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CHLORINATED DIPHENYL ETHERS COMPOUNDS IN THE AQUATIC ENVIRONMENT OF BRITISH COLUMBIA

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By

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ABSTRACT

This report provides a summary of information on chlorinated diphenyl ether compounds in the British Columbia environment obtained as a result of studies conducted by Environment Canada, Commercial Chemicals Division, Pacific and Yukon Region and Department of Fisheries and Oceans, Institute of Ocean Sciences, Pacific Region. These studies were conducted to determine the presence of chlorinated diphenyl ether compounds in coastal regions of southern British Columbia between 1990 and 1998.

A general overview of toxicity and environmental levels of these compounds in other areas of Canada and the world has been presented to provide a broader context for the British Columbia data.

RESUME

Ce rapport fournit un résumé des résultats obtenus lors d'études conduites par Environnement Canada, Division des produits chimiques commerciaux, Région du Pacifique et Yukon, Ministère des Pêches et des Océans, Institut des sciences de la mer concernant les composés d'éther diphényle chloré dans l'environnement de la Colombie-Britannique. Ces études poursuivies entre 1990 et 1998 ont été menées afin de déterminé la présence des composés d'éther diphényle chloré dans les régions côtières sud de la Colombie-Britannique.

Une vue d'ensemble concernant la toxicité et les niveaux environnementaux de ces composés dans d'autres régions au Canada et dans le monde a été fournit afin de permettre au lecteur de mettre la base de données pour la Colombie-Britannique en perspective.

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Summary

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- Chlorinated diphenyl ethers (also called CDPEs, CDEs, polychlorinated diphenyl ethers or PCDEs) resemble PCBs, dioxins, and furans in structure and physicochemical properties. CDPEs and their parent compound, diphenyl ether, are not manufactured in Canada but are imported from the United States. Diphenyl ether is used widely in products such as industrial solvents, dye carriers, high temperature lubricants, thermosetting resins, industrial bacteriostats, surfactants, plastics additives, and antimicrobials in cosmetics, soaps, and sanitizing products. In North America, the main use of diphenyl ether is in heat transfer fluids. Halogenated diphenyl ethers are also used commercially. Brominated diphenyl ethers have been used as flame retardants in plastics, paints, and textiles. Nitro-substituted chlorinated diphenyl ethers have been used primarily in the production of herbicides such as bifenox, CNP, and nitrofen. These herbicides have not been manufactured or used extensively in Canada. Detailed Canadian use information for these products was not available.

- Hydroxychlorodiphenyl ethers (also called chlorophenoxyphenols) are derivatives of chlorinated diphenyl ethers. Triclosan, also called Irgasan, has been widely used as an antimicrobial in cosmetics, sanitizing products, fabric softeners, and as an industrial bacteriostat in textiles, leather, plastic, and rubber.

- The main source of CDPEs and hydroxychlorodiphenyl ethers to the environment is as impurities in chlorophenol-based wood treatment formulations. Significant concentrations of CDPEs were detected in tri-, tetra- and pentachlorophenol wood treatment formulations in Finland and Germany. Higher chlorinated congeners predominate, however, lower chlorinated congeners were detected in some formulations. Unfortunately, although CDPEs were detected in North American formulations, they were not quantified and individual isomers were not identified. The lack of information on predominant isomers in locally used chlorophenol-based wood treatment formulations makes it difficult to identify probable sources of predominant isomers detected in the British Columbia environment.

- The termination of the use of chlorophenol-based antisapstain chemicals in 1990 would have eliminated a major source of CDPE entry into the aquatic environment of British Columbia. Oil-based pentachlorophenol is still used for wood preservation in British Columbia, however, the use of pentachlorophenol for wood preservation in BC appears to be declining. Approximately 202 tonnes were used in 1999 compared to 789 tonnes in 1991. Also, the introduction of environmental codes of practice in the 1980s and the initiation of an aggressive inspection and enforcement program under the federal Fraser River Action Plan (FRAP) in the 1990s has resulted in significant decreases in the release of wood preservation chemicals to the environment.

- CDPEs have been detected in fly ash from incinerators in other areas of the world. More information is needed to determine the predominant isomers released from combustion sources. This information would also be useful for CDPE source identification. Hydroxychlorodiphenyl ethers are produced during the combustion of chlorophenol or chlorine-containing materials. No information was available on combustion sources of CDPEs in British Columbia.

- Other potential sources of CDPE production and release to the environment include the perchlorination of wastewater treatment plant discharges or industrial discharges containing diphenyl ether. Discharges from specific industries, such as chemical, rubber, and textile manufacturing plants, have also been identified as possible sources of CDPEs. Information on CDPEs in municipal wastewater treatment plant and industrial discharges in British Columbia is lacking and loadings to the BC environment from these sources cannot be estimated.

- Recent upgrades at municipal wastewater treatment facilities and the implementation of municipal by-laws and source control initiatives to reduce the discharge of chemicals to storm sewers have undoubtedly reduced releases of a variety of toxic substances to the British Columbia environment. The efficiency of advanced treatment of sewage wastewaters in reducing loadings of CDPEs is not known.

- CDPEs have also been detected in used transformer oils. Historically, transformer fluid leaks and spills were commonplace and may have resulted in past releases of chlorinated diphenyl ethers to the British Columbia environment, particularly in highly industrialized areas and at some contaminated sites.

- Although the presence of CDPEs has not been measured at the many contaminated sites identified in British Columbia, the remediation of these sites, triggered by unacceptable levels of other toxic substances, would also have been effective in reducing environmental releases of CDPEs.

- Information is lacking on the atmospheric transport and deposition of CDPEs in British Columbia. However, since the vapour pressures of some CDPEs are higher than those of PCBs, it is likely that atmospheric transport is a significant means of CDPE distribution in the environment. The presence of CDPEs in areas of the world removed from known sources supports this theory.

b.) Environmental Concerns

- CDPEs are bioaccumulative and, although little information on their environmental persistence is available, their physical and chemical properties resemble those of highly persistent chlorinated organic compounds. In addition, CDPEs and hydroxychlordiphenyl ethers can be converted to the more toxic PCDFs and PCDDs in the environment. CDPEs are rapidly accumulated in biota and slowly released. The half-lives of CDPEs indicate that they are moderately to highly persistent in fish due to their limited ability to metabolize these compounds. It has been reported that the persistence of CDPEs in biological tissues is longer than that of dioxins and furans but shorter than that of PCBs. Some researchers have suggested that biomagnification up the food chain may be a more important route of uptake in higher trophic level aquatic species than is bioconcentration.

- Although information on the toxicity of CDPEs is limited, the potential of CDPEs to produce biological effects in fish and mammals has been demonstrated in the laboratory. Their acute toxicity to adult mammals was moderate, but CDPEs were shown to be fetotoxic, immunotoxic, and thyrotoxic. CDPEs also induced liver enzyme activity and caused histological effects in various internal organs. In fish, LC_{50}s in the μg/L range were reported for trout and medaka exposed to various CDPE isomers. Embryotoxicity has also been observed in some aquatic organisms exposed to CDPEs and diphenyl ether. Existing information on the toxicity of CDPEs to locally found aquatic species is insufficient to determine whether concentrations detected in the BC aquatic environment are likely to result in adverse effects on resident species. In addition, most of the available toxicity information pertains to the lower chlorinated compounds which are not commonly detected in environmental samples. Information on the toxicity of the higher chlorinated CDPE compounds found in the BC environment is lacking.

- Little information is available on the concentrations of chlorinated diphenyl ethers in the environment. Very high levels of CDPEs were detected in the sediments (up to 4,900,000 pg/g dry weight) and fish (800,000 to 14,000,000 pg/g) from Whitby Bay in Lake Ontario and were thought to originate from the use of diphenyl-based heat transfer fluid at a rubber manufacturing plant. CDPE concentrations in the thousands of pg/g have also been detected in trout from the Great Lakes and in sediments from a river in Finland where past spills of chlorophenol-based wood preservatives had been reported. Pike from the river contained 754 to 981 pg/g CDPE wet weight. CDPEs were detected in the hundreds of pg/g range in salmon from an Arctic river removed from known CDPE sources.

- CDPE concentrations in sediments and aquatic biota in British Columbia were much lower than those reported for Whitby Harbour in Lake Ontario, however, levels in sediments from False Creek, Victoria Harbour and the Coal Harbour area of Vancouver Harbour were in the thousands of pg/g dry weight range. CDPEs were detected in virtually all of the samples of BC aquatic biota analyzed. The highest concentrations were detected in crab hepatopancreas (up to 37,250 pg/g wet weight) and English sole (up to 9,389 pg/g wet weight in whole body; up to 5449 pg/g in liver). CDPEs were also present in lower concentrations in sculpin, starry flounder, peamouth chub, whitefish, white sturgeon, burbot, sand sole, mussels, and shrimp.

- There are currently no Canadian or provincial environmental quality guidelines for chlorinated diphenyl ether compounds.

- Higher chlorinated CDPE isomers predominate in both BC sediments and biota. This is in agreement with findings from other areas of the world. The penta-isomer #99, hexa-isomers #153 and 154, and hepta- isomers #184 and 171 accounted for most of the CDPE detected in BC sediments and aquatic biota. Isomers #99, 153, and 154 (as well as several unidentified hepta-CDPE isomers) were detected in chlorophenol-based wood treatment formulations used in Europe. Information on dominant CDPE isomers in chlorophenol-based wood treatment chemicals used in BC was not available. The lack of information on predominant isomers in locally used chlorophenol-based wood treatment formulations makes it difficult to identify probable sources of predominant isomers detected in the British Columbia environment.

- CDPEs were also detected in semi-permeable membrane device (SPMD) samples collected in the lower Fraser River in 1996 by Department of Fisheries and Oceans. In contrast to sediment and biota samples, SPMD samples contained predominantly lower chlorinated CDPEs.

- Diphenyl ether and chlorinated diphenyl ethers have been detected in both fish-eating birds and marine mammals (hundreds to thousands of pg/g) in other areas of the world. In many areas, the environmental levels of CDPE were higher than those of PCDDs, PCDFs, and co-planar PCBs, but lower than the concentrations mono- and di-ortho PCB isomers. No information was available on CDPE concentrations in birds or aquatic mammals in British Columbia.

Recommendations

- An inventory of known past and present sources of chlorophenols to the British Columbia environment should be compiled to identify potential CDPE hot spots and these should be confirmed through select sampling programs to determine present levels of CDPE contamination in the receiving environment.

- Industrial plants/sites identified as potential sources to receiving environment hot spots should be sampled for CDPE contamination in effluents and stormwater discharges.

- The presence of CDPEs in municipal waste water treatment plant effluents should be determined and loadings calculated where possible.

- Efforts should be made to quantify and identify the specific CDPE isomers present in the chlorophenol-based wood treatment formulations which were used in British Columbia. This information would be useful in fingerprinting the sources of CDPEs in environmental samples.

- Additional information on the potential biological effects of CDPEs on local species of aquatic organisms is needed.

- Information on the presence of CDPEs in aquatic birds and mammals in British Columbia is needed.

- There are currently no provincial or federal environmental quality guidelines for CDPEs. The need to develop environmental quality guidelines should be considered based on the results of toxicity tests with local species, source inventories, and environmental surveys in British Columbia.

1. INTRODUCTION

Chlorinated diphenyl ethers (also called CDPEs, CDEs, polychlorinated diphenyl ethers or PCDEs) are organic compounds, which resemble PCBs, dioxins, and furans in structure and properties. CDPEs and their parent compound, diphenyl ether, are not manufactured in Canada but are imported from the United States. Diphenyl ether is used mainly in heat transfer fluids but diphenyl ether and derivatives of chlorinated diphenyl ethers also have a wide variety of industrial applications.

The main source of CDPEs in the environment is associated with their presence as impurities in chlorophenol-based wood treatment formulations. However, other possible sources include municipal incinerators, historic leaks of old transformer oils, and chlorinated discharges from wastewater treatment plants and chemical, rubber, and textile manufacturing plants.

The presence of CDPEs in the environment is of concern. Information on toxicity to aquatic species is limited but the potential of these compounds to produce biological effects in fish and mammals has been demonstrated in the laboratory. CDPEs are bioaccumulative and, although little information is available on their environmental persistence, their physical and chemical properties resemble those of highly persistent chlorinated organic compounds. In addition, they can be converted both thermally and photochemically to the more toxic dioxins and furans.

This report summarizes information on chlorinated diphenyl ether (CDPE) compounds in the aquatic environment of British Columbia obtained from select studies conducted by the Commercial Chemicals Division of Environment Canada, Pacific and Yukon Region and the Department of Fisheries and Oceans, Institute of Ocean Sciences, Pacific Region between 1990 and 1998. These studies were conducted to determine the presence of CDPEs and other chemical contaminants in coastal regions of southern British Columbia.

A general overview of the toxicity and environmental levels of these compounds in other areas of Canada and the world has been presented to provide a broader context for the British Columbia data.

This report also documents the existing legislation and guidelines controlling the use and release of these compounds in British Columbia.

2. USES AND SOURCES OF RELEASE

Chlorinated diphenyl ethers are biaryl ether compounds containing from one to ten chlorines. They resemble PCBs, dioxins, and furans in both structure and in many of their physicochemical properties. PCBs and chlorinated diphenyl ethers have 10 possible congeners with 209 possible isomers and have the same IUPAC numbering system (refer to Table 1). Furans and dioxins have 8 congeners with 135 and 75 possible isomers, respectively.

Diphenyl ether, the parent compound of chlorinated diphenyl ethers, is not manufactured in Canada but is imported from the United States (Environment Canada 1988). Diphenyl ether can enter the environment as a result of its wide range of uses. It is used mainly as a component of heat transfer fluids, but also in industrial solvents, dye-carriers, high temperature lubricants, thermosetting resins, industrial bacteriostat, surfactants, perfumes, plastics, and as antimicrobials in cosmetics, soaps, and sanitizing products (Hawley 1971; Kirk and Othmer 1965; Kirk and Othmer 1985; Wannemacher and DeMaria 1980). In North America, diphenyl ether is used mainly in the production of the Dow Chemical heat transfer fluid Dowtherm A. Other diphenyl ether-based heat transfer fluids used in North America include Dowtherm LF, G, and G-40 (Environment Canada 1988). Diphenyl ether is also found in bituminous coal tar, however, this is the only known natural occurrence of this compound (Karr *et al.* 1967).

The only chlorodiphenyl ether isomer which has been commercially manufactured in North America is 4-monochloro-4-isobutyl-diphenyl ether, a component of the Dow Chemical Company Dielectric Fluid C4, which was produced for use as a dielectric fluid in capacitors (Willis *et al.* 1978).

The halogenated diphenyl ethers also have commercial uses. While brominated diphenyl ethers have been used as flame retardants in plastics, paints, and textiles (Anonymous 1985; Thoma *et al.* 1987; Watanabe and Tatsukawa 1987), nitro-substituted chlorinated diphenyl ethers have been used primarily in the production of herbicides such as the bifenox (2,4-dichlorophenyl 3'-carboxymethyl-4'-nitrophenyl ether), CNP (2,4,6-trichlorphenyl 4'-nitrophenyl ether), nitrofen (2,4-dichlorophenol 4'-nitrophenyl ether) and others (Matsunaka 1975). Chlorinated diphenyl ether based-herbicides are not manufactured in Canada and have not been used extensively in Canada (Environment Canada 1988), however, nitrofen has been registered in Canada under the *Pest Control Products Act.* Nitrofen was the first pesticide to be discontinued due to its developmental toxicity. Bifenox and CNP were registered for use in the United States but not in Canada. Information on the usage of chlorinated diphenyl ether-based herbicides in Canada was not available.

Hydroxychlorodiphenyl ethers (also called chlorophenoxyphenols) are derivatives of chlorinated diphenyl ethers. These compounds exhibit a wide spectrum of antimicrobial activity, especially when the hydroxyl group is in the ortho position relative to

Table 1: IUPAC Numbering System for Chlorinated Diphenyl Ether Isomers

IUPAC No.	Structure	IUPAC No.	Structure
	Monochlorodiphenyl Ethers		**Tetrachlorodiphenyl Ethers**
1	2	40	2,2',3,3'
2	3	41	2,2',3,4
3	4	42	2,2',3,4'
		43	2,2'.3.5
	Dichlorodiphenyl Ethers	44	2,2',3,5'
4	2,2'	45	2,2',3,6
5	2,3	46	2,2',3,6'
6	2,3'	47	2,2',4,4'
7	2,4	48	2,2'4,5
8	2,4'	49	2,2',4,5'
9	2,5	50	2,2',4,6
10	2,6	51	2,2',4,6'
11	3,3'	52	2,2',5,5'
12	3,4	53	2,2',5,6'
13	3,4'	54	2,2',6,6'
14	3,5	55	2,3,3',4
15	4.4'	56	2,3,3',4'
		57	2,3,3',5
	Trichlorodiphenyl Ethers	58	2,3,3',5'
16	2,2',3	59	2,3,3',6
17	2,2',4	60	2,3,4,4'
18	2,2',5	61	2,3,4,5
19	2,2',6	62	2,3,4,6
20	2,3,3'	63	2,3,4',5
21	2,3,4	64	2,3,4',6
22	2,3,4'	65	2,3,5,6
23	2,3,5	66	2,3',4,4'
24	2,3,6	67	2,3',4,5
25	2,3',4	68	2,3',4,5'
26	2,3',5	69	2,3',4,6
27	2,3',6	70	2,3',4',5
28	2,4,4'	71	2,3',4',6
29	2,4,5	72	2,3',5,5'
30	2,4,6	73	2,3',5',6
31	2,4',5	74	2,4,4',5
32	2,4',6	75	2,4,4',6
33	2',3,4	76	2',3,4,5
34	2',3,5	77	3,3',4,4'
35	3,3',4	78	3,3',4,5
36	3,3',5	79	3,3',5,5'
37	3,4,4'	80	3,3',5,5'
38	3,4,5'	81	3,4,4',5
39	3,4',5		

Table 1: IUPAC Numbering System for Chlorinated Diphenyl Ether Isomers

IUPAC No.	Structure	IUPAC No.	Structure
		126	3,3',4,4',5
Pentachlorodiphenyl Ethers		127	3,3',4,5,5'
82	2,2',3,3',4		
83	2,2',3,3',5	**Hexachlorodiphenyl Ethers**	
84	2,2',3,3',6	128	2,2',3,3',4,4'
85	2,2',3,4,4'	129	2,2',3,3',4,5
86	2,2',3,4,5	130	2,2',3,3',4,5'
87	2,2',3,4,5'	131	2,2',3,3',4,6
88	2,2',3,4,6	132	2,2',3,3,'4,6'
89	2,2',3,4,6'	133	2,2',3,3',5,5'
90	2,2',3,4',5	134	2,2',3,3',5,6
91	2,2',3,4',6	135	2,2',3,3',5,6'
92	2,2',3,5,5'	136	2,2',3,3',6,6'
93	2,2',3,5,6	137	2,2',3,4,4',5
94	2,2',3,5,6'	138	2,2',3,4,4',5'
95	2,2',3,5',6	139	2,,2',3,4,4',6
96	2,2',3,6,6'	140	2,2',3,4,4',6'
97	2,2',3',4,5	141	2,2',3,4,5,5'
98	2,2',3',4,6	142	2,2',3,4,5,6
99	2,2',4,4',5	143	2,2',3,4,5,6'
100	2,2',4,4',6	144	2,2',3,4,5',6
101	2,2',4,5,5'	145	2,2',3,4,5,6'
102	2,2',4,5,6'	146	2,2',3,4',5,5'
103	2,2',4,5',6	147	2,2',3,4',5,6
104	2,2',4,6,6'	148	2,2',3,4',5,6'
105	2,3,3',4,4'	149	2,2',3,4',5',6
106	2,3,3',4,5	150	2,2',3,4',6,6'
107	2,3,3',4',5	151	2,2',3,5,5',6
108	2,3,3',4,5'	152	2,2',3,5,6,6'
109	2,3,3',4,6	153	2,2',4,4',5,5'
110	2,3,3',4',6	154	2,2',4,4',5,6'
111	2,3,3',5,5'	155	2,2',4,4',6,6'
112	2,3,3',5,6	156	2,3,3',4,4',5
113	2,3,3',5',6	157	2,3,3',4,4',5'
114	2,3,4,4',5	158	2,3,3',4,4',6
115	2,3,4,4',6	159	2,3,3',4,5,5'
116	2,3,4,5,6	160	2,3,3',4,5,6
117	2,3,4',5,6	161	2,3,3',4,5',6
118	2,3',4,4',5	162	2,3,3',4',5,5'
119	2,3',4,4',6	163	2,3,3',4',5,6
120	2,3',4,5,5'	164	2,3,3',4',5',6
121	2,3',4,5',6	165	2,3,3',5,5',6
122	2',3,3',4,5	166	2,3,4,4',5,6
123	2',3,4,4',5	167	2,3',4,4',5,5'
124	2',3,4,5,5'	168	2,3',4,4',5',6
125	2',3,4,5,6'	169	3,3',4,4',5,5'

Table 1: IUPAC Numbering System for Chlorinated Diphenyl Ether Isomers

IUPAC No.	Structure	IUPAC No.	Structure
	Heptachlorodiphenyl Ethers		**Octachlorodiphenyl Ethers**
170	2,2',3,3',4,4',5	194	2,2',3,3',4,4',5,5'
171	2,2',3,3',4,4',6	195	2,2',3,3',4,4',5,6
172	2,2',3,3',4,5,5'	196	2,2',3,3',4,4',5,6'
173	2,2',3,3',4,5,6	197	2,2',3,3',4,4',6,6'
174	2,2',3,3',4,5,6'	198	2,2',3,3',4,5,5',6
175	2,2',3,3',4,5',6	199	2,2',3,3',4,5,6,6'
176	2,2',3,3',4,6,6'	200	2,2',3,3',4,5',6,6'
177	2,2',3,3',4',5,6	201	2,2',3,3',4,5,5',6'
178	2,2',3,3',5,5',6	202	2,2',3,3',5,5',6,6'
179	2,2',3,3',5,6,6'	203	2,2',3,4,4',5,5',6
180	2,2'3,4,4',5,5'	204	2,2',3,4,4',5,6,6'
181	2,2',3,4,4',5,6	205	2,3,3',4,4',5,5',6
182	2,2',3,4,4',5,6'		
183	2,2',3,4,4',5',6		**Nonachlorodiphenyl Ethers**
184	2,2',3,4,4',6,6'	206	2,2',3,3',4,4',5,5',6
185	2,2',3,4,5,5',6	207	2,2',3,3',4,4',5,6,6'
186	2,2',3,4,5,6,6'	208	2,2',3,3',4,5,5',6,6'
187	2,2',3,4',5,5',6		
188	2,2',3,4',5,6,6'		**Decachlorodiphenyl Ethers**
189	2,3,3',4,4',5,5'	209	2,2',3,3',4,4',5,5,'6,6
190	2,3,3',4,4',5,6		
191	2,3,3',4,4',5',6		
192	2,3,3',4,5,5',6		
193	2,3,3',4',5,5',6		

the ether bond. They have been used as antiseptics in surgical soaps, household chemicals, food preservatives, and in paper and textiles. Triclosan (2,4,4'-trichloro-2-hydroxydiphenyl ether) is a chlorinated diphenyl ether-based compound which is used as an antimicrobial in cosmetics. Triclosan is also used in sanitizing products, fabric softeners and as an industrial bacteriostat in textiles, leather, plastic and rubber. This compound is registered in Canada under the *Pest Control Products Act*. It has also been sold under the name Irgasan DP-300 and Irgasan CH 3565 (Environment Canada 1988).

The presence of chlorinated diphenyl ethers in the environment is due primarily to inadvertent releases associated with the presence of these compounds as contaminants in chemical products such as technical chlorophenols in wood preservatives, bacteriostats, fungicides, slimicides and herbicides (Tulp *et al.* 1979). In particular, the use of chlorophenol-based wood treatment chemicals is thought to be a major source of CDPEs to the environment. Analysis of chlorophenol formulations have revealed a number of contaminants including chlorinated diphenyl ethers, hydroxychlorodiphenyl ethers (also called chlorophenoxyphenols), chlorinated dihydroxybiphenyls, chlorinated dibenzodioxins, and chlorinated dibenzofurans. Agriculture Canada analyzed 34 pentachlorophenol samples taken from four different manufacturers and detected chlorinated diphenyl ether compounds in all samples, but did not quantify these compounds (Singh *et al.* 1985). Humppi and Heinola (1985) reported that the chlorophenol-based wood preservative (Ky-5) used widely in Finland contained tetra- to hexa- chlorinated diphenyl ether compounds. Koistinen *et al.* (1993b) identified a variety of CDPE isomers in Ky-5 including the tetra isomer # 47, the penta isomers #s 99 and 100, the hexa isomers #s 137, 138, 140, 153, 154 and the hepta isomer # 180. A Swedish study found that trichlorophenol formulations contained 100 to 1000 μg/g of tetra- to octa- chlorinated diphenyl ethers (Deinzer *et al.* 1979; Nilsson and Renberg 1974).

Kurz and Ballschmiter (1995) analyzed two pentachlorophenol-based wood preservative formulations and two technical chlorophenol (tri- and tetra-) products used in Germany. Both wood preserving formulations contained similar CDPE patterns, with hepta- to nona- congeners predominating and tri- to penta- congeners present in only low levels in one formulation. Both technical chlorophenol samples contained tri- to nona- congeners, however, the hepta- and octa-congeners dominated. The total CDPE concentration in the 2,3,4,6-tetrachlorophenol (212.6 μg/g) was 50 times greater than that in the Na-2,4,5-trichlorophenate (4.4 μg/g). The tetrachlorophenol sample contained especially high proportions of hexa-isomers #147, 153, 154, hepta-isomer #180 and several unidentified hepta-isomers, octa-isomers #196, 197, 204, and nona-isomer #207. The dominant isomers in the pentachlorophenol-based wood preservative formulations and in the Na-2,4,5-trichlorophenate sample were unidentified hepta-isomers, octa-isomers #196, 197, 204, nona-isomers #206, 207, and decachlorodiphenyl ether isomer #209. Smaller quantities of a variety of other isomers were also detected in all of these chlorophenol-based products.

The main impurities of technical chlorophenol formulations were the hydroxychlorodiphenyl ethers (chlorophenoxyphenols). These compounds can be divided into two groups; predioxins, which have a hydroxyl group in an ortho position relative to the ether bond (and at least one chlorine in an ortho position on the other ring), and isopredioxins, which are substituted in other ways. Predioxins in the environment are of concern as they can be converted to chlorodibenzodioxins by pyrolysis (Langer *et al.* 1973) and by photolysis (Nilsson *et al.* 1974). Chlorinated 2-hydroxydiphenyl ethers (predioxins) and 4-hydroxydiphenyl ethers (isopredioxins) were present in amounts of 1 to 5% in chlorinated phenol formulations (Nilsson and Renberg 1974). Technical pentachlorophenol samples contained hydroxychlorodiphenyl ethers in amounts of 1 to 8%. Three hydroxynonachlorodiphenyl byproducts, including 2-hydroxynonachlorodiphenyl ether (predioxin), 3-hydroxynonachlorodiphenyl ether (isopredioxin 1), and 4-hydroxynonachlorodiphenyl ether (isopredioxin 2), were identified along with their methylated derivatives. The researchers also tentatively identified five hydroxyoctachlorodiphenyl ethers (Deinzer *et al.* 1978; Deinzer *et al.* 1979).

Incomplete combustion is also a potentially significant source of CDPEs to the environment. CDPEs have been detected in the fly ash from incinerators. At present, available information is inadequate to identify predominant CDPE isomers from combustion sources.

Flyash from a municipal incinerator in Helsinki contained primarily 2,2',3,3',4,4'-hexaCDPE (#128) and 2,2',3,3',4,4',5-heptaCDPE (#170) (Passivarta *et al.* 1986), while flyash from the combustion of wastes at a research institute contained primarily 2,3',4,5-tetraCDPE (#67) and 2,2',4,4'-tetraCDPE (#47). Other CDPEs detected in the flyash sample included tetra isomer #77; hexa isomer #167, hepta isomer #180, and octa isomer #196 (Koistinen *et al.* 1993b). Kurz and Ballschmiter (1995) reported that di- and trichlorodiphenyl ethers dominated in fly ash samples from a municipal incinerator in Germany.

Hydroxychlorodiphenyl ethers are also produced during the incineration of chlorophenol or chlorine containing materials and during the hypochlorite treatment of aqueous solutions containing phenol (Onodera *et al.* 1984).

Other potential sources of CDPE production and release to the environment include the perchlorination of wastewater treatment plant discharges or industrial discharges containing diphenyl ether. In wastewater treatment plant effluents, the perchlorination of diphenyl ether can result in the formation of chlorinated diphenyl ethers (Environment Canada 1988). In Cornwall, Ontario concentrations of diphenyl ether in sewage treatment plant effluent exceeded the sublethal no-effect level of 5.25 µg/L (Craig *et al.* 1979). No information was available on the concentrations of CDPEs in treatment plant wastewaters. The chlorination of industrial discharges containing diphenyl ether, such as those from some chemical, rubber, and textile manufacturing plants may result in the release of chlorinated diphenyl ethers to the environment (Environment Canada 1988; Lake *et al.* 1981; Westoo and Noren 1977).

Chlorinated diphenyl ethers have been detected in samples of used transformer fluids (Albro and Parker 1980). Historically, transformer fluid leaks were commonplace and may have resulted in past releases of chlorinated diphenyl ethers to the environment.

Information on potential sources and loadings of CDPEs to the environment in British Columbia is lacking. However, the past widespread use of chlorophenol-based wood treatment chemicals was likely a major source.

In the late 1980s, there were approximately 100 antisapstain facilities using chlorophenate-based formulations for antisapstain control on softwood lumber in British Columbia. Approximately 67% of these were located in coastal areas and the remainder were located in the interior regions of the province. A large number of the coastal mills were located on the lower Fraser River, while two of the world's largest lumber export terminals were located beside one another on the north shore of Burrard Inlet. Chlorophenols were commonly detected in elevated concentrations in the lower Fraser River due to the large number of facilities and the poor operational practices. The annual consumption of these chemicals for antisapstain control was 300,000 to 400,000 kg. This was the largest use of pesticides in the province. The large quantities of chlorophenol antisapstain formulations used in the Georgia Basin prior to 1991 likely resulted in the release of significant quantities of CDPEs. The use of chlorophenol-based formulations for antisapstain control was banned in Canada on December 31, 1990. These chemicals are no longer used at BC mills. The regulated limits of chlorophenols (pentachlorophenol and tetrachlorophenol) in stormwater runoff from antisapstain facilities is 6 µg/L (Environment Canada 1999).

Oil-based mixtures of pentachlorophenol are still registered for wood preservation in Canada and may be a current source of CDPEs to the environment. There are 18 to 22 heavy duty wood preservation plants operating in BC, depending on market conditions. A survey of pesticide use in BC found that 201,642 kg of pentachlorophenol were sold or used in BC in 1999; 55,603 kg of this was used in the Lower Mainland. There are no wood preservative facilities in other areas of the Georgia Basin. There was a significant decrease in the use of pentachlorophenol from 1991 (789,110 kg) to 1999, but an increase from the use in 1995 (122,966 kg) (EC/BC WLAP 2001).

Contaminated stormwater discharge has resulted in the release of unacceptable concentrations of wood preservative chemicals into the BC aquatic environment. However, the development of environmental codes of practice and the implementation of inspection and enforcement programs have been effective in reducing contaminated stormwater discharges. "Most heavy duty wood preservation mills in BC have recognized the risk wood preservation chemicals pose to the environment and have taken steps to prevent the release of these chemicals from their facilities" (Environment Canada 1998). It has been estimated that contaminant loading associated with effluent discharges from these facilities has been reduced by more than 90% due to the FRAP enforcement initiative targeted at this industry sector (Environment Canada 1997).

Wastewater treatment plant effluents have been identified as possible sources of CDPEs to the environment, however, no information on the presence of CDPEs in effluents from BC municipal wastewater treatment plants was available. GVRD and CRD are currently implementing programs to reduce the release of toxic substances in wastewater treatment plant discharges. The Lulu Island and Annacis Island wastewater treatment plants have now been upgraded to secondary treatment and it is expected that the release of particulate-sorbed contaminants has been significantly reduced (Bertold 2000).

The presence of diphenyl ether and chlorinated diphenyl ethers in water bodies removed from known sources suggests that atmospheric deposition may be an important source of these chemicals to the environment (Addison 1977; Koistinen *et al.* 1993b; Swackhamer and Hites 1988). No information was available on atmospheric deposition of CDPEs to the BC environment.

3. LEGISLATION, REGULATIONS, AND GUIDELINES

3.1 Controls on Releases to the Environment

Federal and provincial legislation provide controls on the entry of CDPE compounds into the environment.

CDPE-based pesticides are subject to both provincial and federal legislation on pest control products as are chlorophenol-based wood treatment chemicals. The provincial *Pesticide Control Act* ensures that the sale and use of pesticides in Canada comply with label instructions. The federal *Pest Control Products Act* requires the registration of all pesticides used, manufactured, and sold in Canada. It also regulates these products with respect to their composition, efficacy and package labeling. All compounds used for pesticidal purposes must be registered. In the past, large volumes of chlorophenate-based wood treatment chemicals were used for antisapstain control in BC. However, as of December 31, 1990, chlorophenol-based chemicals were removed from the list of approved antisapstain chemicals under the *Pest Control Products Act*. Oil-based mixtures of pentachlorophenol are still registered for use as wood preservatives in Canada. The federal Pest Management Regulatory Agency, which administers the *Pest Control Products Act*, is currently conducting a re-evaluation of all heavy duty wood preservatives.

In 1988, Environment Canada developed codes of practice and recommendations for the design and operation of heavy duty wood preservation facilities in Canada. Implementation of the codes is voluntary, however, inspection programs conducted by Environment Canada in 1998 showed that 91% of the facilities in British Columbia had complied with the codes' requirements.

Although CDPEs have not been reviewed under the *Canadian Environmental Protection Act* (CEPA 1988), several substances (including PAHs and creosote-impregnated wastes) which may be released to the environment as a result of the use and manufacture of heavy duty wood preservatives have been designated as toxic under Section 11 of CEPA. Under the Act, the federal government is required to develop preventive or control measures for chemicals found to be toxic within two years and to finalize action plans within the next 18 months. The process to develop a plan of action for substances found to be CEPA-toxic is referred to as the Strategic Options Process (SOP). Under the SOP, a multi-stakeholder consultation process is employed to evaluate a range of risk management options which could be implemented to reduce the releases of substances found to be toxic under CEPA. Various stakeholders from industry, government, and non-government organizations make recommendations for the most effective options for managing the toxic substances. Options include regulatory and voluntary initiatives, codes of practice, pollution prevention plans, guidelines for environmental quality and chemical release, and economic measures. SOPs may follow a substance or an industrial sector approach. A chemical approach is normally employed when the main route of entry into the environment is via identifiable industrial processes. A sectorial approach is used when the chemical entry to the environment is primarily a result of commercial use.

The SOP report for the wood preservation sector was completed in 1999. Steering committees and working groups have been formed to oversee the implementation of the report's recommendations concerning the release of CEPA toxic substances from chemical manufacturing, treatment of wood, use of treated wood, and waste management of post-use treated wood.

The ocean disposal of wastes and other materials off the Canadian coast is controlled under the federal *Canadian Environmental Protection Act* (CEPA), Part 7, Division 3. There are currently no criteria for maximum levels of CDPE compounds in materials to be ocean disposed, however, the rejection/screening limit for chlorophenols (penta and tetra isomers) is 1.0 μg/g d.w.

Although the existing regulations under the federal *Canadian Environmental Protection Act* (CEPA) do not specifically address CDPEs, the general provision of the federal *Fisheries Act* (subsection 36(3)) prohibits the deposit of substances that are deleterious to fish into a place where the substance may enter or does enter waters that are frequented by fish. Under this provision, the discharge of any quantity of a deleterious substance is prohibited, unless there is a regulation that permits that discharge. Under the *Fisheries Act*, any substance which may harm fish or alter fish habitat is considered deleterious.

In addition to the codes of practice developed for heavy duty wood preservation facilities, Environment Canada and other government agencies have developed best management practices (BMPs) for a number of activities to minimize input of contaminants into the environment. The implementation of BMPs and pollution prevention practices for stormwater from select industrial facilities may reduce CDPE releases to the environment (Environment Canada 1995).

The provincial *Waste Management Act* (WMA) controls the handling, disposal, and release of wastes from industrial, provincial, and municipal sources. Through a permitting system, this legislation enables allowable releases to be set for pollutants discharged in wastewater and released to the atmosphere. No permits currently contain requirements for CDPE compounds. Under the authority of the WMA, provincial Contaminated Sites Regulations and criteria for various contaminants in soils and water of different use categories have been established. There are currently no criteria for CDPE compounds.

Regional government by-laws such as the GVRD By-law 164 and CRD By-law 2922 have recently been implemented to control wastewater levels of contaminants at the source by limiting the levels entering the sewage system. Chlorinated diphenyl ether compounds are not currently included in the list of controlled substances under these by-laws. However, the CRD by-law lists chlorinated phenols as restricted substances.

3.2 Environmental Quality Guidelines

There are currently no Canadian or provincial environmental quality guidelines for chlorinated diphenyl ether compounds.

3.3 Human Health Guidelines

There are presently no Canadian guidelines on acceptable levels of CDPE compounds in fish and shellfish for human consumption. Incidents of elevated concentrations of CDPE compounds in commercially important species would be reviewed by Health Canada on a case by case basis.

4. PRESENCE IN THE ENVIRONMENT

The presence of chlorinated diphenyl ethers in the environment is of concern. Their potential to produce biological effects in fish and mammals has been demonstrated in the laboratory. CDPEs are bioaccumulative and, although little information is available on their environmental persistence, their physical and chemical properties resemble those of highly persistent chlorinated organic compounds. In addition, CDPEs and some derivatives can be converted both thermally and photochemically to the more toxic PCDFs and PCDDs.

4.1 Biological Effects

4.1.1 Fish and Aquatic Invertebrates

There was little information on the toxicity of chlorinated diphenyl ether compounds to aquatic organisms, especially to species found locally.

Metcalfe *et al.* (1997) examined the toxicity of tetra-CDPE isomers #77 and #71 and penta-CDPEs #118 and #105 to the early life stages of Japanese medaka and concluded that CDPEs in Lake Ontario lake trout have the potential to induce toxic effects in the early life stages of fish. The mono-ortho penta-CDPE isomers #105 and #118 and the non-ortho tetra-isomer #77 were embryotoxic to medaka, however, the di-ortho tetra-isomer #71 did not exhibit significant embryotoxicity. Embryotoxicity was observed in medaka following exposure to individual isomers and to lake trout extract. The LC_{50}s for isomers #77, 71, 105 and 118 were 170.6 μg/L, >2,500 μg/L, 10.8 μg/L, and 605.2 μg/L, respectively. In comparison, the LC_{50} for 2,3,7,8-TCDD was 0.0057 μg/L. The higher toxicity of a mono-ortho isomer compared to a non-ortho isomer has also been observed in mice (Howie *et al.* 1990a). Metcalfe *et al.* (1997) estimated that the toxic equivalency factors (TEFs) for isomers #105, 77, and 118 (relative to 2,3,7,8-TCDD) were 0.00056, 0.00003, and 0.00001, respectively. These values are much lower than the TEF of 0.001 that Safe (1992) suggested for coplanar and mono-ortho coplanar congeners.

Marshall *et al.* (1994) exposed embryos of Japanese medaka to tetra-CDPE #71, penta-CDPE #123, penta-CDPE #126, and 2,3,7,8-TCDD. Like Metcalfe *et al.* (1997), Marshall *et al.* (1994) found that isomer #71 was the least toxic. The other isomers tested exhibited toxicity of approximately three orders of magnitude less than that of 2,3,7,8-TCDD. The lesions observed (yolk-sac edema) in developing embryos were characteristic of those caused by exposure to halogenated aromatic hydrocarbons (HAHs). The authors concluded that CDPEs may contribute to the total embryotoxic burden of HAHs in Great Lakes fish.

Chui *et al.* (1990) exposed brook trout to mono-CDPE #3, di-CDPE #7, tri-CDPE #28 and tetra-CDPE #74 and reported that the LC_{50}s for isomers #3 and #7 were 730 and 660 µg/L, respectively, however the LC_{50}s for isomers #28 and #74 could not be determined as they were greater than the water solubilities of these compounds. The LC_{50} values for isomers #3 and #7 were approximately 2 fold lower than the LC_{50} value for Aroclor 1221 (1200 µg/L), which is a commercial mixture of lower chlorinated PCBs. Chui *et al.* (1990) reported that the 96 hr LC_{50} for mono-CDPE in trout was 700 µg/L, compared to a 96 hr LC_{50} of 900 µg/L for a mono-PCB isomer (Dill *et al.* 1982).

The mechanism of chlorinated diphenyl ether toxicity to fish is not well understood, however, studies indicate that these compounds do not consistently induce hepatic monooxygenases in fish. Chui *et al.* (1985) observed elevated MFO activity in trout exposed to tetra-CDPEs, but not in trout exposed to mono- or tri-CDPEs. Hewitt *et al.* (1996) tested various chloro-, nitro-, and trifluoro-methyl substituted diphenyl ether compounds and reported that they did not induce hepatic ethoxyresorufin *O*-deethylase (EROD) activity in rainbow trout.

Virtually no information was available on the toxicity of chlorinated diphenyl ether to aquatic invertebrates species. Bronzetti *et al.* (1981) observed embryotoxic effects when sea urchin embryos were reared in the presence of diphenyl ether and after a short pretreatment of the eggs before fertilization. There was no evidence of mutagenicity.

4.1.2 Birds and Mammals

The similarity of chlorinated diphenyl ethers to PCBs in both structure and chemistry, combined with their ability to bioaccumulate, has led researchers to speculate that chlorinated diphenyl ethers are a potential threat to the environment. Although several laboratory studies have demonstrated the toxic effects of nitro-substituted chlorinated diphenyl ether-based herbicides to birds and mammals, fewer studies have addressed the toxicity of the non-substituted chlorinated diphenyl ether compounds.

Hoffman *et al.* (1991) exposed American kestrel nestlings to nitro-substituted chlorinated diphenyl ether herbicides over a 10 day period. The oral administration of 500 µg/g nitrofen, bifenox, or oxyfluorofen resulted in total mortality, 66% mortality, and no mortality, respectively. At a 250 µg/g dosage, nitrofen and bifenox (to a lesser extent) caused reduced growth. Exposure to 50 µg/g or more of nitrofen caused an increase in liver weight (as a percent of total body weight). Indications of hepatotoxic effects included increased hepatic GSH peroxidase activity at dosages of 10 µg/g nitrofen or 50 µg/g bifenox or greater. Increased liver enzyme activity was observed following a dosage of 250 µg/g nitrofen. Nitrofen exposure also caused increased total plasma thyroxine (T4) concentrations. The authors noted that altricial (naked or without feathers) nestling kestrels appeared to be more sensitive to nitro-substituted chlorinated diphenyl ether herbicides than were precocial (covered with down) young or adult birds.

Despite its low toxicity to adult mammals (LD_{50} of >2400 µg/g in rats), the nitro-substituted diphenyl ether herbicide, nitrofen, is a potent teratogen and was the first herbicide in the United States to be withdrawn from commercial production due to its developmental toxicity. A maternal dietary exposure to 100 to 500 µg/g throughout pregnancy resulted in neonatal mortality (Francis 1989). Rats administered nitrofen by intubation on the 8^{th} through 18^{th} days of pregnancy exhibited a slightly reduced neonatal survival rate, while a dose of 50 µg/g/day caused 100% neonatal mortality (Ambrose *et al.* 1971; Francis 1989; Kimbrough *et al.* 1974; Stone and Manson 1981). Nitrofen affected most organ systems at doses which were 2 to 3 times below the acute LD_{50} (Francis 1986; Gray *et al.* 1982; Gray *et al.* 1983; Hurt *et al.* 1983). In rats, the kidneys were the most sensitive organ, followed by the Harderian gland, the diaphragm, the heart, and the lungs (Costlow and Manson 1981). The no-effect level for developmental toxicity was estimated to be 0.17 µg/g/day (Hurt *et al.* 1983). A nitrofen analog, 2,4,5-trichlorophenol 4'-nitrophenyl ether, was shown to be 10 times more fetotoxic than nitrofen (Francis 1986; Francis 1989). However, in a subsequent study by Francis (1990) the developmental toxicities of one unchlorinated, three monochlorinated, and five dichlorinated-phenyl 4'-nitrophenyl ether were all found to be less than that of nitrofen. The teratogenicity of nitrofen is not well understood, however, studies by Costlow and Manson (1981) showed that the susceptibility of the embryo to nitrofen was not due to a preferential accumulation in the embryo or to a greater exposure to metabolites.

Nitrofen is unusual in that it causes little or no prenatal mortality but results in malformations in a variety of species, high levels of perinatal deaths, and is active both orally and topically (Francis 1996). Other studies have demonstrated that it is also a carcinogen and a mutagen (Milman *et al.* 1978). In addition, the metabolites of nitrofen were found to be mutagens in the Ames *Salmonella typhimurium* assay (Draper and Casida 1983).

Like nitrofen, the acute toxicity of another nitro-substituted chlorodiphenyl ether herbicide, chlornitrophen or CNP (2,4,6-trichlorophenol-4'nitrophenyl ether), was also very low (LD_{50} of 11,800 µg/g transcutaneously and 4,500 µg/g transabdominally). However, studies by Hiraoka *et al.* (1989) demonstrated that CNP was embryotoxic to mice and CNP degradation products caused skeletal abnormalities in mice. Litters of mice exposed to 500 to 750 µg/g/day of CNP experienced a high incidence of prenatal mortality. The results also indicated that the nitro-substituted chlorinated diphenyl ethers affected male fetuses more severely than female fetus (Francis 1989; Francis 1990).

Two types of developmental toxicity were characteristic of nitro-substituted chlorinated diphenyl ether herbicides. Exposure to these compounds resulted in prenatal mortality and/or perinatal mortality in addition to postnatal morbidity (Francis 1990; Rosiak *et al.* 1997a). In general, the fetotoxicity of the nitro-substituted diphenyl ethers increased with increasing chlorination, however, it was demonstrated that the position of the chlorine substitution was also important. For example, unchlorinated or monochlorinated nitro-substituted diphenyl ethers caused either low or no teratogenicity. Ortho position chlorine substitution was more likely to result in prenatal mortality, while para position chlorine substitution was more likely to result in postnatal mortality (nitrofen syndrome) (Francis 1986; Rosiak *et al.* 1997a).

Nitro-substituted diphenyl ethers caused thyrotoxicity and several effects which were characteristic of postnatal nitrofen syndrome (growth retardation, decreased Harderian gland size, delayed sexual maturation) and also indicative of hypothyroidism (Gray and Kavlock 1983; Gray *et al.* 1983; Manson 1986; Rosiak *et al.* 1997a).

Other studies have shown that nitro-substituted chlorinated diphenyl ether-based herbicides inhibited the enzyme protophorphyrinogen oxidase, which is involved in the biosynthesis of heme and chlorophyll (Camadro *et al.* 1991). According to Butler *et al.* (1988) the herbicide lactofen can cause the development of liver tumours in mice.

Chlorinated diphenyl ethers are considered to be moderately toxic to adult mammals, however, toxicity studies have demonstrated fetotoxicity, immunotoxicity, thyrotoxicity, liver enzyme induction, and histological effects in a variety of internal organs. Rosiak *et al.* (1997a) exposed mice to tetra- to hexa-CDPE isomers #71, 77, 99, 100, 102, 118, 126, 153, and 154 at dosages of up to 100 µg/g/day in order to evaluate the maternal and perinatal toxicity of these compounds. The number of pups born per female and the number of pups surviving per liter (perinatal mortality) were decreased by exposure to hexa-CDPE #154 and tetra-CDPE #71. The number of litters born per female was decreased (without decreased postnatal survival) by exposure to hexa-CDPE #153 and penta-CDPE #102. Exposure to the other CDPE compounds did not cause decreased prenatal or postnatal survival. Rats exposed to 100 µg/g/day of isomer #102 exhibited decreased numbers of litters born and decreased survival of pups carried to term. However, exposure of rats to isomer #71 caused no decrease in the number of litters born or the postnatal survival of rat offspring. Rosiak *et al.* (1997a) noted that the developmental toxicities of CDPEs differed from those of nitro-substituted chlorinated diphenyl ethers in that exposure to CDPEs did not result in postnatal mortality in mice and rats.

Rosiak *et al.* (1997a) also observed that exposure to all CDPE isomers tested (#s 71, 77, 99, 100, 102, 118, 126, 153 and 154) except #77 (3,3',4,4'-tetraCDPE) and #71 (2,3',4',6-tetraCDPE), resulted in significant increases in total cytochrome P-450. However, the authors noted that the lack of induction of cytochrome P-450 following exposure to isomers #77 and 71 may be due to the smaller sample size. The induction of cytochrome P-450 by CDPEs was not closely correlated with the developmental toxicity of the individual

CDPE isomers in rats or mice. Isomers #102 (2,2',4,5,6'-pentaCDPE) and #71 (2,3',4',6-tetraCDPE) were the most toxic to mice. These isomers, and also isomer #126 (3,3',4,4'5-pentaCDPE), were tested for their ability to induce EROD (ethoxyrsorufin), PROD (pentoxyresorufin), and BROD (benzoxyresorufin). All three isomers significantly induced EROD and BROD but only isomer #126 significantly induced PROD. Similarly, Iverson *et al.* (1987) reported that all of the 12 CDPE compounds tested in their study (#s 77, 105, 126, 128, 156, 170, 177, 180, 195, 203, and 209) caused increased P-450 levels or increased monooygenase activities similar to 3-methylcholanthrene or phenobarbitol inducers or a combination of both types. Chui *et al.* (1985) reported that pretreatment of rats with 2,4,4'-triCDPE (#28) and 2,4,4',5-tetraCDPE (#74) increased hepatic MFO activity, with the triCDPE isomer resembling a phenobarbitol-type inducer and the tetraCDPE resembling a mixed type inducer.

CDPEs are structurally similar to nitro-substituted diphenyl ether herbicides and PCBs, both of which are thyrotoxic, and to thyroid hormones. Thyroid function was affected by exposure to CDPEs and related compounds. Rosiak *et al.* (1997b) examined the effects of 2,2',4,5,6'-pentaCDPE (#102), 2',3,4,6'-tetraCDPE (#71), and 2,2',4,4',5,5'-hexaCDPE (#153) on the thyroid levels of maternal and juvenile rats exposed prenatally, and observed that isomers #s 102 and 71 depressed thyroxine levels in maternal and juvenile rats, while isomer #153 depressed only the thyroxine levels in juveniles. Rosiak *et al.* (1997a) noted that isomers with the greatest fetotoxicity, #s 102 and 71, most closely resembled thyroxine. The authors suggested that more information is needed on the role of thyrotoxicity in the developmental toxicity of CDPEs.

Harper *et al.* (1993) reported that the immunotoxicity of three nona-CDPEs and deca-CDPE were unexpectedly high (2.5 to 10 μmol/kg). Howie *et al.* (1990a) also observed immunotoxic effects following exposure of mice to 2,2',3,3',4,4',5,5',6-nonachlorodiphenyl ether (#206) and decachlorodiphenyl ether (#209) at doses as low as 2.5 μmol/kg. At higher doses these chemicals also induced hepatic microsomal AHH and EROD activity. The potencies of the CDPE isomers in inducing AHH and EROD activity were similar to their potencies as immunotoxins. The immunotoxic potencies for the CDPE isomers tested, in descending order, were #157>126>118>77>153>101>154. The ED_{50} values for these isomers were 0.5 to 2.2 μmol/kg; 5.1 to 8.8 μmol/kg; 14.2 to 21.8 μmol/kg; 28.7 to 50.6 μmol/kg; 56.5 to 81.2 μmol/kg and 28.7 to 50.6 μmol/kg, respectively. The only CDPE compound tested which did not cause immunosuppressive effects in mice was hexa-CDPE isomer #167. Howie *et al.* (1990b) observed differences in the structural-activity relationships between PCBs and CDPEs. The coplanar isomers 3,3',4,4'-tetraCDPE (#77) and 3,3',4,4',5-pentaCDPE (#126) were less immunotoxic and had lower enzyme induction potencies than their monoortho analogs, 2,3',4,4',5-pentaCDPE (#118) and 2,3,3',4,4',5-hexaCDPE (#156). In contrast, the corresponding coplanar PCB isomers were more toxic than the monoortho analogs. Also, two diortho-substituted compounds, 2,2',4,5,5'-pentaCDPE (#101) and 2,2',4,4',5,5'-hexaCDPE (#153), were immunotoxic, while the corresponding PCB isomers were not. This difference between the CDPEs and PCBs was explained by the greater distance between the two phenyl rings due to the ether linkage in CDPEs. As a result, the potential steric interactions between the ortho substituents on adjacent rings would be greatly reduced, and the effects of the ortho substituents on the activities of CDPEs as Ah receptor agonists would be much less than for PCBs (Harper *et al.* 1993; Howie *et al.* 1990a). Howie *et al.* (1990b) showed that the CDPE isomers were more than 200 times less immunotoxic than 2,3,7,8-TCDD. However, the authors noted that, depending on the levels and isomers present, CDPEs may contribute significantly to the environmental 2,3,7,8-TCDD toxic equivalence.

Rats exposed to penta-CDPE #99, hexa-CDPE #154 and hepta-CDPE #184 in the diet (0.5 to 500 µg/g) over a 4 week period, exhibited mild histological changes in the liver and thyroid. Minor changes in the thymus, bone marrow, and spleen were also observed following exposure to isomer #184. The authors concluded that isomer #184 was immunosuppressive and that all three isomers were moderately toxic to rats. The no-observable effects level for these CDPE isomers in rats was between 5 and 50 µg/g (Chu and Villeneuve 1990).

Lab studies have also shown that hydroxychlorodiphenyl ethers induce hepatic MFO system enzymes. Hydroxychlorodiphenyl ethers are found as impurities in pentachlorophenol wood treatment formulations and are also metabolites of chlorinated diphenyl ethers. Becker *et al.* (1991) reported that the intraperitoneal toxicity of hydroxychlorodiphenyl ethers was similar to or less than that of pentachlorophenol (Miller *et al.* 1982).

4.2 Environmental Fate

4.2.1 Water and Sediments

Chlorinated diphenyl ethers have low solubilities in water, with the higher chlorinated compounds being less soluble than the lower chlorinated compounds (Weast 1973). Coburn and Comba (1985) reported that the water solubilities of monochlorodiphenyl ether and tetrachlorodiphenyl ether were 3300 µg/L and 140 µg/L, respectively. It has been suggested that emulsifiers and solvents present in industrial discharges may increase the solubility of chlorinated diphenyl ethers entering the environment (Environment Canada 1988).

Chui *et al.* (1990) reported that log octanol-water partition coefficients for 4-CDPE, 2,4-diCDPE, 2,4,4'-triCDPE, and 2,4,4',5-tetraCDPE were 5.01, 5.68, 6.44 and 7.18, respectively. Log octanol-water partition coefficients reported by Neely *et al.* (1974) for tetrachlorinated isomers of PCBs, dioxin and CDPE were 6.4, 6.9, and 7.4, respectively, while Opperhuizen and Voors (1987) reported values of 5.44 and 5.51 for 2,4,5-triCDPE and PCB isomers and 5.78 and 5.82 for 3,3',4,4'-tetraCDPE and PCB isomers, respectively.

Chlorinated diphenyl ethers can be precursors of both polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in the environment

(Buser *et al.* 1978; Choudhry *et al.* 1977a, 1977b, Choudry and Hutzinger 1982; Lindahl *et al.* 1980; Norstrom *et al.* 1976, 1977). Like PCBs, CDPEs can be thermally converted to PCDFs, however, PCBs would be a more important source of PCDFs to the environment due to the fact that much larger amounts of PCBs were produced commercially than CDPEs (Rappe *et al.* 1979). Polyhalogenated 2-phenoxyphenols, which are present as contaminants in commercial formulations of chlorophenols, can undergo photochemically or thermally induced ring closures to produce PCDDs. Upon photolysis, pentachloro-2-phenoxyphenol, one of the contaminants found in 2,4,6-trichlorophenol, produced 1,2,3,8-tetrachlorodibenzodioxin, two trichlorodibenzodioxins, one dichlorodibenzodioxin, and one dichlorodibenzofuran. Pyrolysis of phenoxyphenols resulted in the formation of a dichlorodibenzodioxin and a tetrachlorodibenzodioxin (Nilsson *et al.* 1974). Exposure of Irgasan DP 300 (2,4,4'-trichloro-2-hydroxydiphenyl ether), an antimicrobial agent, to UV radiation or heat can also produce PCDDs (Kanetoshi *et al.* 1987). Bleaching Irgasan DP-300 treated textile products resulted in the formation of 2,3,4,4'-tetrachoro-2-hydroxydiphenyl ether, 2,4,4',5-tetrachloro-2-hydroxydiphenyl ether and 2,3,4,4'5-pentachloro-2-hydroxydiphenyl ether. Subsequent incineration of the textile products caused the chlorinated derivatives to be converted to PCDDs (di- to tetra- isomers) (Kanetoshi *et al.* 1988b). When commercial textile products containing Irgasan DP 300 were exposed to sunlight, 0.02-0.03% of the compound was converted to dichlorodibenzodioxins (Kanetoshi *et al.* 1988a).

The persistence of CDPEs in marine and freshwater environments has not been determined. No evidence of aerobic or anaerobic biodegradation of Irgasan DP-300 by bacteria from activated sludge was observed by Voets *et al.* (1976). Valo and Salkinoja-Salonen (1986) studied the microbial methylation of polychlorinated phenoxyphenols in pure and mixed microbial cultures and in PCPP-contaminated soil under aerobic conditions. These authors reported that the rate of methylation was faster for PCPPs with a hydroxy group in the para position compared to PCPPs with the hydroxy group in the ortho position. Irgasan DP-300 is an ortho OH-PCPP and was not methylated. They also observed that methylation of PCPPs to polychlorinated phenoxy anisoles (PCPAs) resulted in an increase in the lipophilicity of the compounds by a factor of five, suggesting that methylation could result in a greater accumulation in biota.

Studies on the degradation of nitrofen in soils indicated that degradation was greatly enhanced under flooded conditions (Kale and Raghu 1994; Kale *et al.* 1997).

4.2.2 Uptake into Aquatic Biota

Although CDPEs have low solubilities in water, these compounds are readily taken up by aquatic species and even very low concentrations in the environment can result in detectable concentrations in aquatic organisms. Bioconcentration factors (BCFs) vary with species and environmental conditions such as temperature. BCFs in the order of 1000 have been observed for some aquatic species. Kanazawa (1981) reported a BCF of 1109 for topmouth gudgeon (whole body basis), while a BCF of 950 was reported for goldfish (whole body basis) (Miyauchi *et al.* 1981). Coburn and Comba (1985) reported that the BCFs for a monochlorodiphenyl ether and a tetrachlorodiphenyl ether in trout muscle were 736 and 298, respectively, which were approximately 5 to 10% of the BCFs reported for PCBs. Uptake studies with the herbicide CNP 2,4,6-trichlorophenyl-4'nitrophenyl ether) in carp over a 14 day exposure period revealed bioconcentration factors of approximately 334 for muscle, 542 for liver, 862 for kidney, and 547 for gallbladder (Tsuda *et al.* 1990a). The same authors reported that BCFs for the CNP metabolite in carp, CNP-amino or 2,4,6-trichlorophenyl-4'-aminophenyl ether, were 90 for muscle, 402 for liver, 501 for kidney, and 5368 for gallbladder (Tsuda *et al.* 1990b).

Niimi (1986) reported that the absorption efficiencies of chlorinated diphenyl ethers administered orally to rainbow trout ranged from 13 to 65%, and generally decreased with increasing chlorine content for the tri- to hepta- chlorinated diphenyl ether compounds. In comparison, the absorption efficiencies of PCB isomers were generally higher (63 to 93%) than those for corresponding chlorinated diphenyl ether isomers (Niimi and Oliver 1983; Tanabe *et al.* 1982). Niimi and Oliver (1983) did not note any relationship between absorption efficiency and chlorine content of PCB isomers in trout (63 to 80% for dichloro- to decachlorinated isomers), however, Tanabe *et al.* (1982) reported a significant decrease in absorption efficiency in carp with increased chlorine content of the PCB isomer (from 93% for a dichloro- isomer to 67% for octachloro- isomers).

Chui *et al.* (1990) reported that the uptake of chlorinated diphenyl ethers from water into brook trout was rapid. Uptake rates for 4-monoCDPE (#3), 2,4-diCDPE (#7), 2,4,4'-triCDPE (#28), and 2,3,4',5-tetraCDPE (#63) were 19.3, 2.4, 9.8 and 48.9 µg/day, respectively. The authors reported that, at a water concentration of 100 µg/L, the chlorinated diphenyl ether concentrations in the rainbow trout had not reached steady state after seven days of exposure. The authors suggested that the rate of blood flow and respiration can limit the absorption of chlorinated diphenyl ethers by trout. The high lipophilicity of chlorinated diphenyl ether compounds resulted in their accumulation mainly in the adipose tissue and liver.

In contrast to the rapid uptake observed in fish, the elimination of these compounds from trout was slow with depuration half-times of 3.9, 13.6, 63, and 41 days, respectively, for 4-monoCDPE (#3), 2,4-diCDPE (#7), 2,4,4'-triCDPE (#28), and 2,3,4',5-tetraCDPE (#63). The authors concluded that the elimination rate was determined by the lipophilicity and the biotransformation rate of the individual compounds (Chui *et al.* 1990).

The half-lives of chlorinated diphenyl ether compounds indicate that they are moderately to highly persistent in fish. This has led some researchers to suggest that biomagnification through the food chain may be a more important route of uptake than bioconcentration in higher trophic levels aquatic organisms (Niimi *et al.* 1994; Niimi 1985; Niimi 1986). Niimi (1986) reported average half-lives for chlorodiphenyl ethers in rainbow trout of 63 days for a tri-CDPE isomer, more than 100 days for most tetra- to hepta-CDPE isomers, and 46 days for deca-CDPE (based on whole body concentrations). Shorter half-lives were observed for chlorinated diphenyl ether compounds in other studies. For example, Zitko and Carson (1977) reported that half-lives for 2,4,4'-triCDPE (#28); 2,3,4,4'-tetraCDPE (#60); and 2,2',4,4',5-pentaCDPE (#99) isomers were 15, 55 and 55 days, respectively, in juvenile Atlantic salmon following uptake from food. Half-lives for the same compounds following uptake from water were 10, 15, and 15 days, respectively. Half-lives in trout of 4, 14, 63 and 41 days for 4-monoCDPE (#3); 2,4-diCDPE (#7); 2,4,4'-triCDPE (#28); and 2,4,4'5-tetraCDPE (#74) were reported by Chui *et al.* (1990). Neely *et al.* (1974) observed a half-life of 29 days for 3,3',4,4'- tetraCDPE (#77) in trout muscle tissue, while Opperhuizen and Voors (1987) reported that the half-life for this compound in guppies was 23 days. Niimi (1986) suggested that the effect of growth dilution, which was not taken into account in some studies, could partially account for the differences in half-lives observed.

The reported half-lives for chlorinated diphenyl ether compounds were generally comparable to the half-lives of chlorinated pesticides such as dieldrin, chlordane, and DDT (Niimi 1983), longer than those of corresponding dioxin and furan isomers, and shorter than those of corresponding PCB isomers (Niimi and Oliver 1983; Tanabe *et al.* 1982). Niimi (1983) summarized information from a number of studies on the half-lives of a variety of chemical substances in fish under different conditions. The half-lives reported for dieldrin, chlordane, and DDT ranged from 6 to 140 days. Niimi and Oliver (1986) reported that the half-lives for select di-, tri-, tetra- and octachlorinated dioxins in trout ranged from 2 to 43 days, with 1,2,3,4-tetrachlorodibenzodioxin having the longest half-life. Half-lives reported for 1,2,3,7-, 1,3,6,8-, and 2,3,7,8-tetrachlorodibenzodioxin in trout were 3, 7, and 58 to 105 days, respectively. The half-life for octachlorodibenzodioxin in trout was 5 to 7 days. The behaviour of octachlorodibenzodioxin resembled that of decachlorinated diphenyl ether in that the half-lives of these perchlorinated isomers were decreased compared to some of the lower chlorinated compounds (Branson *et al.* 1985; Kleeman *et al.* 1986; Muir *et al.* 1985). In comparison, the half-lives of most tetra- to octachlorinated PCBs in carp exceeded 100 days (Tanabe *et al.* 1982), while half-lives of several hundred days were reported for tetra- and higher chlorinated PCB isomers in rainbow trout (Niimi and Oliver 1983). Researchers have reported a similarity between chlorinated diphenyl ethers and PCBs in that the half-lives of both groups of compounds increased with the increasing chlorine content of the isomer (with the exception of decachlorodiphenyl ether).

The persistence of chlorinated diphenyl ether compounds in fish tissue is a result of the limited ability of fish to metabolize these compounds. Studies have shown that chlorinated diphenyl ethers were transformed to conjugated metabolites prior to elimination (Chui *et al.* 1986). When intravenously injected into winter skate, 4-monoCDPE (#3) was distributed primarily to the liver and bile, with the liver containing the highest concentrations of unmetabolized compound. This finding suggested that 4-monoCDPE was metabolized in the liver and excreted in the bile. Although concentrations of 4-monoCDPE declined quickly in the blood, it was excreted slowly from skate as metabolites in the bile. The authors concluded that metabolites may also be excreted via the gills and kidneys, but these routes of excretion were thought to be of minor importance (Chui *et al.* 1986).

Similarly, the liver appeared to be the primary site of metabolism in goldfish exposed to pentachloro-2-(chloromethyl sulphonamido) diphenyl ether (6-PCSD), the active ingredient in the mothproofing agent, Eulan WA New. High concentrations of a probable metabolite, the amine pentachloro-2-aminodiphenyl ether (5-PAD), were detected in the liver following uptake from water (Machon *et al.* 1984a). A subsequent study by these authors demonstrated species differences in the ability of freshwater fish (during *in vivo* studies) and liver homogenates, from freshwater fish, to form 5-PAD from 6-PCSD. Pike, goldfish and carp showed evidence of 5-PAD formation in both *in vivo* and *in vitro* studies, while rainbow trout, brown trout, perch and eel did not (Machon *et al.* 1986). The liver was also identified as the primary site of 5-PAD formation in northern pike following exposure to 6-PCSD (Machon *et al.* 1984b). In trout, chlorinated diphenyl ethers accumulated mainly in liver and adipose tissue and the depuration curves for whole fish paralleled those for adipose tissue (Chui *et al.* 1990).

Metabolic studies on chlorinated diphenyl ethers revealed similarities to PCBs in that fish preferentially metabolized the lower chlorinated congeners. Chui *et al.* (1990) reported that chlorinated diphenyl ethers were hydroxylated by trout mainly at the 4- and 4'-positions and suggested that 2,4,4'-triCDPE and 2,4,5,4'- tetraCDPE would be metabolized at slower rates than would 4-CDPE and 2,4-diCDPE.

The parent compound, diphenyl ether, was also readily accumulated by fish and excreted slowly (Darrow *et al.* 1978; Neely *et al.* 1974; Poon *et al.* 1986; Wong *et al.* 1981). Darrow *et al.* (1978) observed diphenyl ether metabolism in thorny skate following intravenous administration and concluded that diphenyl ether was rapidly cleared from the plasma but was accumulated by all tissues, especially the liver, and underwent limited metabolism and excretion. No evidence of urinary excretion was observed. Poon *et al.* (1986), however, reported that diphenyl ether was metabolized to hydroxylated and methoxylated derivatives and identified metabolites in the urine and bile of trout which had been administered diphenyl ether intraperitoneally.

Although chlorinated diphenyl ethers have been detected in aquatic invertebrate species in the environment, little is known about the uptake and elimination of these compounds in invertebrate species. Watanabe *et al.* (1985) reported that mussels accumulated the nitro-substituted chlorodiphenyl ether-based herbicide CNP primarily in the adipose tissue. The half-life for this compound in mussels was 4 to 8 days, with more than 90% excreted without being metabolized. A subsequent study by these authors revealed the presence of CNP metabolites in mussels following exposure to CNP. At a water concentration of 12 µg/L CNP, concentrations in the mussels reached a plateau at 30 to 35 µg/g within 9 days. Lower concentrations (0.2 µg/g) of the CNP metabolites, CNP-NH2 and CNP-formamide, were also detected. Elimination studies confirmed a half-life of 4 to 8 days for CNP, however, the metabolites were excreted more slowly (Watanabe *et al.* 1987). A much shorter half-life of 33.8 days was reported by Yamagishi *et al.* (1979) for CNP in short-necked clams.

4.2.3 Uptake into Birds and Mammals

Bioaccumulation studies indicated that the uptake, tissue distribution, and persistence of CDPEs in biota were similar to those of PCBs (Law and Chakrabarti 1983; Newsome *et al.* 1983). Like PCBs and other halogenated aromatic hydrocarbons, CDPEs accumulated in the fatty tissue, with retention being greater for higher chlorinated isomers than for lower chlorinated isomers. However, both the number and position of chlorine substitutions were important in determining the retention of CDPEs in biological tissues (Rosiak *et al.* 1997a). The more toxic tetrachlorodiphenyl ethers were approximately 400 fold more resistant to biodegradation than was the monochlorodiphenyl ether tested (Coburn and Comba 1985). Although CDPEs were eliminated slowly from biological tissues, they were generally less persistent in mammals than were PCBs. The half-lives for hepta- to nona-CDPEs in various tissues of rats were 6 to 13 days compared to >90 days for corresponding PCB isomers (Newsome *et al.* 1983; Tanabe *et al.* 1981).

Rats exposed to 2,2',4,4',5-pentaCDPE (#99) contained the highest levels of this compound in the fat, followed by the skin, liver, kidney, and muscle. This penta-isomer remained in the adipose tissue for a long time, with 5 μg/g persisting 21 days after the administration of a single dose. It was excreted, mainly in the feces, following metabolism to a monohydroxylated compound. Within 7 days, 55% was excreted in the feces and 1.3% was excreted in the urine. In the feces, 64% was present as unchanged pentachlorodiphenyl ether, while 23% was present in hydroxylated form (Komsta *et al.* 1988). In rats, hydroxylation of CDPEs at the ortho positions (dichloro- to pentachloro- isomers) was the dominant pathway for metabolism (Becker *et al.* 1991). Chlorinated phenoxyphenols were detected in the urine of rats dosed with di- and tri-chlorodiphenyl ether (Tulp *et al.* 1979).

Tulp *et al.* (1979) reported that the antimicrobial agent, triclosan or Irgasan DP 300 (5-chloro-2-(2,4,-dichlorphenoxyphenol), was excreted largely unchanged in the urine and feces, but five monohydroxy metabolites were also detected in the urine and three in the feces.

4.2.4 Atmospheric Transport and Deposition

Information was lacking on the atmospheric transport of CDPEs in the environment, however, the vapour pressures of diphenyl ether and, at least some, chlorinated diphenyl ethers at normal temperatures in the environment are higher than those of PCBs. Addison (1977) suggested that, since atmospheric transport constitutes a major source of PCBs to the environment, it may also be an important source of CDPEs. From information reported in Weast (1973), Addison (1977) calculated that the vapour pressure of diphenyl ether would be 2.6×10^{-2} torr at 10° C and 8.3×10^{-2} torr at 25° C. Coburn and Comba (1985) reported that the vapour pressures of a monochlorodiphenyl ether and a tetrachlorodiphenyl ether at 25° C were 7.0×10^{-3} torr and 6.0×10^{-4} torr, respectively. In comparison, Mackay and Wolkoff (1973) reported that the vapour pressures of Aroclors 1242, 1248, 1254, and 1260 at 25° C were 4.06×10^{-4} torr, 4.94×10^{-4} torr, 7.71×10^{-5} torr, and 4.05×10^{-5} torr, respectively. The presence of diphenyl ether and chlorinated diphenyl ethers in water bodies removed from known sources supports the theory that atmospheric transport and deposition is an important source of these chemicals to the environment (Addison 1977; Koistinen *et al.* 1993b; Swackhamer and Hites 1988).

4.3 Concentrations in the Aquatic Environment

4.3.1 General Information

4.3.1.1 Water and Sediment

Very little information was available on concentrations of diphenyl ether or chlorinated diphenyl ethers in ambient waters or bottom sediments of aquatic systems.

Diphenyl ether was detected in seawater samples collected off the coast of Nova Scotia in 1976 and 1977. The concentrations varied with the time of collection and with collection site and ranged from 3000 to 130,000 pg/L. Based on limited data, water concentrations in Bedford Basin were highest during times of possible diphenyl ether input from the atmosphere. For example, the highest concentration was detected when a fire burning at the municipal dump, located about 1.5 km upwind, dispersed smoke over the sampling area. The second highest concentration (54,000 pg/L) was detected in the water after a rainstorm. Freshly fallen snow collected from the Bedford Basin shoreline contained 103,000 pg/L of diphenyl ether (Addison 1977).

Diphenyl ether was detected in the water of Lake Zurich in Switzerland at concentrations of 48,000 pg/L and 8,000 pg/L at the surface of the lake and at a depth of 30 metres, respectively. Diphenyl ether was also detected at a concentration of 3,000 pg/L in groundwater and tap water samples (Grob and Grob 1974).

Sediment samples from Whitby Harbour in Lake Ontario contained di- to octa-CDPE congeners with total concentrations ranging from 50,000 to 4,900,000 pg/g, with the hexachlorinated isomers predominating. The contamination was thought to originate from the use of the diphenyl ether-based Dowtherm heat transfer medium at a nearby rubber manufacturing plant (Coburn and Comba 1985; Environment Canada 1988).

In Narragansett Bay, Rhode Island, tri- and tetra-CDPEs were detected in suspended particulate matter (0.03 and 0.06 pg/g, respectively). However, the authors noted that there was uncertainty associated with these values as the concentrations were estimated from the amount of water filtered. Tri- and tetra-CDPEs were also detected in mussels from Narragansett Bay. Chemical plant discharges entering a tributary river were thought to be the most likely source. These compounds had previously been identified in the wastewaters of the chemical plant and were believed to be by-products from the manufacture of 2,4,4'-trichloro-2-hydroxydiphenyl ether (Lake *et al.* 1981).

CDPEs were not detected in sediments collected from Baltic sediments from Bothnian Bay, a reference site in the Kymijoki River, the Gulf of Finland, or the vicinity of Gotland, Finland in 1991 and 1992. Tetra- through hepta-CDPEs, octa- and nona-CDPEs, and deca-CDPE did not exceed the detection limits of 100, 200 and 400 pg/g dry weight, respectively, at these sites. Sediments collected from a contaminated area of the Kymijoki River contained CDPEs at concentrations ranging from 1,000 to 110,000 pg/g dry weight. The presence of CDPEs in Kymijoki River sediments was attributed to past spills of a chlorophenol-based wood preservative (Koistinen *et al.* 1995a; Koistinen *et al.* 1997a).

4.3.1.2 Aquatic Biota

Chlorinated diphenyl ethers (tetra- to deca- isomers) were detected in walleye and lake trout from the Great Lakes (Niimi *et al.* 1994). The mean total CDPE concentrations in trout (wet weight, whole body basis) from Lakes Ontario, Huron, and Superior were 126,000 pg/g (range of 54,200 to 303,400 pg/g), 16,000 pg/g (range of 6,100 to 29,300 pg/g) and 4,000 pg/g (range of 1,700 to 6,900 pg/g), respectively. The mean total CDPE concentration in walleye (wet weight, whole body basis) from Lake Erie was 57,000 pg/g (range 34,900 to 105,600 pg/g). The concentrations of PCBs in fish from these lakes were also highest in Lake Ontario (5,430,000 pg/g) and lowest in Lake Superior (820,000 pg/g) (De Vault *et al.* 1989).

There were no significant differences in the concentration patterns of the various CDPE congeners in fish from Lakes Ontario, Erie, and Huron, however, a significant difference was noted in the CDPE pattern in Lake Superior fish. In fish from Lakes Ontario, Erie, and Huron, the penta- to hepta-congeners represented 80 to 90% of the total CDPE concentration, with the hexachlorinated compounds accounting for 45 to 60%. In lake trout from Lake Superior, the CDPE concentrations were lower and the pattern observed was somewhat different. The penta- to hepta- compounds represented 53% of the total CDPE, while the octa- and nona- compounds made up the remaining 47%. The most commonly detected hexa- isomers were 2,2',4,4',5,6- (#154); 2,2',4,4',5,5'- (#153); and 2,2',3,4,4',6-hexaCDPE (#139), while the most commonly detected hepta-isomer was 2,2',3,4,4',5',6-heptaCDPE (#183) (Niimi *et al.* 1994). Niimi *et al.* (1994) suggested that this difference may indicate that the influx of CDPE into the Great Lakes is similar to that of PCBs. Strachan and Eisenreich (1990) suggested that non-atmospheric sources contribute 93% of the total PCB input to Lake Ontario, but only 9% to Lake Superior.

Elevated concentrations of CDPE have been detected in fish near point sources and in urban areas. However, atmospheric deposition may be an important source in more remote areas. Decachlorodiphenyl ether was detected in fish from remote Siskiwat Lake on Isle Royale in Lake Superior. As with other contaminants detected in this lake, the presence of decachlorodiphenyl ether was attributed to atmospheric transport since the lake is removed from point sources (Swackhamer and Hites 1988).

Metcalfe *et al.* (1997) reported that a bulk extract sample of Lake Ontario lake trout contained 90,700 pg/g of total CDPEs. The higher chlorinated congeners (specifically, isomers 2,2',4,4',5- pentaCDPE (#99); 2,2',4,4',5,5'- hexaCDPE (#153); 2,2',4,4',5,6- hexaCDPE (#154), and 2,3,3',4,5,6- heptaCDPE (#163)) accounted for over 81% of the total chlorinated diphenyl ether concentration. In contrast, isomers 3,3',4,4'-tetra CDPE (#77), 2,3,4,6-tetra CDPE (#71), 2,3',4,4',5-penta CDPE (#118), and 2,3,3',4,4'-penta CDPE (#105) contributed only 1% of the total amount.

The number of isomers detected increased with the total CDPE concentration present in the sample. In Lake Ontario fish, which contained higher total CDPE concentrations, an average of 24 isomers were detected, while in Lake Superior fish, which contained lower total CDPE concentrations, an average of only six isomers were detected (Niimi *et al.* 1994).

Niimi *et al.* (1994) reported that there was no consistent relationship between the concentrations of CDPE in trout and walleye (whole body basis) and the size of the fish. However, the authors acknowledged that the failure to identify a correlation with size may have been due to the fact that the size range of the fish in their study was small. However, their findings were supported by those of Swackhamer and Hites (1988) and Huestis and Sergeant (1992), who also reported a lack of correlation between CDPE concentrations and fish size. In contrast, a positive correlation between fish size and PCB concentration has been reported (Bache *et al.* 1972; Niimi and Oliver 1989).

Non-migratory bottom-feeding fish (primarily carp) from Lake Ontario basin rivers contained ND to 900,000 pg/g decachlorodiphenyl ether (lipid weight basis). The highest concentrations were present in fish collected at the Love Canal and the Eighteen Mile Creek sites. Both of these sites were located near hazardous waste dumps known to have caused extensive environmental contamination. Dichlorinated diphenyl ethers were also detected in some samples but were not quantified (Jaffe and Hites 1986). Carp and northern pike collected from Whitby Harbour in Lake Ontario, which received discharges from a rubber plant using diphenyl ether-based heat transfer fluid, contained approximately 800,000 to 14,000,000 pg/g of tetra- to deca- CDPE compounds (whole fish samples). Concentrations of total PCDFs in these samples were much lower, ranging from 58 to 254 pg/g (Coburn and Comba 1985; Environment Canada 1988; Huestis and Sergeant 1992).

Carp from embayments and tributaries of Lake Superior and Lake Huron contained CDPE concentrations of 73,000 to 270,000 pg/g (lipid weight) (Jaffe *et al.* 1985). CDPEs were detected in fish collected from the industrialized area of Saginaw Bay in Lake Huron, but not in rural areas or Lake Superior tributaries.

Zitko and Collins (1997) reported that chlorinated diphenyl ethers were detected in all samples of eel collected from the Miramichi Watershed in New Brunswick.

CDPEs were detected in three pike collected from the River Kymijoki in Finland near the former industrial site of wood preservative (Ky-5) production (Koistinen *et* *al.* 1993a). The CDPE concentrations were higher than those of the toxic PCDD and PCDF compounds. Concentrations of tetra- to octa- CDPEs in the three samples ranged from 754 to 981 pg/g (wet weight). The hexa-CDPE homologues contributed 76% to the total CDPE concentration. The compounds detected at the highest concentrations in all three samples of pike from the Finnish river were 2,2',4,4'5-penta CDPE (#99), 2,2',4,4',5,6'-hexa CDPE (#154), and 2,2',4,4',5,5'-hexa CDPE (#153), however, isomers #47, 100, 85, 137, 138, 180, and 195 were also detected (Koistinen *et al.* 1993a). Isomers #99, 154, and 153 were among those detected at the highest concentrations in the fish from Lake Ontario also (Niimi *et al.* 1994). These isomers were detected as impurities in the chlorophenol-based wood preservative, Ky-5 in Finland (Humppi and Heinola 1985) and in several chlorophenol-based wood treatment products in Germany (Kurz and Ballschmiter 1995). Information on the CDPE isomers present in North American chlorophenol-based wood treatment formulations was not available.

Mussels incubated for four weeks in River Kymijoki in Finland also contained polychlorinated diphenyl ethers (400 to 1,100 pg/g lipid weight). Polychlorinated phenoxyanisoles, which were present as contaminants in chlorophenol preparations, were also detected (300,000 pg/g lipid weight) (Koistinen *et al.* 1997b).

Koistinen *et al.* (1993b) collected salmon from three different locations in Finland representing the Baltic, Arctic marine, and freshwater environments. Simojoki River fish, which represent Baltic contamination, contained a mean concentration of 3,205 pg/g wet weight total CDPEs (tetra- to octa- homologues). Salmon from Lake Saimaa, which had possibly been polluted by previous use of chlorophenols, contained 906 pg/g CDPEs. Salmon from the Arctic Tenojoki River contained the lowest CDPE concentrations (408 pg/g). This river received no known point discharges and CDPE input was thought to be from atmospheric deposition.

The patterns of CDPE isomers detected in the salmon differed between the three sites. The CDPE isomer pattern in Lake Saimaa salmon was indicative of chlorophenol contamination. The most abundant isomer in Lake Saimaa salmon was 2,2',4,4',5,6'-hexaCDPE (#154). This isomer, and most of the other CDPE isomers in the salmon from Lake Saimaa, were also found in the wood treatment chemical, Ky-5. Salmon from the Simojoki River, which represents Baltic contamination, also contained many of the CDPE isomers found in Ky-5, but at different proportions than were observed in the Lake Saimaa salmon. The most abundant isomer in the Simojoki River salmon was 2,2',4,4'-tetrachlorodiphenyl ether (# 47), which was also present in both the wood preservative Ky-5 and in flyash. The authors concluded that, although the major source at this site was likely chlorophenols, the isomer pattern suggested the possibility of more CDPE sources. Combustion was a possible source, however, information on the typical isomers produced during combustion is lacking (Koistinen *et al.* 1993b). The low concentrations of CDPEs in salmon from the Arctic Tenojoki River did not reflect the isomer pattern typical of Ky-5 wood preservative, and the authors attributed the presence of CDPEs to atmospheric deposition (Koistinen *et al.* 1993b).

Nitro-substituted chlorinated diphenyl ether derivatives related to the mothproofing agent, Eulan WA New, were detected in fish in the vicinity of textile factories in Sweden. Westoo and Noren (1977) detected up to 400,000 pg/g of 2'3,4,4'5-pentachloro-2-aminodiphenyl ether (5-PAD) and 2',3,4,4',5,6-hexachloro-2-aminodiphenyl ether in fish collected downstream from textile factories.

Nitro-substituted chlorinated diphenyl ether-based herbicides were detected in fish and shellfish in Japan as a result of their extensive use in rice paddy fields. The herbicide CNP was detected in all fish species (46,000 to 880,000 pg/g in muscle tissue) sampled from the Sagami River in Japan a few months following herbicide application, however, the concentrations declined to very low or non-detectable levels later in the year (Watanabe *et al.* 1983).

The widespread use of the hydroxychlorodiphenyl ether-based antibacterial agent, triclosan (or Irgasan), in Japan led to the presence of the methylated form of this compound in aquatic biota. Miyazaki *et al.* (1984) reported that 13 out of 14 samples of topmouth gudgeon from the Tama River contained triclosan methyl at concentrations ranging from 1,000 to 38,000 pg/g (mean of 11,600 pg/g) on a whole body basis. Goby fish collected from the estuary of the river contained very low concentrations (ND to 2,000 pg/g). Triclosan methyl was also detected in clams (3,000 to 5,000 pg/g), mussels (20,000 pg/g) and oysters (13,000 pg/g) collected from Tokyo Bay. The authors concluded that this compound had been formed as a result of biological methylation occurring within the organisms.

Limited information was available on diphenyl ether or chlorinated diphenyl ether compounds in marine species. Addison (1977) reported that cod collected off the Nova Scotia coast in 1977 contained 3,200,000 to 3,900,000 pg/g (lipid weight) of diphenyl ether in liver tissue. In Narragansett Bay, Rhode Island on the east coast of the United States, mussels caged at various distances from the discharge of a chemical manufacturing plant contained higher concentrations of tri- and tetra- CDPEs at sites located near the plant than at sites located farther away (Lake *et al.* 1981). Concentrations at sites close to the plant ranged from 46,000 to 125,000 pg/g for tri-CDPEs and from 198,000 to 416,000 pg/g for the tetra-CDPEs (dry weight basis). Concentrations in mussels from the sites farther removed from the chemical plant contained 2,400 to 5,300 pg/g tri-CDPEs and 9,100 to 32,000 pg/g tetra-CDPEs. Lobster contained 82,000 pg/g tri-CDPEs and 144,000 pg/g tetra-CDPEs, while clams contained 2,400 pg/g tri-CDPEs and 9,100 pg/g tetra-CDPEs. Although other potential sources of CDPEs were also located in this area, the chemical plant was thought to be the main source. Tri- and tetra- CDPEs were detected in the wastewater from the plant and were thought to originate as by-products from the manufacture of 2,4,4'-trichloro-2'-hydroxydiphenyl ether.

Chlorinated diphenyl ethers were detected in salmon from the Baltic Sea in 1986, but were not detected in the liver or fat of cod taken from the Arctic coast of Norway in 1987 and 1988. Five CDPE compounds (2,2',4,4'-tetraCDPE (#47); 2,2',4,4',5-pentaCDPE (#99); 2,2',4,4',5,5'-hexaCDPE (#153); 2,2',3',4,4',5-hexaCDPE (#137); and one unidentified hepta isomer) were identified in the salmon at concentrations ranging from 5 to 19 pg/g (Koistinen *et al.* 1989). In comparison, the toxic PCB coplanar isomers 3,3',4,4'-tetraCDPE (#77) and 3,3',4,4',5-pentaCDPE (#126) were detected in all samples at concentrations ranging from 70 to 900 pg/g and from 30 to 300 pg/g, respectively. Paasivirta *et al.* (1987) detected several CDPEs in commercial fish oil including 2,2',4,4'-tetraCDPE (#47); 2,3,4,4',5-pentaCDE (#114); 2,2'3,4,4',5-hexaCDPE (#137); 2,2'4,4',5,5'-hexaCDPE (#153); and 2,3,3'4,4'5-hexaCDPE (#156). The concentrations of these compounds were not reported. Kurz and Ballschmiter (1995) reported the total CDPE concentration in a 1995 cod liver oil sample (49,000 pg/g lipid weight) was more than 10 times lower than the concentration in a 1985 sample (659,000 pg/g lipid weight). PCB concentrations were also lower in the 1993 fish oil sample. It was not known if this decrease was due to lower environmental levels of these compounds in recent years or to the origin of the more recent sample from a less contaminated location. The dominant isomers in the 1985 cod liver oil sample were hepta-CDPE #180, and octa-CDPEs #195 and 203. Isomers #203 and 195 were also dominant

isomers in the 1993 cod liver oil sample, however, isomer #180 was not elevated. The authors noted that the presence of several highly chlorinated isomers in the fish oil indicated that chlorophenol was a likely source, however, the isomer patterns in fish oil and in chlorophenol formulations exhibited many differences. Some of the dominant isomers in the chlorophenol samples were present at very low concentrations in the fish oil and some of the dominant isomers in the fish oil were present at relatively low concentrations in the chlorophenol samples. The authors suggested that this could be explained by differences in the environmental persistence and bioaccumulation potential of the various isomers.

4.3.1.3 Birds and Mammals

Diphenyl ether and chlorinated diphenyl ethers have been detected in both fish-eating birds and marine mammals.

Diphenyl ether was detected in tissues from a gull and a seal from Nova Scotia in 1977. Subcutaneous fat from a greater black-backed gull contained 1300 pg/g diphenyl ether, while blubber from a grey seal contained 1000 pg/g (lipid weight) diphenyl ether (Addison 1977).

Stafford (1983) reported on the presence of chlorinated diphenyl ethers in eggs and carcasses of fish-eating birds from the southern United States and from Ontario. Average concentrations of tetra-CDPE in black skinner eggs from Louisiana ranged from 100 to 330 pg/g wet weight. Penta-, hexa-, and hepta- CDPE isomers were detected in bald eagle eggs from Michigan and Ohio, however, only 2,2',4,4',5-pentaCDPE (#99) was quantified. Average concentrations of this isomer ranged from 33 to 38 pg/g wet weight in eggs from Michigan, while eggs from Ohio contained 15 pg/g wet weight. Hexa- and hepta- CDPEs were detected in bald eagle eggs from Virginia. Common tern eggs from Rhode Island contained average tri-CDPE and tetra-CDPE concentrations of 120 and 290 pg/g wet weight, respectively. Hexa- and hepta- chlorinated diphenyl ethers were detected, but not quantified, in common tern eggs from the Toronto and Georgian Bay areas of Ontario. The highest CDPE concentrations were detected in common tern carcasses from Rhode Island. Tri-CDPEs ranged from 130 to 280 pg/g (average of 190 pg/g) and tetra-CDPEs ranged from 450 to 900 pg/g (average of 680 pg/g). The tri-CDPE was identified as 2,4,4'-triCDPE (#28) but the tetra-CDPE was not identified. The most likely source of CDPE contamination in terns from Rhode Island was the nearby chemical plant, which was also suspected as the source of CDPEs detected in suspended particulates and aquatic invertebrate species in the Narragansett Bay area (Lake *et al.* 1981).

Custer *et al.* (1985) reported that CDPEs were present in 3 of 14 tern carcasses collected in Providence, Rhode Island (ND to 900,000 pg/g wet weight) but were not detected in carcasses from two other colonies. Variations in the PCB and DDE concentrations in terns from different colonies were also observed. The authors suggested that differences in chemical concentrations between colonies was due to differences in local levels of contamination. The authors stated that the concentrations of CDPEs, PCBs, or DDE were likely not high enough to be harmful to the terns.

Chlorinated diphenyl ether compounds were detected in fish, birds and marine mammals from the Baltic Sea. Concentrations of greater than 1,000 pg/g of 2,2',4,4'5- , and 2,3',4,4',5-CDPE (#s 99 and 118) were detected in muscle tissue of white-tailed eagle from the Baltic area (Paasivirta *et al.* 1987). Koistinen *et al.* (1995b) reported that the concentrations of individual CDPE isomers in the breast muscle of white-tailed eagles ranged from <5,000 to 13,000,000 pg/g (lipid weight). Less variation was observed in the CDPE isomer concentrations in the eggs of black guillemots (<3,000 to 79,000 pg/g lipid weight). Isomers most commonly identified were tetra-CDPE #47, penta-CDPE #99, hexa-CDPE #147/153, hepta-CDPE #180/181, and octa-CDPE #196. The isomer pattern in birds was similar to that identified in fish, seals, sediment and a wood preservative in Finland. However, some differences were noted and were attributed to different contamination sources and to differences in metabolism between species (Koistinen *et al.* 1993a, 1993b, 1995b, 1996, 1997). TEQs for CDPEs in the eagles and guillemots were calculated based on the TEFs proposed by Safe (1992). The TEQs calculated for CDPEs (average of 200 pg/g lipid weight in guillemots; 40 to 1,400 pg/g lipid weight in eagles) were much lower than those calculated for PCBs in these birds (average of 5,000 pg/g lipid weight in guillemots; 9,000 to 340,000 pg/g lipid weight in eagles), however, the TEQs for CDPEs were based on only six non- and mono-ortho CDPE isomers.

A ringed seal collected along the Swedish coast in the Baltic Sea contained chlorinated diphenyl ethers in the 1,000 to 10,000 pg/g lipid weight range in the liver tissue. Brominated diphenyl ether compounds were detected at similar concentrations. A variety of chlorinated diphenyl ether compounds were identified including several hepta- and octa-isomers, two nona- isomers and decachlorodiphenyl ether. Octa- and nona- methoxy chlorinated diphenyl ethers were also tentatively identified (Haglund *et al.* 1997). Methoxy-chlorinated diphenyl ethers have also been detected in fish from the Great Lakes (Stallings *et al.* 1983) and in soil from wood-preserving facilities (Tulp *et al.* 1979).

CDPEs were detected in the blubber tissue of all Baltic region ringed and grey seals found dead in the Gulf of Finland in the winter of 1991 to 1992. The concentrations of individual tetra- through deca- isomers ranged from <300 to 62,000 pg/g lipid weight. Total CDPE concentrations ranged from 39,900 to 373,900 pg/g lipid weight, and were higher than the concentrations of PCDDs, PCDFs, and coplanar PCBs, but lower than those of some mono- and di-ortho PCBs. The authors noted that the concentrations found could not account for the high mortality observed in ringed seals from this region in 1991 (Koistinen *et al.* 1997a).

4.3.2 Concentrations in the British Columbia Environment

Information on CDPE concentrations in sediments and biota in British Columbia is very limited. Bottom sediments, fish, and aquatic invertebrates from False Creek and Vancouver, Victoria, and Esquimalt harbours collected by Environment Canada between 1990 and 1994 were analyzed for CDPEs, as were aquatic biota collected by Department of Fisheries and Oceans between 1992 and 1998. Although concentrations were far below those reported for Whitby Harbour in Lake Ontario, sediments from some sites contained CDPEs in the thousands of pg/g dry weight range. CDPEs were detected in virtually all of the samples of BC aquatic biota analyzed and concentrations exceeded 1000 pg/g wet weight in the hepatopancreas tissue of crabs from some locations. CDPEs were also detected in semi-permeable membrane devices (SPMDs) deployed in the lower Fraser River by Department of Fisheries and Oceans in 1996.

Data on chlorinated diphenyl ether concentrations in the British Columbia environment obtained from Environment Canada sampling programs conducted between 1990 and 1994, and Department of Fisheries and Oceans sampling programs conducted between 1992 and 1998 are presented in Appendix 5. Quality control information is presented in Appendix 4 and sampling and analytical methodologies are summarized in Appendix 1. Sample characteristics information for sediments (particle size, SFR, SVR) and biota (size, sex, number of individuals, moisture content, lipid content) is located in Appendix 3. Environment Canada sampling station coordinates are listed in Appendix 2. Coordinates were not available for Department of Fisheries and Oceans sampling stations. Site maps (Maps 1 to 14) are located at the end of this report.

4.3.2.1 Sediment

Chlorinated diphenyl ethers were detected in sediments collected from False Creek, Coal Harbour, Vancouver Harbour, Victoria Harbour and Esquimalt Harbour during Environment Canada surveys conducted between 1990 and 1994.

CDPE concentrations in BC sediments were much lower than those reported for Whitby Harbour in Lake Ontario (Coburn and Comba 1985), however, concentrations exceeded 1,000 pg/g (dry weight) in False Creek and in the Coal Harbour area of Vancouver Harbour. Sediments from several sites in False Creek contained total chlorinated diphenyl (CDPE) concentrations ranging from 1,005 to 8,349 pg/g. In Coal Harbour, elevated CDPE levels (up to 3,370 pg/g) were detected in sediments collected near the Bayshore Inn, Royal Vancouver Yacht Club, and the past site of Menchion's Shipyard. Sediments from other locations within Vancouver Harbour ranged from below the detection limits to several hundred pg/g. Sediments from L&K Lumber, Neptune Terminals, Canada Place, Ioco Refinery, Port Moody Arm, and Boulder Rock contained 863, 629, 468, 760, 520 and 313 pg/g, respectively.

Chlorinated diphenyl ethers were detected in all sediment samples from Victoria Harbour. Concentrations in sediments from the inner and upper portions of the harbour ranged from 1,444 to 7,420 pg/g, while sediments collected from the outer harbour (near Ogden Point Wharves) contained 40 pg/g. Sediments from the Constance Cove area of Esquimalt Harbour contained CDPE concentrations ranging from below the detection limits to 1,140 pg/g.

Current information on CDPE levels in sediments from these locations was not available. However, at many of the Vancouver Harbour and Victoria Harbour sites, environmental site assessments have been, or are being, conducted as a requirement to obtain approval for site modifications or re-development of the property shoreline. Site assessment reports are reviewed by provincial and federal regulatory agencies to determine whether site remediation is required prior to re-development. Although the BC Ministry of Water, Land and Air Protection's Criteria for Managing Contaminated Sediment in British Columbia do not address CDPE compounds, remedial actions taken to address unacceptable levels of other chemical contaminants would likely also reduce or contain CDPE compounds.

Concentrations in sediments collected from reference sites at Crescent Beach and at Tow Hill in the Queen Charlotte Islands were below the limits of detection.

Table 2 lists the predominant chlorinated diphenyl ether isomers detected in BC sediments and the ranges of their percent contributions to the total CDPE concentrations. Figure 1 shows the percent contributions of the most commonly detected CDPE isomers at each sampling location. The lower chlorinated isomers (mono-, di, tri- and tetra-) were not detected, however, several of the higher chlorinated isomers were detected in most samples. The isomers detected most commonly and at the highest concentrations in sediments were 2,2',4,4',5-penta CDPE (#99); 2,2',4,4',5,6- (#154) and 2,2',4,4',5,5'-hexa CDPE (#153); 2,2,3,4,4',6,6'- (#184) and 2,2',3,3',4,4',6-hepta CDPE (#171). Isomers 2,2',3,3',4,4',5-hepta CDPE (#170) and 2,2',4,4',6-penta (#100) were also detected at low concentrations in two samples. Isomer 2,2',4,5,6'-penta CDPE (#102) was detected at very low concentrations in a few sediment samples.

The isomer pattern of CDPEs in BC sediments was indicative of a chlorophenol source. Chlorophenol-based wood treatment products contain a variety of higher chlorinated CDPEs and isomers #100, 99, 153, 154, and 170 were detected in tetrachlorophenol-based products in Germany. Several other heptachlorodiphenyl ether isomers were also detected but could not be identified and, therefore, it is not known whether isomers #171 and #184 are also present in tetrachlorophenol products. Na-2,4,5-trichlorophenate and pentachlorophenol-based wood preservatives also contained isomers #99, 154, 153, and a variety of unidentified hepta-

Table 2: **Predominant CDPE Isomers Detected in BC Sediment Samples (Environment Canada data)**

Isomer	IUPAC #	% of Samples Containing Isomer	% Contribution to Total CDPE Where Detected (Range)	(Mean ± S.D.)
2,2',4,4',6- penta	100	40	3.44-9.22	5.76± 1.67
2,2',4,4',5- penta	99	65	2.05-22.20	13.72 ± 4.74
2,2',4,4',5,6- hexa	154	73	6.59-100	22.13 ± 16.56
2,2',4,4',5,5'- hexa	153	61	13.08-36.78	22.4 ± 4.5
2,2',3,4,4',6,6'-hepta	184	71	6.11-61.29	24.2 ± 9.5
2,2',3,3',4,4',6-hepta	171	59	4.10-63.29	26.5 ± 17.0

isomers (possibly isomers #171 and #184) (Kurz and Ballschmiter 1985). Chlorophenol-based wood treatment chemicals have been widely used in British Columbia, however, no information was available on the presence of CDPE isomers in these products.

The presence of lower chlorinated CDPE congeners in the environment are usually thought to reflect a combustion-related source. Mono- to tetra-CDPE congeners were not detected in sediment samples in British Columbia with the exception of isomer 2,4'-di CDPE (#8) which was detected (210 pg/g) in one of the duplicate samples from the Lynnterm site. However, since this isomer was also present in the blank sample it was not included in the calculations for total CDPEs.

4.3.2.2 Fish and Aquatic Invertebrates

Chlorinated diphenyl ether compounds were detected in almost all fish and aquatic invertebrate samples collected in Environment Canada (EC) surveys conducted between 1990 and 1994, and Department of Fisheries and Oceans (DFO) surveys conducted between 1992 and 1998 (refer to Appendices 5.2a and b). The results of the two studies are not directly comparable as the analysis was conducted at different labs and the analytical methods did not report identical congeners. The distribution of chlorinated diphenyl ether isomers in biota from the two data sets are presented separately in Tables 3a and 3b and Figure 2.

CDPE compounds were not detected in crab muscle tissue analyzed by EC, but very high concentrations were detected in the hepatopancreas tissue. Crab from Victoria Harbour contained 15,691 to 37,250 pg/g total CDPEs (wet weight) in the hepatopancreas, while concentrations in crabs from Constance Cove in Esquimalt Harbour were much lower (2,483 pg/g). DFO analysis also detected high CDPE levels in crab hepatopancreas. The highest concentration (7791.5 pg/g wet weight) was detected in crab from Rose Bay in Victoria Harbour. Concentrations ranging from 1000 to 4000 pg/g were detected in hepatopancreas of crabs collected from Bedwell Bay, Sechelt, Sandheads, Cowichan Bay, and Gold River. Crabs collected from Esquimalt Harbour, Prince Rupert, and Kitimat contained lower CDPE concentrations (74.6 to 196.3, 364, and 63.4 pg/g, respectively). Crabs collected by DFO from Victoria Harbour in 1994 and from Esquimalt Harbour in 1998 contained much lower concentrations than crabs collected from these harbours by EC in 1990 (15,691 to 37,250 pg/g and 2483 pg/g, respectively). It is not known whether concentrations in Victoria and Esquimalt harbours have declined in recent years, or whether the differences in

concentrations detected in the DFO and EC surveys are due to differences in the analytical methods used by the two labs. As no other samples were collected in Victoria and Esquimalt harbours during the DFO surveys, it is not possible to compare EC and DFO analytical results for other species. Additional sampling in these areas should be undertaken to determine whether CDPE concentrations are declining in aquatic biota.

EC sampling indicated that CDPE concentrations were higher in English sole (whole body samples) from Vancouver Harbour (4,242 to 9,389 pg/g), False Creek (2,120 to 6,074 pg/g), and Victoria Harbour (1,329 pg/g), than in English sole from the less contaminated outer Vancouver Harbour area (836 pg/g). Elevated CDPE concentrations were also detected in liver tissue of English sole and red snapper collected by DFO from Howe Sound (5,449 and 1879 pg/g, respectively), Crofton (515 pg/g), Mill Bay (1,234 pg/g), Bamfield (400 pg/g) and Gold River (1,007 pg/g). CDPEs were not detected in rock sole collected from the EC reference site at Crescent Beach.

CDPE concentrations in staghorn sculpin collected from Vancouver Harbour (498 to 1,168 pg/g) and sand sole from Constance Cove in Esquimalt Harbour (123 pg/g) by EC were lower than CDPE concentrations in English sole from these areas.

Shrimp collected from Vancouver, Victoria and Esquimalt harbours by EC contained detectable CDPE concentrations in 2 of 4 samples. Shrimp from the outer region of Vancouver Harbour contained 4.5 pg/g, while shrimp from Victoria Inner Harbour contained 154 pg/g CDPE.

DFO detected elevated CDPE concentrations in fish from some BC rivers. In the lower reaches of the Fraser River, starry flounder were collected at Mitchell Island and peamouth chub were collected at MacDonald Beach. These fish contained 2767.3 pg/g (liver tissue) and 1487.5 pg/g (whole body) total CDPE, respectively. High CDPE concentrations were also detected in both the liver and muscle tissue of white sturgeon collected near Northwood Pulp and Paper upstream from Prince George (2181 pg/g and 2756 pg/g, respectively), and in liver of white sturgeon collected from the Columbia River at Waneta (1309 pg/g). Lower levels were detected in Fraser River burbot collected at Stoner (451 pg/g), and in whitefish muscle (373 pg/g) and liver (426 pg/g) from Beaver Creek and Genelle River, respectively.

Tables 3a and 3b list the predominant chlorinated diphenyl ether isomers detected in aquatic biota in British Columbia (also refer to Figure 2) and the ranges of their percent contributions to total CDPE concentrations. In aquatic biota, as with sediments, 2,2',3,4,4',5-pentaCDPE (# 99), 2,2',4,4',5,5'-hexaCDPE (#153), 2,2',4,4',5,6'-hexaCDPE (#154), 2,2',3,4,4',6,6'-heptaCDPE (#184) were the predominant isomers. Figure 3 depicts the predominant isomers in sediment and biota at select sites. However, CDPE isomer #s 99, 153, 154 and 184 were also predominant in biota at locations where these isomers were not detected in the sediments. For example, these isomers were predominant in mussels from Lynnterm, Vancouver Wharves and Seaboard and in English sole from the Outer Harbour and Centre Harbour areas of Vancouver Harbour (Figure 3), but were not present in the sediments at these sites. Isomer 2,2',4,4',5-pentaCDPE (#100) was also detected frequently in biota, but at lower concentrations. In contrast to sediments, where 2,2',3,3',4,4',6-heptaCDPE (#171) was one of the predominant isomers detected, this compound was not detected in BC shrimp or mussels and was present at low concentrations in crab hepatopancreas (Figure 3). This hepta-isomer was one of the predominant isomers in fish, however, especially in whole body samples of English sole and staghorn sculpin (16 to 31% and 24 to 29% of the total CDPE, respectively). It is possible that the lower predominance of isomer #171 in aquatic invertebrates may indicate a lower bioaccumulative ability or faster rate of biodegradation for this isomer in these invertebrate species, however, additional information on the presence of #171 in both fish and invertebrate species is needed. Low concentrations of 2,3,3',4,4',5-heptaCDPE (#156) and 2,2',3,3',4,4',5-heptaCDPE (#170) were detected in some biota samples. These hepta-isomers were rarely detected in BC sediments (two and one samples, respectively).

In both the EC and DFO studies, the predominant isomer identified in crab hepatopancreas tissue was hexa-CDPE #153 (reported as a combination of CDPE #147/153 by DFO), which contributed from 32 to 52% of the total CDPE in EC samples and 11 to 63% of the total in DFO samples. Other isomers making significant contributions to the total CDPE concentration in hepatopancreas tissue in both studies were penta-CDPE #99, hexa-CDPE #154, and hepta-CDPE #184 (refer to Tables 3a and 3b). Hepatopancreas samples analyzed by DFO contained significant amounts of octa-CDPE #197. Octa-CDPE isomers were not reported in the analysis for the EC.

The predominant isomers in English sole whole body samples, collected by EC, were hexa-CDPE #153 (22 to 29% of the total CDPE) and hepta-CDPE #171 (16 to 31% of the total CDPE). Other isomers making significant contributions to the total CDPE concentration were isomers penta-CDPE #99 (6 to 15%), hexa-CDPE #154 (15 to 21%), and hepta-CDPE #184 (15 to 20%). In English sole liver samples collected by DFO the dominant isomers were hexa-CDPE #147/153 (5 to 15%), hepta-CDPE #182/171 (6 to 14%), octa-CDPE #196 (6 to 12%), octa-CDPE #197 (8 to 14%), and nona-CDPE #207 (5 to 20%).

Hexa-CDPE #163 was also frequently detected in samples collected by DFO and this isomer made particularly significant contributions to the total CDPE concentration in whitefish from Beaver Creek (11%) and Genelle River (8%) and white sturgeon from the Columbia River (13%). CDPE analysis of EC samples did not include CDPE #163.

The isomer pattern in BC aquatic biota is similar to that in fish from the Great Lakes area (Niimi *et al.* 1994; Metcalfe *et al.* 1997) and Finland (Koistinen *et al.* 1993a) in that isomers # 99, 153, and 154 were detected frequently and were present at the highest concentrations. These isomers were detected in chlorophenol-based wood treatment chemicals in Finland and their presence in the environment indicated a chlorophenol-related source of CDPEs (Humppi and Heinola 1985). One difference noted was the significant contribution of isomer #184 to total CDPE concentrations in several species of BC biota. This isomer was not reported as a dominant isomer in biota collected from the Great Lakes area or Finland, nor was it identified in chlorophenol-based wood treatment formulations in Finland (Ky-5). However, hepta-CDPEs were detected at very high concentrations in Ky-5 and several of these isomers were not identified. The CDPE composition of chlorophenol-based wood treatment chemicals used in BC may have been different from that of Ky-5. It is possible that isomer #184 was present at significant concentrations in chlorophenol-based wood treatment chemicals used in BC. Isomer specific information was not available for CDPEs in North American formulations of chlorophenol-based wood treatment products.

Niimi *et al.* (1994) noted that the majority of the CDPE isomers detected in Lake Ontario fish had chlorine substitution at two or more ortho positions (2,2',6, and 6') and at both para positions (4 and 4'). The authors stated that, while it could not be concluded from their data that the retention of CDPE isomers by fish is determined by their chlorine substitution pattern, the significance of the presence of para and ortho substituted isomers in fish should be studied. The predominant CDPE isomers detected in BC aquatic biota were also chlorinated at both para positions and at least two ortho positions. However, since these isomers were also the predominant isomers detected in BC sediment samples, their presence in aquatic biota may be simply a reflection of presence in the environment, rather than selective uptake or retention by biota.

Researchers have estimated toxic equivalency factors (TEFs) for the non- and mono-ortho substituted CDPEs (#s 77, 126, 169, 105, 114, 118, 123, 156, 157, 167, and 189) which most closely resemble the more toxic dioxin and PCB isomers (Safe 1992; Metcalfe *et al.* 1997). These isomers did not make significant contributions to the total CDPE levels detected in BC sediments and aquatic biota. CDPE #77 (reported as 77/81 in EC samples) was detected in the hepatopancreas of crabs from several BC locations and in fish from the Fraser River, however, concentrations were very low and this isomer contributed less than 1% to the total CDPEs in these samples. CDPE #s 118 and 156 were detected in several samples at low concentrations. CDPE #118 contributed less than 1% of the total CDPE in most samples and up to 3% of the total CDPE in crab hepatopancreas samples. CDPE #156 contributed <0.5% to most biota samples, but was somewhat more abundant in mussels from some Vancouver Harbour sites (up to 7% of total CDPE), the hepatopancreas of crab from the Kitimat area (1.6%), and the liver of English sole from Crofton (4.4%). CDPE #s 123, 169, and 189 were not included CDPE analysis of either DFO or EC samples, but were not reported in the literature as common contaminants of the aquatic environment. The analysis of EC samples did not include CDPE #s 105 or 157. CDPE #s 105 and 157 were detected in some DFO samples at very low concentrations and each contributed less than 0.5% of the total CDPE in the samples.

4.3.2.3 Semipermeable Membrane Device (SPMD) Samples

Triglyceride containing semipermeable membrane devices (SPMDs) were used to sample CDPE congener profiles in the water column at various locations of the Fraser River, which contains the highest industrial activity of any river flowing into the Canadian coastal marine environment. SPMD sampling locations are shown on Map 14. The uptake characteristics of SPMDs are well defined and these sampling devices can be used to estimate time-integrated averages of dissolved contaminants (Huckins *et al.* 1999; Meadows *et al.* 1998). Samples were collected by Department of Fisheries and Oceans between August 6th and September 30th, 1996 at a depth of 2 to 3 metres at low tide.

The major CDPE congeners found within the SPMD did not include those predominant in sediment and biota; congeners #s 100, 99, 154, 153, 184, 171 and 170 were each only present at <1% of the total. The SPMD contained several lower chlorinated CDPE. Congener #s 1, 2, 3, 8, 13, 15, 17, 28, and 47 constituted >89% of the total, of which dichlorinated (#15 in particular) and the three monochlorinated congeners were generally the major contributors (Figure 4). This may be reflective of better solubility of the lower chlorinated CDPEs in water, while the higher chlorinated compounds, if adhered to solids, may not be able to penetrate the membrane. Additionally, the congeners found within the SPMD are not subject to metabolism or excretion as are those in biota.

All sites along the Fraser River showed a similar CDPE pattern in that the lower chlorinated congeners predominated. However, the relative contribution of congeners varies among sites. MacMillan Island/Fort Langley (Map 14) was the least contaminated with CDPEs, which is consistent with its location upstream from the large municipalities and industrial complexes of Greater Vancouver. Among the other sites which are closer to municipalities and industrial activity, Annacis Channel showed the most contamination with CDPEs. Surprisingly, the site further downstream at Chatterton Chemicals had lower levels of CDPEs, with a lower contribution of the mono congeners. Chlorophenol-based wood treatment products generally contain the higher chlorinated congeners, however, this signature is not seen in the SPMDs. Although congener #47 is a known municipal-incineration by-product, there are no published reports indicating the origin of the low chlorination congeners detected in this study.

4.3.2.4 Birds and Mammals

No information was available on chlorinated diphenyl ethers in birds or mammals in British Columbia.

Table 3a: Predominant CDPE Isomers Detected in Aquatic Biota in BC (Environment Canada Data)

Isomer	IUPAC No.	% Samples Containing Isomer	% Contribution to Total CDE (Range) **		(Mean $\pm$ S.D.)**	
Mussels:						
2,2',4,4',6-penta	100	70	0 to 11.7	(5.2 to 11.7)	6.1 $\pm$ 4.6	(8.8 $\pm$ 2.1)
2,2',4,4',5-penta	99	70	0 to 17.1	(12.8 to 17.1)	11.4 $\pm$ 6.6	(14.7 $\pm$ 1.6)
2,2',4,4',5,6'-hexa	154	100	19.0 to 100		35.6 $\pm$ 23.8	
2,2',4,4',5,5'-hexa	153	90	0 to 56.7	(24.2 to 56.7)	32.2 $\pm$ 15.5	(36.8 $\pm$ 10.8)
2,2',3,4,4',6,6'-hepta	184	60	0 to 23.6	(10.6 to 23.6)	10.8 $\pm$ 9.9	(17.9 $\pm$ 4.9)
2,2',3,3',4,4',6-hepta	171	0	Not detected		-	
Dungeness crab (hepatopancreas):						
2,2',4,4',6-penta	100	100	2.0 to 2.7		16.6 $\pm$ 1.8	
2,2',4,4',5-penta	99	100	14.7 to 18.9		2.4 $\pm$ 0.3	
2,2',4,4',5,6'-hexa	154	100	9.9 to 14.0		12.6 $\pm$ 1.8	
2,2',4,4',5,5'-hexa	153	100	32.2 to 52.4		43.3 $\pm$ 8.5	
2,2',3,4,4',6,6'-hepta	184	100	11.5 to 26.0		16.3 $\pm$ 6.6	
2,2',3,3',4,4',6-hepta	171	75	ND to 8.4	(5.5 to 8.4)	4.7 $\pm$ 4.2	(7.3 $\pm$ 1.6)
Shrimp (tail muscle):						
2,2',4,4',6-penta	100	25	0 to 5.2		25.0 $\pm$ 50.0	
2,2',4,4',5-penta	99	25	0 to 27.9		7.0 $\pm$ 14.0	
2,2',4,4',5,6'-hexa	154	25	0 to 100		25.0 $\pm$ 50.0	
2,2',4,4',5,5'-hexa	153	25	0 to 62.3		15.6 $\pm$ 31.2	
2,2',3,4,4',6,6'-hepta	184	0	Not detected		-	
2,2',3,3',4,4',6-hepta	171	0	Not detected		-	
English sole (whole body):						
2,2',4,4',6-penta	100	100	2.9 to 7.0		10.0 $\pm$ 3.5	
2,2',4,4',5-penta	99	100	6.2 to 14.7		4.9 $\pm$ 1.7	
2,2',4,4',5,6'-hexa	154	100	15.4 to 21.1		18.2 $\pm$ 2.6	
2,2',4,4',5,5'-hexa	153	100	22.4 to 28.6		25.2 $\pm$ 2.1	
2,2',3,4,4',6,6'-hepta	184	100	14.7 to 19.8		16.5 $\pm$ 1.9	
2,2',3,3',4,4',6-hepta	171	100	15.8 to 30.9		23.9 $\pm$ 7.5	
Sand Sole (whole body)*:						
2,2',4,4',6-penta	100	-	-		10.6	
2,2',4,4',5-penta	99	-	-		12.2	
2,2',4,4',5,6'-hexa	154	-	-		22.8	
2,2',4,4',5,5'-hexa	153	-	-		39.8	
2,2',3,4,4',6,6'-hepta	184	-	-		14.6	
2,2',3,3',4,4',6-hepta	171	-	-		Not detected	
Staghorn sculpin (whole body):						
2,2',4,4',6-penta	100	0	Not detected		-	
2,2',4,4',5-penta	99	100	10.4 to 17.8		14.2 $\pm$ 3.7	
2,2',4,4',5,6'-hexa	154	100	12.1 to 19.3		15.3 $\pm$ 3.7	
2,2',4,4',5,5'-hexa	153	100	40.7 to 45.6		42.8 $\pm$ 2.5	
2,2',3,4,4',6,6'-hepta	184	33	0 to 2.9		1.0 $\pm$ 1.7	
2,2',3,3',4,4',6-hepta	171	100	24.1 to 29.0		26.7 $\pm$ 2.5	

* Based on a sample from 1 site only

** Range and Mean $\pm$ S.D. are for all samples. Range and Mean $\pm$ S.D. in brackets are for samples with positive values only.

Table 3b: Predominant CDPE Isomers Detected in Aquatic Biota in BC (Department of Fisheries and Oceans Data)

Isomer	IUPAC No.	% Samples Containing Isomer	% Contribution to Total CDE (Range) **		(Mean ± S.D.)**	
Dungeness crab (hepatopancreas):						
2,2',4,4',5-penta	99	80	ND to 20.7	(7.0 to 20.7)	12.5 ± 7.8	(15.7 ± 4.7)
2,2',4,4',5,6'-hexa	154	90	ND to 64.3	(4.0 to 64.3)	11.4 ± 18.7	(12.7 ± 19.4)
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	100	13.5 to 63.0		26.5 ± 14.8	
2,2',3,4,4',6,6'-hepta	184	80	ND to 5.9	(1.3 to 5.9)	3.1 ± 2.2	(3.9 ± 1.6)
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	80	ND to 6.1	(0.11 to 6.1)	1.6 ± 1.9	(2.0 ± 1.9)
2,2',3,3',4,4',5',6-octa	196	80	ND to 7.8	(0.95 to 7.8)	2.8 ± 2.4	(3.5 ± 2.2)
2,2',3,3',4,4',6,6'-octa	197	80	ND to 8.1	(3.5 to 8.1)	4.8 ± 2.9	(6.0 ± 1.6)
2,2',3,3',4,4',5,6,6'-nona	207	80	ND to 10.7	(1.4 to 10.7)	3.1 ± 3.1	(3.8 ± 3.0)
English sole (liver):						
2,2',4,4',5-penta	99	100	4.6 to 9.2		5.9 ± 1.9	
2,2',4,4',5,6'-hexa	154	100	3.3 to 9.9		6.1 ± 2.8	
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	100	5.1 to 14.2		8.7 ± 3.3	
2,2',3,4,4',6,6'-hepta	184	100	4.4 to 5.4		4.9 ± 0.4	
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	100	6.4 to 14.1		9.5 ± 3.0	
2,2',3,3',4,4',5',6-octa	196	100	5.7 to 12.2		10.3 ± 2.4	
2,2',3,3',4,4',6,6'-octa	197	100	7.6 to 14.3		10.8 ± 3.1	
2,2',3,3',4,4',5,6,6'-nona	207	100	5.0 to 19.5		13.2 ± 2.3	
White sturgeon (liver)#:						
2,2',4,4',5-penta	99	50	ND to 8.8		4.4 ± 6.2	
2,2',4,4',5,6'-hexa	154	100	5.0 to 9.6		7.2 ± 3.3	
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	100	6.2 to 10.0		7.7 ± 2.5	
2,2',3,4,4',6,6'-hepta	184	100	2.3 to 5.2		3.8 ± 2.1	
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	100	6.8 to 10.5		8.7 ± 2.6	
2,2',3,3',4,4',5',6-octa	196	100	12.5 to 15.8		14.1 ± 2.3	
2,2',3,3',4,4',6,6'-octa	197	100	6.1 to 9.3		7.7 ± 2.3	
2,2',3,3',4,4',5,6,6'-nona	207	100	7.5 to 10.9		9.2 ± 2.4	
White sturgeon (muscle)*:						
2,2',4,4',5-penta	99	-	6.3		6.3	
2,2',4,4',5,6'-hexa	154	-	5.4		5.4	
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	-	6.5		6.5	
2,2',3,4,4',6,6'-hepta	184	-	3.5		3.5	
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	-	16.2		16.2	
2,2',3,3',4,4',5',6-octa	196	-	13.2		13.2	
2,2',3,3',4,4',6,6'-octa	197	-	4.9		4.9	
2,2',3,3',4,4',5,6,6'-nona	207	-	12.7		12.7	
Whitefish (muscle)*:						
2,2',4,4',5-penta	99	-	10.9		10.9	
2,2',4,4',5,6'-hexa	154	-	11.8		11.8	
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	-	9.0		9.0	
2,2',3,4,4',6,6'-hepta	184	-	6.8		6.8	
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	-	7.7		7.7	
2,2',3,3',4,4',5',6-octa	196	-	7.5		7.5	
2,2',3,3',4,4',6,6'-octa	197	-	5.0		5.0	
2,2',3,3',4,4',5,6,6'-nona	207	-	4.6		4.6	

Note: CDPE #100 was detected in most DFO samples but did not contribute more than 3% of the total CDPE.

- * Based on a sample from 1 site only
- \# Based on samples from 2 sites only
- ** Range and Mean ± S.D. are for all samples. Range and Mean ± S.D. in brackets are for samples with positive values only.

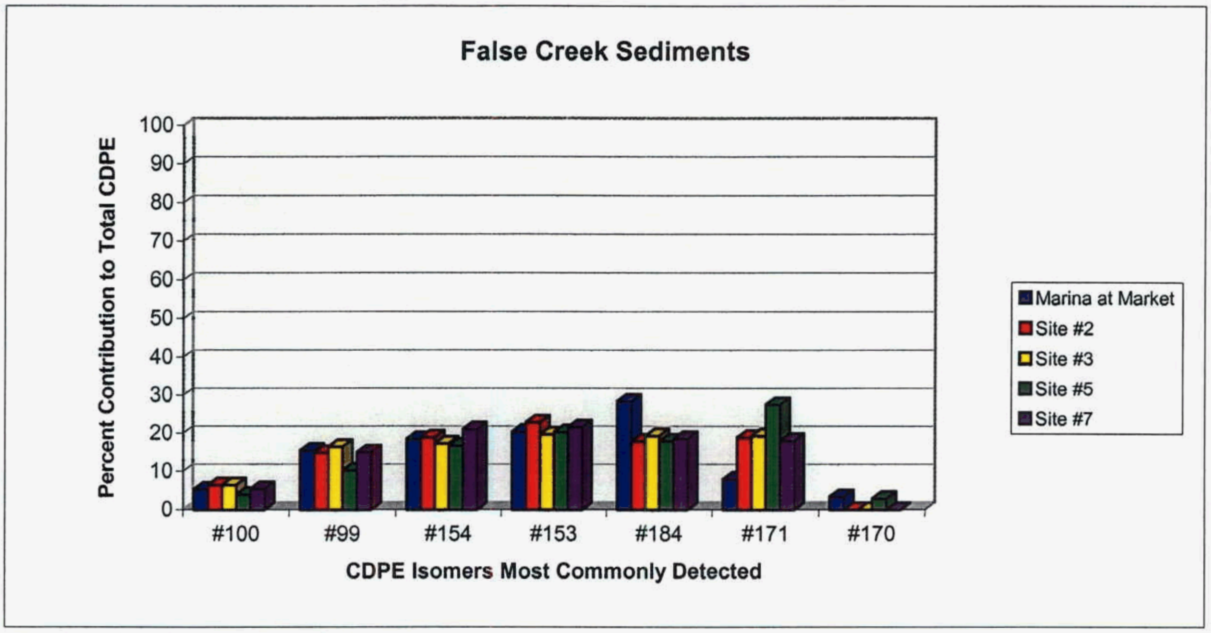
Table 3b *(cont.)*: Predominant CDPE Isomers Detected in Aquatic Biota in BC (Department of Fisheries and Oceans Data)

Isomer	IUPAC No.	% Samples Containing Isomer	% Contribution to Total CDE (Range) **	(Mean ± S.D.)**
Whitefish (liver)*:				
2,2',4,4',5-penta	99	-	15.4	15.4
2,2',4,4',5,6'-hexa	154	-	10.1	10.1
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	-	10.1	10.1
2,2',3,4,4',6,6'-hepta	184	-	5.8	5.8
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	-	9.1	9.1
2,2',3,3',4,4',5',6-octa	196	-	5.1	5.1
2,2',3,3',4,4',6,6'-octa	197	-	4.2	4.2
2,2',3,3',4,4',5,6,6'-nona	207	-	4.9	4.9
Starry flounder (liver)*:				
2,2',4,4',5-penta	99	-	4.1	4.1
2,2',4,4',5,6'-hexa	154	-	3.0	3.0
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	-	7.6	7.6
2,2',3,4,4',6,6'-hepta	184	-	4.5	4.5
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	-	9.7	9.7
2,2',3,3',4,4',5',6-octa	196	-	24.9	24.9
2,2',3,3',4,4',6,6'-octa	197	-	12.7	12.7
2,2',3,3',4,4',5,6,6'-nona	207	-	10.2	10.2
Peamouth chub (whole body)*:				
2,2',4,4',5-penta	99	-	13.7	13.7
2,2',4,4',5,6'-hexa	154	-	6.3	6.3
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	-	8.1	8.1
2,2',3,4,4',6,6'-hepta	184	-	2.2	2.2
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	-	9.6	9.6
2,2',3,3',4,4',5',6-octa	196	-	14.5	14.5
2,2',3,3',4,4',6,6'-octa	197	-	6.6	6.6
2,2',3,3',4,4',5,6,6'-nona	207	-	6.4	6.4
Burbot (whole body)*:				
2,2',4,4',5-penta	99	-	2.6	2.6
2,2',4,4',5,6'-hexa	154	-	2.4	2.4
2,2',3,4',5,6/2,2',4,4',5,5'-hexa	147/153	-	3.9	3.9
2,2',3,4,4',6,6'-hepta	184	-	1.4	1.4
2,2',3,3',4,4',6/2,2',3,3',4,4',6-hepta	182/171	-	13.4	13.4
2,2',3,3',4,4',5',6-octa	196	-	17.8	17.8
2,2',3,3',4,4',6,6'-octa	197	-	8.6	8.6
2,2',3,3',4,4',5,6,6'-nona	207	-	14.6	14.6

Note: CDPE #100 was detected in most DFO samples but did not contribute more than 3% of the total CDPE.
* Based on a sample from 1 site only
\# Based on samples from 2 sites only
** Range and Mean ± S.D. are for all samples. Range and Mean ± S.D. in brackets are for samples with positive values only.

Figures

Figure 1: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Sediments (Environment Canada data)



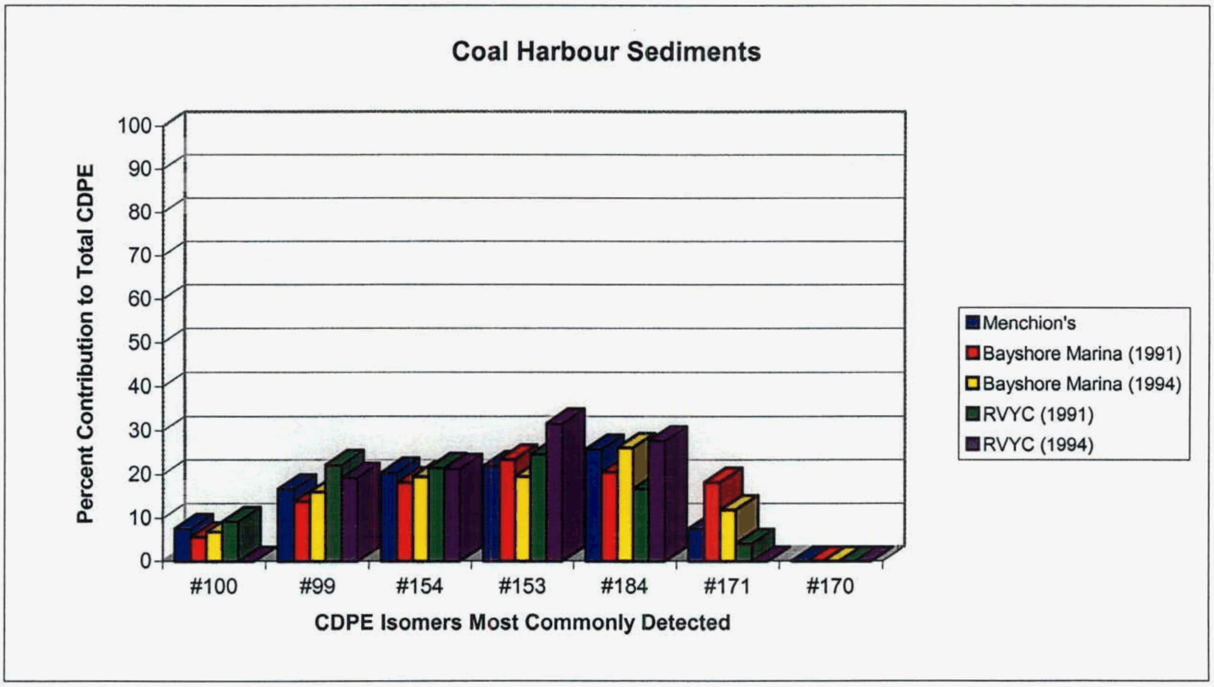
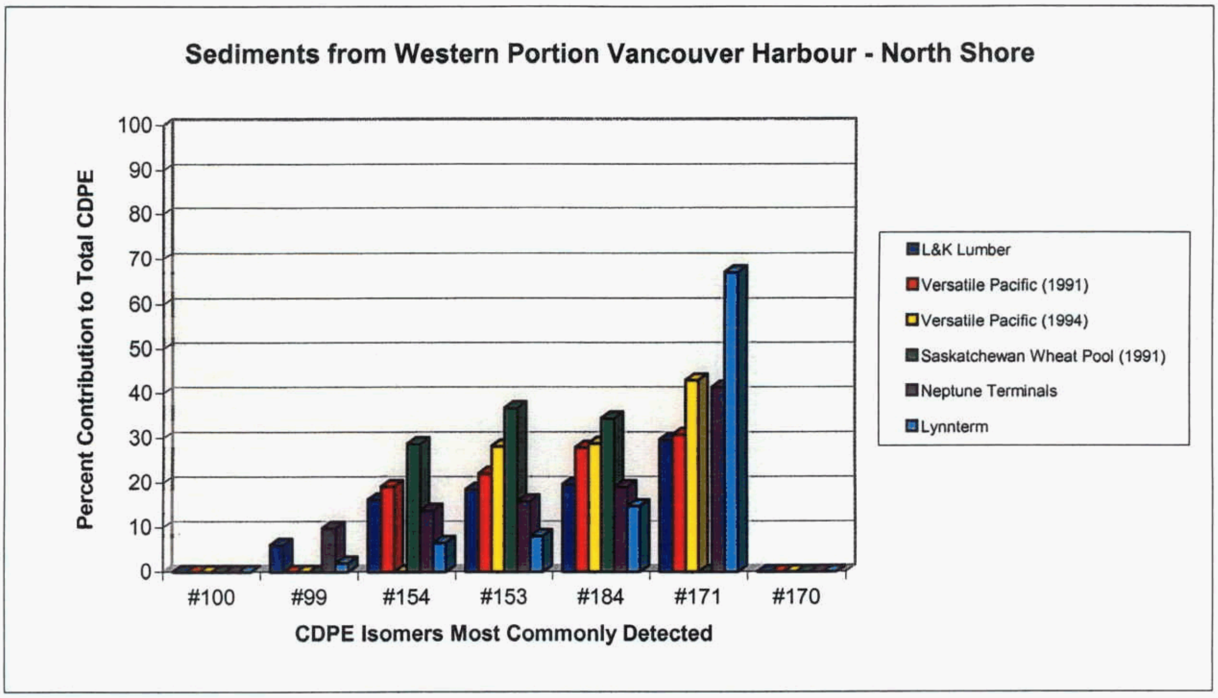


Figure 1: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Sediments (Environment Canada data)



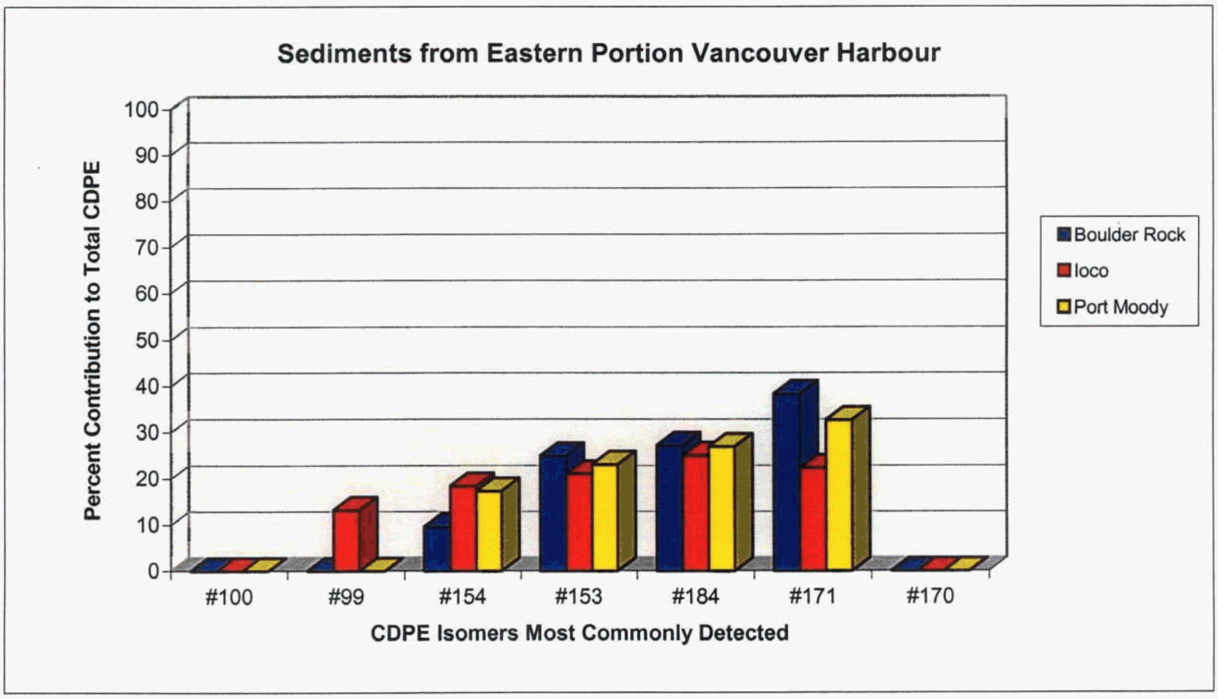
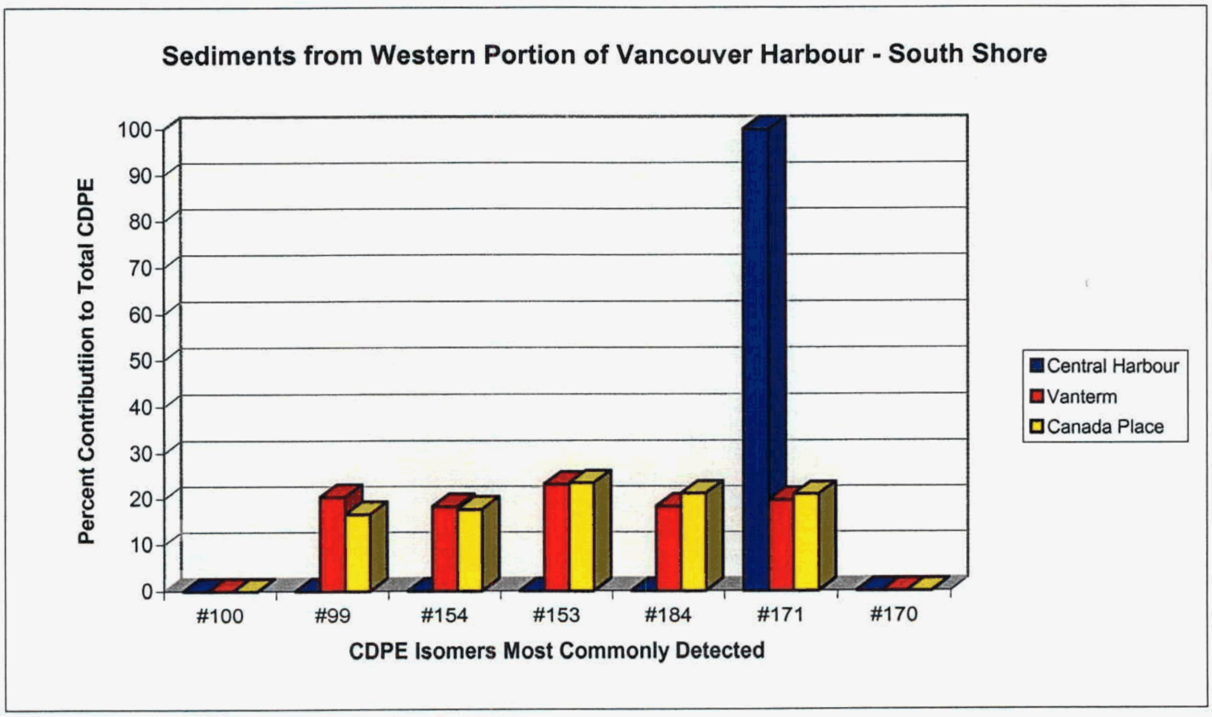
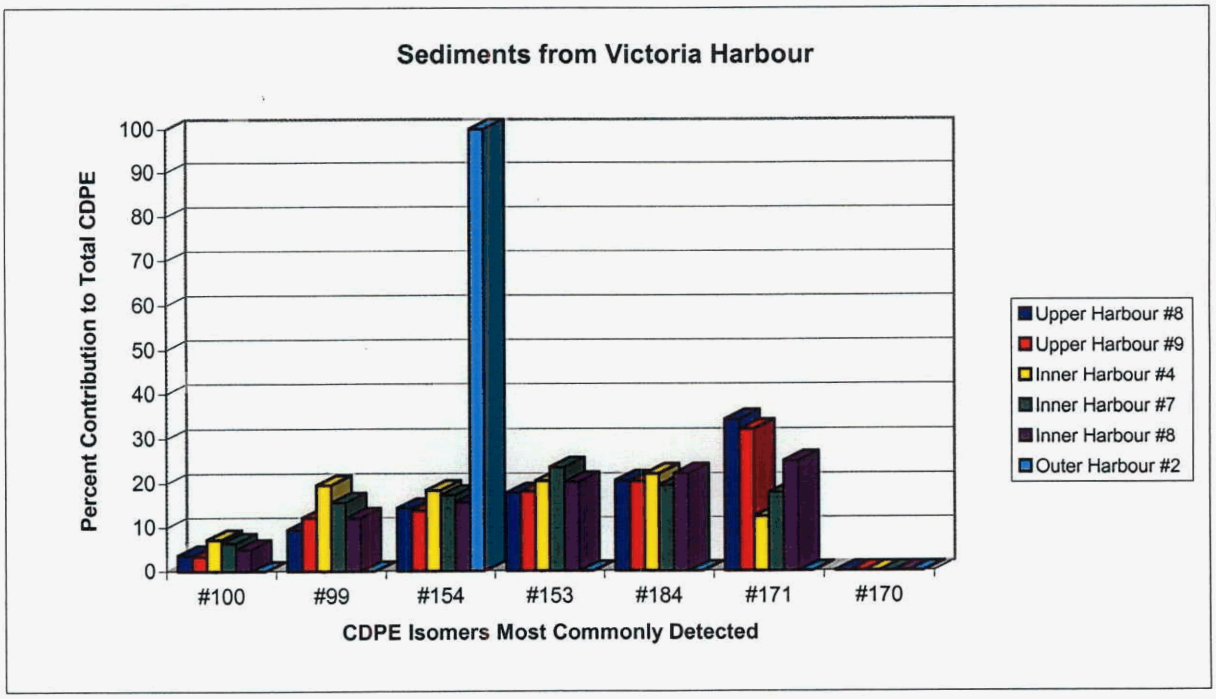


Figure 1: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Sediments (Environment Canada data)





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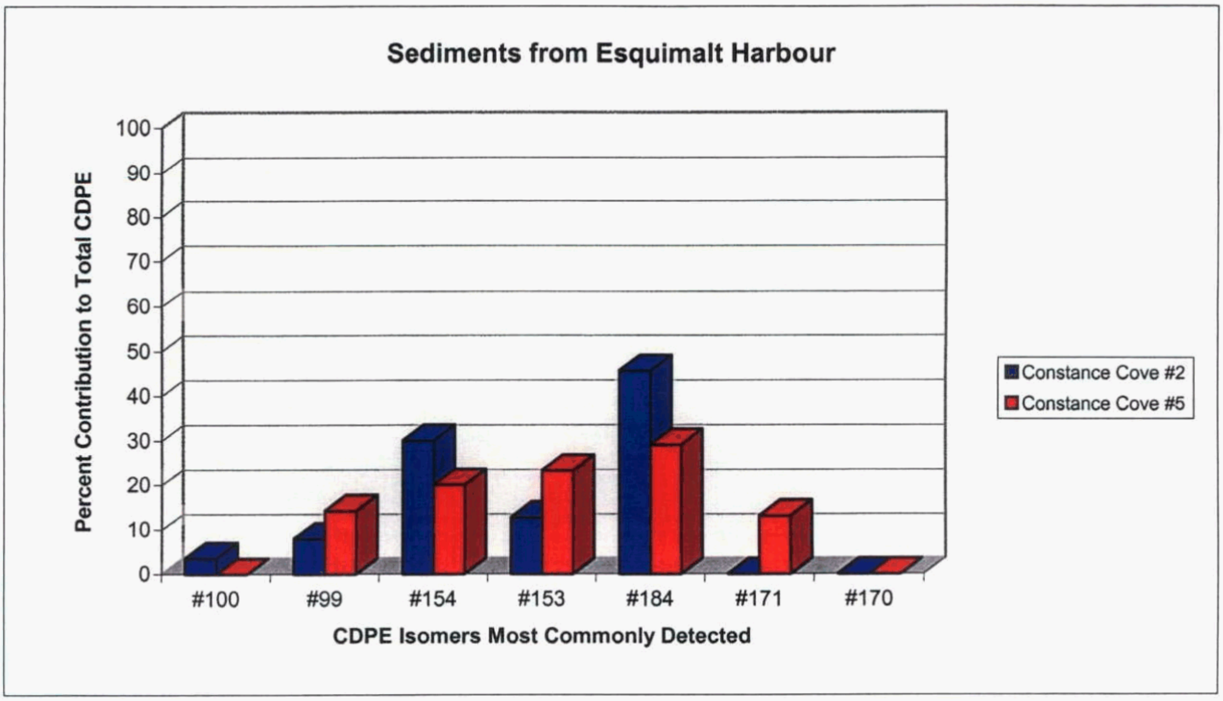


Figure 2: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Aquatic Biota

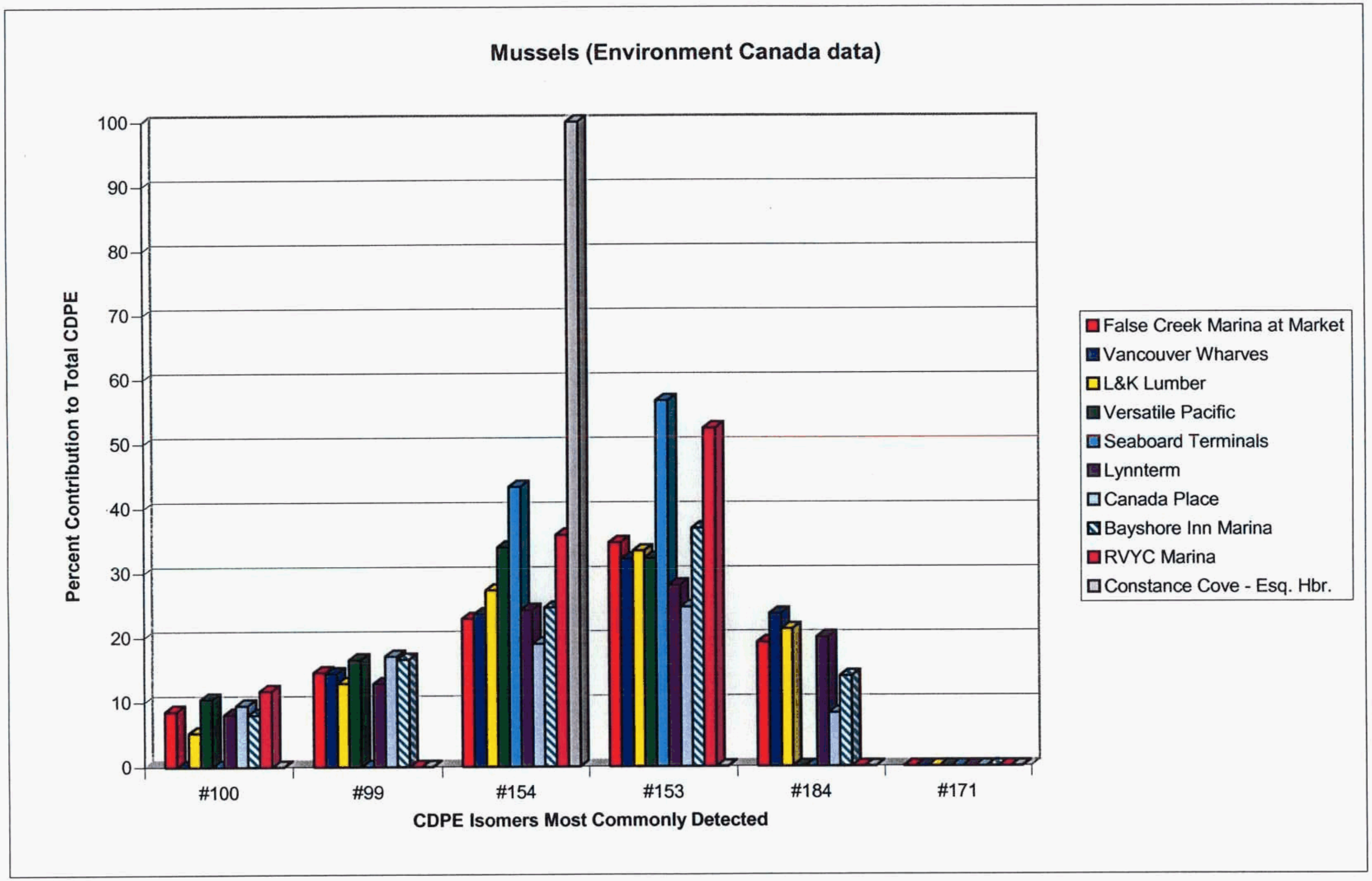


Figure 2: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Aquatic Biota

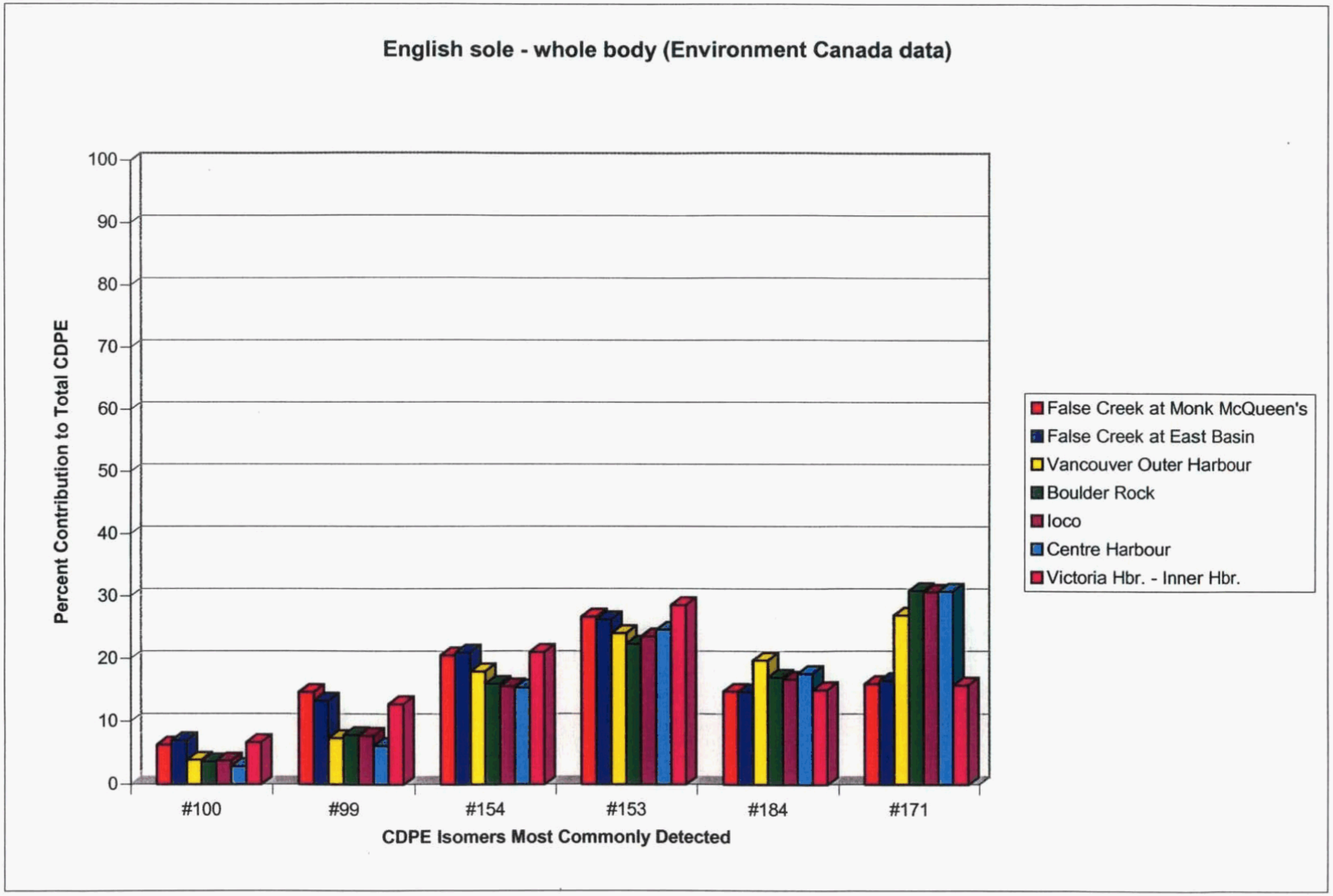


Figure 2: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Aquatic Biota

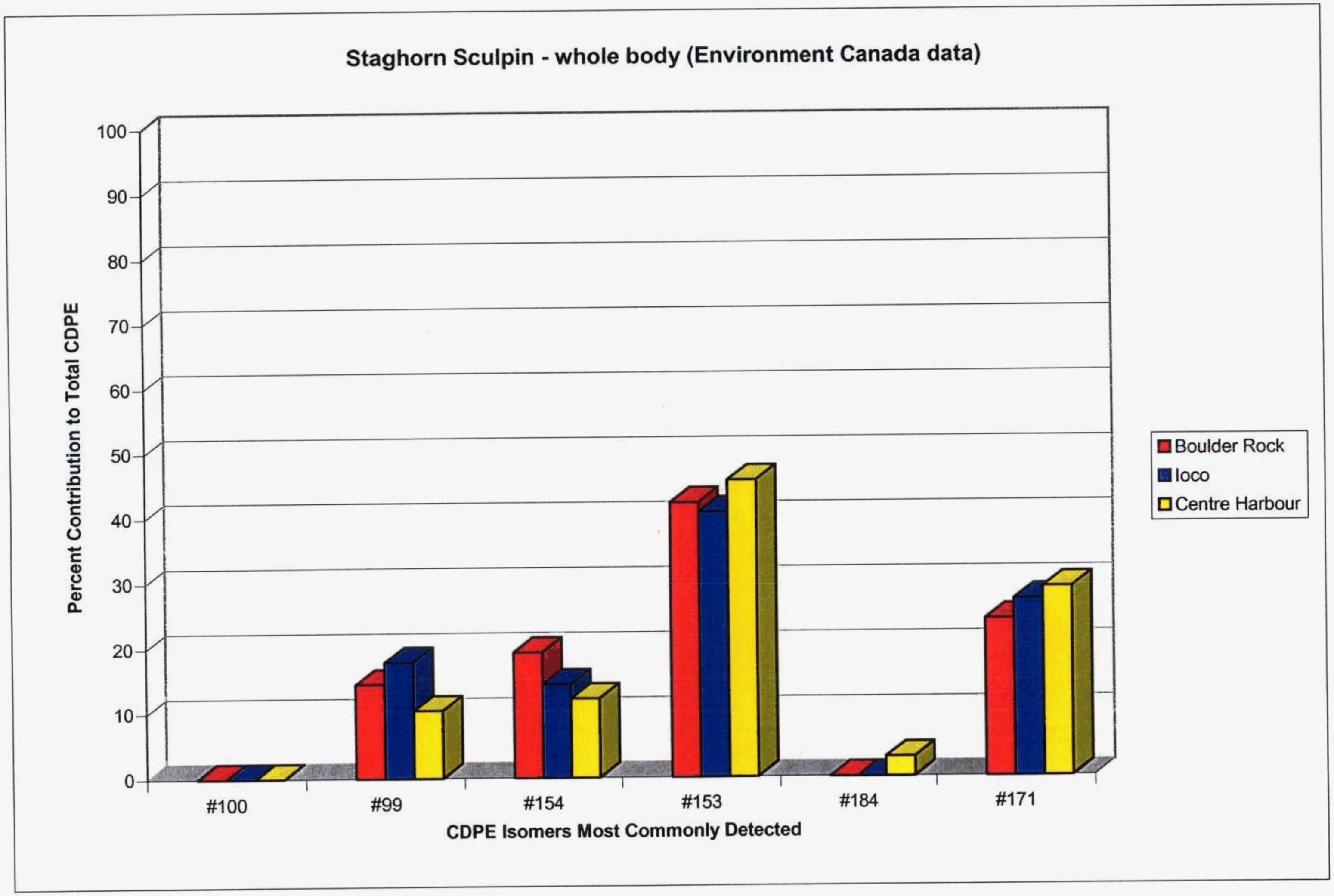


Figure 2: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Aquatic Biota

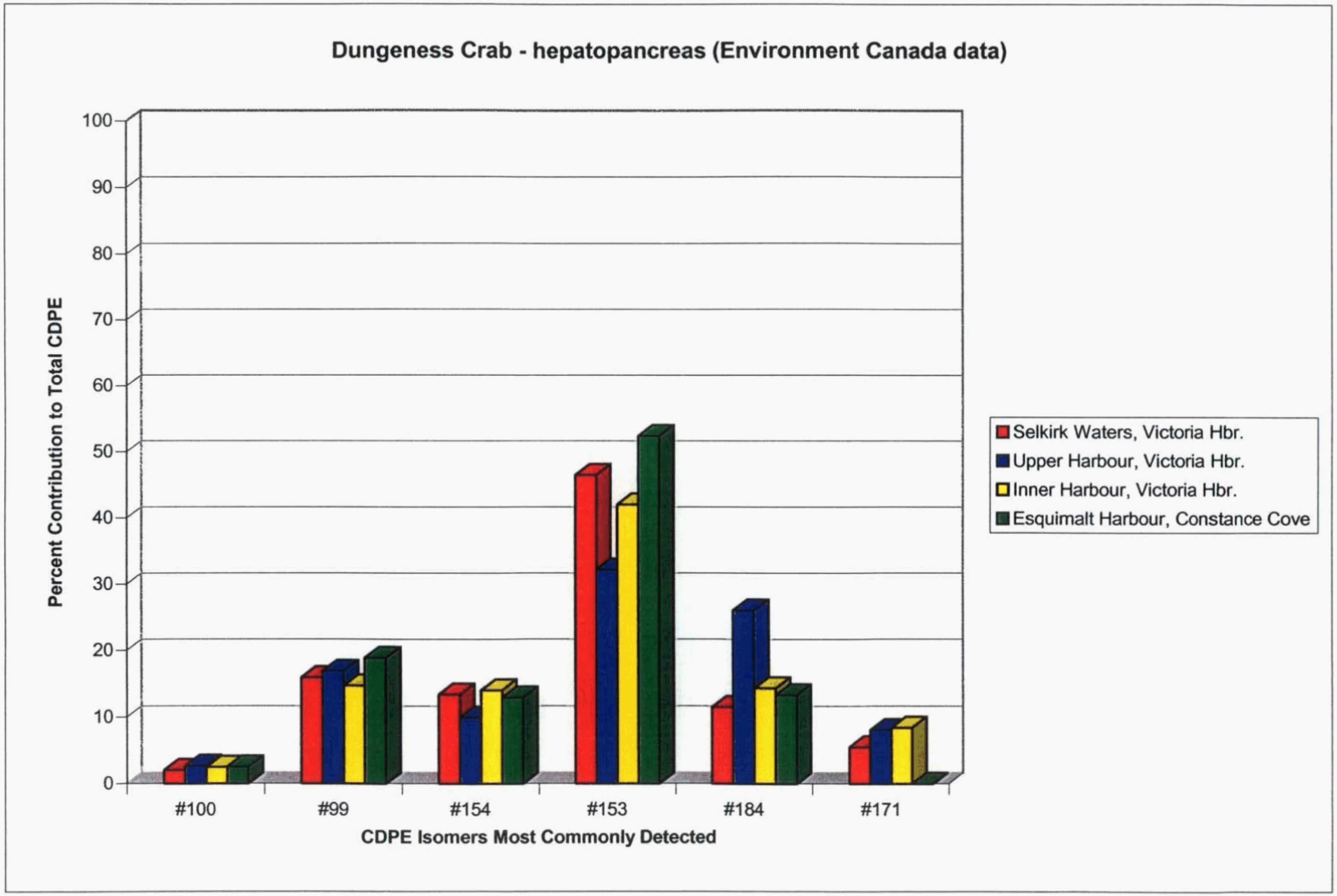


Figure 2: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Aquatic Biota

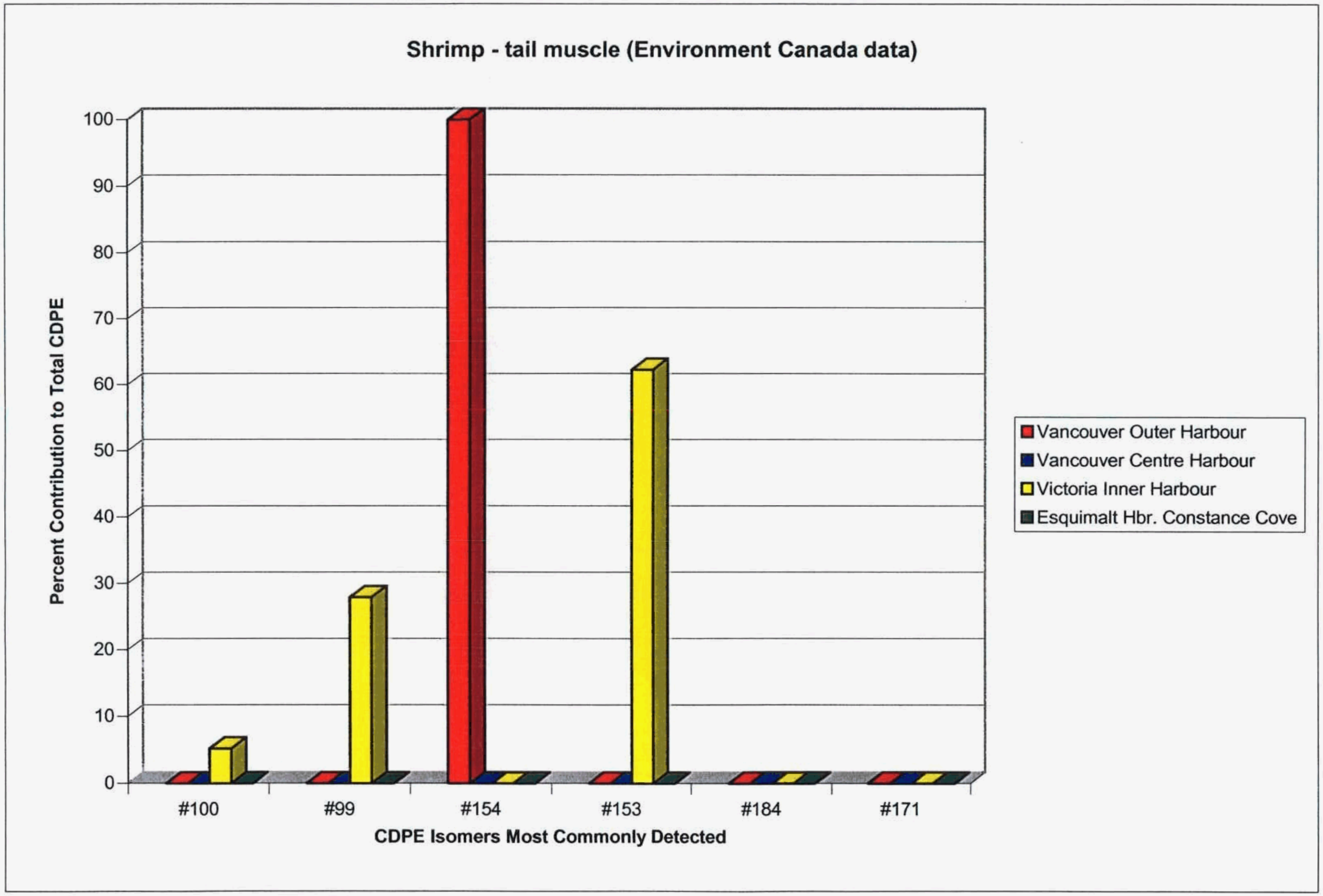
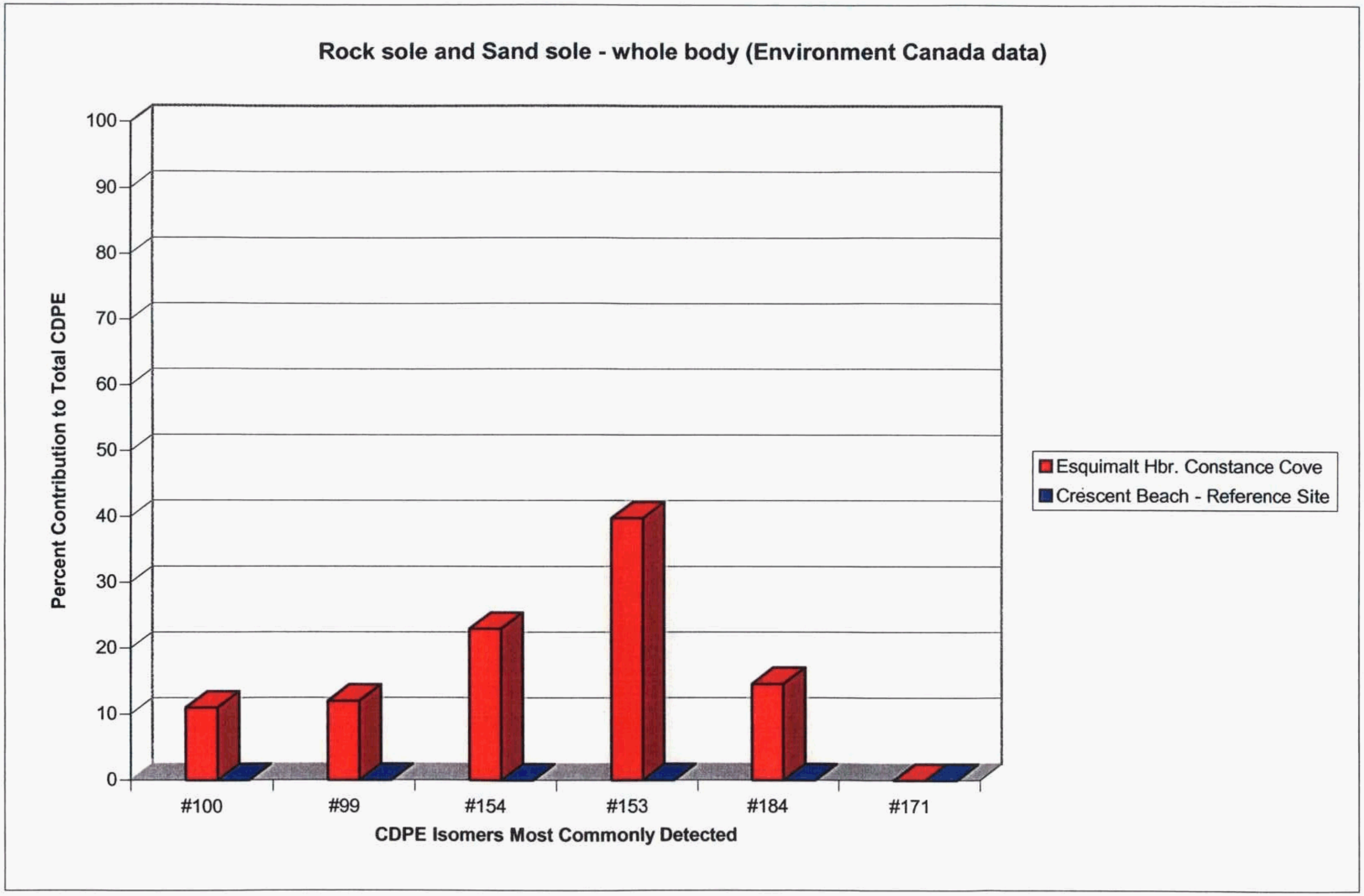


Figure 2: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Aquatic Biota



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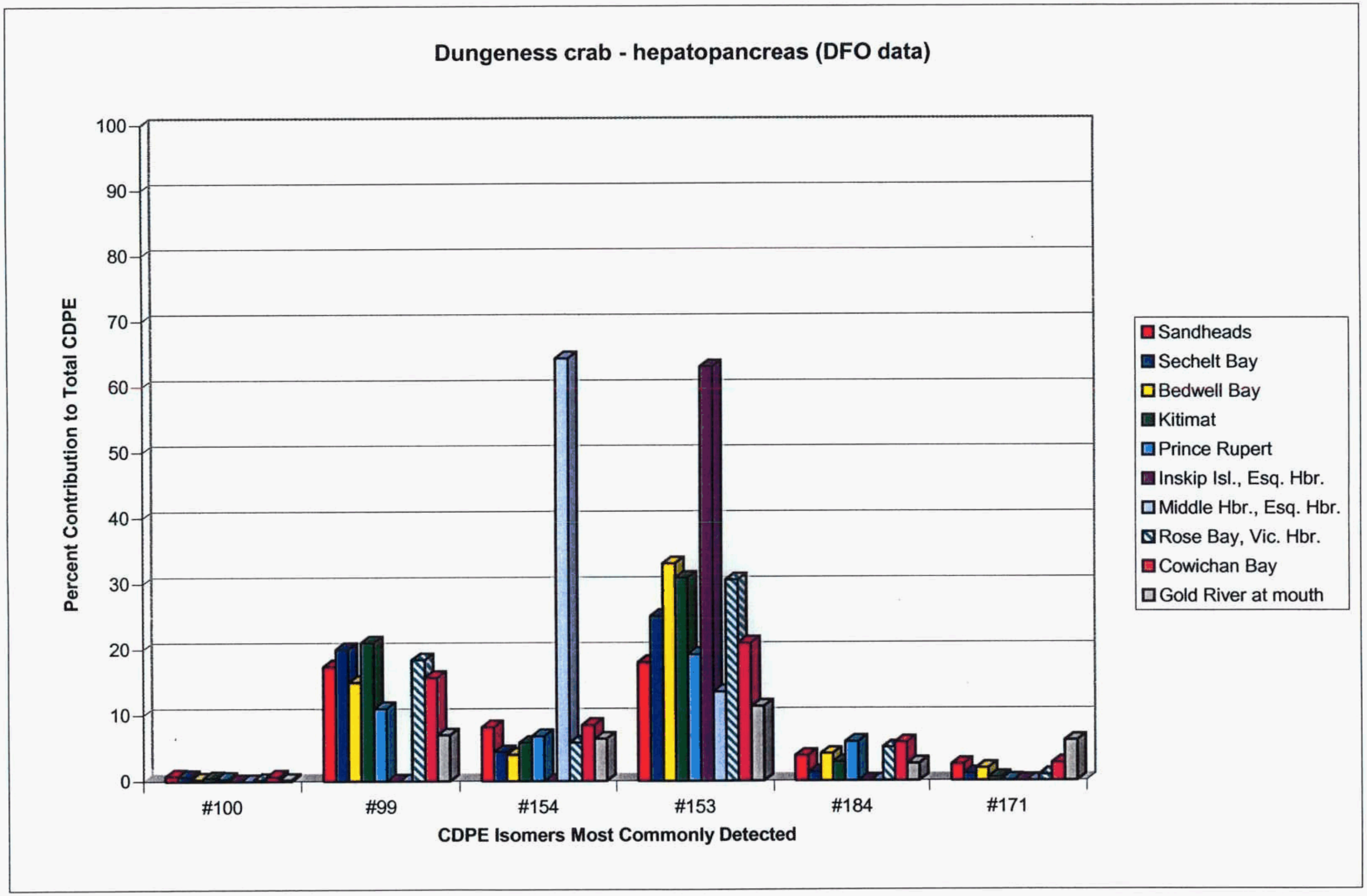
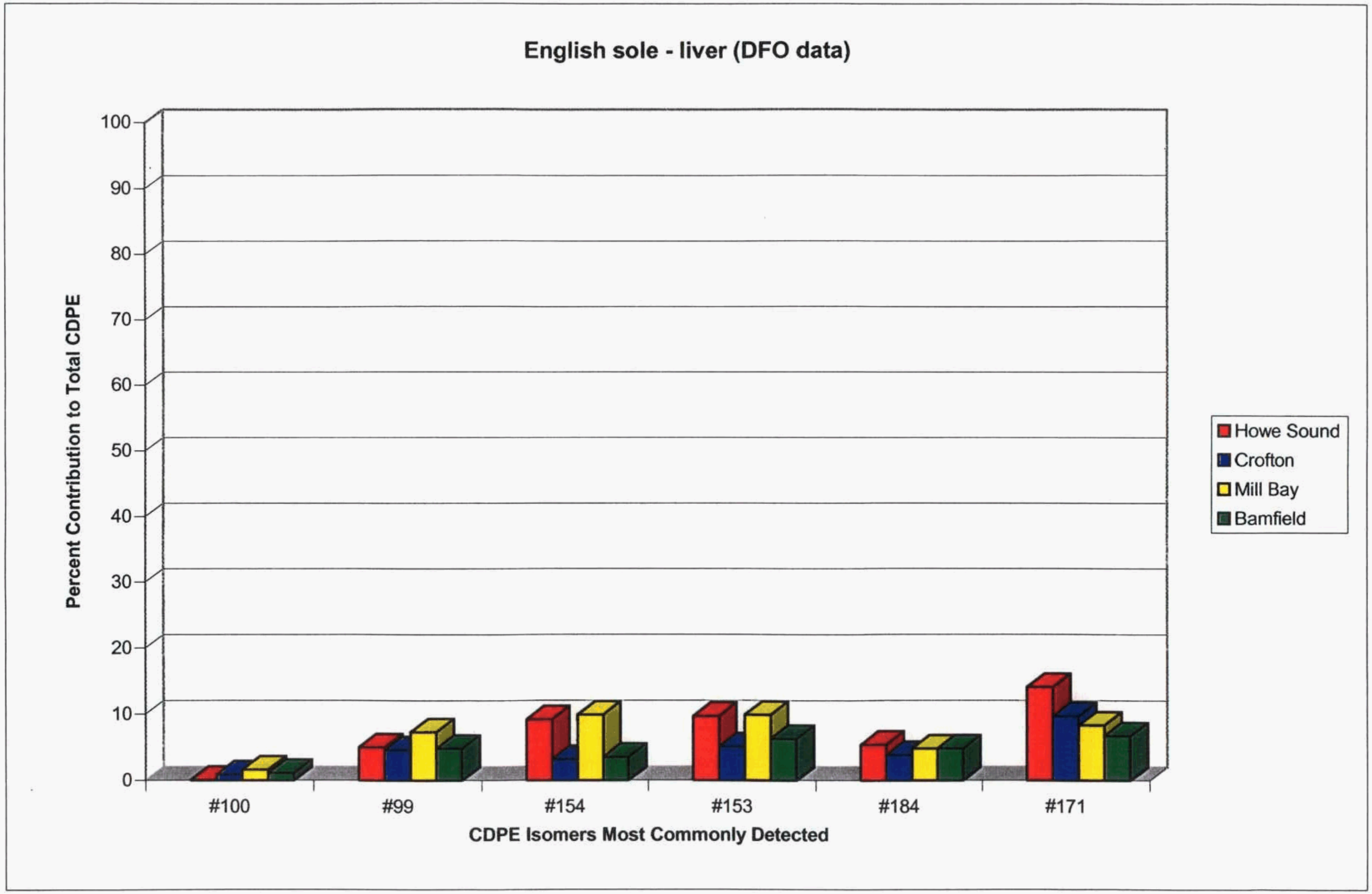


Figure 2: Percent Contributions of the Most Commonly Detected CDPE Isomers in B.C. Aquatic Biota



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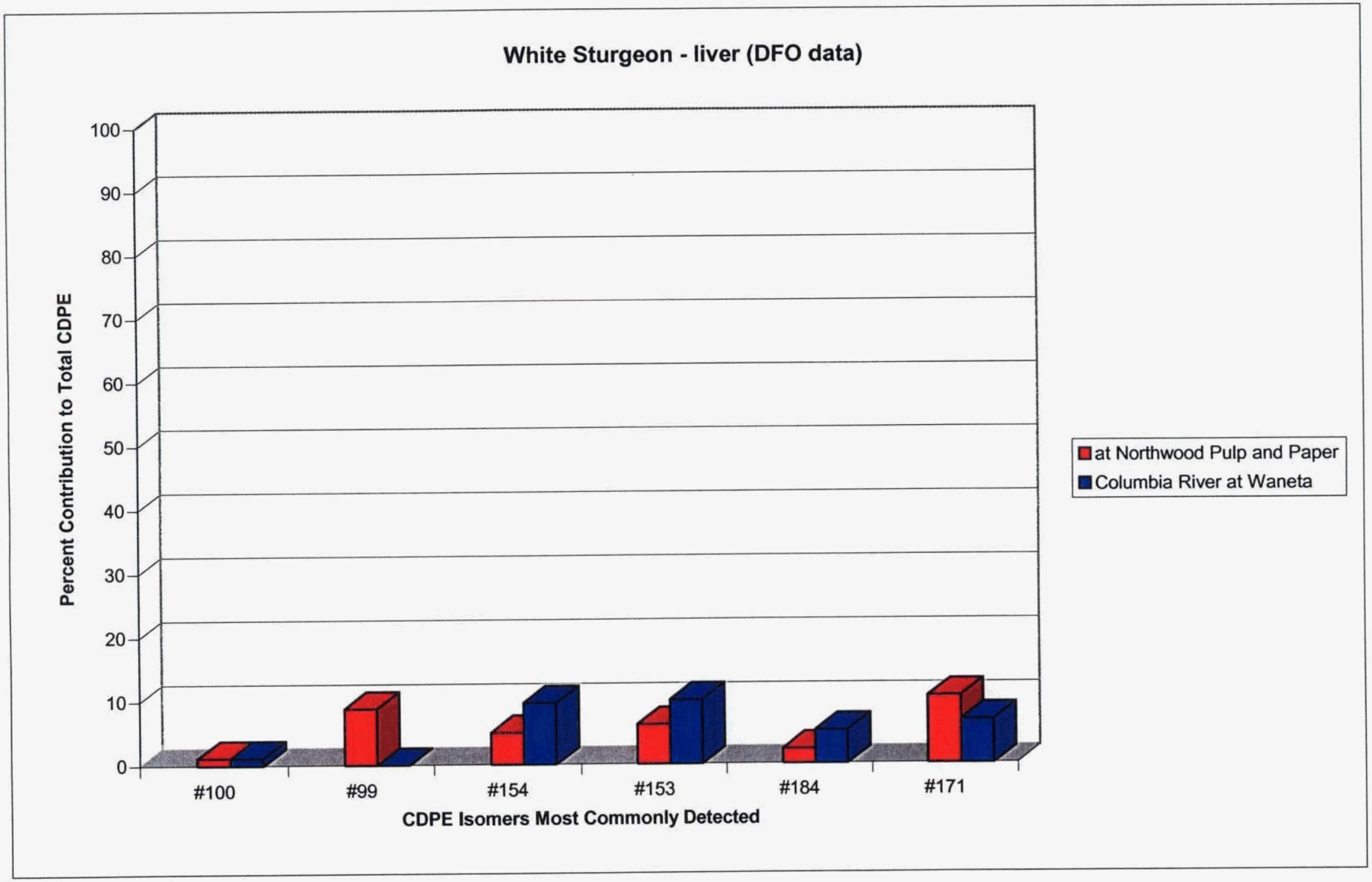
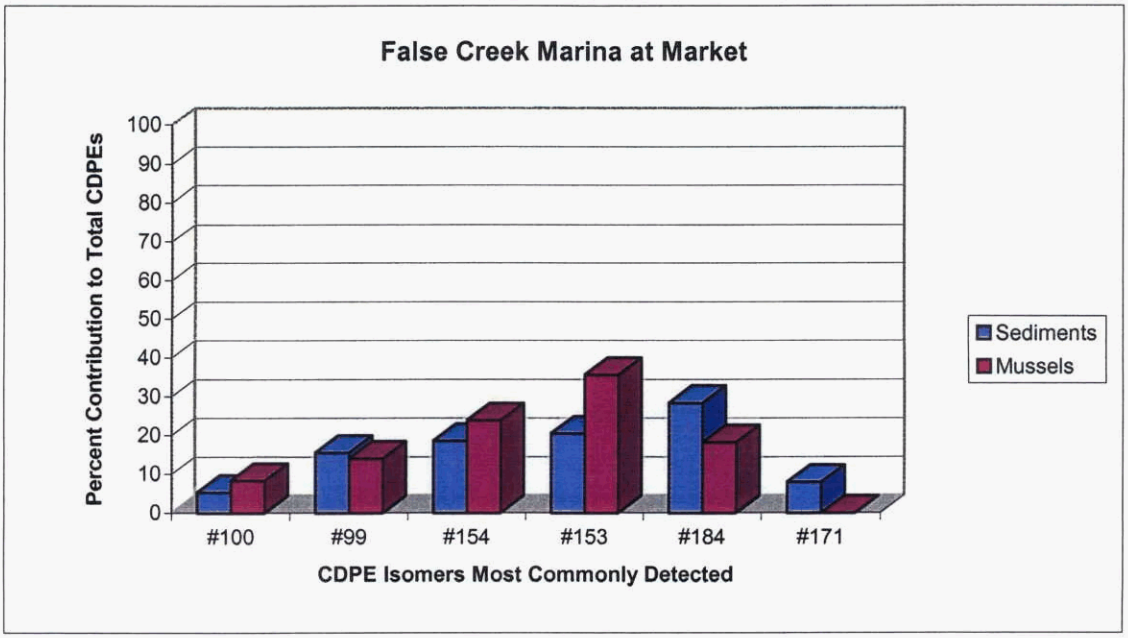
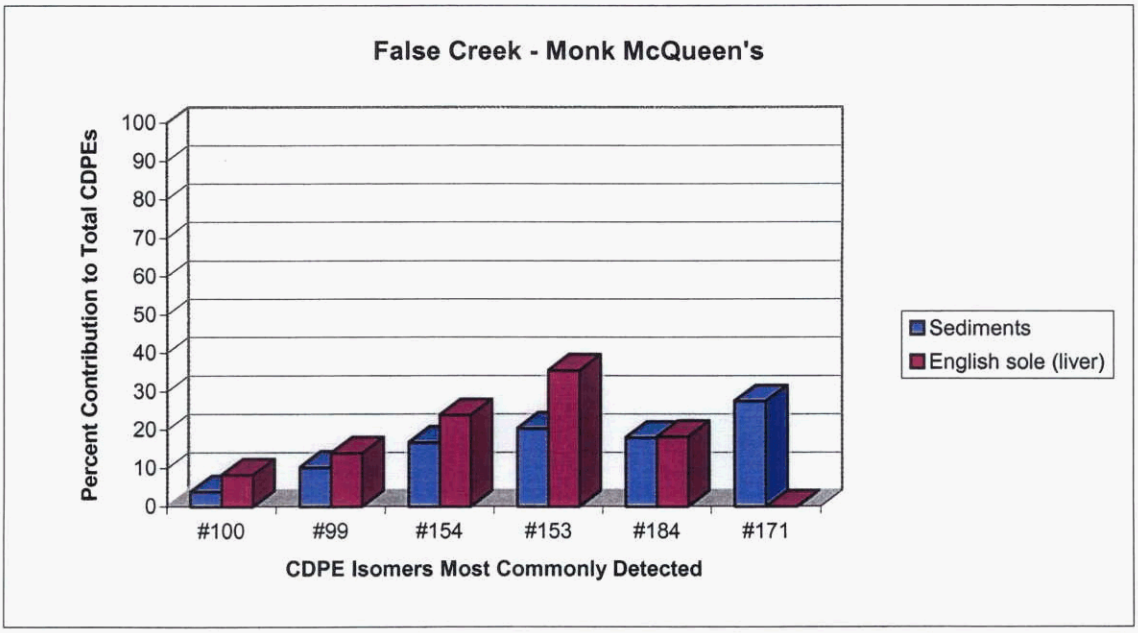


Figure 3: Comparison of CDPE Isomer Distribution in B.C. Sediments and Aquatic Biota (Environment Canada data)





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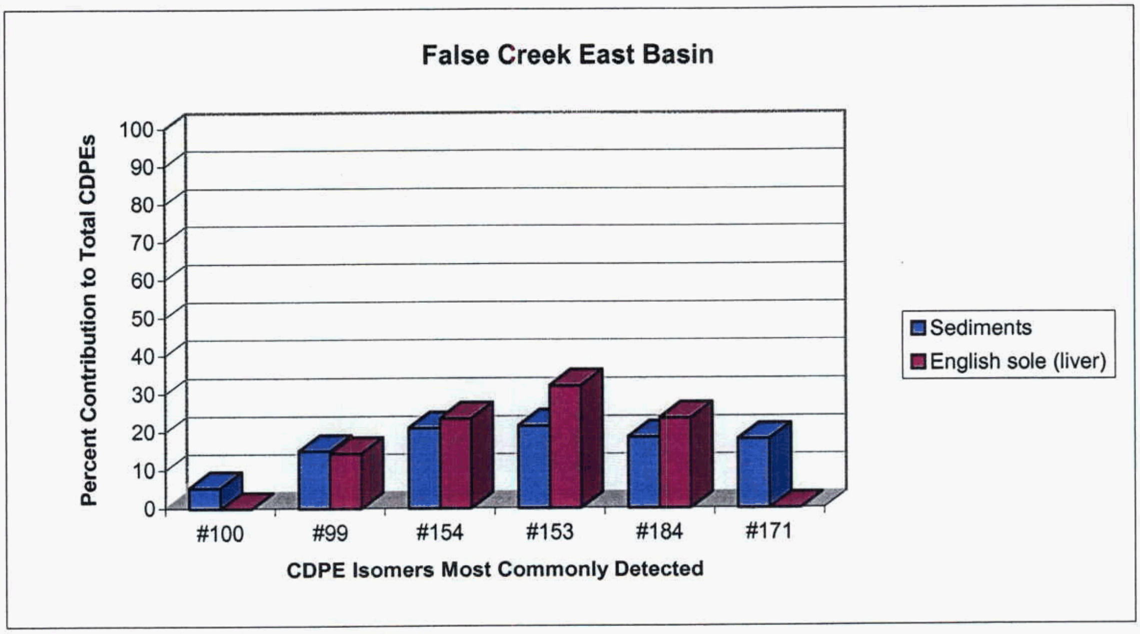


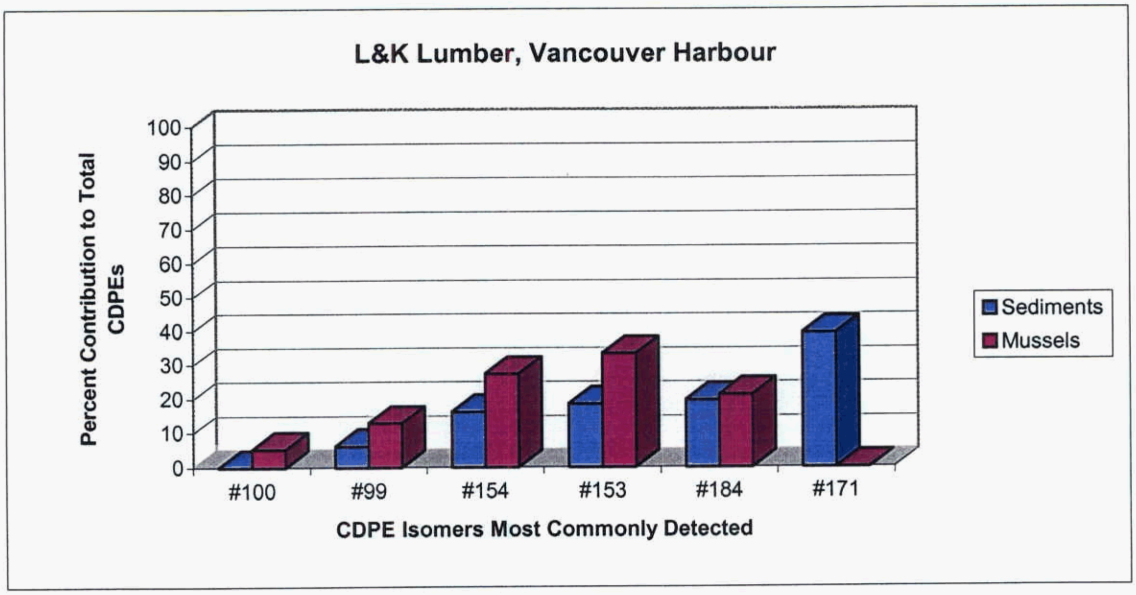
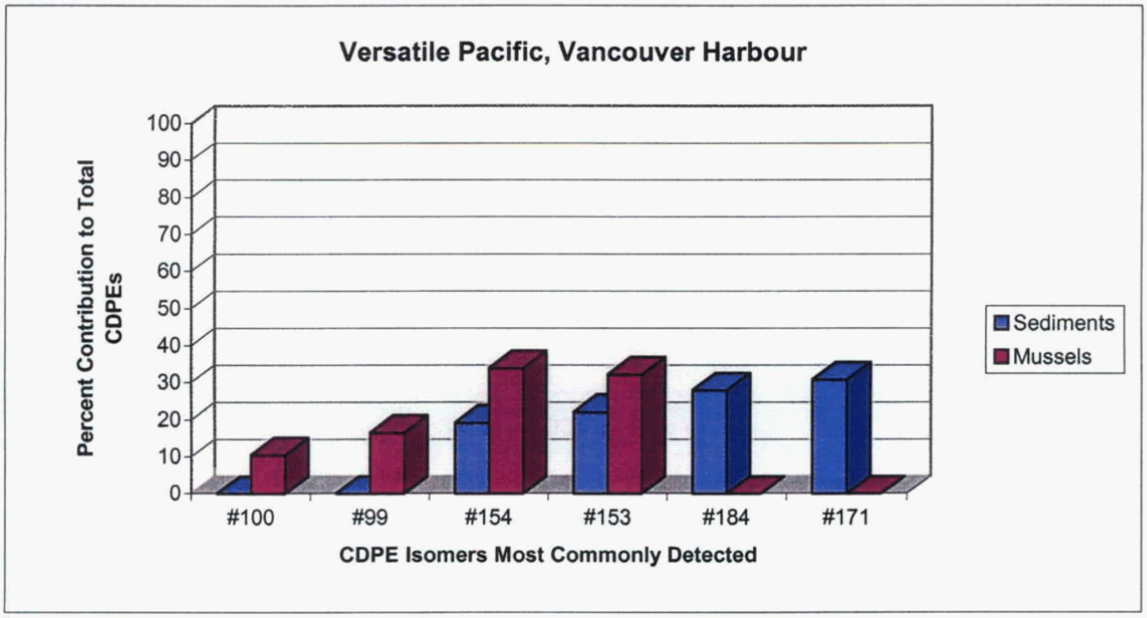


Figure 3: Comparison of CDPE Isomer Distribution in B.C. Sediments and Aquatic Biota (Environment Canada data)



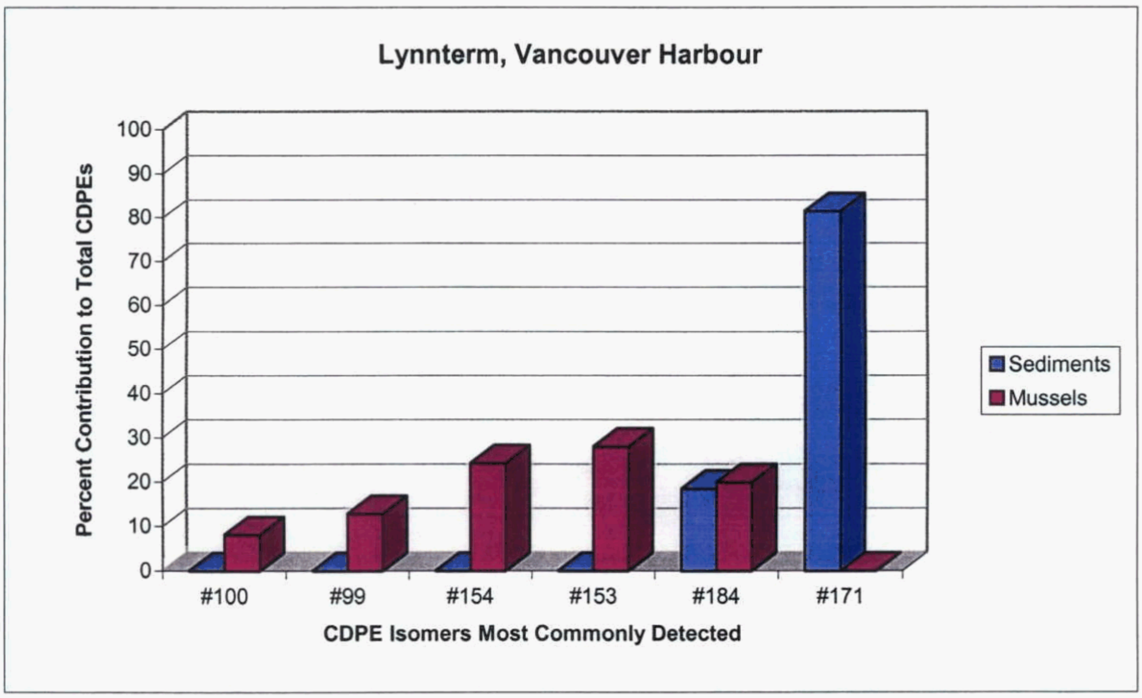
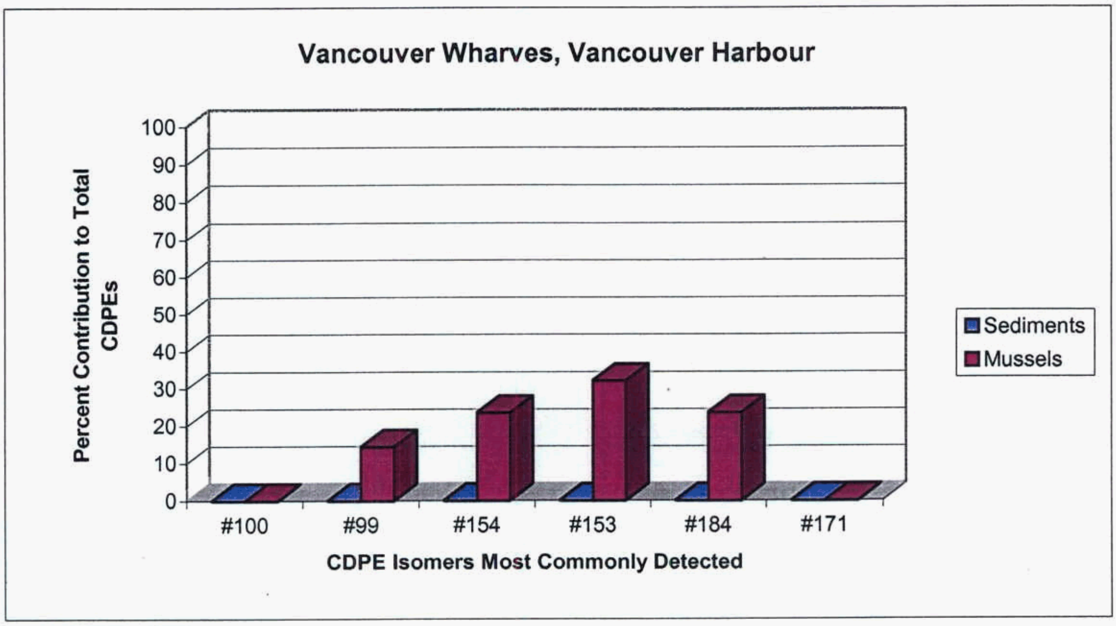
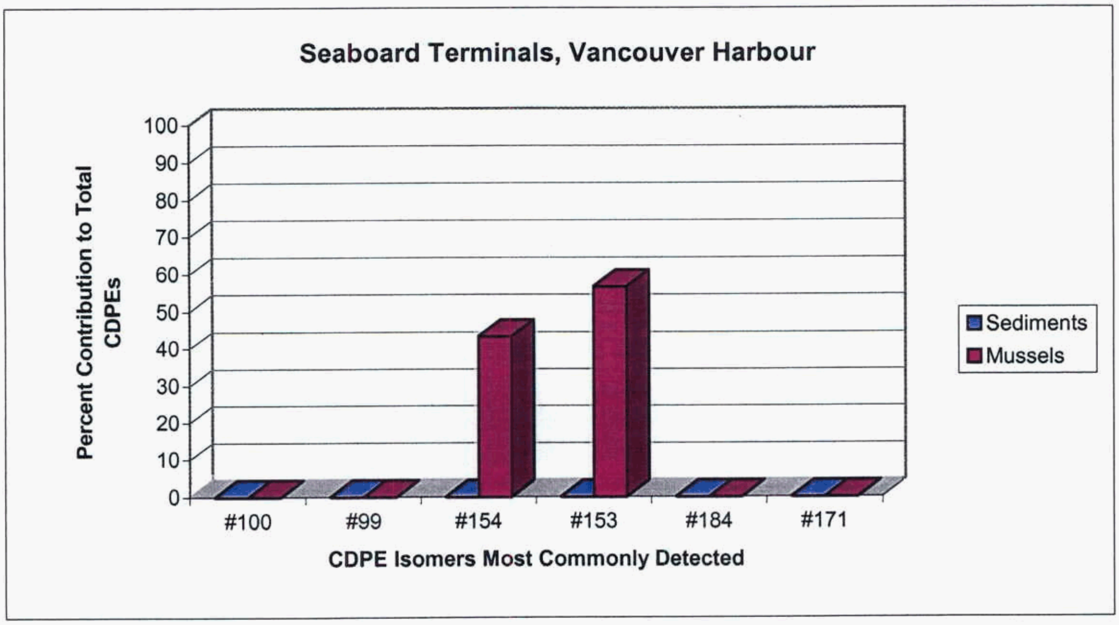


Figure 3: Comparison of CDPE Isomer Distribution in B.C. Sediments and Aquatic Biota (Environment Canada data)





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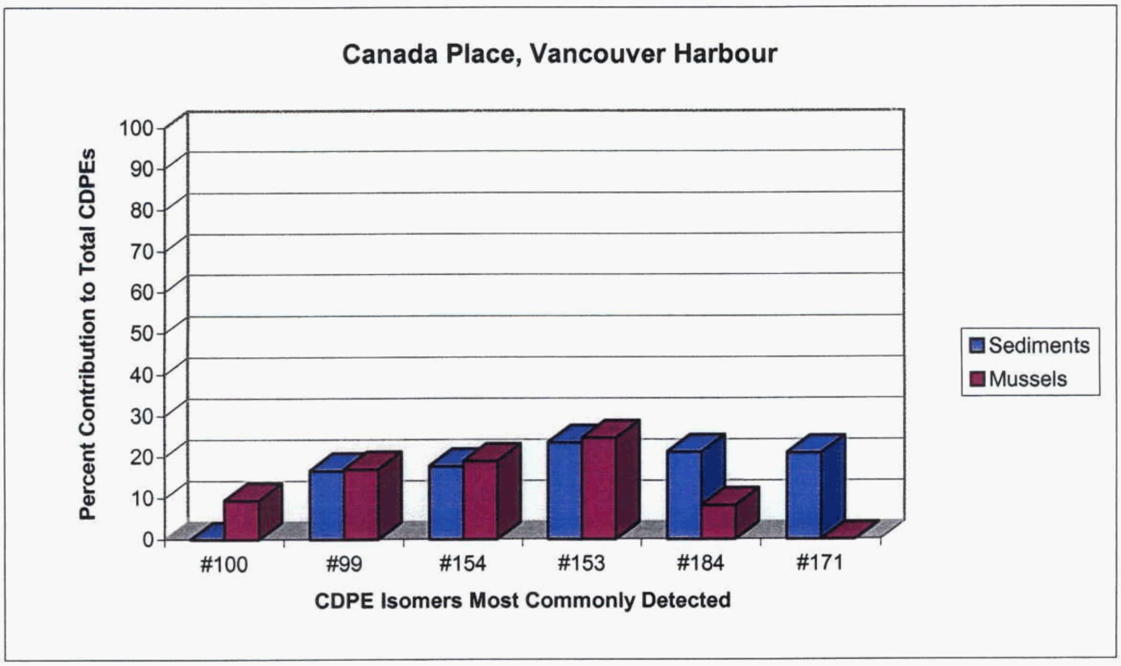

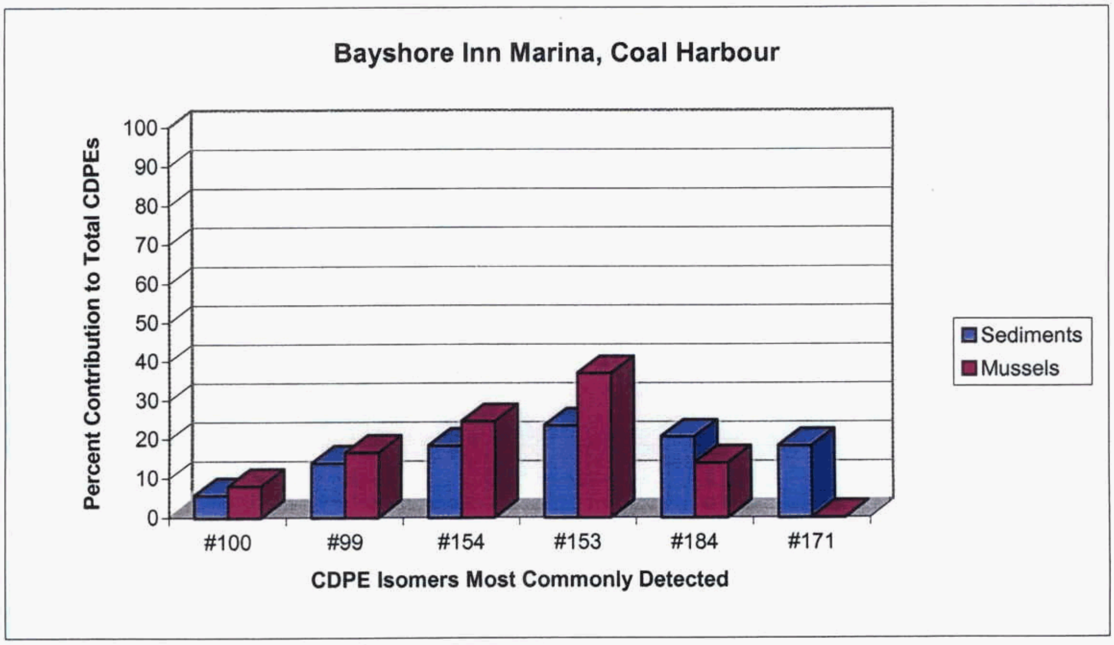

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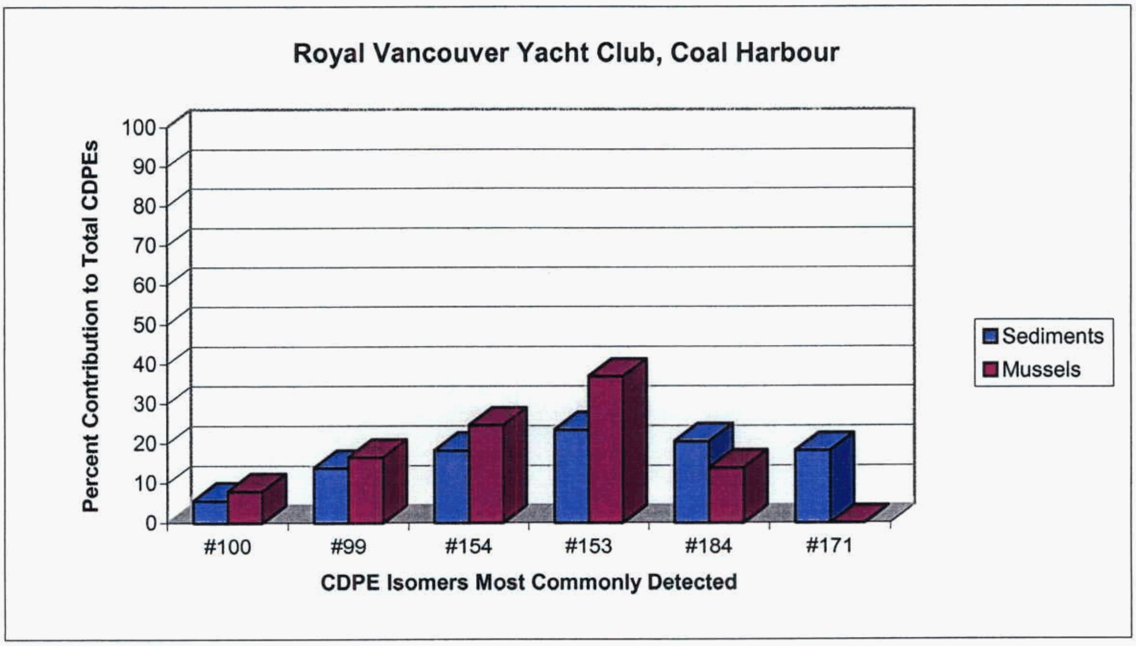


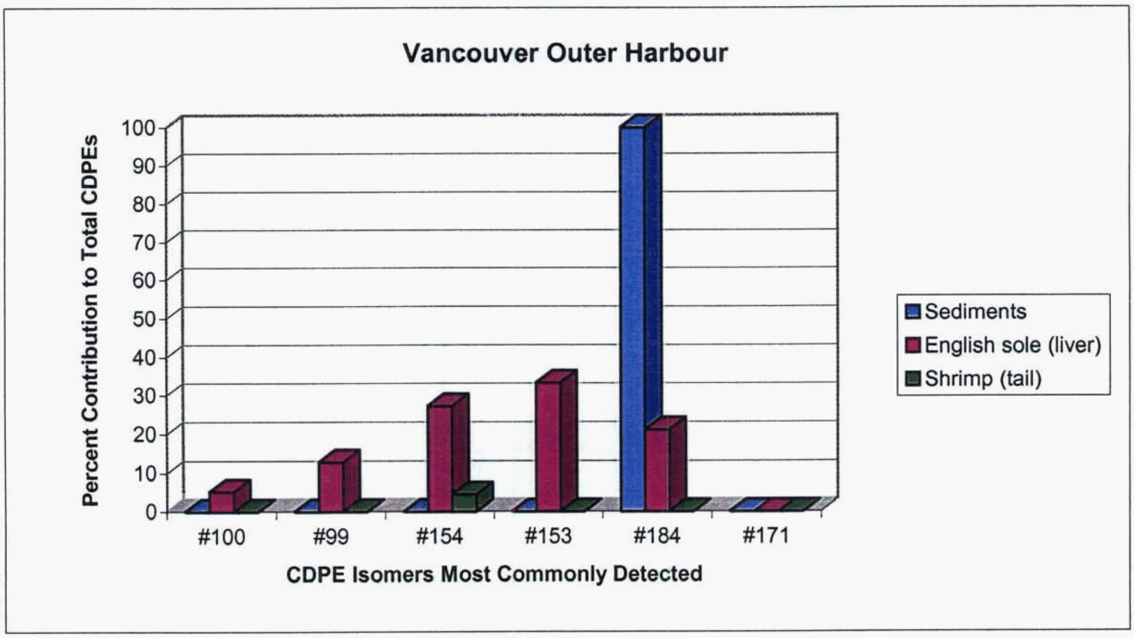
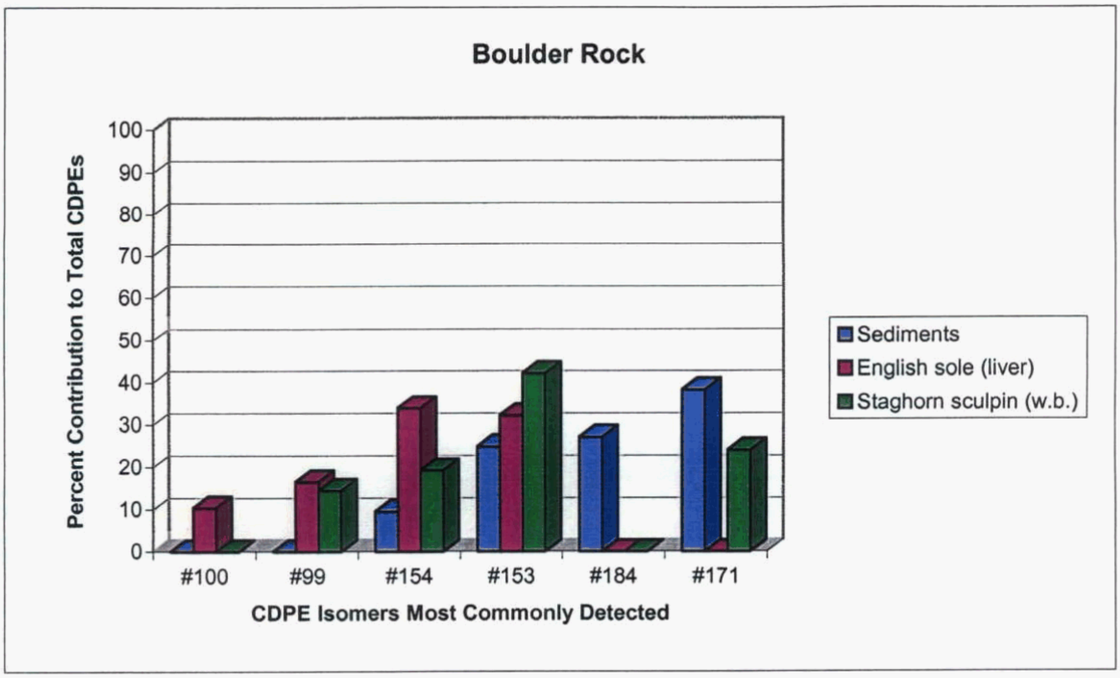


Figure 3: Comparison of CDPE Isomer Distribution in B.C. Sediments and Aquatic Biota (Environment Canada data)



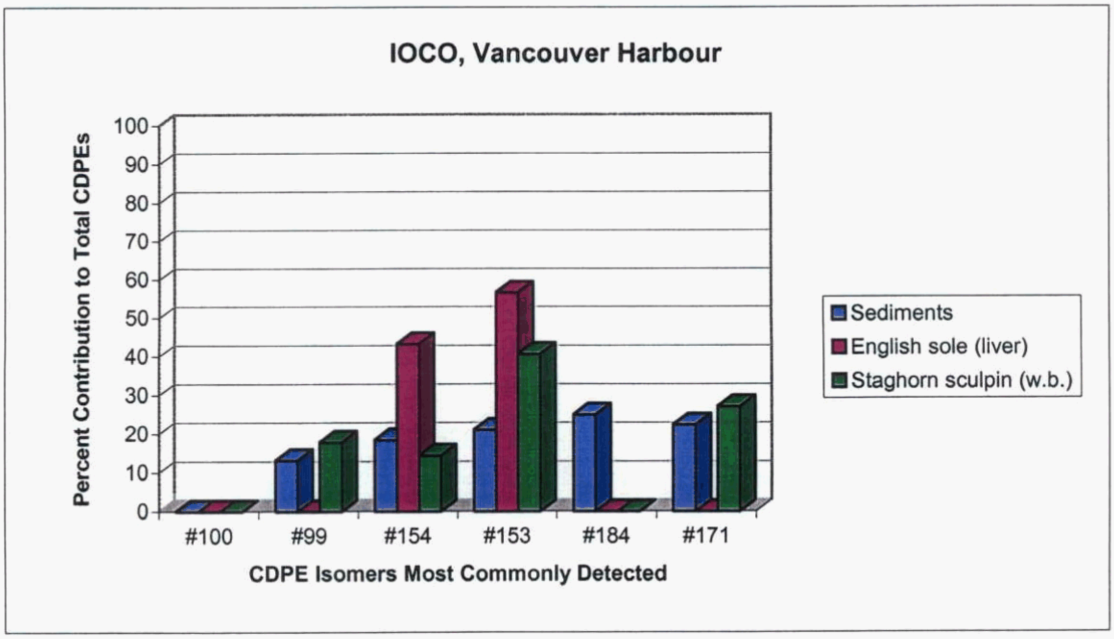
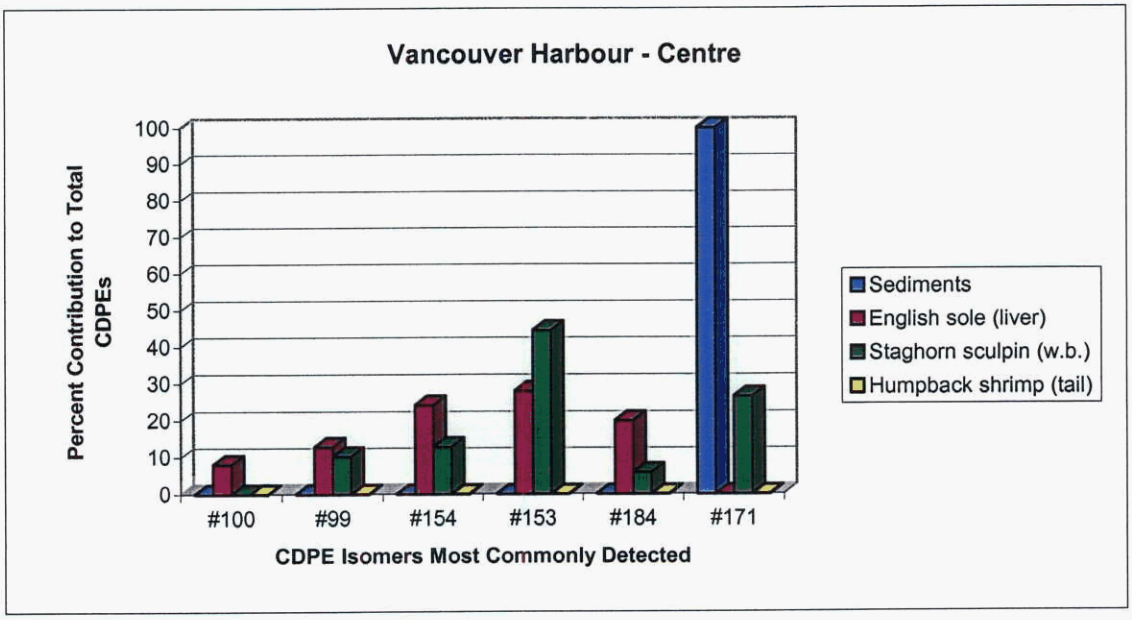


Figure 3: Comparison of CDPE Isomer Distribution in B.C. Sediments and Aquatic Biota (Environment Canada data)



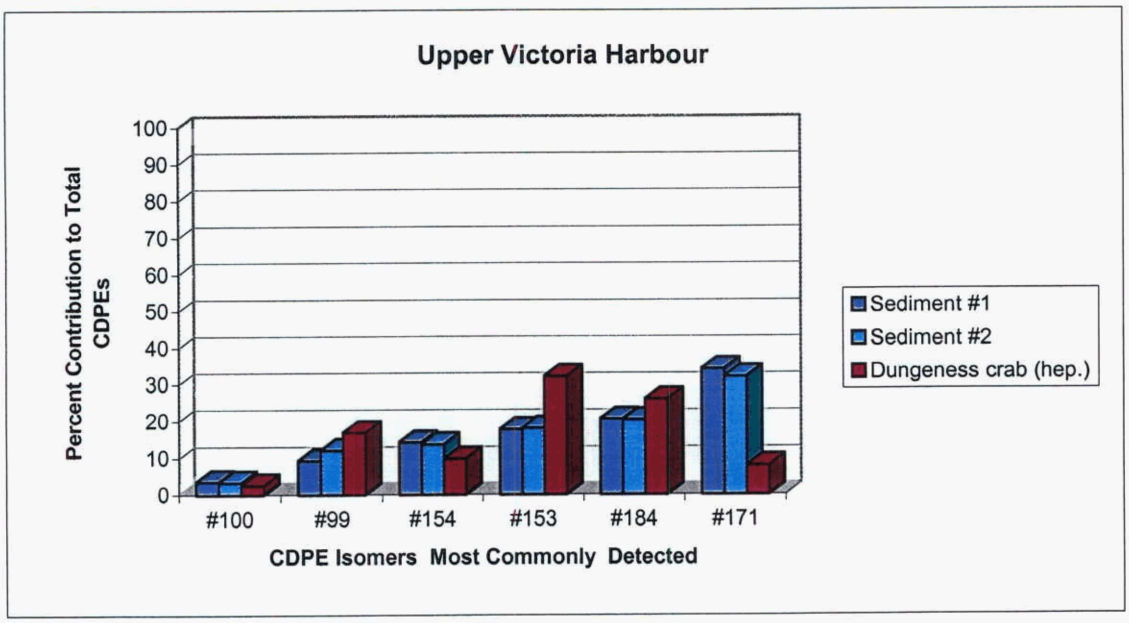
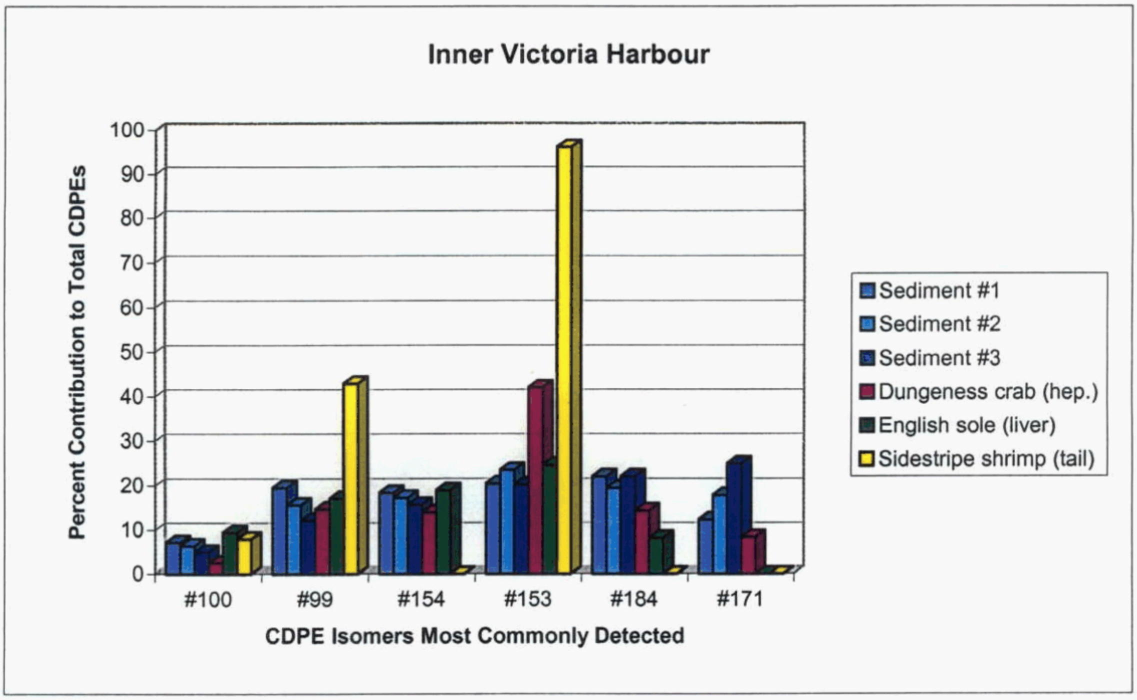


Figure 3: Comparison of CDPE Isomer Distribution in B.C. Sediments and Aquatic Biota (Environment Canada data)



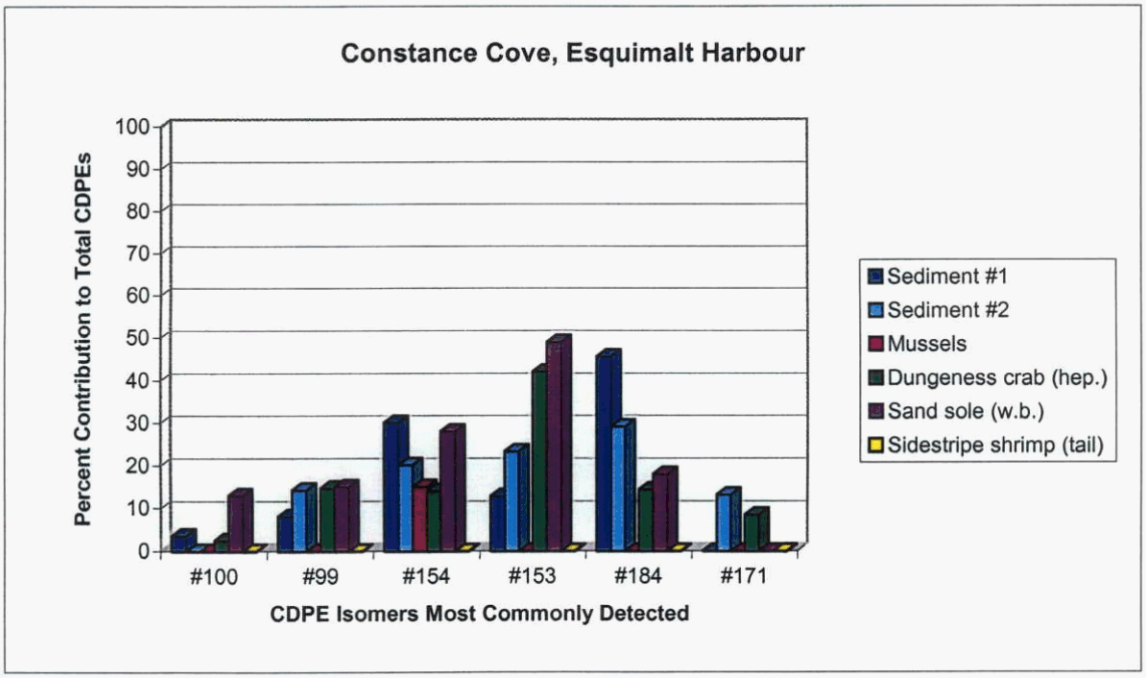


Figure 4a: Profiles of the major CDPE congeners in SPMDs deployed in the water column of the Fraser River

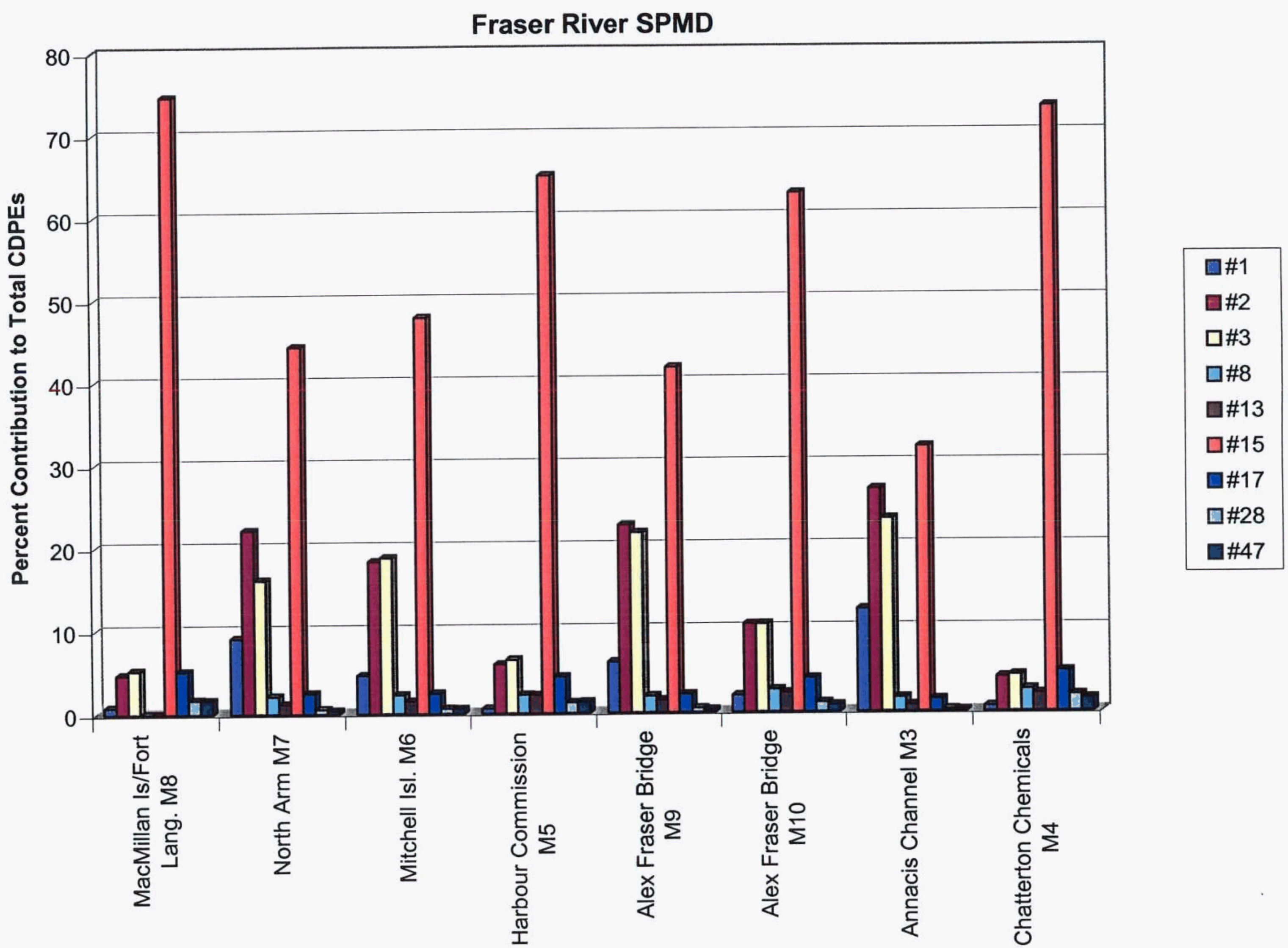
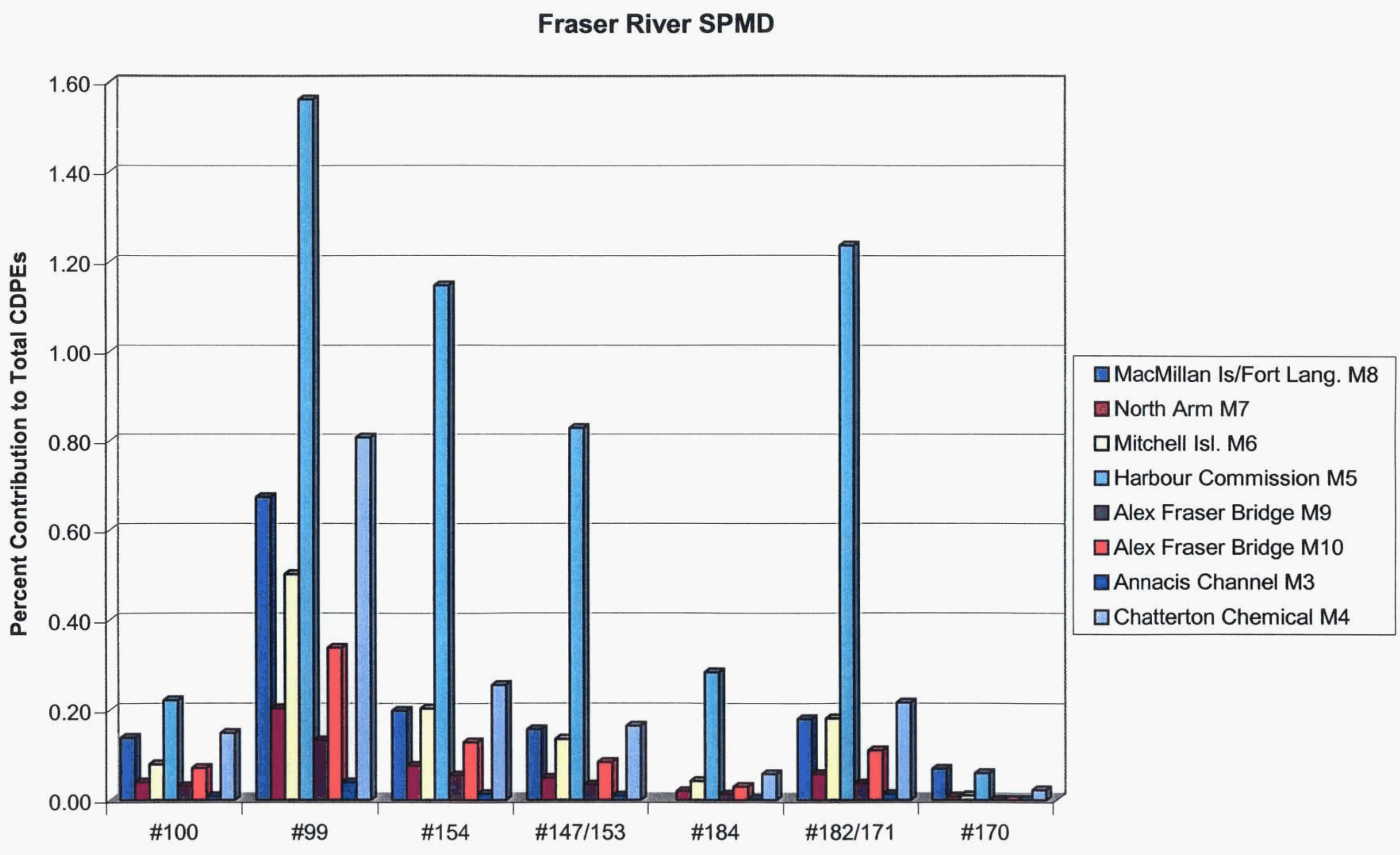


Figure 4b: CDPE Isomers Most Commonly Detected in Sediment and Biota



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APPENDIX 1

SAMPLING AND ANALYTICAL METHODOLOGY

APPENDIX 1a Environment Canada Sampling and Analytical Methodology

1a.1 Field Collection Methods

Sediment grabs were collected with a modified stainless steel Ponar Grab or a stainless steel Smith-MacIntyre grab. A minimum of three grabs were collected at each station. A relatively undisturbed sample of the top 2 cm of sediment from each grab was collected using a stainless steel spoon after carefully decanting overlying water. The surface material from each of the three grabs was composited and then thoroughly mixed in a stainless steel bucket. From the composited sample, three to four subsamples were collected for analyses for CDPE compounds and other organic chemicals. Subsamples were also collected for trace metals, particle size, SVR, and SFR. Samples for CDPE compounds and other organic chemicals were collected in solvent rinsed and heat-treated 125 ml glass jars with heat-treated aluminum foil liners. Samples for trace metals, particle size, SVR, and SFR were collected in a kraft paper bag, enclosed in Whirlpak® bags. Samples were either frozen immediately (-20° C) or temporarily stored on ice in the field until samples could be transferred to lab freezers.

Fish, and some crab samples, were collected using a small otter trawl with a 3.8 cm mesh net and a 5.8 metre throat. The trawl was towed at a speed of approximately 1 to 1.5 knots. Trawl catches were sorted by species. Number of individuals, lengths, and weights were recorded and are presented in Appendix 3.2. At some locations crabs were also collected using crab traps. Mussels and oysters were collected by hand off rocks at low tide. At several sites mussels could not be found growing on rocks, particularly in harbour and marina locations. At these sites mussels were collected from dock structures and pilings at low tide. Clams were dug at low tide using clam shovels and garden forks.

Dissections were performed on teflon boards using sterilized stainless steel scalpels, scissors, and forceps. Tissues collected for analysis included: tail muscle from shrimp and prawns, leg muscle and hepatopancreas from crabs, dorsal muscle (skin removed, liver and gill (without gill arch) from fish, and soft tissue from bivalves. Tissues from individuals of like species and size from each location were composited. Samples were homogenized prior to analysis. Approximately 30 to 50 gram aliquots of homogenized tissue were placed in solvent-rinsed, heat treated 125 ml glass jars for CDPE and lipid content analysis and in Whirlpak® bags for metals analysis. The weight of each homogenized sample was recorded. Samples were kept frozen (-20° C) until analyzed.

APPENDIX 1a.2 Analytical Methods

1a.2.1 Chlorinated Diphenyl Ethers

The following information on analytical methodologies was provided by Axys Analytical Services Ltd. in Sidney, British Columbia.

1a.2.1.1 Sample Handling

Upon receipt, all samples were stored frozen at -20 ° C until just prior to analysis. Samples were thawed and homogenized prior to subsampling for analysis.

1a.2.1.2 Chlorinated Diphenyl Ether Analysis

The samples were analyzed for chlorinated diphenyl ethers using validated methods developed at Axys Analytical Services.

In brief, the chlorinated diphenyl ether analysis method consisted of first spiking the samples with 13C-labelled surrogate standards prior to analysis. Sediment samples were solvent extracted on a shaker table. Tissue samples were ground with sodium sulphate, eluted through a chromatographic column and the extract applied to a Biobeads SX-3 column to remove lipids and other large molecular weight components. Extracts were cleaned up and fractionated on a Florisil column prior to instrumental analysis by high resolution gas chromatography with high resolution mass spectrometric detection (HRGC/HRMS).

Samples were worked up in batches along with accompanying quality control samples. Each batch was analyzed as a unit. The data was reviewed and evaluated in relation to the batch quality control samples. The quality control data must meet specific requirements in order for the batch to be acceptable.

The samples were analyzed in a total of ten batches. A procedural blank was worked up with each batch of samples. In general, the blanks were clean, indicating low background levels of target compounds. One sample in every analysis batch was analyzed in duplicate to demonstrate the precision of the method. The results for sample duplicates were presented with the analytical results for the samples. In total, nine samples were analyzed in duplicate for chlorinated diphenyl ethers. Agreement between the duplicate samples satisfies Axys' quality assurance/quality control criterion of $\pm$ (20% + Method Detection Limits) and the data are acceptable.

The recovery of each surrogate standard was monitored by comparing its response to that of the recovery standard added just prior to analysis. Surrogate standard recoveries are reported with each sample. The surrogate standard recoveries satisfy Axys' quality assurance/quality control criteria and generally fall within the range 40 to 130%.

A "known" sample was analyzed with most batches of samples to demonstrate the accuracy of the method. The "known" sample was either a spiked sediment sample or a spiked tissue sample depending on the matrix of the samples in the batch. The analytical results are compared to the expected values for the samples. Recoveries of the target analytes are generally considered acceptable in the range of 70 to 130% of the expected value. All spiked samples were prepared at Axys by spiking a solution of authentic target compounds into a weighed amount of in-house reference tissue or sediment (well homogenized and analyzed unspiked in-house).

Detection limits were calculated on a sample specific basis and are reported with each sample. The detection limit was calculated as the concentration corresponding to the area reject. The area reject, determined from the ion chromatogram of each compound, is the area of a peak with height three times the maximum height of the noise. Only peaks with responses greater than three times the background noise level were quantified.

1a.2.2 Particle Size Analysis

The Environment Canada Sediment Lab conducted the particle size analysis for sediment samples from Laboratory 1 Batches 1 through 8 using the pipette method (Black 1965). Samples were dried and passed through a series of sieves with decreasing mesh sizes for grain separation. The amount collected from each sieve was weighed and the percent composition of the total weight calculated to determine particle size distribution. Mesh sizes used for grain separation were as follows:

silt and clay	- <0.063 mm (-230 mesh)
very fine sand	- 0.063 - 0.125 mm (230 mesh)
fine sand	- 0.125 - 0.250 mm (120 mesh)
medium sand	- 0.250 - 0.500 mm (60 mesh)
coarse sand	- 0.500 - 1.000 mm (35 mesh)
very coarse sand	- 1.000 - 2.000 mm (18 mesh)
granules	- >2.00 mm (10 mesh)

References:

Black, C.A. (editor). 1965. Methods of Soil Analysis - Part 1. American Society of Agronomy. Chapter 43: 552-562.

1a.2.3 SFR/SVR Analysis

Sediment residue analysis was conducted at the Pacific Environmental Science Centre. Samples were oven dried and then ignited at 550° C in a muffle furnace. The loss of weight on ignition represents the sediment volatile residue (SVR), and the remaining residue represents the sediment fixed residue (SFR). Volatile residue is only an approximate measure of the organic content as results may also reflect loss of water at crystallization, loss of volatile organic matter before combustion, incomplete oxidation, and decomposition of mineral salts during combustion. For a detailed description of the residue analysis refer to APHA (1985) or Swingle and Davidson (1979).

References:

APHA/ AWAA/WPCF. 1985. Standard Methods for the Examination of Water and Wastewater. 14th Edition. Washington, D.C.

Swingle, R.B. and J. W. Davidson. 1979. Environmental Laboratory Manual, Laboratory Services, Department of Environment and Department of Fisheries and Oceans.

1a.2.4 Lipid Content

The following description of analytical methodology was provided by Axys Analytical Services in Sidney, British Columbia.

Gravimetric lipid analyses were carried out on extracts during either the extraction procedure for CDPE compounds or the extraction procedure for PCB congeners and coplanars (many of the samples were also analyzed for PCBs). The percentage lipid was determined using a wet tissue weight.

Colourimetric lipid analyses were carried out on a small number of tissue samples. A lipid extract was prepared by homogenizing dry tissue sample with chloroform/methanol (2:1) and filtering the residue. The filtrate was made up to a volume of 100 mL.

The lipid concentration was quantified colourimetrically using the sulphophosphovanillin method of Barnes and Blackstock (1973). A portion of the lipid extract (0.5 mL) was placed in a test tube, the solvent evaporated under a stream of nitrogen, and concentrated sulphuric acid added (0.5 mL). The stoppered tubes were heated in a water bath (100° C) for 10 minutes. When cool, an aliquot (0.1 mL) of extract was transferred to a test tube, and phosphovanillin reagent (2.5 mL) was added. After 30 minutes the absorbency was measured at 520 nm against a procedural blank. A calibration curve was made with a cholesterol standard. Total lipid concentration was calculated using a conversion factor given by Barnes and Blackstock (1973) which equates 80 mg cholesterol standard with 100 mg total lipid.

Reference:

Barnes. H. and J. Blackstock. 1973. *J. Exp. Mar. Bio. Ecol.* **12**: 103-1189

APPENDIX 1b Department of Fisheries and Oceans Sampling and Analytical Methodology

1b.1 Field Collection Methods

Fish and some Dungeness crab samples were collected using an otter trawl. Trawl catches were sorted by species. Lengths and weights of individuals were recorded and the samples were frozen (-20° C) until further processing was required. In most locations, Dungeness crab were collected using crab traps. Where possible, the hepatopancreas was removed from the crab shortly after the crab was taken from the water and then frozen at -20° C. The sturgeon samples were caught using gill nets (10-inch mesh) and longlines as discussed elsewhere (Macdonald *et al.* 1997).

SPMD samples (combination of 3 separate bags measuring 3.2 cm x 76.2 cm) were placed in the Fraser River between August 6th and September 30th, 1996 at 2-3 cm depth at low tide. One SPMD (M4) was located next to MacMillan Island which is situated on the Fraser River prior to large municipalities and industrial complexes of Greater Vancouver. More extensively sampled were the North and Main Arms of the river which are closer to municipalities of Greater Vancouver and the sites of most of the industrial activity on the Fraser River. Details on the SPMD construction and the procedures used for extraction and cleanup of the SPMD samples, including the alumina chromatography step, have been discussed elsewhere (Rantalainen *et al.* 1998).

MacDonald, D.D., M.G. Ikonomou, A-L Rantalainen, I.H. Rogers, D. Sutherland and J. van-Oostdam. 1997. Contaminants in White Sturgeon (*Acipenser transontanus*) from the Upper Fraser River, British Columbia. *Environ. Toxicol. Chem.* **16**: 479-490.

Rantalainen, A.L., M.G. Ikonomou, and I.H. Rogers. 1998. Lipid-containing semipermeable membrane devices (SPMDs) as concentrators of toxic chemicals in the lower Fraser River, Vancouver, British Columbia. *Chemosphere* **37**: 1119-1138.

APPENDIX 1b.2 Analytical Methods

1b.2.1 Chlorinated Diphenyl Ethers

Materials

The organic solvents used were pesticide residue analysis grade, Caledon Laboratories Ltd., Georgetown, Ontario. High purity water (Milli-RX 20-processed water (15 megohm-cm, 50 ppb total organic carbon (Millipore (Canada), Ltd., Nepean, Ontario) was washed twice with toluene. Sulfuric acid was ACS assured grade (BDH Inc., Toronto, Ontario). Anhydrous granular sodium sulfate (Mallinckrodt Baker, Inc., Paris, Kentucky) was baked at 450 °C for at least overnight before use. The gel permeation columns were packed with a slurry of 70g Biobeads S-X3 (Bio-Rad Laboratories (Canada) Ltd., Mississauga, Ontario) swelled in 1:1 DCM:hexanes for at least 24 hours. Neutral silica (100-200 mesh, Mallinckrodt Baker, Inc., Paris, Kentucky) and neutral alumina (super I activity, ICN Biomedicals, Eschwege, Germany) were activated at least overnight at 200 °C. Acidic silica was prepared by mixing 25 g conc H_2SO_4 with 50 g neutral silica; whereas, basic silica by mixing 14 g of 1 N NaOH with 40 g neutral silica. The columns used had a 1 cm i.d. (1.2 cm o.d.) x 30 cm l, a 100 mL reservoir, a 1 cm o.d. coarse glass frit and a push-in PTFE stopcock with a glass tip (Kimble Glass Inc., Vineland, New Jersey). The non-sterile Millex-SR 0.5 micron disposable syringe filters used to filter some samples were from Millipore (Canada), Ltd., Nepean, Ontario. For the sediment samples, -10+40 mesh granule copper (99.9% ACS, Aldrich) was also needed. The silver nitrate/silica column mixture was prepared one day in advance to use in the following way: mixed stepwise 5.6 g silver nitrate (BDH Inc., Toronto, Ontario) AnalaR grade, 99.8% minimum assay) in 21.5 mL reverse osmosis-processed water (15 megohm-cm product) with 50 g activated silica, let the mixture stand for 30 minutes; applied heat gradually, raising the temperature from 30° C to 120° C over a 5 hour period; conditioned further at 120° C overnight; cooled to room temperature, wrapped in aluminum foil to minimize exposure to light and stored in a dessicator until use (within one day).

The HPLC used for carbon-fibre fractionation consisted of a Waters 590 Programmable HPLC pump, Waters SSV (Solvent Select Valve) and a Waters U6K injection port (2 mL sample loop). To prepare the carbon fibre column, 300 mg glass filter paper (124 mm P100 prefilter sn. 211707 (Nucleopore Corp., Pleasanton, CA) cut into small pieces, 25 mg PX-21 carbon (BP Amoco Chemicals, Naperville, Illinois) and 25-50 mL DCM were mixed together until there were no large lumps of filter paper left (Brinkmann/KINEMATICA POLYTRON PT 10/35 homogenizer probe (Brinkmann Instruments, Inc., Westbury, NY)) and packed into a 5 mm i.d. (7 mm o.d.) x 7.5 cm l stainless steel tube with 2 μ stainless steel frits. A Büchi 461 Water Bath in connection with a Büchi Rotavapor RE121 was used to evaporate bulk solvents.

Procedure

Extraction of biota:

Each thawed sample (stored at –20 °C) was mixed to ensure homogeneity before a subsample (10 g if tissue, 0.1-0.5 g if blubber) was removed. They were analysed in batches of 12; including one procedural blank (processed as samples using 0.15 g triolein, one replicate and one CIL certified reference material (clean herring EDF-2524, contaminated trout EDF-2525 or fortified salmon EDF-2526). To minimize cross-contamination, samples were ranked within a batch such that processing and analysis followed the order of least to most contaminated sample. The weighed tissue was spiked with 50 μL of the internal standard solution. A mortar and pestle was used to grind this spiked sample with granular sodium sulfate (200g). This mixture was poured into a glass column and 250-350 mL 1:1 DCM:hexanes was used to extract the analytes. The solvent was then evaporated with a rotary evaporator (25-30 °C) to a few mLs. If the solution was cloudy or contained particulate matter, it was filtered using a #1010 Hamilton 10 mL syringe with a non-sterile Millex-SR 0.5 micron disposable filter unit. The solution was then loaded onto a GPC column and 1:1 DCM:hexanes was used for elution at a flowrate of ca. 5 mL/min. The first 140 mL fraction (which included the loading solvent of 15-30 mL) was discarded, whereas the following 350 mL was collected and evaporated with a rotary evaporator. This concentrated solution was loaded onto a silica column (2 g basic silica, 1 g neutral, 4 g acidic, 1 g neutral, and 1 g Na_2SO_4 added to the column as layers) that had been packed dry and preconditioned with 50 mL 1:1 DCM:hexanes. The first eluting 60 mL 1:1 DCM:hexanes was collected. If the acidic layer was saturated with colour, the solution was run through an additional silica column. The solvent was exchanged with hexanes, i.e., evaporated with a rotary evaporator to near dryness and then allowed to evaporate just to dryness at room temperature upon which a few mLs of hexanes were added. This solution was then passed through an alumina column (10 g neutral alumina and 1 g Na_2SO_4 added to the column as layers) which was packed dry and conditioned with 25 mL hexanes. After loading the sample and rinsing with 25 mL hexanes, a 60 mL 1:1 DCM:hexanes fraction was collected, evaporated with a rotary evaporator, transferred to a centrifuge tube, and concentrated under N_2 to 0.1 mL. After a solvent exchange with hexanes, the extract was injected into a HPLC system with a carbon fibre column. Fraction I was eluted with 3% DCM in hexanes (4 mL/min for 10 min), Fraction II with 1:1 DCM:cyclohexanes (4 mL/min for 22 min), Fraction III with 1:1 ethyl acetate:benzene (4 mL/min for 25 min) and Fraction IV with backflushed toluene (8 mL/min for 15 min). A subsequent toluene backflush (75 min, 8 mL/min) followed by 1:1 DCM:cyclohexanes and 3% DCM:hexanes (each 5 min, 8 mL/min) ensured no carry-over between samples and a conditioned column. For the chlorodiphenyl ether analysis, fractions I, II and III were combined in an amber microvial with toluene and evaporated under N_2 to ca. 50 μL. After adding 10 μL of the recovery standard solution, the extract was ready for analysis by GC/HRMS.

Instrumental analyses and Quantitation:

A HP 5890 Series II gas chromatograph connected to a VG AutoSpec HRMS operating in EI/SIR (10,000 RP) positive ion mode was used to monitor the M^+ of all PCDE congeners. The GC column used was a DB-5 (30 m x 0.25 mm i.d. x 0.25 µm film thickness). The temperature program was: 100 °C, held 1 min, and increased 4 °C/min until 290 °C, held 2 min (purge start at 2 min, injection 282 °C, source 305 °C, inlet 260 °C).

The internal and recovery standards of chlorodiphenyl ethers were purchased from Cambridge Isotope Laboratories (CIL, Andover, MA, U.S.A.). The internal standard solution (EO-4150) contained $^{13}C_{12}$3,3',4,4'-tetrachlorodiphenyl ether 77 (20 ng/mL), $^{13}C_{12}$2,3,3',4,4'-pentachlorodiphenyl ether 105 (20 ng/mL), $^{13}C_{12}$2,3,3',4,4',5-hexachlorodiphenyl ether 156 (40 ng/mL), $^{13}C_{12}$2,2',3,3',4,4',5-heptachlorodiphenyl ether 170 (40 ng/mL), and $^{13}C_{12}$2,2',3,3',4,4',5,5'-octachlorodiphenyl ether 194 (60 ng/mL). The recovery standard solution (EO-4151) contained $^{13}C_{12}$2,2',3,3',4,4'-hexachlorodiphenyl ether 128 (100 ng/mL) and $^{13}C_{12}$3,3',4,4'-tetrabromodiphenyl ether 77 (100 ng/mL).

Targeted Chlorodiphenyl ethers [(congeners) predicted via 1/2rrt values]

Homologue	pg in calibration solution	Congener
Mo-CDE	75,75	1,3 (2)
Di-CDE	75,75,75	7,8,15 (13)
Tri-CDE	75,75,75	17,28,33 (32,16,22,37,35)
Te-CDE	99,99,75,75,174	67,47,74,66,77 (62,75,68,51,49,71)
Pe-CDE	99,108,193,210,128,113,88	100,101,99,118,85,126,105 (102,119,116,90,89)
Hx-CDE	121,113,99,86,99,82,150,95,85	154,153,140,167,137,138,156,157,128 (150,147,163)
Hp-CDE	199,199,199,199,386	187,172,180,177,170 (184,182/171,181,190)
Oc-CDE	248,278,424,189	201,196,194,195 (204,197,203)
No-CDE		(208,207,206)
De-CDE	301	209
CDE ^{13}C	150,75,150,150,226	Cl 128,Cl 77,Cl 156,Cl 170,Cl 194

APPENDIX 2

SAMPLING STATION COORDINATES

APPENDIX 2.1 **Sampling Station Coordinates - Environment Canada Sediment Samples**

Site No.	Location	Latitude	Longitude	Water Depth (m)
FALSE CREEK				
FC-1	Marina at Market			
	Station 3	49° 16.310'	123° 08.178'	3
	Station 4	49° 16.280'	123° 08.178'	6
	Station 5	49° 16.255'	123° 08.166'	4
FC-5	At Granville Ferries			
	Station 1	49° 16.480'	123° 08.064'	7.5
FC-6	Off Granville Island Hotel			
	Station 1	49° 16.200'	123° 07.706'	6
FC-7	Off Marina at Monk McQueen's			
	Station 1	49° 16.136'	123° 07.264'	6
FC-10	Northeast corner			
	Station 1	49° 16.503'	123° 06.237'	7
BURRARD INLET				
BI-1	Vancouver Outer Harbour (Pacific Environment Institute)			
	Station 2	49° 19.72'	123° 13.52'	54
BI-2	Vancouver Wharves			
	Station 4	49° 18.546'	123° 06.963'	19
BI-3	L&K Lumber			
	Station 2a	49° 18.654'	123° 06.700'	14
BI-4	Vancouver Shipyard/Seaspan			
	Station 4	49° 18.644'	123° 06.333'	8

APPENDIX 2.1 **Sampling Station Coordinates - Environment Canada Sediment Samples** ***cont.***

Site No.	Location	Latitude	Longitude	Water Depth (m)
BURRARD INLET cont.				
BI-5	Versatile Pacific (was Burrard Yarrows)			
	Station 2	49° 18.500'	123° 04.684'	11
	Station 5	49° 18.367'	123° 04.663'	18
BI-7	Saskatchewan Wheat Pool			
	Station 1	49° 18.267'	123° 03.507'	14
	Station 2	49° 18.300'	123° 03.428'	13
BI-8	Neptune Terminals			
	Station 3a	49° 18.215'	123° 02.817'	12.8
BI-9	Seaboard Terminals			
	Station 1x	49° 18.061'	123° 02.621'	15.5
BI-10	Lynnterm			
	Station 4	48° 17.803'	123° 01.634'	15
BI-12	Allied Shipyards			
	Station 2	49° 18.187'	123° 01.345'	9
BI-14	Boulder Rock			
	Station 1	49° 18.20 '	122° 56.36 '	28
BI-15	Ioco			
	Station 1	49° 17.84 '	122° 53.13 '	12
BI-17	Port Moody			
	Station 1	49° 17.50 '	122° 55.66 '	21
BI-19	Central Harbour			
	Station 1	49° 17.95 '	123° 05.00 '	34

APPENDIX 2.1 **Sampling Station Coordinates - Environment Canada Sediment Samples *cont.***

Site No.	Location	Latitude	Longitude	Water Depth (m)
BURRARD INLET cont.				
BI-23	Vanterm			
	Station 2	49° 17.345'	123° 04.305'	19-28
BI-26	Canada Place			
	Station 2	49° 17.365'	123° 06.634'	18-20
Coal Harbour Area:				
CH-1	Bayshore Inn Marina			
	Station 1	49° 17.580'	123° 07.575'	3
	Station 3	49° 17.597'	123° 07.614'	2
	Station 4	49° 17.613'	123° 07.649'	6
	Station 5	49° 17.627'	123° 07.688'	6.5
CH-3	Royal Vancouver Yacht Club Marina			
	Station 4	49° 17.719'	123° 07.587'	6
	Station 5	49° 17.685'	123° 07.563'	6
	Station 6	49° 17.709'	123° 07.638'	5
	Station 7	49° 17.738'	123° 07.697'	5
CH-5	Menchion's Shipyard			
	Station 1a	49° 17.500'	123° 07.617'	7
VICTORIA HARBOUR				
Upper Harbour:				
VH-16	UH-8	48° 25.787'	123° 22.222'	2.5
VH-17	UH-9	48° 25.940'	123° 22.208'	7.5

APPENDIX 2.1 **Sampling Station Coordinates - Environment Canada Sediment Samples** *cont.*

Site No.	Location	Latitude	Longitude	Water Depth (m)
VICTORIA HARBOUR cont.				
Inner Harbour:				
VH-21	IH-4	48° 25.307'	123° 22.119'	2
VH-23	IH-6	48° 25.395'	123° 22.446'	6.5
VH-23a	IH-7			
VH-24	IH-8	48° 25.384'	123° 22.655'	5
Outer Harbour:				
VH-31	OH-2	48° 24.962'	123° 23.281'	13-18
ESQUIMALT HARBOUR				
Constance Cove:				
EH-9	Station 2	48° 26.018'	123° 25.214'	9
EH-12	Station 5	48° 26.008'	123° 25.862'	11.5
EH-14	Station 7	48° 26.032'	123° 25.641'	13
REFERENCE SITES				
RF-1	Crescent Beach Station 1	49° 03.358'	122° 53.199'	1
Queen Charlotte Islands:				
RF-11	Tow Hill	54°	131°	

APPENDIX 2.2 Sampling Station Coordinates - Environment Canada Biota Samples

Site No.	Location		Latitude	Longitude
False Creek Area:				
FC-1	Marina at Market			
	Station 3		49° 16.310'	123° 08.178'
	Station 4		49° 16.280'	123° 08.178'
	Station 5		49° 16.255'	123° 08.166'
FCT-1	East Basin Trawl	start	49° 16.187	123° 07.205'
		stop	49° 16.296	123° 06.888'
FCT-2	Monk McQueen's Trawl			
		start	49° 16.159'	123° 07.413'
		stop	49° 16.273'	123° 06.992'
Burrard Inlet:				
BI-1	Vancouver Outer Harbour (Pacific Environment Institute)			
	Trawl VOHT-2	start	49° 19.75'	123° 14.32'
		stop	49° 19.73'	123° 13.62'
BI-2	Vancouver Wharves			
	Station M1		49° 18.528'	123° 06.891'
	Station M2		49° 18.497'	123° 06.810'
BI-3	L&K Lumber			
	Station M1		49° 18.667'	123° 06.564'
BI-5	Versatile Pacific (was Burrard Yarrows)			
	Station M2		49° 18.451'	123° 04.460'
BI-9	Seaboard Terminals			
	Station M2		49° 18.079'	123° 02.653'

APPENDIX 2.2 Sampling Station Coordinates - Environment Canada Biota Samples *cont.*

Site No.	Location		Latitude	Longitude
BURRARD INLET cont.				
BI-10	Lynnterm			
	Station M2		49° 17.824'	123° 01.706'
BI-14	Boulder Rock			
	Trawl BRT-1a	start	49° 18.13'	122° 56.34'
		stop	49° 17.75'	122° 56.78'
	-1b	start	49° 18.21'	122° 56.23'
		stop	49° 17.75'	122° 56.78'
BI-15	IOCO			
	Trawl IT-1	start	49° 17.88'	122° 52.95'
		stop	49° 17.72'	122° 53.65'
BI-19	Centre Harbour			
	Trawl CtrT-1a	start	49° 18.17'	122° 05.38'
		stop	49° 17.91'	122° 04.43'
	-1b	start	49° 18.17'	122° 05.61'
		stop	49° 17.95'	122° 04.70'
BI-26	Canada Place			
	Station M1		49° 17.308'	123° 06.840'
Coal Harbour Area:				
CH-1	Bayshore Marina			
	Station 5		49° 17.603'	123°07.821'
	Station 8		49° 17.608'	123° 07.649'
	Station 10		49° 17.588'	123° 07.587'
	Station 11		49° 17.573'	123° 07.579'
CH-3	Royal Vancouver Yacht Club			
	Station 2		49° 17.732'	123° 07.581'
	Station 3		49° 17.726'	123° 07.596'
	Station 8		49° 17.728'	123° 07.521'

APPENDIX 2.2 **Sampling Station Coordinates - Environment Canada Biota Samples** *cont.*

Site No.	Location		Latitude	Longitude
Victoria Harbour:				
Selkirk Waters:				
SWT-3	Trawl SWT-3	start	48° 26.349'	123° 22.843'
		stop	48° 26.192'	123° 22.652'
Upper Harbour:				
UH-C2	Station C2		48° 26.051'	123° 22.617'
Inner Harbour				
IH-C3	Station C3		48° 25.409'	123 22.811'
IHT-1	Trawl IHT-1	start	48° 26.012'	123 22.546'
		stop	48° 25.781'	123 22.260'
Esquimalt Harbour:				
Constance Cove				
CC-M1	Station M1		48° 26.014'	123° 26.097'
CC-C1	Station C1		48° 26.067'	123° 26.150'
CCT-1	Trawl CCT-1	start	48° 26.147'	123° 25.997'
		stop	48° 26.112'	123° 25.476'
Reference Site				
RF-1	Crescent Beach Station 1		49° 03.358'	122° 53.199'

APPENDIX 3

SAMPLE INFORMATION

APPENDIX 3.1 SEDIMENT CHARACTERISTICS (Environment Canada data)

SITE NO.	LOCATION	DATE	MEDIAN PARTICLE SIZE	CLAY AND SILT (%) Clay (%)		Silt (%)	SAND (%) Very Fine Sand (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Very Coarse Sand (%)	GRANULES (%)	SFR	SVR
	FALSE CREEK AREA:													
FC-1	Marina at Market													
	Station 3,4,5 (composite)	25-Mar-91	silt	21.4	8.9	37.9	2.1	2.5	4.34	4.8	6.1	19.2	919000	80600
FC-5	At Granville Ferries													
	Station 1	4-Jun-91	silt	24.8	11.3	49.8	9	2.9	1.6	0.6	0.14	0	944000	55600
		16-Nov-94	clay and silt	[	62.9	]	11.6	10.9	10.9	3.2	0.5	<0.1	931000	68900
FC-6	Off Granville Island Hotel													
	Station 1	4-Jun-91	silt	26.8	9.4	43.5	11.6	6	1.8	0.62	0.27	0.41	942000	57900
	Station 2	16-Nov-94	clay and silt	[	53.1	]	10.4	13.7	15.2	3.6	1.3	2.7	934000	66000
FC-7	Off Marina at Monk McQueen's													
	Station 1	4-Jun-91	silt	17.7	7.3	31.6	4.6	8.6	10.7	11.1	5.01	5.04	930000	70200
	(Lab duplicate)						NO INFORMATION						927000	72600
		16-Nov-94	clay and silt	[	72	]	6.7	8.1	7.3	3.4	2.5	<0.1	919000	81300
FC-10	Northeast corner													
	Station 1	4-Jun-91	clay and silt	19.7	12.2	47.2	4.4	5.6	5.5	2.9	1.8	1.5	914000	86200
	(Lab duplicate)						NO INFORMATION						910000	90000
	BURRARD INLET:													
BI-1	Vancouver Outer Harbour (Pacific Environment Institute)													
	Station 2	9-Sep-91	silt	32	10.4	54.5	2.4	0.67	0.11	0.04	0.01	0	949000	51000
	(Lab duplicate)						NO INFORMATION						949000	50800
BI-2	Vancouver Wharves													
	Station 4	12-Sep-91	medium sand	[	1.1	]	1.2	14.4	44.6	19.6	8.5	10.6	759000	241000
	(Repeat analysis)						NO INFORMATION						938000	62300
BI-3	L & K Lumber													
	Station 2a	12-Sep-91	very fine sand	[	40.8	]	15.9	19.6	16.7	4.8	1.1	1.1	929000	71300
	(Repeat analysis)		clay and silt	[	80.2	]	8.5	5.1	3.7	2.5	0.9	0.1	NI	NI
BI-4	Vancouver Shipyards/Seaspan													
	Station 4	12-Sep-91	coarse sand	1.73	0.44	2.7	0.99	5.5	27	40	16.2	5.6	941000	58900
BI-5	Versatile Pacific (was Burrard Yarrows)													
	Station 2	20-Aug-84	clay and silt	[	62.3	]	9.9	8.8	8	6.9	2.3	1.8	NI	NI
	Station 5	12-Sep-91	very fine sand	15.5	4.8	27.2	19.2	26.2	3.8	1.8	0.69	1.4	950000	49700
BI-7	Saskatchewan Wheat Pool													
	Station 1	12-Sep-91	very fine sand	10.2	2.4	22.3	31.5	26.6	4.3	0.6	0.2	2.6	967000	32900
	Station 2	15-Nov-94	very fine sand	[	32.4	]	26.9	27	11.4	1.8	0.4	0.1	953000	47100

APPENDIX 3.1 SEDIMENT CHARACTERISTICS (Environment Canada data)

SITE NO.	LOCATION	DATE	MEDIAN PARTICLE SIZE	CLAY AND SILT (%) Clay (%)		Silt (%)	SAND (%) Very Fine Sand (%)	Fine Sand (%)	Medium Sand (%)	Coarse Sand (%)	Very Coarse Sand (%)	GRANULES (%)	SFR	SVR
	BURRARD INLET cont.:													
BI-8	**Neptune Terminals**													
	Station 3a	15-Nov-94	fine sand	[	20.2	]	20.5	34.6	18	3.7	2.2	0.8	933000	67200
BI-9	**Seaboard Terminals**													
	Station 1x	12-Sep-91	medium sand	[	8.8	]	9.3	16.4	21.5	12.4	9.2	22.4	960000	40400
	(Repeat analysis)		medium sand	2.7	1.6	10.2	8.5	18.5	20.2	11.7	7.5	21.2	NI	NI
BI-10	**Lynnterm**													
	Station 4	11-Sep-91	fine sand	3.3	1.4	7.1	8.3	44.5	27	4.4	1	3.2	963000	37200
BI-12	**Allied Shipyards**													
	Station 3	15-Nov-94	very fine sand	[	32.8	]	20.4	27.7	17.7	1.1	0.3	<0.1	921000	80600
BI-14	**Boulder Rock**													
	Station 1	11-Sep-91	silt	18.9	4.7	41.7	28.2	6.24	0.18	0.04	0	0	948000	51800
	(Lab duplicate)						NO INFORMATION						953000	46700
BI-15	**IOCO**													
	Station 1	10-Sep-91	medium sand	[	30	]	6	10	12	14	23	5	894000	106000
BI-17	**Port Moody**													
	Station1	11-Sep-91					NO INFORMATION						912000	87700
	(Blind duplicate)						NO INFORMATION						920000	79700
BI-19	**Central Harbour**													
	Station 1	12-Sep-91	silt	20.2	6.5	34.1	15.8	16.7	2.8	0.21	0.05	5.8	951000	48900
BI-23	**Vanterm**													
	Station 2	12-Sep-91	coarse sand	5.7	2.4	13.5	4.6	8	14.3	15.8	16.1	22.8	939000	61500
	(Lab duplicate)						NO INFORMATION						938000	62200
	(Blind duplicate)						NO INFORMATION						949000	50800
BI-26	**Canada Place (Pier BC; NHB)**													
	Station 2	12-Sep-91	silt	23.1	7.7	42.2	13.8	7.9	4.8	0.52	0.06	0	943000	57100
	(Lab duplicate)												942000	57800
	(Blind duplicate)												940000	60400
	COAL HARBOUR AREA:													
CH-1	**Bayshore Inn Marina**													
	Station 1,3,4 (composite)	25-Mar-91	silt	20.2	6.7	38.4	1.9	2.9	3.3	3.6	4.4	30.4	898000	102000
	Station 5	15-Nov-94	clay and silt	[	53.4	]	9.1	12.2	15.4	5.5	0.4	4	919000	80600
CH-3	**Royal Vancouver Yacht Club Marina (RVYC)**													
	Station 4,5,6 (composite)	25-Mar-91					NO INFORMATION						921000	79500
	Station 7	11-Nov-94	fine sand	[	26.7	]	8.7	14.7	21.1	10.4	6.5	11.9	948000	51600
CH-5	**Menchion's Shipyard**													
	Station 1a	Nov-15-94	clay and silt	[	88.5	]	6.1	3.3	1.8	0.3	<0.1	<0.1	942000	57800

APPENDIX 3.1 SEDIMENT CHARACTERISTICS (Environment Canada data)

SITE NO.	LOCATION	DATE	MEDIAN PARTICLE SIZE	CLAY AND SILT (%) Clay (%) / Silt (%)	SAND (%) Very Fine Sand (%)	SAND (%) Fine Sand (%)	SAND (%) Medium Sand (%)	SAND (%) Coarse Sand (%)	SAND (%) Very Coarse Sand (%)	GRANULES (%)	SFR	SVR
	VICTORIA HARBOUR cont.:											
	Upper Harbour:											
VH-16	Stn. UH-8: Garbage Depot/Standard Oil	11-Jul-90	very fine sand	[43.4]	21.7	18.2	15.3	0.4	0	0	881000	119000
VH-17	Stn. UH-9: Boatbuilding Facility	6-Mar-91		NO INFORMATION								
	Inner Harbour:											
VH-18	Stn. IH-1; Off Songhees	11-Jul-90	very fine sand	[28.9]	27.7	24.7	13.9	4.2	2.1	0.5	936000	64400
VH-19	Stn. IH-2: West Coast Air	11-Jul-90	very fine sand	[35.6]	19.5	19.2	16.8	1.8	1.8	1.3	949000	51400
VH-21	Stn. IH-4; Undersea Gardens	11-Jul-90	very fine sand	[32.5]	24.4	22.2	12.9	4.4	0.2	3.8	939000	61000
VH-23a	Stn. IH-7; west side of Laurel Point	11-Jul-90		[36]	21.6	20	14.6	2.5	1.8	0.5	926000	73600
VH-24	Stn. IH-8; Trotac Marine	11-Jul-90	very fine sand	[35.1]	17.3	18.9	23.6	4.3	0.4	0.4	877000	123000
	Outer Harbour:											
VH-31	Stn. OH-2; Ogden Point Wharves	11-Jul-90	very fine sand	[27.4]	37.1	24.4	10.4	0.7	0	0	963000	37200
	ESQUIMALT HARBOUR:											
	Constance Cove:											
EH-9	Station 2	11-Jul-90	fine sand	[28]	12.2	18.4	25.5	12.5	3.4	<0.1	904000	95900
EH-12	Station 5	11-Jul-90	clay and silt	[59.7]	17.7	11.9	10.3	0.4	<0.1	<0.1	950000	50000
EH-14	Trawl site	11-Jul-90	clay and silt	[52.8]	13	15.3	17.3	0.5	0.3	0.8	928000	72300
	(Blind duplicate)		clay and silt	[93.8]	3	1.7	1.2	0.3	<0.1	<0.1	NI	NI
	REFERENCE AREAS:											
RF-1	Crescent Beach Station 1	28-Aug-88	medium sand	[1.6]	13.4	32.6	37.2	8.7	2.9	3.7	988000	12300
RF-11	Tow Hill, Queen Charlotte Islands	22-Jul-89	fine sand	[14.2]	42.3	24	6.3	4.9	4.2	4.1	NI	NI

Clay	<0.004 mm
Silt	0.004 - 0.063mm
Silt and clay	<0.063 mm
Very fine sand	0.063 - 0.125 mm
Fine sand	0.125 - 0.25 mm
Medium sand	0.25 - 0.50 mm
Coarse sand	0.50 - 1.00 mm
Very coarse sand	1.00 - 2.00 mm
Granules	>2.00 mm

NI No information available

APPENDIX 3.2a BIOTA SAMPLE INFORMATION (Environment Canada)

SITE NO.	LOCATION	DATE	SPECIES	TISSUE	NO.	SEX	AGE	LENGTH (cm)	WEIGHT (g)	MOISTURE CONTENT (%)	LIPID CONTENT (%)
	False Creek Area:										
FC-1	Marina at Market										
	Station 3,4,5 (composite)	25-Mar-91	Mussels (large)	Soft tissue	177	NI	NI	3.5-5.2	NI	87	1
FCT-1	East Basin Trawl	4-Jun-91	English sole	Whole body	9	NI	NI	14.8-19.0	32.6-54.0	80	2
FCT-2	Monk McQueen's Trawl	6-Jun-91	English sole	Whole body	10	NI	NI	18.5-26.0	57.2-154.0	78/80	1.7
	Burrard Inlet:										
BI-1	Vancouver Outer Harbour, (Pacific Environment Institute) Trawl VOHT-1	9-Jun-91	Pink shrimp	Tail	67	NI	NI	3.8-11.2	4.2-9.3	77	NI
		9-Jun-91	English sole	Whole body	6	NI	NI	24.5-27	140.0-192.6	75	NI
BI-2	Vancouver Wharves Stations M1, M2 (composite)	29-Oct-91	Mussels (mixed sizes)	Soft tissue	82	NI	NI	0.5-4.5	NI	84/86	0.7
BI-3	L & K Lumber Station M1	29-Oct-91	Mussels (small)	Soft tissue	56	NI	NI	1.5-4.0	NI	88	0.6/0.7
BI-5	Versatile Pacific/Burrard Yarrows Station M2	29-Oct-91	Mussels (small)	Soft tissue	98	NI	NI	0.2-2.0	NI	88	1.2
BI-9	Seaboard Terminals Station M2	29-Oct-91	Mussels (small)	Soft tissue	87	NI	NI	0.5-2.5	NI	85/86	0.8
BI-10	Lynnterm Station M2	29-Oct-91	Mussels (small)	Soft tissue	117	NI	NI	0.5-3.5	NI	86/84/85	1.4/1.4
BI-14	Boulder Rock Trawl BRT-1	11-Sep-91	English sole	Whole body	8	NI	NI	21.5-26	113.0-177.2	73	6.4
		11-Sep-91	Staghorn sculpin	Whole body	7	NI	NI	15.0-24.0	40.8-208.0	80	0.94

APPENDIX 3.2a BIOTA SAMPLE INFORMATION (Environment Canada)

SITE NO.	LOCATION	DATE	SPECIES	TISSUE	NO.	SEX	AGE	LENGTH (cm)	WEIGHT (g)	MOISTURE CONTENT (%)	LIPID CONTENT (%)
	Burrard Inlet cont.:										
BI-15	Ioco										
	Trawl IT-1	10-Sep-91	English sole	Whole body	10	NI	NI	20.5-28	87.2-169.8	76	4.8
		10-Sep-91	Staghorn sculpin	Whole body	6	NI	NI	11.5-21.0	16.4-79.8	80	0.99
BI-19	**Centre Harbour**										
	Trawl CtrT-1	12-Sep-91	English sole	Whole body	8	NI	NI	21.0-25.5	93.8-154.2	77	3.4
		12-Sep-91	Pacific sculpin	Whole body	5	NI	NI	19.5-25.0	161.6-211.2	79/79	1.5
		12-Sep-91	Humpback shrimp	Tail	44	NI	NI	8.5-13.0	8.2-21.4	78	0.2
BI-26	Canada Place										
	Station M1	29-Oct-91	Mussels (mixed sizes)	Soft tissue	56	NI	NI	1.0-4.5	NI	85/87	1.5
	Coal Harbour:										
CH-1	Bayshore Inn Marina										
	Stations 5,8,10,11 (composite)	25-Mar-91	Mussels (large)	Soft tissue	128	NI	NI	3.6-6.3	NI	0.89	88
CH-3	Royal Vancouver Yacht Club (RVYC) Marina										
	Stations 2,3,8 (composite)	25-Mar-91	Mussels (large)	Soft tissue	83	NI	NI	4.0-6.2	NI	89/90	0.4
	Victoria Harbour:										
	Selkirk Waters										
SWT-3	Trawl SWT-3	10-Jul-90	Dungeness crab	Hepatopancreas	8	8M	NI	16.0-19.0	408.4-750.0	81.7	8.4
	Upper Harbour										
UH-C2	Station C2	11-Jul-90	Dungeness crab	Muscle	8	8M	NI	16.0-19.0	408.4-750.0	80.4	0.05
	Station C2	11-Jul-90	Dungeness crab	Hepatopancreas	8	8M	NI	16.0-19.0	408.4-750.0	77.2	12
	Inner Harbour										
IH-C3/IHT-1	Station C3 and Trawl IHT-1	10-Jul-90	Dungeness crab	Hepatopancreas	4	4M	NI	15.0-18.0	441.8-497.0	73/72	14
IHT-1	Trawl IHT-1	10-Jul-90	English sole	Whole body	52	NI	NI	5.4-11.3	1.4-15.8	78.7	1.0
	Trawl IHT-1	10-Jul-90	Shrimp	Tail	148	NI	NI	5.4-11.3	1.4-11.8	75.5	0.5

APPENDIX 3.2a BIOTA SAMPLE INFORMATION (Environment Canada)

SITE NO.	LOCATION	DATE	SPECIES	TISSUE	NO.	SEX	AGE	LENGTH (cm)	WEIGHT (g)	MOISTURE CONTENT (%)	LIPID CONTENT (%)
	Esquimalt Harbour:										
	Constance Cove										
CC-M1	Station M1	9-Jul-90	Mussels (mixed sizes)	Soft tissue	126	NI	NI	2.5-5.0	NI	84	1.2
CC-C1	Station C1	9-Jul-90	Dungeness crab	Hepatopancreas	9	9M	NI	14.0-19.0	405.4-752.8	83.9	5.0
CCT-1	Trawl CCT-1	7-Sep-90	Sand sole	Whole body	1	NI	NI	20	78.2	75	1.8
	Trawl CCT-1	9-Jul-90	Sidestripe shrimp	Tail	152	NI	NI	4.5-9.5	0.6-7.0	75.6	0.3
	<u>**Reference Sites:**</u>										
RF-1	Crescent Beach										
	CBT-1	16-Jun-91	Rock sole	Whole body	17	NI	NI	8.5-12.5	5.0-16.8	75/76	2.0/2.1

NI no information was available

APPENDIX 3.2b BIOTA SAMPLE INFORMATION (Department of Fisheries and Oceans data)

SITE NO.	LOCATION	DATE	SPECIES	TISSUE	NO.	SEX	AGE	LENGTH (cm)	WEIGHT (g)	MOISTURE CONTENT (%)	LIPID CONTENT (%)
	Fraser River:										
PC	MacDonald Beach/Iona Island	10-Jun-92	Peamouth chub	Whole body	2	NI	NI	23.3-23.7	75.6-105.7	NI	NI
SF	at Mitchell Island	2-May-93	Starry flounder	Liver	6	NI	NI	26.5-28.3	165.5-215.5	NI	6.2
B1	at Stoner	25-Mar-92	Burbot	Whole body	1	M	NI	50.9	998.1	73.9	7.45
WS1	Across from Northwood Pulp&Paper (10 km u/s Prince George)	21-Oct-92	White sturgeon	Liver	1	M	52+	193	54500	43	43.9
WS2	Across from Northwood Pulp&Paper (10 km u/s Prince George)	21-Oct-92	White sturgeon	Muscle	1	M	52+	193	54500	47.6	38.95
	Columbia River:										
WS1	at Waneta	2-Sep-94	White sturgeon	Liver	1	NI	NI	NI	NI	82.7	4
	Inland sites:										
WF1	Beaver Creek	12-Jul-94	Whitefish	Muscle	NI	NI	NI	NI	NI	NI	NI
WF2	Genelle River	14-Jul-94	Whitefish	Muscle	NI	NI	NI	NI	NI	NI	NI
	Georgia Strait:										
C8	at Sandheads	16-Sep-93	Dungeness crab	Hepatopancreas	2	M	NI	17.6-17.7	437.5-533.3	NI	24.4
C9	Sechelt Bay	5-Mar-94	Dungeness crab	Hepatopancreas	4	M	NI	15.4-17.5	425.4-608.6	76.5	16.3
	Burrard Inlet:										
C1	Bedwell Bay	28-Mar-94	Dungeness crab	Hepatopancreas	3	M	NI	15.3-16.5	502.6-566.0	80.4	8.1

APPENDIX 3.2b BIOTA SAMPLE INFORMATION (Department of Fisheries and Oceans data)

SITE NO.	LOCATION	DATE	SPECIES	TISSUE	NO.	SEX	AGE	LENGTH (cm)	WEIGHT (g)	MOISTURE CONTENT (%)	LIPID CONTENT (%)
	Howe Sound:										
S4	123-29' 52" lat, 49-23' 90" long	22-Oct-92	English sole	Liver	6	NI	NI	24.5-27.9	129.7-200.9	NI	11.8
RS	123-18' 10" lat, 49-34' 50" long	20-Oct-92	Red snapper	Liver	14	NI	NI	13.0-20.1	32.5-129.5	NI	16.8
	Kitimat Area:										
C3	Crab River at Garden Channel	23-Jul-93	Dungeness crab	Hepatopancreas	6	M	NI	16.8-18.2	534.2-695.0	NI	14.7
	Prince Rupert Area:										
C7		12-May-95	Dungeness crab	Hepatopancreas	3	NI	NI	17.3-17.9	18.2-19.8	82.1	5.9
	Vancouver Island (east coast):										
C4	Esquimalt Harbour - Inskip Island	2-Sep-98	Dungeness crab	Hepatopancreas	6	M	NI	16.0-18.0	488.8-661.5	72.8	8.6
C5	Esquimalt Harbour - middle harbour	2-Sep-98	Dungeness crab	Hepatopancreas	6	M	NI	15.4-16.6	476.1-553.0	73.3	8.8
C10	Victoria Harbour - Rose Bay	23-Mar-94	Dungeness crab	Hepatopancreas	5	M	NI	16.3-18.1	551.8-706.5	73.7	NI
C2	Cowichan Bay	29-Mar-96	Dungeness crab	Hepatopancreas	1	NI	NI	NI	NI	73.6	7.6
S3	Crofton	24-Nov-92	English sole	Liver	1	NI	NI	22.2	102.7	NI	14.5
S5	Mill Bay	25-Nov-92	English sole	Liver	6	NI	NI	23.0-29.7	113.7-226.5	NI	14.1
	Vancouver Island (west coast):										
S1+S2	at Bamfield, middle channel	4-Nov-92	English sole	Liver	13	NI	NI	22.2-33.2	80.4-268.2	NI	10.1
C6	at mouth of Gold River	14-Feb-89	Dungeness crab	Hepatopancreas	4	M	NI	13.5-16.7	201.3-441.9	NI	9.4

NI No information available

APPENDIX 4

QUALITY ASSURANCE AND QUALITY CONTROL

Sample	Procedural Blank	Procedural Blank	Procedural Blank	Procedural Blank
I.D. No.	CE-S BLK 005 I	CE-S BLK 006	CE-S BLK 007	CE-S BLK 008
Diphenyl Compounds:				
2-monochlorodiphenylether (CD-1)	<5	<6.2	<18	<8.1
4-monochlorodiphenylether (CD-3)	<5	<6.2	<18	<8.1
2,4-dichlorodiphenylether (CD-7)	<99	<8.8	<320	<230
2,4'-dichlorodiphenylether (CD-8)	NDR(110)	<70	NDR (340)	<190
4,4'-dichlorodiphenylether (CD-15)	<66	<63	<220	<150
2,2',4-trichlorodiphenylether (CD-17)	<14	<37	<69	<27
2,4,4'-trichlorodiphenylether (CD-28)	<13	<34	<64	<24
2',3,4-trichlorodiphenylether (CD-33)	<17	<44	<83	<32
3,3',4-trichlorodiphenylether (CD-35)	<13	<36	<64	<24
2,4,4',6-tetrachlorodiphenylether (CD-75)	<12	<17	<42	<20
2,3',4',6-tetrachlorodiphenylether (CD-71)	<16	<21	<54	<26
2,4,4',5-tetrachlorodiphenylether (CD-74)	<17	<23	<58	<28
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<22	<29	<74	<37
3,3',4,4'/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<12	<16	<40	<20
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<7.6	<4.9	<24	<16
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<9.4	<6/1	<30	<20
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<12	<7.3	<37	<25
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<12	<10	<39	<20
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<16	<14	<51	<26
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<19	<16	<59	<31
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<9.4	<4.2	<22	<16
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<15	<6.8	<37	<27
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<15	<6.0	<44	<39
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<12	<9.9	<40	<24
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<14	<12	<50	<30
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<16	<17	<58	<30
Decachlorodiphenylether (CD-209)	<16	<7.2	<44	<31
Surrogate Standards (% Recovery)				
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	69	70	67	86
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	76	63	57	95

Sample	Procedural Blank	Procedural Blank	Procedural Blank
I.D. No.	CE-S BLK 009	CE-S BLK 010	CE-S BLK 011 i
Diphenyl Compounds:			
2-monochlorodiphenylether (CD-1)	<5.4	<7.5	<5.7
4-monochlorodiphenylether (CD-3)	<5.4	<7.5	<5.7
2,4-dichlorodiphenylether (CD-7)	<170	<240	<230
2,4'-dichlorodiphenylether (CD-8)	150	<210	<200
4,4'-dichlorodiphenylether (CD-15)	<120	<170	<160
2,2',4-trichlorodiphenylether (CD-17)	<25	<45	<24
2,4,4'-trichlorodiphenylether (CD-28)	<23	<40	<21
2',3,4-trichlorodiphenylether (CD-33)	<30	<52	<28
3,3',4-trichlorodiphenylether (CD-35)	<23	<41	<22
2,4,4',6-tetrachlorodiphenylether (CD-75)	<15	<20	<21
2,3',4',6-tetrachlorodiphenylether (CD-71)	<19	<26	<27
2,4,4',5-tetrachlorodiphenylether (CD-74)	<21	<28	<38
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<28	<36	<29
3,3',4,4'/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<16	<20	<20
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<13	<18	<14
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<16	<22	<17
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<20	<27	<21
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<17	<22	<24
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<24	<29	<32
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<27	<32	<35
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<9.6	<12	<13
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<17	<20	<22
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<22	<23	<25
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<20	<12	<21
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<25	<15	<26
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<47	<18	<23
Decachlorodiphenylether (CD-209)	<18	<25	<25
Surrogate Standards (% Recovery)			
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	72	75	80
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	70	84	72

Sample		Spiked Sediment	
I.D. No.		*CE-S-SPM 005i*	
	Determined	Expected	% Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (CD-1)	800	1000	80
4-monochlorodiphenylether (CD-3)	–	–	–
2,4-dichlorodiphenylether (CD-7)	450	500	90
2,4'-dichlorodiphenylether (CD-8)	460	500	92
4,4'-dichlorodiphenylether (CD-15)	460	500	92
2,2',4-trichlorodiphenylether (CD-17)	450	500	90
2,4,4'-trichlorodiphenylether (CD-28)	540	500	108
2',3,4-trichlorodiphenylether (CD-33)	490	550	89
3,3',4-trichlorodiphenylether (CD-35)	560	500	112
2,4,4',6-tetrachlorodiphenylether (CD-75)	490	500	98
2,3',4',6-tetrachlorodiphenylether (CD-71)	540	530	102
2,4,4',5-tetrachlorodiphenylether (CD-74)	520	500	104
2,3',4,4'-tetrachlorodiphenylether (CD-66)	510	500	102
3,3',4,4'/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	1000	1100	91
2,2',4,4',6-pentachlorodiphenylether (CD-100)	540	540	100
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	430	500	86
2,3',4,4',6-pentachlorodiphenylether (CD-119)	460	500	92
2,2',4,4',5-pentachlorodiphenylether (CD-99)	540	520	104
2,3',4,4',5-pentachlorodiphenylether (CD-118)	510	500	102
3,3',4,4',5-pentachlorodiphenylether (CD-126)	650	540	120
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	510	540	94
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	510	520	98
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	73	50	146
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	440	510	86
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	430	500	86
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	50	50	100
Decachlorodiphenylether (CD-209)	380	540	70
Surrogate Standards (% Recovery)			
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	77		
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	100		

Sample	Spiked Sediment		
I.D. No.	CE-S-SPM 006		
	Deterimined	Expected	% Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (CD-1)	640	1000	64
4-monochlorodiphenylether (CD-3)	-	-	-
2,4-dichlorodiphenylether (CD-7)	380	500	76
2,4'-dichlorodiphenylether (CD-8)	390	500	78
4,4'-dichlorodiphenylether (CD-15)	440	500	88
2,2',4-trichlorodiphenylether (CD-17)	410	500	82
2,4,4'-trichlorodiphenylether (CD-28)	460	550	84
2',3,4-trichlorodiphenylether (CD-33)	420	500	84
3,3',4-trichlorodiphenylether (CD-35)	500	500	100
2,4,4',6-tetrachlorodiphenylether (CD-75)	420	500	84
2,3',4',6-tetrachlorodiphenylether (CD-71)	480	550	87
2,4,4',5-tetrachlorodiphenylether (CD-74)	480	500	96
2,3',4,4'-tetrachlorodiphenylether (CD-66)	470	495	95
3,3',4,4'/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	1000	1000	100
2,2',4,4',6-pentachlorodiphenylether (CD-100)	500	550	91
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	430	500	86
2,3',4,4',6-pentachlorodiphenylether (CD-119)	430	495	87
2,2',4,4',5-pentachlorodiphenylether (CD-99)	510	500	102
2,3',4,4',5-pentachlorodiphenylether (CD-118)	500	500	100
3,3',4,4',5-pentachlorodiphenylether (CD-126)	600	550	109
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	480	550	87
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	520	550	95
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	52	50	104
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	440	550	80
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	440	500	88
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	51	50	102
Decachlorodiphenylether (CD-209)	450	550	82

Surrogate Standards (% Recovery)

13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	79
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	84

Sample		Spiked Sediment	
I.D. No.		CE-S-SPM 008	
	Determined	Expected	% Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (CD-1)	730	1045	70
4-monochlorodiphenylether (CD-3)	–	–	–
2,4-dichlorodiphenylether (CD-7)	440	500	88
2,4'-dichlorodiphenylether (CD-8)	470	500	94
4,4'-dichlorodiphenylether (CD-15)	400	500	80
2,2',4-trichlorodiphenylether (CD-17)	440	500	88
2,4,4'-trichlorodiphenylether (CD-28)	490	550	89
2',3,4-trichlorodiphenylether (CD-33)	450	500	90
3,3',4-trichlorodiphenylether (CD-35)	480	500	96
2,4,4',6-tetrachlorodiphenylether (CD-75)	450	500	90
2,3',4',6-tetrachlorodiphenylether (CD-71)	500	530	94
2,4,4',5-tetrachlorodiphenylether (CD-74)	460	500	92
2,3',4,4'-tetrachlorodiphenylether (CD-66)	450	495	91
3,3',4,4'/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	940	1060	89
2,2',4,4',6-pentachlorodiphenylether (CD-100)	540	535	101
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	440	500	88
2,3',4,4',6-pentachlorodiphenylether (CD-119)	440	495	89
2,2',4,4',5-pentachlorodiphenylether (CD-99)	470	525	90
2,3',4,4',5-pentachlorodiphenylether (CD-118)	460	505	91
3,3',4,4',5-pentachlorodiphenylether (CD-126)	560	545	103
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	450	540	83
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	490	520	94
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	56	50	112
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	380	510	75
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	370	505	73
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	47	50	94
Decachlorodiphenylether (CD-209)	450	540	83

Surrogate Standards (% Recovery)

13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	82
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	100

Sample	Spiked Sediment		
I.D. No.	CE-S-SPM 010		
	Determined	Expected	% Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (CD-1)	790	1045	76
4-monochlorodiphenylether (CD-3)	-	-	-
2,4-dichlorodiphenylether (CD-7)	400	500	80
2,4'-dichlorodiphenylether (CD-8)	460	500	92
4,4'-dichlorodiphenylether (CD-15)	440	500	88
2,2',4-trichlorodiphenylether (CD-17)	420	500	84
2,4,4'-trichlorodiphenylether (CD-28)	470	550	85
2',3,4-trichlorodiphenylether (CD-33)	420	500	84
3,3',4-trichlorodiphenylether (CD-35)	470	500	94
2,4,4',6-tetrachlorodiphenylether (CD-75)	460	500	92
2,3',4',6-tetrachlorodiphenylether (CD-71)	470	530	89
2,4,4',5-tetrachlorodiphenylether (CD-74)	470	500	94
2,3',4,4'-tetrachlorodiphenylether (CD-66)	460	495	93
3,3',4,4'/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	970	1060	92
2,2',4,4',6-pentachlorodiphenylether (CD-100)	520	535	97
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	440	500	88
2,3',4,4',6-pentachlorodiphenylether (CD-119)	450	495	91
2,2',4,4',5-pentachlorodiphenylether (CD-99)	480	525	91
2,3',4,4',5-pentachlorodiphenylether (CD-118)	440	505	87
3,3',4,4',5-pentachlorodiphenylether (CD-126)	540	545	99
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	480	540	89
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	500	520	96
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	64	50	128
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	450	510	88
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	460	505	91
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	56	50	112
Decachlorodiphenylether (CD-209)	480	540	89
Surrogate Standards (% Recovery)			
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	58		
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	64		

Procedural Blanks:

Sample	Procedural Blank	Procedural Blank	Procedural Blank
I.D. No.	CE-T-BLK-02	CE-T-BLK 03 I	CE-S BLK 041
Diphenyl Compounds:			
2-monochlorodiphenylether (BZ 1)	<4.3	<3.5	<3.1
4-monochlorodiphenylether (BZ 3)	<4.3	<3.5	<3.1
2,4-dichlorodiphenylether (BZ 7)	<92	<74	<86
2,4'-dichlorodiphenylether (BZ 8)	<89	<67	<76
4,4'-dichlorodiphenylether (BZ 15)	<65	<52	<55
2,2',4-trichlorodiphenylether (BZ 17)	<12	<14	<8.5
2,4,4'-trichlorodiphenylether (BZ 28)	<11	<12	<7.7
2',3,4-trichlorodiphenylether (BZ 33)	<13	<16	<9.6
3,3',4-trichlorodiphenylether (BZ 35)	<10	<13	<7.6
2,4,4',6-tetrachlorodiphenylether (BZ 75)	<7.1	<10	<9.6
2,3',4'6-tetrachlorodiphenylether (BZ 71)	<8.5	<13	<12
2,4,4'5-tetrachlorodiphenylether (BZ 74)	<8.7	<14	<12
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	<11	<17	<17
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	<5.7	<9.9	<8.2
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	<6.3	<5.2	<4.2
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	<7.7	<6.4	<4.8
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	<8.7	<7.6	<6.0
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	<8.4	<11	<7.2
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	<11	<15	<9.2
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	<11	<17	<9.8
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	<2.7	<6.3	<3.2
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	<4.1	<14	<4.7
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	<5.4	<16	<4.6
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	<7.1	<12	<13
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	<7.9	<13	<15
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	<7.3	<12	<7.9
Decachlorodiphenylether (BZ 209)	<5.9	<14	<5.0
Surrogate Standards (% Recovery)			
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	70	74	78
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	85	74	77

Procedural Blanks:

Sample	Procedural Blank	Procedural Blank
I.D. No.	CE-T-BLK-009	CE-T-BLK 041
Diphenyl Compounds:		
2-monochlorodiphenylether (BZ 1)	<5.4	<3..1
4-monochlorodiphenylether (BZ 3)	<5.4	<3.1
2,4-dichlorodiphenylether (BZ 7)	<170	<86
2,4'-dichlorodiphenylether (BZ 8)	<140	<76
4,4'-dichlorodiphenylether (BZ 15)	<120	<55
2,2',4-trichlorodiphenylether (BZ 17)	<25	<8.5
2,4,4'-trichlorodiphenylether (BZ 28)	<23	<7.7
2',3,4-trichlorodiphenylether (BZ 33)	<30	<9.6
3,3',4-trichlorodiphenylether (BZ 35)	<23	<7.6
2,4,4',6-tetrachlorodiphenylether (BZ 75)	<15	<9.6
2,3',4'6-tetrachlorodiphenylether (BZ 71)	<19	<12
2,4,4'5-tetrachlorodiphenylether (BZ 74)	<21	<12
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	<28	<17
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	<16	<8.2
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	<13	<4.2
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	<16	<4.8
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	<20	<6.0
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	<17	<7.2
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	<24	<9.2
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	<27	<9.8
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	<9.6	<3.2
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	<17	<4.7
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	<22	<4.6
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	<20	<13
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	<25	<15
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	<47	<7.9
Decachlorodiphenylether (BZ 209)	<18	<5.0
Surrogate Standards (% Recovery)		
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	72	78
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	70	77

Spiked Reference Samples

Sample I.D. No.	Spiked Sample CET-SPM 04 I		
	Determined	Expected	% Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (BZ 1)	940	1045	90
4-monochlorodiphenylether (BZ 3)			
2,4-dichlorodiphenylether (BZ 7)	530	500	110
2,4'-dichlorodiphenylether (BZ 8)	510	500	100
4,4'-dichlorodiphenylether (BZ 15)	550	500	110
2,2',4-trichlorodiphenylether (BZ 17)	520	500	100
2,4,4'-trichlorodiphenylether (BZ 28)	580	550	110
2',3,4-trichlorodiphenylether (BZ 33)	490	500	98
3,3',4-trichlorodiphenylether (BZ 35)	560	500	110
2,4,4',6-tetrachlorodiphenylether (BZ 75)	500	500	100
2,3',4'6-tetrachlorodiphenylether (BZ 71)	530	530	100
2,4,4'5-tetrachlorodiphenylether (BZ 74)	520	500	100
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	590	495	120
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	1100	1060	100
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	540	535	100
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	510	500	100
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	480	495	97
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	590	525	110
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	620	505	120
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	580	545	110
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	570	540	110
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	510	520	98
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	59	50	120
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	450	510	88
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	400	505	79
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	53	50	110
Decachlorodiphenylether (BZ 209)	460	540	85

Surrogate Standards (% Recovery)

13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	76
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	90

Spiked Reference Samples

Sample I.D. No.	Spiked Sample CE-T-SPM 05 I		
	Determined	Expected	Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (BZ 1)	31000	30000	100
4-monochlorodiphenylether (BZ 3)			
2,4-dichlorodiphenylether (BZ 7)	15000	15000	100
2,4'-dichlorodiphenylether (BZ 8)	14000	15000	93
4,4'-dichlorodiphenylether (BZ 15)	15000	15000	100
2,2',4-trichlorodiphenylether (BZ 17)	18000	15000	120
2,4,4'-trichlorodiphenylether (BZ 28)	20000	16000	130
2',3,4-trichlorodiphenylether (BZ 33)	19000	15000	130
3,3',4-trichlorodiphenylether (BZ 35)	19000	15000	130
2,4,4',6-tetrachlorodiphenylether (BZ 75)	14000	15000	93
2,3',4'6-tetrachlorodiphenylether (BZ 71)	15000	16000	94
2,4,4'5-tetrachlorodiphenylether (BZ 74)	14000	15000	93
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	19000	15000	130
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	32000	33000	97
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	18000	16000	110
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	16000	15000	110
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	16000	15000	110
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	18000	16000	110
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	19000	15000	130
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	20000	16000	130
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	16000	16000	100
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	17000	16000	110
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	2100	1500	140
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	14000	15000	93
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	13000	15000	87
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	1700	1500	110
Decachlorodiphenylether (BZ 209)	13000	16000	81
Surrogate Standards (% Recovery)			
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	64		
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	68		

Spiked Reference Samples

Sample I.D. No.	Spiked Sample CL-T-CRM 180		
	Determined	Expected	Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (BZ 1)	990	1045	95
4-monochlorodiphenylether (BZ 3)			
2,4-dichlorodiphenylether (BZ 7)	520	500	104
2,4'-dichlorodiphenylether (BZ 8)	530	500	106
4,4'-dichlorodiphenylether (BZ 15)	550	500	110
2,2',4-trichlorodiphenylether (BZ 17)	470	500	94
2,4,4'-trichlorodiphenylether (BZ 28)	530	550	96
2',3,4-trichlorodiphenylether (BZ 33)	490	500	98
3,3',4-trichlorodiphenylether (BZ 35)	540	500	108
2,4,4',6-tetrachlorodiphenylether (BZ 75)	500	500	100
2,3',4'6-tetrachlorodiphenylether (BZ 71)	520	530	98
2,4,4'5-tetrachlorodiphenylether (BZ 74)	500	500	100
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	690	495	139
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	1000	1060	94
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	530	535	99
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	480	500	96
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	480	495	97
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	550	525	105
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	560	505	111
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	550	545	101
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	560	540	104
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	580	520	112
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	54	50	108
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	500	510	98
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	460	505	91
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	48	50	96
Decachlorodiphenylether (BZ 209)	440	540	81
Surrogate Standards (% Recovery)			
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	64		
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	68		

Spiked Reference Samples

Sample I.D. No.	Spiked Sample CE-T-SPM 05i		
	Determined	Expected	Recovery
Diphenyl Compounds:			
2-monochlorodiphenylether (BZ 1)	900	1045	86
4-monochlorodiphenylether (BZ 3)			
2,4-dichlorodiphenylether (BZ 7)	440	500	88
2,4'-dichlorodiphenylether (BZ 8)	510	500	102
4,4'-dichlorodiphenylether (BZ 15)	430	500	86
2,2',4-trichlorodiphenylether (BZ 17)	480	500	96
2,4,4'-trichlorodiphenylether (BZ 28)	500	550	91
2',3,4-trichlorodiphenylether (BZ 33)	470	500	94
3,3',4-trichlorodiphenylether (BZ 35)	480	500	96
2,4,4',6-tetrachlorodiphenylether (BZ 75)	450	500	90
2,3',4'6-tetrachlorodiphenylether (BZ 71)	490	530	92
2,4,4'5-tetrachlorodiphenylether (BZ 74)	450	500	90
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	450	495	91
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	980	1060	92
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	540	535	101
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	490	500	98
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	480	495	97
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	530	525	101
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	550	505	109
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	530	545	97
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	480	540	89
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	510	520	98
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	52	50	104
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	590	510	116
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	520	505	103
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	48	50	96
Decachlorodiphenylether (BZ 209)	550	540	102
Surrogate Standards (% Recovery)			
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	66		
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	54		

Internal Laboratory Duplicates:

	Sample 1 Replicate 1	Replicate 2	Sample 2 Replicate 1	Replicate 2
Diphenyl Compounds:				
2-monochlorodiphenylether (BZ 1)	<3.6	<1.0	<7.9	<3.0
4-monochlorodiphenylether (BZ 3)	<3.6	<1.0	<7.9	<3.0
2,4-dichlorodiphenylether (BZ 7)	<50	<9.8	<120	<48
2,4'-dichlorodiphenylether (BZ 8)	<46	<8.9	<100	<43
4,4'-dichlorodiphenylether (BZ 15)	<36	<7.0	<76	<31
2,2',4-trichlorodiphenylether (BZ 17)	<13	<4.4	<25	<7.4
2,4,4'-trichlorodiphenylether (BZ 28)	<12	<4.0	<23	<6.7
2',3,4-trichlorodiphenylether (BZ 33)	<15	<5.1	<28	<8.4
3,3',4-trichlorodiphenylether (BZ 35)	<12	<4.2	<22	<6.6
2,4,4',6-tetrachlorodiphenylether (BZ 75)	<6.9	<2.8	<16	<7.0
2,3',4'6-tetrachlorodiphenylether (BZ 71)	<8.5	<3.5	<20	<8.6
2,4,4'5-tetrachlorodiphenylether (BZ 74)	<9.4	<3.8	<21	<9.1
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	<12	<4.7	<28	<12
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	<6.6	<2.7	<14	<6.0
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	9.4	8.4	28	37
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	<4.8	<3.3	<6.8	<5.1
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	<5.7	<4.0	<8.5	<6.5
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	16	14	68	56
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	<12	<5.7	<23	<16
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	<13	<6.4	<24	<17
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	25	26	150	150
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	38	38	220	180
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	<11	<5.1	<16	<4.9
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	21	18	150	180
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	<12	<7.7	220	230
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	<18	<3.2	<10	<7.9
Decachlorodiphenylether (BZ 209)	<11	<3.5	<6.0	NDR (7.8)
Total	109.4	104.4	836	833
Surrogate Standards (% Recovery)				
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	97	100.00	63	70
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	80	88.00	90	79

Internal Laboratory Duplicates:

	Sample 3 Replicate 1	Replicate 2	Sample 4 Replicate 1	Replicate 2
Diphenyl Compounds:				
2-monochlorodiphenylether (BZ 1)	<4.2	<7.7	<4.3	<4.1
4-monochlorodiphenylether (BZ 3)	<4.2	<7.7	26	24
2,4-dichlorodiphenylether (BZ 7)	<91	<350	<87	<86
2,4'-dichlorodiphenylether (BZ 8)	<160	<110	<84	<83
4,4'-dichlorodiphenylether (BZ 15)	<62	<100	<61	<61
2,2',4-trichlorodiphenylether (BZ 17)	<15	<25	<12	<11
2,4,4'-trichlorodiphenylether (BZ 28)	<14	<23	<11	<10
2',3,4-trichlorodiphenylether (BZ 33)	<18	<30	<13	<13
3,3',4-trichlorodiphenylether (BZ 35)	<14	<24	<10	<9.7
2,4,4',6-tetrachlorodiphenylether (BZ 75)	<8.1	<19	<6.7	<6.8
2,3',4'6-tetrachlorodiphenylether (BZ 71)	<10	<23	<8.0	<8.1
2,4,4'5-tetrachlorodiphenylether (BZ 74)	<11	<26	<8.2	<8.4
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	<15	<34	<10	<10
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	<8.4	<19	<5.3	<5.4
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	<27	<39	15	14
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	<7.6	<7.4	<8.5	<8.0
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	<9.5	<9.2	<9.6	<9.0
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	120	110	27	20
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	<17	<25	<7.9	<12
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	<19	<28	<8.5	<12
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	150	120	30	28
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	520	490	39	35
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	<21	<29	8.1	7
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	68	<57	13	19
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	310	330	<9.1	<11
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	<26	<43	<7.1	<7.3
Decachlorodiphenylether (BZ 209)	<18	<22	<7.5	<7.1
Total	1168	1050	158.1	147
Surrogate Standards (% Recovery)				
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	74	52	62	82
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	75	50	54	73

Blind Duplicates

	Sample 1 Original	Blind Duplicate
Diphenyl Compounds:		
2-monochlorodiphenylether (BZ 1)	<2.0	<3.1
4-monochlorodiphenylether (BZ 3)	<2.0	<3.1
2,4-dichlorodiphenylether (BZ 7)	<40	<86
2,4'-dichlorodiphenylether (BZ 8)	<37	<160
4,4'-dichlorodiphenylether (BZ 15)	<29	<59
2,2',4-trichlorodiphenylether (BZ 17)	<9.3	<9.1
2,4,4'-trichlorodiphenylether (BZ 28)	<8.4	<8.4
2',3,4-trichlorodiphenylether (BZ 33)	<11	<11
3,3',4-trichlorodiphenylether (BZ 35)	<8.7	<8.6
2,4,4',6-tetrachlorodiphenylether (BZ 75)	<7.7	<7.1
2,3',4'6-tetrachlorodiphenylether (BZ 71)	<9.4	<8.9
2,4,4'5-tetrachlorodiphenylether (BZ 74)	<10	<9.8
2,3',4,4'-tetrachlorodiphenylether (BZ 66)	<14	<13
3,3',4,4'-tetrachlorodiphenylether (BZ 77/81)	<7.3	<7.4
2,2',4,4',6-pentachlorodiphenylether (BZ 100)	420	120
2,2',4,5,6'-pentachlorodiphenylether (BZ 102)	8.5	<12
2,3',4,4',6-pentachlorodiphenylether (BZ 119)	<8.2	<15
2,2',4,4',5-pentachlorodiphenylether (BZ 99)	870	320
2,3',4,4',5-pentachlorodiphenylether (BZ 118)	56	<18
3,3',4,4',5-pentachlorodiphenylether (BZ 126)	<12	<20
2,2',4,4',5,6'-hexachlorodiphenylether (BZ 154)	1300	420
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	1700	540
2,3,3',4,4',5-hexachlorodiphenylether (BZ 156)	<12	<16
2,2',3,4,4',6,6'-heptachlorodiphenylether (BZ 184)	710	380
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	970	340
2,2',3,3',4,4',5-heptachlorodiphenylether (BZ 170)	39	<14
Decachlorodiphenylether (BZ 209)	NDR (98)	<14
Total	6073.5 NDR (6171.5)	2120
Surrogate Standards (% Recovery)		
13C-3,3',4,4'-tetrachlorodiphenylether (BZ 77)	76	86
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (BZ 194)	83	80

APPENDIX 4.3 Quality Assurance/Quality Control (Department of Fisheries and Oceans)

Sample: Pro-Blk 26/6/00 frl-III
Sample Type: Procedural Blank
Laboratory: I.O.S. Regional Contaminants Laboratory
Site: N/A
Sampling Date: N/A
Sample Processing Date: 26-Jun-00
Sample Wt. Submitted for Analysis (g): N/A

Sample Net Wt. Extracted (g): 10.00
GC Column & MS: DB5-60m Autospec
% Lipid: N/A
% Moisture N/A
Initial Calibration Date: 2-Aug-00
Analysis Date: 2-Aug-00
File #: CDE19A121I

Congener	pg/g	DL
2-MoCDE (1)	ND	0.2
3-MoCDE (2)***	ND	0.2
4-MoCDE(3)	ND	0.2
2,4-DiCDE (7)	ND	0.2
2,4'-DiCDE (8)	ND	0.2
3,4'-DiCDE (13)**	ND	0.2
4,4'-DiCDE (15)	ND	0.2
2,4',6-TrCDE (32)**	ND	0.2
2,2',4-TrCDE (17)	ND	0.2
2,4,4'-TrCDE (28)	ND	0.2
2',3,4-TrCDE (33)	ND	0.2
2,2',3-TrCDE (16)***	ND	0.2
2,3,4'-TrCDE (22)**	ND	0.2
3,4,4'-TrCDE (37)**	ND	0.2
3,3',4-TrCDE (35)	ND	0.2
2,3,4,6-TeCDE (62)**	ND	0.2
2,4,4',6-TeCDE (75)	ND	0.2
2,3',4,5'-TeCDE (68)**	ND	0.2
2,2',4,6'-TeCDE (51)**	ND	0.2
2,2',4,5'-TeCDE (49)**	ND	0.2
2,3',4,5-TeCDE (67)	ND	0.2
2,3',4',6-TeCDE (71)	ND	0.2
2,2',4,4'-TeCDE (47)	1.4	0.2
2,4,4',5-TeCDE (74)	ND	0.2
2,3',4,4'-TeCDE (66)	ND	0.2
3,3',4,4'-TeCDE (77)	ND	0.2
2,2',4,4',6-PeCDE (100)	ND	0.3
2,2',4,5,6'-PeCDE (102)	ND	0.3
2,3',4,4',6-PeCDE (119)	ND	0.3
2,2',4,5,5'-PeCDE (101)	ND	0.3
2,3,4,5,6-PeCDE (116)**	ND	0.3
2,2',3,4',5-PeCDE (90)**	ND	0.3
2,2',4,4',5-PeCDE (99)	4.0	0.3
2,3',4,4',5-PeCDE (118)	ND	0.3
2,2',3,4,6'-PeCDE (89)**	ND	0.3
2,2',3,4,4'-PeCDE (85)	ND	0.3
3,3',4,4',5-PeCDE (126)	ND	0.3
2,3,3',4,4'-PeCDE (105)	ND	0.3
2,2',3,4',6,6'-HxCDE (150)***	0.4	0.4
2,2',4,4',5,6'-HxCDE (154)	4.4	0.4
2,2',3,4',5,6-HxCDE (147)**/		
2,2',4,4',5,5'-HxCDE (153)	6.1	0.4
2,3,3',4',5,6-HxCDE (163)**	2.4	0.4
2,2',3,4,4',6'-HxCDE (140)	1.3	0.4
2,3',4,4',5,5'-HxCDE (167)	ND	0.4
2,2',3,4,4',5-HxCDE (137)	ND	0.4
2,2',3,4,4',5'-HxCDE (138)	1.9	0.4
2,3,3',4,4',5-HxCDE (156)	0.9	0.4
2,3,3',4,4',5'-HxCDE (157)	ND	0.4
2,2',3,3',4,4'-HxCDE (128)	ND	0.4
2,2',3, 4,4',6,6'-HpCDE (184)	3.0	0.4
2,2',3,4',5,5',6-HpCDE (187)	ND	0.4
2,2',3, 4,4',5,6'-HpCDE (182)**/		
2,2',3,3',4,4',6-HpCDE (171)	3.3	0.4
2,2',3,3',4,5,5'-HpCDE (172)	ND	0.4
2,2',3,4,4',5,6-HpCDE (181)**	ND	0.4
2,2',3, 4,4',5,5'-HpCDE (180)	ND	0.4
2,3,3',4,4',5,6-HpCDE (190)**	ND	0.4
2,2',3,3',4',5,6-HpCDE (177)	ND	0.4
2,2',3,3',4,4',5-HpCDE (170)	ND	0.4
2,2',3,4,4',5,6,6'-OcCDE (204)**	0.9	0.3
2,2',3,3',4,4',6,6'-OcCDE (197)**	3.3	0.3
2,2',3,4,4',5,5',6-OcCDE (203)**	NDR(0.5)	0.3
2,2',3,3',4,5,5',6'-OcCDE (201)	NDR(0.5)	0.3
2,2',3,3',4,4',5',6-OcCDE (196)	3.5	0.3
2,2',3,3',4,4',5,5'-OcCDE (194)	ND	0.3
2,2',3,3',4,4',5,6-OcCDE (195)	ND	0.3
2,2',3,3',4,4',5,5',6-NoCDE (208)***	ND	0.5
2,2',3,3',4,4',5,6,6'-NoCDE (207)***	ND	0.5
2,2',3,3',4,4',5,5',6-NoCDE (206)**	ND	0.5
2,2',3,3',4,4',5,5',6,6'-DeCDE (209)	ND	0.6

Homologue	pg/g	DL	NP
MoCDE	ND	0.2	0
DiCDE	ND	0.2	0
TrCDE	ND	0.2	0
TeCDE	1.4	0.2	1
PeCDE	4.0	0.3	1
HxCDE	17.4	0.4	8
HpCDE	6.3	0.4	3
OcCDE	7.7	0.3	3
NoCDE	ND	0.5	0
DeCDE	ND	0.6	0

Surrogate	Amount Added (pg)	% Recovery
13C12-3,3',4,4'-TeCDE (77)	1000	52
13C12-2,3,3',4,4',5-HxCDE (156)	2000	75
13C12-2,2',3,3',4,4',5-HpCDE (170)	2000	49
13C12-2,2',3,3',4,4',5,5'-OcCDE (194)	3000	45
13C12-2,2',3,3',4,4'- HxCDE (128)	1000	Recovery Standard

Note: (1) Results are corrected for surrogate recovery
(2) ND = not detected
(3) NDR = not detected due to incorrect isotopic ratio
(4) DL = detection limit (pg/g/analyte peak)
(5) N/A = not applicable
(6) pg/g values in brackets are not included in homologue totals
(7) Homologue totals include identified congeners
(8) * Relative retention time (rrt) relative to recovery standard
(9) ** Measured relative elution times from: Nevalainen, et al., Environ. Sci. and Technol., 1994, 28, 1341-1347
(10) *** Calculated from 1/2 relative elution times from: Nevalainen, et al., Environ. Sci. and Technol., 1994, 28, 1341-1347
(11) Nona concentrations calculated using estimated RRF = 1 and 13C-OcCDE(194) as surrogate

APPENDIX 5

ENVIRONMENTAL CONCENTRATIONS OF CDPE COMPOUNDS AND PERCENT CONTRIBUTIONS OF INDIVIDUAL ISOMERS TO THE TOTAL CONCENTRATION

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

Location	FALSE CREEK: False Creek at Market Marina (Stns. 3,4,5 comp.) FC-1	Percent Contribution	False Creek at Granville Ferries FC-5	Percent Contribution	False Creek off Granville Island Hotel FC-6	Percent Contribution	False Creek off Monk McQueen's FC-7	Percent Contribution
Date	Mar. 25, 1991		June 4, 1991		June 4, 1991		June 4, 1991	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<3.5	-	<6.6	-	<3.9	-	<9.6	-
4-monochlorodiphenylether (CD-3)	<3.5	-	<6.6	-	<3.9	-	<9.6	-
2,4-dichlorodiphenylether (CD-7)	<31	-	<54	-	<25	-	<94	-
2,4'-dichlorodiphenylether (CD-8)	<170	-	<450	-	<150	-	<630	-
4,4'-dichlorodiphenylether (CD-15)	<22	-	<39	-	<18	-	<68	-
2,2',4-trichlorodiphenylether (CD-17)	<28	-	<27	-	<15	-	<52	-
2,4,4'-trichlorodiphenylether (CD-28)	<26	-	<25	-	<14	-	<47	-
2',3,4-trichlorodiphenylether (CD-33)	<33	-	<32	-	<18	-	<61	-
3,3',4-trichlorodiphenylether (CD-35)	<26	-	<26	-	<21	-	<49	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<10	-	<14	-	<7.2	-	<22	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<14	-	<18	-	<9.2	-	<29	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<14	-	<27	-	<9.8	-	<31	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<18	-	<25	-	<12	-	<39	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<10	-	<14	-	<7	-	<22	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	140	5.30	65	6.47	160	6.45	330	3.95
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	14	0.53	<9.9	-	11	0.44	19	0.23
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<3.6	-	<12	-	<3.2	-	<18	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	410	15.52	150	14.93	410	16.54	860	10.30
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<6.9	-	<28	-	18	0.73	<28	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<7.8	-	<32	-	<7	-	<32	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	490	18.55	190	18.91	430	17.35	1400	16.77
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	540	20.44	230	22.89	490	19.77	1700	20.36
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<51	-	<51	-	NDR (8.5)	-	<12	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	750	28.39	180	17.91	480	19.36	1500	17.97
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	210	7.95	190	18.91	480	19.36	2300	27.55
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	88	3.33	<98	-	<51	-	240	2.87
Decachlorodiphenylether (CD-209)	<38	-	<67	-	NDR (27)	-	<99	-
Total	2642	100.00	1005	100.00	2479 (2514.5)	100.00	8349	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	100		93		110		110	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	70		93		83		100	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	FALSE CREEK cont.:		VANCOUVER HARBOUR:			
Location	False Creek Northeast Corner FC-10	Percent Contribution	Vancouver Outer Harbour BI-2	Percent Contribution	Vancouver Wharves (Stn. 4) BI-2	Percent Contribution
Date	June 4, 1991		Sept. 9, 1991		Sept. 12, 1991	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<25	-	<4.1	-	<11	-
4-monochlorodiphenylether (CD-3)	<25	-	<4.1	-	<11	-
2,4-dichlorodiphenylether (CD-7)	<280	-	<84	-	<220	-
2,4'-dichlorodiphenylether (CD-8)	<2200	-	<200	-	NDR (400)*	-
4,4'-dichlorodiphenylether (CD-15)	<200	-	<60	-	<150	-
2,2',4-trichlorodiphenylether (CD-17)	<120	-	<13	-	<37	-
2,4,4'-trichlorodiphenylether (CD-28)	<110	-	<11	-	<34	-
2',3,4-trichlorodiphenylether (CD-33)	<140	-	<15	-	<45	-
3,3',4-trichlorodiphenylether (CD-35)	<110	-	<12	-	<35	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<73	-	<7.4	-	<29	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<94	-	<9.4	-	<37	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<100	-	<10	-	<40	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<130	-	<13	-	<52	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<71	-	<7.1	-	<28	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	200	5.48	<7.5	-	<20	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<51	-	<9.4	-	<24	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<61	-	<12	-	<30	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	550	15.07	<22	-	<23	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<110	-	<13	-	<30	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<120	-	<14	-	<36	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	770	21.10	<28	-	<14	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	790	21.64	<42	-	<23	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<130	-	<20	-	<44	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	680	18.63	54	100.00	<27	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	660	18.08	<47	-	<32	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<260	-	<30	-	<48	-
Decachlorodiphenylether (CD-209)	<250	-	<28	-	<49	-
Total	3650	100.00	54	100.00	ND	-
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	64		93		41	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	62		80		40	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VANCOUVER HARBOUR cont.:

Location	L & K Lumber (Stn. 2a) BI-3	Percent Contribution	Vancouver Shipyards/Seaspan (Stn. 4) BI-4	Percent Contribution	Versatile Pacific (Burrard Yarrows) (Stn. 5) BI-5	Percent Contribution	Lab Duplicate	Percent Contribution
Date	Sept. 12, 1991		Sept. 12, 1991		Sept. 12, 1991			
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<17	-	<4.1	-	<4.8	-	<4	-
4-monochlorodiphenylether (CD-3)	<17	-	<4.1	-	<4.8	-	<4	-
2,4-dichlorodiphenylether (CD-7)	<250	-	<72	-	<91	-	<61	-
2,4'-dichlorodiphenylether (CD-8)	NDR (520)*	-	NDR (140)*	-	NDR (140)*	-	NDR (130)*	-
4,4'-dichlorodiphenylether (CD-15)	<170	-	<48	-	<61	-	<41	-
2,2',4-trichlorodiphenylether (CD-17)	<68	-	<21	-	<15	-	<13	-
2,4,4'-trichlorodiphenylether (CD-28)	<63	-	<20	-	<14	-	<12	-
2',3,4-trichlorodiphenylether (CD-33)	<82	-	<26	-	<18	-	<16	-
3,3',4-trichlorodiphenylether (CD-35)	<63	-	<20	-	<14	-	<12	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<32	-	<8.4	-	<9.8	-	<11	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<41	-	<11	-	<12	-	<14	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<44	-	<12	-	<13	-	<15	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<57	-	<15	-	<17	-	<19	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<31	-	<8.1	-	<9.4	-	<10	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<33	-	<5.4	-	NDR(14)	-	NDR (14)	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<41	-	<6.6	-	<9.8	-	<9	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<52	-	<8.3	-	<12	-	<11	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	53	6.14	<8.5	-	NDR(31)	-	NDR (31)	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<57	-	<11	-	<18	-	<12	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<67	-	<13	-	<22	-	<14	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	140	16.22	<5.1	-	33	19.19	33	55.00
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	160	18.54	<8.2	-	38	22.09	NDR (32)	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	NDR (71)	-	<15	-	<21	-	<21	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	170	19.70	<8.3	-	48	27.91	27	45.00
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	340	39.40	<10	-	53	30.81	NDR (36)	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<91	-	<18	-	<30	-	<27	-
Decachlorodiphenylether (CD-209)	<51	-	<18	-	<18	-	<18	-
Total	863 (934)	100.00	ND	-	172 (217)	100.00	60 (173)	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	100		86		100		100	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	100		93		110		120	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VANCOUVER HARBOUR cont.:

Location	Versatile Pacific (Burrard Yarrows) (Stn. 2) BI-5	Percent Contribution	Saskatchewan Wheat Pool (Stn. 1) BI-7	Percent Contribution	Saskatchewan Wheat Pool (Stn. 2) BI-7	Percent Contribution	Neptune Terminals (Stn. 3a) BI-8	Percent Contribution
Date	Nov. 15, 1994		Sept. 12, 1991		Nov. 15, 1994		Nov. 15, 1994	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<2.3	-	<5.2	-	<10	-	<11	-
4-monochlorodiphenylether (CD-3)	<2.6	-	<5.2	-	<10	-	<11	-
2,4-dichlorodiphenylether (CD-7)	<71	-	<99	-	<170	-	<190	-
2,4'-dichlorodiphenylether (CD-8)	<120	-	NDR (230)*	-	<380	-	<290	-
4,4'-dichlorodiphenylether (CD-15)	<47	-	<66	-	<110	-	<16	-
2,2',4-trichlorodiphenylether (CD-17)	<8.9	-	<20	-	<31	-	<29	-
2,4,4'-trichlorodiphenylether (CD-28)	<7.1	-	<18	-	<28	-	<37	-
2',3,4-trichlorodiphenylether (CD-33)	<10	-	<24	-	<37	-	<34	-
3,3',4-trichlorodiphenylether (CD-35)	<8	-	<18	-	<28	-	<26	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<7.7	-	<9.4	-	<23	-	<26	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<10	-	<12	-	<29	-	<34	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<10	-	<13	-	<31	-	<36	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<14	-	<17	-	<41	-	<47	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<7.7	-	<9	-	<23	-	<36	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<8.1	-	<6.8	-	<17	-	<19	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<6.2	-	<7.3	-	<20	-	<24	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<7.5	-	<9.2	-	<24	-	<30	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<25	-	<15	-	<29	-	62	9.86
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<13	-	<16	-	<40	-	<33	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<15	-	<19	-	<46	-	<37	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<35	-	25	28.74	<22	-	87	13.83
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	44	28.21	32	36.78	<48	-	100	15.90
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<16	-	<19	-	<38	-	<51	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	45	28.85	30	34.48	<32	-	120	19.08
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	67	42.95	NDR (90)	-	<32	-	260	41.34
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<24	-	<26	-	<63	-	<63	-
Decachlorodiphenylether (CD-209)	<20	-	<24	-	<38	-	<57	-
Total	156	100.00	87 (177)	100.00	ND	-	629	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	100		96		76		90	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	110		110		84		77	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VANCOUVER HARBOUR cont.:

Location	Seaboard Terminals (Stn. 1x) BI-9	Percent Contribution	Lynnterm (Stn. 4) BI-10	Percent Contribution	Lab Duplicate	Percent Contribution	Blind Duplicate	Percent Contribution
Date	Sept. 12, 1991		Sept. 11, 1991					
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<2.7	-	<2.6	-	<2.6	-	<2	-
4-monochlorodiphenylether (CD-3)	<2.7	-	<2.6	-	<2.6	-	<2	-
2,4-dichlorodiphenylether (CD-7)	<72	-	<79	-	<44	-	<30	-
2,4'-dichlorodiphenylether (CD-8)	<60	-	<150	-	<84	-	210*	-
4,4'-dichlorodiphenylether (CD-15)	<48	-	<56	-	<31	-	<22	-
2,2',4-trichlorodiphenylether (CD-17)	<13	-	<13	-	<7.2	-	<12	-
2,4,4'-trichlorodiphenylether (CD-28)	<12	-	<12	-	<6.3	-	<11	-
2',3,4-trichlorodiphenylether (CD-33)	<16	-	<15	-	<8.3	-	<14	-
3,3',4-trichlorodiphenylether (CD-35)	<12	-	<12	-	<6.5	-	<12	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<9	-	<7.1	-	<5.4	-	<6.5	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<12	-	<8.9	-	<6.8	-	<8.3	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<12	-	<9.5	-	<7.3	-	<8.9	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<16	-	<12	-	<9.6	-	<11	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<9	-	<6.8	-	<5.2	-	<6.3	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<7.3	-	<4.2	-	<3.6	-	<2.7	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<9.2	-	<5.2	-	<4.6	-	<3.3	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<11	-	<6.5	-	<5.6	-	<4	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<8.2	-	<7.3	-	<16	-	12	6.15
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<11	-	<9.8	-	<8.3	-	<10	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<13	-	<11	-	<9.2	-	<12	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<5.8	-	<19	-	25	10.55	18	9.23
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<8.9	-	<26	-	31	13.08	22	11.28
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<20	-	<8.4	-	<7.0	-	8.1	4.15
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<8	-	22	18.49	31	13.08	25	12.81
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<10	-	97	81.51	150	63.29	110	56.38
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<19	-	<11	-	<8.4	-	<8	-
Decachlorodiphenylether (CD-209)	<25	-	<13	-	<11	-	<4.1	-
Total	ND	-	119	100.00	237	100.00	195.1	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	90		81		86		94	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	110		73		81		100	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VANCOUVER HARBOUR cont.:

Location	Allied Shipyards (Stn. 3) BI-12	Percent Contribution	Boulder Rock (Stn. 1) BI-14	Percent Contribution	IOCO (Stn. 1) BI-15	Percent Contribution	Port Moody (Stn. 1) BI-17	Percent Contribution
Date	Nov. 15, 1994		Sept. 11, 1991		Sept. 10, 1991		Sept. 11, 1991	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<5.2	-	<6.3	-	<10	-	<7.6	-
4-monochlorodiphenylether (CD-3)	<5.2	-	<6.3	-	<10	-	<7.6	-
2,4-dichlorodiphenylether (CD-7)	<98	-	<130	-	<150	-	<130	-
2,4'-dichlorodiphenylether (CD-8)	<110	-	<110	-	<360	-	<240	-
4,4'-dichlorodiphenylether (CD-15)	<69	-	<94	-	<110	-	<93	-
2,2',4-trichlorodiphenylether (CD-17)	<24	-	<21	-	<41	-	<27	-
2,4,4'-trichlorodiphenylether (CD-28)	<21	-	<19	-	<36	-	<34	-
2',3,4-trichlorodiphenylether (CD-33)	<28	-	<25	-	<48	-	<31	-
3,3',4-trichlorodiphenylether (CD-35)	<22	-	<19	-	<37	-	<24	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<13	-	<15	-	<16	-	<19	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<17	-	<19	-	<20	-	<24	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<18	-	<20	-	<21	-	<26	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<24	-	<27	-	<28	-	<34	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<13	-	<15	-	<15	-	<18	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<9.1	-	<12	-	<43	-	<31	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<11	-	<14	-	<19	-	<11	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<14	-	<17	-	<24	-	<14	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<22	-	30	9.58	100	13.16	<58	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<30	-	<22	-	<41	-	<26	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<34	-	<24	-	<46	-	<29	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<9.2	-	NDR (48)	-	140	18.42	90	17.31
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<21	-	78	24.92	160	21.05	120	23.08
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<23	-	<24	-	<42	-	<24	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<28	-	85	27.16	190	25.00	140	26.92
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<45	-	120	38.34	170	22.37	170	32.69
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<42	-	<34	-	<56	-	<50	-
Decachlorodiphenylether (CD-209)	<48	-	<36	-	<51	-	<28	-
Total	ND	-	313 (361)	100.00	760	100.00	520	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	110		86		96		91	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	85		74		85		76	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VANCOUVER HARBOUR cont.:

Location	Central Harbour (Stn. 1) BI-19	Percent Contribution	Vanterm (Stn. 2) BI-23	Percent Contribution	Canada Place (Stn. 2) BI-26	Percent Contribution
Date	Sept. 12, 1991		Sept. 12, 1991		Sept. 12, 1991	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<6.8	-	<1.9	-	<6.4	-
4-monochlorodiphenylether (CD-3)	<6.8	-	<1.9	-	<6.4	-
2,4-dichlorodiphenylether (CD-7)	<120	-	<34	-	<120	-
2,4'-dichlorodiphenylether (CD-8)	<160	-	<84	-	NDR (260)*	-
4,4'-dichlorodiphenylether (CD-15)	<82	-	<23	-	<81	-
2,2',4-trichlorodiphenylether (CD-17)	<25	-	<8.9	-	<37	-
2,4,4'-trichlorodiphenylether (CD-28)	<22	-	<8.2	-	<34	-
2',3,4-trichlorodiphenylether (CD-33)	<29	-	<11	-	<44	-
3,3',4-trichlorodiphenylether (CD-35)	<22	-	<8.3	-	<34	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<16	-	<5.0	-	<17	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<20	-	<6.3	-	<22	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<21	-	<6.9	-	<24	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<28	-	<8.9	-	<31	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<15	-	<4.8	-	<17	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<12	-	<12	-	NDR (34)	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<15	-	<3.8	-	<14	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<18	-	<4.8	-	<18	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<22	-	29	20.42	78	16.67
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<29	-	<7.1	-	<26	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<33	-	<8.4	-	<31	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<27	-	26	18.31	83	17.74
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<37	-	33	23.24	110	23.50
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<28	-	<11	-	<35	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	NDR (32)	-	26	18.31	99	21.15
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	43	100.00	28	19.72	98	20.94
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<41	-	<17	-	<50	-
Decachlorodiphenylether (CD-209)	<48	-	<7.1	-	<20	-
Total	43 (75)	100.00	142	100.00	468 (502)	100.00
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	68		96		100	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	61		100		110	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	COAL HARBOUR:					
Location	Old Menchion's Shipyard Site (Stn. 1a) CH-5	Percent Contribution	Bayshore Inn Marina (Stns. 1,3,4 comp.) CH-1	Percent Contribution	Lab Duplicate	Percent Contribution
Date	Nov. 15, 1994		Mar. 25, 1991			
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<6.3	-	<7.5	-	<5.9	-
4-monochlorodiphenylether (CD-3)	<6.3	-	<7.5	-	<5.9	-
2,4-dichlorodiphenylether (CD-7)	<120	-	<32	-	<69	-
2,4'-dichlorodiphenylether (CD-8)	<180	-	<190	-	<56	-
4,4'-dichlorodiphenylether (CD-15)	<83	-	<23	-	<50	-
2,2',4-trichlorodiphenylether (CD-17)	<28	-	<24	-	<45	-
2,4,4'-trichlorodiphenylether (CD-28)	<25	-	<22	-	NDR(84)	-
2',3,4-trichlorodiphenylether (CD-33)	<33	-	<29	-	<53	-
3,3',4-trichlorodiphenylether (CD-35)	<25	-	<23	-	<42	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<13	-	<11	-	<24	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<16	-	<15	-	<30	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<17	-	<16	-	<32	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<23	-	<20	-	<41	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<12	-	<11	-	<23	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	100	7.58	30	5.98	28	5.37
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<18	-	<4.7	-	<10	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<23	-	<5.6	-	<13	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	220	16.67	65	12.95	77	14.78
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<34	-	<24	-	<33	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<38	-	<27	-	<37	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	270	20.45	87	17.33	100	19.19
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	290	21.97	110	21.91	130	24.95
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<26	-	NDR(56)	-	<47	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	340	25.76	110	21.91	100	19.19
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	100	7.58	100	19.92	86	16.51
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<60	-	<76	-	<100	-
Decachlorodiphenylether (CD-209)	<38	-	<9.6	-	<85	-
Total	1320	100.00	502 (558)	100.00	521 (605)	100.00
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	95		120		94	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	60		88		86	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

COAL HARBOUR cont.:

Location	Bayshore Inn Marina (Stn. 5) CH-1	Percent Contribution	Royal Vancouver Yacht Club Marina (Stns. 4,5,6 comp.) CH-3	Percent Contribution	Royal Vancouver Yacht Club Marina (Stn. 7) CH-3	Percent Contribution
Date	Nov. 15, 1994		Mar. 25, 1991		Nov. 15, 1994	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<14	-	<7.8	-	<2.9	-
4-monochlorodiphenylether (CD-3)	<14	-	<7.8	-	<2.9	-
2,4-dichlorodiphenylether (CD-7)	<170	-	<64	-	<64	-
2,4'-dichlorodiphenylether (CD-8)	<150	-	<410	-	<110	-
4,4'-dichlorodiphenylether (CD-15)	<120	-	<46	-	<42	-
2,2',4-trichlorodiphenylether (CD-17)	<65	-	<34	-	<9.4	-
2,4,4'-trichlorodiphenylether (CD-28)	<58	-	<36	-	<8.5	-
2',3,4-trichlorodiphenylether (CD-33)	<76	-	<41	-	<11	-
3,3',4-trichlorodiphenylether (CD-35)	<59	-	<33	-	<8.4	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<26	-	<19	-	<9.7	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<33	-	<24	-	<12	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<36	-	NDR (75)	-	<13	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<47	-	<33	-	<18	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<25	-	<18	-	<9.7	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	230	6.82	270	9.22	<16	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<38	-	19	0.65	<8.4	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<47	-	<9.3	-	<10	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	540	16.02	650	22.20	39	19.31
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<89	-	29	0.99	<14	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<99	-	<20	-	<17	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	660	19.58	630	21.52	43	21.29
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	660	19.58	720	24.59	64	31.68
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<61	-	<54	-	<17	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	880	26.11	490	16.73	56	27.72
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	400	11.87	120	4.10	<28	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<140	-	<81	-	<27	-
Decachlorodiphenylether (CD-209)	<100	-	<71	-	<31	-
Total	3370	100.00	2928 (3003)	100.00	202	100.00
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	110		100		99	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	54		100		100	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VICTORIA HARBOUR:							
Location	Upper Harbour Garbage Depot/Standard Oil Site #UH-8	Percent Contribution	Lab Duplicate	Percent Contribution	Upper Harbour Boatbuilding Facility Site # UH-9	Percent Contribution	Inner Harbour Undersea Gardens Site # IH-4	Percent Contribution
Date	VH-16 July 11, 1990				VH-17 Mar. 6, 1991		VH-21 July 11, 1990	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<11	-	<11	-	<19	-	<6.6	-
4-monochlorodiphenylether (CD-3)	<11	-	<11	-	<19	-	<6.6	-
2,4-dichlorodiphenylether (CD-7)	<150	-	<200	-	<400	-	<120	-
2,4'-dichlorodiphenylether (CD-8)	<240	-	<320	-	<550	-	<180	-
4,4'-dichlorodiphenylether (CD-15)	<100	-	<140	-	<280	-	<86	-
2,2',4-trichlorodiphenylether (CD-17)	<43	-	<67	-	<590	-	<42	-
2,4,4'-trichlorodiphenylether (CD-28)	<40	-	<62	-	<87	-	<39	-
2',3,4-trichlorodiphenylether (CD-33)	<52	-	<80	-	<110	-	<50	-
3,3',4-trichlorodiphenylether (CD-35)	<40	-	<62	-	<87	-	<39	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<30	-	<31	-	<73	-	<28	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<39	-	<40	-	<94	-	<36	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<41	-	<43	-	<100	-	<38	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<53	-	<55	-	<130	-	<49	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<28	-	<30	-	<69	-	<27	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	240	3.34	300	4.04	150	3.44	310	7.21
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<37	-	<40	-	<59	-	<30	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<46	-	<50	-	<73	-	<30	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	660	9.18	720	9.70	530	12.16	840	19.53
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<81	-	<120	-	<120	-	<66	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<94	-	<130	-	<140	-	<76	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	990	13.77	1100	14.82	600	13.76	790	18.37
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	1200	16.69	1400	18.87	790	18.12	880	20.47
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<66	-	<100	-	<150	-	<70	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	1500	20.86	1500	20.22	890	20.41	950	22.09
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	2600	36.16	2400	32.35	1400	32.11	530	12.33
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<190	-	<280	-	<200	-	<170	-
Decachlorodiphenylether (CD-209)	<150	-	<210	-	<220	-	<87	-
Total	7190	100.00	7420	100.00	4360	100.00	4300	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	100		96		67		100	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	63		67		49		67	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VICTORIA HARBOUR cont.

Location	Inner Harbour West of Laurel Point Site # IH-7 VH-23a	Percent Contribution	Blind Duplicate	Percent Contribution	Inner Harbour Trotac Marine Site # IH-8 VH-24	Percent Contribution	Outer Harbour Ogden Pt. Wharves Site OH-2 VH-31	Percent Contribution
Date	July 11, 1990				July 11, 1990		July 11, 1990	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<8.7	-	<6.6	-	<18	-	<6.3	-
4-monochlorodiphenylether (CD-3)	<8.7	-	<6.6	-	<18	-	<15	-
2,4-dichlorodiphenylether (CD-7)	<200	-	<110	-	<240	-	<250	-
2,4'-dichlorodiphenylether (CD-8)	<160	-	<88	-	<310	-	<200	-
4,4'-dichlorodiphenylether (CD-15)	<130	-	<70	-	<160	-	<160	-
2,2',4-trichlorodiphenylether (CD-17)	<26	-	<33	-	<54	-	<30	-
2,4,4'-trichlorodiphenylether (CD-28)	<23	-	<30	-	<50	-	<27	-
2',3,4-trichlorodiphenylether (CD-33)	<30	-	<39	-	<64	-	<35	-
3,3',4-trichlorodiphenylether (CD-35)	<23	-	<30	-	<50	-	<27	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<24	-	<22	-	<32	-	<23	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<31	-	<29	-	<41	-	<30	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<33	-	<30	-	<44	-	<32	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<44	-	<41	-	<56	-	<43	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<24	-	<22	-	<30	-	<23	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	94	6.51	100	6.33	140	4.98	<16	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<26	-	<17	-	<28	-	<20	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<32	-	<20	-	<35	-	<24	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	220	15.24	250	15.82	340	12.10	<47	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<48	-	<44	-	<77	-	<26	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<55	-	<51	-	<89	-	<31	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	260	18.01	260	16.46	440	15.66	40	100.00
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	360	24.93	350	22.15	570	20.28	<61	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<42	-	<45	-	<87	-	<32	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	270	18.70	320	20.25	620	22.06	<46	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	240	16.62	300	18.99	700	24.91	<40	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<88	-	<80	-	<200	-	<49	-
Decachlorodiphenylether (CD-209)	<52	-	<69	-	<220	-	<58	-
Total	1444	100.00	1580	100.00	2810	100.00	40	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	92		89		84		97	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	86		78		62		91	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	ESQUIMALT HARBOUR:							
Location	Constance Cove Station 2 EH-9	Percent Contribution	Blind Duplicate	Percent Contribution	Constance Cove Station 5 EH-12	Percent Contribution	Blind Duplicate	Percent Contribution
Date	July 9, 1990				July 9, 1990			
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<3.3	-	<13	-	<6.4	-	<10	-
4-monochlorodiphenylether (CD-3)	<3.3	-	<13	-	<6.4	-	<10	-
2,4-dichlorodiphenylether (CD-7)	<69	-	<250	-	<95	-	<160	-
2,4'-dichlorodiphenylether (CD-8)	<360	-	<630	-	<140	-	<150	-
4,4'-dichlorodiphenylether (CD-15)	<50	-	<170	-	<65	-	<110	-
2,2',4-trichlorodiphenylether (CD-17)	<28	-	<110	-	<27	-	<45	-
2,4,4'-trichlorodiphenylether (CD-28)	<25	-	<100	-	<25	-	<42	-
2',3,4-trichlorodiphenylether (CD-33)	<33	-	<130	-	<33	-	<54	-
3,3',4-trichlorodiphenylether (CD-35)	<26	-	<100	-	<25	-	<42	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<13	-	<44	-	<9.9	-	<17	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<17	-	<56	-	<13	-	<22	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<18	-	<60	-	<14	-	<24	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<23	-	<78	-	<18	-	<30	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<13	-	<42	-	<9.4	-	<16	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	33	7.05	<36	-	<12	-	<57	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<6.9	-	<45	-	<15	-	<22	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<8.2	-	<56	-	<19	-	<28	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	75	16.03	<90	-	73	18.02	120	10.53
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<22	-	<68	-	<30	-	<49	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<25	-	<78	-	<35	-	<57	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	100	21.37	120	38.71	92	22.72	200	17.54
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	120	25.64	NDR (160)	-	100	24.69	250	21.93
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<42	-	<130	-	<30	-	<59	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	140	29.91	190	61.29	140	34.57	270	23.68
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<30	-	<72	-	<39	-	300	26.32
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<90	-	<170	-	<66	-	<120	-
Decachlorodiphenylether (CD-209)	<62	-	<140	-	<21	-	<74	-
Total	468	100.00	310	100.00	405	100.00	1140	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	110		110		110		120	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	100		96		80		85	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	ESQUIMALT HARBOUR cont.:	
Location	**Constance Cove Trawl Site (CCT-1) EH-14**	**Percent Contribution**
Date	**July 11, 1990**	
Diphenyl Compounds:		
2-monochlorodiphenylether (CD-1)	<12	-
4-monochlorodiphenylether (CD-3)	<12	-
2,4-dichlorodiphenylether (CD-7)	<210	-
2,4'-dichlorodiphenylether (CD-8)	<480	-
4,4'-dichlorodiphenylether (CD-15)	<150	-
2,2',4-trichlorodiphenylether (CD-17)	<68	-
2,4,4'-trichlorodiphenylether (CD-28)	<63	-
2',3,4-trichlorodiphenylether (CD-33)	<82	-
3,3',4-trichlorodiphenylether (CD-35)	<63	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<49	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<63	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<67	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<86	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<46	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<48	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<59	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<73	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<76	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<100	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<120	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<61	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<64	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<120	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<72	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<77	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<170	-
Decachlorodiphenylether (CD-209)	<140	-
Total	ND	-
Surrogate Standards (% Recovery)		
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	100	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	93	

Appendix 5.1a

Chlorinated Diphenyl Ether Concentrations in BC Sediments (pg/g dry weight) and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	REFERENCE SITES:					
Location	Crescent Beach Station #1 RF-1	Percent Contribution	Tow Hill RF-11	Percent Contribution	Lab Duplicate	Percent Contribution
Date	June 18, 1991		July 28, 1989			
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<3.4	-	<4.8	-	<5	-
4-monochlorodiphenylether (CD-3)	<3.4	-	<4.8	-	<5	-
2,4-dichlorodiphenylether (CD-7)	<88	-	<110	-	<110	-
2,4'-dichlorodiphenylether (CD-8)	<72	-	<92	-	<90	-
4,4'-dichlorodiphenylether (CD-15)	<58	-	<73	-	<72	-
2,2',4-trichlorodiphenylether (CD-17)	<9.9	-	<16	-	<14	-
2,4,4'-trichlorodiphenylether (CD-28)	<9.0	-	<15	-	<13	-
2',3,4-trichlorodiphenylether (CD-33)	<12	-	<20	-	<17	-
3,3',4-trichlorodiphenylether (CD-35)	<8.9	-	<15	-	<13	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<11	-	<16	-	<13	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<14	-	<21	-	<17	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<15	-	<22	-	<18	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<20	-	<29	-	<24	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<11	-	<16	-	<13	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<5.3	-	<9.6	-	<9.2	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<6.8	-	<12	-	<12	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<8.2	-	<15	-	<14	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<12	-	<18	-	<12	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<16	-	<25	-	<17	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<18	-	<29	-	<19	-
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<7.1	-	<11	-	<11	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<12	-	<19	-	<18	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<18	-	<25	-	<18	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<8.7	-	<8.6	-	<9.6	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<11	-	<11	-	<12	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<21	-	<18	-	<23	-
Decachlorodiphenylether (CD-209)	<16	-	<21	-	<15	-
Total	ND	-	ND	-	ND	-
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	84		81		75	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	120		130**		96	

NDR - detected but did not meet quantification limit
ND - not detected
* - present in procedural blank. Not included in the calculation of total concentrations
(#) - total concentration including NDR values
** - the surrogate recovery is higher than the normal acceptance limit; however, the data should not be affected.

Appendix 5.1b

Chlorinated Diphenyl Ether Concentrations in Semi-Permeable Membrane Device Samples and Percent Contributions of Individual Isomers to the Total Concentration (Fisheries and Oceans Data)

Location	FRASER RIVER: Annacis Channel (Stn. M3) (~1m depth)	Percent Contribution	Chatterton Chemicals (Stn. M4) (~3m depth)	Percent Contribution	Harbour Commission (Stn. M5) (~2.5m depth)	Percent Contribution	Mitchell Isl. railway bridge (Stn. M6) (~3m depth)	Percent Contribution
Date	Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	2555	12.30	19.3	0.62	27	0.60	502.2	4.60
3-monochlorodiphenylether (CD-2)	5574.6	26.84	128.3	4.15	265.2	5.88	1996.8	18.27
4-monochlorodiphenylether (CD-3)	4825.2	23.24	134.8	4.36	289.3	6.41	2047.8	18.74
2,4-dichlorodiphenylether (CD-7)	83.6	0.40	<1.9	-	22.7	0.50	54.9	0.50
2,4'-dichlorodiphenylether (CD-8)	353	1.70	82.5	2.67	100.6	2.23	246.5	2.26
3,4'-dichlorodiphenylether (CD-13)	163.1	0.79	66.2	2.14	97.5	2.16	162.1	1.48
4,4'-dichlorodiphenylether (CD-15)	6641.7	31.98	2266	73.23	2934.5	65.04	5229.3	47.85
2,2',3-trichlorodiphenylether (CD-16)	24.7	0.12	11.5	0.37	14.8	0.33	20.9	0.19
2,2',4-trichlorodiphenylether (CD-17)	309.9	1.49	149.4	4.83	197	4.37	266.7	2.44
2,3,4'-trichlorodiphenylether (CD-22)	<0.4	-	<2.4	-	<1.2	-	16.2	0.15
2,4,4'-trichlorodiphenylether (CD-28)	55.8	0.27	61.7	1.99	57.3	1.27	66.5	0.61
2,4',6-trichlorodiphenylether (CD-32)	80.4	0.39	<2.4	-	<1.2	-	<1.9	-
2',3,4-trichlorodiphenylether (CD-33)	<0.4	-	<2.4	-	1.6	0.04	<1.9	-
3,3',4-trichlorodiphenylether (CD-35)	<0.4	-	<2.4	-	<1.2	-	<1.9	-
3,4,4'-trichlorodiphenylether (CD-37)	9.8	0.05	9.1	0.29	11.8	0.26	<1.9	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	32	0.15	48.4	1.56	59.9	1.33	62.6	0.57
2,2',4,5'-tetrachlorodiphenylether (CD-49)	<0.4	-	10.3	0.33	10.5	0.23	5.3	0.05
2,2',4,6'-tetrachlorodiphenylether (CD-51)	11.1	0.05	<0.8	-	<0.6	-	<0.4	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	1.9	0.01	<0.8	-	<0.6	-	<0.4	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.4	-	<0.8	-	<0.6	-	<0.4	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	<0.4	-	<0.8	-	<0.6	-	<0.4	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<0.4	-	<0.8	-	<0.6	-	<0.4	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<0.4	-	<0.8	-	<0.6	-	<0.4	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	0.6	0.00	2.5	0.08	9.1	0.20	16.4	0.15
2,3',4,4'-tetrachlorodiphenylether (CD-66)	1.6	0.01	6.6	0.21	7.5	0.17	6.7	0.06
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<0.4	-	<0.8	-	<0.6	-	<0.4	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<0.5	-	<1.8	-	<2.2	-	<0.8	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	1.3	0.01	4.5	0.15	11.3	0.25	9.6	0.09
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<0.5	-	<0.5	-	<0.3	-	0.8	0.01
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	<0.5	-	<0.5	-	<0.3	-	<0.8	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	1.7	0.01	4.6	0.15	10	0.22	8.7	0.08
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<0.5	-	<0.5	-	2.1	0.05	1.7	0.02
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NDR(0.6)	-	NDR(2.3)	-	NDR(4.2)	-	<0.8	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<0.5	-	<0.5	-	1.1	0.02	0.9	0.01
2,2',4,4',5-pentachlorodiphenylether (CD-99)	8.1	0.04	25	0.81	70.5	1.56	54.8	0.50
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<0.5	-	<0.5	-	<0.3	-	<0.8	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	0.9	0.00	5.4	0.17	4.6	0.10	3.9	0.04
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<0.5	-	<1.8	-	<2.2	-	<0.8	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	<0.3	-	<0.9	-	1.3	0.03	0.8	0.01
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	0.4	0.00	1.1	0.04	5.2	0.12	2.2	0.02
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	0.6	0.00	1.9	0.06	11	0.24	4.7	0.04
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	1.7	0.01	6.6	0.21	13.4	0.30	5.9	0.05
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	<0.3	-	<0.9	-	1.8	0.04	1.1	0.01

Appendix 5.1b

Chlorinated Diphenyl Ether Concentrations in Semi-Permeable Membrane Device Samples and Percent Contributions of Individual Isomers to the Total Concentration (Fisheries and Oceans Data)

Location	FRASER RIVER: Annacis Channel Old Site 3 (Stn. M3) (~1m depth)	Percent Contribution	Chatterton Chemicals (Stn. M4) (~3m depth)	Percent Contribution	Harbour Commission (Stn. M5) (~2.5m depth)	Percent Contribution	Mitchell Isl. railway bridge (Stn. M6) (~3m depth)	Percent Contribution
Date	Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996	
Diphenyl Compounds:								
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	2.8	0.01	7.9	0.26	51.8	1.15	22.2	0.20
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/	2	0.01	5.1	0.16	37.4	0.83	14.8	0.14
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	7.8	0.04	8.6	0.28	8.1	0.18	9	0.08
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<0.3	-	<0.9	-	<0.9	-	<0.6	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	1.6	0.01	4.5	0.15	17.9	0.40	9.1	0.08
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	<0.3	-	NDR(1.1)	-	NDR(1.0)	-	<0.6	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	<0.3	-	1.4	0.05	8.8	0.20	3.2	0.03
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	<0.3	-	<0.7	-	<0.6	-	<0.4	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	0.6	0.00	1.8	0.06	12.8	0.28	4.6	0.04
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	<0.3	-	<0.7	-	<0.6	-	<0.4	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD	2.7	0.01	6.7	0.22	55.8	1.24	19.8	0.18
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	<0.3	-	<0.7	-	<0.6	-	<0.4	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<0.3	-	0.7	0.02	2.7	0.06	1.1	0.01
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	<0.3	-	<0.7	-	<0.6	-	<0.4	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<0.3	-	<0.7	-	<0.6	-	<0.4	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	0.6	0.00	<0.30	-	0.3	0.01	NDR(0.4)	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	<0.2	-	0.5	0.02	1.3	0.03	0.7	0.01
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	3.5	0.02	5.3	0.17	36	0.80	18.1	0.17
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	1.5	0.01	2.1	0.07	13.8	0.31	7.7	0.07
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	<0.2	-	<0.3	-	<0.3	-	<0.3	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	<0.2	-	<0.3	-	3.9	0.09	2	0.02
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	0.8	0.00	1.1	0.04	8.8	0.20	4	0.04
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	<0.2	-	<0.3	-	<0.3	-	<0.3	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	2.7	0.01	2.8	0.09	10.3	0.23	11.6	0.11
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	0.6	0.00	<0.3	-	2.5	0.06	2.6	0.02
Decachlorodiphenylether (CD-209)	<0.7	-	<1.5	-	1.1	0.02	1.5	0.01
Total	20765.9 (20766.5)	100	3094.2 (3097.6)		4511.9 (7129.8)	100	10928 (10929.2)	100

Appendix 5.1b

Chlorinated Diphenyl Ether Concentrations in Semi-Permeable Membrane Device Samples and Percent Contributions of Individual Isomers to the Total Concentration (Fisheries and Oceans Data)

Location	FRASER RIVER: North Arm (Stn. M7) (~3m depth)	Percent Contribution	Old Site of Albion Ferry MacMillan Is/Fort Lang. (Stn. M8) (~2m depth)	Percent Contribution	Southwest of Alex Fraser Bridge (Stn. M9) (~3m depth)	Percent Contribution	Southwest of Alex Fraser Bridge (Stn. M10) (~3m depth)	Percent Contribution
Date	Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	824.8	9.04	17.8	0.82	107.3	2.00	632	6.09
3-monochlorodiphenylether (CD-2)	2011.2	22.05	102.2	4.72	565.6	10.55	2341.7	22.57
4-monochlorodiphenylether (CD-3)	1462.2	16.03	113	5.21	565.2	10.54	2243.8	21.63
2,4-dichlorodiphenylether (CD-7)	46.4	0.51	<50.2	-	37.6	0.70	55.9	0.54
2,4'-dichlorodiphenylether (CD-8)	192.9	2.12	<50.2	-	146	2.72	205.3	1.98
3,4'-dichlorodiphenylether (CD-13)	104.9	1.15	<50.2	-	123.7	2.31	153.7	1.48
4,4'-dichlorodiphenylether (CD-15)	4041.9	44.32	1618	74.65	3366.8	62.81	4328.1	41.71
2,2',3-trichlorodiphenylether (CD-16)	17.6	0.19	9.5	0.44	17.3	0.32	17.4	0.17
2,2',4-trichlorodiphenylether (CD-17)	223.6	2.45	110.9	5.12	217.5	4.06	226.5	2.18
2,3,4'-trichlorodiphenylether (CD-22)	<2.3	-	<3.3	-	<1.7	-	<1.7	-
2,4,4'-trichlorodiphenylether (CD-28)	50.6	0.55	36.9	1.70	61.1	1.14	54	0.52
2,4',6-trichlorodiphenylether (CD-32)	<2.3	-	25.1	1.16	<1.7	-	<1.7	-
2',3,4-trichlorodiphenylether (CD-33)	<2.3	-	<3.3	-	<1.7	-	<1.7	-
3,3',4-trichlorodiphenylether (CD-35)	<2.3	-	<3.3	-	<1.7	-	<1.7	-
3,4,4'-trichlorodiphenylether (CD-37)	9.5	0.10	6	0.28	9.6	0.18	8.3	0.08
2,2',4,4'-tetrachlorodiphenylether (CD-47)	35.3	0.39	35.3	1.63	44.8	0.84	33.9	0.33
2,2',4,5'-tetrachlorodiphenylether (CD-49)	9.2	0.10	8.5	0.39	<0.5	-	8	0.08
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<0.9	-	<1.3	-	7.6	0.14	<0.5	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	<0.9	-	<1.3	-	1.9	0.04	1.8	0.02
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.9	-	<1.3	-	<0.5	-	<0.5	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	<0.9	-	<1.3	-	<0.5	-	<0.5	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<0.9	-	<1.3	-	<0.5	-	<0.5	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<0.9	-	<1.3	-	<0.5	-	<0.5	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	2.3	0.03	<1.3	-	1.3	0.02	1.1	0.01
2,3',4,4'-tetrachlorodiphenylether (CD-66)	2.1	0.02	9	0.42	4.5	0.08	3.1	0.03
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<0.9	-	<1.3	-	<0.5	-	<0.5	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<1.0	-	<2.3	-	<1.0	-	<0.7	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	3	0.03	3.1	0.14	3.4	0.06	2.7	0.03
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<0.5	-	<1.0	-	<0.3	-	<0.7	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	<0.5	-	<1.0	-	<0.3	-	<0.7	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	3.6	0.04	3	0.14	3.8	0.07	3.2	0.03
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	0.6	0.01	<1.0	-	<0.3	-	<0.7	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	<1.0	-	NDR(2.2)	-	NDR(1.7)	-	NDR(1.6)	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<0.5	-	<1.0	-	<0.3	-	<0.7	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	18.5	0.20	14.6	0.67	18.1	0.34	13.7	0.13
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<0.5	-	<1.0	-	<0.3	-	<0.7	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	1.5	0.02	11.8	0.54	4	0.07	3	0.03
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<1.0	-	<2.3	-	<1.0	-	<0.7	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	0.5	0.01	<0.8	-	<0.6	-	<0.5	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	1	0.01	1.7	0.08	1.1	0.02	0.8	0.01
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	1.6	0.02	2.9	0.13	1.5	0.03	1.1	0.01
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	3.6	0.04	4.7	0.22	4.6	0.09	3.8	0.04
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	0.5	0.01	<0.8	-	<0.6	-	<0.5	-

Appendix 5.1b

Chlorinated Diphenyl Ether Concentrations in Semi-Permeable Membrane Device Samples and Percent Contributions of Individual Isomers to the Total Concentration (Fisheries and Oceans Data)

Location	FRASER RIVER: North Arm (Stn. M7) (~3m depth)	Percent Contribution	Old Site of Albion Ferry MacMillan Is/Fort Lang. (Stn. M8) (~2m depth)	Percent Contribution	Southwest of Alex Fraser Bridge (Stn. M9) (~3m depth)	Percent Contribution	Southwest of Alex Fraser Bridge (Stn. M10) (~3m depth)	Percent Contribution
Date	Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996		Aug/Sept, 1996	
Diphenyl Compounds:								
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	7	0.08	4.3	0.20	6.9	0.13	5.7	0.05
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/	4.5	0.05	3.4	0.16	4.5	0.08	3.5	0.03
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	8.5	0.09	7.2	0.33	7.7	0.14	8.1	0.08
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<0.5	-	<0.8	-	<0.6	-	<0.5	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	4.2	0.05	2.9	0.13	3.8	0.07	3.2	0.03
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	<0.5	-	NDR(1.7)	-	<0.6	-	<0.5	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	1.1	0.01	1.1	0.05	<0.5	-	<0.4	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	<0.5	-	<0.7	-	<0.5	-	<0.4	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	1.8	0.02	NDR(0.8)		1.6	0.03	1.3	0.01
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	<0.5	-	<0.7	-	<0.5	-	<0.4	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD	5.3	0.06	3.9	0.18	5.9	0.11	3.8	0.04
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	<0.5	-	<0.7	-	<0.5	-	<0.4	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	0.7	0.01	1.5	0.07	<0.5	-	<0.4	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	<0.5	-	<0.7	-	<0.5	-	<0.4	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<0.5	-	<0.7	-	<0.5	-	<0.4	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	<0.3	-	1.2	0.06	<0.2	-	<0.2	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	<0.3	-	<0.5	-	NDR(0.2)	-	<0.2	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	6.2	0.07	5.8	0.27	5.8	0.11	3.3	0.03
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	3.4	0.04	2.1	0.10	2.8	0.05	1.6	0.02
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	<0.3	-	<0.5	-	<0.2	-	<0.2	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	0.8	0.01	<0.5	-	0.9	0.02	0.3	0.00
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	1	0.01	<0.5	-	1.3	0.02	0.6	0.01
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	<0.3	-	<0.5	-	<0.3	-	<0.2	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	4.9	0.05	<0.5	-	3.9	0.07	1.5	0.01
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	1.5	0.02	<0.5	-	1.1	0.02	<0.2	-
Decachlorodiphenylether (CD-209)	<1.4	-	<2.3	-	<0.9	-	<0.5	-
Total	9120	100	2167.4 (2140.5)	100	5360.5 (5365.4)	100	10375.8 (10381.0)	100

NDR - detected but did not meet quantification limit
ND - not detected
(#) - total CDPE concentration including NDR values
NA - not analyzed for

Appendix 5.2a   Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	FALSE CREEK:							
Location	False Creek Marina at Market (Stn. 3,4,5 comp.) FC-1	Percent Contribution	Lab Duplicate	Percent Contribution	False Creek at Monk McQueen's (MMT-1) FCT-1	Percent Contribution	Blind Duplicate	Percent Contribution
Species	Mussels				English sole			
Tissue	Soft tissue				Whole body			
Date	March 25, 1991				June 6, 1991			
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<3.6	-	<1.0	-	<2.0	-	<3.1	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<3.6	-	<1.0	-	<2.0	-	<3.1	-
2,4-dichlorodiphenylether (CD-7)	<50	-	<9.8	-	<40	-	<86	-
2,4'-dichlorodiphenylether (CD-8)	<46	-	<8.9	-	<37	-	<160	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<36	-	<7.0	-	<29	-	<59	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<13	-	<4.4	-	<9.3	-	<9.1	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<12	-	<4.0	-	<8.4	-	<8.4	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<15	-	<5.1	-	<11	-	<11	-
3,3',4-trichlorodiphenylether (CD-35)	<12	-	<4.2	-	<8.7	-	<8.6	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<6.9	-	<2.8	-	<7.7	-	<7.1	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<8.5	-	<3.5	-	<9.4	-	<8.9	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<9.4	-	<3.8	-	<10	-	<9.8	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<12	-	<4.7	-	<14	-	<13	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<6.6	-	<2.7	-	<7.3	-	<7.4	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	9.4	8.59	8.4	8.05	420	6.92	120	5.66
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<4.8	-	<3.3	-	8.5	0.14	<12	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<5.7	-	<4.0	-	<8.2	-	<15	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	16	14.63	14	13.41	870	14.32	320	15.09
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA		NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<12	-	<5.7	-	56	0.92	<18	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<13	-	<6.4	-	<12	-	<20	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-	NA	-

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	FALSE CREEK:							
Location	False Creek Marina at Market (Stn. 3,4,5 comp.) FC-1	Percent Contribution	Lab Duplicate	Percent Contribution	False Creek at Monk McQueen's (MMT-1) FCT-1	Percent Contribution	Blind Duplicate	Percent Contribution
Species	Mussels				English sole			
Tissue	Soft tissue				Whole body			
Date	March 25, 1991				June 6, 1991			
Diphenyl Compounds:				-				
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	25	22.85	26	24.90	1300	21.40	420	19.81
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	38	34.73	38	36.40	1700	27.99	540	25.47
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<11	-	<5.1	-	<12	-	<16	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	21	19.20	18	17.24	710	11.69	380	17.92
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<12	-	<7.7	-	970	15.97	340	16.04
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<18	-	<3.2	-	39	0.64	<14	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	<11	-	<3.5	-	NDR (98)	-	<14	-
Total	109.4	100.00	104.4	100.00	6073.5 (6171.5)	100.00	2120	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	97		100		78		86	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	80		88		83		80	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	FALSE CREEK:		VANCOUVER HARBOUR:			
Location	False Creek East Basin (Trawl EBT-1) FCT-1	Percent Contribution	Outer Harbour (Trawl VOHT-2) BI-1	Percent Contribution	Outer Harbour (Trawl VOHT-2) BI-1	Percent Contribution
Species / Tissue	English sole / Whole body		Pink Shrimp / Tails		English sole / Whole body	
Date	June 6, 1991		Sept. 9, 1991		Sept. 9, 1991	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<9.5	-	<3.0	-	<7.9	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<9.5	-	<3.0	-	<7.9	-
2,4-dichlorodiphenylether (CD-7)	<190	-	<94	-	<120	-
2,4'-dichlorodiphenylether (CD-8)	<180	-	<82	-	<100	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<130	-	<59	-	<76	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<24	-	<13	-	<25	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<22	-	<12	-	<23	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<28	-	<15	-	<28	-
3,3',4-trichlorodiphenylether (CD-35)	<21	-	<12	-	<22	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<16	-	<8.9	-	<16	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<20	-	<11	-	<20	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<20	-	<11	-	<21	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<26	-	<15	-	<28	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<13	-	<7.6	-	<14	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	200	7.01	<4.7	-	28	3.35
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<32	-	<5.4	-	<6.8	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<36	-	<6.9	-	<8.5	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	380	13.32	<4.9	-	68	8.13
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<30	-	<0.94	-	<23	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<32	-	<1.0	-	<24	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	FALSE CREEK:		VANCOUVER HARBOUR:			
Location	False Creek East Basin (Trawl EBT-1) FCT-1	Percent Contribution	Outer Harbour (Trawl VOHT-2) BI-1	Percent Contribution	Outer Harbour (Trawl VOHT-2) BI-1	Percent Contribution
Species / Tissue	English sole / Whole body		Pink Shrimp / Tails		English sole / Whole body	
Date	June 6, 1991		Sept. 9, 1991		Sept. 9, 1991	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	600	21.03	4.5	100.00	150	17.94
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	750	26.29	NDR (5.5)	-	220	26.32
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	13	0.46	<4.8	-	<16	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	420	14.72	<10	-	150	17.94
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	470	16.47	<12	-	220	26.32
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	20	0.70	<10	-	<10	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	<12	-	<4.2	-	<6.0	-
Total	2853	100.00	4.5 (10)	100.00	836	100.00
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	74		82		63	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	78		91		90	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VANCOUVER HARBOUR cont.:

Location	Lab Duplicate	Percent Contribution	Vancouver Wharves (Stn. 2; M1/M2 comp.) BI-2	Percent Contribution	L & K Lumber (Stn. M1) BI-3	Percent Contribution	Versatile Pacific (Burrard Yarrows) (Stn. M2) BI-5	Percent Contribution
Species			Mussels		Mussels		Mussels	
Tissue			Soft tissue		Soft tissue		Soft tissue	
Date			Oct. 29, 1991		Oct. 29, 1991		Oct. 29, 1991	
2-monochlorodiphenylether (CD-1)	<3.0	-	<3.7	-	<5.0	-	<6.2	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<3.0	-	<3.7	-	<5.0	-	<6.2	-
2,4-dichlorodiphenylether (CD-7)	<48	-	<120	-	<62	-	<160	-
2,4'-dichlorodiphenylether (CD-8)	<43	-	<110	-	<60	-	<160	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<31	-	<84	-	<44	-	<110	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<7.4	-	<12	-	<12	-	<22	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<6.7	-	<11	-	<11	-	<20	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<8.4	-	<13	-	<13	-	<26	-
3,3',4-trichlorodiphenylether (CD-35)	<6.6	-	<10	-	<10	-	<19	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<7.0	-	<7.2	-	<8.2	-	<12	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<8.6	-	<8.6	-	<9.7	-	<15	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<9.1	-	<8.8	-	<10	-	<15	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<12	-	<11	-	<13	-	<20	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<6.0	-	<5.7	-	<6.5	-	<10	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	37	4.44	NDR (9.2)	-	6.9	5.23	12	10.44
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<5.1	-	<9.7	-	<7.7	-	<14	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<6.5	-	<11	-	<8.6	-	<15	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	56	6.72	22	14.43	17	12.89	19	16.54
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<16	-	<11	-	<8.1	-	<14	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<17	-	<12	-	<8.8	-	<16	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-	NA	-

Appendix 5.2a — Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

VANCOUVER HARBOUR cont.:

Location	Lab Duplicate	Percent Contribution	Vancouver Wharves (Stn. 2; M1/M2 comp.) BI-2	- Contribution	L & K Lumber (Stn. M1) BI-3	Percent Contribution	Versatile Pacific (Burrard Yarrows) (Stn. M2) BI-5	Percent Contribution
Species			Mussels		Mussels		Mussels	
Tissue			Soft tissue		Soft tissue		Soft tissue	
Date	March 25, 1991		Oct. 29, 1991		Oct. 29, 1991		Oct. 29, 1991	
Diphenyl Compounds:								
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	150	18.01	36	23.61	36	27.29	39	33.94
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA		NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	180	21.61	49	32.13	44	33.36	37	32.20
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<4.9	-	9.5	6.23	NDR (5.9)	-	7.9	6.88
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	180	21.61	36	23.61	28	21.23	<15	-
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	230	27.61	<8.8	-	<13	-	<17	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<7.9	-	<11	-	<8.2	-	<16	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	NDR (7.8)	-	<9.8	-	<4.3	-	<8.0	-
	833 (840.8)	100.00	152.5 (161.7)	100.00	131.9 (137.8)	100.00	114.9	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	70		72		80		57	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	79		47		70		57	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VANCOUVER HARBOUR cont.:							
Location	Seaboard Terminals (Stn. M2) BI-9	Percent Contribution	Lynnterm (Stn. M2) BI-10	Percent Contribution	Boulder Rock (Trawl BRT-1a&b) BI-14	Percent Contribution	Boulder Rock (Trawl BRT-1a&b) BI-14	Percent Contribution
Species	Mussels		Mussels		English sole		Staghorn Sculpin	
Tissue	Soft tissue		Soft tissue		Whole body		Whole body	
Date	Oct. 29, 1991		Oct. 29, 1991		Sept. 11, 1991		Sept. 11, 1991	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<44	-	<4.9	-	<1.8	-	<3.4	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<44	-	<4.9	-	<1.8	-	<3.4	-
2,4-dichlorodiphenylether (CD-7)	<630	-	<84	-	<25	-	<73	-
2,4'-dichlorodiphenylether (CD-8)	NDR (690)	-	<81	-	<22	-	<140	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<440	-	<59	-	<16	-	<50	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<94	-	<12	-	<5.3	-	<7.0	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<86	-	<11	-	<4.9	-	<6.5	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<110	-	<14	-	<6.0	-	<8.5	-
3,3',4-trichlorodiphenylether (CD-35)	<82	-	<11	-	<4.8	-	<6.6	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<71	-	<7.6	-	<7.4	-	<6.7	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<84.	-	<9.1	-	<9.1	-	<8.5	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<87	-	<9.4	-	<9.6	-	<9.3	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<110	-	<12	-	23	0.24	<12	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<57	-	<14	-	<6.3	-	<7.0	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<53	-	17	8.08	340	3.62	<27	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<64	-	<8.8	-	NDR (9.6)	-	<6.9	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<72	-	<9.9	-	7.3	0.08	<8.7	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<46	-	27	12.83	740	7.88	72	14.46
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<59	-	<10	-	65	0.69	<16	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<63	-	<11	-	<6.0	-	<18	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-	NA	-

Appendix 5.2a

Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VANCOUVER HARBOUR cont.:							
Location	Seaboard Terminals (Stn. M2) BI-9	Percent Contribution	Lynnterm (Stn. M2) BI-10	Percent Contribution	Boulder Rock (Trawl BRT-1a&b) BI-14	Percent Contribution	Boulder Rock (Trawl BRT-1a&b) BI-14	Percent Contribution
Species Tissue Date	Mussels Soft tissue Oct. 29, 1991		Mussels Soft tissue Oct. 29, 1991		English sole Whole body Sept. 11, 1991		Staghorn Sculpin Whole body Sept. 11, 1991	
Diphenyl Compounds:								
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	52	43.33	51	24.24	1500	15.98	96	19.28
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	68	56.67	59	28.04	2100	22.37	210	42.17
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<39	-	8.4	3.99	<2.8	-	<14	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<65	-	42	19.96	1600	17.04	<37	-
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<72	-	NDR (11)	-	2900	30.89	120	24.10
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<57	-	<9.1	-	85	0.91	<14	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	<48	-	6	2.85	29	0.31	<8.4	-
Total	120 (810)	100.00	210.4 (221.4)	100.00	9389.3 (9398.9)	100.00	498	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	**		82		64		85	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	**		78		60		81	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VANCOUVER HARBOUR cont.:							
Location	IOCO (Trawl IT-1) BI-15	Percent Contribution	IOCO (Trawl IT-1) BI-15	Percent Contribution	Centre Harbour (Trawl Ctr. T-1a&b) BI-19	Percent Contribution	Lab	Percent Contribution
Species	English sole		Staghorn sculpin		Staghorn Sculpin			
Tissue	Whole body		Whole body		Whole body			
Date	Sept. 10, 1991		Sept. 10, 1991		Sept. 12, 1991			
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<0.29	-	<3.5	-	<4.2	-	<7.7	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<0.29	-	<3.5	-	<4.2	-	<7.7	-
2,4-dichlorodiphenylether (CD-7)	<62	-	<78	-	<91	-	<350	-
2,4'-dichlorodiphenylether (CD-8)	<55	-	<130	-	<160	-	<110	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<40	-	<54	-	<62	-	<100	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<7.6	-	<13	-	<15	-	<25	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<7.0	-	<12	-	<14	-	<23	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<8.7	-	<16	-	<18	-	<30	-
3,3',4-trichlorodiphenylether (CD-35)	<6.8	-	<12	-	<14	-	<24	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<11	-	<9.3	-	<8.1	-	<19	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<14	-	<12	-	<10	-	<23	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<14	-	<13	-	<11	-	<26	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<19	-	<17	-	<15	-	<34	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<9.4	-	<9.7	-	<8.4	-	<19	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	160	3.77	<28	-	<27	-	<39	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	7.6	0.18	<12	-	<7.6	-	<7.4	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<7.0	-	<15	-	<9.5	-	<9.2	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	330	7.78	92	17.83	120	10.27	110	10.48
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	21	0.50	<20	-	<17	-	<25	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<11	-	<22	-	<19	-	<28	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-	NA	-

Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VANCOUVER HARBOUR cont.:							
Location	IOCO (Trawl IT-1) BI-15	Percent Contribution	IOCO (Trawl IT-1) BI-15	Percent Contribution	Centre Harbour (Trawl Ctr. T-1a&b) BI-19	Percent Contribution	Lab Duplicate	Percent Contribution
Species	English sole		Staghorn sculpin		Staghorn Sculpin			
Tissue	Whole body		Whole body		Whole body			
Date	Sept. 10, 1991		Sept. 10, 1991	-	Sept. 12, 1991			
Diphenyl Compounds:								
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	660	15.56	74	14.34	150	12.84	120	11.43
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	1000	23.58	210	40.70	520	44.52	490	46.67
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<5.3	-	<16	-	<21	-	<29	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	710	16.74	<31	-	68	5.82	<57	-
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	1300	30.65	140	27.13	310	26.54	330	31.43
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	39	0.92	<19	-	<26	-	<43	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	14	0.33	<18	-	<18	-	<22	-
Total	4241.6	100.00	516	100.00	1168	100.00	1050	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	71		73		74		52	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	77		70		75		50	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VANCOUVER HARBOUR cont.:							
Location	Centre Harbour BI-19	Percent Contribution	Centre Harbour BI-19	Percent Contribution	Canada Place (Stn. M1) BI-26	Percent Contribution	Lab Duplicate	Percent Contribution
Species	English sole		Humpback shrimp		Mussels			
Tissue	Whole body		Tail muscle		Soft tissue			
Date	Sept. 12, 1991		Sept. 12, 1991		Oct. 29, 1991			
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<1.4	-	<7.4	-	<4.3	-	<4.1	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<1.4	-	<7.4	-	26	16.45	24	16.33
2,4-dichlorodiphenylether (CD-7)	<22	-	<150	-	<87	-	<86	-
2,4'-dichlorodiphenylether (CD-8)	<20	-	<270	-	<84	-	<83	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<14	-	<100	-	<61	-	<61	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<3.8	-	<32	-	<12	-	<11	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<3.4	-	<30	-	<11	-	<10	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<4.3	-	<39	-	<13	-	<13	-
3,3',4-trichlorodiphenylether (CD-35)	<3.4	-	<30	-	<10	-	<9.7	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<4.5	-	<16	-	<6.7	-	<6.8	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<5.6	-	<20	-	<8.0	-	<8.1	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<5.9	-	<22	-	<8.2	-	<8.4	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	12	0.25	<29	-	<10	-	<10	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<3.9	-	<17	-	<5.3	-	<5.4	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	140	2.87	<14	-	15	9.49	14	9.52
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<2.8	-	<17	-	<8.5	-	<8.0	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<3.5	-	<21	-	<9.6	-	<9.0	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	300	6.16	<19	-	27	17.08	20	13.61
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	34	0.70	<27	-	<7.9	-	<12	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<5.7	-	<30	-	<8.5	-	<12	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-	NA	-

Appendix 5.2a

Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VANCOUVER HARBOUR cont.:							
Location	Centre Harbour BI-19	Percent Contribution	Centre Harbour BI-19	Percent Contribution	Canada Place (Stn. M1) BI-26	Percent Contribution	Lab Duplicate	Percent Contribution
Species	English sole		Humpback shrimp		Mussels			
Tissue	Whole body		Tail muscle		Soft tissue			
Date	Sept. 12, 1991		Sept. 12, 1991		Oct. 29, 1991			
Diphenyl Compounds:								
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	750	15.40	<11	-	30	18.98	28	19.05
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	1200	24.64	<33	-	39	24.67	35	23.81
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<2.7	-	<32	-	8.1	5.12	7	4.76
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	860	17.66	<19	-	13	8.22	19	12.93
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	1500	30.80	<24	-	<9.1	-	<11	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	60	1.23	<31	-	<7.1	-	<7.3	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	14	0.29	<18	-	<7.5	-	<7.1	-
Total	4870	100.00	ND	-	158.1	100.00	147	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	51		52		62		82	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	72		50		54		73	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	COAL HARBOUR:			
Location	Bayshore Inn Marina (Stns. M5,8,10,11) CH-1	Percent Contribution	Royal Vancouver Yacht Club Marina (Stns. 2,3,8) CH-3	Percent Contribution
Species	Mussels		Mussels	
Tissue	Soft tissue		Soft tissue	
Date	Mar. 25, 1991		Mar. 24, 1991	
Diphenyl Compounds:				
2-monochlorodiphenylether (CD-1)	<1.0	-	<5.7	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<1.0	-	<5.7	-
2,4-dichlorodiphenylether (CD-7)	<19	-	<64	-
2,4'-dichlorodiphenylether (CD-8)	<17	-	<58	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<13	-	<45	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<4.6	-	<18	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<4.2	-	<17	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<5.3	-	<21	-
3,3',4-trichlorodiphenylether (CD-35)	<4.3	-	<17	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<2.7	-	<11	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<3.3	-	<14	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<3.7	-	<15	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<4.5	-	<19	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<2.6	-	<11	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	15	8.02	17	11.72
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<2.0	-	<12	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<2.3	-	<14	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	31	16.58	<16	-
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<4.6	-	<21	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<5.1	-	<23	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	COAL HARBOUR:			
Location	Bayshore Inn Marina (Stns. M5,8,10,11) CH-1	Percent Contribution	Royal Vancouver Yacht Club Marina (Stns. 2,3,8) CH-3	Percent Contribution
Species	Mussels		Mussels	
Tissue	Soft tissue		Soft tissue	
Date	Mar. 25, 1991		Mar. 24, 1991	
Diphenyl Compounds:				
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	46	24.60	52	35.86
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	69	36.90	76	52.41
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<4.8	-	<19	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	26	13.90	<20	-
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<3.3	-	<22	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<4.9	-	<19	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-
Decachlorodiphenylether (CD-209)	<2.6	-	<14	-
Total	187	100.00	145	100.00
Surrogate Standards (% Recovery)				
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	98		93	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	85		94	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VICTORIA HARBOUR:							
Location	Selkirk Waters (Trawl SWT-3) SWT-3	Percent Contribution	Upper Harbour (Stn. C2) UH-C2	Percent Contribution	Upper Harbour (Stn. C2) UH-C2	Percent Contribution	Inner Harbour [Stn C3 & Trawl IHT-' IH-3/IHT-1	Percent Contribution
Species	Dungeness crab		Dungeness crab		Dungeness crab		Dungeness crab	
Tissue	Hepatopancreas		Hepatopancreas		Muscle		Hepatopancreas	
Date	July 11, 1990		July 10, 1990		July 10, 1990		July 10, 1990	
Diphenyl Compounds:								
2-monochlorodiphenylether (CD-1)	<1.7	-	<72	-	<2.5	-	<3.3	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<1.7	-	<72	-	<2.5	-	<3.3	-
2,4-dichlorodiphenylether (CD-7)	<52	-	<780	-	<6.0	-	<82	-
2,4'-dichlorodiphenylether (CD-8)	<45	-	<710	-	<89	-	<73	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<33	-	<550	-	<4.1	-	<52	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<4.3	-	<190	-	<7.0	-	<7.9	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	17	0.11	<170	-	<6.5	-	24	0.08
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<4.9	-	<210	-	<8.5	-	<9.0	-
3,3',4-trichlorodiphenylether (CD-35)	<3.8	-	<180	-	<6.6	-	<7.0	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<7.7	-	<170	-	<6.2	-	<11	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<8.4	-	<210	-	<7.8	-	<13	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	110	0.70	320	0.88	<8.6	-	140	0.49
2,3',4,4'-tetrachlorodiphenylether (CD-66)	180	1.15	360	0.97	<11	-	200	0.70
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	22	0.14	<160	-	<6.4	-	20	0.07
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	320	2.04	990	2.66	<3.1	-	710	2.49
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	NDR (13)	-	<100	-	<3.8	-	25	0.09
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	14	0.09	<120	-	<48	-	NDR (16)	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	2500	15.93	6300	16.91	<5.9	-	4200	14.72
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	330	2.10	880	2.36	<8.4	-	450	1.58
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<7.0	-	<270	-	<9.2	-	<11	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-	NA	-

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VICTORIA HARBOUR:							
Location	Selkirk Waters (Trawl SWT-3) SWT-3	Percent Contribution	Upper Harbour (Stn. C2) UH-C2	Percent Contribution	Upper Harbour (Stn. C2) UH-C2	Percent Contribution	Inner Harbour (Stn C3 & Trawl IHT-' IH-3/IHT-1	Percent Contribution
Species Tissue Date	Dungeness crab Hepatopancreas July 11, 1990		Dungeness crab Hepatopancreas July 10, 1990		Dungeness crab Muscle July 10, 1990		Dungeness crab Hepatopancreas July 10, 1990	
Diphenyl Compounds:								
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	2100	13.38	3700	9.93	<4.9	-	4000	14.02
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	7300	46.52	12000	32.21	<9.8	-	12000	42.07
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<3.2	-	<260	-	<8.1	-	<5.1	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	1800	11.47	9700	26.04	<6.1	-	4100	14.37
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	860	5.48	3000	8.05	<7.6	-	2400	8.41
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	91	0.58	<550	-	<12	-	170	0.60
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	47	0.30	NDR (350)	-	<7.2	-	85	0.30
Total	15691 (15704)	100.00	37250 (37600)	100.00	ND	-	28524 NDR (28540)	100.00
Surrogate Standards (% Recovery)								
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	78		42		92		77	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	68		25		90		68	

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	VICTORIA HARBOUR cont.:				ESQUIMALT HARBOUR:	
Location	Inner Harbour (Trawl IHT-1) IHT-1	Percent Contribution	Inner Harbour (Trawl IHT-1) IHT-1	Percent Contribution	Constance Cove (Stn. M2) CCM1	Percent Contribution
Species	English sole		Sidestripe shrimp		Mussels	
Tissue	Whole body		Tail muscle		Soft tissue	
Date	July 10, 1990		July 10, 1990		July 10, 1990	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<2.8	-	<3.0	-	<10	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<2.8	-	<3.0	-	<10	-
2,4-dichlorodiphenylether (CD-7)	<53	-	<77	-	<97	-
2,4'-dichlorodiphenylether (CD-8)	<47	-	<88	-	<88	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<34	-	<49	-	<68	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<8.7	-	<14	-	<34	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<6.2	-	<13	-	<30	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<7.6	-	<16	-	<38	-
3,3',4-trichlorodiphenylether (CD-35)	<6.0	-	<13	-	<31	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<5.3	-	<8.4	-	<24	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<6.5	-	<10	-	<29	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<6.8	-	<11	-	<32	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<9.2	-	<14	-	<39	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<4.5	-	<7.1	-	<22	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA		NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA		NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	89	6.70	8	5.19	<13	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<4.0	-	<5.0	-	<16	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<5.1	-	<6.3	-	<19	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	170	12.79	43	27.92	<21	-
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA		NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	NDR (15)	-	<8.0	-	<28	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<8.4	-	<8.5	-	<31	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

Location	VICTORIA HARBOUR cont.: Inner Harbour (Trawl IHT-1) IHT-1	Percent Contribution	Inner Harbour (Trawl IHT-1) IHT-1	Percent Contribution	ESQUIMALT HARBOUR: Constance Cove (Stn. M2) CCM1	Percent Contribution
Species / Tissue / Date	English sole / Whole body / July 10, 1990		Sidestripe shrimp / Tail muscle / July 10, 1990		Mussels / Soft tissue / July 10, 1990	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	280	21.07	NDR (23)	-	15	100.00
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	380	28.59	98	62.34	NDR (35)	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<3.9	-	7	4.55	<17	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	200	15.05	<9.7	-	<27	-
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	210	15.80	NDR (28)	-	<31	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	NDR (12)	-	<7.2	-	<30	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	<6.2	-	<8.0	-	<28	-
Total	1329 (1356)	100.00	154 (205)	100.00	15 (50)	100.00
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	71		76		23	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	75		88		24	

Appendix 5.2a   Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	ESQUIMALT HARBOUR cont.:					
Location	Constance Cove (Trawl CCT-1) CCT-1		Constance Cove (Stn. C1) CC-C1		Constance Cove (Trawl CCT-1) CCT-1	
Species Tissue Date	Sidestripe shrimp Tail muscle July 9, 1990	Percent Contribution	Dungeness crab Hepatopancreas July 9, 1990	Percent Contribution	Sand sole Whole body July 9, 1990	Percent Contribution
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<2.3	-	<13	-	<2.8	-
3-monochlorodiphenylether (CD-2)	NA	-	NA	-	NA	-
4-monochlorodiphenylether (CD-3)	<2.3	-	<13	-	<2.8	-
2,4-dichlorodiphenylether (CD-7)	<38	-	<220	-	<44	-
2,4'-dichlorodiphenylether (CD-8)	<35	-	<200	-	<40	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	NA	-	NA	-
4,4'-dichlorodiphenylether (CD-15)	<27	-	<160	-	<31	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	NA	-	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<9.4	-	<51	-	<10	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	NA	-	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<8.6	-	<46	-	<9.3	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-	NA	-	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<11	-	<58	-	<12	-
3,3',4-trichlorodiphenylether (CD-35)	<8.8	-	<48	-	<9.6	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	NA	-	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	NA	-	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	NA	-	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	NA	-	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	NA	-	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	NA	-	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	NA	-	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<5.8	-	<27	-	<5.8	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<7.0	-	<33	-	<7.1	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<7.8	-	<41	-	<7.8	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<9.6	-	<44	-	<9.6	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	NA	-	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<5.5	-	<25	-	<5.5	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	NA	-	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	NA	-	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-	NA	-	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-	NA	-	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<4.4	-	63	2.54	13	10.57
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<5.4	-	<36	-	<5.5	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-	NA	-	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<6.5	-	<43	-	<6.6	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<7.6	-	470	18.93	15	12.20
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	NA	-	NA	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<9.9	-	<74	-	<13	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<11	-	<68	-	<14	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-	NA	-	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-	NA	-	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-	NA	-	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-	NA	-	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-	NA	-	NA	-

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	ESQUIMALT HARBOUR cont.:					
Location	Constance Cove (Trawl CCT-1) CCT-1		Constance Cove (Stn. C1) CC-C1		Constance Cove (Trawl CCT-1) CCT-1	
Species Tissue Date	Sidestripe shrimp Tail muscle July 9, 1990	Percent Contribution	Dungeness crab Hepatopancreas July 9, 1990	Percent Contribution	Sand sole Whole body July 9, 1990	Percent Contribution
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<4.3	-	320	12.89	28	22.76
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-	NA	-	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<9.5	-	1300	52.36	49	39.84
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<6.3	-	<64	-	<12	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-	NA	-	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-	NA	-	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-	NA	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<10	-	330	13.29	18	14.63
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-	NA	-	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<12	-	<56	-	<13	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<11	-	<62	-	<11	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-	NA	-	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-	NA	-	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-	NA	-	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-	NA	-	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-	NA	-	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-	NA	-	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-	NA	-	NA	-
Decachlorodiphenylether (CD-209)	<3.7	-	<55	-	<6.8	-
Total	ND	-	2483	100.00	123	100.00
Surrogate Standards (% Recovery)						
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	81		84		80	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	83		80		83	

Appendix 5.2a — Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	REFERENCE SITE:	
Location	Crescent Beach (CBT-1) RF-1	Percent Contribution
Species	Rock sole	
Tissue	Whole body	
Date	Jan. 1, 1991	
Diphenyl Compounds:		
2-monochlorodiphenylether (CD-1)	<3.6	-
3-monochlorodiphenylether (CD-2)	NA	-
4-monochlorodiphenylether (CD-3)	<3.6	-
2,4-dichlorodiphenylether (CD-7)	<79	-
2,4'-dichlorodiphenylether (CD-8)	<170	-
3,4'-dichlorodiphenylether (CD-13)	NA	-
4,4'-dichlorodiphenylether (CD-15)	<54	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-
2,2',4-trichlorodiphenylether (CD-17)	<7.9	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-
2,4,4'-trichlorodiphenylether (CD-28)	<7.3	-
2,4',6-trichlorodiphenylether (CD-32)	NA	-
2',3,4-trichlorodiphenylether (CD-33)	<9.6	-
3,3',4-trichlorodiphenylether (CD-35)	<7.5	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<7.2	-
2,3',4',6-tetrachlorodiphenylether (CD-71)	<9.0	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<10	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	<13	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	<7.5	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	<7.2	-
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<8.7	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NA	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<11	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	<12	-
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	
2,3',4,4',5-pentachlorodiphenylether (CD-118)	<7.4	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<8.1	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	NA	-
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NA	-
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	NA	-
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	NA	-
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	NA	-

Appendix 5.2a Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Environment Canada data)

	REFERENCE SITE:	
Location	Crescent Beach (CBT-1) RF-1	Percent Contribution
Species	Rock sole	
Tissue	Whole body	
Date	Jan. 1, 1991	
Diphenyl Compounds:		
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<14	-
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	NA	-
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	<13	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<9.3	-
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	NA	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	NA	-
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NA	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	NA	-
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<16	-
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	NA	-
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	NA	-
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	NA	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	<12	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<16	-
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	NA	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	NA	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	NA	-
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	NA	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	NA	-
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	NA	-
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	NA	-
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	NA	-
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	NA	-
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NA	-
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	NA	-
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	NA	-
Decachlorodiphenylether (CD-209)	<8.2	-
Total	ND	-
Surrogate Standards (% Recovery)		
13C-3,3',4,4'-tetrachlorodiphenylether (CD-77)	77	
13C-2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	69	

NDR - detected but did not meet quantification limit
ND - not detected
(#) - total CDPE concentration including NDR values
NA - not analyzed for

** - the surrogate recovery is higher than the normal acceptance limit; however, the data should not be affected

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	FRASER RIVER:					
Location	MacDonald Beach/ Iona Island (Stn. PC)	Percent Contribution	Mitchell Island (Stn. SF)	Percent Contribution	Stoner (Stn. B1)	Percent Contribution
Species	Peamouth Chub		Starry flounder		Burbot	
Tissue	whole body		liver		Whole body	
Date	June 10, 1992		May 2, 1993		Mar. 25, 1992	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<0.1	-	<0.1	-	<0.1	-
3-monochlorodiphenylether (CD-2)	<0.1	-	<0.1	-	<0.1	-
4-monochlorodiphenylether (CD-3)	<0.1	-	<0.1	-	<0.1	-
2,4-dichlorodiphenylether (CD-7)	<0.2	-	<0.5	-	<0.1	-
2,4'-dichlorodiphenylether (CD-8)	<0.2	-	<0.5	-	<0.1	-
3,4'-dichlorodiphenylether (CD-13)	<0.2	-	<0.5	-	<0.1	-
4,4'-dichlorodiphenylether (CD-15)	<0.2	-	2.8	0.10	<0.1	-
2,2',3-trichlorodiphenylether (CD-16)	<0.3	-	<0.2	-	<0.3	-
2,2',4-trichlorodiphenylether (CD-17)	<0.3	-	0.5	0.02	<0.3	-
2,3,4'-trichlorodiphenylether (CD-22)	<0.3	-	<0.2	-	<0.3	-
2,4,4'-trichlorodiphenylether (CD-28)	5.4	0.36	3.6	0.13	31.3	6.94
2,4',6-trichlorodiphenylether (CD-32)	<0.3	-	<0.2	-	<0.3	-
2',3,4-trichlorodiphenylether (CD-33)	<0.3	-	<0.2	-	<0.3	-
3,3',4-trichlorodiphenylether (CD-35)	<0.3	-	<0.2	-	<0.3	-
3,4,4'-trichlorodiphenylether (CD-37)	0.4	0.03	0.8	0.03	<0.3	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	71.1	4.78	12.7	0.46	42.4	9.40
2,2',4,5'-tetrachlorodiphenylether (CD-49)	0.3	0.02	0.4	0.01	<0.2	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<0.2	-	<0.1	-	<0.2	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	<0.2	-	<0.1	-	<0.2	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.2	-	<0.1	-	<0.2	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	<0.2	-	<0.1	-	NDR(0.5)	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	0.5	0.03	0.4	0.01	1.1	0.24
2,3',4',6-tetrachlorodiphenylether (CD-71)	<0.2	-	<0.1	-	<0.2	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	3.3	0.22	4.1	0.15	0.9	0.20
2,3',4,4'-tetrachlorodiphenylether (CD-66)	6.5	0.44	3.1	0.11	0.6	0.13
3,3',4,4'-tetrachlorodiphenylether (CD-77)	0.8	0.05	0.5	0.02	0.4	0.09
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<1.2	-	<0.5	-	<0.3	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	47.9	3.22	20.9	0.76	2.4	0.53
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<0.1	-	1.4	0.05	<0.3	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	0.8	0.05	0.4	0.01	<0.3	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	32.4	2.18	15.5	0.56	1.5	0.33
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	1.5	0.10	<0.1	-	<0.3	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	2.4	0.16	NDR (1.6)	-	0.5	0.11
2,3',4,4',6-pentachlorodiphenylether (CD-119)	1.2	0.08	1	0.04	<0.3	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	203.4	13.67	113	4.08	11.7	2.59
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<0.1	-	<0.1	-	<0.3	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	25.1	1.69	12.4	0.45	1.3	0.29
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<1.2	-	<0.5	-	<0.3	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	7.6	0.51	11.1	0.40	0.5	0.11
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	17.8	1.20	10	0.36	1.2	0.27
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	4.4	0.30	57.1	2.06	3.1	0.69
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	30.6	2.06	53.5	1.93	2.8	0.62
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	5.8	0.39	20	0.72	0.4	0.09

Appendix 5.2b

Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	FRASER RIVER:					
Location	MacDonald Beach/ Iona Island (Stn. PC)	Percent Contribution	Mitchell Island (Stn. SF)	Percent Contribution	Stoner (Stn. B1)	Percent Contribution
Species	Peamouth Chub		Starry flounder		Burbot	
Tissue	whole body		liver		Whole body	
Date	June 10, 1992		May 2, 1993		Mar. 25, 1992	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	94.2	6.33	81.7	2.95	11	2.44
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	120.3	8.09	209.3	7.56	17.6	3.90
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	1.2	0.08	2.7	0.10	0.8	0.18
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	0.5	0.03	<0.5	-	<0.1	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	91.5	6.15	101.1	3.65	5.2	1.15
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	1.7	0.11	1.4	0.05	0.3	0.07
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	36.5	2.45	47.4	1.71	11.7	2.59
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	<0.2	-	<0.2	-	<0.1	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	32.7	2.20	123.1	4.45	6.5	1.44
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	2.2	0.15	4.9	0.18	0.4	0.09
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	142.5	9.58	267.3	9.66	60.4	13.40
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	1.3	0.09	0.5	0.02	0.2	0.04
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	9.2	0.62	15.1	0.55	2.7	0.60
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	0.9	0.06	1.7	0.06	0.2	0.04
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<0.2	-	<0.2	-	<0.1	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	3.2	0.22	5.1	0.18	1.8	0.40
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	1	0.07	3.7	0.13	1.6	0.35
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	215.7	14.50	688.7	24.89	80.1	17.76
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	98.4	6.62	350.6	12.67	38.6	8.56
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	2.2	0.15	4.7	0.17	0.6	0.13
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	21.1	1.42	35.5	1.28	9.6	2.13
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	11.5	0.77	137.4	4.97	12.3	2.73
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	1.6	0.11	1.6	0.06	1.3	0.29
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	95	6.39	283.2	10.23	66	14.64
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	22.1	1.49	32.3	1.17	15.1	3.35
Decachlorodiphenylether (CD-209)	11.8	0.79	23.1	0.83	4.8	1.06
Total	1487.5	100.00	2767.3	100.00	450.9	100.00

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

Location	Across from Northwood Pulp&Paper 10km u/s Prince George (Stn. WS-2)	Percent Contribution	Across from Northwood Pulp&Paper 10km u/s Prince George (Stn. WS-3)	Percent Contribution
Species	White sturgeon		White sturgeon	
Tissue	liver		muscle tissue	
Date	Oct. 21, 1992		Oct. 21, 1992	
Diphenyl Compounds:				
2-monochlorodiphenylether (CD-1)	<1.3	-	<0.1	-
3-monochlorodiphenylether (CD-2)	<1.3	-	<0.1	-
4-monochlorodiphenylether (CD-3)	<1.3	-	<0.1	-
2,4-dichlorodiphenylether (CD-7)	<1.8	-	<0.1	-
2,4'-dichlorodiphenylether (CD-8)	<1.8	-	<0.1	-
3,4'-dichlorodiphenylether (CD-13)	<1.8	-	<0.1	-
4,4'-dichlorodiphenylether (CD-15)	<1.8	-	<0.1	-
2,2',3-trichlorodiphenylether (CD-16)	<3.3	-	<0.4	-
2,2',4-trichlorodiphenylether (CD-17)	<3.3	-	<0.4	-
2,3,4'-trichlorodiphenylether (CD-22)	<3.3	-	<0.4	-
2,4,4'-trichlorodiphenylether (CD-28)	63.1	2.89	45.5	1.65
2,4',6-trichlorodiphenylether (CD-32)	<3.3	-	<0.4	-
2',3,4-trichlorodiphenylether (CD-33)	<3.3	-	<0.4	-
3,3',4-trichlorodiphenylether (CD-35)	<3.3	-	<0.4	-
3,4,4'-trichlorodiphenylether (CD-37)	4.9	0.22	<0.4	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	95.3	4.37	95	3.45
2,2',4,5'-tetrachlorodiphenylether (CD-49)	8.6	0.39	10.6	0.38
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<5.6	-	<0.4	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	<5.6	-	<0.4	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<5.6	-	<0.4	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	6.6	0.30	6.7	0.24
2,4,4',6-tetrachlorodiphenylether (CD-75)	5.8	0.27	5.8	0.21
2,3',4',6-tetrachlorodiphenylether (CD-71)	<5.6	-	(NDR 4.1)	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	<5.6	-	<0.4	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	NDR(11.3)	-	<0.4	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<5.6	-	<0.4	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<8.4	-	<10.0	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	24.1	1.11	24.1	0.87
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<1.2	-	<10.0	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	<1.2	-	<0.2	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	26.3	1.21	26	0.94
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<1.2	-	3.4	0.12
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NDR(16.4)	-	NDR (17.9)	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<1.2	-	3.5	0.13
2,2',4,4',5-pentachlorodiphenylether (CD-99)	191.4	8.78	172.9	6.27
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<1.2	-	<0.2	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	12.4	0.57	<10.0	-
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<8.4	-	<10.0	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	9.8	0.45	11.2	0.41
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	10.2	0.47	11.9	0.43
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	41.7	1.91	48.6	1.76
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	93.7	4.30	93.1	3.38
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	<2.4	-	9.6	0.35

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

Location	Across from Northwood Pulp&Paper 10km u/s Prince George (Stn. WS-2)	Percent Contribution	Across from Northwood Pulp&Paper 10km u/s Prince George (Stn. WS-3)	Percent Contribution
Species Tissue	White sturgeon liver		White sturgeon muscle tissue	
Date	Oct. 21, 1992		Oct. 21, 1992	
Diphenyl Compounds:				
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	108.5	4.98	150	5.44
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	134.8	6.18	180.3	6.54
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	9.2	0.42	13	0.47
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<2.4	-	<0.2	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	80.7	3.70	108.1	3.92
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	11.8	0.54	22.4	0.81
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	33	1.51	63.7	2.31
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	<2.6	-	<0.3	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	49.1	2.25	96.5	3.50
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	<2.6	-	3.8	0.14
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	229.4	10.52	446.7	16.21
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	<2.6	-	3.3	0.12
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	9.7	0.44	15.9	0.58
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	<2.6	-	<0.3	-
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<2.6	-	<0.3	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	6.3	0.29	9.2	0.33
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	1.6	0.07	2.8	0.10
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	345.3	15.83	364.8	13.24
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	132.8	6.09	133.6	4.85
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	2.7	0.12	2.1	0.08
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	37.2	1.71	36.5	1.32
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	72.3	3.32	75.3	2.73
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	4.3	0.20	6.6	0.24
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	237.7	10.90	349.3	12.67
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	48.3	2.21	74	2.69
Decachlorodiphenylether (CD-209)	32.1	1.47	30.2	1.10
Total	2180.7	100.00	2756	100.00

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	INTERIOR REGION:					
Location	Beaver Creek (Stn. WF1)	Percent Contribution	Genelle River (Stn. WF2)	Percent Contribution	Columbia River at Waneta (Stn. WS-1)	Percent Contribution
Species	Whitefish		Whitefish		White sturgeon	
Tissue	muscle		muscle		liver	
Date	July 12, 1994		July 14, 1994		Sept. 2, 1994	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<0.2	-	<0.1	-	<1.8	-
3-monochlorodiphenylether (CD-2)	<0.2	-	<0.1	-	<1.8	-
4-monochlorodiphenylether (CD-3)	<0.2	-	<0.1	-	<1.8	-
2,4-dichlorodiphenylether (CD-7)	<0.3	-	<0.2	-	<2.5	-
2,4'-dichlorodiphenylether (CD-8)	<0.3	-	<0.2	-	<2.5	-
3,4'-dichlorodiphenylether (CD-13)	<0.3	-	<0.2	-	<2.5	-
4,4'-dichlorodiphenylether (CD-15)	<0.3	-	<0.2	-	<2.5	-
2,2',3-trichlorodiphenylether (CD-16)	<0.3	-	<0.2	-	<2.8	-
2,2',4-trichlorodiphenylether (CD-17)	<0.3	-	<0.2	-	<2.8	-
2,3,4'-trichlorodiphenylether (CD-22)	<0.3	-	NDR (0.3)	-	<2.8	-
2,4,4'-trichlorodiphenylether (CD-28)	1	0.27	0.6	0.14	<2.8	-
2,4',6-trichlorodiphenylether (CD-32)	<0.3	-	<0.2	-	<2.8	-
2',3,4-trichlorodiphenylether (CD-33)	<0.3	-	<0.2	-	<2.8	-
3,3',4-trichlorodiphenylether (CD-35)	<0.3	-	<0.2	-	<2.8	-
3,4,4'-trichlorodiphenylether (CD-37)	<0.3	-	<0.2	-	<2.8	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	2.4	0.64	3.7	0.87	3.1	0.24
2,2',4,5'-tetrachlorodiphenylether (CD-49)	<0.2	-	<0.1	-	<2.5	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<0.2	-	<0.1	-	<2.5	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	<0.2	-	<0.1	-	<2.5	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.2	-	<0.1	-	<2.5	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	<0.2	-	<0.1	-	<2.5	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	<0.2	-	<0.1	-	<2.5	-
2,3',4'6-tetrachlorodiphenylether (CD-71)	<0.2	-	<0.1	-	<2.5	-
2,4,4'5-tetrachlorodiphenylether (CD-74)	0.3	0.08	0.4	0.09	<2.5	-
2,3',4,4'-tetrachlorodiphenylether (CD-66)	0.6	0.16	0.2	0.05	<2.5	-
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<0.2	-	<0.1	-	5.9	0.45
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (BZ 77/81)	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<0.5	-	<0.1	-	<1.3	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	8.6	2.30	11.9	2.79	8.4	0.64
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<0.1	-	<0.1	-	<1.3	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	<0.1	-	0.2	0.05	<1.3	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	6.6	1.77	10.1	2.37	16.2	1.24
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<0.1	-	0.4	0.09	<1.3	-
2,3,3',4,4'-pentachlordiphenylether (CD-105)	0.5	0.13	NDR (0.9)	-	<1.3	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	0.1	0.03	0.3	0.07	60.7	4.64
2,2',4,4',5-pentachlorodiphenylether (CD-99)	40.8	10.93	65.4	15.35	<1.3	-
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<0.1	-	<0.1	-	<1.3	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	3.3	0.88	3.3	0.77	2.2	0.17
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<0.5	-	<0.1	-	<1.3	-
2,2'3,3',4,4'-hexachlordiphenylether (CD-128)	2.4	0.64	3	0.70	14.1	1.08
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	4.3	1.15	5.3	1.24	6.8	0.52
2,2'.3.4.4',5'-hexachlorodiphenylether (CD-138)	12.1	3.24	15.6	3.66	32.1	2.45
2,2',3,4,4',6'-hexachlorodiphenylether (CD-140)	12.8	3.43	14.8	3.47	55.1	4.21
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	4.3	1.15	4.2	0.99	11.3	0.86

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	INTERIOR REGION:					
Location	Beaver Creek (Stn. WF1)	Percent Contribution	Genelle River (Stn. WF2)	Percent Contribution	Columbia River at Waneta (Stn. WS-1)	Percent Contribution
Species	Whitefish		Whitefish		White sturgeon	
Tissue	muscle		muscle		liver	
Date	July 12, 1994		July 14, 1994		Sept. 2, 1994	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	43.9	11.76	43.2	10.14	125.7	9.60
2,2',3,4',5,6-/2,2',4,4',5.5'-hexachlorodiphenylether (CD-147/153)	33.6	9.00	42.9	10.07	130.4	9.96
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	0.9	0.24	1	0.23	2.2	0.17
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	0.2	0.05	<0.2	-	0.9	0.07
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	41	10.98	35.7	8.38	167.6	12.80
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	<0.2	-	NDR (0.4)	-	<0.9	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	12.1	3.24	15.6	3.66	9.1	0.70
2,2',3,4,4',5,6-heptachlorodiphenylether (CD-181)	<0.2	-	<0.1	-	<1.1	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	25.5	6.83	24.7	5.80	67.4	5.15
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	1	0.27	0.9	0.21	2.9	0.22
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	28.9	7.74	38.9	9.13	89.2	6.81
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	0.3	0.08	0.5	0.12	<1.1	-
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	3.2	0.86	3.8	0.89	10.2	0.78
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	0.4	0.11	<0.1	-	2.2	0.17
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<0.2	-	<0.1	-	<1.1	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	1	0.27	1.1	0.26	6.3	0.48
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	1.2	0.32	1.5	0.35	<0.8	-
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	27.8	7.45	21.8	5.12	164	12.53
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	18.7	5.01	17.9	4.20	121.7	9.30
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	0.4	0.11	0.3	0.07	2.9	0.22
2,2',3,4,4',5,5',6-octachlorodiphenylether (CD-203)	3.8	1.02	3.3	0.77	24.5	1.87
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	6.5	1.74	5.9	1.38	35.2	2.69
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	0.4	0.11	0.5	0.12	3.5	0.27
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	17	4.55	20.8	4.88	98.1	7.49
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	4	1.07	5.1	1.20	16.7	1.28
Decachlorodiphenylether (CD-209)	1.5	0.40	1.2	0.28	12.3	0.94
Total	373.4	100.00	426	100.00	1308.9	100.00

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	GEORGIA STRAIT:				BURRARD INLET:	
Location	Sandheads (Stn. C8)	Percent Contribution	Sechelt Bay (Stn. C9)	Percent Contribution	Bedwell Bay (Stn. C1)	Percent Contribution
Species	Dungeness crab		Dungeness crab		Dungeness crab	
Tissue	hepatopancreas		hepatopancreas		hepatopancreas	
Date	Sept. 16, 1993		Mar. 5, 1994		Mar. 28, 1994	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<0.1	-	<1.9	-	<0.8	-
3-monochlorodiphenylether (CD-2)	<0.1	-	<1.9	-	<0.8	-
4-monochlorodiphenylether (CD-3)	<0.1	-	<1.9	-	<0.8	-
2,4-dichlorodiphenylether (CD-7)	<0.2	-	<2.7	-	<1.1	-
2,4'-dichlorodiphenylether (CD-8)	<0.2	-	<2.7	-	<1.1	-
3,4'-dichlorodiphenylether (CD-13)	<0.2	-	<2.7	-	<1.1	-
4,4'-dichlorodiphenylether (CD-15)	<0.2	-	<2.7	-	<1.1	-
2,2',3-trichlorodiphenylether (CD-16)	0.9	0.05	<3.4	-	<1.7	-
2,2',4-trichlorodiphenylether (CD-17)	1.6	0.09	<3.4	-	<1.7	-
2,3,4'-trichlorodiphenylether (CD-22)	<0.6	-	<3.4	-	<1.7	-
2,4,4'-trichlorodiphenylether (CD-28)	21.4	1.15	8.9	0.68	3.5	0.09
2,4',6-trichlorodiphenylether (CD-32)	<0.6	-	<3.4	-	<1.7	-
2',3,4-trichlorodiphenylether (CD-33)	<0.6	-	<3.4	-	<1.7	-
3,3',4-trichlorodiphenylether (CD-35)	<0.6	-	<3.4	-	<1.7	-
3,4,4'-trichlorodiphenylether (CD-37)	1.6	0.09	<3.4	-	<1.7	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	51.1	2.75	56.5	4.31	28.3	0.71
2,2',4,5'-tetrachlorodiphenylether (CD-49)	2.3	0.12	<2.4	-	<1.0	-
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<0.3	-	<2.4	-	<1.0	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	<0.3	-	<2.4	-	<1.0	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.3	-	<2.4	-	<1.0	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	0.4		<2.4	-	<1.0	-
2,4,4',6-tetrachlorodiphenylether (CD-75)	2.1	0.11	<2.4	-	1.1	0.03
2,3',4',6-tetrachlorodiphenylether (CD-71)	<0.3	-	<2.4	-	<1.0	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	9.5	0.51	11.5	0.88	5.4	0.14
2,3',4,4'-tetrachlorodiphenylether (CD-66)	13.3	0.72	8.5	0.65	11	0.28
3,3',4,4'-tetrachlorodiphenylether (CD-77)	1.8	0.10	<2.4	-	<1.0	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<2.0	-	<1.6	-	<1.6	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	37.7	2.03	45.4	3.46	37.5	0.95
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<0.2	-	<1.1	-	<0.4	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	2.7	0.15	2.8	0.21	4.3	0.11
2,2',4,4',6-pentachlorodiphenylether (CD-100)	14.8	0.80	9	0.69	13.6	0.34
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	1.8	0.10	<1.1	-	3.8	0.10
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NDR (4.6)	-	10.6	0.81	4.2	0.11
2,3',4,4',6-pentachlorodiphenylether (CD-119)	1.9	0.10	<1.1	-	2.6	0.07
2,2',4,4',5-pentachlorodiphenylether (CD-99)	323.7	17.41	270.2	20.59	586.7	14.81
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<0.2	-	<1.1	-	<0.4	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	36.4	1.96	36	2.74	89.7	2.26
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<2.0	-	<1.6	-	<1.6	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	11.4	0.61	8	0.61	27	0.68
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	9.5	0.51	4	0.30	9.8	0.25
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	75.9	4.08	42	3.20	230.6	5.82
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	18.2	0.98	9.5	0.72	19.1	0.48
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	15.9	0.86	2.8	0.21	37.4	0.94

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	GEORGIA STRAIT:				BURRARD INLET:	
Location	Sandheads (Stn. C8)	Percent Contribution	Sechelt Bay (Stn. C9)	Percent Contribution	Bedwell Bay (Stn. C1)	Percent Contribution
Species Tissue	Dungeness crab hepatopancreas		Dungeness crab hepatopancreas		Dungeness crab hepatopancreas	
Date	Sept. 16, 1993		Mar. 5, 1994		Mar. 28, 1994	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	152.4	8.20	57.8	4.40	159.1	4.02
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	333.9	17.96	323.6	24.66	1310.7	33.09
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<1.3	-	1.9	0.14	4	0.10
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<1.3	-	<0.6	-	2.1	0.05
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	71.9	3.87	56.3	4.29	144.7	3.65
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NDR (4.7)	-	NDR (4.2)	-	8.7	0.22
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	48.4	2.60	18.7	1.43	148.3	3.74
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	<0.4	-	<0.3	-	NA	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	70.6	3.80	17.7	1.35	162.1	4.09
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	7.5	0.40	4.1	0.31	30.1	0.76
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	46	2.47	14.8	1.13	75	1.89
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	2.6	0.14	<0.3	-	<0.9	-
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	6.7	0.36	9.2	0.70	14.3	0.36
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	2.2	0.12	0.9	0.07	5.3	0.13
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	0.5	0.03	<0.3	-	<0.9	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	4.8	0.26	7.4	0.56	14	0.35
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	4.7	0.25	6.7	0.51	12.7	0.32
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	75.4	4.06	39.4	3.00	105.9	2.67
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	150.4	8.09	84.8	6.46	237.5	6.00
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	4.6	0.25	3.4	0.26	13.9	0.35
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	37.6	2.02	23.6	1.80	119.6	3.02
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	78.9	4.24	13.2	1.01	141.7	3.58
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	3.1	0.17	3.4	0.26	4.2	0.11
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	67.4	3.63	45.6	3.48	86	2.17
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	25.3	1.36	42.6	3.25	26.8	0.68
Decachlorodiphenylether (CD-209)	8.5	0.46	11.4	0.87	18.6	0.47
Total	1859.3	100.00	1312.2	100.00	3960.9	100.00

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	HOWE SOUND:			
Location	Trawl #9 (Stn. S4)	Percent Contribution	Trawl #1 (Stn. RS)	Percent Contribution
Species	English sole		Red snapper	
Tissue	liver		liver	
Date	Oct. 22, 1992		Oct. 20, 1992	
Diphenyl Compounds:				
2-monochlorodiphenylether (CD-1)	<0.2	-	<0.1	-
3-monochlorodiphenylether (CD-2)	<0.2	-	<0.1	-
4-monochlorodiphenylether (CD-3)	<0.2	-	<0.1	-
2,4-dichlorodiphenylether (CD-7)	<0.3	-	<0.1	-
2,4'-dichlorodiphenylether (CD-8)	<0.3	-	<0.1	-
3,4'-dichlorodiphenylether (CD-13)	<0.3	-	<0.1	-
4,4'-dichlorodiphenylether (CD-15)	<0.3	-	<0.1	-
2,2',3-trichlorodiphenylether (CD-16)	<0.4	-	<0.3	-
2,2',4-trichlorodiphenylether (CD-17)	<0.4	-	NDR (0.4)	-
2,3,4'-trichlorodiphenylether (CD-22)	<0.4	-	<0.3	-
2,4,4'-trichlorodiphenylether (CD-28)	2.8	0.05	4.6	0.24
2,4',6-trichlorodiphenylether (CD-32)	<0.4	-	<0.3	-
2',3,4-trichlorodiphenylether (CD-33)	<0.4	-	<0.3	-
3,3',4-trichlorodiphenylether (CD-35)	<0.4	-	0.4	0.02
3,4,4'-trichlorodiphenylether (CD-37)	<0.4	-	<0.3	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	22.1	0.41	18.5	0.98
2,2',4,5'-tetrachlorodiphenylether (CD-49)	2.7	0.05	1.3	0.07
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<0.1	-	<0.3	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	<0.1	-	NDR (1.2)	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.1	-	<0.3	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	0.2	0.00	1.2	0.06
2,4,4',6-tetrachlorodiphenylether (CD-75)	1.5	0.03	0.6	0.03
2,3',4',6-tetrachlorodiphenylether (CD-71)	<0.1	-	<0.3	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	2.1	0.04	2.6	0.14
2,3',4,4'-tetrachlorodiphenylether (CD-66)	4.1	0.08	4.1	0.22
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<0.1	-	<0.3	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<1.1	-	<1.8	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	38	0.70	23.3	1.24
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	<1.1	-	<1.8	-
2,2',3,4',5-pentachlorodiphenylether (CD-90)	2.4	0.04	1.3	0.07
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	69.7	1.28	23.3	1.24
2,2',4,4',6-pentachlorodiphenylether (CD-100)	3.6	0.07	0.8	0.04
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	2	0.04	NDR (4.3)	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	5.3	0.10	1.4	0.07
2,2',4,4',5-pentachlorodiphenylether (CD-99)	272	4.99	173.1	9.21
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<1.1	-	<0.5	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	30.8	0.57	18.2	0.97
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<1.1	-	<1.8	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	29.2	0.54	12.8	0.68
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	18.9	0.35	11.2	0.60
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	124.7	2.29	68.7	3.66
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	116.7	2.14	60.4	3.21
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	54.2	0.99	13	0.69

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	HOWE SOUND:			
Location	Trawl #9 (Stn. S4)	Percent Contribution	Trawl #1 (Stn. RS)	Percent Contribution
Species	English sole		English sole	
Tissue	liver		liver	
Date	Oct. 22, 1992		Oct. 20, 1992	
Diphenyl Compounds:				
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	502.2	9.22	111.3	5.92
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	528.3	9.70	267.5	14.24
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	3.3	0.06	2.3	0.12
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	0.8	0.01	<1.0	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	247.9	4.55	115.8	6.16
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	3.6	0.07	2.1	0.11
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	123.2	2.26	41.9	2.23
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	<0.6	-	<0.4	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	291.4	5.35	93.9	5.00
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	12.2	0.22	3.7	0.20
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	766.4	14.07	222.8	11.86
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	3.2	0.06	1	0.05
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	34.5	0.63	11.6	0.62
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	3.4	0.06	1.3	0.07
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<0.6	-	<0.4	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	10	0.18	3	0.16
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	14.8	0.27	3.4	0.18
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	667	12.24	197.6	10.52
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	459.6	8.43	153.8	8.19
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	7.8	0.14	1.8	0.10
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	85	1.56	25.9	1.38
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	230.1	4.22	58.7	3.12
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	9.1	0.17	1.4	0.07
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	507.1	9.31	94.5	5.03
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	82	1.50	14.6	0.78
Decachlorodiphenylether (CD-209)	53	0.97	8.1	0.43
Total	5448.9	100.00	1878.8	100.00

Appendix 5.2b — Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	KITIMAT AREA:		PRINCE RUPERT AREA:	
Location	Crab River at Garden Channel (Stn. C3)	Percent Contribution	PCT 7,9 & 12 (Stn. C7)	Percent Contribution
Species	Dungeness crab		Dungeness crab	
Tissue	hepatopancreas		hepatopancreas	
Date	July 23, 1993		May 12, 1995	
Diphenyl Compounds:				
2-monochlorodiphenylether (CD-1)	<0.1	-	<0.2	-
3-monochlorodiphenylether (CD-2)	<0.1	-	<0.2	-
4-monochlorodiphenylether (CD-3)	<0.1	-	<0.2	-
2,4-dichlorodiphenylether (CD-7)	<0.1	-	<0.3	-
2,4'-dichlorodiphenylether (CD-8)	<0.1	-	<0.3	-
3,4'-dichlorodiphenylether (CD-13)	<0.1	-	<0.3	-
4,4'-dichlorodiphenylether (CD-15)	<0.1	-	<0.3	-
2,2',3-trichlorodiphenylether (CD-16)	<0.2	-	<0.4	-
2,2',4-trichlorodiphenylether (CD-17)	<0.2	-	<0.4	-
2,3,4'-trichlorodiphenylether (CD-22)	<0.2	-	<0.4	-
2,4,4'-trichlorodiphenylether (CD-28)	0.8	1.24	NDR (0.9)	-
2,4',6-trichlorodiphenylether (CD-32)	<0.2	-	<0.4	-
2',3,4-trichlorodiphenylether (CD-33)	<0.2	-	<0.4	-
3,3',4-trichlorodiphenylether (CD-35)	<0.2	-	<0.4	-
3,4,4'-trichlorodiphenylether (CD-37)	<0.2	-	<0.4	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	3	4.66	4.6	1.20
2,2',4,5'-tetrachlorodiphenylether (CD-49)	0.6	0.93	0.5	0.13
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<0.1	-	<0.2	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NDR (0.5)	-	<0.2	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.1	-	<0.2	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	<0.1	-	0.3	0.08
2,4,4',6-tetrachlorodiphenylether (CD-75)	0.3	0.47	0.4	0.10
2,3',4',6-tetrachlorodiphenylether (CD-71)	<0.1	-	<0.2	-
2,4,4',5-tetrachlorodiphenylether (CD-74)	0.6	0.93	0.8	0.21
2,3',4,4'-tetrachlorodiphenylether (CD-66)	0.8	1.24	0.7	0.18
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<0.1	-	<0.2	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (CD-77/81)	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<0.3	-	<0.1	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	1.2	1.86	2.6	0.68
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<0.1	-	<0.1	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	0.2	0.31	0.3	0.08
2,2',4,4',6-pentachlorodiphenylether (CD-100)	0.3	0.47	1.4	0.37
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<0.1	-	<0.1	-
2,3,3',4,4'-pentachlorodiphenylether (CD-105)	NDR (0.8)	-	NDR (0.6)	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	<0.1	-	<0.1	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	13.1	20.34	39.8	10.42
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<0.1	-	<0.1	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	1.8	2.80	5.4	1.41
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<0.3	-	<0.1	-
2,2',3,3',4,4'-hexachlorodiphenylether (CD-128)	0.4	0.62	1.9	0.50
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	NDR (0.1)	-	0.8	0.21
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	3.5	5.43	12.7	3.32
2,2',3,4,4',6-hexachlorodiphenylether (CD-140)	3.1	4.81	4.4	1.15
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	0.6	0.93	3.7	0.97

Appendix 5.2b **Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)**

	KITIMAT AREA:		PRINCE RUPERT AREA:	
Location	**Crab River at Garden Channel (Stn. C3)**	**Percent Contribution**	**PCT 7,9 & 12 (Stn. C7)**	**Percent Contribution**
Species Tissue	**Dungeness crab hepatopancreas**		**Dungeness crab hepatopancreas**	
Date	**July 23, 1993**		**May 12, 1995**	
Diphenyl Compounds:				
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	3.7	5.75	24.6	6.44
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	19.5	30.28	69.7	18.25
2,2',4,4',5,5'-hexachlorodiphenylether (CD-153)	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	0.8	1.24	1.1	0.29
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<0.1	-	<0.3	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	0.7	1.09	15.7	4.11
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NDR (0.3)	-	NDR (0.9)	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	1	1.55	15.6	4.08
2,2',3,4,4',5,6,-heptachlorodiphenylether (CD-181)	<0.1	-	<0.4	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	1.8	2.80	21.4	5.60
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	0.3	0.47	2	0.52
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	0.3	0.47	18.5	4.84
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	<0.1	-	0.5	0.13
2,2',3,3',4,4',6-heptachlorodiphenylether (CD-171)	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<0.1	-	1.9	0.50
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	<0.1	-	0.6	0.16
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<0.1	-	<0.4	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	0.2	0.31	1.3	0.34
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	<0.1	-	1.6	0.42
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	0.6	0.93	18.1	4.74
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	2.2	3.42	28.7	7.51
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	0.1	0.16	0.7	0.18
2,2',3,4,4',5,5'-6-octachlorodiphenylether (CD-203)	0.8	1.24	9.2	2.41
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	0.8	1.24	13.9	3.64
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	<0.1	-	1.3	0.34
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	0.9	1.40	39	10.21
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	0.4	0.62	11.5	3.01
Decachlorodiphenylether (CD-209)	<0.2	-	4.8	1.26
Total	64.4	100.00	382	100.00

Appendix 5.2b

Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	VANCOUVER ISLAND (east coast):					
Location	Esquimalt Harbour Inskip Island (Stn. C4)	Percent Contribution	Esquimalt Harbour Middle harbour, inside boundary (Stn. C5)	Percent Contribution	Victoria Harbour Rose Bay (Stn. C10)	Percent Contribution
Species	Dungeness crab		Dungeness crab		Dungeness crab	
Tissue	heptaopancreas		heptaopancreas		hepatopancreas	
Date	Sept. 2, 1998		Sept. 2, 1998		Mar. 23, 1994	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	NA	-	<8.4	-	<0.3	-
3-monochlorodiphenylether (CD-2)	NA	-	<8.4	-	<0.3	-
4-monochlorodiphenylether (CD-3)	NA	-	<8.4	-	<0.3	-
2,4-dichlorodiphenylether (CD-7)	NA	-	<25.5	-	<0.4	-
2,4'-dichlorodiphenylether (CD-8)	NA	-	<25.5	-	<0.4	-
3,4'-dichlorodiphenylether (CD-13)	NA	-	<25.5	-	<0.4	-
4,4'-dichlorodiphenylether (CD-15)	NA	-	<25.5	-	<0.4	-
2,2',3-trichlorodiphenylether (CD-16)	NA	-	<5.9	-	<0.9	-
2,2',4-trichlorodiphenylether (CD-17)	NA	-	<5.9	-	<0.9	-
2,3,4'-trichlorodiphenylether (CD-22)	NA	-	<5.9	-	<0.9	-
2,4,4'-trichlorodiphenylether (CD-28)	NA	-	<5.9	-	4.7	0.06
2,4',6-trichlorodiphenylether (CD-32)	NA	-	<5.9	-	<0.9	-
2',3,4-trichlorodiphenylether (CD-33)	NA	-	<5.9	-	<0.9	-
3,3',4-trichlorodiphenylether (CD-35)	NA	-	<5.9	-	<0.9	-
3,4,4'-trichlorodiphenylether (CD-37)	NA	-	<5.9	-	<0.9	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	NA	-	<28.1	-	49.3	0.63
2,2',4,5'-tetrachlorodiphenylether (CD-49)	NA	-	<28.1	-	2.2	0.03
2,2',4,6'-tetrachlorodiphenylether (CD-51)	NA	-	<28.1	-	<0.4	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NA	-	<28.1	-	<0.4	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	NA	-	<28.1	-	2.4	0.03
2,3',4,5'-tetrachlorodiphenylether (CD-68)	NA	-	<28.1	-	1	0.01
2,4,4',6-tetrachlorodiphenylether (BZ 75)	NA	-	<28.1	-	1.6	0.02
2,3',4'6-tetrachlorodiphenylether (CD-71)	NA	-	<28.1	-	<0.4	-
2,4,4'5-tetrachlorodiphenylether (CD-74)	NA	-	<28.1	-	17.2	0.22
2,3',4,4'-tetrachlorodiphenylether (CD-66)	NA	-	<28.1	-	27	0.35
3,3',4,4'-tetrachlorodiphenylether (CD-77)	NA	-	<28.1	-	4	0.05
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (BZ 77/81)	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	NA	-	<3.3	-	<1.8	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	NA	-	<3.3	-	120.4	1.55
2,2',3,4',5-pentachlorodiphenylether (CD-90)	NA		<3.3	-	<0.2	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	NA		<3.3	-	5	0.06
2,2',4,4',6-pentachlorodiphenylether (CD-100)	NA	-	<3.3	-	18.7	0.24
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	NA	-	<3.3	-	12.2	0.16
2,3,3',4,4'-pentachlordiphenylether (CD-105)	NA	-	<3.3	-	8.2	0.11
2,3',4,4',6-pentachlorodiphenylether (CD-119)	NA	-	<3.3	-	4	0.05
2,2',4,4',5-pentachlorodiphenylether (CD-99)	NA	-	<3.3	-	1430.8	18.36
2,3,4,5,6-pentachlorodiphenylether (CD-116)	NA	-	<3.3	-	<0.2	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	NA	-	<3.3	-	183.1	2.35
3,3',4,4',5-pentachlorodiphenylether (CD-126)	NA	-	<3.3	-	<1.8	-
2,2'3,3',4,4'-hexachlordiphenylether (CD-128)	11.3	15.15	15	7.64	72	0.92
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	<6.7	-	<5.7	-	38.5	0.49
2.2'.3.4.4',5'-hexachlorodiphenylether (CD-138)	16.3	21.85	12	6.11	492.3	6.32
2,2',3,4,4',6'-hexachlorodiphenylether (CD-140)	<6.7	-	<5.7	-	32.7	0.42
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	<6.7	-	8.8	4.48	90.8	1.17

Appendix 5.2b   **Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)**

	VANCOUVER ISLAND (east coast):					
Location	**Esquimalt Harbour Inskip Island (Stn. C4)**	**Percent Contribution**	**Esquimalt Harbour Middle harbour, Inside boundary (Stn. C5)**	**Percent Contribution**	**Victoria Harbour Rose Bay (Stn. C10)**	**Percent Contribution**
Species / Tissue	**Dungeness crab heptaopancreas**		**Dungeness crab heptaopancreas**		**Dungeness crab hepatopancreas**	
Date	**Sept. 2, 1998**		**Sept. 2, 1998**		**Mar. 23, 1994**	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	<6.7	-	126.3	64.34	448	5.75
2,2',3,4',5,6-/2,2',4,4',5.5'-hexachlorodiphenylether (CD-147/153)	47	63.00	28.4	13.45	2375.8	30.49
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	<6.7	-	<5.7	-	6.2	0.08
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<6.7	-	<5.7	-	2.8	0.04
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	<6.7	-	<5.7	-	316.5	4.06
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	<6.7	-	<5.7	-	18.5	0.24
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	<3.4	-	<3.1	-	284.9	3.66
2,2',3,4,4',5,6-heptachlorodiphenylether (CD-181)	<3.4	-	<3.1	-	<1.7	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	<3.4	-	<3.1	-	392.8	5.04
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	<3.4	-	<3.1	-	52.9	0.68
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	<3.4	-	<3.1	-	69.1	0.89
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	<3.4	-	<3.1	-	5.3	0.07
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	<3.4	-	4.1	2.09	35.3	0.45
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	<3.4	-	<3.1	-	9.5	0.12
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<3.4	-	<3.1	-	<1.7	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	<2.7	-	3.7	1.88	19.7	0.25
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	<2.7	-	<2.5	-	17.3	0.22
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	<2.7	-	<2.5	-	102.2	1.31
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	<2.7	-	<2.5	-	348.6	4.47
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	<2.7	-	<2.5	-	23.4	0.30
2,2',3,4,4',5,5',6-octachlorodiphenylether (CD-203)	<2.7	-	<2.5	-	188.1	2.41
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	<2.7	-	<2.5	-	188.3	2.42
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	<3.5	-	<4.2	-	13.2	0.17
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	<3.5	-	<4.2	-	141.2	1.81
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	<3.5	-	<4.2	-	85.4	1.10
Decachlorodiphenylether (CD-209)	<9.3	-	<13.5	-	28.4	0.36
Total	74.6	100.00	196.3	100.00	7791.5	100.00

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	VANCOUVER ISLAND (east coast):					
Location	Cowichan Bay Trap #3 (Stn. C2)	Percent Contribution	Crofton (Stn. S3)	Percent Contribution	Mill Bay (Stn. S5)	Percent Contribution
Species	Dungeness crab		English sole		English sole	
Tissue	heptaopancreas		liver		liver	
Date	Mar. 29, 1996		Nov. 24, 1992		Nov. 25, 1992	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<1.2	-	<3.0	-	<0.1	-
3-monochlorodiphenylether (CD-2)	<1.2	-	<3.0	-	<0.1	-
4-monochlorodiphenylether (CD-3)	<1.2	-	<3.0	-	<0.1	-
2,4-dichlorodiphenylether (CD-7)	<1.9	-	<4.2	-	<0.2	-
2,4'-dichlorodiphenylether (CD-8)	<1.9	-	<4.2	-	<0.2	-
3,4'-dichlorodiphenylether (CD-13)	<1.9	-	<4.2	-	<0.2	-
4,4'-dichlorodiphenylether (CD-15)	<1.9	-	<4.2	-	<0.2	-
2,2',3-trichlorodiphenylether (CD-16)	<1.8	-	<4.7	-	NDR (0.5)	-
2,2',4-trichlorodiphenylether (CD-17)	<1.8	-	<4.7	-	<0.3	-
2,3,4'-trichlorodiphenylether (CD-22)	<1.8	-	<4.7	-	<0.3	-
2,4,4'-trichlorodiphenylether (CD-28)	2.6	0.25	<4.7	-	2	0.16
2,4',6-trichlorodiphenylether (CD-32)	<1.8	-	<4.7	-	<0.3	-
2',3,4-trichlorodiphenylether (CD-33)	<1.8	-	<4.7	-	<0.3	-
3,3',4-trichlorodiphenylether (CD-35)	<1.8	-	<4.7	-	<0.3	-
3,4,4'-trichlorodiphenylether (CD-37)	<1.8	-	<4.7	-	<0.3	-
2,2',4,4'-tetrachlorodiphenylether (CD-47)	18.1	1.74	<3.5	-	8.8	0.71
2,2',4,5'-tetrachlorodiphenylether (CD-49)	<1.8	-	<3.5	-	0.8	0.06
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<1.8	-	<3.5	-	<0.2	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	<1.8	-	<3.5	-	<0.2	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<1.8	-	<3.5	-	<0.2	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	<1.8	-	<3.5	-	1.3	0.11
2,4,4',6-tetrachlorodiphenylether (BZ 75)	<1.8	-	<3.5	-	0.5	0.04
2,3',4'6-tetrachlorodiphenylether (CD-71)	<1.8	-	<3.5	-	<0.2	-
2,4,4'5-tetrachlorodiphenylether (CD-74)	NDR (3.2)	-	<3.5	-	1.4	0.11
2,3',4,4'-tetrachlorodiphenylether (CD-66)	3.9	0.37	<3.5	-	1.3	0.11
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<1.8	-	<3.5	-	<0.2	-
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (BZ 77/81)	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<1.4	-	<2.2	-	<0.7	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	17.5	1.68	4.8	0.93	13.9	1.13
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<1.4	-	<2.2	-	<0.1	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	2	0.19	<2.2	-	0.8	0.06
2,2',4,4',6-pentachlorodiphenylether (CD-100)	7.5	0.72	4.4	0.85	20.1	1.63
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	<1.4	-	<2.2	-	1.1	0.09
2,3,3',4,4'-pentachlordiphenylether (CD-105)	2.2	0.21	<2.2	-	NDR (1.9)	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	1.4	0.13	<2.2	-	1.4	0.11
2,2',4,4',5-pentachlorodiphenylether (CD-99)	163.8	15.74	23.7	4.60	90.3	7.32
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<1.4	-	<2.2	-	<0.1	-
2,3',4,4',5-pentachlorodiphenylether (CD-118)	14.8	1.42	3.6	0.70	6.8	0.55
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<1.4	-	<2.2	-	<0.7	-
2,2'3,3',4,4'-hexachlordiphenylether (CD-128)	7.1	0.68	2.7	0.52	7.3	0.59
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	3.3	0.32	2.4	0.47	6.5	0.53
2,2',3,4,4',5'-hexachlorodiphenylether (CD-138)	50.1	4.81	8.8	1.71	32.4	2.63
2,2',3,4,4',6'-hexachlorodiphenylether (CD-140)	9.8	0.94	6.7	1.30	29.3	2.37
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	14.5	1.39	<1.9	-	13.3	1.08

Appendix 5.2b

Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	VANCOUVER ISLAND (east coast):					
Location	Cowichan Bay Trap #3 (Stn. C2)	Percent Contribution	Crofton (Stn. S3)	Percent Contribution	Mill Bay (Stn. S5)	Percent Contribution
Species / Tissue	Dungeness crab heptaopancreas		English sole liver		English sole liver	
Date	Mar. 29, 1996		Nov. 24, 1992		Nov. 25, 1992	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	88	8.46	16.6	3.22	122.1	9.89
2,2',3,4',5,6-/2,2',4,4',5.5'-hexachlorodiphenylether (CD-147/153)	217.9	20.94	26.2	5.08	122.3	9.91
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	2	0.19	22.7	4.41	2	0.16
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<1.1	-	<1.9	-	<0.3	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	48.9	4.70	11.7	2.27	69.5	5.63
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	NDR (2.4)	-	<1.9	-	NDR (1.8)	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	30.4	2.92	9.3	1.80	19.9	1.61
2,2',3,4,4',5,6-heptachlorodiphenylether (CD-181)	<1.0	-	<2.5	-	<0.1	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	60	5.77	19.7	3.82	58.8	4.76
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	7.1	0.68	3.1	0.60	2.7	0.22
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	27.6	2.65	50	9.70	102	8.26
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	<1.0	-	2.5	0.49	0.7	0.06
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	3.6	0.35	7	1.36	6.3	0.51
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	1	0.10	3.5	0.68	1	0.08
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<1.0	-	<2.5	-	<0.1	-
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	4.4	0.42	<3.2	-	2.2	0.18
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	2.4	0.23	4.6	0.89	4.1	0.33
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	30.5	2.93	60.9	11.82	121.1	9.81
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	68.5	6.58	61.1	11.86	93.6	7.58
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	2.6	0.25	<3.2	-	2.1	0.17
2,2',3,4,4',5,5',6-octachlorodiphenylether (CD-203)	11.4	1.10	8.2	1.59	13.4	1.09
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	39.2	3.77	23.2	4.50	28.5	2.31
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	NDR (0.9)	-	<1.6	-	2.7	0.22
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	54.1	5.20	80.9	15.70	151.1	12.24
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	15.4	1.48	25.3	4.91	42.7	3.46
Decachlorodiphenylether (CD-209)	7	0.67	21.7	4.21	26.1	2.11
Total	1040.6	100.00	515.3	100.00	1234.2	100.00

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

	VANCOUVER ISLAND (west coast):					
Location	Bamfield middle channel (Stn. S1/S2)	Percent Contribution	Lab duplicate (Stn. S1/S2)	Percent Contribution	Gold River at mouth (Stn. C6)	Percent Contribution
Species	English sole		English sole		Dungeness crab	
Tissue	liver		liver		hepatopancreas	
Date	Nov. 4, 1992		Nov. 4, 1992		Feb. 14, 1989	
Diphenyl Compounds:						
2-monochlorodiphenylether (CD-1)	<0.1	-	<0.3	-	NDR (11.7)	-
3-monochlorodiphenylether (CD-2)	<0.1	-	<0.3	-	<2.0	-
4-monochlorodiphenylether (CD-3)	<0.1	-	<0.3	-	<2.0	-
2,4-dichlorodiphenylether (CD-7)	<0.2	-	<0.4	-	<1.1	-
2,4'-dichlorodiphenylether (CD-8)	<0.2	-	<0.4	-	NDR (49.1)	-
3,4'-dichlorodiphenylether (CD-13)	<0.2	-	<0.4	-	<1.1	-
4,4'-dichlorodiphenylether (CD-15)	<0.2	-	<0.4	-	<1.1	-
2,2',3-trichlorodiphenylether (CD-16)	0.3	0.07	0.7	0.18	<0.3	-
2,2',4-trichlorodiphenylether (CD-17)	<0.3	-	<0.5	-	1.7	0.17
2,3,4'-trichlorodiphenylether (CD-22)	<0.3	-	<0.5	-	<0.3	-
2,4,4'-trichlorodiphenylether (CD-28)	0.6	0.15	0.6	0.15	95.6	9.49
2,4',6-trichlorodiphenylether (CD-32)	<0.3	-	<0.5	-	<0.3	-
2',3,4-trichlorodiphenylether (CD-33)	<0.3	-	<0.5	-	<0.3	-
3,3',4-trichlorodiphenylether (CD-35)	<0.3	-	<0.5	-	<0.3	-
3,4,4'-trichlorodiphenylether (CD-37)	<0.3	-	<0.5	-	0.6	0.06
2,2',4,4'-tetrachlorodiphenylether (CD-47)	2.9	0.72	3.1	0.78	129.9	12.90
2,2',4,5'-tetrachlorodiphenylether (CD-49)	<0.1	-	<0.3	-	1.6	0.16
2,2',4,6'-tetrachlorodiphenylether (CD-51)	<0.1	-	<0.3	-	<0.1	-
2,3,4,6-tetrachlorodiphenylether (CD-62)	NDR (1.3)	-	<0.3	-	<0.1	-
2,3',4,5-tetrachlorodiphenylether (CD-67)	<0.1	-	<0.3	-	<0.1	-
2,3',4,5'-tetrachlorodiphenylether (CD-68)	0.6	0.15	<0.3	-	0.3	0.03
2,4,4',6-tetrachlorodiphenylether (CD-75)	0.2	0.05	<0.3	-	3.2	0.32
2,3',4'6-tetrachlorodiphenylether (CD-71)	<0.1	-	<0.3	-	<0.1	-
2,4,4'5-tetrachlorodiphenylether (CD-74)	0.5	0.12	0.6	0.15	8.6	0.85
2,3',4,4'-tetrachlorodiphenylether (CD-66)	0.6	0.15	<0.3	-	4	0.40
3,3',4,4'-tetrachlorodiphenylether (CD-77)	<0.1	-	<0.3	-	1.7	0.17
3,3',4,4'-/3,4,4',5-tetrachlorodiphenylether (BZ 77/81)	NA	-	NA	-	NA	-
2,2',3,4,6'-pentachlorodiphenylether (CD-89)	<0.3	-	<0.5	-	<1.5	-
2,2',3,4,4'-pentachlorodiphenylether (CD-85)	2.6	0.64	2.8	0.71	91	9.03
2,2',3,4',5-pentachlorodiphenylether (CD-90)	<0.3	-	<0.5	-	<1.5	-
2,2',4,5,5'-pentachlorodiphenylether (CD-101)	0.4	0.10	<0.5	-	<0.8	-
2,2',4,4',6-pentachlorodiphenylether (CD-100)	4.4	1.09	4.1	1.04	1.8	0.18
2,2',4,5,6'-pentachlorodiphenylether (CD-102)	0.5	0.12	<0.5	-	<0.8	-
2,3,3',4,4'-pentachlordiphenylether (CD-105)	NDR (0.7)	-	NDR (1.1)	-	2.1	0.21
2,3,4,5,6-pentachlorodiphenylether (CD-116)	<0.3	-	<0.5	-	<0.8	-
2,3',4,4',6-pentachlorodiphenylether (CD-119)	NDR (0.3)	-	<0.5	-	NDR (6.2)	-
2,2',4,4',5-pentachlorodiphenylether (CD-99)	19.3	4.76	18.4	4.66	70.1	6.96
2,3',4,4',5-pentachlorodiphenylether (CD-118)	2	0.49	1.5	0.38	9.4	0.93
3,3',4,4',5-pentachlorodiphenylether (CD-126)	<0.3	-	6.4	1.62	<1.5	-
2,2'3,3',4,4'-hexachlordiphenylether (CD-128)	1.7	0.42	<0.3	-	1.4	0.14
2,2',3,4,4',5-hexachlorodiphenylether (CD-137)	1	0.25	1	0.25	1.2	0.12
2,2'.3.4.4',5'-hexachlorodiphenylether (CD-138)	7.4	1.83	7.6	1.92	17.6	1.75
2,2',3,4,4',6'-hexachlorodiphenylether (CD-140)	7.3	1.80	7.2	1.82	8	0.79
2,2',3,4',6,6'-hexachlorodiphenylether (CD-150)	3.8	0.94	3.9	0.99	59.9	5.95

Appendix 5.2b Chlorinated Diphenyl Ether Concentrations (pg/g wet weight) in BC Aquatic Biota and Percent Contributions of Individual Isomers to the Total Concentration (Department of Fisheries and Oceans data)

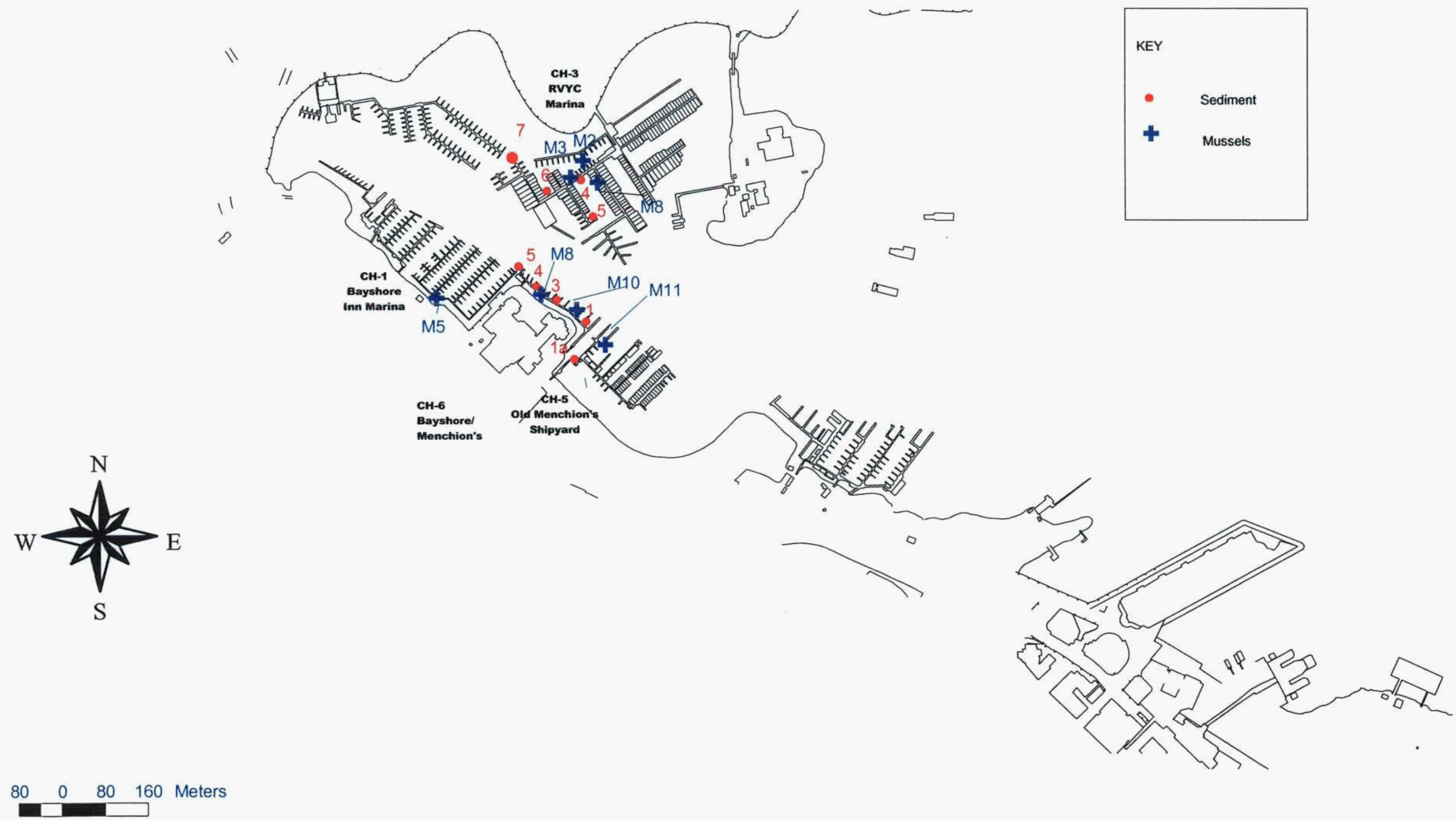
	VANCOUVER ISLAND (west coast):					
Location	Bamfield middle channel (Stn. S1/S2)	Percent Contribution	Lab duplicate (Stn. S1/S2)	Percent Contribution	Gold River at mouth (Stn. C6)	Percent Contribution
Species / Tissue	English sole liver		English sole liver		Dungeness crab hepatopancreas	
Date	Nov. 4, 1992		Nov. 4, 1992		Feb. 14, 1989	
Diphenyl Compounds:						
2,2',4,4',5,6'-hexachlorodiphenylether (CD-154)	14.2	3.51	20	5.06	64.5	6.40
2,2',3,4',5,6-/2,2',4,4',5,5'-hexachlorodiphenylether (CD-147/153)	25.7	6.34	28.4	7.19	113.6	11.28
2,2',4,4',5,5'-hexachlorodiphenylether (BZ 153)	NA	-	NA	-	NA	-
2,3,3',4,4',5-hexachlorodiphenylether (CD-156)	1.6	0.39	2.4	0.61	1.8	0.18
2,3,3',4,4',5'-hexachlorodiphenylether (CD-157)	<0.1	-	<0.3	-	<0.2	-
2,3,3',4',5,6-hexachlorodiphenylether (CD-163)	11.5	2.84	12.7	3.22	21.5	2.13
2,3',4,4',5,5'-hexachlorodiphenylether (CD-167)	0.4	0.10	0.3	0.08	NDR (1.7)	-
2,2',3,4,4',5,5'-heptachlorodiphenylether (CD-180)	5.1	1.26	<0.2	-	12.1	1.20
2,2',3,4,4',5,6-heptachlorodiphenylether (CD-181)	<0.2	-	<0.2	-	<0.1	-
2,2',3,4,4',6,6'-heptachlorodiphenylether (CD-184)	19.6	4.84	17.3	4.38	25.9	2.57
2,2',3,4,5,5',6-heptachlorodiphenylether (CD-187)	1	0.25	1.1	0.28	1.6	0.16
2,2',3,4,4',5,6'-/2,2',3,3',4,4',6-heptachlorodiphenylether (CD-182/171)	27.2	6.71	25.1	6.35	61.2	6.08
2,2',3,3',4,4',5'-heptachlorodiphenylether (CD-172)	0.5	0.12	<0.2	-	0.4	0.04
2,2',3,3',4,4',6-heptachlorodiphenylether (BZ 171)	NA	-	NA	-	NA	-
2,2',3,3',4,4',5-heptachlorodiphenylether (CD-170)	1.6	0.39	1.7	0.43	1.7	0.17
2,2',3,3',4',5,6-heptachlorodiphenylether (CD-177)	0.6	0.15	<0.2	-	0.4	0.04
2,3,3',4,4',5,6-heptachlorodiphenylether (CD-190)	<0.2	-	3.1	0.78	0.1	0.01
2,2',3,3',4,4',5,5'-octachlorodiphenylether (CD-194)	1.2	0.30	1	0.25	0.9	0.09
2,2',3,3',4,4',5,6-octachlorodiphenylether (CD-195)	1.6	0.39	2.7	0.68	0.7	0.07
2,2',3,3',4,4',5',6-octachlorodiphenylether (CD-196)	47	11.60	22.4	5.67	78.1	7.75
2,2',3,3',4,4',6,6'-octachlorodiphenylether (CD-197)	58.1	14.34	56.2	14.23	53.6	5.32
2,2',3,3',4',5,5',6-octachlorodiphenylether (CD-201)	1.5	0.37	1.3	0.33	0.5	0.05
2,2',3,4,4',5,5',6-octachlorodiphenylether (CD-203)	7.7	1.90	8	2.03	6.4	0.64
2,2',3,4,4',5,6,6'-octachlorodiphenylether (CD-204)	12.6	3.11	12.2	3.09	22.7	2.25
2,2',3,3',4,5,5',6,6'-nonachlorodiphenylether (CD-208)	1.9	0.47	2.1	0.53	0.4	0.04
2,2',3,3',4,4',5,6,6'-nonachlorodiphenylether (CD-207)	70.4	17.38	77.2	19.54	23.3	2.31
2,2',3,3',4,4',5,5',6-nonachlorodiphenylether (CD-206)	19.3	4.76	18.1	4.58	4.4	0.44
Decachlorodiphenylether (CD-209)	18.7	4.62	23.8	6.03	1.7	0.17
Total	405.1	100.00	395	100.00	1007.2	100.00

NDR - detected but did not meet quantification limit
ND - not detected
(#) - total CDPE concentration including NDR values
NA - not analyzed for

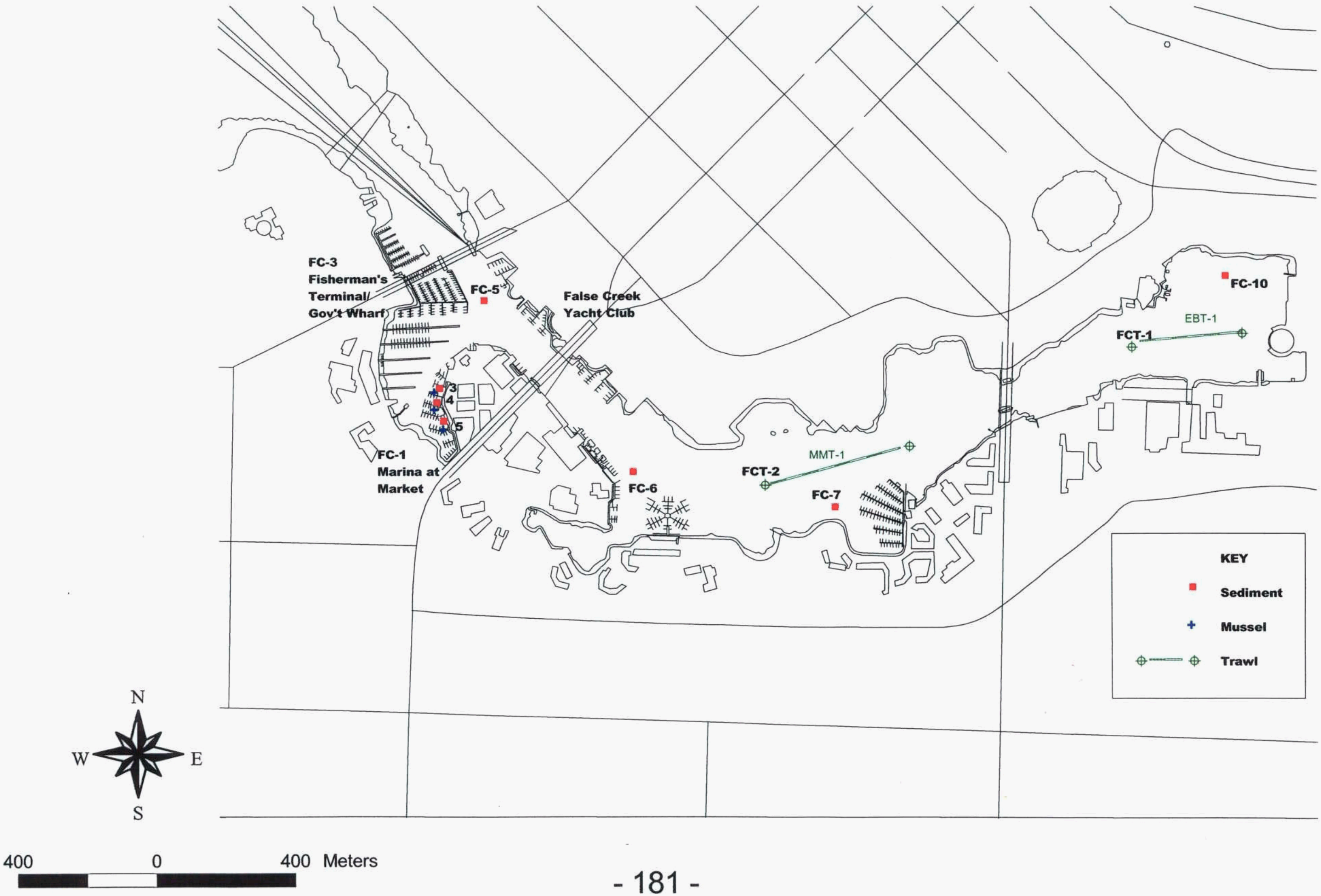
SITE LOCATION

MAPS

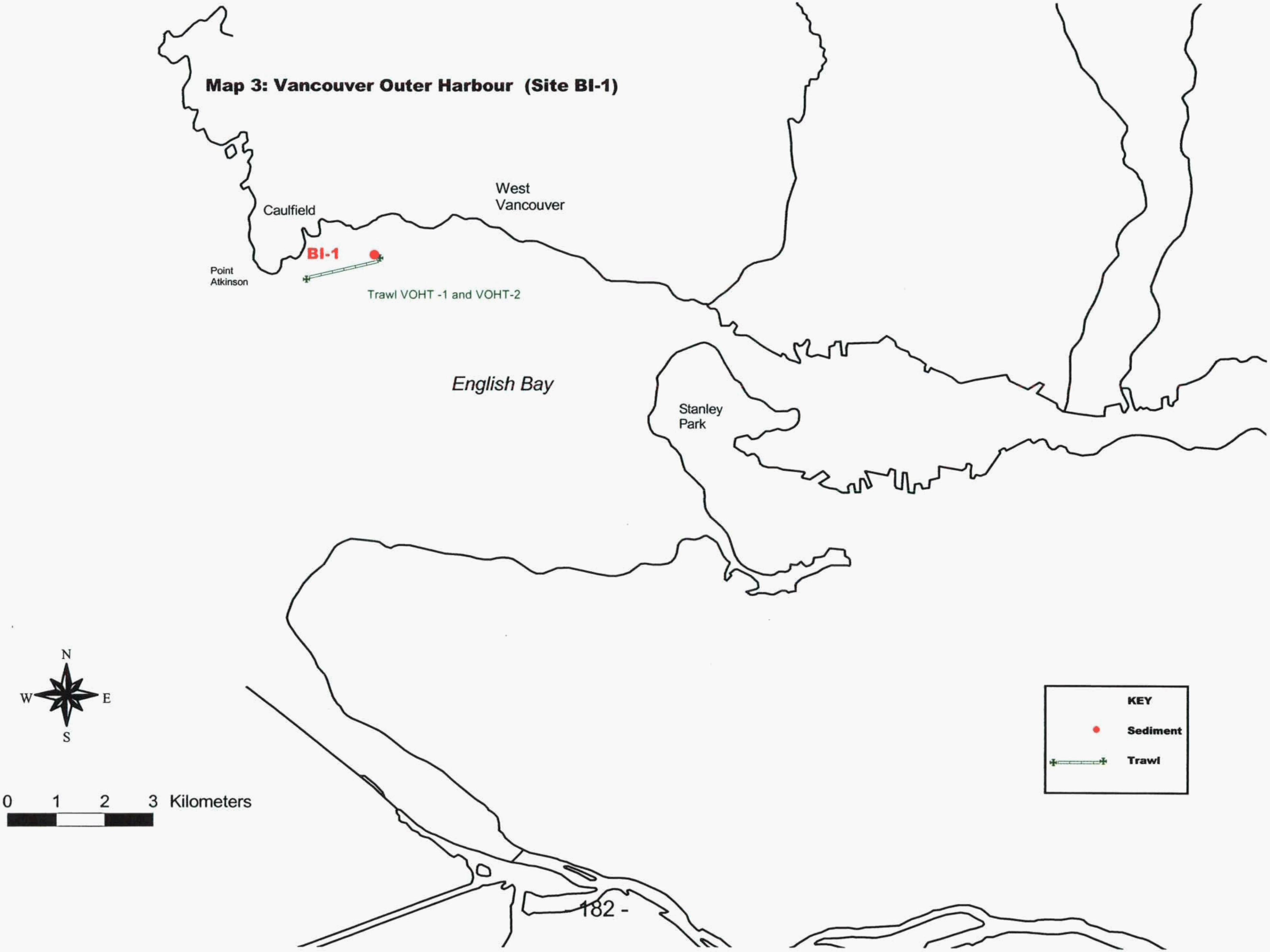
Map 1 : Coal Harbour Sampling Locations (CH-1-CH-5)



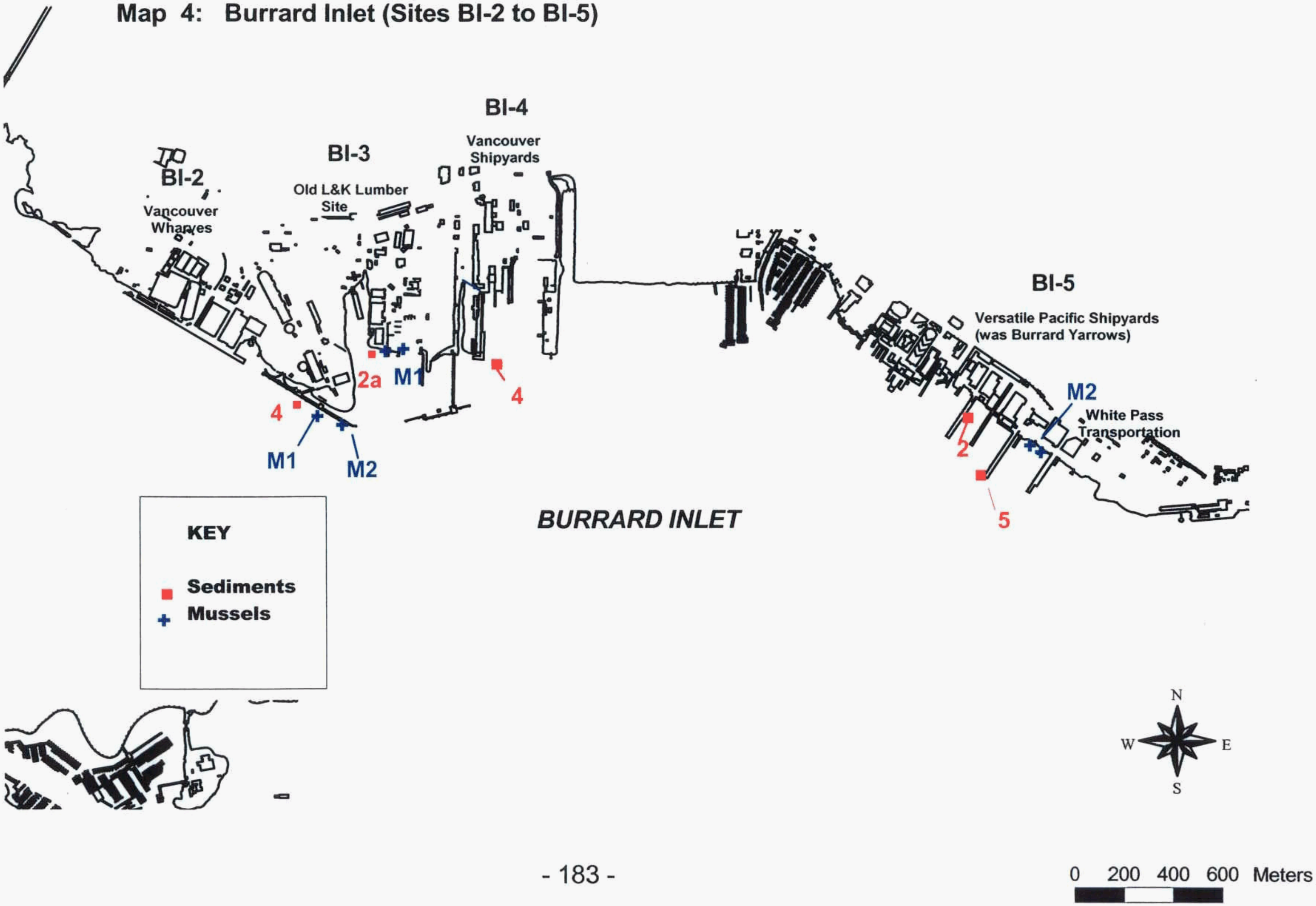
Map 2 : False Creek (FC-1 to FC-10)



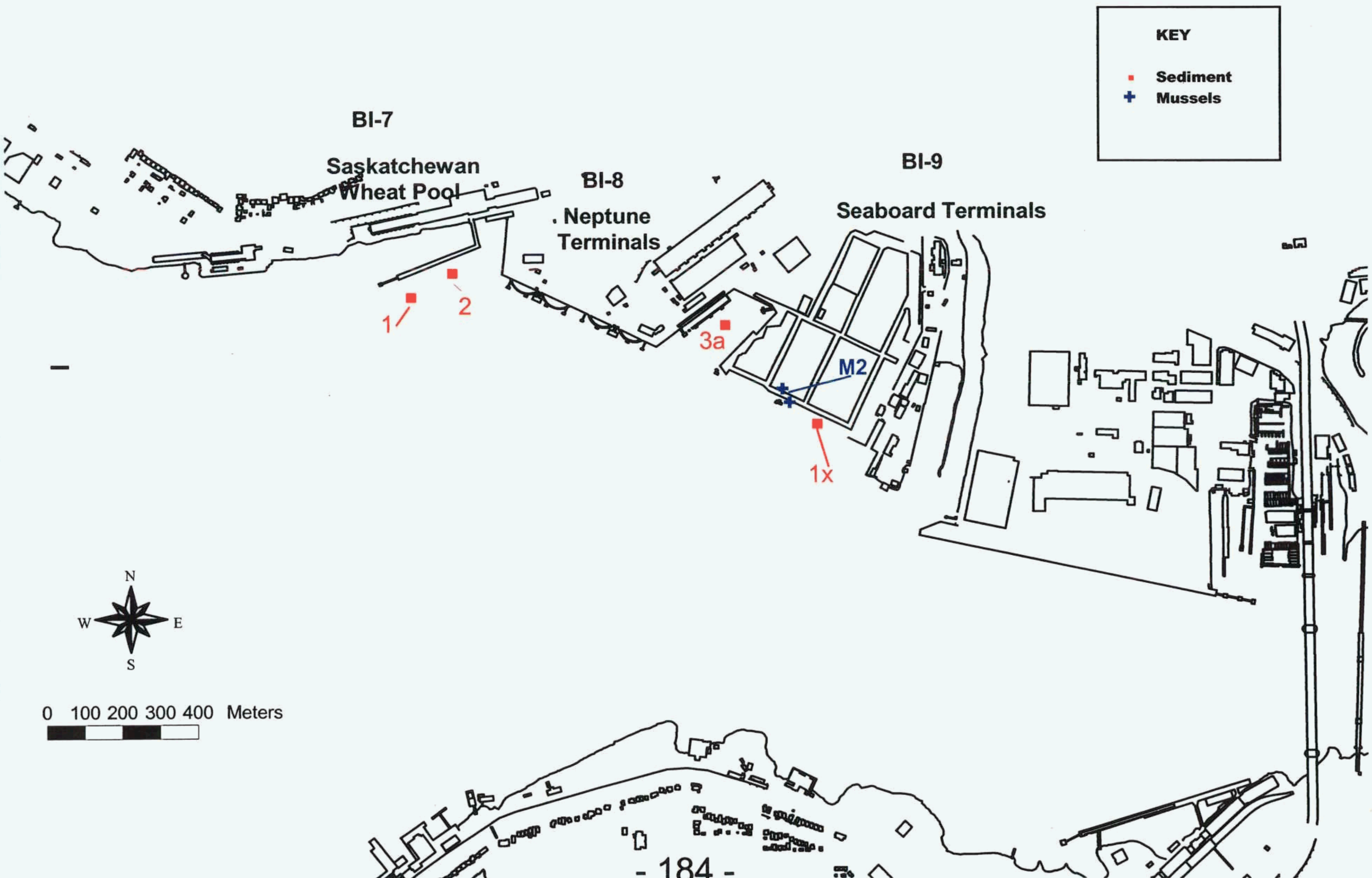
Map 3: Vancouver Outer Harbour (Site BI-1)



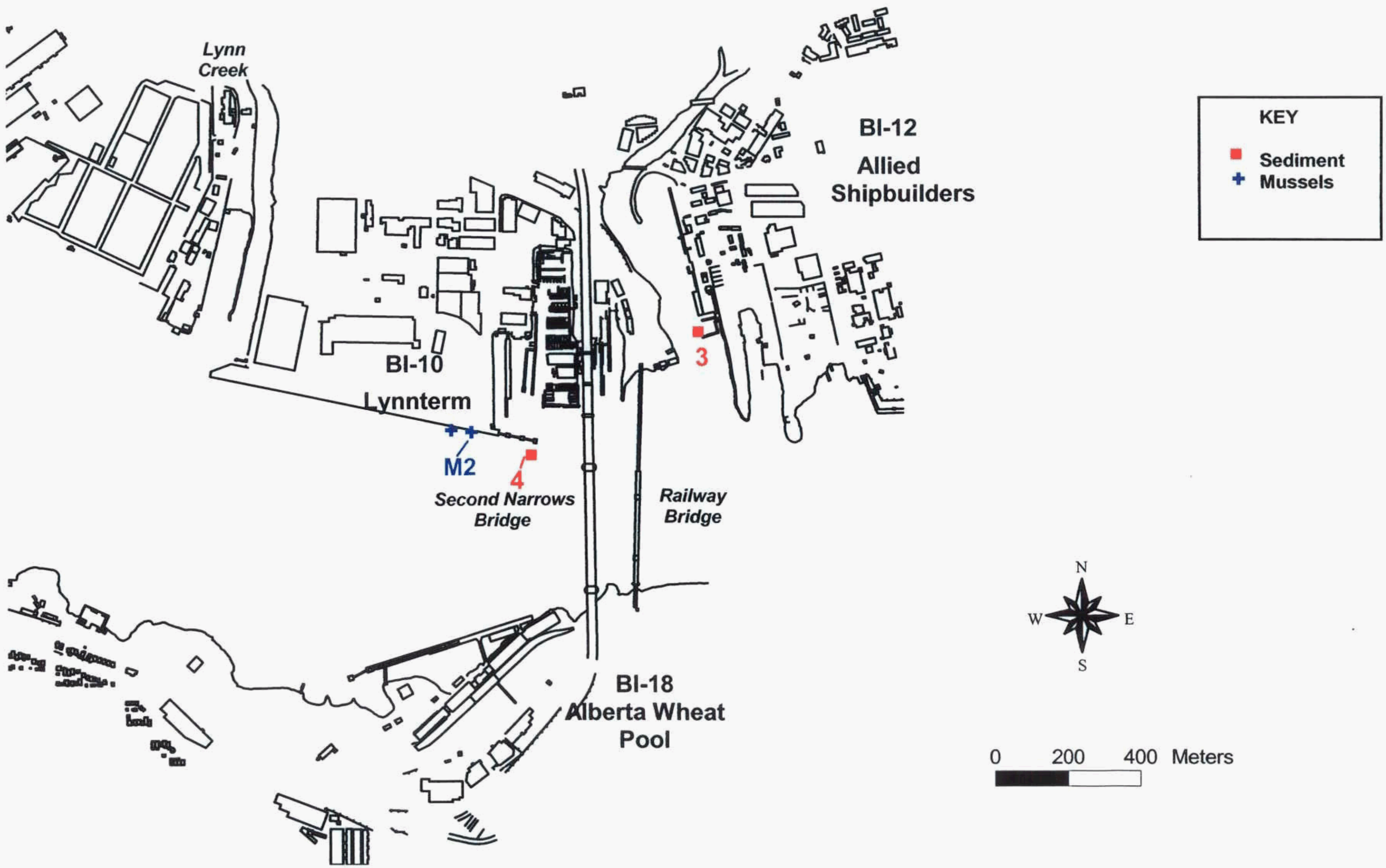
Map 4: Burrard Inlet (Sites BI-2 to BI-5)



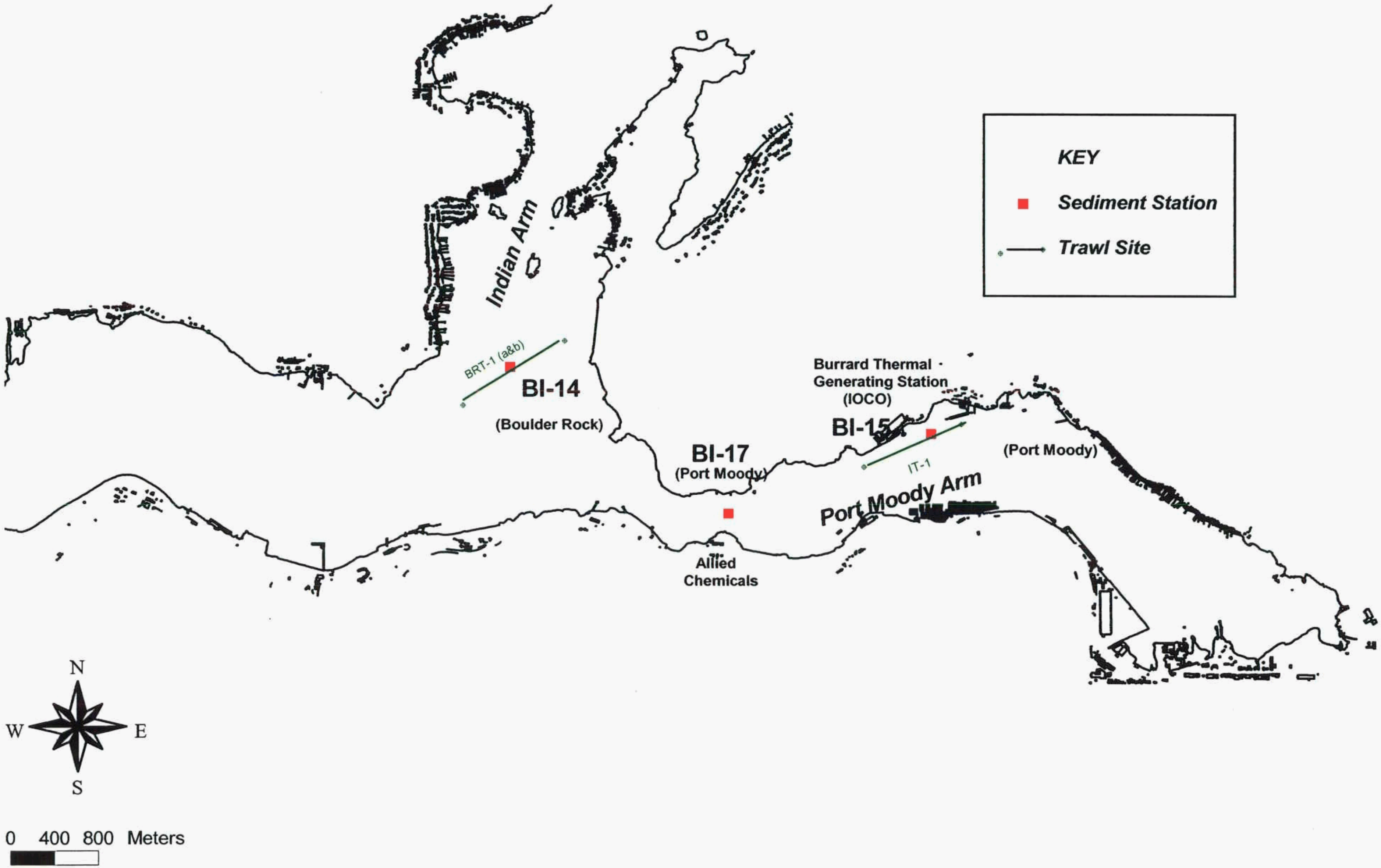
Map 5: Burrard Inlet (Sites BI-7, BI-8, and BI-9)



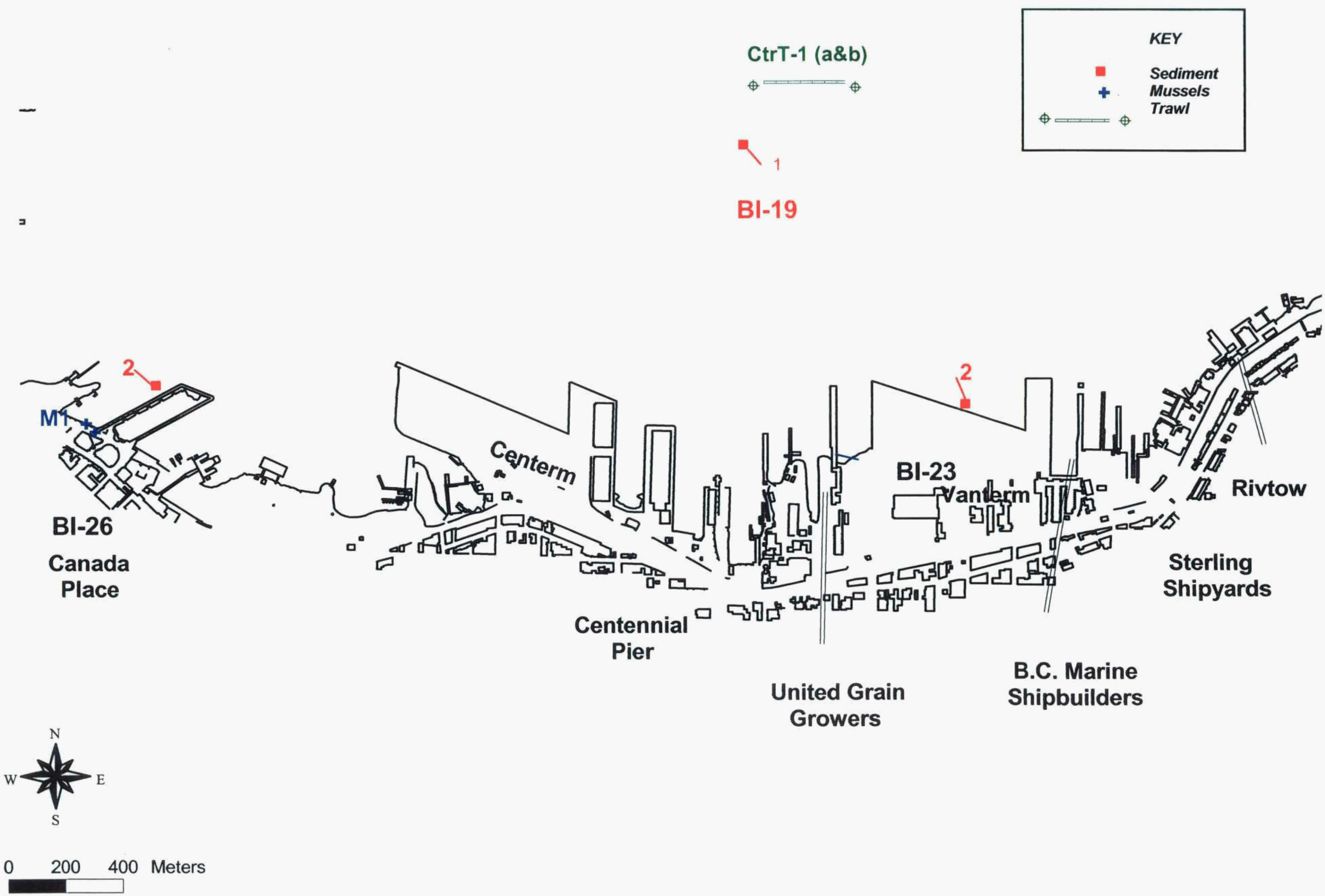
Map 6: Burrard Inlet (Sites BI-10 and 12)



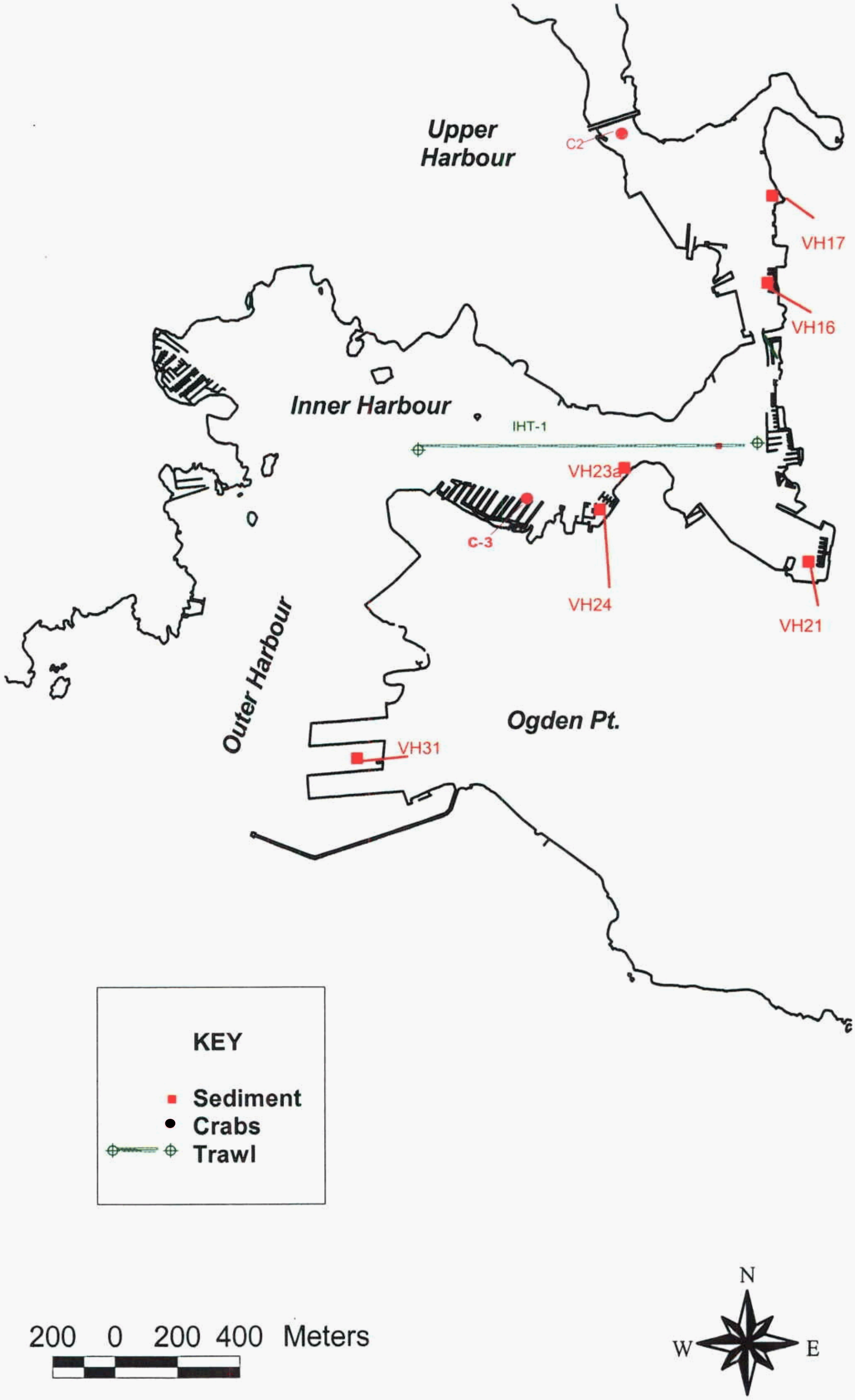
Map 7: Burrard Inlet (Sites BI-14 to BI-17)



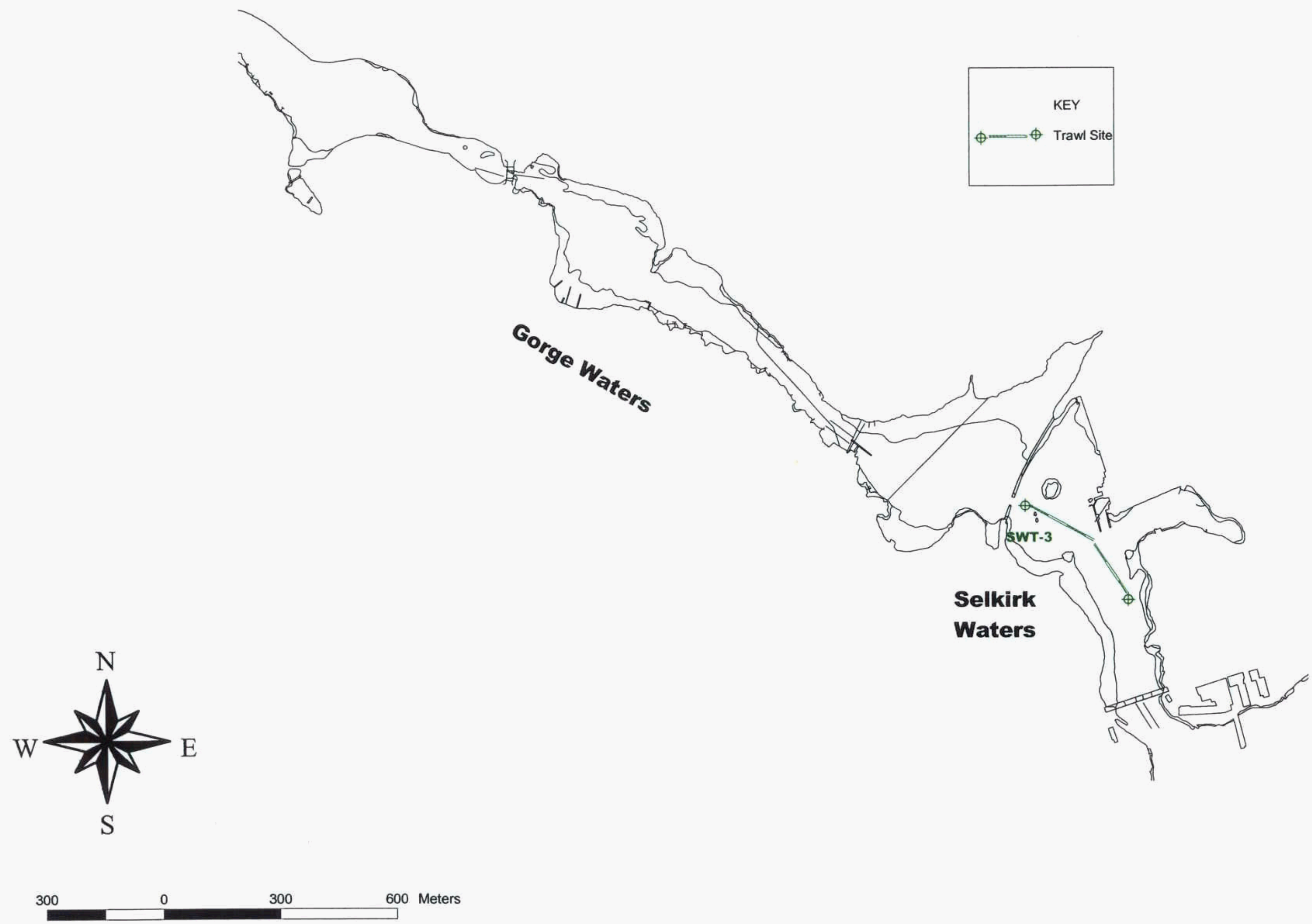
Map 8: Burrard Inlet (Sites BI-19 , BI-23 and BI-26)

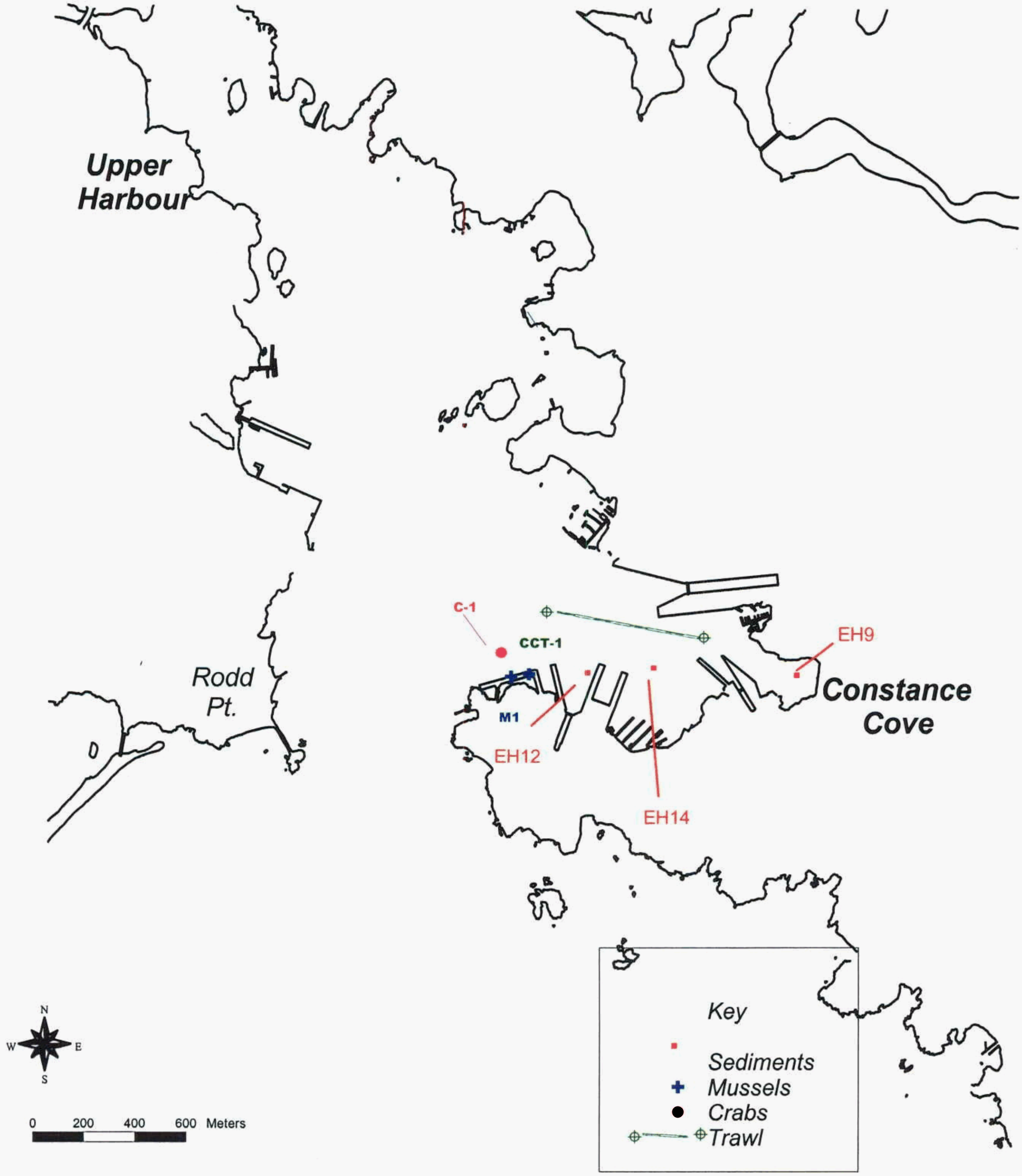


Map 9 : Victoria Harbour - Upper, Inner and Outer Harbour



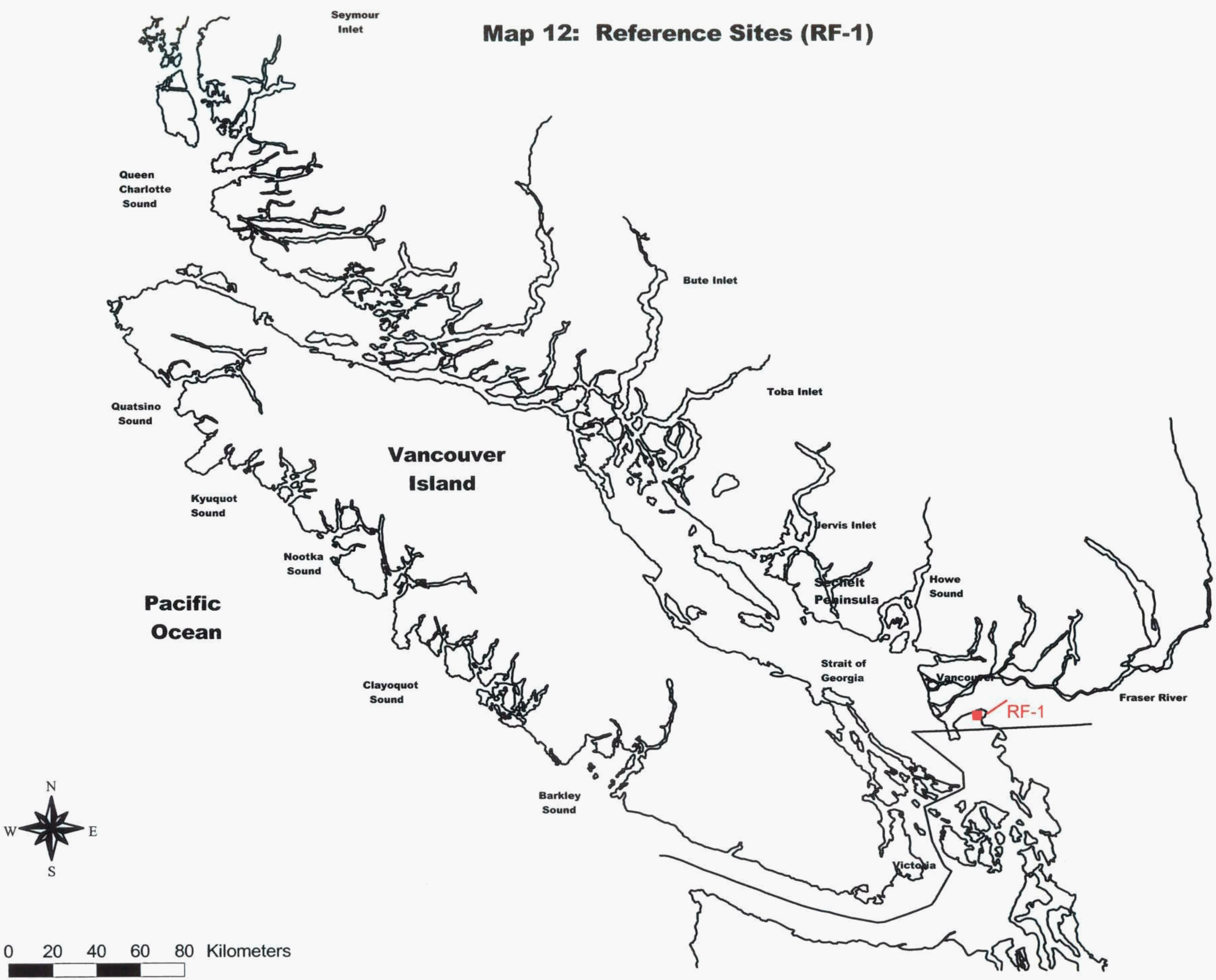
Map 10 : Victoria Harbour (Selkirk and Gorge Waters)



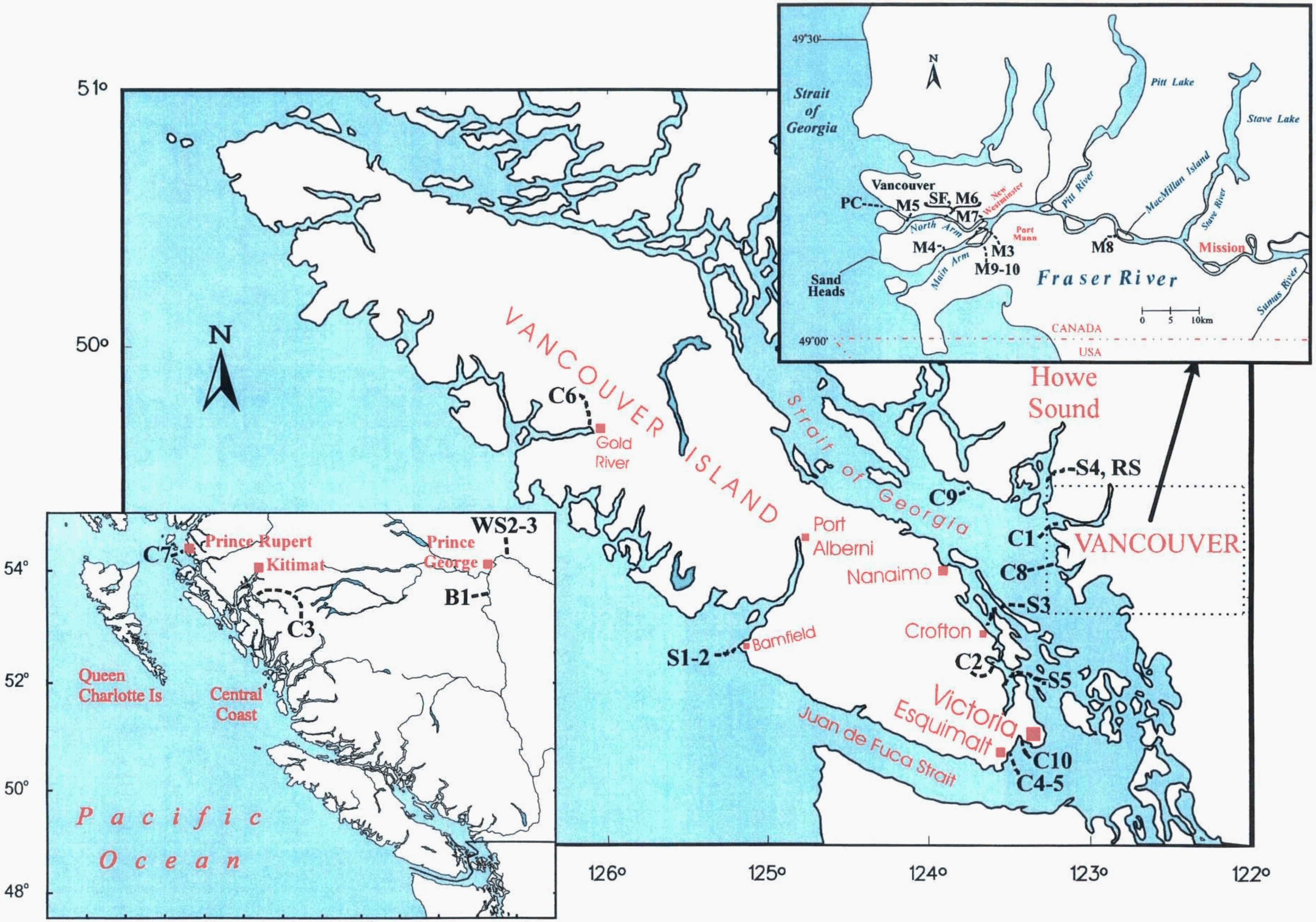


Map 11: Esquimalt Harbour

Map 12: Reference Sites (RF-1)



Map 13 : Queen Charlotte Islands Reference Site (RF-11)



Map 14: DFO Sampling Sites