDF	60.30	117640	95008.4	0.12		0.12	1.27	1.24	DPE,B
1,2,3,6,7,8-HxCDF	60.40	111622	96563	0.10		0.11	1.27	1.16	DPE,B
2,3,4,6,7,8-HxCDF	61.38	162329	113871	0.17		0.18	1.16	1.43	DPE,B
1,2,3,7,8,9-HxCDF	ND						1.28		
13C-1,2,3,4,7,8-HxCDF	60.28	50729800	93838900	74.84	74.84		1.10	0.54	
13C-1,2,3,6,7,8-HxCDF	60.38	53363400	105956000	77.25	77.25		1.18	0.50	
13C-2,3,4,6,7,8-HxCDF	61.36	47986700	93072800	73.65	73.65		1.09	0.52	
13C-1,2,3,7,8,9-HxCDF	62.32	44208000	84578900	77.16	77.16		0.95	0.52	
1,2,3,4,7,8-HxCDD	ND						1.08		
1,2,3,6,7,8-HxCDD	62.02	73952.2	52832.8	0.10		0.11	0.96	1.40	B
1,2,3,7,8,9-HxCDD	62.25	67582.8	60194.7	0.11		0.11	1.01	1.12	B
13C-1,2,3,4,7,8-HxCDD	61.53	60553700	47416200	68.52	68.52		0.90	1.28	
13C-1,2,3,6,7,8-HxCDD	62.00	72443000	56680300	70.33	70.33		1.05	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	62.24	98289100	76741800					1.28	
1,2,3,4,6,7,8-HpCDF	ND						1.48		
1,2,3,4,7,8,9-HpCDF	66.25	86362.4	83576.5	0.12		0.13	1.44	1.03	DPE,B
13C-1,2,3,4,6,7,8-HpCDF	64.49	34247700	75518100	72.70	72.70		0.86	0.45	
13C-1,2,3,4,7,8,9-HpCDF	66.24	29124100	67864200	75.39	75.39		0.73	0.43	
1,2,3,4,6,7,8-HpCDD	66.04	103331	90837.2	0.17		0.18	0.94	1.14	B
13C-1,2,3,4,6,7,8-HpCDD	66.04	61098300	58082100	75.42	75.42		0.90	1.05	
OCDD	69.12	354585	463697	0.78		0.82	1.01	0.76	B
13C-OCDD	69.11	97318500	108823000	180.02	90.01		0.65	0.89	
OCDF	69.16	118985	130574	0.18		0.19	1.35	0.91	DPE,B

TABLE C.6. SPMD Raw Data Calculation Spreadsheets for Deployment Four Quality Control Samples

a. Sample 82-S

Deployment 4	010222 Run	SAMPLE 3	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.92		
13C-2,3,7,8-TCDF	36.47	138098000	174459000	97.77	97.77		1.43	0.79	
IS-13C-1,2,3,4-TCDD	38.11	98395800	125065000					0.79	
2,3,7,8-TCDD	ND						1.01		
13C-2,3,7,8-TCDD	38.56	108947000	142945000	110.36	110.36		1.02	0.76	
37Cl-TCDD	38.58	97886900		41.25	82.49		2.41		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	51.26	200420000	124758000	125.89	125.89		1.16	1.61	
13C-2,3,4,7,8-PeCDF	54.36	159820000	99335100	97.88	97.88		1.18	1.61	
1,2,3,7,8-PeCDD	ND						0.97		
13C-1,2,3,7,8-PeCDD	*55.41&55.56	136085000	89945500	124.47	124.47		0.81	1.51	C
1,2,3,4,7,8-HxCDF	ND						1.20		
1,2,3,6,7,8-HxCDF	ND						1.27		
2,3,4,6,7,8-HxCDF	ND						1.15		
1,2,3,7,8,9-HxCDF	ND						0.82		
13C-1,2,3,4,7,8-HxCDF	60.42	72136100	132275000	123.72	123.72		1.03	0.55	
13C-1,2,3,6,7,8-HxCDF	60.50	59292900	125859000	90.36	90.36		1.27	0.47	
13C-2,3,4,6,7,8-HxCDF	61.49	58779000	117164000	98.68	98.68		1.11	0.50	
13C-1,2,3,7,8,9-HxCDF	62.44	53427100	105424000	101.46	101.46		0.97	0.51	
1,2,3,4,7,8-HxCDD	ND						1.10		
1,2,3,6,7,8-HxCDD	ND						0.99		
1,2,3,7,8,9-HxCDD	ND						1.04		
13C-1,2,3,4,7,8-HxCDD	62.05	91363900	64055700	141.23	141.23		0.68	1.43	
13C-1,2,3,6,7,8-HxCDD	62.10	91599300	80285000	89.57	89.57		1.19	1.14	
IS-13C-1,2,3,7,8,9-HxCDD	62.35	89622000	71412500					1.25	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.42		
13C-1,2,3,4,6,7,8-HpCDF	64.59	29326600	67432400	76.02	76.02		0.79	0.43	
13C-1,2,3,4,7,8,9-HpCDF	66.34	22348500	51577500	81.46	81.46		0.56	0.43	
1,2,3,4,6,7,8-HpCDD	ND						0.96		
13C-1,2,3,4,6,7,8-HpCDD	66.11	60590000	57623700	106.86	106.86		0.69	1.05	
OCDD	ND						1.10		
13C-OCDD	69.22	80140200	90081800	178.47	89.24		0.59	0.89	
OCDF	ND						1.19		

TABLE C.6 continued

b. Sample 88-S

Deployment 4	010228-1- Run	SAMPLE 2	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.90		
13C-2,3,7,8-TCDF	36.33	238442000	300252000	96.77	96.77		1.49	0.79	
IS-13C-1,2,3,4-TCDD	37.54	166285000	206479000					0.81	
2,3,7,8-TCDD	ND						0.71		
13C-2,3,7,8-TCDD	38.42	178094000	224182000	105.68	105.68		1.02	0.79	
37Cl-TCDD	38.44	157899000		42.53	85.06		2.23		
1,2,3,7,8-PeCDF	ND						0.95		
2,3,4,7,8-PeCDF	ND						1.04		
13C-1,2,3,7,8-PeCDF	51.22	291976000	177505000	107.53	107.53		1.17	1.64	
13C-2,3,4,7,8-PeCDF	54.33	314687000	194137000	92.14	92.14		1.48	1.62	
1,2,3,7,8-PeCDD	ND						0.99		
13C-1,2,3,7,8-PeCDD	*55.39&55.45	233472000	161747000	89.07	89.07		1.19	1.44	C
1,2,3,4,7,8-HxCDF	ND						1.24		
1,2,3,6,7,8-HxCDF	ND						1.32		
2,3,4,6,7,8-HxCDF	ND						1.19		
1,2,3,7,8,9-HxCDF	ND						2.56		
13C-1,2,3,4,7,8-HxCDF	60.43	90712800	178549000	97.57	97.57		0.91	0.51	
13C-1,2,3,6,7,8-HxCDF	60.52	168388000	322362000	101.92	101.92		1.58	0.52	
13C-2,3,4,6,7,8-HxCDF	61.51	108459000	212119000	92.18	92.18		1.14	0.51	
13C-1,2,3,7,8,9-HxCDF	62.46	113810000	219846000	114.30	114.30		0.96	0.52	
1,2,3,4,7,8-HxCDD	ND						0.94		
1,2,3,6,7,8-HxCDD	ND						1.11		
1,2,3,7,8,9-HxCDD	ND						1.05		
13C-1,2,3,4,7,8-HxCDD	?	139499000	105760000	131.79	131.79		0.61	1.32	
13C-1,2,3,6,7,8-HxCDD	62.12	208650000	162634000	97.94	97.94		1.25	1.28	
IS-13C-1,2,3,7,8,9-HxCDD	62.36	171427000	132647000					1.29	
1,2,3,4,6,7,8-HpCDF	ND						1.50		
1,2,3,4,7,8,9-HpCDF	ND						1.48		
13C-1,2,3,4,6,7,8-HpCDF	65.03	69104400	154934000	98.47	98.47		0.75	0.45	
13C-1,2,3,4,7,8,9-HpCDF	66.37	52245700	120862000	98.09	98.09		0.58	0.43	
1,2,3,4,6,7,8-HpCDD	ND						0.98		
13C-1,2,3,4,6,7,8-HpCDD	66.16	111071000	105462000	99.93	99.93		0.71	1.05	
OCDD	69.28	779391	896209	2.53		2.65	1.10	0.87	B
13C-OCDD	69.27	57598200	62487200	74.15	37.07		0.53	0.92	
OCDF	ND						1.25		

TABLE C.6 continued

c. Sample 89-S

Deployment 4 Congener	010401 Run Retention Time	SAMPLE 11 M ion area	Dialysis Blank M+ ion area	1 SPMD Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.93		
13C-2,3,7,8-TCDF	41.51	209362000	264260000	74.19	74.19		1.40	0.79	
IS-13C-1,2,3,4-TCDD	43.42	198115000	258605000					0.77	
2,3,7,8-TCDD	ND						1.05		
13C-2,3,7,8-TCDD	44.31	156998000	206547000	77.43	77.43		1.03	0.76	
37Cl-TCDD	44.34	201395000		43.21	86.41		2.35		
1,2,3,7,8-PeCDF	ND			0.00			0.94		
2,3,4,7,8-PeCDF	58.02	645198	410907	0.25		0.52	1.00	1.57	DPE, B
13C-1,2,3,7,8-PeCDF	56.13	279993000	175433000	67.13	67.13		1.49	1.60	
13C-2,3,4,7,8-PeCDF	57.59	261293000	164443000	64.26	64.26		1.45	1.59	
1,2,3,7,8-PeCDD	ND						0.93		
13C-1,2,3,7,8-PeCDD	58.49	212037000	142422000	68.27	68.27		1.14	1.49	
1,2,3,4,7,8-HxCDF	ND						1.27		
1,2,3,6,7,8-HxCDF	ND						1.25		
2,3,4,6,7,8-HxCDF	63.50	1969030	1544220	0.95		2.00	1.18	1.28	DPE, B
1,2,3,7,8,9-HxCDF	ND						1.31		
13C-1,2,3,4,7,8-HxCDF	62.53	111777000	206589000	40.39	40.39		2.03	0.54	
13C-1,2,3,6,7,8-HxCDF	63.02	94512600	172868000	36.52	36.52		1.89	0.55	
13C-2,3,4,6,7,8-HxCDF	63.49	110922000	202623000	49.96	49.96		1.62	0.55	
13C-1,2,3,7,8,9-HxCDF	64.42	89661000	165585000	73.11	73.11		0.90	0.54	
1,2,3,4,7,8-HxCDD	ND						1.13		
1,2,3,6,7,8-HxCDD	ND						0.95		
1,2,3,7,8,9-HxCDD	ND						1.00		
13C-1,2,3,4,7,8-HxCDD	64.05	134960000	109071000	52.74	52.74		1.19	1.24	
13C-1,2,3,6,7,8-HxCDD	64.12	162190000	130995000	64.32	64.32		1.18	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	64.32	212253000	175583000					1.21	
1,2,3,4,6,7,8-HpCDF	ND						1.41		
1,2,3,4,7,8,9-HpCDF	ND						1.38		
13C-1,2,3,4,6,7,8-HpCDF	66.47	54409600	117467000	107.54	107.54		0.41	0.46	
13C-1,2,3,4,7,8,9-HpCDF	68.19	47257400	105296000	21.40	21.40		1.84	0.45	S
1,2,3,4,6,7,8-HpCDD	67.57	251505	237209	0.27		0.56	0.92	1.06	B
13C-1,2,3,4,6,7,8-HpCDD	67.56	101022000	97585400	21.73	21.73		2.36	1.04	S
OCDD	71.25	1204490	1243770	1.72		3.60	0.97	0.97	B
13C-OCDD	71.25	137274000	157455000	29.40	14.70		2.58	0.87	S
OCDF	ND						1.06		

TABLE C.6 continued

d. Sample 95-S

Deployment 4	010327-1 Run	SAMPLE 3	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						1.04		
13C-2,3,7,8-TCDF	39.54	133794000	168197000	53.22	53.22		2.43	0.80	
IS-13C-1,2,3,4-TCDD	41.36	102871000	130192000					0.79	
2,3,7,8-TCDD	ND						1.19		
13C-2,3,7,8-TCDD	42.18	100086000	126110000	44.46	44.46		2.18	0.79	
37Cl-TCDD	42.21	95833900		38.65	77.30		2.41		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	54.51	188679000	123714000	41.13	41.13		3.26	1.53	
13C-2,3,4,7,8-PeCDF	56.56	194239000	124675000	40.81	40.81		3.35	1.56	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	57.47	154580000	157468000	46.92	46.92		2.85	0.98	C
1,2,3,4,7,8-HxCDF	ND						1.27		
1,2,3,6,7,8-HxCDF	ND						1.29		
2,3,4,6,7,8-HxCDF	ND						1.19		
1,2,3,7,8,9-HxCDF	ND						1.06		
13C-1,2,3,4,7,8-HxCDF	62.06	89563500	171341000	113.43	113.43		0.96	0.52	
13C-1,2,3,6,7,8-HxCDF	62.15	110617000	205806000	107.99	107.99		1.22	0.54	
13C-2,3,4,6,7,8-HxCDF	63.07	96910200	184891000	110.56	110.56		1.06	0.52	
13C-1,2,3,7,8,9-HxCDF	64.01	86769000	161731000	109.72	109.72		0.94	0.54	
1,2,3,4,7,8-HxCDD	ND						1.15		
1,2,3,6,7,8-HxCDD	ND						1.03		
1,2,3,7,8,9-HxCDD	ND						1.07		
13C-1,2,3,4,7,8-HxCDD	63.21	98496300	79173800	103.72	103.72		0.71	1.24	
13C-1,2,3,6,7,8-HxCDD	63.26	160327000	127034000	111.94	111.94		1.07	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	63.50	133080000	107284000					1.24	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.46		
13C-1,2,3,4,6,7,8-HpCDF	66.06	67381500	146418000	96.30	96.30		0.92	0.46	
13C-1,2,3,4,7,8,9-HpCDF	67.39	58099200	131098000	89.95	89.95		0.88	0.44	
1,2,3,4,6,7,8-HpCDD	ND						0.99		
13C-1,2,3,4,6,7,8-HpCDD	67.17	115621000	110546000	89.03	89.03		1.06	1.05	
OCDD	ND						1.06		
13C-OCDD	70.35	182430000	205418000	178.83	89.42		0.90	0.89	
OCDF	ND						1.15		

TABLE C.6 continued

e. Sample 96-S

Deployment 4	010327-1 Run	SAMPLE 5	Field Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						1.04		
13C-2,3,7,8-TCDF	41.10	99999400	123355000	58.23	58.23		2.43	0.81	
IS-13C-1,2,3,4-TCDD	42.46	69467900	88077500					0.79	
2,3,7,8-TCDD	ND						1.19		
13C-2,3,7,8-TCDD	43.39	67808300	88152800	45.35	45.35		2.18	0.77	
37Cl-TCDD	43.41	66373400		39.64	79.28		2.41		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	55.41	115222000	74582200	36.96	36.96		3.26	1.54	
13C-2,3,4,7,8-PeCDF	57.38	106549000	69064500	33.25	33.25		3.35	1.54	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	58.24	70096600	71438000	31.48	31.48		2.85	0.98	C
1,2,3,4,7,8-HxCDF	ND						1.27		
1,2,3,6,7,8-HxCDF	ND						1.29		
2,3,4,6,7,8-HxCDF	ND						1.19		
1,2,3,7,8,9-HxCDF	ND						1.06		
13C-1,2,3,4,7,8-HxCDF	62.31	35569900	67313500	97.33	97.33		0.96	0.53	
13C-1,2,3,6,7,8-HxCDF	62.39	30821900	57668300	65.71	65.71		1.22	0.53	
13C-2,3,4,6,7,8-HxCDF	63.30	55734800	104300000	136.63	136.63		1.06	0.53	
13C-1,2,3,7,8,9-HxCDF	64.23	44300400	82682200	122.01	122.01		0.94	0.54	
1,2,3,4,7,8-HxCDD	ND						1.15		
1,2,3,6,7,8-HxCDD	ND						1.03		
1,2,3,7,8,9-HxCDD	ND						1.07		
13C-1,2,3,4,7,8-HxCDD	63.44	68435500	56862200	159.16	159.16		0.71	1.20	S
13C-1,2,3,6,7,8-HxCDD	63.49	76886700	61947400	117.68	117.68		1.07	1.24	
IS-13C-1,2,3,7,8,9-HxCDD	64.11	60650600	49811400					1.22	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.46		
13C-1,2,3,4,6,7,8-HpCDF	66.29	28387700	60952700	87.56	87.56		0.92	0.47	
13C-1,2,3,4,7,8,9-HpCDF	67.59	23544700	51224700	77.35	77.35		0.88	0.46	
1,2,3,4,6,7,8-HpCDD	ND						0.99		
13C-1,2,3,4,6,7,8-HpCDD	67.36	56380800	53137700	93.82	93.82		1.06	1.06	
OCDD	ND						1.06		
13C-OCDD	70.58	61285900	68380200	130.10	65.05		0.90	0.90	
OCDF	ND						1.15		

TABLE C.6 continued

f. Sample 102-S

Deployment 4	010327-1 Run	SAMPLE 4	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						1.04		
13C-2,3,7,8-TCDF	40.15	151728000	192375000	50.04	50.04		2.43	0.79	
IS-13C-1,2,3,4-TCDD	41.55	126152000	156262000					0.81	
2,3,7,8-TCDD	ND						1.19		
13C-2,3,7,8-TCDD	42.41	113171000	149898000	42.67	42.67		2.18	0.75	
37Cl-TCDD	42.42	97385000		32.03	64.05		2.41		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	ND						1.02		
13C-1,2,3,7,8-PeCDF	55.08	230476000	150482000	41.39	41.39		3.26	1.53	
13C-2,3,4,7,8-PeCDF	57.11	243371000	159734000	42.57	42.57		3.35	1.52	
1,2,3,7,8-PeCDD	ND						1.02		
13C-1,2,3,7,8-PeCDD	58.00	187116000	193653000	47.25	47.25		2.85	0.97	C
1,2,3,4,7,8-HxCDF	ND						1.27		
1,2,3,6,7,8-HxCDF	ND						1.29		
2,3,4,6,7,8-HxCDF	ND						1.19		
1,2,3,7,8,9-HxCDF	ND						1.06		
13C-1,2,3,4,7,8-HxCDF	62.15	117003000	228619000	135.89	135.89		0.96	0.51	
13C-1,2,3,6,7,8-HxCDF	62.24	119133000	222716000	105.50	105.50		1.22	0.53	
13C-2,3,4,6,7,8-HxCDF	63.16	118252000	223774000	121.35	121.35		1.06	0.53	
13C-1,2,3,7,8,9-HxCDF	64.09	103428000	195797000	119.48	119.48		0.94	0.53	
1,2,3,4,7,8-HxCDD	ND						1.15		
1,2,3,6,7,8-HxCDD	ND						1.03		
1,2,3,7,8,9-HxCDD	ND						1.07		
13C-1,2,3,4,7,8-HxCDD	63.30	138340000	110916000	131.58	131.58		0.71	1.25	
13C-1,2,3,6,7,8-HxCDD	63.35	170648000	136131000	108.06	108.06		1.07	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	63.58	147429000	118373000					1.25	
1,2,3,4,6,7,8-HpCDF	ND						1.44		
1,2,3,4,7,8,9-HpCDF	ND						1.46		
13C-1,2,3,4,6,7,8-HpCDF	66.14	81111700	179462000	106.14	106.14		0.92	0.45	
13C-1,2,3,4,7,8,9-HpCDF	67.47	67667900	150357000	93.74	93.74		0.88	0.45	
1,2,3,4,6,7,8-HpCDD	ND						0.99		
13C-1,2,3,4,6,7,8-HpCDD	67.24	142398000	138450000	99.98	99.98		1.06	1.03	
OCDD	70.46	541371	649088	0.88		0.92	1.06	0.83	B
13C-OCDD	70.44	118953000	134510000	105.68	52.84		0.90	0.88	
OCDF	ND						1.15		

TABLE C.6 continued

g. Sample 103-S

Deployment 4	010401 Run	SAMPLE 5	Matrix Spike	2 SPMDs					
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	42.38	137916000	177351000	22.72	56.80	23.77	0.93	0.78	
13C-2,3,7,8-TCDF	42.35	664543000	826287000	87.93	87.93		1.40	0.80	
IS-13C-1,2,3,4-TCDD	44.25	528692000	684345000					0.77	
2,3,7,8-TCDD	45.20	119946000	150140000	22.03	55.09	23.05	1.05	0.80	
13C-2,3,7,8-TCDD	45.16	504923000	665493000	93.85	93.85		1.03	0.76	
37Cl-TCDD	45.20	488747000		39.29	78.58		2.35		
1,2,3,7,8-PeCDF	56.41	784216000	494479000	111.60	55.80	116.76	0.94	1.59	
2,3,4,7,8-PeCDF	58.24	615797000	389891000	111.73	55.87	116.90	1.00	1.58	
13C-1,2,3,7,8-PeCDF	56.39	753105000	466247000	67.67	67.67		1.49	1.62	
13C-2,3,4,7,8-PeCDF	58.23	553453000	342729000	50.93	50.93		1.45	1.61	
1,2,3,7,8-PeCDD	59.12	380701000	279417000	106.60	53.30	111.53	0.93	1.36	C
13C-1,2,3,7,8-PeCDD	59.10	377577000	285264000	48.07	48.07		1.14	1.32	C
1,2,3,4,7,8-HxCDF	63.08	283539000	221552000	106.23	53.12	111.14	1.27	1.28	
1,2,3,6,7,8-HxCDF	63.17	178851000	137963000	109.05	54.52	114.09	1.25	1.30	
2,3,4,6,7,8-HxCDF	64.03	213207000	167950000	111.76	55.88	116.92	1.18	1.27	
1,2,3,7,8,9-HxCDF	64.55	145624000	112694000	104.00	52.00	108.81	1.31	1.29	
13C-1,2,3,4,7,8-HxCDF	63.07	129703000	244260000	71.93	71.93		2.03	0.53	
13C-1,2,3,6,7,8-HxCDF	63.15	81831600	151443000	48.31	48.31		1.89	0.54	
13C-2,3,4,6,7,8-HxCDF	64.02	101245000	188994000	70.12	70.12		1.62	0.54	
13C-1,2,3,7,8,9-HxCDF	64.54	66437600	123442000	82.46	82.46		0.90	0.54	
1,2,3,4,7,8-HxCDD	64.18	151569000	122475000	103.61	51.80	108.40	1.13	1.24	
1,2,3,6,7,8-HxCDD	64.25	127984000	102940000	108.19	54.09	113.19	0.95	1.24	
1,2,3,7,8,9-HxCDD	64.45	144855000	115974000	113.59	56.79	118.84	1.00	1.25	
13C-1,2,3,4,7,8-HxCDD	64.17	129474000	104991000	76.84	76.84		1.19	1.23	
13C-1,2,3,6,7,8-HxCDD	64.24	125166000	100324000	75.01	75.01		1.18	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	64.44	139759000	116023000					1.20	
1,2,3,4,6,7,8-HpCDF	66.57	73927200	71416000	119.72	59.86	125.26	1.41	1.04	
1,2,3,4,7,8,9-HpCDF	68.28	237076000	224123000	113.81	56.91	119.07	1.38	1.06	
13C-1,2,3,4,6,7,8-HpCDF	66.56	25707300	60444400	81.74	81.74		0.41	0.43	
13C-1,2,3,4,7,8,9-HpCDF	68.27	91747000	201380000	62.35	62.35		1.84	0.46	
1,2,3,4,6,7,8-HpCDD	68.05	185422000	181735000	114.13	57.07	119.41	0.92	1.02	
13C-1,2,3,4,6,7,8-HpCDD	68.04	177101000	171583000	57.84	57.84		2.36	1.03	
OCDD	71.35	322996000	374750000	222.92	55.73	233.23	0.97	0.86	
13C-OCDD	71.35	299155000	349443000	98.11	49.06		2.58	0.86	
OCDF	71.42	409755000	451595000	250.71	62.68	262.31	1.06	0.91	

TABLE C.6 continued

h. Sample 109-S

Deployment 4	010331 Run	SAMPLE 3	Process Blank						
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	ND						0.96		
13C-2,3,7,8-TCDF	41.14	64861800	80460000	89.25	89.25		1.34	0.81	
IS-13C-1,2,3,4-TCDD	43.07	54140800	67444500					0.80	
2,3,7,8-TCDD	ND						1.08		
13C-2,3,7,8-TCDD	43.51	51022900	65367000	94.26	94.26		1.02	0.78	
37Cl-TCDD	43.54	40352200		29.65	59.30		2.51		
1,2,3,7,8-PeCDF	ND						0.94		
2,3,4,7,8-PeCDF	ND						1.00		
13C-1,2,3,7,8-PeCDF	55.46	100346000	61272700	71.48	71.48		1.86	1.64	
13C-2,3,4,7,8-PeCDF	57.37	107675000	65743900	61.07	61.07		2.34	1.64	
1,2,3,7,8-PeCDD	ND						0.88		
13C-1,2,3,7,8-PeCDD	58.28--copeak	98756400	67159700	61.44	61.44		2.22	1.47	
1,2,3,4,7,8-HxCDF	ND						1.23		DPE
1,2,3,6,7,8-HxCDF	62.46	93296.1	76880	0.07		0.07	1.14	1.21	DPE, B
2,3,4,6,7,8-HxCDF	ND						1.12		DPE
1,2,3,7,8,9-HxCDF	ND						1.25		DPE
13C-1,2,3,4,7,8-HxCDF	62.36	73164500	138382000	99.81	99.81		1.09	0.53	
13C-1,2,3,6,7,8-HxCDF	62.45	75839200	142298000	99.22	99.22		1.13	0.53	
13C-2,3,4,6,7,8-HxCDF	63.34	73128900	137359000	101.51	101.51		1.07	0.53	
13C-1,2,3,7,8,9-HxCDF	64.28	66061900	125625000	109.92	109.92		0.90	0.53	
1,2,3,4,7,8-HxCDD	ND						1.07		
1,2,3,6,7,8-HxCDD	ND						0.91		
1,2,3,7,8,9-HxCDD	ND						0.99		
13C-1,2,3,4,7,8-HxCDD	63.49	97680800	78897100	96.03	96.03		0.95	1.24	
13C-1,2,3,6,7,8-HxCDD	63.57	107834000	86227200	105.34	105.34		0.95	1.25	
IS-13C-1,2,3,7,8,9-HxCDD	64.18	106996000	87159700					1.23	
1,2,3,4,6,7,8-HpCDF	ND						1.38		
1,2,3,4,7,8,9-HpCDF	ND						1.32		
13C-1,2,3,4,6,7,8-HpCDF	66.32	39887100	89117400	113.04	113.04		0.59	0.45	
13C-1,2,3,4,7,8,9-HpCDF	68.04	34098500	78053300	120.20	120.20		0.48	0.44	
1,2,3,4,6,7,8-HpCDD	ND						0.97		
13C-1,2,3,4,6,7,8-HpCDD	67.42	78023300	72623400	125.74	125.74		0.62	1.07	
OCDD	71.07	531501	629460	0.76		0.79	1.19	0.84	B
13C-OCDD	71.06	119536000	138533000	218.92	109.46		0.61	0.86	
OCDF	ND						1.16		

TABLE C.7. SPMD Raw Data Calculation Spreadsheets for Method Detection Limit Study Two Samples

a. Sample 110-S

MDL Study Sample	010328 Run	SAMPLE 3							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	40.15	135921	193573	0.85		0.88	0.93	0.70	
13C-2,3,7,8-TCDF	40.15	18817400	23020300	83.48	83.48		1.40	0.82	
IS-13C-1,2,3,4-TCDD	41.52	16052400	19694000					0.82	
2,3,7,8-TCDD	42.41	248901	292391	1.70		1.77	0.86	0.85	
13C-2,3,7,8-TCDD	42.41	17174600	20146100	92.47	92.47		1.13	0.85	
37Cl-TCDD	42.41	13634300		37.04	74.09		2.29		
1,2,3,7,8-PeCDF	55.08	1428470	1009800	5.83		6.10	0.94	1.41	
2,3,4,7,8-PeCDF	57.09	1509160	1032580	8.95		9.37	0.98	1.46	
13C-1,2,3,7,8-PeCDF	55.07	22758600	21758100	89.98	89.98		1.38	1.05	
13C-2,3,4,7,8-PeCDF	57.08	14599200	14313700	59.09	59.09		1.37	1.02	
1,2,3,7,8-PeCDD	58.02	1527480	1343190	7.61		7.96	0.95	1.14	
13C-1,2,3,7,8-PeCDD	57.58	18857000	20784600	96.45	96.45		1.15	0.91	C
1,2,3,4,7,8-HxCDF	62.16	761795	651189	5.42		5.67	1.26	1.17	
1,2,3,6,7,8-HxCDF	62.23	1661970	1282160	6.60		6.91	1.20	1.30	
2,3,4,6,7,8-HxCDF	63.14	1317650	948758	7.58		7.93	1.12	1.39	
1,2,3,7,8,9-HxCDF	64.09	1162620	907244	9.83		10.29	0.88	1.28	
13C-1,2,3,4,7,8-HxCDF	62.13	7725070	12973500	108.12	108.12		0.61	0.60	
13C-1,2,3,6,7,8-HxCDF	62.22	12044500	25177400	87.68	87.68		1.35	0.48	
13C-2,3,4,6,7,8-HxCDF	63.13	9248350	17449500	88.30	88.30		0.96	0.53	
13C-1,2,3,7,8,9-HxCDF	64.09	8395720	15638100	89.13	89.13		0.86	0.54	
1,2,3,4,7,8-HxCDD	63.29	1032530	716328	12.55		13.13	0.96		
1,2,3,6,7,8-HxCDD	63.36	1220810	1069550	6.50		6.80	1.04		
1,2,3,7,8,9-HxCDD	63.59	1467630	1240170	10.94		11.45	1.03		
13C-1,2,3,4,7,8-HxCDD	63.28	7779030	6701540	78.10	78.10		0.59	1.16	
13C-1,2,3,6,7,8-HxCDD	63.34	18621500	15179000	94.71	94.71		1.14	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	63.57	16852700	14506300					1.16	
1,2,3,4,6,7,8-HpCDF	66.16	1202530	860355	6.57		6.87	1.45	1.40	
1,2,3,4,7,8,9-HpCDF	67.50	1120630	942281	7.74		8.10	1.39	1.19	
13C-1,2,3,4,6,7,8-HpCDF	66.13	6811340	14874400	83.71	83.71		0.83	0.46	
13C-1,2,3,4,7,8,9-HpCDF	67.47	5972490	13140600	82.21	82.21		0.74	0.45	
1,2,3,4,6,7,8-HpCDD	67.25	1551110	1672720	13.37		13.99	0.92	0.93	
13C-1,2,3,4,6,7,8-HpCDD	67.24	12719900	13491200	84.27	84.27		0.99	0.94	
OCDD	70.43	1630710	1263700	11.67		12.21	1.09	1.29	
13C-OCDD	70.44	21529800	24163700	160.43	80.22		0.91	0.89	
OCDF	70.51	1680280	1694220	14.72		15.40	1.00	0.99	

TABLE C.7 continued

b. Sample 111-S

MDL Study Sample   010328 Run   SAMPLE 4

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	40.16	77192.8	99342.6	1.73		1.81	0.93	0.78	
13C-2,3,7,8-TCDF	40.16	4938870	6010430	78.31	78.31		1.40	0.82	
IS-13C-1,2,3,4-TCDD	41.51	4526080	5447380					0.83	
2,3,7,8-TCDD	42.36	33591.9	36290.6	0.91		0.96	0.86	0.93	
13C-2,3,7,8-TCDD	42.36	4129170	4808610	79.37	79.37		1.13	0.86	
37Cl-TCDD	42.41	2835250		27.32	54.64		2.29		
1,2,3,7,8-PeCDF	55.07	283922	207790	5.77		6.04	0.94	1.37	
2,3,4,7,8-PeCDF	57.07	291651	214351	6.51		6.81	0.98	1.36	
13C-1,2,3,7,8-PeCDF	55.02	5437530	3622900	65.64	65.64		1.38	1.50	
13C-2,3,4,7,8-PeCDF	57.06	4872400	3048200	58.02	58.02		1.37	1.60	
1,2,3,7,8-PeCDD	58.00	102788	78524.5	4.02		4.21	0.95	1.31	
13C-1,2,3,7,8-PeCDD	57.58	2740040	1995620	41.30	41.30		1.15	1.37	C
1,2,3,4,7,8-HxCDF	62.12	132268	101155	5.32		5.56	1.26	1.31	
1,2,3,6,7,8-HxCDF	62.22	348217	266181	5.68		5.94	1.20	1.31	
2,3,4,6,7,8-HxCDF	63.14	221002	174700	6.10		6.38	1.12	1.27	
1,2,3,7,8,9-HxCDF	64.08	140780	112220	6.21		6.49	0.88	1.25	
13C-1,2,3,4,7,8-HxCDF	62.12	1108750	2378440	85.73	85.73		0.61	0.47	
13C-1,2,3,6,7,8-HxCDF	62.21	3326410	5706160	100.14	100.14		1.35	0.58	
13C-2,3,4,6,7,8-HxCDF	63.13	2008250	3783460	90.16	90.16		0.96	0.53	
13C-1,2,3,7,8,9-HxCDF	64.07	1550750	3102370	81.22	81.22		0.86	0.50	
1,2,3,4,7,8-HxCDD	63.29	302769	245546	17.30		18.10	0.96	1.23	
1,2,3,6,7,8-HxCDD	63.36	283346	255063	7.91		8.27	1.04	1.11	
1,2,3,7,8,9-HxCDD	63.54	172167	159519	6.59		6.89	1.03	1.08	
13C-1,2,3,4,7,8-HxCDD	63.27	1783250	1509910	83.60	83.60		0.59	1.18	
13C-1,2,3,6,7,8-HxCDD	63.32	3310450	3216860	86.08	86.08		1.14	1.03	
IS-13C-1,2,3,7,8,9-HxCDD	63.56	3748310	2914250					1.29	
1,2,3,4,6,7,8-HpCDF	66.13	186432	167931	6.14		6.42	1.45	1.11	
1,2,3,4,7,8,9-HpCDF	67.47	207852	181064	8.08		8.45	1.39	1.15	
13C-1,2,3,4,6,7,8-HpCDF	66.13	1283540	2703690	72.44	72.44		0.83	0.47	
13C-1,2,3,4,7,8,9-HpCDF	67.46	1136140	2317690	69.92	69.92		0.74	0.49	
1,2,3,4,6,7,8-HpCDD	67.25	545198	467167	24.34		25.47	0.92	1.17	
13C-1,2,3,4,6,7,8-HpCDD	67.23	2396320	2124470	68.41	68.41		0.99	1.13	
OCDD	70.46	723594	841620	43.94		45.97	1.09	0.86	
13C-OCDD	70.43	3253260	3309220	108.45	54.22		0.91	0.98	
OCDF	70.54	311068	328622	19.43		20.33	1.00	0.95	

TABLE C.7 continued

c. Sample 112-S

MDL Study Sample	010328 Run	SAMPLE 5							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	40.22	896026	1150510	1.57		1.64	0.93	0.78	
13C-2,3,7,8-TCDF	40.15	61087800	78862200	91.86	91.86		1.40	0.77	
IS-13C-1,2,3,4-TCDD	41.54	47037400	61636700					0.76	
2,3,7,8-TCDD	42.43	752470	848588	1.53		1.61	0.86	0.89	
13C-2,3,7,8-TCDD	42.40	52324400	69710800	99.46	99.46		1.13	0.75	
37Cl-TCDD	42.45	42070200		39.01	78.02		2.29		
1,2,3,7,8-PeCDF	55.08	4627120	2885310	6.24		6.52	0.94	1.60	
2,3,4,7,8-PeCDF	57.10	4233090	3094070	5.98		6.25	0.98	1.37	
13C-1,2,3,7,8-PeCDF	55.08	78085500	50084000	85.22	85.22		1.38	1.56	
13C-2,3,4,7,8-PeCDF	57.09	76113500	48748500	83.94	83.94		1.37	1.56	
1,2,3,7,8-PeCDD	58.03	3084840	2367770	4.94		5.17	0.95	1.30	
13C-1,2,3,7,8-PeCDD	58.00	67829500	48181400	92.85	92.85		1.15	1.41	C
1,2,3,4,7,8-HxCDF	62.16	2927040	2240710	6.58		6.89	1.26	1.31	
1,2,3,6,7,8-HxCDF	62.25	6022480	5263210	5.57		5.83	1.20	1.14	
2,3,4,6,7,8-HxCDF	63.16	4221550	3311770	6.29		6.58	1.12	1.27	
1,2,3,7,8,9-HxCDF	64.12	3908390	2985700	8.09		8.46	0.88	1.31	
13C-1,2,3,4,7,8-HxCDF	62.16	23385400	38994200	85.46	85.46		0.61	0.60	
13C-1,2,3,6,7,8-HxCDF	62.23	55724900	113468000	104.53	104.53		1.35	0.49	
13C-2,3,4,6,7,8-HxCDF	63.15	36962400	69895800	92.70	92.70		0.96	0.53	
13C-1,2,3,7,8,9-HxCDF	64.10	33175200	64155400	94.67	94.67		0.86	0.52	
1,2,3,4,7,8-HxCDD	?	2445380	1637060	7.10		7.43	0.96	1.49	
1,2,3,6,7,8-HxCDD	63.34	4376780	3558870	5.54		5.80	1.04	1.23	
1,2,3,7,8,9-HxCDD	63.59	4520560	3580610	8.02		8.39	1.03	1.26	
13C-1,2,3,4,7,8-HxCDD	?	33767100	25983700	84.52	84.52		0.59	1.30	
13C-1,2,3,6,7,8-HxCDD	63.35	75494200	61817700	100.92	100.92		1.14	1.22	
IS-13C-1,2,3,7,8,9-HxCDD	63.58	65288700	54270000					1.20	
1,2,3,4,6,7,8-HpCDF	66.17	4481120	3985550	6.62		6.92	1.45	1.12	
1,2,3,4,7,8,9-HpCDF	67.51	3732130	3270630	6.87		7.19	1.39	1.14	
13C-1,2,3,4,6,7,8-HpCDF	66.16	27137800	61264400	89.50	89.50		0.83	0.44	
13C-1,2,3,4,7,8,9-HpCDF	67.49	23371200	49773600	82.52	82.52		0.74	0.47	
1,2,3,4,6,7,8-HpCDD	67.27	3345820	3308750	6.48		6.78	0.92	1.01	
13C-1,2,3,4,6,7,8-HpCDD	67.25	56953900	54734900	94.19	94.19		0.99	1.04	
OCDD	70.46	6016600	6299090	12.75		13.33	1.09	0.96	
13C-OCDD	70.45	83760500	94259200	163.94	81.97		0.91	0.89	
OCDF	70.54	5362290	5743770	12.44		13.01	1.00	0.93	

TABLE C.7 continued

d. Sample 113-S

MDL Study Sample	010328 Run	SAMPLE 6							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	40.09	19451.7	27945.1	4.21		4.40	0.93	0.70	
13C-2,3,7,8-TCDF	40.14	543573	666182	46.71	46.71		1.40	0.82	
IS-13C-1,2,3,4-TCDD	41.40	839537	1007780					0.83	C
2,3,7,8-TCDD	42.43	35458.3	39868.9	5.02		5.25	0.86	0.89	C
13C-2,3,7,8-TCDD	42.40	800732	954039	84.13	84.13		1.13	0.84	C
37Cl-TCDD	42.41	906049		47.07	94.14		2.29		
1,2,3,7,8-PeCDF	55.09	60896.9	45489.1	11.63		12.17	0.94	1.34	
2,3,4,7,8-PeCDF	57.10	49731.5	30595.4	9.30		9.73	0.98	1.63	
13C-1,2,3,7,8-PeCDF	55.05	568914	404099	38.06	38.06		1.38	1.41	
13C-2,3,4,7,8-PeCDF	57.08	548076	331815	34.80	34.80		1.37	1.65	
1,2,3,7,8-PeCDD	58.02	85419.7	61853.7	33.45		34.99	0.95	1.38	
13C-1,2,3,7,8-PeCDD	58.02	266736	195747	21.77	21.77		1.15	1.36	S, C
1,2,3,4,7,8-HxCDF	62.17	46526.1	34806.8	6.85		7.17	1.26	1.34	
1,2,3,6,7,8-HxCDF	62.23	60831.7	46865.4	7.08		7.40	1.20	1.30	
2,3,4,6,7,8-HxCDF	63.11	72235.8	61458.5	12.79		13.38	1.12	1.18	
1,2,3,7,8,9-HxCDF	64.10	78102.8	63014	17.65		18.47	0.88	1.24	
13C-1,2,3,4,7,8-HxCDF	62.18	345800	597225	146.60	146.60		0.61	0.58	S
13C-1,2,3,6,7,8-HxCDF	62.23	424595	845823	89.06	89.06		1.35	0.50	
13C-2,3,4,6,7,8-HxCDF	63.14	293988	639023	91.84	91.84		0.96	0.46	
13C-1,2,3,7,8,9-HxCDF	64.09	331417	581256	100.73	100.73		0.86	0.57	
1,2,3,4,7,8-HxCDD	63.29	132897	90219.7	70.65		73.92	0.96	1.47	
1,2,3,6,7,8-HxCDD	63.35	124061	90825	13.43		14.05	1.04	1.37	
1,2,3,7,8,9-HxCDD	63.59	229846	167089	41.58		43.51	1.03	1.38	
13C-1,2,3,4,7,8-HxCDD	?	171406	156693	52.66	52.66		0.59	1.09	
13C-1,2,3,6,7,8-HxCDD	63.33	843277	690770	127.93	127.93		1.14	1.22	
IS-13C-1,2,3,7,8,9-HxCDD	63.58	561020	492676					1.14	
1,2,3,4,6,7,8-HpCDF	66.16	77097.4	67596.6	12.98		13.58	1.45	1.14	
1,2,3,4,7,8,9-HpCDF	67.46	95291.5	84858.7	18.49		19.34	1.39	1.12	
13C-1,2,3,4,6,7,8-HpCDF	66.14	243431	526696	88.47	88.47		0.83	0.46	
13C-1,2,3,4,7,8,9-HpCDF	67.48	264756	434307	89.48	89.48		0.74	0.61	
1,2,3,4,6,7,8-HpCDD	67.23	288315	257281	62.33		65.21	0.92	1.12	
13C-1,2,3,4,6,7,8-HpCDD	67.25	474407	477063	91.04	91.04		0.99	0.99	
OCDD	70.46	241034	240538	68.78		71.96	1.09	1.00	
13C-OCDD	70.48	685451	604500	134.79	67.39		0.91	1.13	
OCDF	70.52	189643	189777	58.63		61.34	1.00	1.00	

TABLE C.7 continued

e. Sample 114-S

MDL Study Sample	010328 Run	SAMPLE 7							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	40.04	41025.7	50833.1	1.32		1.38	0.93	0.81	
13C-2,3,7,8-TCDF	40.04	3415520	4075500	73.14	73.14		1.40	0.84	
IS-13C-1,2,3,4-TCDD	41.41	3344180	3960700					0.84	
2,3,7,8-TCDD	42.38	60853.1	66536.5	2.84		2.97	0.86	0.91	
13C-2,3,7,8-TCDD	42.38	2380890	2863080	63.58	63.58		1.13	0.83	
37Cl-TCDD	42.39	2151050		28.05	56.11		2.29		
1,2,3,7,8-PeCDF	55.00	157887	95575.1	5.88		6.15	0.94	1.65	
2,3,4,7,8-PeCDF	57.02	225361	169068	9.18		9.60	0.98	1.33	
13C-1,2,3,7,8-PeCDF	54.59	2728330	1856520	45.35	45.35		1.38	1.47	
13C-2,3,4,7,8-PeCDF	57.04	2718250	1658620	43.78	43.78		1.37	1.64	
1,2,3,7,8-PeCDD	57.56	297961	228734	19.39		20.29	0.95	1.30	
13C-1,2,3,7,8-PeCDD	57.55	1557750	1295390	33.97	33.97		1.15	1.20	C
1,2,3,4,7,8-HxCDF	62.10	121737	99124.7	11.56		12.09	1.26	1.23	
1,2,3,6,7,8-HxCDF	62.19	348819	258056	10.74		11.24	1.20	1.35	
2,3,4,6,7,8-HxCDF	63.11	249956	187088	14.58		15.26	1.12	1.34	
1,2,3,7,8,9-HxCDF	64.07	169714	148124	16.25		17.00	0.88	1.15	
13C-1,2,3,4,7,8-HxCDF	62.10	551727	966586	83.06	83.06		0.61	0.57	
13C-1,2,3,6,7,8-HxCDF	62.19	1681520	3033600	116.32	116.32		1.35	0.55	
13C-2,3,4,6,7,8-HxCDF	63.11	914656	1760690	92.67	92.67		0.96	0.52	
13C-1,2,3,7,8,9-HxCDF	64.07	783914	1449250	86.73	86.73		0.86	0.54	
1,2,3,4,7,8-HxCDD	63.25	165567	107179	24.23		25.35	0.96	1.54	
1,2,3,6,7,8-HxCDD	63.34	261394	223125	13.42		14.04	1.04	1.17	
1,2,3,7,8,9-HxCDD	63.57	181701	159844	14.39		15.05	1.03	1.14	
13C-1,2,3,4,7,8-HxCDD	63.25	661120	508441	66.06	66.06		0.59	1.30	
13C-1,2,3,6,7,8-HxCDD	63.31	1846810	1614800	101.58	101.58		1.14	1.14	
IS-13C-1,2,3,7,8,9-HxCDD	63.55	1678290	1316020					1.28	
1,2,3,4,6,7,8-HpCDF	66.12	137935	113522	17.15		17.95	1.45	1.22	
1,2,3,4,7,8,9-HpCDF	67.44	84804.9	74062.5	9.67		10.11	1.39	1.15	
13C-1,2,3,4,6,7,8-HpCDF	66.12	304039	708502	40.93	40.93		0.83	0.43	
13C-1,2,3,4,7,8,9-HpCDF	67.45	399124	779869	53.11	53.11		0.74	0.51	
1,2,3,4,6,7,8-HpCDD	67.25	280042	246102	30.43		31.83	0.92	1.14	
13C-1,2,3,4,6,7,8-HpCDD	67.22	936273	943426	63.29	63.29		0.99	0.99	
OCDD	70.43	212232	211741	27.67		28.95	1.09	1.00	
13C-OCDD	70.41	1304820	1518240	103.81	51.90		0.91	0.86	
OCDF	70.50	173604	168535	24.16		25.27	1.00	1.03	

TABLE C.7 continued

f. Sample 115-S

MDL Study Sample   010328 Run   SAMPLE 8

Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	40.02	1985000	2706670	1.96		2.06	0.93	0.73	
13C-2,3,7,8-TCDF	40.02	113247000	143095000	111.57	111.57		1.40	0.79	
IS-13C-1,2,3,4-TCDD	41.40	72502000	91381300					0.79	
2,3,7,8-TCDD	42.30	1485100	1813000	2.22		2.32	0.86	0.82	
13C-2,3,7,8-TCDD	42.26	74959300	98751200	93.88	93.88		1.13	0.76	
37Cl-TCDD	42.28	41080200		24.71	49.42		2.29		
1,2,3,7,8-PeCDF	54.59	14486600	9249380	10.70		11.20	0.94	1.57	
2,3,4,7,8-PeCDF	57.03	18434700	12239100	11.90		12.45	0.98	1.51	
13C-1,2,3,7,8-PeCDF	54.56	143542000	92345900	104.00	104.00		1.38	1.55	
13C-2,3,4,7,8-PeCDF	56.59	160825000	101591000	116.99	116.99		1.37	1.58	
1,2,3,7,8-PeCDD	57.53	15092400	14868700	10.27		10.74	0.95	1.02	
13C-1,2,3,7,8-PeCDD	57.53	134161000	172412000	162.70	162.70		1.15	0.78	S, C
1,2,3,4,7,8-HxCDF	62.11	13520800	10786500	10.89		11.40	1.26	1.25	
1,2,3,6,7,8-HxCDF	62.18	33086300	26641600	12.13		12.69	1.20	1.24	
2,3,4,6,7,8-HxCDF	63.11	22135400	17579900	12.64		13.22	1.12	1.26	
1,2,3,7,8,9-HxCDF	64.07	22036500	17582300	17.33		18.13	0.88	1.25	
13C-1,2,3,4,7,8-HxCDF	62.10	59694300	117564000	90.23	90.23		0.61	0.51	
13C-1,2,3,6,7,8-HxCDF	62.17	140591000	270342000	94.33	94.33		1.35	0.52	
13C-2,3,4,6,7,8-HxCDF	63.10	96385500	184219000	90.44	90.44		0.96	0.52	
13C-1,2,3,7,8,9-HxCDF	64.05	89410100	171508000	94.29	94.29		0.86	0.52	
1,2,3,4,7,8-HxCDD	?	8854150	6359050	11.42		11.95	0.96	1.39	
1,2,3,6,7,8-HxCDD	63.30	25569000	20994500	12.58		13.16	1.04	1.22	
1,2,3,7,8,9-HxCDD	63.54	19626900	16013200	14.09		14.74	1.03	1.23	
13C-1,2,3,4,7,8-HxCDD	?	77293200	61111200	72.74	72.74		0.59	1.26	
13C-1,2,3,6,7,8-HxCDD	63.30	197734000	157208000	96.92	96.92		1.14	1.26	
IS-13C-1,2,3,7,8,9-HxCDD	63.53	176922000	144873000					1.22	
1,2,3,4,6,7,8-HpCDF	66.12	20819100	19455300	12.27		12.84	1.45	1.07	
1,2,3,4,7,8,9-HpCDF	67.45	18718300	17414400	13.17		13.78	1.39	1.07	
13C-1,2,3,4,6,7,8-HpCDF	66.10	70201400	156466000	85.26	85.26		0.83	0.45	
13C-1,2,3,4,7,8,9-HpCDF	67.44	61982400	134875000	82.51	82.51		0.74	0.46	
1,2,3,4,6,7,8-HpCDD	67.21	15200400	15075500	11.88		12.43	0.92	1.01	
13C-1,2,3,4,6,7,8-HpCDD	67.21	141685000	135337000	86.79	86.79		0.99	1.05	
OCDD	70.41	28795500	33762000	21.75		22.75	1.09	0.85	
13C-OCDD	70.40	249009000	280921000	181.32	90.66		0.91	0.89	
OCDF	70.48	32203700	36437700	25.82		27.01	1.00	0.88	

TABLE C.7 continued

g. Sample 116-S

MDL Study Sample	010328 Run	SAMPLE 9							
Congener	Retention Time	M ion area	M+ ion area	Concentration Cex (ng/extract)	% Surrogate Recovery	[SPMD] (ng/kg)	RR and RF	Peak Ratio	Data Flags
2,3,7,8-TCDF	40.03	55915.8	67226.5	0.56		0.59	0.93	0.83	
13C-2,3,7,8-TCDF	40.03	10473400	12981300	87.69	87.69		1.40	0.81	
IS-13C-1,2,3,4-TCDD	41.39	8837760	10241400					0.86	
2,3,7,8-TCDD	42.32	19684.4	22948.8	0.24		0.25	0.86	0.86	
13C-2,3,7,8-TCDD	42.30	8995600	11605400	95.63	95.63		1.13	0.78	
37Cl-TCDD	42.33	7380260		36.42	72.84		2.29		
1,2,3,7,8-PeCDF	55.00	713667	427494	6.46		6.76	0.94	1.67	
2,3,4,7,8-PeCDF	57.01	699689	490753	7.21		7.54	0.98	1.43	
13C-1,2,3,7,8-PeCDF	54.56	11217500	7565800	71.13	71.13		1.38	1.48	
13C-2,3,4,7,8-PeCDF	57.00	10398900	6423410	64.42	64.42		1.37	1.62	
1,2,3,7,8-PeCDD	57.56	290947	272007	6.35		6.65	0.95	1.07	C
13C-1,2,3,7,8-PeCDD	57.54	5282310	4025780	42.43	42.43		1.15	1.31	C
1,2,3,4,7,8-HxCDF	62.12	368139	249322	7.01		7.34	1.26	1.48	
1,2,3,6,7,8-HxCDF	62.17	811393	697350	6.43		6.72	1.20	1.16	
2,3,4,6,7,8-HxCDF	63.10	561948	406642	6.83		7.15	1.12	1.38	
1,2,3,7,8,9-HxCDF	64.08	488285	415829	9.90		10.36	0.88	1.17	
13C-1,2,3,4,7,8-HxCDF	62.12	2580710	4413190	90.59	90.59		0.61	0.58	
13C-1,2,3,6,7,8-HxCDF	62.17	6620790	12973800	114.45	114.45		1.35	0.51	
13C-2,3,4,6,7,8-HxCDF	63.10	4406830	8251920	103.81	103.81		0.96	0.53	
13C-1,2,3,7,8,9-HxCDF	64.06	3639780	6779750	95.81	95.81		0.86	0.54	
1,2,3,4,7,8-HxCDD	63.26	383191	297822	12.03		12.58	0.96	1.29	
1,2,3,6,7,8-HxCDD	63.31	517591	387222	5.41		5.66	1.04	1.34	
1,2,3,7,8,9-HxCDD	63.54	445336	354093	7.12		7.45	1.03	1.26	
13C-1,2,3,4,7,8-HxCDD	63.24	3285240	2596650	78.66	78.66		0.59	1.27	
13C-1,2,3,6,7,8-HxCDD	63.30	8841320	7190490	111.39	111.39		1.14	1.23	
IS-13C-1,2,3,7,8,9-HxCDD	63.54	7074990	5571830					1.27	
1,2,3,4,6,7,8-HpCDF	66.12	498548	438440	7.64		8.00	1.45	1.14	
1,2,3,4,7,8,9-HpCDF	67.44	339739	283425	6.71		7.02	1.39	1.20	
13C-1,2,3,4,6,7,8-HpCDF	66.11	2727180	5742410	81.07	81.07		0.83	0.47	
13C-1,2,3,4,7,8,9-HpCDF	67.45	2052220	4610690	71.06	71.06		0.74	0.45	
1,2,3,4,6,7,8-HpCDD	67.22	451672	417724	9.07		9.49	0.92	1.08	
13C-1,2,3,4,6,7,8-HpCDD	67.21	5430710	4984290	83.03	83.03		0.99	1.09	
OCDD	70.41	846457	951299	21.97		22.99	1.09	0.89	
13C-OCDD	70.39	7139880	7935190	131.24	65.62		0.91	0.90	
OCDF	70.47	506970	520239	13.58		14.21	1.00	0.97	

Appendix D

SPMD QUALITY CONTROL SAMPLE CONCENTRATIONS

FOR THE 2000 FIELD SEASON

Table D.1 SPMD Quality Control Sample Concentrations for the 2000 Field Season

Quality Control Identification Key:

DB	Dialysis Blank
FB	Field Blank
MS	Matrix Spike
PB	Process Blank

Data Flag Information Key:

B	Positive peak identification for a blank
C	Co-eluting peak present
DPE	Diphenyl ether interference with the dioxin peak
O	Carryover from HRGC / HRMS calibration standard
S	Percent surrogate recoveries were either above or below the established limits set by the EPA in method 1613-B (Telliard 1994)
Y	Syringe contamination in the laboratory during extraction or cleanup

TABLE D.1. SPMD Quality Control Sample Concentrations for the 2000 Field Season

a. Deployment One: Androscoggin River at Dixfield 6/2/00 to 6/30/00

SPMD Concentrations (ng congener/kg SPMD)		Week 1		Week 2			Week 3		Week 4			
Type of QC	DL	FB	PB	FB	DB	PB	FB	PB	FB	MS	PB	Data Flags
congener/sample ID	(ng/kg)	18-S	24-S	25-S	26-S	32-S	33-S	39-S	40-S	41-S	47-S	
2,3,7,8-TCDF	0.80	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	43.83	<DL	
1,2,3,7,8-PeCDF	2.08	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	224.14	<DL	
2,3,4,7,8-PeCDF	3.13	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	225.83	<DL	
1,2,3,4,7,8-HxCDF	2.59	<DL	<DL	<DL	0.48	<DL	<DL	<DL	<DL	247.86	<DL	B, DPE
1,2,3,6,7,8-HxCDF	2.46	<DL	0.02	<DL	0.40	<DL	<DL	<DL	<DL	230.81	<DL	O, B, DPE
2,3,4,6,7,8-HxCDF	2.88	<DL	0.07	<DL	<DL	<DL	<DL	<DL	<DL	257.79	<DL	O, B
1,2,3,7,8,9-HxCDF	1.68	<DL	0.05	<DL	<DL	<DL	<DL	<DL	1.14	235.06	<DL	O, B, DPE
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	0.48	<DL	<DL	252.03	<DL	B, DPE
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	258.53	<DL	
OCDF	7.18	<DL	0.08	<DL	<DL	<DL	<DL	<DL	<DL	383.71	<DL	O, B
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	45.83	<DL	
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	0.86	<DL	<DL	<DL	<DL	251.37	<DL	B
1,2,3,4,7,8-HxCDD	3.08	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	235.93	<DL	
1,2,3,6,7,8-HxCDD	1.22	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	254.79	<DL	
1,2,3,7,8,9-HxCDD	2.84	<DL	0.03	<DL	<DL	<DL	<DL	<DL	<DL	451.81	<DL	O, B
1,2,3,4,6,7,8-HpCDD	2.31	<DL	0.06	<DL	<DL	<DL	<DL	<DL	<DL	234.45	<DL	O, B
OCDD	6.70	<DL	0.28	<DL	<DL	<DL	<DL	<DL	<DL	491.79	<DL	O, B
TEQ (<DL = 0)		0.00	0.02	0.00	0.94	0.00	0.00	0.00	0.11	624.65	0.00	
TEQ_{TP} (<DL = 0)		0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	425.70	0.00	

NOTE: **DL = Detection Limit**

TABLE D.1 continued

b. Deployment Two: Androscoggin River at Dixfield 6/30/00 to 7/28/00

SPMD Concentrations (ng congener/kg SPMD)											
		Week 1		**Week 2**	**Week 3**			**Week 4**			
Type of QC	**DL**	**FB**	**PB**	**FB**	**DB**	**FB**	**PB**	**FB**	**MS**	**PB**	**Data Flags**
congener/sample ID	**(ng/kg)**	48-S	50-S	51-S	54-S	55-S	57-S	58-S	59-S	65-S	
2,3,7,8-TCDF	0.80	1.45	<DL	0.74	<DL	0.54	0.05	<DL	23.91	<DL	B, DPE, O
1,2,3,7,8-PeCDF	2.08	<DL	0.06	<DL	0.09	<DL	<DL	<DL	118.11	<DL	B, DPE, O
2,3,4,7,8-PeCDF	3.13	0.69	0.14	1.79	<DL	0.26	0.03	<DL	120.98	<DL	B, DPE, O
1,2,3,4,7,8-HxCDF	2.59	0.15	0.05	<DL	<DL	<DL	<DL	<DL	122.52	<DL	B, DPE, O
1,2,3,6,7,8-HxCDF	2.46	<DL	0.05	<DL	<DL	0.13	<DL	<DL	129.72	<DL	B, DPE, O
2,3,4,6,7,8-HxCDF	2.88	1.88	0.28	4.85	<DL	0.59	<DL	1.10	134.41	0.95	B, DPE, O
1,2,3,7,8,9-HxCDF	1.68	<DL	0.07	<DL	<DL	<DL	<DL	1.06	154.60	0.87	B, DPE, O
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	<DL	<DL	144.14	0.68	B, DPE, O
1,2,3,4,7,8,9-HpCDF	1.56	<DL	0.05	<DL	<DL	<DL	<DL	<DL	147.74	<DL	B, DPE, O
OCDF	7.18	0.36	0.11	<DL	0.34	<DL	<DL	<DL	240.34	2.35	B, DPE, O
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	<DL	<DL	24.08	<DL	
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	<DL	<DL	<DL	<DL	107.56	<DL	
1,2,3,4,7,8-HxCDD	3.08	0.11	0.05	<DL	<DL	<DL	<DL	<DL	122.66	<DL	B, O
1,2,3,6,7,8-HxCDD	1.22	<DL	<DL	<DL	<DL	<DL	<DL	<DL	116.36	<DL	
1,2,3,7,8,9-HxCDD	2.84	<DL	<DL	<DL	<DL	<DL	<DL	<DL	125.81	<DL	
1,2,3,4,6,7,8-HpCDD	2.31	<DL	<DL	<DL	0.16	<DL	<DL	<DL	132.28	0.93	B, O
OCDD	6.70	0.72	0.18	1.48	0.88	0.77	<DL	11.94	294.88	10.67	B, O
TEQ (<DL = 0)		0.71	0.12	1.45	0.01	0.25	0.02	0.22	295.33	0.20	
TEQ_{TP} (<DL = 0)		0.49	0.07	0.97	0.00	0.18	0.02	0.00	200.43	0.00	

NOTE: **DL = Detection Limit**

TABLE D.1 continued

c. Deployment Three: Kennebec River at Norridgewock and Fairfield 8/3/00 to 9/26/00

SPMD Concentrations (ng congener/kg SPMD)		Norridgewock--Upstream			Fairfield--Downstream			
Type of QC	**DL**	**FB**	**DB**	**PB**	**FB**	**MS**	**PB**	**Data Flags**
congener/sample ID	**(ng/kg)**	66-S	67-S	73-S	74-S	75-S	81-S	
2,3,7,8-TCDF	0.80	<DL	<DL	<DL	0.11	26.54	<DL	B, DPE, Y
1,2,3,7,8-PeCDF	2.08	<DL	<DL	<DL	<DL	127.66	<DL	
2,3,4,7,8-PeCDF	3.13	<DL	<DL	<DL	<DL	125.73	<DL	
1,2,3,4,7,8-HxCDF	2.59	<DL	0.31	0.15	0.12	123.52	0.12	B, DPE, Y, O
1,2,3,6,7,8-HxCDF	2.46	<DL	<DL	0.13	0.09	129.02	0.11	B, DPE, Y, O
2,3,4,6,7,8-HxCDF	2.88	0.51	<DL	0.24	0.18	136.30	0.18	B, DPE, Y, O
1,2,3,7,8,9-HxCDF	1.68	<DL	0.65	0.14	0.12	124.07	<DL	B, DPE, Y, O
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	125.72	<DL	
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	0.19	<DL	124.92	0.13	B, DPE, Y, O
OCDF	7.18	<DL	<DL	<DL	0.15	203.79	0.19	B, DPE, Y, O
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	26.79	<DL	
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	<DL	135.13	<DL	
1,2,3,4,7,8-HxCDD	3.08	0.27	<DL	<DL	<DL	125.55	<DL	B, Y
1,2,3,6,7,8-HxCDD	1.22	0.26	<DL	<DL	<DL	128.40	0.11	B, Y
1,2,3,7,8,9-HxCDD	2.84	<DL	<DL	<DL	0.13	142.09	0.11	B, Y, O
1,2,3,4,6,7,8-HpCDD	2.31	0.46	<DL	0.34	<DL	127.36	0.18	B, Y, O
OCDD	6.70	3.76	<DL	1.99	0.60	250.01	0.82	B, Y, O
TEQ (<DL = 0)		0.11	0.10	0.07	0.07	328.54	0.07	
TEQ_{TP} (<DL = 0)		0.00	0.00	0.00	0.01	233.82	0.00	

NOTE: **DL = Detection Limit**

TABLE D.1 continued

d. Deployment Four: Androscoggin River at Rumford and Dixfield 9/19/00 to 10/17/00

SPMD Concentrations (ng congener/kg SPMD)		Rumford--Upstream				Dixfield--Downstream				
Type of QC	DL	FB	PB	DB	PB	FB	PB	MS	PB	Data Flags
congener/sample ID	(ng/kg)	82-S	88-S	89-S	95-S	96-S	102-S	103-S	109-S	
2,3,7,8-TCDF	0.80	<DL	<DL	<DL	<DL	<DL	<DL	23.77	<DL	
1,2,3,7,8-PeCDF	2.08	<DL	<DL	<DL	<DL	<DL	<DL	116.76	<DL	
2,3,4,7,8-PeCDF	3.13	<DL	<DL	0.52	<DL	<DL	<DL	116.90	<DL	B, DPE
1,2,3,4,7,8-HxCDF	2.59	<DL	<DL	<DL	<DL	<DL	<DL	111.14	<DL	
1,2,3,6,7,8-HxCDF	2.46	<DL	<DL	<DL	<DL	<DL	<DL	114.09	0.07	
2,3,4,6,7,8-HxCDF	2.88	<DL	<DL	2.00	<DL	<DL	<DL	116.92	<DL	B, DPE
1,2,3,7,8,9-HxCDF	1.68	<DL	<DL	<DL	<DL	<DL	<DL	108.81	<DL	
1,2,3,4,6,7,8-HpCDF	2.65	<DL	<DL	<DL	<DL	<DL	<DL	125.26	<DL	
1,2,3,4,7,8,9-HpCDF	1.56	<DL	<DL	<DL	<DL	<DL	<DL	119.07	<DL	
OCDF	7.18	<DL	<DL	<DL	<DL	<DL	<DL	262.31	<DL	
2,3,7,8-TCDD	2.10	<DL	<DL	<DL	<DL	<DL	<DL	23.05	<DL	
1,2,3,7,8-PeCDD	2.14	<DL	<DL	<DL	<DL	<DL	<DL	111.53	<DL	
1,2,3,4,7,8-HxCDD	3.08	<DL	<DL	<DL	<DL	<DL	<DL	108.40	<DL	
1,2,3,6,7,8-HxCDD	1.22	<DL	<DL	<DL	<DL	<DL	<DL	113.19	<DL	
1,2,3,7,8,9-HxCDD	2.84	<DL	<DL	<DL	<DL	<DL	<DL	118.84	<DL	
1,2,3,4,6,7,8-HpCDD	2.31	<DL	<DL	0.56	<DL	<DL	<DL	119.41	<DL	B
OCDD	6.70	<DL	2.65	3.60	<DL	<DL	0.92	233.23	0.79	B
TEQ (<DL = 0)		0.00	0.00	0.46	0.00	0.00	0.00	284.07	0.01	
TEQ_{TP} (<DL = 0)		0.00	0.00	0.26	0.00	0.00	0.00	201.25	0.00	

NOTE: **DL = Detection Limit**

Appendix E

SPMD SAMPLE PERCENT SURROGATE RECOVERIES

FOR THE 2000 FIELD SEASON

Data Flag Information Key:

C Co-eluting peak present

M Shifted peak unable to be quantified

S Percent surrogate recoveries were either above or below the established limits set by the EPA in method 1613-B (Telliard 1994)

Quality Control Identification Key:

DB Dialysis Blank

FB Field Blank

MS Matrix Spike

PB Process Blank

TABLE E.1. Percent Surrogate Recoveries for the 2000 Field Season Deployed SPMD Samples

a. Deployment One: Androscoggin River at Dixfield 6/2/00 to 6/30/00

% Surrogate Recovery	**Week 1**	**Week 2**	**Week 3**	**Week 4, N=5**					**Deployment 1**	**Data Flags**
congener/sample ID	19-S	27-S	34-S	42-S	43-S	44-S	45-S	46-S	Mean	
13C-2,3,7,8-TCDF	21.99	48.23	34.46	275.25	49.98	49.05	50.17	45.61	71.84	S
13C-1,2,3,7,8-PeCDF	39.21	47.82	51.50	284.58	46.26	69.05	59.88	55.80	81.76	S
13C-2,3,4,7,8-PeCDF	33.17	39.74	39.46	226.38	38.00	55.87	47.70	45.91	65.78	S
13C-1,2,3,4,7,8-HxCDF	81.49	65.99	80.81	123.96	86.66	71.97	67.73	66.09	80.59	
13C-1,2,3,6,7,8-HxCDF	84.70	66.21	68.44	111.32	65.38	64.72	67.09	53.54	72.68	
13C-2,3,4,6,7,8-HxCDF	115.28	77.03	86.38	122.81	76.81	70.95	67.34	61.12	84.71	
13C-1,2,3,7,8,9-HxCDF	60.01	81.18	81.53	99.15	41.61	52.32	45.28	38.30	62.42	
13C-1,2,3,4,6,7,8-HpCDF	59.94	65.58	77.58	120.59	36.76	53.77	62.91	46.76	65.48	
13C-1,2,3,4,7,8,9-HpCDF	63.70	59.09	53.32	64.62	3.60	5.49	6.84	5.65	32.79	S
13C-2,3,7,8-TCDD	30.58	53.14	44.73	108.34	61.83	62.20	61.50	55.95	59.78	
13C-1,2,3,7,8-PeCDD	37.20	46.33	50.91	231.62	34.09	58.05	56.09	52.89	70.90	S
13C-1,2,3,4,7,8-HxCDD	108.35	66.32	67.16	142.48	95.38	78.92	76.52	73.70	88.60	
13C-1,2,3,6,7,8-HxCDD	146.06	60.59	70.20	116.75	69.72	72.03	68.52	59.92	82.97	
13C-1,2,3,4,6,7,8-HpCDD	72.37	90.83	103.01	141.50	17.39	16.80	23.69	20.60	60.77	S
13C-OCDD	68.59	5.97	7.13	118.58	70.11	2.71	2.75	81.60	44.68	S
Cleanup Standard Recovery										
37Cl-TCDD	63.52	79.10	50.70	231.42	83.89	80.80	60.49	62.47	89.05	S

TABLE E.1 continued

b. Deployment Two: Androscoggin River at Dixfield 6/30/00 to 7/28/00

% Surrogate Recovery	7/7 to 7/14	**6/30 to 7/14**	7/7 to 7/28	**6/30 to 7/28**					**Deployment 2**	**Data**
congener/sample ID	49-S	52-S	56-S	60-S	61-S	62-S	63-S	64-S	Mean	**Flags**
13C-2,3,7,8-TCDF	71.44	72.85	72.35	52.44	40.46	78.18	45.83	44.86	59.80	
13C-1,2,3,7,8-PeCDF	57.70	63.95	65.77	55.24	42.37	81.59	43.77	46.12	57.06	
13C-2,3,4,7,8-PeCDF	41.26	49.94	51.15	55.63	44.35	88.58	45.05	47.29	52.91	
13C-1,2,3,4,7,8-HxCDF	244.10	165.95	93.24	55.06	59.73	97.66	53.32	48.82	102.23	S
13C-1,2,3,6,7,8-HxCDF	130.71	105.91	92.60	47.47	56.42	83.55	43.81	43.45	75.49	
13C-2,3,4,6,7,8-HxCDF	209.31	206.40	86.87	52.96	55.46	91.77	50.21	48.66	100.20	S
13C-1,2,3,7,8,9-HxCDF	81.64	94.98	99.89	54.00	41.71	94.04	49.81	49.18	70.66	
13C-1,2,3,4,6,7,8-HpCDF	165.24	75.27	96.91	43.58	36.14	77.98	41.41	42.74	72.41	S
13C-1,2,3,4,7,8,9-HpCDF	201.12	85.10	77.64	47.88	31.10	83.55	41.71	45.35	76.68	S
13C-2,3,7,8-TCDD	95.92	103.00	97.94	60.79	57.02	113.83	62.80	63.10	81.80	
13C-1,2,3,7,8-PeCDD	38.07	46.27	50.22	62.52	50.00	119.90	57.27	60.76	60.63	
13C-1,2,3,4,7,8-HxCDD	179.97	186.33	81.11	69.11	65.48	127.89	75.10	70.49	106.94	S
13C-1,2,3,6,7,8-HxCDD	248.75	251.07	102.95	61.24	61.95	117.42	62.15	61.88	120.93	S
13C-1,2,3,4,6,7,8-HpCDD	182.73	89.62	93.73	57.39	46.27	98.28	51.22	55.64	84.36	S
13C-OCDD	214.11	89.84	73.15	56.16	40.21	111.73	52.77	60.69	87.33	S
Cleanup Standard Recovery										
37Cl-TCDD	86.49	90.99	66.40	48.60	44.26	42.10	49.12	48.28	59.53	

TABLE E.1 continued

c. Deployment Three: Kennebec River at Norridgewock and Fairfield 8/3/00 to 9/26/00

% Surrogate Recovery	Norridgewock--Upstream					Fairfield--Downstream					Deployment 3	Data
congener/sample ID	68-S	69-S	70-S	71-S	72-S	76-S	77-S	78-S	79-S	80-S	Mean	Flags
13C-2,3,7,8-TCDF	72.42	105.29	76.81	72.79	75.73	83.82	79.93	69.07	73.90	76.48	78.62	
13C-1,2,3,7,8-PeCDF	73.03	105.97	74.56	72.34	74.03	77.14	74.26	65.97	67.58	69.45	75.43	
13C-2,3,4,7,8-PeCDF	71.72	98.60	77.66	71.35	73.49	63.47	62.53	56.60	58.43	60.48	69.43	
13C-1,2,3,4,7,8-HxCDF	73.06	109.10	77.01	73.36	72.57	79.74	75.56	59.30	70.85	68.72	75.93	
13C-1,2,3,6,7,8-HxCDF	75.28	105.95	77.54	70.60	74.42	80.85	75.95	61.60	73.52	66.97	76.27	
13C-2,3,4,6,7,8-HxCDF	75.62	108.80	78.80	75.79	71.90	87.63	81.81	67.51	75.21	74.56	79.76	
13C-1,2,3,7,8,9-HxCDF	78.56	114.72	79.93	77.86	79.04	97.52	91.57	73.25	85.53	84.68	86.26	
13C-1,2,3,4,6,7,8-HpCDF	69.88	96.15	72.97	65.58	69.07	90.18	99.48	77.46	100.90	95.91	83.76	
13C-1,2,3,4,7,8,9-HpCDF	59.47	79.60	64.22	53.19	58.27	94.25	110.09	87.38	114.29	108.66	82.94	
13C-2,3,7,8-TCDD	75.72	110.35	77.94	75.77	76.92	85.35	77.15	66.75	70.92	72.24	78.91	
13C-1,2,3,7,8-PeCDD	74.14	108.07	78.82	74.62	76.58	61.25	54.96	50.09	49.51	51.41	67.94	
13C-1,2,3,4,7,8-HxCDD	76.58	108.69	80.32	76.17	80.17	78.33	74.31	60.77	64.22	68.50	76.81	
13C-1,2,3,6,7,8-HxCDD	77.21	116.26	81.78	81.17	77.94	76.20	76.41	63.62	70.07	69.20	78.98	
13C-1,2,3,4,6,7,8-HpCDD	73.72	100.29	72.69	59.94	68.79	101.47	110.69	88.67	111.64	108.21	89.61	
13C-OCDD	36.30	44.37	39.01	33.26	28.88	90.39	110.70	87.59	110.08	114.77	69.53	
Cleanup Standard Recovery												
37Cl-TCDD	53.50	56.05	57.39	55.38	57.73	51.01	52.35	58.82	50.16	54.96	54.73	

TABLE E.1 continued

d. Deployment Four: Androscoggin River Upstream at Rumford 9/19/00 to 10/17/00

% Surrogate Recovery	Rumford--Upstream										Deployment 4	Data
congener/sample ID	83-S	84-S	85-S	86-S	87-S	90-S	91-S	92-S	93-S	94-S	Site 13 Mean	Flags
13C-2,3,7,8-TCDF	189.30	99.89	145.70	79.40	84.16	89.55	99.88	54.84	92.50	99.02	103.42	S
13C-1,2,3,7,8-PeCDF	216.00	114.05	190.91	94.10	96.25	117.85	89.37	51.02	89.10	92.33	115.10	S
13C-2,3,4,7,8-PeCDF	122.72	111.50	145.14	54.36	91.92	79.18	80.16	49.80	83.89	87.95	90.66	
13C-1,2,3,4,7,8-HxCDF	131.27	72.68	116.79	110.23	113.53	115.07	96.81	58.56	33.96	29.07	87.80	
13C-1,2,3,6,7,8-HxCDF	65.46	47.73	59.62	79.00	68.56	78.70	89.48	56.58	30.86	25.17	60.12	
13C-2,3,4,6,7,8-HxCDF	102.53	49.42	86.73	98.90	113.96	109.46	88.61	58.31	30.54	63.10	80.16	
13C-1,2,3,7,8,9-HxCDF	100.91	110.65	87.48	93.30	99.59	108.14	103.99	60.84	104.21	94.79	96.39	
13C-1,2,3,4,6,7,8-HpCDF	70.11	94.03	55.90	66.40	71.83	85.68	110.34	292.53	164.32	142.30	115.34	S
13C-1,2,3,4,7,8,9-HpCDF	86.77	107.71	56.51	62.26	100.26	95.85	88.99	51.08	30.59	28.04	70.81	
13C-2,3,7,8-TCDD	30.67	103.17	182.83	99.17	93.48	107.99	112.11	59.23	101.70	106.48	99.68	
13C-1,2,3,7,8-PeCDD	344.19	98.79	80.34	72.19	71.54	81.18	82.69	48.63	87.63	92.26	105.94	C, S
13C-1,2,3,4,7,8-HxCDD	144.00	94.72	115.27	116.67	99.39	111.40	87.35	58.42	71.16	70.09	96.85	
13C-1,2,3,6,7,8-HxCDD	84.08	101.36	80.71	93.07	99.99	109.02	95.55	48.09	79.83	82.88	87.46	
13C-1,2,3,4,6,7,8-HpCDD	103.54	117.53	61.26	72.97	112.02	101.63	94.47	58.10	25.34	27.40	77.43	
13C-OCDD	46.55	93.66	29.85	33.16	94.91	40.76	74.73	38.78	20.71	19.53	49.26	S
Cleanup Standard Recovery												
37Cl-TCDD	70.94	91.94	82.65	90.21	77.10	79.40	84.51	88.93	79.43	91.87	83.70	

TABLE E.1 continued

e. Deployment Four: Androscoggin River Downstream at Dixfield 9/19/00 to 10/17/00

% Surrogate Recovery	**Dixfield--Downstream**										**Deployment 4**	**Data**
congener/sample ID	97-S	98-S	99-S	100-S	101-S	104-S	105-S	106-S	107-S	108-S	Site 10 Mean	**Flags**
13C-2,3,7,8-TCDF	48.07	80.52	68.76	100.48	96.20	90.49	88.05	82.05	72.57	90.35	81.75	
13C-1,2,3,7,8-PeCDF	28.76	51.58	51.15	65.48	62.16	59.15	57.00	52.95	40.43	71.66	54.03	
13C-2,3,4,7,8-PeCDF	26.23	37.01	33.90	46.55	42.67	39.10	41.08	36.65	26.08	60.28	38.96	
13C-1,2,3,4,7,8-HxCDF	120.94	109.13	94.61	171.25	180.05	187.48	173.58	154.30	136.85	73.03	140.12	S
13C-1,2,3,6,7,8-HxCDF	67.74	65.36	42.94	153.59	116.09	114.77	137.92	122.61	83.28	61.69	96.60	
13C-2,3,4,6,7,8-HxCDF	89.35	99.20	68.03	129.26	130.52	133.51	134.81	125.40	105.42	73.22	108.87	
13C-1,2,3,7,8,9-HxCDF	85.13	93.43	104.24	109.29	105.95	106.99	109.42	100.44	78.86	87.27	98.10	
13C-1,2,3,4,6,7,8-HpCDF	102.65	87.54	95.99	76.80	72.01	249.65	252.91	227.57	164.23	313.59	164.29	S
13C-1,2,3,4,7,8,9-HpCDF	88.63	114.37	123.85	299.36	202.82	297.07	260.09	264.17	201.09	69.97	192.14	S
13C-2,3,7,8-TCDD	36.06	90.84	89.57	117.90	110.35	108.35	102.38	94.89	86.92	96.78	93.40	
13C-1,2,3,7,8-PeCDD	23.59	40.25	31.21	41.79	42.61	40.38	36.84	33.86	22.43	59.48	37.24	C, S
13C-1,2,3,4,7,8-HxCDD	129.71	107.37	66.76	114.25	126.60	130.27	117.88	106.89	90.44	75.76	106.59	
13C-1,2,3,6,7,8-HxCDD	75.58	79.09	46.68	117.85	90.52	111.37	111.37	99.80	87.81	78.70	89.88	
13C-1,2,3,4,6,7,8-HpCDD	94.95	119.74	136.29	283.49	63.68	301.99	287.99	249.71	188.85	69.39	179.61	S
13C-OCDD	71.03	97.47	107.63	258.45	218.00	231.25	240.53	203.80	164.86	54.40	164.74	S
Cleanup Standard Recovery												
37Cl-TCDD	50.93	65.46	72.72	75.23	77.36	73.05	73.79	63.13	56.65	69.05	67.74	

TABLE E.2. Percent Surrogate Recoveries for the 2000 Field Season Quality Control SPMD Samples

a. Method Detection Limit Study One

% Surrogate Recovery	Each spiked with 1:20 dioxin PAR and 1:40 Co-PCB PAR					**Basis for the Detection Limits**			
Type of QC	**MDL**	**MDL**	**MDL**	**MDL**	**MDL**	**MDL**	**MDL**	**MDL**	**Data Flags**
congener/sample ID	11-S	12-S	13-S	14-S	15-S	16-S	17-S	Mean	
13C-2,3,7,8-TCDF	28.69	28.38	24.75	24.59	23.25	24.52	24.55	25.53	S
13C-1,2,3,7,8-PeCDF	40.96	40.59	38.80	37.44	40.09	37.46	38.48	39.12	
13C-2,3,4,7,8-PeCDF	31.07	31.80	29.34	30.40	30.49	29.89	32.07	30.72	
13C-1,2,3,4,7,8-HxCDF	56.43	65.22	57.30	78.09	74.38	61.94	58.62	64.57	
13C-1,2,3,6,7,8-HxCDF	55.94	53.69	56.35	70.79	64.89	52.69	52.84	58.17	
13C-2,3,4,6,7,8-HxCDF	61.35	61.84	71.09	98.65	81.29	68.59	70.59	73.34	
13C-1,2,3,7,8,9-HxCDF	70.85	75.39	72.79	72.16	71.52	79.05	71.48	73.32	
13C-1,2,3,4,6,7,8-HpCDF	123.89	95.68	124.39	119.06	70.51	95.26	94.04	103.26	
13C-1,2,3,4,7,8,9-HpCDF	119.02	94.93	135.66	125.18	64.62	100.59	93.14	104.73	
13C-2,3,7,8-TCDD	42.32	43.02	39.17	39.28	36.85	34.74	37.82	39.03	
13C-1,2,3,7,8-PeCDD	40.64	46.63	43.15	41.50	49.73	48.97	46.94	45.37	
13C-1,2,3,4,7,8-HxCDD	54.99	52.59	49.22	64.54	61.09	49.83	48.44	54.39	
13C-1,2,3,6,7,8-HxCDD	55.23	58.98	62.34	67.19	52.39	55.31	53.39	57.83	
13C-1,2,3,4,6,7,8-HpCDD	102.84	118.29	114.18	118.07	106.72	127.78	122.30	115.74	
13C-OCDD	90.28	18.06	24.48	25.96	15.42	17.25	23.24	30.67	S
Cleanup Standard Recovery									
37Cl-TCDD	91.36	106.42	112.66	90.23	84.09	96.05	89.28	95.73	

TABLE E.2 continued

b. Deployment One: Androscoggin River at Dixfield 6/2/00 to 6/30/00

% Surrogate Recovery	Week 1		Week 2			Week 3		Week 4				
Type of QC	FB	PB	FB	DB	PB	FB	PB	FB	MS	PB	Deployment 1	Data
congener/sample ID	18-S	24-S	25-S	26-S	32-S	33-S	39-S	40-S	41-S	47-S	Mean	Flags
13C-2,3,7,8-TCDF	18.17	54.81	18.55	10.21	65.48	13.37	52.79	19.18	48.11	70.35	37.10	S
13C-1,2,3,7,8-PeCDF	65.82	58.53	27.52	24.90	66.99	26.44	56.46	28.73	30.54	53.79	43.97	
13C-2,3,4,7,8-PeCDF	68.63	53.81	20.90	12.00	55.25	20.71	45.95	19.60	23.86	46.92	36.76	S
13C-1,2,3,4,7,8-HxCDF	119.01	93.44	49.14	55.67	111.80	44.02	69.03	31.90	29.43	58.68	66.21	
13C-1,2,3,6,7,8-HxCDF	133.01	97.85	51.46	73.91	79.97	49.41	69.86	39.39	36.87	63.66	69.54	
13C-2,3,4,6,7,8-HxCDF	105.30	122.40	69.72	92.20	80.82	61.44	71.35	39.41	40.86	62.91	74.64	
13C-1,2,3,7,8,9-HxCDF	182.61	65.60	64.72	79.03	81.79	63.23	71.54	46.60	57.03	73.11	78.53	
13C-1,2,3,4,6,7,8-HpCDF	197.54	66.62	95.09	50.75	93.65	105.87	124.40	67.02	50.55	71.46	92.29	
13C-1,2,3,4,7,8,9-HpCDF	171.14	68.30	79.39	off!	104.42	94.46	88.92	off	38.78	33.04	84.81	S, M
13C-2,3,7,8-TCDD	23.54	62.21	25.27	14.83	74.56	19.42	58.42	24.22	28.39	76.88	40.77	S
13C-1,2,3,7,8-PeCDD	89.09	48.07	27.06	18.14	58.48	27.44	51.28	35.59	32.34	46.89	43.44	S
13C-1,2,3,4,7,8-HxCDD	75.86	127.54	45.17	61.78	83.47	44.69	66.25	22.76	36.08	69.40	63.30	
13C-1,2,3,6,7,8-HxCDD	70.39	168.44	48.25	74.48	72.37	47.92	67.01	31.46	37.92	66.49	68.47	
13C-1,2,3,4,6,7,8-HpCDD	222.68	74.99	78.72	2.36	122.38	79.51	82.53	58.24	52.85	103.56	87.78	S
13C-OCDD	159.44	68.28	68.80	77.13	69.60	10.22	87.40	40.78	51.94	66.78	70.04	S
Cleanup Standard Recovery												
37Cl-TCDD	72.18	89.44	72.52	94.13	102.93	47.37	53.04	62.30	65.30	95.13	75.43	

TABLE E.2 continued

c. Deployment Two: Androscoggin River at Dixfield 6/30/00 to 7/28/00

% Surrogate Recovery	Week 1		Week 2	Week 3			Week 4				
Type of QC	FB	PB	FB	DB	FB	PB	FB	MS	PB	Deployment 2	Data
congener/sample ID	48-S	50-S	51-S	54-S	55-S	57-S	58-S	59-S	65-S	Mean	Flags
13C-2,3,7,8-TCDF	102.22	103.92	82.64	107.29	94.98	105.01	38.91	168.91	54.89	95.42	
13C-1,2,3,7,8-PeCDF	79.59	87.87	54.11	82.77	72.56	103.05	39.70	71.99	52.23	71.54	
13C-2,3,4,7,8-PeCDF	68.65	89.13	39.32	65.85	52.78	102.97	36.36	67.75	54.16	64.11	
13C-1,2,3,4,7,8-HxCDF	96.03	65.94	151.75	279.90	267.52	59.91	46.87	80.76	61.05	123.30	S
13C-1,2,3,6,7,8-HxCDF	84.76	67.77	97.51	231.03	246.90	66.23	43.72	68.79	58.60	107.26	S
13C-2,3,4,6,7,8-HxCDF	99.24	76.58	214.55	263.38	249.18	72.39	46.39	74.76	59.80	128.48	S
13C-1,2,3,7,8,9-HxCDF	113.62	131.05	83.53	111.85	106.18	119.42	45.91	77.85	65.01	94.93	
13C-1,2,3,4,6,7,8-HpCDF	0.00	176.10	72.12	66.23	266.33	185.16	35.39	65.37	56.23	102.55	S,M
13C-1,2,3,4,7,8,9-HpCDF	0.00	34.31	95.54	291.13	271.09	32.32	44.35	68.79	61.85	99.93	S,M
13C-2,3,7,8-TCDD	117.81	106.81	89.30	122.72	107.88	108.17	59.79	99.43	65.45	97.49	
13C-1,2,3,7,8-PeCDD	65.84	97.43	31.81	61.45	49.47	107.69	56.67	103.04	57.92	70.15	
13C-1,2,3,4,7,8-HxCDD	92.07	95.21	162.16	249.49	209.91	85.59	72.35	108.45	67.67	126.99	S
13C-1,2,3,6,7,8-HxCDD	103.29	102.87	313.99	299.80	290.23	91.44	62.64	102.61	69.78	159.63	S
13C-1,2,3,4,6,7,8-HpCDD	109.06	35.71	91.12	298.31	261.39	32.61	47.88	88.02	67.68	114.64	
13C-OCDD	105.08	28.20	111.91	307.21	284.06	25.94	52.91	105.04	69.72	121.12	S
Cleanup Standard Recovery											
37Cl-TCDD	95.42	81.77	91.80	89.66	81.67	82.86	41.52	47.52	49.58	73.53	

TABLE E.2 continued

d. Deployment Three: Kennebec River at Norridgewock and Fairfield 8/3/00 to 9/26/00

% Surrogate Recovery	Norridgewock--Upstream			Fairfield--Downstream				
Type of QC	**FB**	**DB**	**PB**	**FB**	**MS**	**PB**	**Deployment 3**	**Data Flags**
congener/sample ID	66-S	67-S	73-S	74-S	75-S	81-S	Mean	
13C-2,3,7,8-TCDF	69.04	69.01	66.28	75.44	89.67	65.34	72.46	
13C-1,2,3,7,8-PeCDF	66.43	54.02	54.46	66.11	81.48	60.85	63.89	
13C-2,3,4,7,8-PeCDF	65.60	59.21	60.40	55.11	69.70	61.89	61.98	
13C-1,2,3,4,7,8-HxCDF	66.65	71.47	73.68	70.40	85.62	74.84	73.78	
13C-1,2,3,6,7,8-HxCDF	67.89	73.26	77.81	67.88	82.71	77.25	74.47	
13C-2,3,4,6,7,8-HxCDF	67.34	69.49	70.96	72.22	87.28	73.65	73.49	
13C-1,2,3,7,8,9-HxCDF	68.11	69.86	68.93	81.01	96.67	77.16	76.96	
13C-1,2,3,4,6,7,8-HpCDF	67.95	59.59	70.76	77.57	95.23	72.70	73.97	
13C-1,2,3,4,7,8,9-HpCDF	62.14	49.75	61.77	83.18	102.63	75.39	72.48	
13C-2,3,7,8-TCDD	70.43	66.39	62.72	76.73	85.92	64.07	71.04	
13C-1,2,3,7,8-PeCDD	65.75	56.68	52.40	55.18	62.71	53.25	57.66	
13C-1,2,3,4,7,8-HxCDD	68.28	65.50	63.76	74.21	82.39	68.52	70.45	
13C-1,2,3,6,7,8-HxCDD	71.55	75.94	81.60	69.62	80.33	70.33	74.89	
13C-1,2,3,4,6,7,8-HpCDD	70.94	51.34	68.81	90.02	108.75	75.42	77.55	
13C-OCDD	54.42	44.99	79.14	76.27	115.12	90.01	76.66	
Cleanup Standard Recovery								
37Cl-TCDD	55.10	55.93	50.00	52.92	56.51	57.59	54.68	

TABLE E.2 continued

e. Deployment Four: Androscoggin River at Rumford and Dixfield 9/19/00 to 10/17/00

% Surrogate Recovery	Rumford--Upstream				Dixfield--Downstream					
Type of QC	FB	PB	DB	PB	FB	PB	MS	PB	Deployment 4	Data
congener/sample ID	82-S	88-S	89-S	95-S	96-S	102-S	103-S	109-S	Mean	Flags
13C-2,3,7,8-TCDF	97.77	96.77	74.19	53.22	58.23	50.04	87.93	89.25	75.92	
13C-1,2,3,7,8-PeCDF	125.89	107.53	67.13	41.13	36.96	41.39	67.67	71.48	69.90	
13C-2,3,4,7,8-PeCDF	97.88	92.14	64.26	40.81	33.25	42.57	50.93	61.07	60.36	
13C-1,2,3,4,7,8-HxCDF	123.72	97.57	40.39	113.43	97.33	135.89	71.93	99.81	97.51	
13C-1,2,3,6,7,8-HxCDF	90.36	101.92	36.52	107.99	65.71	105.50	48.31	99.22	81.94	
13C-2,3,4,6,7,8-HxCDF	98.68	92.18	49.96	110.56	136.63	121.35	70.12	101.51	97.62	
13C-1,2,3,7,8,9-HxCDF	101.46	114.30	73.11	109.72	122.01	119.48	82.46	109.92	104.06	
13C-1,2,3,4,6,7,8-HpCDF	76.02	98.47	107.54	96.30	87.56	106.14	81.74	113.04	95.85	
13C-1,2,3,4,7,8,9-HpCDF	81.46	98.09	21.40	89.95	77.35	93.74	62.35	120.20	80.57	
13C-2,3,7,8-TCDD	110.36	105.68	77.43	44.46	45.35	42.67	93.85	94.26	76.76	
13C-1,2,3,7,8-PeCDD	124.47	89.07	68.27	46.92	31.48	47.25	48.07	61.44	64.62	
13C-1,2,3,4,7,8-HxCDD	141.23	131.79	52.74	103.72	159.16	131.58	76.84	96.03	111.63	
13C-1,2,3,6,7,8-HxCDD	89.57	97.94	64.32	111.94	117.68	108.06	75.01	105.34	96.23	
13C-1,2,3,4,6,7,8-HpCDD	106.86	99.93	21.73	89.03	93.82	99.98	57.84	125.74	86.86	
13C-OCDD	89.24	37.07	14.70	89.42	65.05	52.84	49.06	109.46	63.35	S
Cleanup Standard Recovery										
37Cl-TCDD	82.49	85.06	86.41	77.30	79.28	64.05	78.58	59.30	76.56	

TABLE E.2 continued

f. Method Detection Limit Study Two

% Surrogate Recovery	Each spiked with 1:20 dioxin PAR and 1:40 Co-PCB PAR								
Type of QC	MDL	MDL	MDL	MDL	MDL	MDL	MDL	MDL	Data Flags
congener/sample ID	110-S	111-S	112-S	113-S	114-S	115-S	116-S	Mean	
13C-2,3,7,8-TCDF	83.48	78.31	91.86	46.71	73.14	111.57	87.69	81.82	
13C-1,2,3,7,8-PeCDF	89.98	65.64	85.22	38.06	45.35	104.00	71.13	71.34	
13C-2,3,4,7,8-PeCDF	59.09	58.02	83.94	34.80	43.78	116.99	64.42	65.86	
13C-1,2,3,4,7,8-HxCDF	108.12	85.73	85.46	146.60	83.06	90.23	90.59	98.54	
13C-1,2,3,6,7,8-HxCDF	87.68	100.14	104.53	89.06	116.32	94.33	114.45	100.93	
13C-2,3,4,6,7,8-HxCDF	88.30	90.16	92.70	91.84	92.67	90.44	103.81	92.84	
13C-1,2,3,7,8,9-HxCDF	89.13	81.22	94.67	100.73	86.73	94.29	95.81	91.80	
13C-1,2,3,4,6,7,8-HpCDF	83.71	72.44	89.50	88.47	40.93	85.26	81.07	77.34	
13C-1,2,3,4,7,8,9-HpCDF	82.21	69.92	82.52	89.48	53.11	82.51	71.06	75.83	
13C-2,3,7,8-TCDD	92.47	79.37	99.46	84.13	63.58	93.88	95.63	86.93	
13C-1,2,3,7,8-PeCDD	96.45	41.30	92.85	21.77	33.97	162.70	42.43	70.21	S
13C-1,2,3,4,7,8-HxCDD	78.10	83.60	84.52	52.66	66.06	72.74	78.66	73.76	
13C-1,2,3,6,7,8-HxCDD	94.71	86.08	100.92	127.93	101.58	96.92	111.39	102.79	
13C-1,2,3,4,6,7,8-HpCDD	84.27	68.41	94.19	91.04	63.29	86.79	83.03	81.57	
13C-OCDD	80.22	54.22	81.97	67.39	51.90	90.66	65.62	70.28	
Cleanup Standard Recovery									
37Cl-TCDD	74.09	54.64	78.02	94.14	56.11	49.42	72.84	68.47	

BIOGRAPHY OF THE AUTHOR

Heather A. Shoven was born on August 29, 1977 in Kankakee, Illinois. She was raised in Kankakee along with two brothers and a sister by her parents, Michael T. and MaryAnn Shoven. She graduated from Bishop McNamara High School in 1995.

Moving to Wisconsin, she attended Marquette University in Milwaukee and graduated *summa cum laude* in 1999 with an Honors Bachelor of Science degree in Biochemistry/Molecular Biology. While at Marquette, Heather became a member of both Phi Beta Kappa and Alpha Sigma Nu. She worked as a teaching assistant for the chemistry department and a laboratory assistant in a university biochemistry laboratory. During her senior year she worked as a project assistant with Keep Greater Milwaukee Beautiful, Inc., a non-profit environmental organization.

Heather left the Midwest in the summer of 1999 to enter the Water Resources Option in the Ecology and Environmental Sciences program at the University of Maine. Working at the Senator George J. Mitchell Center for Environmental and Watershed Research, she was able to present her research in many different forums including the 2000 and 2001 Maine Water Conferences, the 2000 Gordon Research Conference on Environmental Sciences: Water, the 6th International SPMD Symposium and Workshop, the Northeast Regional Meeting of the National Council for Air and Stream Improvement, and the Maine state legislature. After receiving her degree, Heather plans to work on water resource issues with a government agency. She has applied for positions at both the state and federal levels. Heather is a candidate for the Master of Science degree in Ecology and Environmental Sciences from The University of Maine in August, 2001.