Niagara River Biomonitoring Study 2015, Caged Mussels (*Elliptio complanata*), and Semi-Permeable Membrane Devices (SPMDs)

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ADDENDUM: April 2022

Estimated 2015 water concentrations of contaminants using SPMD data provided in an earlier version of this report have been updated to reflect changes in the Performance Reference Compound (PRCs) values used for the calculations.

Table 1 is to be replaced with the updated version of the table provided in the following pages.

NOTE: The text in the report has been modified accordingly to reflect the information in the updated Table 1, and although estimated water concentrations have increased significantly for some parameters using the modified PRCs, the contaminant trends both spatially (i.e., location of identified sources) and with time remain the same.

Table 1 (updated April 2022): Mean estimated water concentrations (ng/L) using 2015 SPMD data and the USGS Water Concentration Estimator.

Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.

Values that exceed the criteria were highlighted in **red** font. U/S = upstream; D/S = downstream

	Agency	Water Quality	Two Mile Creek			Pettit Flume (U/S)			Pettit Flume (Outer)			Pettit Flume D/S			Fishermans Park (U/S)			Fishermans Park (D/S)		
		Criteria	mean	SD	Exceedence	mean	SD		mean	SD		mean	SD		mean	SD		mean	SD	
		ng/L	(ng/L)	(ng/L)	Factor (EF)	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF
1,3-Dichlorobenzene	MECP	2500	0.90	0.23		0.29	0.51		141	18.0		2.2	0.47		1.9	0.06		3.1	0.47	
1,4-Dichlorobenzene	MECP	4000	7.8	0.91		2.4	4.20		300	69.8		12	1.9		7.9	0.40		18	3.91	
1,2-Dichlorobenzene	NYSDEC	3000	1.0	0.04		0.43	0.75		72	14.3		1.6	0.40		1.2	0.14		2.0	0.70	
1,3,5-Trichlorobenzene	MECP	650	0.03	0.01		0.003	0.01		4.1	0.44		0.08	0.01		0.11	0.04		0.13	0.07	
1,2,4-Trichlorobenzene	MECP	500	0.21	0.05		0.12	0.02		30	3.55		0.34	0.05		0.29	0.09		1.2	0.61	
1,2,3-Trichlorobenzene	MECP	900	0.06	0.02		0.04	0.01		15	1.94		0.12	0.02		0.04	0.02		0.35	0.19	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.04	0.01		0.04	0.01		10	0.93		0.18	0.03		0.20	0.08		0.32	0.23	
1,2,3,4-Tetrachlorobenzene	MECP	100	0.04	0.01		0.02	0.001		16	1.74		0.22	0.03		0.07	0.03		0.39	0.26	
Hexachlorobutadiene	NYSDEC	10	0.01	0.01		0.00	0.002		0.10	0.02		0.00	0.001		0.01	0.004		0.01	0.01	
Pentachlorobenzene	MECP	30	0.13	0.02		0.07	0.02		10	0.74		0.25	0.05		0.31	0.14		0.62	0.46	
Hexachlorobenzene	NYSDEC	0.03	0.28	0.04	9	0.06	0.02	2	4.5	0.29	151	0.25	0.05	8	0.56	0.25	19	0.69	0.56	23
HCH, gamma	NYSDEC	8																		
HCH, alpha	NYSDEC	2																		
HCH, beta																				
HCH, delta			0.01	0.01		0.01	0.01		0.004	0.01		0.003	0.003		0.003	0.01		0.002	0.002	
Aldrin	NYSDEC	2																		
Octachlorostyrene	NYSDEC	0.006	0.004	0.01					0.03	0.002	5									
2,4'-DDE			0.01	0.01		0.01	0.01		0.02	0.003		0.01	0.01		0.01	0.01		0.01	0.02	
4,4'-DDE	NYSDEC	0.007	0.19	0.04	27	0.08	0.02	11	0.14	0.01	20	0.05	0.01	8	0.17	0.08	24	0.12	0.10	17
2,4'-DDD			0.13	0.03		0.02	0.01		0.11	0.004		0.01	0.001					0.03	0.03	
4,4'-DDD	NYSDEC	0.08	0.43	0.07	5	0.06	0.01		0.43	0.01	5	0.05	0.01		0.14	0.07	2	0.09	0.08	1
2,4'-DDT			0.06	0.01		0.05	0.01		0.03	0.03		0.02	0.01		0.08	0.07		0.05	0.05	
4,4'-DDT	NYSDEC	0.01	0.07	0.01	7				0.03	0.02	2									
Mirex	NYSDEC	0.001	0.23	0.12	231				0.05	0.09	51									
Chlordane, alpha (cis)			0.26	0.03		0.04	0.01		0.19	0.01		0.03	0.004		0.08	0.03		0.05	0.04	
Chlordane, gamma (trans)			0.16	0.02		0.03	0.01		0.11	0.01		0.02	0.004		0.05	0.02		0.03	0.03	
Nonachlor, cis-			0.03	0.00		0.01	0.002		0.02	0.001		0.01	0.001		0.02	0.01		0.01	0.01	
Nonachlor, trans-			0.13	0.02		0.03	0.01		0.09	0.004		0.02	0.01		0.05	0.02		0.04	0.03	
Heptachlor	NYSDEC	0.2																		
Heptachlor Epoxide	NYSDEC	0.3	0.13	0.02		0.06	0.02		0.05	0.01		0.04	0.01		0.08	0.04		0.04	0.03	
alpha-Endosulphan	MECP (proposed)	3	0.04	0.07																
beta-Endosulphan						0.005	0.01													
Endosulphan Sulphate			0.06	0.11		0.01	0.01		0.18	0.15								0.02	0.03	
Dieldrin	NYSDEC	0.0006	0.39	0.05	649	0.11	0.04	186	0.11	0.01	185	0.06	0.01	106	0.17	0.07	286	0.11	0.07	187
Endrin	NYSDEC	2				0.001	0.001													
Methoxychlor	NYSDEC	30	0.05	0.05														0.01	0.02	
Total PCB	NYSDEC	0.001	17	2.90	17289	6.4	1.84	6417	186	14.5	186335	4.9	1.19	4901	14	6.34	14237	7.6	6.45	7624

Table 1 (updated April 2022): Continued

Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.

Values that exceed the criteria were highlighted in **red** font. U/S = upstream; D/S = downstream

	Agency	Water Quality Criteria ng/L	GRP (U/S Marina) mean (ng/L)	SD (ng/L)	EF	GRP (Marina) mean (ng/L)	SD (ng/L)	EF	GRP (U/S) mean (ng/L)	SD (ng/L)	EF	GRP (mid) mean (ng/L)	SD (ng/L)	EF	GRP (D/S) mean (ng/L)	SD (ng/L)	EF	102 nd St. (U/S) mean (ng/L)	SD (ng/L)	EF	LNR (D/S 102nd St.) mean (ng/L)	SD (ng/L)	EF	Cayuga Creek mean (ng/L)	SD (ng/L)	EF
1,3-Dichlorobenzene	MECP	2500	1.9	0.76		12	2.46		2.6	0.69		2.4	0.77		1.3	1.18		2.1	0.36		5.1	4.61		2.0	1.88	
1,4-Dichlorobenzene	MECP	4000	6.9	1.58		39	7.75		11	1.91		11	1.21		7.1	6.21		8.0	0.50		11	9.55		8.0	6.95	
1,2-Dichlorobenzene	NYSDEC	3000	0.56	0.48		4.9	1.25		1.5	0.50		1.7	0.49		1.1	0.94		0.98	0.11		0.83	0.73		1.5	1.39	
1,3,5-Trichlorobenzene	MECP	650	0.03	0.003		0.23	0.05		0.03	0.002		0.03	0.01		0.02	0.002		0.03	0.004		0.18	0.01		0.21	0.05	
1,2,4-Trichlorobenzene	MECP	500	0.10	0.01		0.88	0.10		0.13	0.01		0.34	0.04		0.09	0.01		0.14	0.01		1.03	0.04		0.81	0.15	
1,2,3-Trichlorobenzene	MECP	900	0.02	0.03		0.16	0.06		0.03	0.02		0.06	0.01		0.01	0.01		0.02	0.002		0.22	0.00		0.08	0.02	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.05	0.01		0.31	0.08		0.06	0.003		0.07	0.01		0.04	0.01		0.17	0.02		0.81	0.06		0.67	0.20	
1,2,3,4-Tetrachlorobenzene	MECP	100	0.03	0.004		0.24	0.06		0.04	0.02		0.04	0.01		0.02	0.003		0.04	0.01		2.7	0.05		1.0	0.27	
Hexachlorobutadiene	NYSDEC	10	0.01	0.004		0.01	0.01					0.01	0.003		0.001	0.001		0.003			0.004	0.001		0.02	0.01	
Pentachlorobenzene	MECP	30	0.11	0.02		0.27	0.08		0.11	0.004		0.11	0.01		0.08	0.01		0.09	0.01		2.1	0.07		0.71	0.22	
Hexachlorobenzene	NYSDEC	0.03	0.18	0.01	6	0.28	0.10	9	0.15	0.01	5	0.18	0.04	6	0.11	0.02	4	0.16	0.03	5	0.52	0.01	17	0.23	0.06	8
HCH, gamma	NYSDEC	8																0.06	0.11		0.06	0.06		0.72	0.02	
HCH, alpha	NYSDEC	2																0.07	0.12		0.25	0.03		36	0.79	18
HCH, beta																								9.5	0.29	
HCH, delta																		0.01	0.01		0.02	0.001		0.81	0.29	
Aldrin	NYSDEC	2													0.001	0.002					0.005	0.004				
Octachlorostyrene	NYSDEC	0.006				0.02	0.005	3																0.01	0.001	1.2
2,4'-DDE			0.01	0.01		0.08	0.07		0.005	0.01		0.01	0.01		0.01	0.003		0.01	0.002		0.01	0.002		0.02	0.01	
4,4'-DDE	NYSDEC	0.007	0.06	0.01	9	0.33	0.10	47	0.05	0.004	8	0.08	0.01	11	0.05	0.01	8	0.06	0.01	8	0.06	0.01	9	0.21	0.05	29
2,4'-DDD									0.01	0.01		0.01	0.02		0.01	0.01		0.02	0.002		0.06	0.003		0.06	0.02	
4,4'-DDD	NYSDEC	0.08	0.06	0.01		0.30	0.09	4	0.06	0.01		0.06	0.005		0.05	0.01		0.05	0.01		0.22	0.01	3	0.28	0.08	3
2,4'-DDT			0.04	0.04		0.27	0.02		0.03	0.03		0.02	0.03		0.03	0.01		0.02	0.005		0.02	0.003		0.05	0.02	
4,4'-DDT	NYSDEC	0.01													0.002	0.004		0.01	0.01		0.01	0.01				
Mirex	NYSDEC	0.001													0.003	0.005	3	0.01	0.01	8	0.004	0.01	4	0.11	0.02	109
Chlordane, alpha (cis)			0.03	0.01		0.09	0.03		0.03	0.002		0.04	0.01		0.02	0.01		0.03	0.01		0.03	0.002		0.10	0.03	
Chlordane, gamma (trans)			0.02	0.004		0.07	0.02		0.02	0.001		0.03	0.002		0.02	0.003		0.02	0.004		0.02	0.001		0.06	0.02	
Nonachlor, cis-			0.01	0.001		0.02	0.01		0.01	0.001		0.01	0.001		0.01	0.002		0.01	0.002		0.01	0.001		0.01	0.004	
Nonachlor, trans-			0.02	0.004		0.04	0.01		0.02	0.001		0.02	0.004		0.02	0.003		0.02	0.004		0.02	0.001		0.05	0.01	
Heptachlor	NYSDEC	0.2													0.001	0.002		0.002	0.004							
Heptachlor Epoxide	NYSDEC	0.3	0.06	0.01		0.02	0.02		0.05	0.004		0.06	0.01		0.04	0.01		0.04	0.004		0.04	0.002		0.05	0.02	
alpha-Endosulphan	MECP (proposed)	3																								
beta-Endosulphan																										
Endosulphan Sulphate																										
Dieldrin	NYSDEC	0.0006	0.10	0.01	160	0.09	0.03	147	0.08	0.01	128	0.09	0.01	158	0.08	0.02	137	0.08	0.01	136	0.07	0.002	123	0.09	0.01	144
Endrin	NYSDEC	2																								
Methoxychlor	NYSDEC	30																								
Total PCB	NYSDEC	0.001	96	10.95	95813	77	27.34	77320	18	1.87	18376	15	2.67	15466	9.0	2.30	9018	8.3	1.64	8250	10	0.52	10284	3.3	0.81	3346

Table 1 (updated April 2022): Continued

Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.

Values that exceed the criteria were highlighted in **red** font. U/S = upstream; D/S = downstream

	Agency	Water Quality Criteria ng/L	LNR (D/S Cayuga Ck) mean (ng/L)	SD (ng/L)	EF	U/S Occ mean (ng/L)	SD (ng/L)	EF	Storm Sewer A mean (ng/L)	SD (ng/L)	EF	Storm Sewer B mean (ng/L)	SD (ng/L)	EF	Storm Sewer C mean (ng/L)	SD (ng/L)	EF	Occ 003 mean (ng/L)	SD (ng/L)	EF	U/S Gill Creek (in NR) mean (ng/L)	SD (ng/L)	EF	Gill Creek (mouth) mean (ng/L)	SD (ng/L)	EF
1,3-Dichlorobenzene	MECP	2500	0.88	1.52		2.1	0.27		1.7	1.58		1.2	1.16		1.6	1.41		74	6.43		0.81	0.73		15	1.50	
1,4-Dichlorobenzene	MECP	4000	3.3	5.73		7.7	0.33		4.8	4.25		7.3	1.00		6.7	0.83		46	2.47		2.8	2.44		34	2.55	
1,2-Dichlorobenzene	NYSDEC	3000	0.23	0.40		0.57	0.51		0.62	0.54		0.38	0.66		0.66	0.57		5.3	0.21		0.48	0.42		15	1.45	
1,3,5-Trichlorobenzene	MECP	650	0.08	0.04		0.03	0.001		0.02	0.01		0.03	0.004		0.06	0.005		0.83	0.26		0.01	0.01		0.08	0.02	
1,2,4-Trichlorobenzene	MECP	500	0.19	0.10		0.07	0.003		0.08	0.01		0.09	0.01		0.14	0.01		18	3.95		0.04	0.04		3.3	0.41	
1,2,3-Trichlorobenzene	MECP	900	0.05	0.02		0.01	0.01		0.02	0.00		0.02	0.005		0.02	0.02		2.52	0.62		0.01	0.01		0.80	0.13	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.25	0.14		0.07	0.002		0.07	0.01		0.10	0.02		0.23	0.02		3.6	0.98		0.10	0.08		0.51	0.16	
1,2,3,4-Tetrachlorobenzene	MECP	100	0.38	0.19		0.07	0.005		0.19	0.01		0.21	0.03		0.31	0.02		3.5	6.14		0.04	0.03		0.28	0.09	
Hexachlorobutadiene	NYSDEC	10	0.005	0.003		0.003			0.01	0.00		0.02	0.01		0.03	0.01		16	6.48		0.01	0.005		8.7	1.88	
Pentachlorobenzene	MECP	30	0.42	0.23		0.14	0.01		0.24	0.05		0.32	0.06		0.55	0.04		8.4	3.00		0.06	0.05		0.35	0.14	
Hexachlorobenzene	NYSDEC	0.03	0.22	0.14	7	0.12	0.01	4	0.10	0.01	3	0.12	0.02	4	0.70	0.08	23	4.0	1.55	134	0.09	0.07	3	0.32	0.13	11
HCH, gamma	NYSDEC	8	0.03	0.05		0.02	0.04								0.03	0.05		0.07	0.06					1.1	0.19	
HCH, alpha	NYSDEC	2	1.4	0.20		0.97	0.07		0.68	0.15		0.53	0.07		0.48	0.01		0.84	0.09					16	0.16	8
HCH, beta			0.55	0.15		0.08	0.14		0.16	0.14					0.43	0.08		0.73	0.16					2.4	0.18	
HCH, delta			0.05	0.03		0.01	0.002		0.01	0.004		0.01	0.002		0.01	0.002		0.03	0.01		0.01	0.01		0.22	0.06	
Aldrin	NYSDEC	2	0.002	0.004		0.002	0.004		0.001	0.002					0.001	0.002		0.004	0.01					0.002	0.003	
Octachlorostyrene	NYSDEC	0.006	0.01	0.01	0.8	0.01	0.001	1.1	0.01	0.002	1.3	0.01	0.004	1.3	0.10	0.01	16	0.47	0.19	78	0.02	0.01	3	0.02	0.01	3
2,4'-DDE			0.02	0.02		0.01	0.001		0.01	0.01								0.01	0.01		0.003	0.01				
4,4'-DDE	NYSDEC	0.007	0.14	0.10	20	0.06	0.004	8	0.04	0.003	6	0.04	0.01	6	0.04	0.003	5	0.07	0.02	10	0.03	0.02	5	0.03	0.01	5
2,4'-DDD			0.06	0.03		0.02	0.002		0.01	0.01		0.005	0.01		0.003	0.01		0.01	0.01							
4,4'-DDD	NYSDEC	0.08	0.19	0.11	2	0.06	0.01		0.04	0.01		0.03	0.01		0.03	0.001		0.06	0.02		0.02	0.02		0.03	0.02	
2,4'-DDT			0.07	0.04		0.03	0.003		0.01	0.01		0.01	0.01					0.02	0.02		0.01	0.004		0.01	0.01	
4,4'-DDT	NYSDEC	0.01							0.01	0.005																
Mirex	NYSDEC	0.001	0.08	0.05	76	0.02	0.001	18	0.01	0.01	11				0.11	0.01	106	1.4	0.51	1434						
Chlordane, alpha (cis)			0.07	0.05		0.03	0.001		0.02	0.001		0.02	0.002		0.02	0.002		0.03	0.01		0.01	0.01		0.01	0.01	
Chlordane, gamma (trans)			0.05	0.03		0.02	0.001		0.01	0.001		0.01	0.002		0.01	0.001		0.02	0.01		0.01	0.01		0.01	0.003	
Nonachlor, cis-			0.02	0.01		0.01			0.004	0.001		0.005	0.001		0.004	0.001		0.01	0.002		0.003	0.002		0.004	0.002	
Nonachlor, trans-			0.06	0.04		0.02	0.001		0.01	0.001		0.01	0.002		0.01			0.02	0.01		0.01	0.01		0.01	0.004	
Heptachlor	NYSDEC	0.2	0.002	0.003		0.002	0.003		0.002	0.003								0.01	0.01							
Heptachlor Epoxide	NYSDEC	0.3	0.05	0.02		0.04	0.001		0.04	0.002		0.04	0.003		0.03	0.001		0.06	0.02		0.06	0.04		0.04	0.02	
alpha-Endosulphan	MECP (proposed)	3																								
beta-Endosulphan																										
Endosulphan Sulphate																										
Dieldrin	NYSDEC	0.0006	0.08	0.04	140	0.07	0.004	110	0.06	0.002	106	0.06	0.01	105	0.06	0.001	92	0.08	0.02	139	0.10	0.06	160	0.08	0.03	135
Endrin	NYSDEC	2																								
Methoxychlor	NYSDEC	30										0.01	0.01													
Total PCB	NYSDEC	0.001	9.3	5.85	9293	6.8	0.22	6832	4.8	0.40	4768	4.8	0.96	4828	5.0	0.09	4951	186	114.3	185918	0.56	0.48	558	7.0	2.50	7017

Table 1 (updated April 2022): Continued

Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.

Values that exceed the criteria were highlighted in **red** font. U/S = upstream; D/S = downstream

	Agency	Water Quality	BRC (U/S)			BRC			BRC (D/S)			FE			Ushers Ck			Chippawa Channel			NOTL			Balsam Lake		
		Criteria	mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD	
		ng/L	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF
1,3-Dichlorobenzene	MECP	2500	1.4	0.04		1.2	0.16		1.8	0.28		0.46	0.40		0.26	0.46		0.30	0.52		1.3	0.25		0.95	0.30	
1,4-Dichlorobenzene	MECP	4000	4.9	0.17		5.6	0.99		4.2			4.4	0.23		4.0	0.54		2.7	2.39		5.6	0.41		4.1	0.71	
1,2-Dichlorobenzene	NYSDEC	3000	0.55	0.78		0.65	0.93		1.1	0.01		0.37	0.32		0.69	0.70		0.18	0.31		0.29	0.50		0.70	0.64	
1,3,5-Trichlorobenzene	MECP	650				0.04	0.03		0.03						0.002	0.004					0.003	0.004				
1,2,4-Trichlorobenzene	MECP	500	0.08	0.001		0.13	0.09		0.24	0.002											0.08	0.001				
1,2,3-Trichlorobenzene	MECP	900	0.04	0.003		0.05	0.04		0.07	0.01					0.01	0.02		0.02	0.01		0.01	0.02				
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.06	0.005		0.39	0.03		0.25	0.01		0.001	0.001		0.01	0.01		0.001	0.002		0.04	0.01				
1,2,3,4-Tetrachlorobenzene	MECP	100	0.10	0.004		0.46	0.06		0.32	0.02		0.002			0.003	0.003					0.08	0.01				
Hexachlorobutadiene	NYSDEC	10	0.02	0.001		0.25	0.01		0.12	0.01					0.002	0.004		0.002	0.003		0.01	0.001				
Pentachlorobenzene	MECP	30	0.15	0.004		2.6	0.05		1.3	0.09		0.01	0.001		0.05	0.01		0.01	0.003		0.07	0.01		0.004	0.003	
Hexachlorobenzene	NYSDEC	0.03	0.34	0.01	11	1.8	0.50	59	1.1	0.11	38	0.02	0.002		0.02	0.01		0.02	0.003		0.08	0.02	3	0.01	0.01	
HCH, gamma	NYSDEC	8	0.06	0.09		0.30	0.15		0.17	0.24		0.06	0.10													
HCH, alpha	NYSDEC	2				0.20	0.01																			
HCH, beta																										
HCH, delta			0.005	0.01		0.01	0.01		0.004	0.01											0.004	0.01				
Aldrin	NYSDEC	2				0.01	0.002																			
Octachlorostyrene	NYSDEC	0.006	0.07	0.003	12	0.10	0.02	17	0.10	0.01	17										0.04	0.01	6			
2,4'-DDE						0.001	0.001					0.01														
4,4'-DDE	NYSDEC	0.007	0.01		2	0.04	0.005	6	0.02	0.003	2	0.62	0.03	88	0.13	0.03	19	0.05	0.01	8	0.02	0.003	3	0.02	0.01	3
2,4'-DDD						0.003	0.001		0.001	0.002		0.03	0.002		0.01	0.003		0.005	0.001							
4,4'-DDD	NYSDEC	0.08	0.01		0	0.01	0.003		0.01	0.001		0.15	0.01	2	0.04	0.01		0.03	0.003		0.01	0.002		0.001	0.002	
2,4'-DDT			0.002	0.003					0.002	0.003		0.01	0.001		0.001	0.001					0.003	0.01				
4,4'-DDT	NYSDEC	0.01			0	0.01	0.002		0.003	0.005		0.03	0.002	3	0.01	0.002		0.01	0.001							
Mirex	NYSDEC	0.001			0	0.02	0.01	21	0.01	0.002	11															
Chlordane, alpha (cis)			0.005			0.01	0.001		0.01	0.001		0.01	0.001		0.02	0.003		0.01	0.001		0.01	0.001		0.003	0.003	
Chlordane, gamma (trans)			0.003			0.004	0.001		0.004	0.001		0.01			0.01	0.003		0.005	0.001		0.01	0.001		0.003	0.002	
Nonachlor, cis-			0.001			0.002			0.002			0.003			0.01	0.000		0.001	0.001		0.002	0.001				
Nonachlor, trans-			0.004			0.01	0.001		0.005	0.001		0.01			0.03	0.01		0.01	0.001		0.01	0.002		0.004	0.002	
Heptachlor	NYSDEC	0.2	0.001	0.002																	0.01	0.01		0.05	0.05	
Heptachlor Epoxide	NYSDEC	0.3	0.02	0.001		0.02	0.01		0.02	0.002		0.03	0.001		0.02	0.005		0.02	0.003		0.02	0.003		0.01	0.004	
alpha-Endosulphan	MECP (proposed)	3				0.16	0.02																			
beta-Endosulphan						0.07	0.10																			
Endosulphan Sulphate																										
Dieldrin	NYSDEC	0.0006	0.05		86	0.05	0.01	79	0.05	0.01	90	0.06	0.01	106	0.04	0.01	65	0.06	0.01	98	0.05	0.005	83	0.02	0.01	39
Endrin	NYSDEC	2																								
Methoxychlor	NYSDEC	30																								
Total PCB	NYSDEC	0.001	0.27	0.02	267	1.6	0.61	1574	0.75	0.11	750	0.20	0.01	198	0.12	0.04	122	0.12	0.04	125	0.64	0.14	642	0.06	0.02	57

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Executive Summary

The Niagara River is the interconnecting channel between Lake Erie and Lake Ontario. Numerous persistent toxic and bioaccumulative contaminants from waste disposal sites, industrial outfalls, municipal point sources and non-point sources have been discharged to the Niagara River for decades. Since 1983 the Ontario Ministry of Environment, Conservation and Parks (MECP) has been committed to the biomonitoring of contaminants in the Niagara River using caged mussels (*Elliptio complanata*) and more recently using passive samplers known as semi-permeable membrane devices (SPMDs) as part of Ontario's commitment to the Niagara River Toxics Management Plan (NRTMP). These studies have provided information on suspected contaminant sources and source areas in the river between Fort Erie (FE) and downstream at the mouth of the river at Niagara-on-the-Lake (NOTL).

The water quality dataset (2005-2015; Hill, 2018) from Environment and Climate Change Canada (ECCC) Upstream/Downstream (US/DS) Niagara River Monitoring Program identified several organic contaminants which exceed water quality criteria/objectives (WQC) (e.g., hexachlorobenzene (HCB), octachlorostyrene (OCS), mirex, and total PCBs), and also show evidence of statistically significant Niagara River sources: i.e., contaminants that have higher water concentrations at NOTL compared with FE. The 2015 caged mussel and SPMD data were used to identify sources of these contaminants to the river (Table ES1). With the exception of metabolites of DDT at Fort Erie, sources of contaminants were not identified on the Canadian side of the river.

Table ES1: Niagara River sources identified from caged mussel and/or SPMD data for compounds identified in the ECCC US/DS water quality monitoring dataset that have concentrations higher at NOTL than at FE .

US/DS data suggest NR sources	*NR sources identified by Caged Mussels and/or SPMD Data*
1,2,3-Trichlorobenzene	Gill Creek, Pettit Flume Cove, Occidental Chemical Buffalo Ave. Plant,
1,2,4-Trichlorobenzene 1,3,5-Trichlorobenzene 1,2,3,4-Tetrachlorobenzene Pentachlorobenzene Hexachlorobenzene[1]	Pettit Flume Cove, Bloody Run Creek, Occidental Chemical Buffalo Ave. Plant
α-HCH γ-HCH (Lindane)	Cayuga Creek and Gill Creek
α-chlordane[2]	Two Mile Creek, Cayuga Creek, and Pettit Flume
pp-DDE[3]	Fort Erie, Gratwick Riverside Park marina, Cayuga Creek
Dieldrin	Two Mile Creek
a- Endosulfan	Two Mile Creek and Bloody Run Creek
Mirex	Occidental Chemical Buffalo Ave. Plant and associated sites
Octachlorostryene	Pettit Flume Cove, Bloody Run Creek, Occidental Chemical Buffalo Ave. Plant, Gill Creek
Hexachlorobutadiene	Occidental Chemical Buffalo Ave plant and Gill Creek
Total PCBs[4]	Two Mile Creek/Rattlesnake Creek, Occidental Chemical Buffalo Ave plant,
	upstream of Gratwick Riverside Park (source still to be identified), Pettit Flume Cove

[1]HCB present at all sites in the river >WQC
[2]Low concentrations of α- chlordane were present at all stations sampled on the river
[3]pp-DDE present at all sites in the river >WQC
[4]Total PCBs present at all sites in the river >WQC

SPMD data, reported as ng/SPMD were used to estimate mean water concentrations (ng/L) using the United States Geological Survey (USGS) SPMD Water Concentration Estimator. These values were compared with the most stringent of the relevant New York State Department of Environmental Conservation (NYSDEC) guidelines, the US Environmental Protection Agency (EPA) guidelines, ECCC and/or MECP Provincial Water Quality Objectives.

In summary, SPMD data suggested that water concentrations of dieldrin, DDT metabolites (4'4,-DDE and 4'4,-DDD), mirex, HCB, OCS and total PCBs exceeded the most stringent water quality criteria at multiple stations. However, in general, organochlorinated pesticides were present at low concentrations throughout the Niagara River. Chlorinated benzenes and chlorinated industrial compounds were detected at many of the stations on the American side of the river, but, concentrations overall, with the exception of HCB and OCS at the Pettit Flume Cove, Bloody Run Creek and Occidental Chemical Co. Buffalo Ave plant, were low and below the most stringent WQC. Estimated water concentrations for total PCBs at the Occidental Chemical outfall were as high as 71 ng/L. Additionally, elevated concentrations of PCBs were present upstream of Gratwick Riverside Park. The 2018 survey will attempt to track down a source of the PCBs associated with this area. PCBs exceeded the WQC at all stations monitored in the Niagara River.

Long-term trends for caged mussel data show that at American locations that were remediated, COCs remain low (e.g., chlorinated benzenes at the Pettit Flume and 102nd St. Waste site; PCBs at Gill Creek). For sites that were not remediated, COCs remain consistent through time, and the sites remain a source to the river (e.g., Two Mile Creek-PCBs; Bloody Run Creek-chlorinated benzenes, dioxins and furans). The 2015 mussel, SPMD and sediment data confirm the previous survey data that showed the Pettit Flume and Bloody Run Creek to be sources of dioxins and furans to the river. Data for sediment collected downstream of the Pettit Flume cove and at Fisherman's Park showed that dioxin contaminated sediment from the Pettit Flume is likely migrating off-site. Additionally, sediment and caged mussels collected downstream of Bloody Run Creek also show movement of dioxins and furans offsite. Without further remedial actions at these sites these trends are unlikely to change through time. Likewise, the Occidental Chemical Co. will continue to remain a source of multiple contaminants to the river (chlorinated benzenes, industrial organic compounds (OCS, HCBD), mirex and PCBs).

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Introduction and Background

The Niagara River (64 km long), is the interconnecting channel between Lake Erie and Lake Ontario. Since 1983, the Ontario Ministry of Environment, Conservation and Parks (MECP) has been committed to both routine and specialized biomonitoring of contaminants in the river using caged mussels (*Elliptio complanata*) as part of Ontario's commitment to the Niagara River Toxic Management Plan (NRTMP). These studies have provided information on suspected contaminant sources and source areas on the American as well as the Canadian side of the river between Fort Erie and Niagara-on-the-Lake (Richman *et al*. 2011).

Numerous persistent, toxic and bioaccumulative contaminants from waste disposal sites, industry, municipal point sources and non-point sources have been discharged to the Niagara River for decades. The river was identified as an Area of Concern by the International Joint Commission in 1987. Currently, due to environmental improvements through government and local stakeholder/industry remedial actions, the Niagara River (Ontario) RAP (Remedial Action Plan) is moving towards delisting the Canadian side of the river as an AOC. On the American side of the river, sediment investigations are ongoing, and remedial actions will be taken as needed to address areas where contaminated sediments contribute to Beneficial Use Impairments. Delisting of the US AOC is not expected until 2025 or possibly later.

The biota in the river can accumulate contaminants from the water, sediment and the food chain. Since they are sensitive indicators and accumulate the contaminants at higher concentrations than are present in the water, the use of caged mussels as a biomonitor has been an effective tool to measure the presence of contaminants in the river.

The 2015 biomonitoring survey using mussels (*Elliptio complanata*) was a follow up to surveys conducted every two to three years since 1983. In 2009, passive samplers known as semi permeable membrane devices (SPMDs) were introduced at selective stations to assess their effectiveness at accumulating organic compounds. Geographic contaminant patterns matched well with the caged mussels, and additional compounds not previously detected in the mussels were measured in the passive samplers. This may be due to differences in contaminant uptake processes in the passive samplers compared with the mussels. Accordingly, SPMDs were deployed in 2012 and 2015 at a selected number of stations including a control site (Balsam Lake) to further assess their effectiveness as contaminant monitors and obtain a more complete database of the stations routinely monitored with mussels.

Objectives

The biota in the river can accumulate contaminants from the water, sediment and the food chain. The principle behind the mussel biomonitoring program was to take mussels from a relatively uncontaminated site and place them in an environment that was known or suspected of being contaminated with persistent, bioaccumulative, toxic substances. Mussels are abundant, easily collected and transported, and sedentary, which means that their contaminant exposure is reflective of relatively local conditions. They are responsive to their surrounding environment so tissue concentrations can often reflect short-term fluctuations in contaminant concentrations which may not be detected by routine water quality monitoring (Kauss and Hamdy, 1991; Lobel *et al*., 1991; Metcalfe and Charlton, 1990; Muncaster *et al.,* 1989). *Elliptio complanata* is a filter feeder (feeding on plankton and organic detritus) and will accumulate contaminants directly from both the water column and particulate matter (Pennak, 1978). This makes it a good biomonitor since contaminants often partition between the dissolved and particulate phases.

SPMDs and other passive samplers efficiently sequester hydrophobic contaminants dissolved in the water and may be more reliable monitors than the caged mussels since the monitoring method is standardized among all stations. Biota don't always survive the exposure, or they may be stressed which can affect uptake and depuration leading to inaccurate measurements of ambient exposure concentrations. Additionally, there may be variability in the bioaccumulation due to their physical condition, sex or age (Lobel *et al*. 1991).

Deployment of SPMDs between 14-30 days has been shown to be sufficient to accumulate most hydrophobic contaminants that are environmentally relevant, although studies have suggested that depending on the contaminant, they may require a longer deployment time to be in equilibrium with the environment (Huckins *et al.* 1996; Petty *et al.* 2000). While some studies have shown agreement in geographic contaminant trends between SPMDs and mussels (Prest *et al.* 1992; Prest *et al.* 1995; Herve *et al.* 1995; Peven *et al.* 1996), others did not find a good correlation (Richardson *et al.* 2001; Degger *et al.* 2011). One explanation was that the variability in the performance of mussels had an effect on study outcomes, but these studies also highlighted the importance of the different contaminant uptake processes for SPMDs and mussels (dissolved-phase only, and both dissolved- and particulate-phase, respectively). Accordingly, it may be useful to use the two datasets in tandem to compare the relative patterns of contamination among the stations but not compare the actual concentrations between the monitors.

The objectives of the survey in 2015 were consistent with earlier surveys and are listed below:

- Identify contaminant sources or source areas requiring more detailed follow-up investigations based on uptake of contaminants in selected biomonitors.

- Compare results with ongoing long-term contaminant monitoring using indigenous species (i.e., young of the year (YOY) spottail shiners and emerald shiners) and identify spatial and temporal trends.

- Augment ongoing upstream/downstream Niagara River Toxics Management Plan programs by providing information on contaminants present in the river between Fort Erie and Niagara-on-the-Lake. The Environment and Climate Change Canada (ECCC) Upstream/Downstream (US/DS) water monitoring dataset (2005-2015; Hill, 2018) identified several organic contaminants which exceed the most stringent water quality criteria (WQC) and show evidence of statistically significant Niagara River sources: i.e., contaminants that have higher concentrations at Niagara-on-the-Lake compared with Fort Erie. The cage mussel and SPMD dataset will be used to identify sources of these contaminants in the river.

Methods

Sample Locations

During the week of July 7^{th} 2015, mussels were deployed at sites on the Canadian and US side of the Niagara River (Figure 1; Appendix A provides site coordinates). Caged mussels were retrieved during the week of July 28^{th}. Historically, caged mussels deployed on the Canadian side of the river in tributaries typically did not have detectable concentrations of organochlorine (OC) pesticides or chlorinated benzene compounds. Accordingly, in 2015 SPMDs were deployed at Ushers Creek and the Chippawa Channel in place of mussels. Both mussels and SPMDs were deployed at the head and mouth of the river: Fort Erie (FE) and Niagara-on-the-Lake (NOTL).

On the US side, mussels were deployed at stations with long-term monitoring datasets (e.g., the Occidental Chemical Corp. (Buffalo Ave facility) sewer 003, Gill Creek, Two Mile Creek, Pettit Flume and Bloody Run Creek) for OC pesticides, and chlorinated benzenes and in some cases congener specific PCB analyses and/or polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDD/F). At other locations, (e.g., Gratwick Riverside Park (GRP), Cayuga Creek, Little Niagara River (LNR) and 102^{nd} St. Hazardous Waste Site, mussels were only analysed for congener specific PCBs. SPMDs were deployed at most stations on the US side of the river (Appendix A).

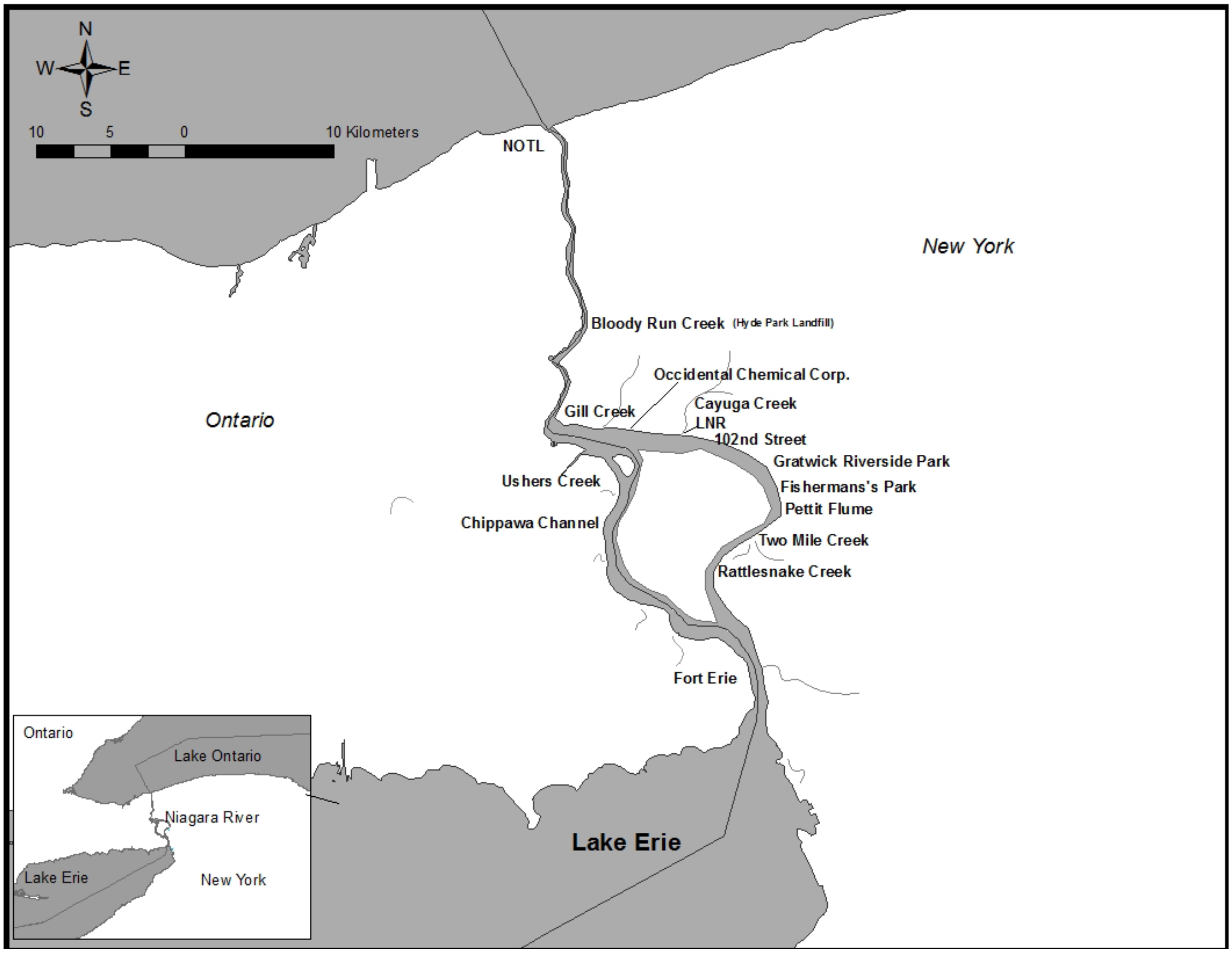


Figure 1: 2015 Niagara River caged mussel biomonitoring locations. Some locations have multiple sampling stations.

Collection Methods and Ambient Measurements

Mussel Deployment/Retrieval and Sample Preparation

Mussels were collected by divers from Balsam Lake, a relatively uncontaminated lake located in Victoria County, Ontario. Mussels of approximately the same size (6.5 to 7.2 cm) were selected to reduce variability due to tissue weight and mussel age. They were placed in buckets lined with clean bioassay (food-grade) polyethylene bags partially filled with lake water and then sealed with trapped air inside for transportation back to the laboratory. Rapid temperature fluctuations were avoided. Five, randomly selected mussels were submitted for analysis of contaminants to determine initial tissue contaminant concentrations. These mussels are referred to as the "Balsam Lake control mussels".

A minimum of five clean mussels (and/or up to 28 mussels, depending on analytical requirements) were placed in clean, galvanized wire cages (about 30 cm x 36 cm x 10cm; 1 cage per station). These were anchored to the bottom using spikes or rope attached to a concrete block in water of at least 1 m depth. All caged mussels were deployed for three weeks (21 days). After the three week deployment, at 18 selected stations three randomly selected mussels were retrieved and analysed individually for percent lipid and total PCBs (polychlorinated biphenyls), organochlorine pesticides, chlorinated benzenes and industrial chlorinated compounds (Appendix A). At 18 stations, three replicates of 6 mussels each were composited and submitted for congener-specific PCBs. Additionally, at 10 stations mussels (one composite of four mussels) were submitted for dioxins and furans.

Upon retrieval, mussels were immediately shucked, excess water drained and the soft tissues weighed (Appendix C). Mussels were either wrapped individually in hexane-rinsed aluminum foil or packaged as composites, placed in plastic bags, and frozen until analysis. Mussels submitted for PCB congener-specific analysis were freeze-dried prior to analysis. In all cases, the mussels were not depurated prior to analysis.

Sediment

At 16 stations located at either Bloody Run Creek, the Pettit Flume, Fisherman's Park and Two Mile Creek, surficial sediment (top 3 cm) grab samples were collected, during mussel retrieval, with a hexane rinsed mini ponar or if the sediment was hard packed (e.g., sand and gravel) a stainless steel spoon for PCDD/Fs analysis. All sediment samples were also analysed for total organic carbon and particle size (Appendix A).

Water Chemistry

Water temperature, DO and conductivity measurements were collected *in situ* during deployment and retrieval of mussels at all stations using a YSI sonde (Appendix Table B).

SPMD Deployment

SPMDs were obtained from Environmental Sampling Technologies (EST) who is the manufacturer of the SPMD equipment, media preparation and dialysis services. Analysis of the SPMDs for contaminants of interest was performed by AXYS Analytical Services Ltd. SPMDs were deployed at 29 stations to measure contaminant uptake from the dissolved phase in water (Appendix A). Additionally, SPMDs were deployed in Balsam Lake for three weeks to compare uptake with the Balsam Lake Control mussels. Briefly, 91.4 cm x 2.5 cm low density polyethylene lay-flat tubing was filled with 1 mL of high purity triolein then heat-sealed and stored frozen in aluminum canisters for transportation to the Niagara River. EST also spiked the SPMDs with Performance Reference Compounds (PRC). These compounds are used to measure rates of loss, which allow adjustment of the SPMD data to reflect field sampling conditions. Each SPMD was spiked with 60 ng/SPMD of PCB 14, PCB 29 and PCB 50. At each site, three SPMDs were placed on a "spider carrier" within a galvanized metal shroud and deployed by placing them in the current on the sediment using site rocks or steel pegs to hold them in place. Three field blanks were opened and exposed to the air for the duration of the deployment and retrieval to assess the impact of atmospheric contamination on the SPMDs. Two sites were on the US side and one site was on the Canadian side.

SPMDs were retrieved simultaneously with the caged mussels, placed in metal containers, and stored on ice until return to the laboratory where they were stored frozen until analysis by SGS AXYS Analytical. All SPMD data were reported in Appendix F as ng/SPMD.

Analytical Methods

The mussel samples were analyzed for total-PCB and OC pesticides using the OMOE method E3136 (OMOE, 2008a; summarized in Richman and Somers, 2010). PCB congeners were analysed in biota using OMOE method E3411 and E3485 (OMOE, 2008b) and the seventeen 2,3,7,8-substituted toxic PCDD/Fs and homologue totals were analysed in mussels and sediment using the OMOE method DFPCB-E3418 (OMOE, 2008c; Richman and Somers, 2005). A select number of sediment samples were analysed for PCDD/F using a new MOECC screening method that utilizes a modified sample preparation procedure involving the QuEChERS technology in conjunction with the analysis being carried out using the same GC/HRMS system stated above and quantitation by isotope dilution (E3535) (OMOE, 2015). Particle size and TOC in sediment were analyzed by OMOE methods E3328A and E3142A (OMOE, 2008d-e; described in Richman and Milani, 2010).

All mussel data are reported on a wet weight basis with the exception of the data for congener-specific PCBs. These mussels were freeze dried prior to analysis so concentrations are reported as dry weight. The total PCB concentration (sum of the 52 congeners) for these samples were also converted to wet weight by determining the ratio of wet to dry weight for each individual sample to facilitate a comparison with historical PCB data. The water content of the mussel tissue ranged from 84-91%. All sediment data are reported on a dry weight basis.

SPMDs were analysed for PCBs, OC pesticides, chlorinated benzenes and dioxins and furans by AXYS with a combined gas chromatography/low resolution mass spectrometry (GC/LRMS) analysis (based on EPA Method 8270 OC/D, EPA Method 625, EPA Method 1613B respectively). Prior to the analysis, all parameters were co-extracted (AXYS in house method MLA-013 (fractionation only). Detailed descriptions of analytical methods can be provided upon request. All SPMD data are reported as ng/SPMD (equivalent to ng/mL triolein) unless otherwise noted.

The remaining PRC PCBs (14, 29 and 50) measured following retrieval were subtracted from the total PCB data and for the description of homologue patterns.

Data Analysis

For the caged mussel data, a “W” flag represents the smallest amount of an analyte that can be reliably detected by the procedure used. Concentrations described as “trace” are flagged with a “<T”. Trace values ranged from greater than “W” to 10 times “W” for organic parameters. Data flagged as trace indicate that the presence of the

analyte is confirmed but the actual concentrations reported should be interpreted with caution. Basically, “T” indicates the limit of quantification. Both “W” and “T” are based on the precision of the analytical method which is in turn based on replicate measurements for the same analyte. For example, a blank sample is spiked at a low concentration with an analyte. Replicates of the sample are analysed and the “W” value is set at 2/3 of the standard deviation of the replicate measurements. Additional QA/QC includes the comparison of each sample run (which is generally 12 to 25 samples) against prepared standards.There are method blanks and recovery checks using spikes. An independent control standard is used to monitor accuracy and stability, duplicate samples are used to test within run precision, and calibration standards are used for a drift check. Details on QA/QC expectations are provided in the method manuals listed above.

In the case of PCDD/Fs and dioxin-like PCBs, a “sample run” usually consisted of 10 samples. An analyte was considered to be above the detection limit when the result met standard peak definition (usually 3-5 times signal:noise ratio) or was greater than five times a corresponding positive result determined to be present in the method blank used within that specific sample set. “W” and “T” values do not apply to these analytical procedures. Data that do not meet peak definition and/or are less than five times the method blank are flagged as “<“.

Toxicity Equivalency Factors (TEFs) have been used to express the toxicity of different dioxins and furans and dioxin-like PCBs (DL-PCBs) on a common basis. The World Health Organization (WHO) TEFs for the protection of fish were used for the calculations for both sediment and mussel value (van den Berg et al., 2006). Concentrations of individual isomers were converted to toxicity equivalents of 2,3,7,8-TCDD and then summed to yield a total toxic equivalent (TEQ). TEQs were calculated to express toxicity of the compounds as a single number to facilitate comparisons of mussel tissue and sediment dioxin/furan concentrations among stations and through time. Sediment TEQ concentrations can be compared with the Canadian Council of Ministers of the Environment (CCME) interim sediment guideline of 21.1 pg TEQ/g.

Using SPMDs to Estimate Water Concentrations

The amount of accumulated chemical in the SPMDs is proportional to the ambient concentrations of the dissolved phase of the chemical. However, temperature, bio-fouling and water current velocity have been shown to affect uptake rates (Huckins *et al.* 1996; Petty *et al.* 2000; Vrana and Schuurmann 2002; Booij *et al.* 2006; Wang *et al.* 2009). Huckins *et al.* (1996) showed that sampling rates increased with ambient temperature and hydrophobicity (up to about a log K_{ow} of 6), but, other studies have also shown sampling rates to decrease for compounds that have a log K_{ow} of greater than 6 (Petty et al. 2000), and that temperature may not have a significant impact on uptake rates (Booij *et al.* 2003).

In the Niagara River survey, temperature generally ranged from 20 to 25 ^{o}C at most stations (Appendix B) and there was minimal bio-fouling of the SPMDs at all sites. Although not measured, visual observations of the water currents at each station suggested that velocity likely did vary. Even if water current rates were available, the SPMDs were, at times, covered by large rocks as camouflage, which would alter the flow in the immediate vicinity of the SPMD. Differences in uptake rates due to these site by site variations in water current can affect the accurate estimates of water concentrations of the compounds of interest among the sites. However, large differences in contaminant concentrations among sites that would identify sources should not be affected by these site to site variations.

One method to account for these differences is to use Performance Reference Compounds (PRCs) which are standardized compounds added to the triolein (Huckins *et al.* 2002). The effects of environmental variables (e.g. temperature, water current) on the uptake rates of the compounds of interest can be approximated by the effects of these variables on the loss rates of the PRCs. PRCs for PCB congeners 14, 29 and 50 were added to the SPMDs and their concentrations were measured after deployment. This information was entered into the United States Geological Survey (USGS) SPMD Water Concentration Estimator.

Water concentrations estimated in this way were compared to NYSDEC, EPA, ECCC or MECP water quality criteria/objectives (WQC) (which ever was most conservative), to determine if the presence of these compounds could be potentially problematic to biota. Additionally, the SPMD estimated concentrations were compared with the US/DS measured water quality data at NOTL which was reported for July 2015 coinciding with the deployment of the SPMDs. These comparisons are useful to identify locations that could be important sources of contaminants. However, many of the contaminants are hydrophobic (e.g. PCBs), and are likely bound to sediment. Since SPMDs measure the concentration of the compounds in the dissolved phase only, they do not account for the contaminant concentrations on particulate matter. Accordingly, impacts on the benthic community and food chain effects could be underestimated if concentrations are just below or similar to the criteria since the particulate phase is unaccounted. This underestimation of possible risk is compounded because WQC tend to be based on whole water concentrations which include both the dissolved phase and particulate phase concentrations.

Results

Balsam Lake Control Mussels, SPMDs and SPMD Field and Lab Blanks

Balsam Lake

Trace concentrations of congener specific PCBs were not detected in the Balsam Lake mussels in 2015. This is not surprising given that the historically low tissue concentrations detected in previous surveys were close to the analytical detection limits (2006-2012: Total PCBs (sum of 52 congeners) range: 0.6 – 6 ng/g wet wt.). Atmospheric deposition was suspected as the likely PCB source to the lake in previous surveys since there was no local point source (Johnson *et al*., 2005; MacDonald and Metcalfe 1991). The corresponding PCB concentration in sediment collected in 2006 from the same area where the mussels were collected was also low at 4 ng/g dry wt.

and not indicative of a point source (Richman *et al.* 2011). Organochlorine pesticides and chlorinated compounds were all below the detection limit in the Balsam Lake mussels with the exception of trace concentrations of p,p'-DDE (2 ng/g and 4 ng/g) in two of the five mussels analysed (Appendix D1).

The mean total PCB concentration in the SPMDs was 5.2 ng/SPMD (standard deviation (SD) 0.7 ng/SPMD). The mean total PCB water concentration estimated using the USGS SPMD Water Concentration Estimator was 0.06 ng/L (SD 0.02 ng/L). For comparison, the Ontario Provincial Water Quality Objective for an unfiltered water sample is 1 ng/L. The NYSDEC Water quality Criteria used as a benchmark for the NRTMP is 0.001 ng/L. The homologue pattern for the SPMD was consistent with the profile for the caged mussels in 2006-2012 also suggesting atmospheric deposition as the sources. The SPMD data showed low concentrations of 4,4'- DDE (mean: 2 ng/SPMD; estimated water concentration was 0.02 ng/L (SD 0.01 ng/L), and low concentrations of 4,4'-DDD, HCB, trans-nonachlor (a component of the pesticide chlordane), endosulphan sulphate, and heptachlor epoxide (all means < 1.5 ng/SPMD), and dieldrin (mean 2.0 ng/SPMD) (Appendix F). Estimated water concentrations for these organochlorinated pesticides ranged from 0.001 to 0.05 ng/L (Table 1).

Field Blanks

SPMD field blanks were exposed to the air at three stations for the duration of sample deployment and retrieval (Ushers Creek, Gratwick Riverside Park (GRP), and Bloody Run Creek). The detection of contaminants represents the potential for the SPMDs to adsorb contaminants from the atmosphere. The field blanks had low concentrations (< 0.2 ng/SPMD) for delta HCH, dieldrin (<0.05 ng/SPMD) and PCBs (5.2 – 6.3 ng/SPMD). The only compounds that were consistently detected in the field blanks were 1,4 dichlorobenzene (mean 12.5 ng/SPMD; SD 1.7 ng/SPMD), 1,2 dichlorobenzene, 1,3 dichlorobenzene and 1,2,3 trichlorobenzene (< 3 ng/SPMD). However, these compounds were also present in the lab blanks at similar concentrations and suggest laboratory contamination (Appendix F). SPMD data presented in this report were not blank subtracted.

The PCB homologue pattern in the field blanks was similar to the Balsam Lake SPMD pattern (Figure 2). All three field blanks and Balsam Lake had the trichlorobiphenyls as the dominant homologue. Since the concentration of total PCBs in the SPMD field blanks was similar to the Balsam Lake SPMDs, it is possible the Balsam Lake samples represented exposure to the atmosphere during deployment/retrieval rather than available PCBs in the water. However, the source of PCBs to the water is likely atmospheric as well. PCB congeners were all non-detect in the lab blanks.

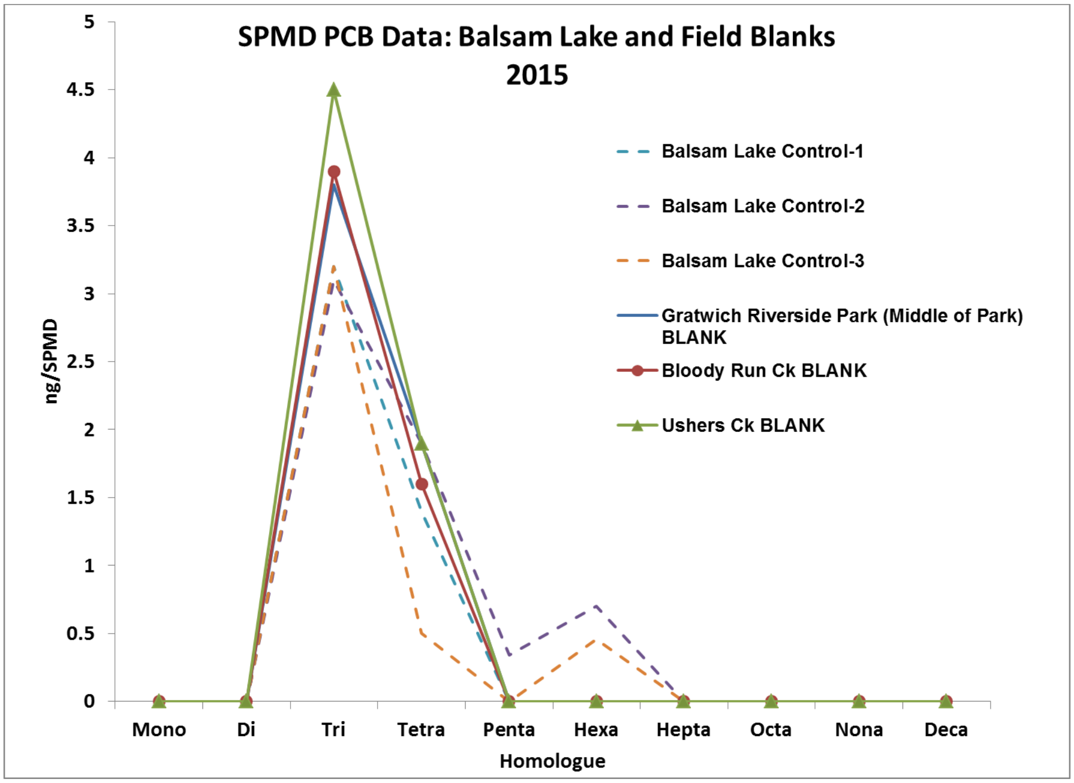


Figure 2: PCB homologue distribution patterns in SPMDs deployed in water in Balsam Lake (dashed lines), and SPMD field blanks exposed to the air during deployment and retrieval, 2015 (solid lines).

Caged Mussel and SPMD Data: Niagara River

Organochlorine Pesticides

With the exception of p,p'- DDE, organochlorine pesticides(OC) have not been routinely detected in caged mussels. Accordingly, the SPMD data provide the best evidence of the presence of these compounds at specific locations in the Niagara River. All raw SPMD data are provided in Appendix F. Water concentrations estimated using the USGS SPMD Water Concentration Estimator are provided in Table 1. The relative patterns of contamination among stations (i.e. locations with high or low concentrations) were consistent between the raw SPMD data (ng/SPMD) and the estimated water concentrations (ng/L).

Overall, SPMD data showed OC pesticides were present at low concentrations throughout the Niagara River, however, criteria for dieldrin, DDT metabolites (4'4,-DDE and 4'4,-DDD), α-HCH (isomer of lindane) and mirex were exceeded at multiple stations (Table 1). This is consistent with the ECCC US/DS water quality monitoring dataset (Hill, 2018) which also showed exceedances in criteria in the water at NOTL for the above chemicals (with the exception of α-HCH). Additionally ECCC found that concentrations of lindane, chlordane, α-endosulphan and mirex were higher in water at NOTL than FE indicating sources of these contaminants in the Niagara River.

Table 1 (updated April 2022): Mean estimated water concentrations (ng/L) using 2015 SPMD data and the USGS Water Concentration Estimator.
Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.
Values that exceed the criteria were highlighted in **red** font. U/S = upstream; D/S = downstream

	Agency	**Water Quality Criteria** ng/L	Two Mile Creek mean (ng/L)	SD (ng/L)	**Exceedence Factor (EF)**	Pettit Flume (U/S) mean (ng/L)	SD (ng/L)	**EF**	Pettit Flume (Outer) mean (ng/L)	SD (ng/L)	**EF**	Pettit Flume D/S mean (ng/L)	SD (ng/L)	**EF**	Fishermans Park (U/S) mean (ng/L)	SD (ng/L)	**EF**	Fishermans Park (D/S) mean (ng/L)	SD (ng/L)	**EF**
1,3-Dichlorobenzene	MECP	**2500**	0.90	0.23		0.29	0.51		141	18.0		2.2	0.47		1.9	0.06		3.1	0.47	
1,4-Dichlorobenzene	MECP	**4000**	7.8	0.91		2.4	4.20		300	69.8		12	1.9		7.9	0.40		18	3.91	
1,2-Dichlorobenzene	NYSDEC	**3000**	1.0	0.04		0.43	0.75		72	14.3		1.6	0.40		1.2	0.14		2.0	0.70	
1,3,5-Trichlorobenzene	MECP	**650**	0.03	0.01		0.003	0.01		4.1	0.44		0.08	0.01		0.11	0.04		0.13	0.07	
1,2,4-Trichlorobenzene	MECP	**500**	0.21	0.05		0.12	0.02		30	3.55		0.34	0.05		0.29	0.09		1.2	0.61	
1,2,3-Trichlorobenzene	MECP	**900**	0.06	0.02		0.04	0.01		15	1.94		0.12	0.02		0.04	0.02		0.35	0.19	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.04	0.01		0.04	0.01		10	0.93		0.18	0.03		0.20	0.08		0.32	0.23	
1,2,3,4-Tetrachlorobenzene	MECP	**100**	0.04	0.01		0.02	0.001		16	1.74		0.22	0.03		0.07	0.03		0.39	0.26	
Hexachlorobutadiene	NYSDEC	**10**	0.01	0.01		0.00	0.002		0.10	0.02		0.00	0.001		0.01	0.004		0.01	0.01	
Pentachlorobenzene	MECP	**30**	0.13	0.02		0.07	0.02		10	0.74		0.25	0.05		0.31	0.14		0.62	0.46	
Hexachlorobenzene	NYSDEC	**0.03**	0.28	0.04	**9**	0.06	0.02	**2**	4.5	0.29	**151**	0.25	0.05	**8**	0.56	0.25	**19**	0.69	0.56	**23**
HCH, gamma	NYSDEC	**8**																		
HCH, alpha	NYSDEC	**2**																		
HCH, beta																				
HCH, delta			0.01	0.01		0.01	0.01		0.004	0.01		0.003	0.003		0.003	0.01		0.002	0.002	
Aldrin	NYSDEC	**2**																		
Octachlorostyrene	NYSDEC	**0.006**	0.004	0.01					0.03	0.002	**5**									
2,4'-DDE			0.01	0.01		0.01	0.01		0.02	0.003		0.01	0.01		0.01	0.01		0.01	0.02	
4,4'-DDE	NYSDEC	**0.007**	0.19	0.04	**27**	0.08	0.02	**11**	0.14	0.01	**20**	0.05	0.01	**8**	0.17	0.08	**24**	0.12	0.10	**17**
2,4'-DDD			0.13	0.03		0.02	0.01		0.11	0.004		0.01	0.001					0.03	0.03	
4,4'-DDD	NYSDEC	**0.08**	0.43	0.07	**5**	0.06	0.01		0.43	0.01	**5**	0.05	0.01		0.14	0.07	**2**	0.09	0.08	**1**
2,4'-DDT			0.06	0.01		0.05	0.01		0.03	0.03		0.02	0.01		0.08	0.07		0.05	0.05	
4,4'-DDT	NYSDEC	**0.01**	0.07	0.01	**7**				0.03	0.02	**2**									
Mirex	NYSDEC	**0.001**	0.23	0.12	**231**				0.05	0.09	**51**									
Chlordane, alpha (cis)			0.26	0.03		0.04	0.01		0.19	0.01		0.03	0.004		0.08	0.03		0.05	0.04	
Chlordane, gamma (trans)			0.16	0.02		0.03	0.01		0.11	0.01		0.02	0.004		0.05	0.02		0.03	0.03	
Nonachlor, cis-			0.03	0.00		0.01	0.002		0.02	0.001		0.01	0.001		0.02	0.01		0.01	0.01	
Nonachlor, trans-			0.13	0.02		0.03	0.01		0.09	0.004		0.02	0.01		0.05	0.02		0.04	0.03	
Heptachlor	NYSDEC	**0.2**																		
Heptachlor Epoxide	NYSDEC	**0.3**	0.13	0.02		0.06	0.02		0.05	0.01		0.04	0.01		0.08	0.04		0.04	0.03	
alpha-Endosulphan	MECP (proposed)	**3**	0.04	0.07																
beta-Endosulphan						0.005	0.01													
Endosulphan Sulphate			0.06	0.11		0.01	0.01		0.18	0.15								0.02	0.03	
Dieldrin	NYSDEC	**0.0006**	0.39	0.05	**649**	0.11	0.04	**186**	0.11	0.01	**185**	0.06	0.01	**106**	0.17	0.07	**286**	0.11	0.07	**187**
Endrin	NYSDEC	**2**				0.001	0.001													
Methoxychlor	NYSDEC	**30**	0.05	0.05														0.01	0.02	
Total PCB	NYSDEC	**0.001**	17	2.90	**17289**	6.4	1.84	**6417**	186	14.5	**186335**	4.9	1.19	**4901**	14	6.34	**14237**	7.6	6.45	**7624**

Table 1 (updated April 2022): Continued

Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.

Values that exceed the criteria were highlighted in **red** font. U/S = upstream; D/S = downstream

	Agency	Water Quality Criteria ng/L	GRP (U/S Marina) mean (ng/L)	SD (ng/L)	EF	GRP (Marina) mean (ng/L)	SD (ng/L)	EF	GRP (U/S) mean (ng/L)	SD (ng/L)	EF	GRP (mid) mean (ng/L)	SD (ng/L)	EF	GRP (D/S) mean (ng/L)	SD (ng/L)	EF	102 nd St. (U/S) mean (ng/L)	SD (ng/L)	EF	LNR (D/S 102nd St.) mean (ng/L)	SD (ng/L)	EF	Cayuga Creek mean (ng/L)	SD (ng/L)	EF
1,3-Dichlorobenzene	MECP	2500	1.9	0.76		12	2.46		2.6	0.69		2.4	0.77		1.3	1.18		2.1	0.36		5.1	4.61		2.0	1.88	
1,4-Dichlorobenzene	MECP	4000	6.9	1.58		39	7.75		11	1.91		11	1.21		7.1	6.21		8.0	0.50		11	9.55		8.0	6.95	
1,2-Dichlorobenzene	NYSDEC	3000	0.56	0.48		4.9	1.25		1.5	0.50		1.7	0.49		1.1	0.94		0.98	0.11		0.83	0.73		1.5	1.39	
1,3,5-Trichlorobenzene	MECP	650	0.03	0.003		0.23	0.05		0.03	0.002		0.03	0.01		0.02	0.002		0.03	0.004		0.18	0.01		0.21	0.05	
1,2,4-Trichlorobenzene	MECP	500	0.10	0.01		0.88	0.10		0.13	0.01		0.34	0.04		0.09	0.01		0.14	0.01		1.03	0.04		0.81	0.15	
1,2,3-Trichlorobenzene	MECP	900	0.02	0.03		0.16	0.06		0.03	0.02		0.06	0.01		0.01	0.01		0.02	0.002		0.22	0.00		0.08	0.02	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.05	0.01		0.31	0.08		0.06	0.003		0.07	0.01		0.04	0.01		0.17	0.02		0.81	0.06		0.67	0.20	
1,2,3,4-Tetrachlorobenzene	MECP	100	0.03	0.004		0.24	0.06		0.04	0.02		0.04	0.01		0.02	0.003		0.04	0.01		2.7	0.05		1.0	0.27	
Hexachlorobutadiene	NYSDEC	10	0.01	0.004		0.01	0.01					0.01	0.003		0.001	0.001		0.003			0.004	0.001		0.02	0.01	
Pentachlorobenzene	MECP	30	0.11	0.02		0.27	0.08		0.11	0.004		0.11	0.01		0.08	0.01		0.09	0.01		2.1	0.07		0.71	0.22	
Hexachlorobenzene	NYSDEC	0.03	0.18	0.01	6	0.28	0.10	9	0.15	0.01	5	0.18	0.04	6	0.11	0.02	4	0.16	0.03	5	0.52	0.01	17	0.23	0.06	8
HCH, gamma	NYSDEC	8																0.06	0.11		0.06	0.06		0.72	0.02	
HCH, alpha	NYSDEC	2																0.07	0.12		0.25	0.03		36	0.79	18
HCH, beta																								9.5	0.29	
HCH, delta																		0.01	0.01		0.02	0.001		0.81	0.29	
Aldrin	NYSDEC	2													0.001	0.002					0.005	0.004				
Octachlorostyrene	NYSDEC	0.006				0.02	0.005	3																0.01	0.001	1.2
2,4'-DDE			0.01	0.01		0.08	0.07		0.005	0.01		0.01	0.01		0.01	0.003		0.01	0.002		0.01	0.002		0.02	0.01	
4,4'-DDE	NYSDEC	0.007	0.06	0.01	9	0.33	0.10	47	0.05	0.004	8	0.08	0.01	11	0.05	0.01	8	0.06	0.01	8	0.06	0.01	9	0.21	0.05	29
2,4'-DDD									0.01	0.01		0.01	0.02		0.01	0.01		0.02	0.002		0.06	0.003		0.06	0.02	
4,4'-DDD	NYSDEC	0.08	0.06	0.01		0.30	0.09	4	0.06	0.01		0.06	0.005		0.05	0.01		0.05	0.01		0.22	0.01	3	0.28	0.08	3
2,4'-DDT			0.04	0.04		0.27	0.02		0.03	0.03		0.02	0.03		0.03	0.01		0.02	0.005		0.02	0.003		0.05	0.02	
4,4'-DDT	NYSDEC	0.01													0.002	0.004		0.01	0.01		0.01	0.01				
Mirex	NYSDEC	0.001													0.003	0.005	3	0.01	0.01	8	0.004	0.01	4	0.11	0.02	109
Chlordane, alpha (cis)			0.03	0.01		0.09	0.03		0.03	0.002		0.04	0.01		0.02	0.01		0.03	0.01		0.03	0.002		0.10	0.03	
Chlordane, gamma (trans)			0.02	0.004		0.07	0.02		0.02	0.001		0.03	0.002		0.02	0.003		0.02	0.004		0.02	0.001		0.06	0.02	
Nonachlor, cis-			0.01	0.001		0.02	0.01		0.01	0.001		0.01	0.001		0.01	0.002		0.01	0.002		0.01	0.001		0.01	0.004	
Nonachlor, trans-			0.02	0.004		0.04	0.01		0.02	0.001		0.02	0.004		0.02	0.003		0.02	0.004		0.02	0.001		0.05	0.01	
Heptachlor	NYSDEC	0.2													0.001	0.002		0.002	0.004							
Heptachlor Epoxide	NYSDEC	0.3	0.06	0.01		0.02	0.02		0.05	0.004		0.06	0.01		0.04	0.01		0.04	0.004		0.04	0.002		0.05	0.02	
alpha-Endosulphan	MECP (proposed)	3																								
beta-Endosulphan																										
Endosulphan Sulphate																										
Dieldrin	NYSDEC	0.0006	0.10	0.01	160	0.09	0.03	147	0.08	0.01	128	0.09	0.01	158	0.08	0.02	137	0.08	0.01	136	0.07	0.002	123	0.09	0.01	144
Endrin	NYSDEC	2																								
Methoxychlor	NYSDEC	30																								
Total PCB	NYSDEC	0.001	96	10.95	95813	77	27.34	77320	18	1.87	18376	15	2.67	15466	9.0	2.30	9018	8.3	1.64	8250	10	0.52	10284	3.3	0.81	3346

Table 1 (updated April 2022): Continued

Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.

Values that exceed the criteria were highlighted in **red** font. U/S = upstream; D/S = downstream

	Agency	Water Quality	LNR (D/S Cayuga Ck)			U/S Occ			Storm Sewer A			Storm Sewer B			Storm Sewer C			Occ 003			U/S Gill Creek (in NR)			Gill Creek (mouth)		
		Criteria	mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD	
		ng/L	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF
1,3-Dichlorobenzene	MECP	2500	0.88	1.52		2.1	0.27		1.7	1.58		1.2	1.16		1.6	1.41		74	6.43		0.81	0.73		15	1.50	
1,4-Dichlorobenzene	MECP	4000	3.3	5.73		7.7	0.33		4.8	4.25		7.3	1.00		6.7	0.83		46	2.47		2.8	2.44		34	2.55	
1,2-Dichlorobenzene	NYSDEC	3000	0.23	0.40		0.57	0.51		0.62	0.54		0.38	0.66		0.66	0.57		5.3	0.21		0.48	0.42		15	1.45	
1,3,5-Trichlorobenzene	MECP	650	0.08	0.04		0.03	0.001		0.02	0.01		0.03	0.004		0.06	0.005		0.83	0.26		0.01	0.01		0.08	0.02	
1,2,4-Trichlorobenzene	MECP	500	0.19	0.10		0.07	0.003		0.08	0.01		0.09	0.01		0.14	0.01		18	3.95		0.04	0.04		3.3	0.41	
1,2,3-Trichlorobenzene	MECP	900	0.05	0.02		0.01	0.01		0.02	0.00		0.02	0.005		0.02	0.02		2.52	0.62		0.01	0.01		0.80	0.13	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.25	0.14		0.07	0.002		0.07	0.01		0.10	0.02		0.23	0.02		3.6	0.98		0.10	0.08		0.51	0.16	
1,2,3,4-Tetrachlorobenzene	MECP	100	0.38	0.19		0.07	0.005		0.19	0.01		0.21	0.03		0.31	0.02		3.5	6.14		0.04	0.03		0.28	0.09	
Hexachlorobutadiene	NYSDEC	10	0.005	0.003		0.003			0.01	0.00		0.02	0.01		0.03	0.01		16	6.48		0.01	0.005		8.7	1.88	
Pentachlorobenzene	MECP	30	0.42	0.23		0.14	0.01		0.24	0.05		0.32	0.06		0.55	0.04		8.4	3.00		0.06	0.05		0.35	0.14	
Hexachlorobenzene	NYSDEC	0.03	0.22	0.14	7	0.12	0.01	4	0.10	0.01	3	0.12	0.02	4	0.70	0.08	23	4.0	1.55	134	0.09	0.07	3	0.32	0.13	11
HCH, gamma	NYSDEC	8	0.03	0.05		0.02	0.04								0.03	0.05		0.07	0.06					1.1	0.19	
HCH, alpha	NYSDEC	2	1.4	0.20		0.97	0.07		0.68	0.15		0.53	0.07		0.48	0.01		0.84	0.09					16	0.16	8
HCH, beta			0.55	0.15		0.08	0.14		0.16	0.14					0.43	0.08		0.73	0.16					2.4	0.18	
HCH, delta			0.05	0.03		0.01	0.002		0.01	0.004		0.01	0.002		0.01	0.002		0.03	0.01		0.01	0.01		0.22	0.06	
Aldrin	NYSDEC	2	0.002	0.004		0.002	0.004		0.001	0.002					0.001	0.002		0.004	0.01					0.002	0.003	
Octachlorostyrene	NYSDEC	0.006	0.01	0.01	0.8	0.01	0.001	1.1	0.01	0.002	1.3	0.01	0.004	1.3	0.10	0.01	16	0.47	0.19	78	0.02	0.01	3	0.02	0.01	3
2,4'-DDE			0.02	0.02		0.01	0.001		0.01	0.01								0.01	0.01		0.003	0.01				
4,4'-DDE	NYSDEC	0.007	0.14	0.10	20	0.06	0.004	8	0.04	0.003	6	0.04	0.01	6	0.04	0.003	5	0.07	0.02	10	0.03	0.02	5	0.03	0.01	5
2,4'-DDD			0.06	0.03		0.02	0.002		0.01	0.01		0.005	0.01		0.003	0.01		0.01	0.01							
4,4'-DDD	NYSDEC	0.08	0.19	0.11	2	0.06	0.01		0.04	0.01		0.03	0.01		0.03	0.001		0.06	0.02		0.02	0.02		0.03	0.02	
2,4'-DDT			0.07	0.04		0.03	0.003		0.01	0.01		0.01	0.01					0.02	0.02		0.01	0.004		0.01	0.01	
4,4'-DDT	NYSDEC	0.01							0.01	0.005																
Mirex	NYSDEC	0.001	0.08	0.05	76	0.02	0.001	18	0.01	0.01	11				0.11	0.01	106	1.4	0.51	1434						
Chlordane, alpha (cis)			0.07	0.05		0.03	0.001		0.02	0.001		0.02	0.002		0.02	0.002		0.03	0.01		0.01	0.01		0.01	0.01	
Chlordane, gamma (trans)			0.05	0.03		0.02	0.001		0.01	0.001		0.01	0.002		0.01	0.001		0.02	0.01		0.01	0.01		0.01	0.003	
Nonachlor, cis-			0.02	0.01		0.01			0.004	0.001		0.005	0.001		0.004	0.001		0.01	0.002		0.003	0.002		0.004	0.002	
Nonachlor, trans-			0.06	0.04		0.02	0.001		0.01	0.001		0.01	0.002		0.01			0.02	0.01		0.01	0.01		0.01	0.004	
Heptachlor	NYSDEC	0.2	0.002	0.003		0.002	0.003		0.002	0.003								0.01	0.01							
Heptachlor Epoxide	NYSDEC	0.3	0.05	0.02		0.04	0.001		0.04	0.002		0.04	0.003		0.03	0.001		0.06	0.02		0.06	0.04		0.04	0.02	
alpha-Endosulphan	MECP (proposed)	3																								
beta-Endosulphan																										
Endosulphan Sulphate																										
Dieldrin	NYSDEC	0.0006	0.08	0.04	140	0.07	0.004	110	0.06	0.002	106	0.06	0.01	105	0.06	0.001	92	0.08	0.02	139	0.10	0.06	160	0.08	0.03	135
Endrin	NYSDEC	2																								
Methoxychlor	NYSDEC	30										0.01	0.01													
Total PCB	NYSDEC	0.001	9.3	5.85	9293	6.8	0.22	6832	4.8	0.40	4768	4.8	0.96	4828	5.0	0.09	4951	186	114.3	185918	0.56	0.48	558	7.0	2.50	7017

Table 1 (updated April 2022): Continued

Concentrations were compared with Water Quality Criteria: Exceedence Fatcors (EF) represent the ratio of the water concentration estimate to the criteria.

Values that exceed the criteria were highlighted in **red** font.   U/S = upstream; D/S = downstream

	Agency	Water Quality	BRC (U/S)			BRC			BRC (D/S)			FE			Ushers Ck			Chippawa Channel			NOTL			Balsam Lake		
		Criteria	mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD		mean	SD	
		ng/L	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF	(ng/L)	(ng/L)	EF
1,3-Dichlorobenzene	MECP	2500	1.4	0.04		1.2	0.16		1.8	0.28		0.46	0.40		0.26	0.46		0.30	0.52		1.3	0.25		0.95	0.30	
1,4-Dichlorobenzene	MECP	4000	4.9	0.17		5.6	0.99		4.2			4.4	0.23		4.0	0.54		2.7	2.39		5.6	0.41		4.1	0.71	
1,2-Dichlorobenzene	NYSDEC	3000	0.55	0.78		0.65	0.93		1.1	0.01		0.37	0.32		0.69	0.70		0.18	0.31		0.29	0.50		0.70	0.64	
1,3,5-Trichlorobenzene	MECP	650				0.04	0.03		0.03						0.002	0.004					0.003	0.004				
1,2,4-Trichlorobenzene	MECP	500	0.08	0.001		0.13	0.09		0.24	0.002											0.08	0.001				
1,2,3-Trichlorobenzene	MECP	900	0.04	0.003		0.05	0.04		0.07	0.01					0.01	0.02		0.02	0.01		0.01	0.02				
1,2,4,5-/1,2,3,5-Tetrachlorobenzene			0.06	0.005		0.39	0.03		0.25	0.01		0.001	0.001		0.01	0.01		0.001	0.002		0.04	0.01				
1,2,3,4-Tetrachlorobenzene	MECP	100	0.10	0.004		0.46	0.06		0.32	0.02		0.002			0.003	0.003					0.08	0.01				
Hexachlorobutadiene	NYSDEC	10	0.02	0.001		0.25	0.01		0.12	0.01					0.002	0.004		0.002	0.003		0.01	0.001				
Pentachlorobenzene	MECP	30	0.15	0.004		2.6	0.05		1.3	0.09		0.01	0.001		0.05	0.01		0.01	0.003		0.07	0.01		0.004	0.003	
Hexachlorobenzene	NYSDEC	0.03	0.34	0.01	11	1.8	0.50	59	1.1	0.11	38	0.02	0.002		0.02	0.01		0.02	0.003		0.08	0.02	3	0.01	0.01	
HCH, gamma	NYSDEC	8	0.06	0.09		0.30	0.15		0.17	0.24		0.06	0.10													
HCH, alpha	NYSDEC	2				0.20	0.01																			
HCH, beta																										
HCH, delta			0.005	0.01		0.01	0.01		0.004	0.01											0.004	0.01				
Aldrin	NYSDEC	2				0.01	0.002																			
Octachlorostyrene	NYSDEC	0.006	0.07	0.003	12	0.10	0.02	17	0.10	0.01	17										0.04	0.01	6			
2,4'-DDE						0.001	0.001					0.01														
4,4'-DDE	NYSDEC	0.007	0.01		2	0.04	0.005	6	0.02	0.003	2	0.62	0.03	88	0.13	0.03	19	0.05	0.01	8	0.02	0.003	3	0.02	0.01	3
2,4'-DDD						0.003	0.001		0.001	0.002		0.03	0.002		0.01	0.003		0.005	0.001							
4,4'-DDD	NYSDEC	0.08	0.01		0	0.01	0.003		0.01	0.001		0.15	0.01	2	0.04	0.01		0.03	0.003		0.01	0.002		0.001	0.002	
2,4'-DDT			0.002	0.003					0.002	0.003		0.01	0.001		0.001	0.001					0.003	0.01				
4,4'-DDT	NYSDEC	0.01			0	0.01	0.002		0.003	0.005		0.03	0.002	3	0.01	0.002		0.01	0.001							
Mirex	NYSDEC	0.001			0	0.02	0.01	21	0.01	0.002	11															
Chlordane, alpha (cis)			0.005			0.01	0.001		0.01	0.001		0.01	0.001		0.02	0.003		0.01	0.001		0.01	0.001		0.003	0.003	
Chlordane, gamma (trans)			0.003			0.004	0.001		0.004	0.001		0.01			0.01	0.003		0.005	0.001		0.01	0.001		0.003	0.002	
Nonachlor, cis-			0.001			0.002			0.002			0.003			0.01	0.000		0.001	0.001		0.002	0.001				
Nonachlor, trans-			0.004			0.01	0.001		0.005	0.001		0.01			0.03	0.01		0.01	0.001		0.01	0.002		0.004	0.002	
Heptachlor	NYSDEC	0.2	0.001	0.002																	0.01	0.01		0.05	0.05	
Heptachlor Epoxide	NYSDEC	0.3	0.02	0.001		0.02	0.01		0.02	0.002		0.03	0.001		0.02	0.005		0.02	0.003		0.02	0.003		0.01	0.004	
alpha-Endosulphan	MECP (proposed)	3				0.16	0.02																			
beta-Endosulphan						0.07	0.10																			
Endosulphan Sulphate																										
Dieldrin	NYSDEC	0.0006	0.05		86	0.05	0.01	79	0.05	0.01	90	0.06	0.01	106	0.04	0.01	65	0.06	0.01	98	0.05	0.005	83	0.02	0.01	39
Endrin	NYSDEC	2																								
Methoxychlor	NYSDEC	30																								
Total PCB	NYSDEC	0.001	0.27	0.02	267	1.6	0.61	1574	0.75	0.11	750	0.20	0.01	198	0.12	0.04	122	0.12	0.04	125	0.64	0.14	642	0.06	0.02	57

In contract, the US/DS water quality data identified Lake Erie as a source of metabolites of DDT and dieldrin to the Niagara River, in addition to sources within the Niagara River (Hill and Klawunn 2009; Hill, 2018).

Generally, pesticides and their by-products and isomers (e.g., lindane and α-HCH; heptachlor epoxide; chlordane and trans and cis isomers), were present at the highest concentrations in SPMDs in tributaries such as Gill Creek, Two Mile Creek and Cayuga Creek suggesting that these tributaries are sources to the Niagara River (Figures 3-5). ECCC water quality data for the month of July 2015 at NOTL (concurrent with the SPMD deployment period) was compared with estimated concentrations of contaminants in SPMDs deployed at stations in this study to highlight these areas as sources. Estimated concentrations of α-HCH at Cayuga Creek were 1200 times higher than concentrations measured at NOTL in the water by ECCC. Estimated concentrations of α-chlordane at Two Mile Creek and the Pettit Flume were 65 and 47 times greater than NOTL water concentrations respectively. The SPMD data indicated that historically there was also widespread use of some of these persistent compounds including DDT and dieldrin, since many of the pesticides were present at all sites at concentrations that were similar on both sides of the river.

The highest SPMD concentrations of 4,4'-DDE were present at Fort Erie (Figure 6). The Fort Erie SPMD data was consistent with the caged mussel data for 4,4'-DDE (Appendix D1) and consistent with data from earlier surveys. A likely explanation for relatively higher 4,4'-DDE concentrations at Fort Erie is that from 1952 to 1967, DDT was applied to trees and shrubs in Fort Erie every two weeks from June through to the end of September to control caddisflies (Fredeen, 1971). The area sprayed included 8 km of river bank and shrubbery and trees extending about 1 km from the river along every street. Additionally, an area extending beyond the city limits for about 1.6 km north and a large park to the south of Fort Erie were also routinely sprayed with DDT. The estimated water concentration from the SPMDs were 32 times higher than the concentrations measured using SPMDs at NOTL and suggest that this area is a source of 4,4'-DDE to the river due to the historical spraying. Further investigation of the Fort Erie site will continue in 2018 for the purpose of investigating/differentiating the legacy contamination from any potential, ongoing sources of DDT and metabolites.

The highest concentration of the insecticide mirex was present in SPMDs deployed near the **Occidental Chemical Corporation** Buffalo Avenue Plant (herein referred to as Occidental and/or OCC), at their 003 sewer outfall (Figure 7). Occidental is located adjacent to the Niagara River upstream of the Niagara River's confluence with Gill Creek. The facility (formally known as Hooker Chemical Co. which began operation in 1903), has manufactured over 250 chemical products including Mirex. Permitted wastewater is discharged to the river from the 003 outfall. As well, there were at least 10 hazardous waste sites located on the property which were known to leach contaminants into the groundwater (NRTC, 1984) until the 1990s when extensive remediation was undertaken at various locations on the property to contain and reduce the movement of these contaminants. Recent monitoring using caged mussels and SPMDs at historical sewers located along the Niagara River have not detected contaminants, or they have been present at low concentrations. However, Sewer 003 is an active outfall servicing the Occidental facility and is an ongoing source of contaminants to the River (See section on chlorinated benzenes/ industrial compounds and PCBs: Figures 8-12, 15, 19-20). The presence of mirex in the Niagara River at this site suggested that mirex is possibly entering into the river either through runoff in the vicinity of the Occidental 003 sewer or directly from the sewer. Mirex concentration near the sewer were 1434 times greater than the water quality criteria. The 10 year annual mean water concentration at NOTL was used since the concentration for the month of July 2015 was below the detection limit.

The presence of mirex in SPMDs at the 003 sewer, in the Little Niagara River (LNR) at a station downstream of 102nd St. Hazardous Waste Site, and at Bloody Run Creek was consistent with historical caged mussel data collected since the 1980's (Richman *et al.* 2011). In 2012 the highest concentration of mirex in SPMDs was present in the LNR and associated stations. Occidental was the sole producer of mirex until 1976 when its use was restricted by both Canadian and U.S. legislation (Apeti and Lauenstein, 2006; Interagency Task Force on Hazardous Waste, 1979). Additionally, Hooker Chemical disposed of waste into the 102nd Street Hazardous Waste Site and Hyde Park Hazardous Waste Site (which contaminated Bloody Run Creek), when they were in operation.

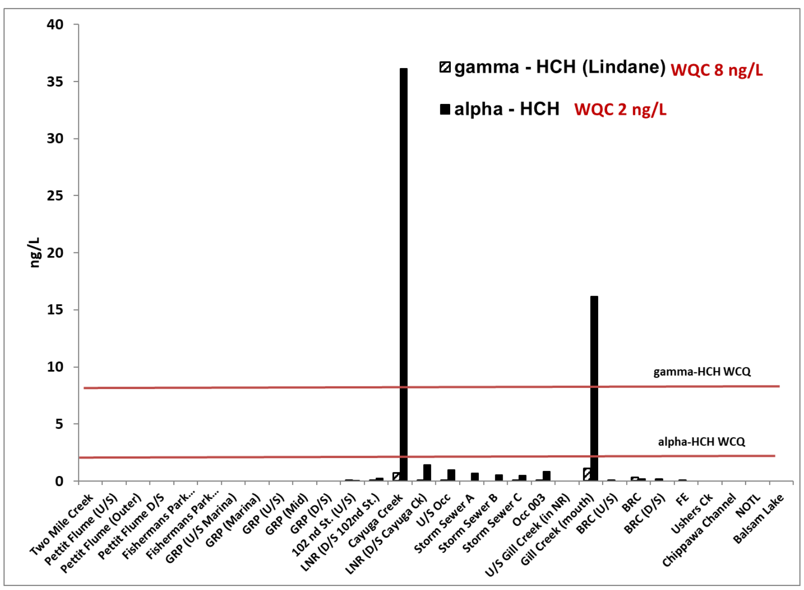


Figure 3: Estimated water concentrations (ng/L) for organochlorine pesticides (lindane and isomer alpha HCH) in SPMDs, Niagara River, 2015. WQC (Water Quality Criteria). **NOTE**: on all figures stations are listed from upstream to downstream. Canadian sites begin at Fort Erie (FE) and extend to the end of the X axis. GRP: Gratwick Riverside Park; LNR: Little Niagara River; BRC: Bloody Run Creek; NOTL: Niagara-on-the-Lake.

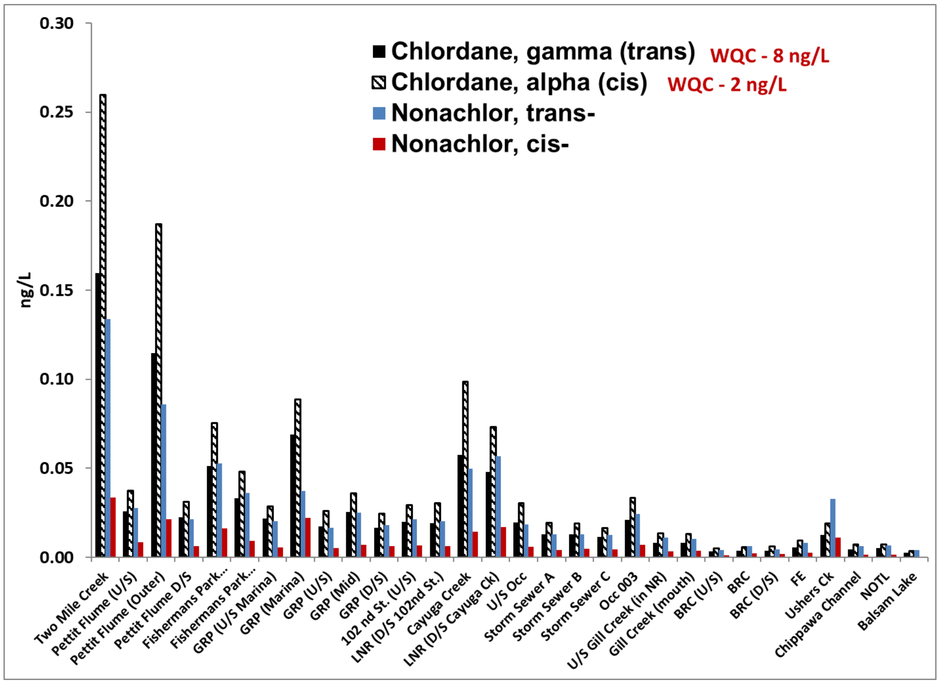


Figure 4: Estimated water concentrations (ng/L) for organochlorine pesticides (chlordane and isomers) in SPMDs, Niagara River, 2015**.**

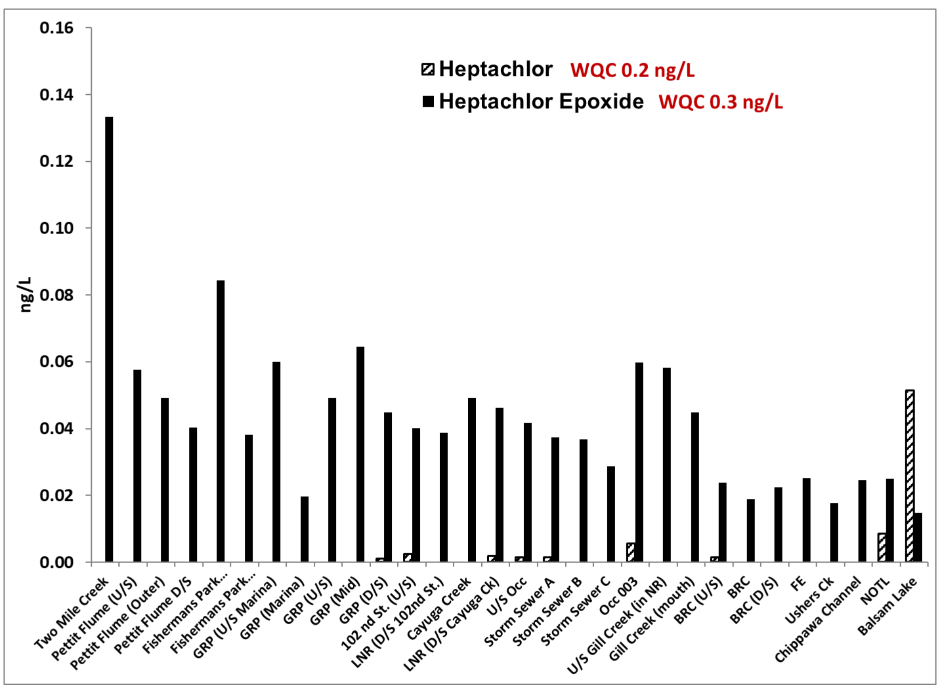


Figure 5: Estimated water concentrations (ng/L) for organochlorine pesticides (heptachlor and heptachlor epoxide) in SPMDs, Niagara River, 2015.

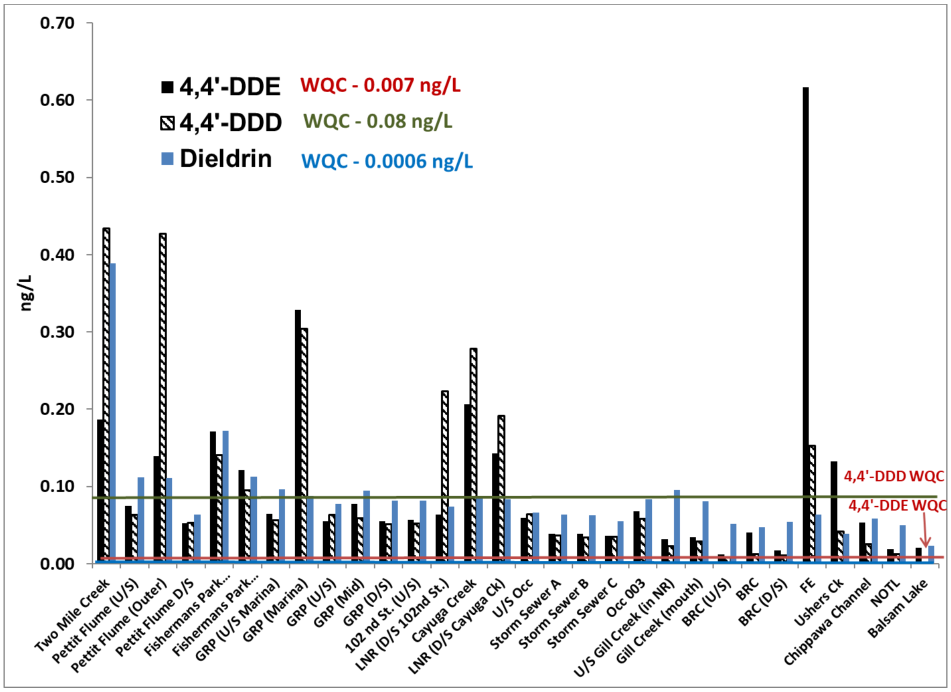


Figure 6: Estimated water concentrations (ng/L) for organochlorine pesticides (DDT metabolites and dieldrin) in SPMDs, Niagara River, 2015.

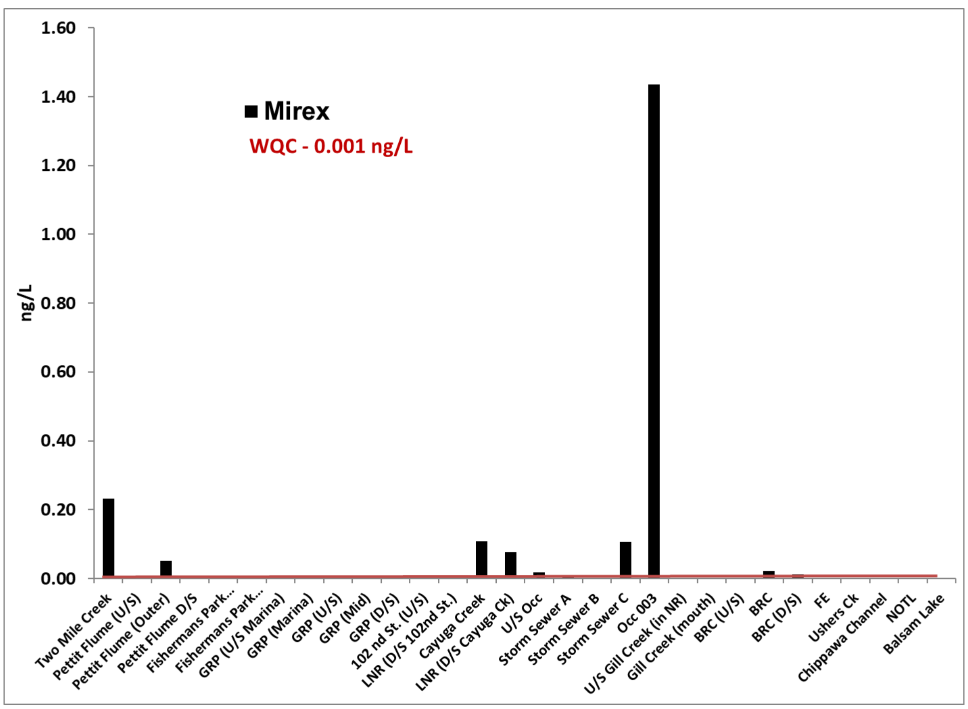


Figure 7: Estimated water concentrations (ng/L) for organochlorine pesticides (mirex) in SPMDs, Niagara River, 2015.

Chlorinated Benzenes and Industrial Compounds

The ECCC US/DS water monitoring dataset (2005-2015; Hill, 2018) identified several organic contaminants that exceed the most stringent water quality criteria and/or showed evidence of statistically significant Niagara River sources: e.g., hexachlorobenzene (HCB), pentachlorobenzene, octachlorostyrene (OCS), and hexachlorobutadiene (HCBD). Multiple sources in the river have been identified using the caged mussel and SPMD dataset. A relative comparison of chlorinated benzene concentrations among stations for both mussels and SPMDs identified the Pettit Flume, Occidental (Sewer 003), Bloody Run Creek and to a lesser extent the 102nd St. Hazardous Waste Site as sources of these contaminants (Figures 8 –10). Sources of octachlorostyrene (OCS) were Occidental Sewer 003 and Bloody Run Creek (WQC exceeded at these locations), and hexachlorobutadiene (HCBD) sources were Occidental and Gill Creek (Figures 11-13). The WQC for hexachlorobenzene (HCB) was exceeded at all stations on the US side of the river and at NOTL on the Canadian side, however, the highest concentrations were present in both mussels and SPMDs at the Pettit Flume, Occidental Sewer 003, and Bloody Run Creek .

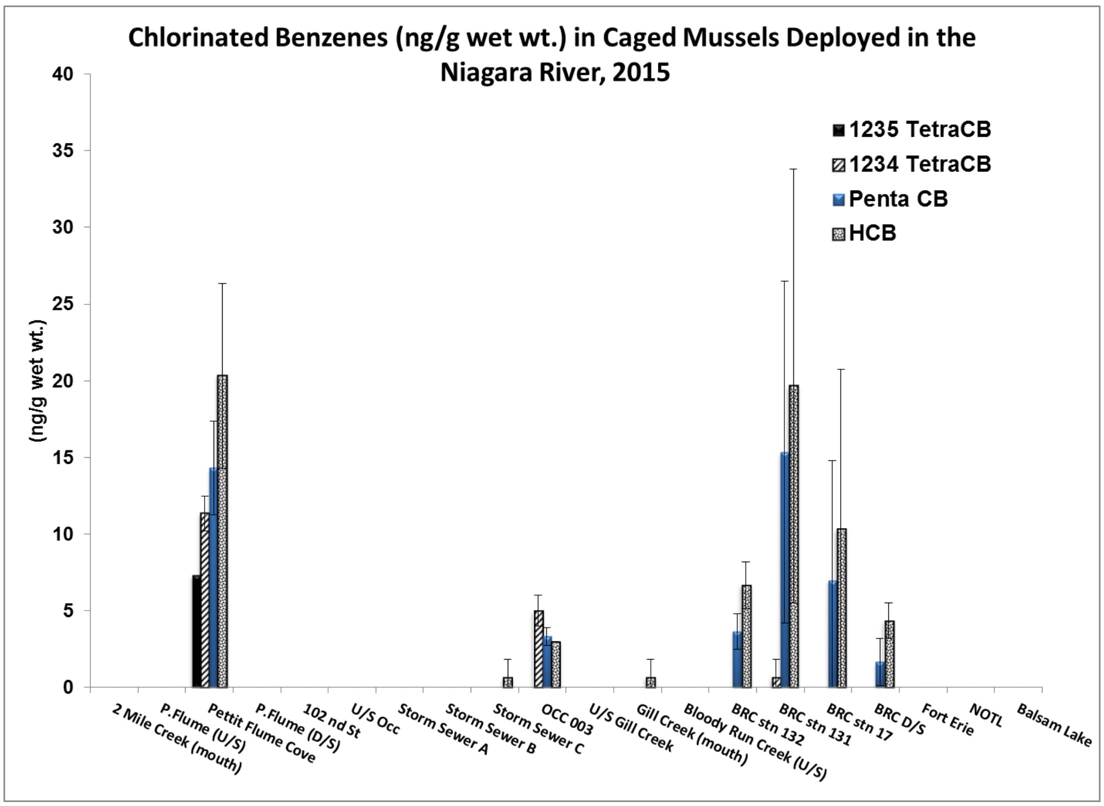


Figure 8: Mean (+/- SE) concentrations of chlorinated benzenes in caged mussels deployed in the Niagara River 2015).

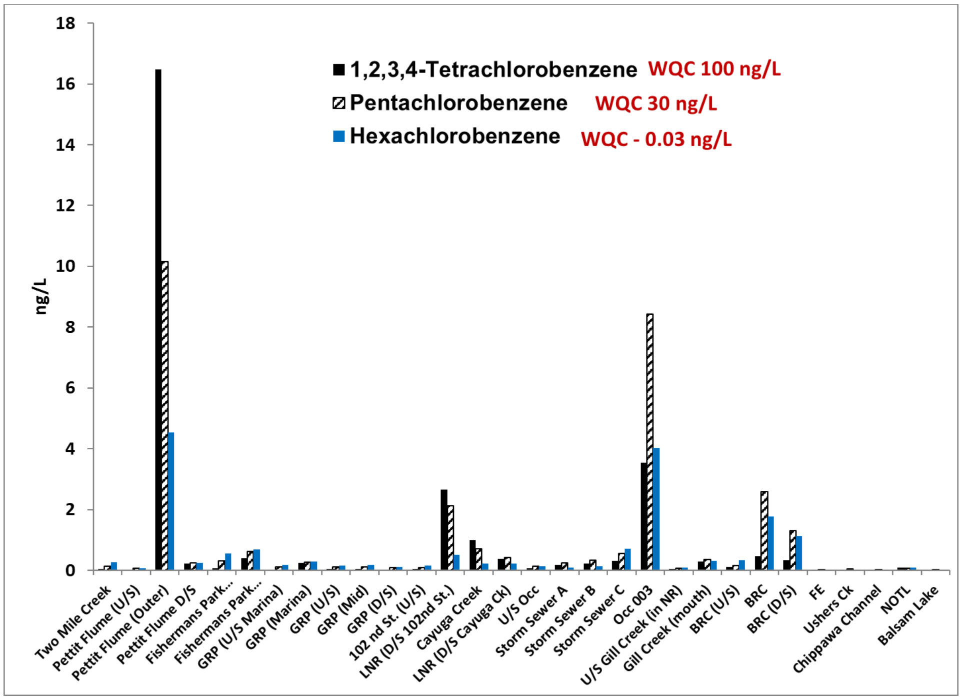


Figure 9: Estimated water concentrations (ng/L) for chlorinated benzenes in SPMDs deployed in the Niagara River, 2015.

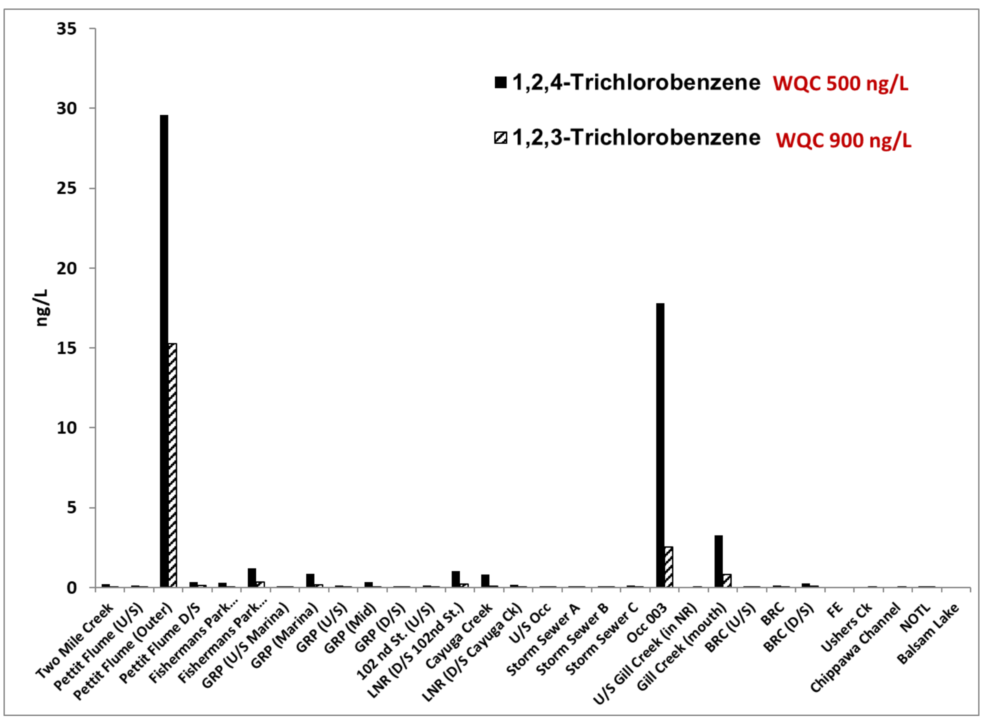


Figure 10: Estimated water concentrations (ng/L) for trichlorobenzenes from SPMDs deployed in the Niagara River, 2015.

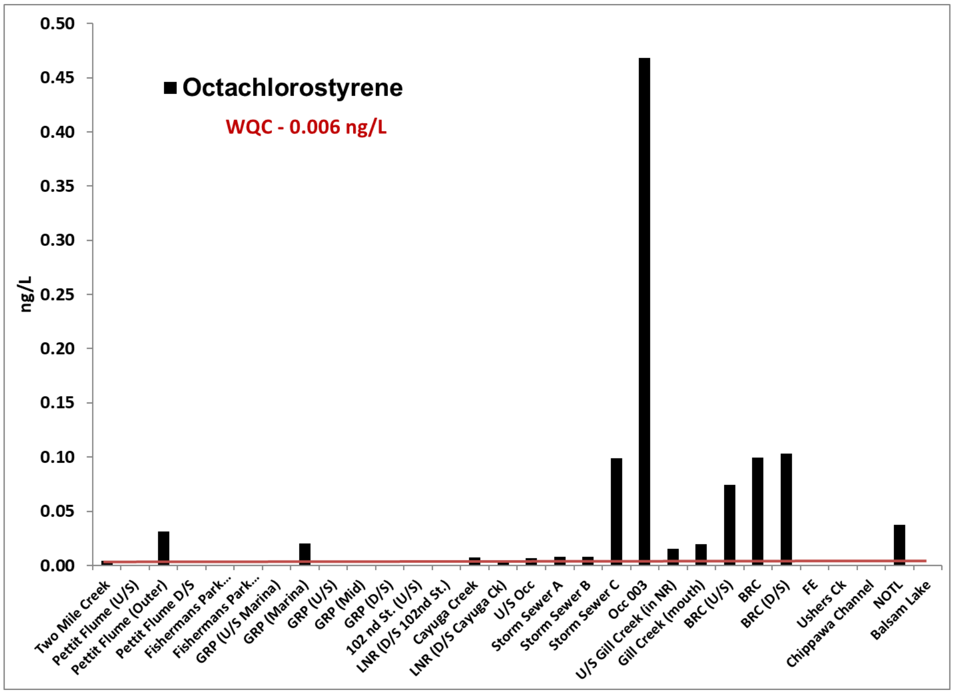


Figure 11: Estimated water concentrations (ng/L) for OCS from SPMDs deployed in the Niagara River, 2015.

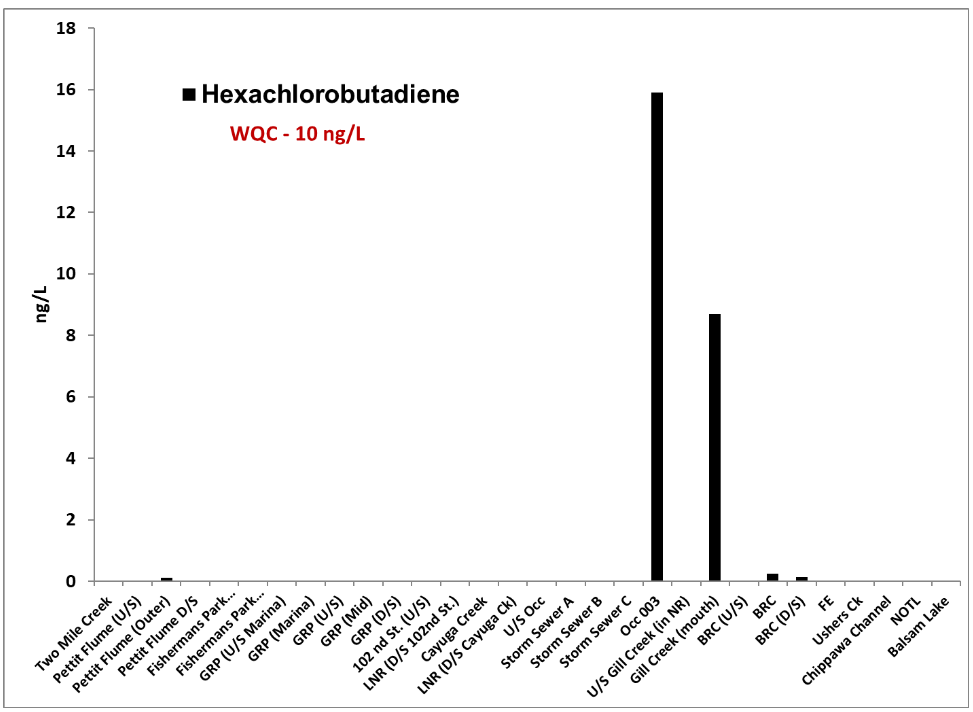


Figure 12: Estimated water concentrations (ng/L) for HCBD from SPMDs deployed in the Niagara River, 2015

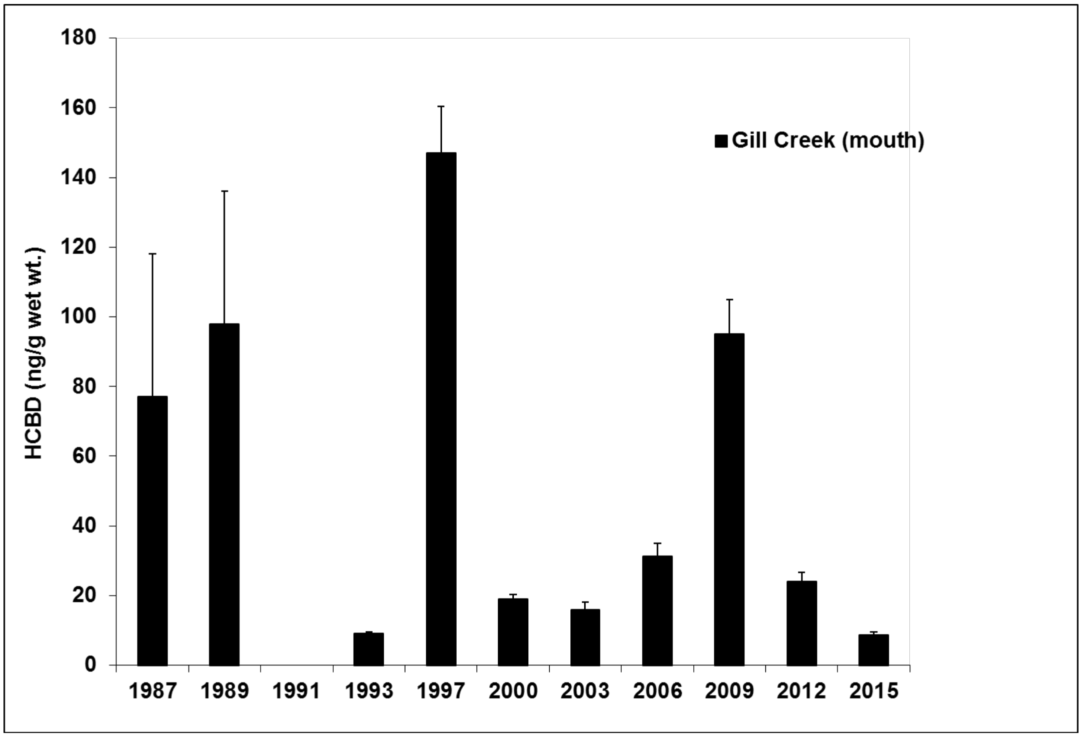


Figure 13: Mean (+/- SE) concentrations of HCBD in caged mussels deployed at the mouth of Gill Creek through time (1987-2015).

The ***Pettit Flume*** is a storm sewer in North Tonawanda that received waste water from the Occidental Chemical Corporation's Durez Division plant and hazardous waste site (Geologic Testing Consultants Ltd., 1984). The storm sewer discharges from the shore into a cove of the Niagara River. Remediation of the site from 1990 to 1995 included on-site containment of contaminants, removal of contaminated sediment from sewer lines, and sediment removal from the cove. The sediments were contaminated with inorganic and organic wastes including chlorinated phenols, chlorotoluene, dioxins and furans and phenol tar containing chlorinated benzenes (Interagency Task Force on Hazardous Waste, 1979; US EPA and NYSDEC, 2004). Prior to the remediation of the cove, tetrachlorobenzene, pentachlorobenzene and HCB were detected at high concentrations in mussels (Figure 14). Post remediation monitoring consistently showed that concentrations in mussels have remained low relative to pre-remediation. Nevertheless, the mussel and SPMD data continue to identify the Pettit Flume as a source of chlorinated benzenes relative to other locations in the river. The estimated water concentration based on the SPMD data for HCB at the Pettit Flume was 151 times greater than the most stringent water quality criteria. For pentachlorobenzene and 1,2,3,4-tetrachlorobenzene the estimated water concentrations from the SPMD data were greater than concentrations measured at NOTL, however, these concentrations were 3 and 6 times lower than the water quality criteria respectively.

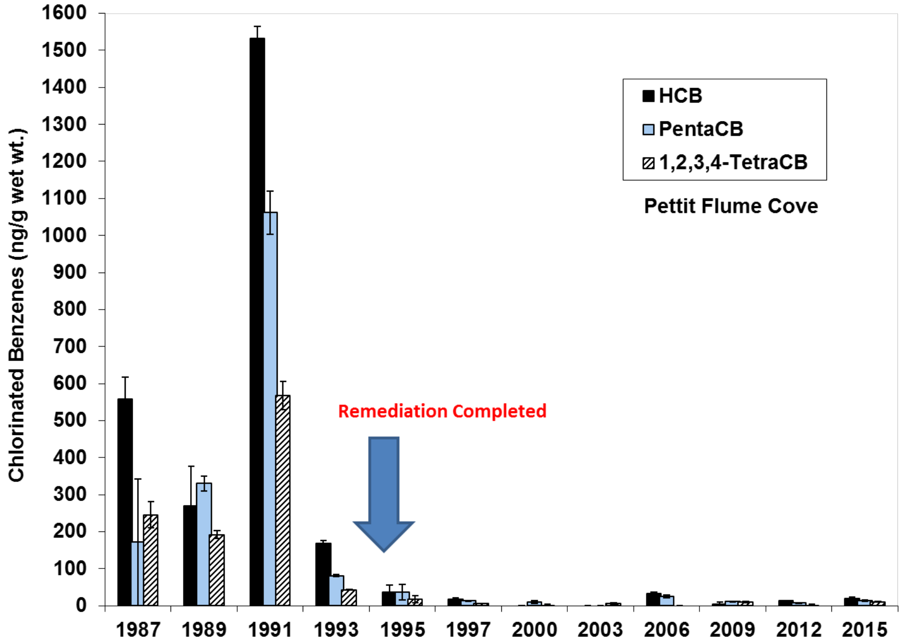


Figure 14: Mean (+/- SE) concentrations of organic compounds in caged mussels deployed at the Pettit Flume Cove through time (1987-2015).

Occidental's Buffalo Avenue Plant first described above when referring to it as a source of mirex to the Niagara River, also discharges chlorinated benzenes and other industrial compounds in its permitted wastewater (Figures 8-12 and 15).

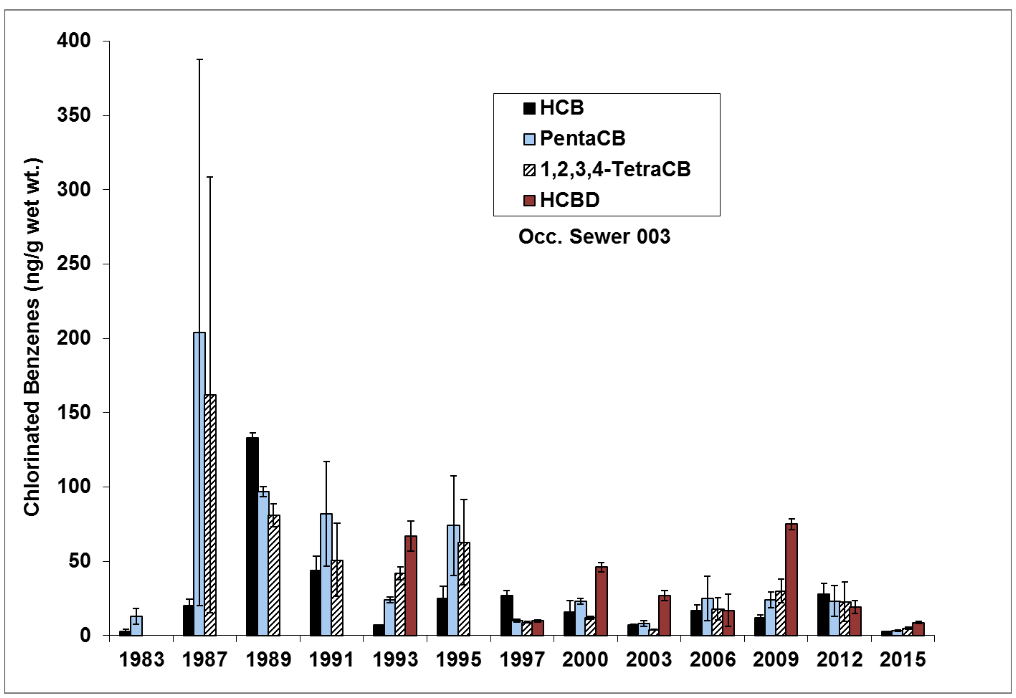


Figure 15: Mean (+/- SE) concentrations of chlorinated organic compounds in caged mussels deployed at the Occidental Chemical Corp. Sewer 003 through time (1983-2015).

Estimated water concentrations at the 003 sewer for OCS and HCBD were 78 and 1.6 times the WQC. Long term monitoring data using caged mussels was consistent with the SPMD data in identifying this outfall as a source of these contaminants of concern.

Hyde Park: a 6.1 hectare hazardous waste disposal site, was operated by the Hooker Chemical Co. (now Occidental Chemical Corp.) from 1953 to 1975 (NRTC, 1984). Approximately 55,000 tons of halogenated wastes including chlorinated benzenes, toluenes and phenols were buried at this site (Interagency Task Force on Hazardous Waste, 1979). ***Bloody Run Creek (BRC)***, which runs adjacent to the waste site, drains storm water run-off and overburden leachate overflow from the site and discharges it into the lower Niagara River. Despite the remediation at the Hyde Park site and the upper section of the Creek throughout the early 1990's, the lower section continues to be a source of contaminants to the Niagara River. Chlorobenzenes which include 1,2,3,4-tetrachlorobenzene, pentachlorobenzene and HCB have been detected in mussels deployed at BRC site since 1987 (Figure 16 & 17). There has been variation in contaminant concentrations measured in mussels through time likely due to fluctuations in surface runoff from the contaminated soil in the gorge, but the compounds present at this site have remained consistent and bioavailable. The reason for the high concentrations of HCB and pentaCb measured in 1993 is unknown and could possibly have been related to high precipitation and increased runoff during the deployment period. Interestingly, a review of the US/DS suspended sediment data for July of 1993 also showed an increase in HCB at NOTL relative to the annual mean HCB concentration suggesting an episodic event that may have also been captured by the caged mussels (Burniston et al 2015).

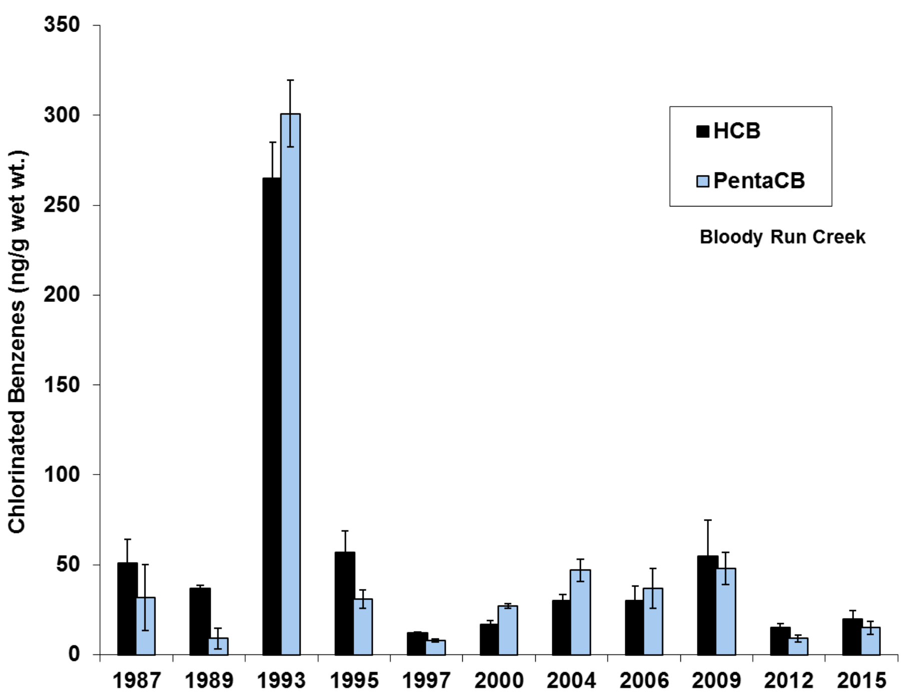


Figure 16: Mean (+/- SE) concentrations of chlorinated organic compounds in caged mussels deployed at Bloody Run Creek through time (1987-2015).

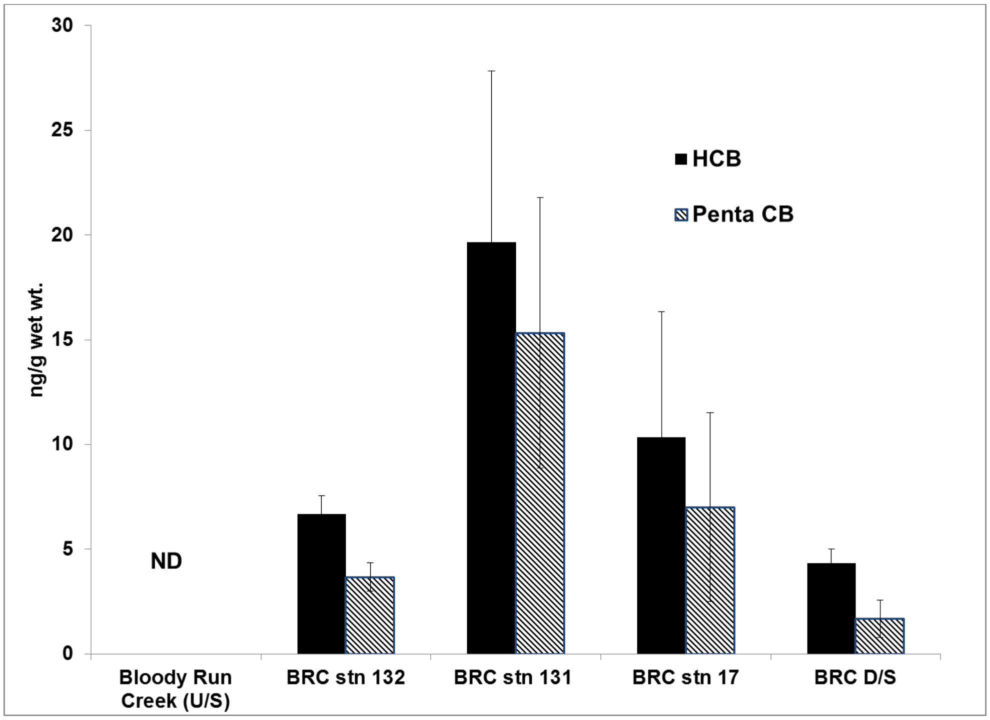


Figure 17: Mean (+/- SE) concentrations of hexachlorobenzene and pentachlorobenzene in caged mussels deployed at Bloody Run Creek and upstream and downstream of the contaminated area, 2015. ND (non-detect)

At the **Canadian Sites**, the highest estimated water concentrations of pentachlorobenzene (mean 0.07 ng/L; SD 0.01 ng/L), hexachlorobenzene (mean 0.08 ng/L; SD 0.02 ng/L), and 1,2,3,4-tetrachlorobenzene (mean: 0.08 ng/L; SD 0.01 ng/L), were detected in SPMDs at NOTL (Figure 18). This is consistent with the 2012 study and not surprising since contaminants detected from US sources on the upper river will be mixed with the relatively cleaner water from the Canadian side as the water passes over the falls, and then detected on the Canadian side at the mouth of the river. This is also consistent with the ECCC US/DS water quality data where contaminants with sources within the Niagara River such as the contaminants listed above were detected only at NOTL and not at the upstream (Fort Erie) site (Hill and Klawunn 2009; Hill, 2018).

Figure 18 shows an increase in pentachlorobenzene at Ushers Creek relative to Fort Erie and Chippawa Channel suggestive of a possible source. There are no industrial sources on Ushers Creek but there is a golf course. Pentachlorobenzene is present as an impurity in fungicides and in several herbicides, and pesticides currently in use in Canada (Canada.ca Fact sheet) suggesting that the golf course could be a potential source. However, to put the SPMD estimated water concentration in perspective, it is at least four times lower than the ECCC measured concentration at NOTL. For comparison to other identified sources in the Niagara River, the concentration at Ushers Creek is 200 times lower than concentrations estimated for the Petite Flume cove and 168 times lower than the concentration estimated at Occidental sewer 003.

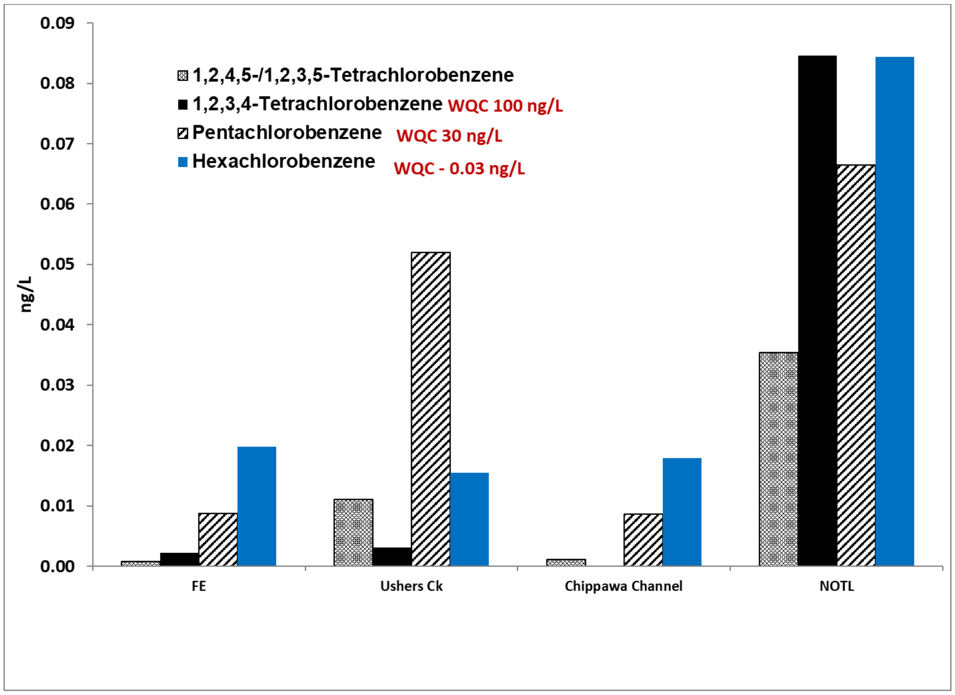


Figure 18: Chlorinated Benzenes in SPMDs (ng/L) (mean +/- SD) deployed on the Canadian side of the Niagara River, 2015.

Total PCB (Polychlorinated Biphenyls)

The caged mussel and SPMD data identified the sites within the Niagara River that are potential sources of PCBs (Figures 19 & 20). Generally, the two datasets were consistent; however, PCBs are highly hydrophobic and depending on the Aroclor, will mostly be present in the particulate phase rather than the dissolved phase. Accordingly, the caged mussel PCB concentrations likely reflected PCB contamination in both the sediment and water column due to their feeding behaviour, while the SPMDs would only be reflecting PCBs in the dissolved-phase in water; the lower chlorinated homologues. Additionally, since mussels are live biomonitors they may react to an unfavourable environment by shutting down and thereby reduce their capacity to accumulate the contaminants compared with the SPMDs.

The 2015 data for PCBs at all sites were consistent with historical datasets identifying the same locations as sources of PCBs. Mussels and/or SPMDs identified Occidental Sewer 003 and Two Mile Creek as sources of PCBs as well as a PCB source(s) upstream of Gratwick Riverside Park. The SPMDs also had high concentrations of total PCBs at the Pettit Flume, however, a review of the data show a highly unusual congener distribution driven by mono and dichlorobiphenyls (PCB-1, 2 and 3): a pattern that was also observed in 2012 which confirms that it was not an anomaly for this site (Figure 21). The caged mussels are not analysed for these congeners so this site was not identified as a significant source using that dataset. The homologue pattern may reflect the presence of Aroclor 1221 although a source has not been determined. Listed industrial uses of A1221 were as a dielectric fluid in capacitors, in gas transmission turbines, as a plasticizer in rubber, and in adhesives.

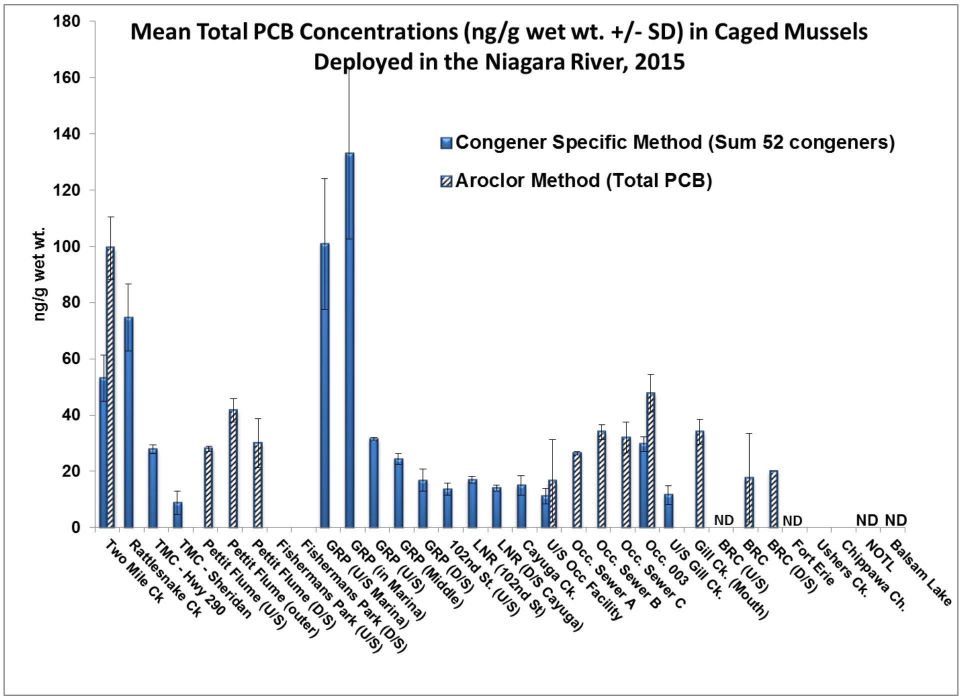


Figure 19: Mean (+/- SD) total PCB concentrations in caged mussels (analysis congener specific method (sum of 52 congeners ND<5 ng/g) and/or Aroclor method (ND<20 ng/g)) deployed at sites along the Niagara River in 2015. ND (non-detect). Mussels were not deployed at Fisherman's Park, Ushers Creek or Chippawa Channel.

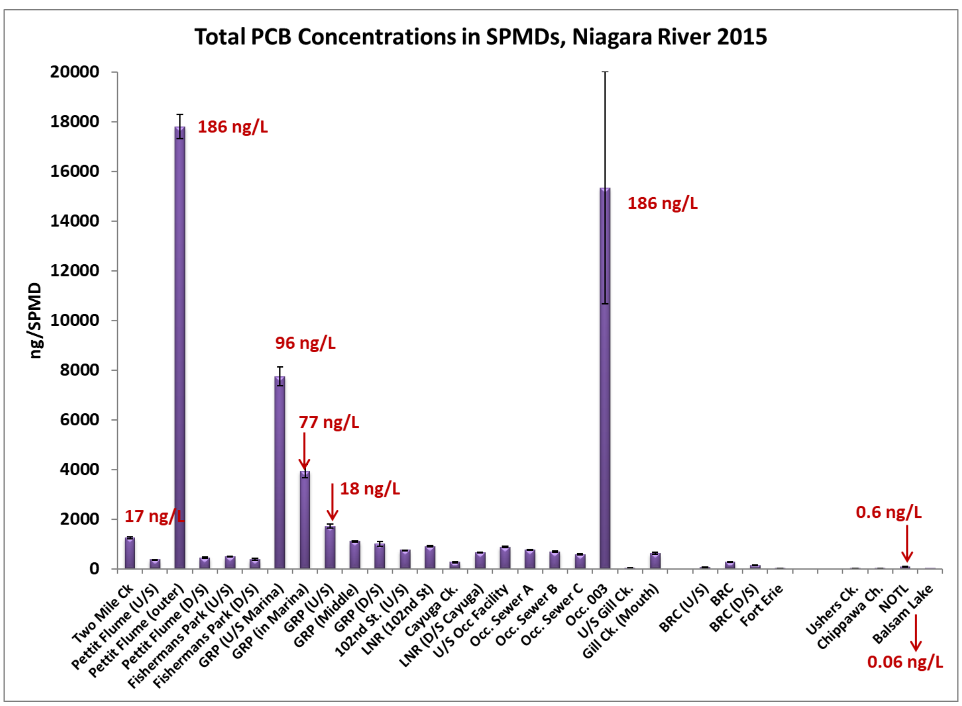


Figure 20: Mean (+/- SD) total PCBs (sum of 209 congeners) for SPMDs deployed in the Niagara River, 2015 with estimated water concentrations (ng/L). For reference, the WQC for total PCBs is 0.001 ng/L (NYSDEC).

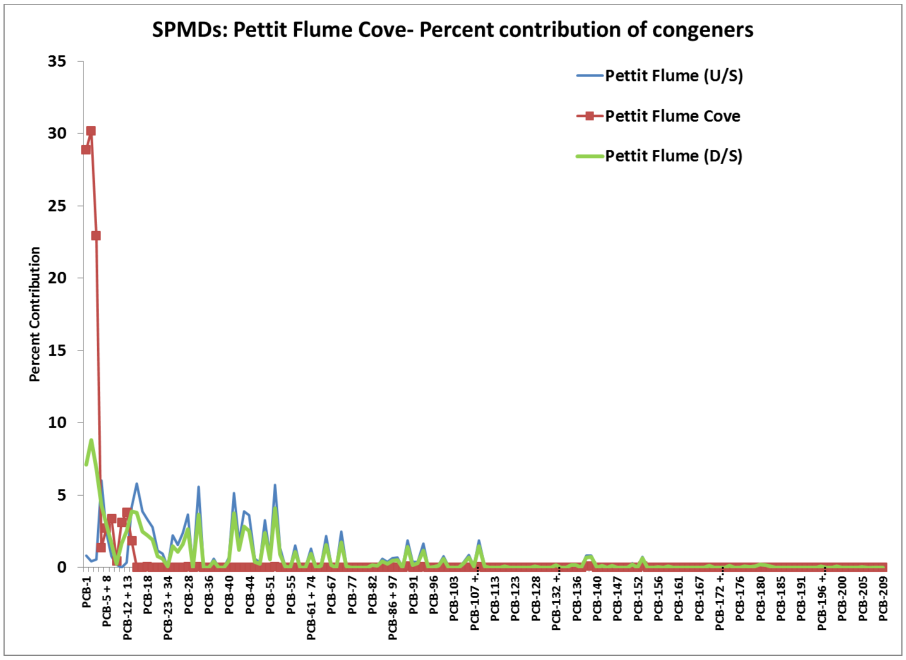


Figure 21: Congener pattern (percent contribution of each congener to total PCBs) for SPMDs deployed in the Pettit Flume Cove, and U/S and D/S of the cove, (208 congeners), 2015.

The congener pattern for PCBs detected in mussels and SPMDs at the OCC. Sewer 003 resembled Aroclor 1248 and was consistent with data from 2012 identifying this sewer outfall as a source of bioavailable PCBs (Figure 22).

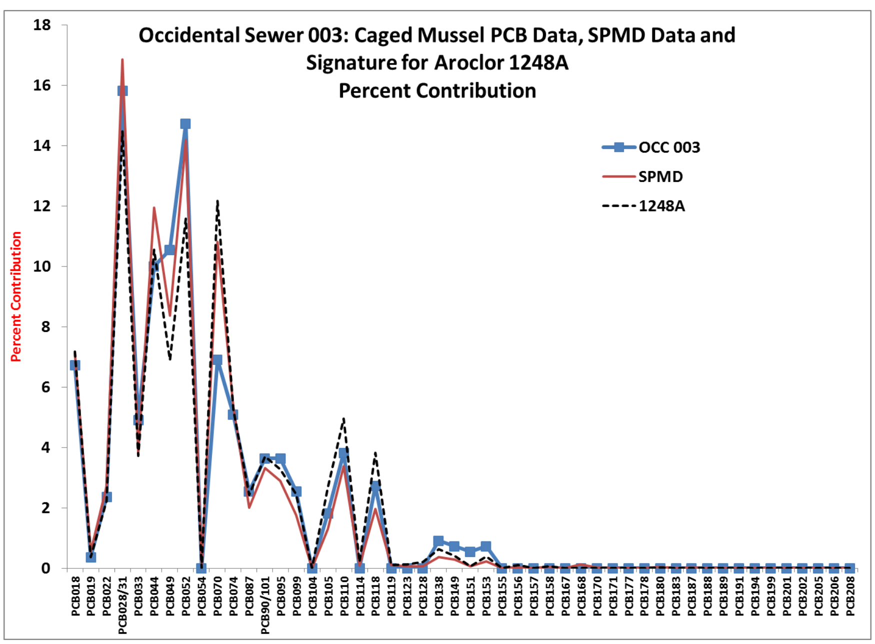


Figure 22: Congener pattern (percent contribution of each congener to total PCBs) for caged mussels, SPMDs and the pattern for Aroclor 1248A. The number of congeners presented for SPMDs and Aroclor 1248 were reduced to match the 52 congeners analysed in mussels.

Gratwick Riverside Park (GRP) is located along the shore of the Niagara River in the city of North Tonawanda. It is 53 acres and was used, prior to the 1970's, as a landfill that accepted municipal and industrial waste as well as metallurgical slag, and phenolic waste from the Occidental Durez site. It was identified as a State Superfund site and remedial actions began in 1999. The goal of the remediation was to provide shoreline protection, install a slurry wall between the site and the river to act as a hydraulic barrier and prevent the movement of contaminants to the river, cap the site so that it can be used as a park and collect and treat contaminated groundwater. Remediation of the site was completed by 2003 (USEPA and NYDEC 2003). The 2012 SPMD and caged mussel data identified PCBs at the upper end of the Park as being higher than most other sites in the river suggesting two possibilities: 1) PCBs were still leaching into the river from the former waste site; 2) there were other sources of PCBs upstream of GRP. In the 2015 survey, additional sampling stations were located immediately upstream of GRP in a marina, and about 135 m further upstream of GRP along the Niagara River shoreline. Both SPMD and caged mussel data had PCB concentrations that were higher at these two stations than concentrations measured at the GRP station which suggested that there were sources of PCBs upstream of GRP. Mean estimated water concentrations from the SPMDs were 96 ng/L and 77 ng/L at these upstream stations compared with 18 ng/L at GRP. Concentrations continued to decrease with increasing distance downstream of the area with high PCB concentrations (Figures 19 & 20). The congener patterns in mussels and SPMDs for all the sites associated with this location were the same suggesting a common source. The pattern in the mussels somewhat reflected Aroclor 1248, although there were some differences (PCB 21/33, 44 and 70), up until congener 119, but then the higher chlorinated congeners were also elevated in the caged mussels and so in total, the pattern reflected a combination of Aroclor 1248 and possibly Aroclor 1254 (Figures 23; Appendix G). The SPMD congener data has a similar pattern to Aroclor 1248 as well (Figure 24). Fisherman's Park, about 800 m further upstream, had low concentrations of PCBs in SPMDs (mussels were not analysed for PCBs at that site) (Figure 20) which suggests that the source is likely between Fishermans Park and GRP.

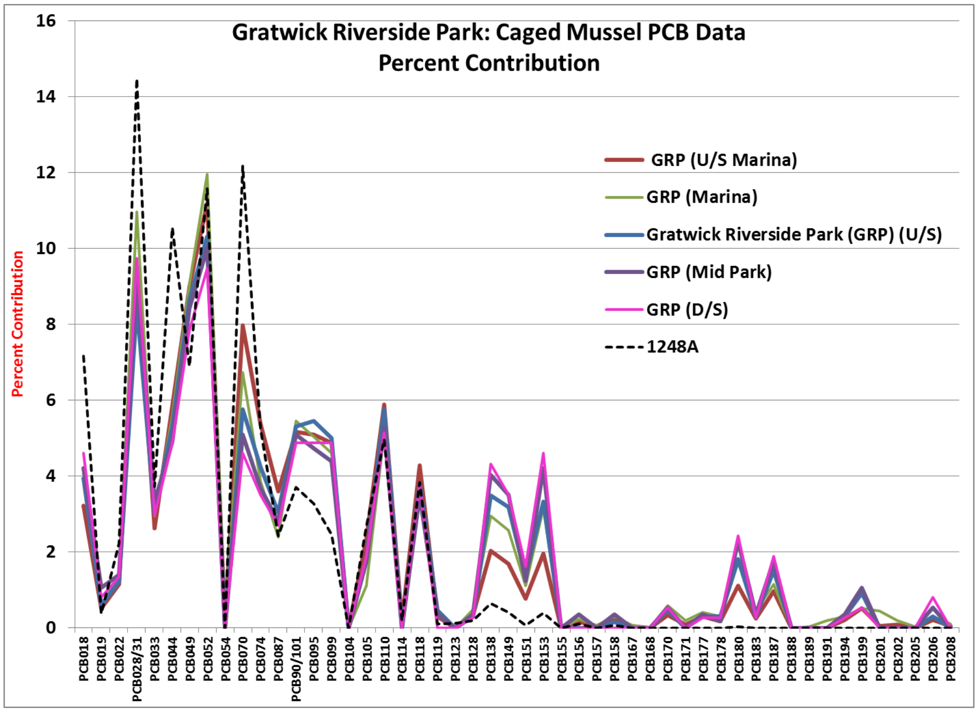


Figure 23: Congener patterns (percent contribution of each congener to total PCB concentration) in the caged mussels deployed along the shoreline U/S and D/S of GRP compared with the pattern for Aroclor 1248.

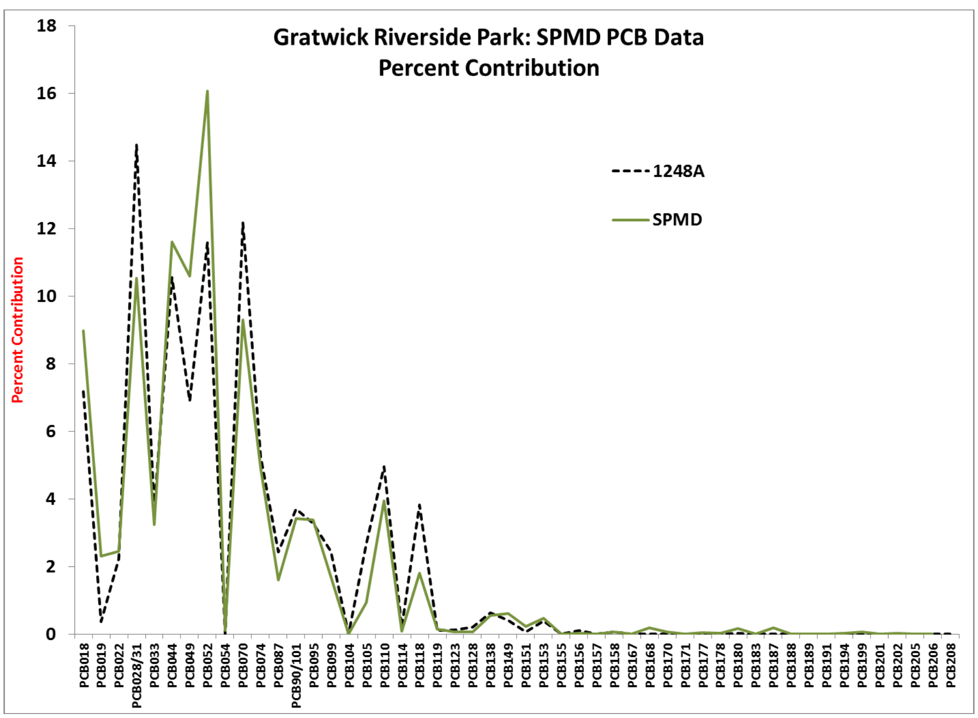


Figure 24: Congener patterns (percent contribution of each congener to total PCB concentration) in the SPMD deployed at the GRP station U/S of the marina compared with the pattern for Aroclor 1248.

Two Mile Creek has been identified by NYSDEC as a PCB contaminated site due to historic and ongoing active sources (e.g., runoff from landfills, inactive hazardous waste sites, storm sewers and industries located upstream) (Niagara River Secretariat 2002). Mussels were deployed at three sites in Two Mile Creek: At the head of the river at Sheridan Rd., downstream of Hwy 290, and at the mouth of the creek upstream of Niagara Street. Congener patterns in the mussels were similar within the creek at all three sites, although there were some differences likely due to the multiple sources at different locations along the length of the creek (Figure 25). The congener pattern most resembled Aroclor 1254 compared with the other Aroclors, although the increase in percent contribution for higher chlorinated congeners suggests input from Aroclor 1260 as well. The mean total PCB concentration for the station located at the head of the creek was lower than at the two downstream stations (sum of 52 congeners, total PCBs: 8.8 ng/g wet wt., SD 4.2 ng/g) compared with 28 ng/g wet wt. (SD 1.5 ng/g) at station Hwy 290 and a range from 44 to 60 ng/g (wet wt.) for mussels deployed at the creek mouth.

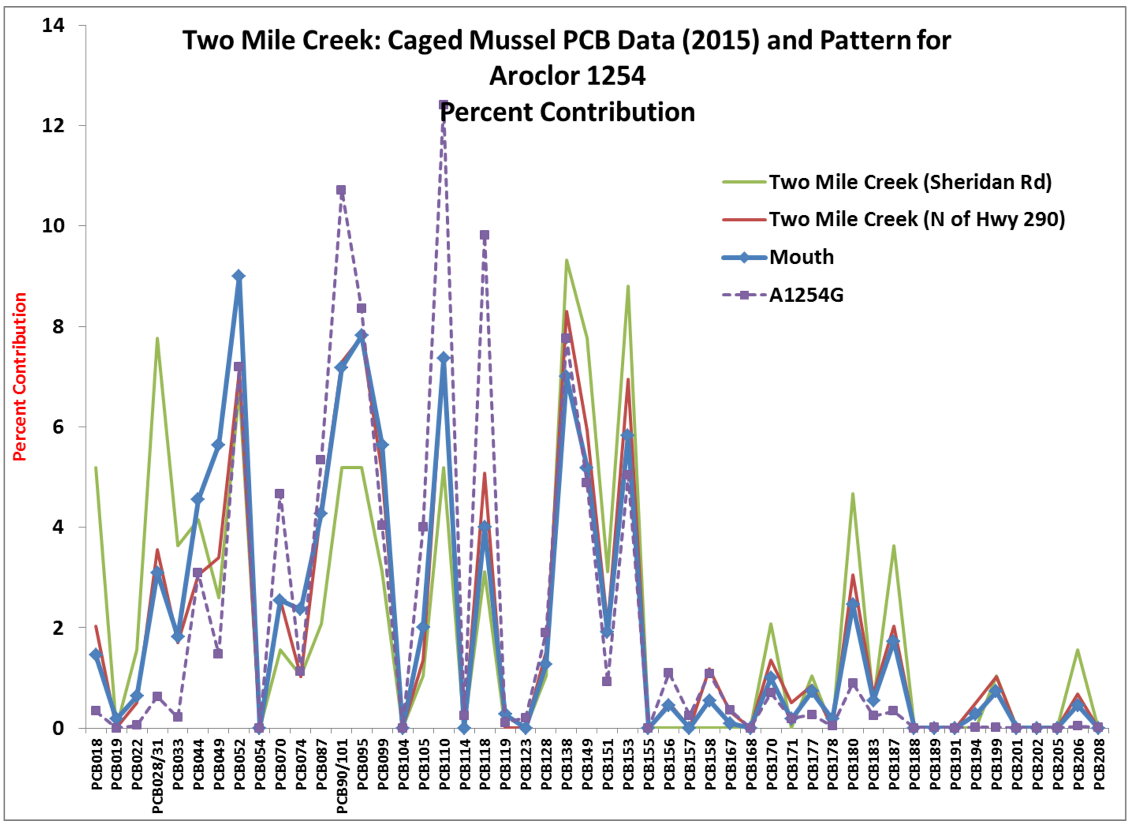


Figure 25: Congener patterns (percent contribution of each congener to total PCB concentration) in the caged mussels deployed along Two Mile Creek (2015) compared with the pattern for Aroclor 1254.

The mouth of Two Mile Creek has also been monitored since 1987 using caged mussels analysed by the Aroclor method. Mussels analysed using this method had higher concentrations than the congener specific method discussed above (mean Aroclor method: 99

ng/g SD 11 ng/g), however, there has been no change through time in mussel tissue concentrations regardless of the analytical method (Figure 26). This is not unexpected since there has not been any remediation at the mouth of the creek.

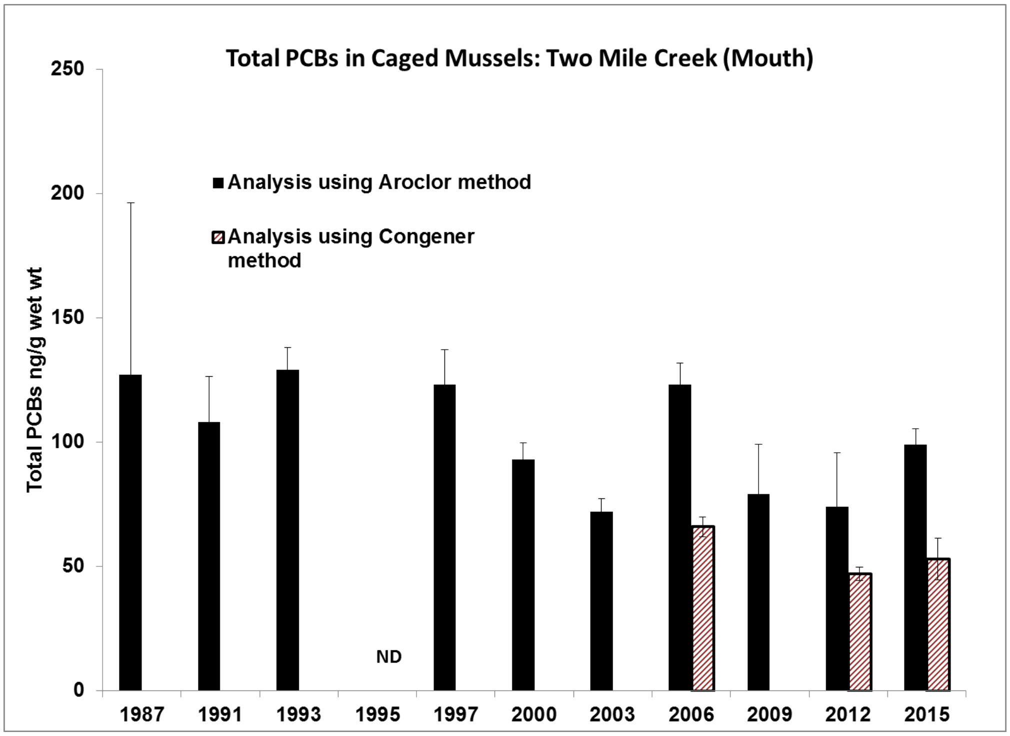


Figure 26: Mean (+/- SE) total PCB concentrations (Aroclor analytical method (ng/g wet wt.) in caged mussels deployed at the mouth of Two Mile Creek through time (1987-2015) and congener specific method (2006-2015).

A PCB contaminated tributary, Rattlesnake Creek, flows intermittently into the lower portion of Two Mile Creek (caged mussels sum of 52 congeners: 75 ng/g wet wt. SD 12 ng/g). These data were consistent with the data from 2009 (82 ng/g wet wt. SD 3 ng/g). The congener pattern for mussels deployed in Rattlesnake Creek is different from the pattern at the mouth of Two Mile Creek suggesting another distinct source within this watershed (Figure 27). Mussels deployed in Rattlesnake Creek had a higher percent contribution from the lower chlorinated congeners (e.g., PCB-31 to 52) than Two Mile Creek, and a lower percent contribution from the higher chlorinated congeners compared with Two Mile Creek (e.g., most congeners from PCB-110 to PCB-208). The unusual pattern for the lower chlorinated congeners (high percent contribution from PCB-44, 49 and 52) and low contribution from PCB -110, 118, 138, 149, makes it difficult to match the Rattlesnake Creek PCBs with any specific Aroclor. The pattern may be a reflection of PCB volatilization and/or dechlorination. This unusual pattern for PCB-44 to 52, was replicated in mussels at the mouth of Two Mile Creek and provides a line of evidence that suggested that Rattlesnake Creek is a possible source of PCBs to Two Mile Creek. The similarity in the congener pattern in the Two Mile Creek SPMDs with Rattlesnake Creek mussels (2009 and 2015) (Figure 27) provides a second line of evidence, and suggested the need for a PCB track-down study to determine the contributions and loadings of various PCB sources within the watershed to Two Mile Creek.

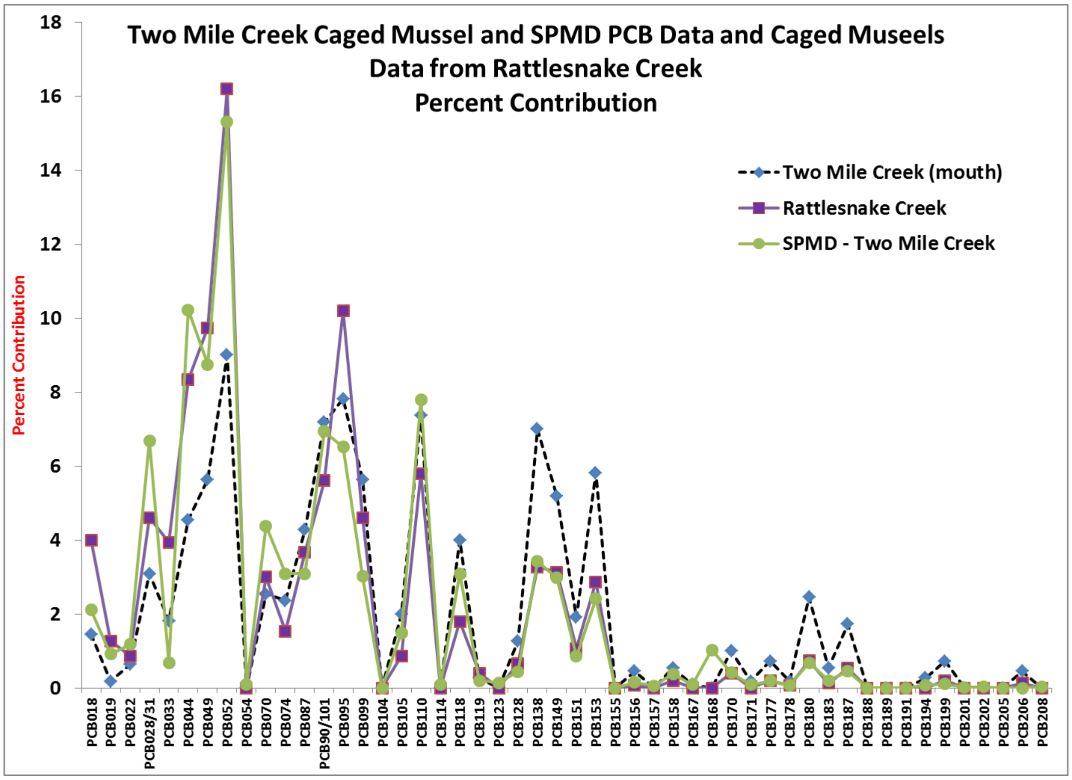


Figure 27: PCB congener patterns (percent contribution of each congener to total PCB) in caged mussels deployed in Rattlesnake Creek and Two Mile Creek, and the SPMD deployed at the mouth of Two Mile Creek, 2015. The number of congeners presented for SPMDs were reduced to match the 52 congeners analysed in mussels.

Gill Creek: Gill Creek discharges into the Niagara River just above Niagara Falls on the U.S. side. The creek received contaminants from the Olin Chemical Corporation (Buffalo Avenue Plant) and the E. I. Dupont Company upstream of the mouth. Additionally, NYSDEC identified over 100 sources of contaminants within the watershed. Gill creek was a major contributor of PCBs to the Niagara River; estimated to have contributed as much as 20% of the total PCB load (USEPA and NYSDEC, 1994). Remediation of PCB contaminated sediment in Gill Creek upstream of the mouth was completed in 1992. Additional sediment remediation was completed further upstream in 1998. Concentrations of total PCBs in caged mussels deployed at these two sites have decreased post remediation and remain consistently low through time (2015 mean: 34 ng/g +/- SE 2.5 ng/g wet wt.) (Figure 28).

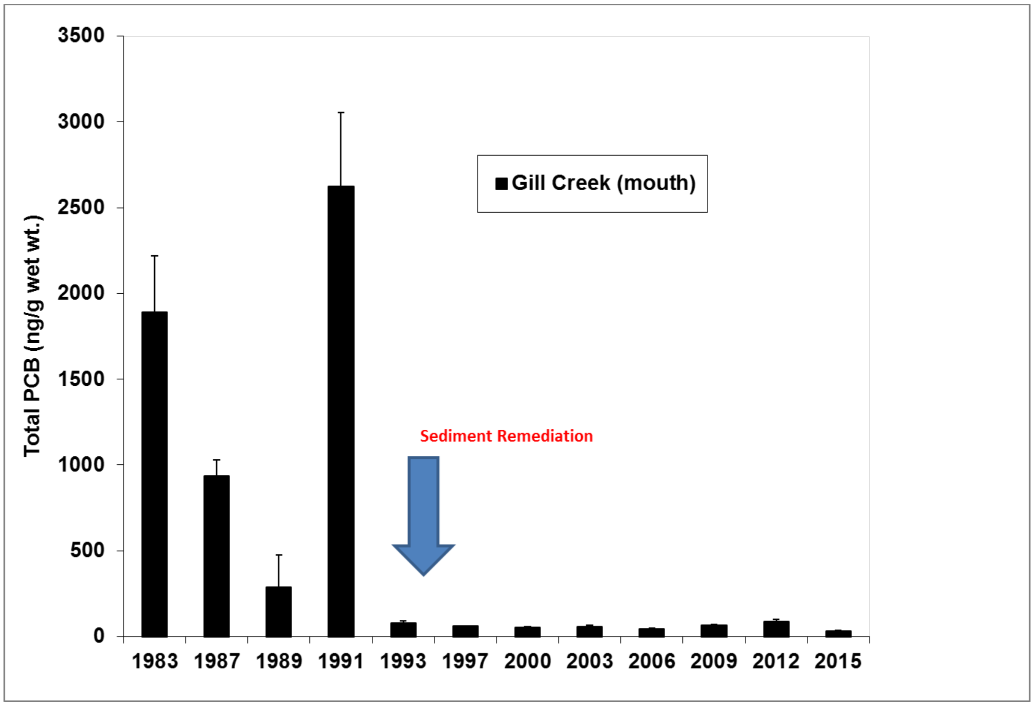


Figure 28: Mean (+/- SE) total PCB concentrations (Aroclor analytical method (ng/g wet wt.) in caged mussels deployed at the mouth of Gill Creek through time (1983-2015).

Canadian Sites: Total PCB concentrations (measured using the congener specific method) in caged mussels deployed at Fort Erie were below the detection limit, and at NOTL ranged from 1.4 to 2.3 ng/g (wet wt.). NOTL had the highest PCB concentrations in SPMDs compared with the other Canadian sites (Figure 29; Appendix F). The higher PCB concentration at NOTL was likely due to the contributions of PCBs from the US side as discussed earlier for OCS, tetra, penta, and hexachlorobenzene since PCB concentrations in mussels, and estimated water concentrations from the SPMDs deployed at Canadian sites have historically been lower than those reported at US sites suspected of being sources (Figures 20).

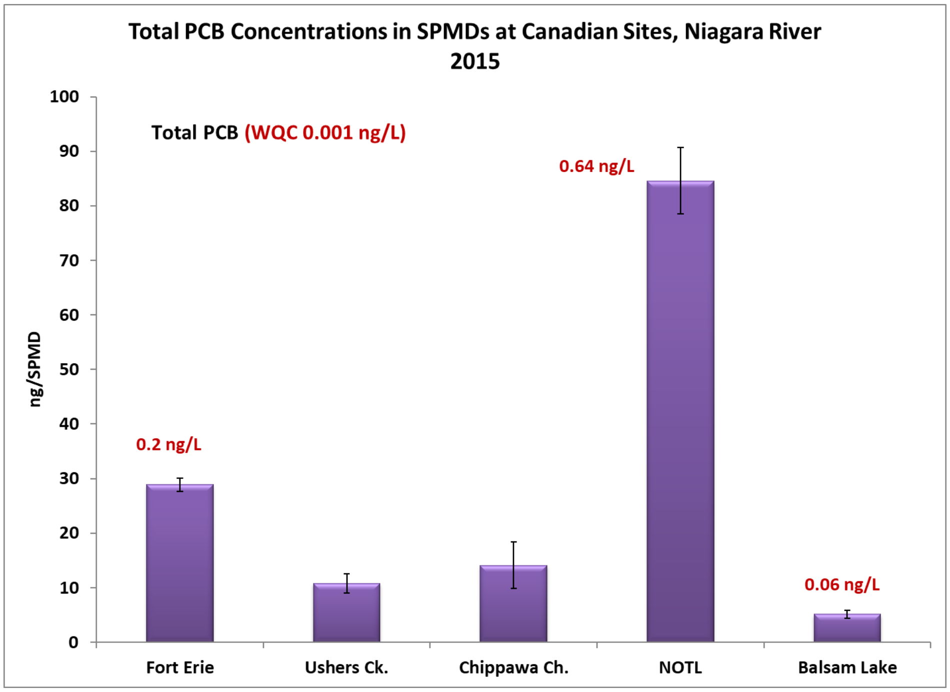


Figure 29: Mean +/- SD total PCBs (sum of 209 congeners) for SPMDs (**ng/SPMD**) deployed on the Canadian side of the Niagara River, 2015 with estimated water concentrations (ng/L) compared with the most stringent water quality criteria (WQC).

Polychlorinated dibenzo-p-dioxins and Polychlorinated dibenzofurans

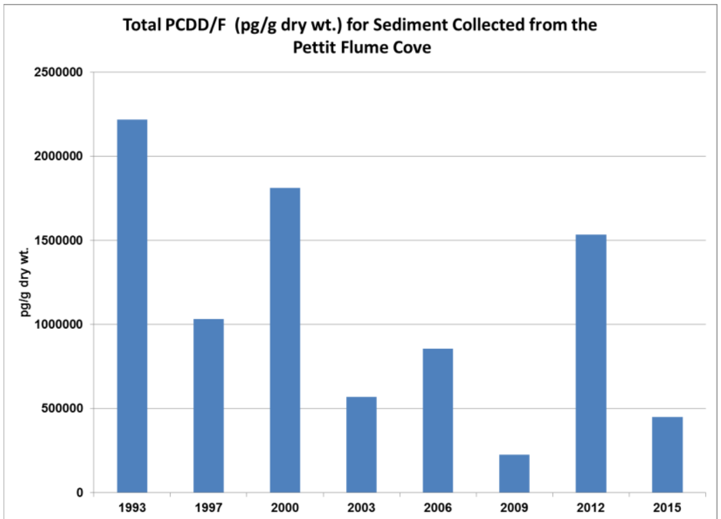
Pettit Flume and Fisherman's Park: In contrast to the reductions in chlorinated benzenes in mussels, high concentrations of dioxins and furans have been measured in sediment and mussels deployed in the cove consistently since 1993 suggesting the presence of a source that had eluded the remediation in the early 1990's and additional sediment remedial efforts in 2000 (US EPA and NYSDEC 2002). The sediment collected in 2015 from the cove was highly contaminated with dioxins and furans with a TEQ of 8,830 pg/g (Appendix D3). Sediment collected in previous surveys (1993-2012) had total TEQ concentrations that ranged from 3800 to 48,000 pg/g (Richman *et al.* 2011) (Figure 30; Appendix E). The CCME interim sediment guideline is 21.1 pg TEQ/g for comparison.The dioxin and furan isomer patterns in sediments from the cove were unique to the cove when compared to other sites in the Niagara River (i.e., concentration of octachlorodioxin was low relative to other isomers). The Pettit Flume outfall is identified as the source of contamination since sediment collected from a site immediately upstream of the cove in past surveys (1993-2015) has typically had low PCDD/F contamination (total TEQ ranged from 10 to 37 pg/g) and isomer patterns in the upstream sediment samples did not match the unique Pettit Flume profile (Richman 2013).

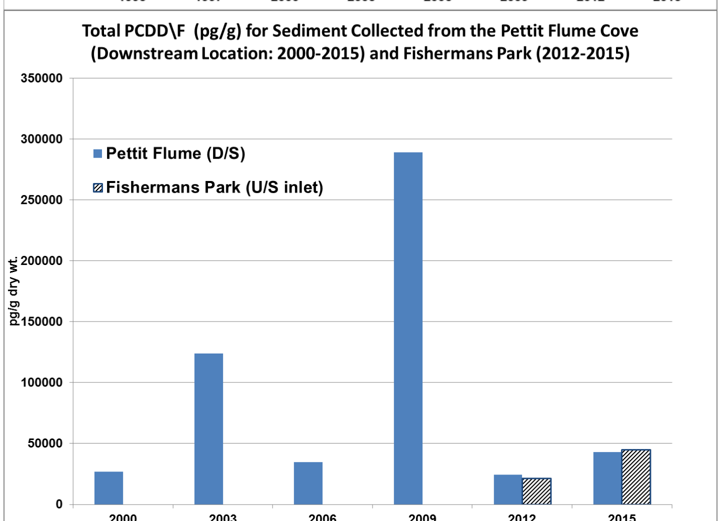
The continued presence of contaminants in the cove was possibly due, in part, to residual contamination in the sewer system. Camera inspections (authorized by Occidental) of the sewer line in 2008 and 2009 identified sediment deposits throughout the sewer. Chemical analysis of the sediment detected contaminants associated with the waste deposited in the cove. A decision to manually vacuum the sediment deposits and line portions of the sewer with resin coated liner tubes to prevent further infiltration of contaminated water and sediment was announced by NYSDEC in October 2013 (NYSDEC Fact Sheet 2013). Some of this work was completed in 2014 and may have led to the lower concentrations measured in the sediment in 2015. However, the sediment contamination of the cove has proven to be heterogeneous and additional data would be required to confirm that a decrease in surface sediment concentration was consistent throughout the area. PCDD/Fs were also measured in caged mussels deployed in the cove suggesting that they are bioavailable (Appendix D3).

Further remediation of the dioxin contaminated cove sediment has not been announced to date. However, PCDD/Fs at high concentrations (840 pg TEQ/g) and isomer patterns consistent with those observed in cove sediments were also found in sediment collected from stations located at the downstream end of the cove and at Fisherman's Park about 0.5 km downstream of the cove. Data collected since 2000 has been consistent in showing that contaminated sediment may be migrating out of the cove into the Niagara River (Figure 30).

Bloody Run Creek (BRC): Sediment collected from the shoreline of the Niagara River in the vicinity of Bloody Run Creek between 1993 and 2015 had consistently high concentrations of PCDD/Fs although concentrations have increased and decreased randomly confirming the heterogeneous spatial pattern of contamination along the shoreline (Appendix E; Figure 31). The TEQ has ranged from 3,300 pg TEQ/G to 120,000 pg TEQ/g. In 2015 additional sediment stations located along the shoreline in the vicinity of BRC and upstream and downstream of the historical stations were sampled. Some of these samples were analysed using a new MECP screening method used to identify areas that may be contaminated with PCDD/F. All historical sampling locations had sediment analysed using the routine method (Appendix D3). The dioxins and isomer patterns found in Bloody Run Creek sediments were distinct from those seen at other sites in the Niagara River with lower concentrations of octachlorodioxin relative to the 1,2,3,4,6,7,8-heptachlorodioxin. Furthermore, all the tetra dioxin was in the form of 2,3,7,8-TCDD, the most toxic form of dioxin. The unique congener pattern present in the sediment was also present in the SPMDs and caged mussels demonstrating bioavailability of the contaminants.

Sediment collected in 2012 from the "upstream" reference site (about 90 m upstream of BRC) had a relatively high TEQ (346 pg TEQ/g), compared to previous years, and the congener pattern was consistent with the BRC pattern and not the typical "upstream pattern" characteristic of this station. These data suggested that our sampling location was either not consistent with previous surveys or possibly, the BRC footprint was larger than previously suspected. Accordingly, additional sampling locations were added to the 2015 survey. In 2015 the historical upstream station had a total TEQ which was lower than 2012 (88 pg TEQ/g), but the congener pattern was a combination of the contaminated site and patterns more typical of upstream conditions (Figure 32). Given the range in PCDD/F concentrations through time it is possibly that sediment in this area is mobile due to frequent resuspension and settling because of the large fluctuation in water levels when the reservoir is closed and reopened on a daily basis.





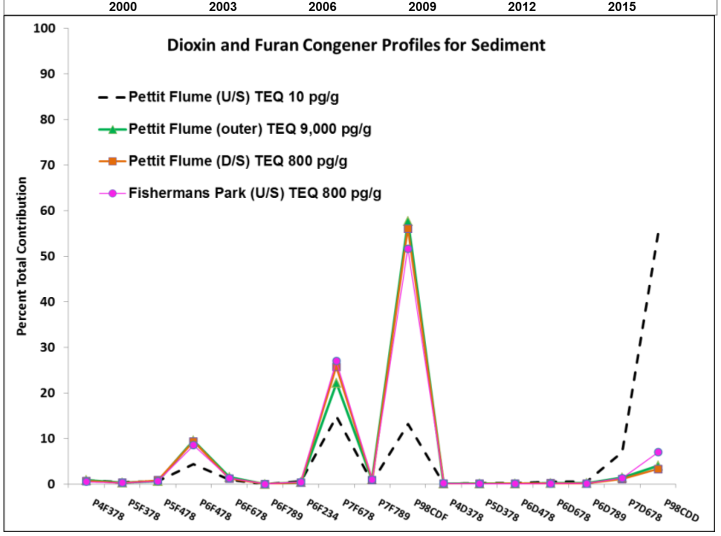


Figure 30: Total PCDD/F trend through time data for the Pettit Flume cove and Fisherman's Park and congener patterns in sediment collected from the Pettit Flume and Fisherman's Park, 2015. Sediment was not collected from Fisherman's Park prior to 2012.

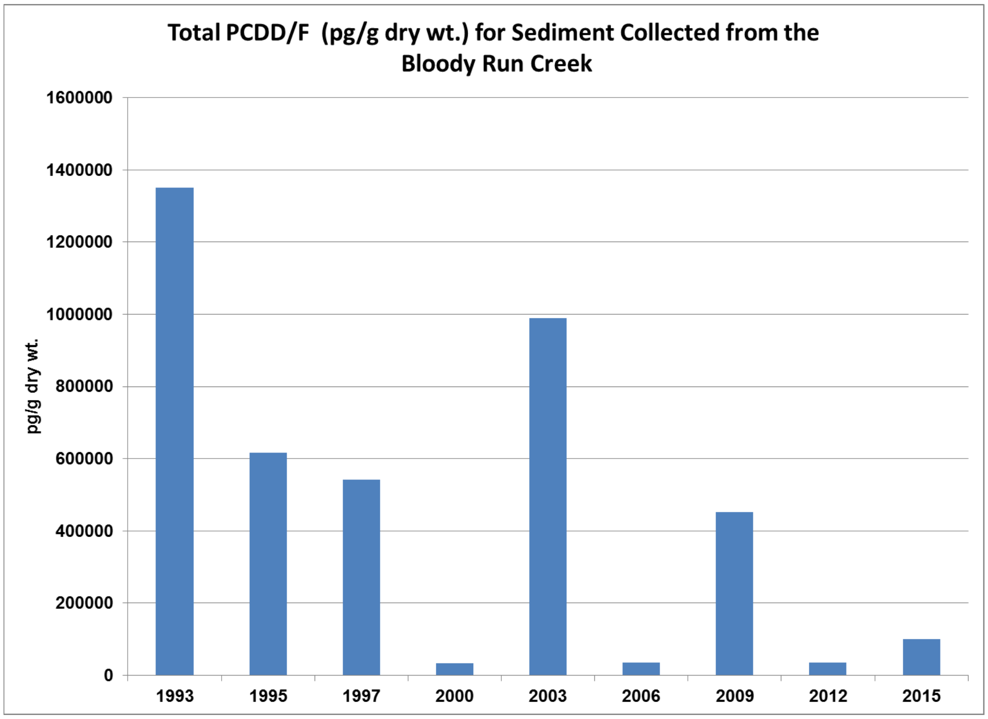


Figure 31: PCDD/F trend through time data for sediment collected from the Niagara River shoreline associated with Bloody Run Creek.

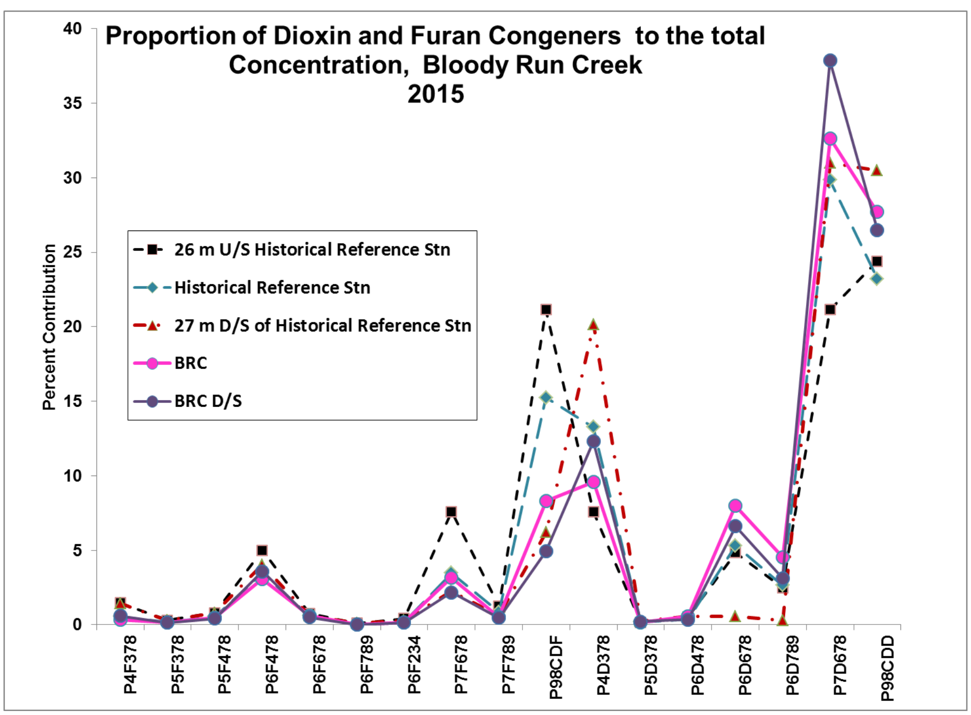


Figure 32: PCDD/F congener patterns in sediment collected from the Niagara River shoreline associated with Bloody Run Creek, 2015.

Conclusions & Recommendations

- The ECCC US/DS water monitoring data (2005-2015) (Hill et al. 2018) identified specific contaminants of concern that were suspected of having Niagara River sources since contaminant concentrations were higher at NOTL than Fort Erie. The deployment of caged mussels and SPMDs in 2015 in the nearshore provided data that identified sources of organic compounds to the Niagara River. These included:

    - Tributaries - Two Mile Creek (PCBs, 4,4'-DDD, heptachlor epoxide, α-chlordane, dieldrin), Cayuga Creek (PCBs, 4,4'-DDD, 4,4'-DDE, α-HCH), and Gill Creek (α-HCH, HCBD).
    - The Pettit Flume cove (4,4'-DDD, α-chlordane, PCBs, trichlorobenzenes, 1,2,3,4 – tetrachlorobenzene, 1,2,4,5/1,2,3,5-tetrachlorobenzene, pentachlorobenzene, HCB, and dioxins and furans).
    - Bloody Run Creek (1,2,3,4 – tetrachlorobenzene, pentachlorobenzene, HCB, OCS, and dioxins and furans).
    - Occidental Chemcial Corp. (PCBs, trichlorobenzenes,1,2,3,4 – tetrachlorobenzene, 1,2,4,5/1,2,3,5-tetrachlorobenzene, pentachlorobenzene, HCB, OCS, HCBD, mirex).
    - GRP marina and upstream of the marina – PCB, 4,4'-DDD, 4,4'-DDE.
    - With the exception of 4,4'-DDD and 4,4'-DDE at Fort Erie, no sources of organic contaminants were identified on the Canadian side of the river.

- Overall, water concentration estimates from SPMD data for most compounds on both side of the river were below Water Quality Criteria with the exception of PCBs, dieldrin, metabolites of DDT, HCB, OCS and mirex. Many of the contaminants being monitored are hydrophobic and are likely bound to sediment and may not be completely available for accumulation by the SPMDs. Accordingly, impacts on the benthic community and food chain cannot be fully assessed from this monitoring tool.

- High concentrations of PCBs in SPMDs deployed at the OCC Sewer 003 in 2012 and 2015 (estimated at 237 ng/L and 186 ng/L respectively) suggested that this outfall may be an important source of PCBs to the river. It is recommended that the discharge history of this outfall be reviewed to investigate whether the SPMD data reflects intermittent occurrences, or ongoing, long-term PCB discharges.

- High PCB concentrations were present in SPMDs deployed at two locations upstream of the Gratwick Riverside Park Hazardous Waste Site suggesting that there is/are upstream source(s) of PCBs to the river. The biomonitoring study conducted in 2018 investigated the area between Fisherman's Park and GRP in an attempt to track down the source.

- Dioxin contaminated sediment samples collected from Fisherman's Park in both 2012 and 2015 suggested movement and transport of contaminated sediment from the Pettit Flume cove. Following source control of PCDD/F to the cove, a full site characterization of PCDD/F contamination in the cove is recommended followed by a review of potential sediment remedial options.

- A follow-up assessment of the high concentrations of metabolites of DDT at Fort Erie on the Canadian side of the Niagara River is recommended for 2018.

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Appendices

Appendix A: Station Location

Station Location	Station #	Northing	Easting	Total PCB OC pesticides Chlorinated Benzenes	Congener Specific PCBs	Dioxins Furans	Sediment	SPMDs
Canadian sites								
Balsam Lake (Control)	18 01 0001	4938157	674831					
Fort Erie (FE)	05 02 203	4754908	670305	√	√			√
Ushers Creek	05 15 06	4767068	659995					√
Chippawa Channel	05 02 51	4768226	661232					√
Niagara on the Lake (NOTL)	05 11 09	4790824	657471	√	√			√
American Sites								
Two Mile Creek	05 02 197	4764036	670595	√	√			√
Rattlesnake Creek	05 15 38	4763739	670555		√			
Two Mile Creek (Near Sheridan Rd) (historical – 2006)	05 15 36	4760793	671510		√		Dioxin	
Two Mile Creek (N of Hwy 290)	05 15 42	4762540	671147		√		Dioxin	
Pettit Flume - U/S	05 02 185	4766739	672260	√		√	Dioxin	√
Pettit Flume - Site B	05 02 186	4766806	672236	√		√	Dioxin	√
Pettit Flume - D/S	05 02 187	4766795	672170	√		√	Dioxin	√
Fisherman's Park - U/S	05 02 01	4767294	671992			√	Dioxin	√
Fishermans's Park - D/S	05 02 02	4767371	671979			√	Dioxin	√
Gratwick Riverside Park (GRP) - U/S of Marina	05 02 213	4768157	671730		√			√
Gratwick Riverside Park - U/S - in Marina	05 02 122	4768307	671761		√			√
Gratwick Riverside Park - U/S	05 02 31	4768285	671655		√			√
Gratwick Riverside Park - mid stn	05 02 214	4768683	671282		√			√
Gratwick Riverside Park - D/S	05 02 199	4769277	670593		√			√
102nd Street Upstream site (at outfall)	05 02 215	4770806	667256		√			√
Little Niagara River (LNR) (D/S 102nd St. waste site)	05 02 095	4771208	666639		√			√
Cayuga Creek	05 15 31	4771997	665978		√			√
LNR (D/S Cayuga Creek)	05 02 96	4771057	665523		√			√
U/S of Occidental Chem. Co.	05 02 97	4770936	662808	√	√			√
D/S of Storm Sewer (A)	05 02 46	4770825	662238	√				√
D/S of Storm Sewer (B)	05 02 94	4771020	662329	√				√
D/S of Storm Sewer (C)	05 02 43	4770883	662101	√				√
Occidental 003	05 02 42	4771074	662219	√	√			√
Niagara River - U/S Gill Creek	05 02 98	4771388	661048	√				√
Gill Creek - Mouth	05 02 37	4771395	660686	√	√			√
Bloody Run Creek (BRC) - "New" U/S	11 02 0026	4777883	659105				Dioxin	
Bloody Run Creek - U/S	11 02 0018	4777914	659122	√		√	Dioxin	√
BRC: 27 m D/S of station 18	11 02 0027	4777908	659127				Dioxin	
BRC: 25M U/S of stn. 132	11 02 0028	4777940	659144				Dioxin	
BRC: Btwn stn 132 and stn 17	11 02 0030	4777965	659169				Dioxin	
BRC: on shore 10m E of Stn 0017	11 02 0029	4777978	659186				Dioxin	
Bloody Run Creek	11 02 0017	4777974	659171	√		√		
Bloody Run Creek	11 02 0131	4777962	659155	√		√		
Bloody Run Creek	11 02 0132	4777965	659160	√		√	Dioxin	√
Bloody Run Creek - "New" D/S 18 m U/S stn 25	11 02 0031	4777993	659191				Dioxin	
Bloody Run Creek - D/S	11 02 0025	4778024	659199	√		√	Dioxin	√

Appendix B

2015 Niagara River Biomonitoring
Field Water Quality Measurements

Sonde = YSI 600 QS

Dissolved oxygen sensor calibrated before every measurement

Conductivity values are temperature compensated, except where noted

Station Name	Station #	Depth (m)	Date	Cond. (µs/cm) (uncompensated)	Cond. (µs/cm) (Temp. compensated to 25°C)	Temp. (°C)	DO (%)	DO (mg/L)
Fisherman's Park U/S	05 02 0001	0.9	07-Jul-15	267	285.96	21.5	102	9.0
			28-Jul-15	277	284.57	23.6	80.4	6.9
Fisherman's Park D/S	05 02 0002	0.9	07-Jul-15	271	294.50	20.8	87.8	7.8
			28-Jul-15	283	290.73	23.6	71.4	6.1
Pettit Flume U/S	05 02 0185	1.2	07-Jul-15	260	281.97	20.9	98.3	----
			28-Jul-15	278	282.29	24.2	97.7	----
Pettit Flume D/S	05 02 0187	0.6	07-Jul-15	263	284.63	21.0	97.3	----
			28-Jul-15	279	282.22	24.4	100.8	8.4
Pettit Flume (Outer Site B)	05 02 0186	1.0	07-Jul-15	506	542.05	21.5	93.9	8.3
			28-Jul-15	484	501.14	23.2	112.6	9.6
Two Mile Creek (mouth)	05 02 0197	0.9	07-Jul-15	1570	1609.76	23.7	88.8	7.5
			28-Jul-15	1312	1319.52	24.7	64.6	5.4
Two Mile Creek (near Hwy 290)	05 15 0042	0.5	07-Jul-15	1512	1517.77	24.8	>190	----
			28-Jul-15	965	934.81	26.7	107.3	8.6
Two Mile Creek (near Sheridan)	05 15 0036	0.5	07-Jul-15	1803	1687.57	28.6	200?	----
			28-Jul-15	1969	1785.78	30.4	164.1?	12.3
Rattlesnake Creek	05 15 0038	0.2	07-Jul-15	1704	1810.65	21.9	61.3	5.4
			28-Jul-15	2020	2023.85	24.9	20.2	1.7
Gratwick Riverside Park U/S	05 02 0031	0.8	08-Jul-15	267	291.96	20.5	96.8	8.7
			29-Jul-15	282	286.91	24.1	98.3	8.3
GRP (upstream of marina)	05 02 0213	1.2	08-Jul-15	266	290.87	20.5	99.3	8.9
			29-Jul-15	281	286.44	24.0	107.8	9.1
U/S GRP in Marina	05 02 0122	1.7	08-Jul-15	299	321.61	21.3	84.8	7.5
			29-Jul-15	*Not measured.*				
GRP middle of the park	05 02 0214	0.9	08-Jul-15	271	290.90	21.4	101.9	9.0
			29-Jul-15	285	288.29	24.4	124.6	10.4
GRP D/S	05 02 0199	0.6	08-Jul-15	279	299.48	21.4	114	10.1
			29-Jul-15	286	286.54	24.9	120.3	10.0
102nd St. U/S	05 02 0093	0.6	08-Jul-15	299	315.80	22.2	154	13.5
			29-Jul-15	293	289.15	25.7	137	11.2
Outfall U/S end of 102nd St.	05 02 0215	0.4	08-Jul-15	541	645.20	16.5	76.9	7.5
			29-Jul-15	354	368.71	22.9	90.6	7.8
Little Niagara River (near 102nd St.)	05 02 0095	0.8	08-Jul-15	299	312.66	22.7	160	13.9
			29-Jul-15	298	289.74	26.5	152	12.2
Little Niagara River (D/S Cayuga Crk.)	05 02 0096	0.7	08-Jul-15	345	364.39	22.2	126	11.0
			29-Jul-15	*Not measured.*				
Cayuga Crk. (within Crk.)	05 15 0031	0.8	08-Jul-15	1194	1253.54	22.5	53.7	4.6
			29-Jul-15	593	573.39	26.8	70.9	5.7

2015 Niagara River Biomonitoring

Field Water Quality Measurements continued

Station Name	Station #	Depth (m)	Date	Cond. (µs/cm) (uncompensated)	Cond. (µs/cm) (Temp. compensated to 25°C)	Temp. (°C)	DO (%)	DO (mg/L)
U/S of Occidental	05 02 0097	0.7	09-Jul-15	267	293.79	20.2	88.5	8.0
			30-Jul-15	296	298.27	24.6	96.4	8.0
Occidental D/S Storm Sewer A	05 02 0046	0.5	09-Jul-15	264	289.89	20.3	88.2	8.0
			30-Jul-15	291	292.11	24.8	98.3	8.2
Occidental D/S Storm Sewer B	05 02 0094	0.5	09-Jul-15	263	290.00	20.1	88.9	8.0
			30-Jul-15	291	293.23	24.6	96.6	8.0
Occidental D/S Storm Sewer C	05 02 0044	0.5	09-Jul-15	261	288.40	20.0	91	8.2
			30-Jul-15	290	292.22	24.6	97.1	8.1
Occidental Sewer 003	05 02 0042	0.6	09-Jul-15	320	345.61	21.1	88	7.8
			30-Jul-15	298	298.00	25.0	102	8.4
350 m U/S Gill Creek mouth (in the Niagara River)	05 02 0098	0.5	09-Jul-15	248	275.77	19.7	95.1	8.7
			30-Jul-15	271	275.71	24.1	109.9	9.2
Gill Creek (mouth)	05 02 0037	1.5	09-Jul-15	266	293.92	20.0	92	8.4
			30-Jul-15	289	292.90	24.3	105.9	8.9
Bloody Run Creek	11 02 0017	0.7	10-Jul-15	244	274.22	19.2	120	11.1
			31-Jul-15	Not measured.				
Bloody Run Creek	11 02 0132	0.7	10-Jul-15	244	274.81	19.1	119	11.0
			31-Jul-15	*Not measured.*				
Bloody Run Creek	11 02 0131	0.7	10-Jul-15	246	277.65	19.0	115	10.7
			31-Jul-15	Not measured.				
Bloody Run Creek U/S	11 02 0018	0.4	10-Jul-15	243	274.27	19.0	115	10.7
			31-Jul-15	*Not measured. Found in correct location, but high and dry.*				
Bloody Run Creek D/S	11 02 0025	0.7	10-Jul-15	244	274.81	19.1	115.3	10.6
			31-Jul-15	*Not measured.*				
Fort Erie	05 02 0203	0.8	10-Jul-15	247	272.36	20.1	128	11.8
			31-Jul-15	260	268.15	23.4	142.7	12.15
Ushers Creek	05 15 0006	0.7	10-Jul-15	249	278.06	19.5	108	10.0
			31-Jul-15	269	274.21	24.0	127.9	10.8
Chippawa Channel	05 02 0051	0.7	10-Jul-15	246	274.13	19.6	110	10.1
			31-Jul-15	265	272.77	23.5	118.3	10.1
Niagara on the Lake	11 02 0009	1.0	10-Jul-15	251	277.93	19.9	109	10.0
			31-Jul-15	*Not measured.*				
Balsam Lake Control	18 01 0001	1.6	13-Jul-15	136	138.10	24.2	98	8.2
			04-Aug-15	119	125.94	22.1	92.2	8.0

Appendix Table C: 2015 Niagara River Biomonitoring

Mussel Weights

Station Name	Station #	Deployed	Retrieved	GL15XXXX	# Mussels	Wet Weight (g, tared)	Dry Weight (g, tared)	percent dry	percent water
Fisherman's Park (U/S)	1	07-Jul-15	28-JUL-2015	1089	4	22.74	0		
Fisherman's Park (D/S)	2	07-Jul-15	28-JUL-2015	1090	4	25.81	0		
Pettit Flume (U/S)	185	07-Jul-15	28-JUL-2015	1091	1	5.65	0		
Pettit Flume (U/S)	185	07-Jul-15	28-JUL-2015	1092	1	5.81	0		
Pettit Flume (U/S)	185	07-Jul-15	28-JUL-2015	1093	1	6.3	0		
Pettit Flume (U/S)	185	07-Jul-15	28-JUL-2015	1094	4	26.7	0		
Pettit Flume (D/S)	187	07-Jul-15	28-JUL-2015	1095	1	6.08	0		
Pettit Flume (D/S)	187	07-Jul-15	28-JUL-2015	1096	1	6.08	0		
Pettit Flume (D/S)	187	07-Jul-15	28-JUL-2015	1097	1	5.88	0		
Pettit Flume (D/S)	187	07-Jul-15	28-JUL-2015	1098	4	28.23	0		
Pettit Flume Cove	186	07-Jul-15	28-JUL-2015	1099	1	6.28	0		
Pettit Flume Cove	186	07-Jul-15	28-JUL-2015	1100	1	8.27	0		
Pettit Flume Cove	186	07-Jul-15	28-JUL-2015	1101	1	9.84	0		
Pettit Flume Cove	186	07-Jul-15	28-JUL-2015	1102	4	30.89	0		
Two Mile Creek (mouth)	197	07-Jul-15	28-JUL-2015	1103	1	5.44	0		
Two Mile Creek (mouth)	197	07-Jul-15	28-JUL-2015	1104	1	8.16	0		
Two Mile Creek (mouth)	197	07-Jul-15	28-JUL-2015	1105	1	6.82	0		
Two Mile Creek (mouth)	197	07-Jul-15	28-JUL-2015	1106	6	44.86	6.43	14	86
Two Mile Creek (mouth)	197	07-Jul-15	28-JUL-2015	1107	6	45.83	6.29	14	86
Two Mile Creek (mouth)	197	07-Jul-15	28-JUL-2015	1108	6	44.26	6.78	15	85
Rattlesnake Creek	38	07-Jul-15	28-JUL-2015	1109	6	41.33	6.38	15	85
Rattlesnake Creek	38	07-Jul-15	28-JUL-2015	1110	6	39.88	5.91	15	85
Rattlesnake Creek	38	07-Jul-15	28-JUL-2015	1111	6	38.07	5.50	14	86
Two Mile Creek (N of Hwy 290)	42	07-Jul-15	28-JUL-2015	1112	6	40.93	5.35	13	87
Two Mile Creek (N of Hwy 290)	42	08-Jul-15	29-JUL-2015	1113	6	43.25	6.44	15	85
Two Mile Creek (N of Hwy 290)	42	08-Jul-15	29-JUL-2015	1114	6	45.35	6.61	15	85
Two Mile Creek (Sheridan Rd)	36	08-Jul-15	29-JUL-2015	1115	6	37.22	5.00	13	87
Two Mile Creek (Sheridan Rd)	36	08-Jul-15	29-JUL-2015	1116	6	35.38	5.02	14	86
Two Mile Creek (Sheridan Rd)	36	08-Jul-15	29-JUL-2015	1117	6	38.59	5.26	14	86
Gratwick Riverside Park (GRP) (U/S)	31	08-Jul-15	29-JUL-2015	1118	6	39.86	5.65	14	86
Gratwick Riverside Park (GRP) (U/S)	31	08-Jul-15	29-JUL-2015	1119	6	42.43	5.94	14	86
Gratwick Riverside Park (GRP) (U/S)	31	08-Jul-15	29-JUL-2015	1120	6	42.62	6.27	15	85
GRP (U/S Marina)	213	08-Jul-15	29-JUL-2015	1121	6	40.79	5.20	13	87
GRP (U/S Marina)	213	08-Jul-15	29-JUL-2015	1122	6	38.39	5.02	13	87
GRP (U/S Marina)	213	08-Jul-15	29-JUL-2015	1123	6	38.56	4.89	13	87
GRP (Marina)	122	08-Jul-15	29-JUL-2015	1124	6	45.2	6.14	14	86
GRP (Marina)	122	08-Jul-15	29-JUL-2015	1125	6	46.05	6.83	15	85
GRP (Marina)	122	08-Jul-15	29-JUL-2015	1126	6	49.59	7.57	15	85
GRP (Mid Park)	214	08-Jul-15	29-JUL-2015	1127	6	43.66	6.08	14	86
GRP (Mid Park)	214	08-Jul-15	29-JUL-2015	1128	6	45.83	6.02	13	87
GRP (Mid Park)	214	08-Jul-15	29-JUL-2015	1129	6	43.66	5.03	12	88
GRP (D/S)	199	08-Jul-15	29-JUL-2015	1130	6	41.53	5.44	13	87
GRP (D/S)	199	08-Jul-15	29-JUL-2015	1131	6	40.85	6.04	15	85
GRP (D/S)	199	08-Jul-15	29-JUL-2015	1132	4	26.72	3.51	13	87
102nd St. (U/S)	93	08-Jul-15	29-JUL-2015	1133	6	48.13	5.82	12	88
102nd St. (U/S)	93	08-Jul-15	29-JUL-2015	1134	6	45.82	5.79	13	87
102nd St. (U/S)	93	08-Jul-15	29-JUL-2015	1135	6	41.48	5.69	14	86
102 nd St (@outfall U/S of landfill)	215	08-Jul-15	29-JUL-2015	1136	1	6.68	0		
102 nd St (@outfall U/S of landfill)	215	08-Jul-15	29-JUL-2015	1137	1	5.77	0		
102 nd St (@outfall U/S of landfill)	215	08-Jul-15	29-JUL-2015	1138	1	6.66	0		
Little Niagara River (LNR) (D/S 102nd St.)	95	08-Jul-15	29-JUL-2015	1139	6	46.85	6.16	13	87
Little Niagara River (LNR) (D/S 102nd St.)	95	08-Jul-15	29-JUL-2015	1140	6	39.71	5.45	14	86
Little Niagara River (LNR) (D/S 102nd St.)	95	08-Jul-15	29-JUL-2015	1141	6	40.45	5.87	15	85
LNR D/S Cayuga Creek	96	08-Jul-15	29-JUL-2015	1142	6	41.76	6.34	15	85
LNR D/S Cayuga Creek	96	09-Jul-15	30-JUL-2015	1143	6	44.85	6.91	15	85
LNR D/S Cayuga Creek	96	09-Jul-15	30-JUL-2015	1144	6	MISSING	6.15		
Cayuga Creek	31	09-Jul-15	30-JUL-2015	1145	6	45.18	6.98	15	85
Cayuga Creek	31	09-Jul-15	30-JUL-2015	1146	6	44.61	6.76	15	85
Cayuga Creek	31	09-Jul-15	30-JUL-2015	1147	6	45.13	6.70	15	85

Appendix Table C: 2015 Niagara River Biomonitoring

Mussel Weights: Continued

Station Name	Station #	Deployed	Retrieved	GL15XXXX	# Mussels	Wet Weight (g, tared)	Dry Weight (g, tared)	percent dry	percent water
U/S Occidental Chem.	97	09-Jul-15	30-JUL-2015	1148	6	41.63	6.04	15	85
U/S Occidental Chem.	97	09-Jul-15	30-JUL-2015	1149	6	38.72	4.92	13	87
U/S Occidental Chem.	97	09-Jul-15	30-JUL-2015	1150	6	42.77	5.22	12	88
U/S Occidental Chem.	97	09-Jul-15	30-JUL-2015	1151	1	7.52	0		
U/S Occidental Chem.	97	09-Jul-15	30-JUL-2015	1152	1	8.84	0		
U/S Occidental Chem.	97	09-Jul-15	30-JUL-2015	1153	1	5.17	0		
Storm Sewer A (D/S)	46	09-Jul-15	30-JUL-2015	1154	1	5.78	0		
Storm Sewer A (D/S)	46	09-Jul-15	30-JUL-2015	1155	1	7.82	0		
Storm Sewer A (D/S)	46	09-Jul-15	30-JUL-2015	1156	1	7.27	0		
Storm Sewer B (D/S)	94	09-Jul-15	30-JUL-2015	1157	1	5.76	0		
Storm Sewer B (D/S)	94	09-Jul-15	30-JUL-2015	1158	1	6.12	0		
Storm Sewer B (D/S)	94	09-Jul-15	30-JUL-2015	1159	1	7.03	0		
Storm Sewer C (D/S)	44	09-Jul-15	30-JUL-2015	1160	1	7.09	0		
Storm Sewer C (D/S)	44	09-Jul-15	30-JUL-2015	1161	1	6.58	0		
Storm Sewer C (D/S)	44	09-Jul-15	30-JUL-2015	1162	1	5.81	0		
OCC 003	42	09-Jul-15	30-JUL-2015	1163	6	37.12	6.10	16	84
OCC 003	42	09-Jul-15	30-JUL-2015	1164	6	38.62	6.01	16	84
OCC 003	42	09-Jul-15	30-JUL-2015	1165	6	34.53	5.77	17	83
OCC 003	42	09-Jul-15	30-JUL-2015	1166	1	6.6	0		
OCC 003	42	09-Jul-15	30-JUL-2015	1167	1	6.41	0		
OCC 003	42	09-Jul-15	30-JUL-2015	1168	1	6.26	0		
Gill Creek (U/S mouth)	98	09-Jul-15	30-JUL-2015	1169	1	7.51	0		
Gill Creek (U/S mouth)	98	09-Jul-15	30-JUL-2015	1170	1	5.76	0		
Gill Creek (U/S mouth)	98	09-Jul-15	30-JUL-2015	1171	1	6.56	0		
Gill Creek (mouth)	37	09-Jul-15	30-JUL-2015	1172	6	40.62	5.32	13	87
Gill Creek (mouth)	37	10-Jul-15	31-JUL-2015	1173	6	37.99	5.10	13	87
Gill Creek (mouth)	37	10-Jul-15	31-JUL-2015	1174	6	41.81	5.87	14	86
Gill Creek (mouth)	37	10-Jul-15	31-JUL-2015	1175	1	5.91	0		
Gill Creek (mouth)	37	10-Jul-15	31-JUL-2015	1176	1	6.19	0		
Gill Creek (mouth)	37	10-Jul-15	31-JUL-2015	1177	1	7.93	0		
Bloody Run Creek (BRC) D/S	25	10-Jul-15	31-JUL-2015	1178	1	5.18	0		
Bloody Run Creek (BRC) D/S	25	10-Jul-15	31-JUL-2015	1179	1	6.41	0		
Bloody Run Creek (BRC) D/S	25	10-Jul-15	31-JUL-2015	1180	1	6.7	0		
Bloody Run Creek (BRC) D/S	25	10-Jul-15	31-JUL-2015	1181	4	28.68	0		
Bloody Run Creek	17	10-Jul-15	31-JUL-2015	1182	1	6.73	0		
Bloody Run Creek	17	10-Jul-15	31-JUL-2015	1183	1	6.91	0		
Bloody Run Creek	17	10-Jul-15	31-JUL-2015	1184	1	6.4	0		
Bloody Run Creek	17	10-Jul-15	31-JUL-2015	1185	4	30.13	0		
BRC (7TH + 8TH POBT FROM S)	131	10-Jul-15	31-JUL-2015	1186	1	7.68	0		
BRC (7TH + 8TH POBT FROM S)	131	10-Jul-15	31-JUL-2015	1187	1	5.88	0		
BRC (7TH + 8TH POBT FROM S)	131	10-Jul-15	31-JUL-2015	1188	1	6.82	0		
BRC (7TH + 8TH POBT FROM S)	131	10-Jul-15	31-JUL-2015	1189	4	25.31	0		
BRC (U/S)	18	10-Jul-15	31-JUL-2015	1233	1	6.12	0		
BRC (U/S)	18	10-Jul-15	31-JUL-2015	1234	1	6.02	0		
BRC (U/S)	18	10-Jul-15	31-JUL-2015	1235	1	6.48	0		
BRC (U/S)	18	10-Jul-15	31-JUL-2015	1236	4	25.54	0		
BRC (4th_5th pole) U/S stn 131	132	10-Jul-15	31-JUL-2015	1237	1	8.63	0		
BRC (4th_5th pole) U/S stn 131	132	10-Jul-15	31-JUL-2015	1238	1	6.79	0		
BRC (4th_5th pole) U/S stn 131	132	10-Jul-15	31-JUL-2015	1239	1	7.61	0		
BRC (4th_5th pole) U/S stn 131	132	10-Jul-15	31-JUL-2015	1240	4	29.77	0		
Fort Erie	203	10-Jul-15	31-JUL-2015	1241	1	6.31	0		
Fort Erie	203	10-Jul-15	31-JUL-2015	1242	1	7.74	0		
Fort Erie	203	10-Jul-15	31-JUL-2015	1243	1	6.34	0		
Fort Erie	203	10-Jul-15	31-JUL-2015	1244	6	42.19	6.62	16	84
Fort Erie	203	10-Jul-15	31-JUL-2015	1245	6	43.98	6.25	14	86
Fort Erie	203	10-Jul-15	31-JUL-2015	1246	6	49.9	6.73	13	87
NOTL	9	10-Jul-15	31-JUL-2015	1247	1	8.74	0		
NOTL	9	10-Jul-15	31-JUL-2015	1248	1	6.33	0		
NOTL	9	10-Jul-15	31-JUL-2015	1249	1	7.33	0		
NOTL	9	10-Jul-15	31-JUL-2015	1250	6	45.84	6.27	14	86
NOTL	9	10-Jul-15	31-JUL-2015	1251	6	38.76	5.73	15	85
NOTL	9	10-Jul-15	31-JUL-2015	1252	6	41.24	5.93	14	86
Balsam Lake Control	1		10-Jul-15	1253	1	7.85	0		
Balsam Lake Control	1		10-Jul-15	1254	1	7.97	0		
Balsam Lake Control	1		10-Jul-15	1255	1	8.27	0		
Balsam Lake Control	1		10-Jul-15	1256	6	42.18	5.43	13	87
Balsam Lake Control	1		10-Jul-15	1257	6	43.52	5.73	13	87
Balsam Lake Control	1		10-Jul-15	1258	6	47.16	5.58	12	88
Balsam Lake Control	1		10-Jul-15	1259	1	8.67	0		
Balsam Lake Control	1		10-Jul-15	1260	1	7.9	0		

Appendix D1: Tissue concentrations (ng/g wet wt.) of organic compounds in caged mussels, Niagara River, 2015. <W= no measurable response; <T= measurable trace amount;
PS1=PCB resembled mixture of Aroclor 1248,1254,1260; PS40= resemble Aroclor 1254 AND 1260; MCP= max poss. Conc'n due to chromatographic overlap

Station Description	BOW	Stn type	Stn No	Samp No	Retrieval Date	Lipid	cis-nonachlor	DDT & Metabolites		Aldrin	a-BHC (hexachlorocyclo-hexane)	b-BHC (hexachlorocyclo-hexane)		g-BHC (hexachlorocyclo-hexane)	a-Chlordane	g-Chlordane	Heptachlor	Mirex	Oxychlordane
						%	ng/g wet	ng/g wet		ng/g wet	ng/g wet	ng/g wet		ng/g wet	ng/g wet	ng/g wet	ng/g wet	ng/g wet	ng/g wet
							<=W	<=W		<=W	<=W	<=W		<=W	<=W	<=W	<=W	<=W	<=W
							2	2		1	1	1		1	2	2	1	5	2
American Sites																			
Two Mile Creek (mouth)	5	2	197	GL151103	28-JUL-2015	0.96	2	2		1	1	1		1	2	2	1	5	2
Two Mile Creek (mouth)	5	2	197	GL151104	28-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
Two Mile Creek (mouth)	5	2	197	GL151105	28-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume (U/S)	5	2	185	GL151091	28-JUL-2015	0.84	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume (U/S)	5	2	185	GL151092	28-JUL-2015	0.92	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume (U/S)	5	2	185	GL151093	28-JUL-2015	0.9	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume Cove	5	2	186	GL151099	28-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume Cove	5	2	186	GL151100	28-JUL-2015	1.4	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume Cove	5	2	186	GL151101	28-JUL-2015	0.87	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume (D/S)	5	2	187	GL151095	28-JUL-2015	0.99	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume (D/S)	5	2	187	GL151096	28-JUL-2015	0.83	2	2		1	1	1		1	2	2	1	5	2
Pettit Flume (D/S)	5	2	187	GL151097	28-JUL-2015	0.91	2	2		1	1	1		1	2	2	1	5	2
102 nd St (@outfall U/S of landfill)	5	2	215	GL151136	29-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
102 nd St (@outfall U/S of landfill)	5	2	215	GL151137	29-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
102 nd St (@outfall U/S of landfill)	5	2	215	GL151138	29-JUL-2015	0.91	2	2		1	1	1		1	2	2	1	5	2
U/S Occidental Chem.	5	2	97	GL151151	30-JUL-2015	0.78	2	2		1	1	1		1	2	2	1	5	2
U/S Occidental Chem.	5	2	97	GL151152	30-JUL-2015	0.66	2	3	<T	1	1	1		1	2	2	1	5	2
U/S Occidental Chem.	5	2	97	GL151153	30-JUL-2015	0.88	2	2		1	1	1		1	2	2	1	5	2
Storm Sewer A (D/S)	5	2	46	GL151154	30-JUL-2015	0.95	2	4	<T	1	1	1		1	2	2	1	5	2
Storm Sewer A (D/S)	5	2	46	GL151155	30-JUL-2015	0.79	2	2		1	1	1		1	2	2	1	5	2
Storm Sewer A (D/S)	5	2	46	GL151156	30-JUL-2015	1	2	2		1	1	1		1	2	2	1	5	2
Storm Sewer B (D/S)	5	2	94	GL151157	30-JUL-2015	0.98	2	3	<T	1	1	1		1	2	2	1	5	2
Storm Sewer B (D/S)	5	2	94	GL151158	30-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
Storm Sewer B (D/S)	5	2	94	GL151159	30-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
Storm Sewer C (D/S)	5	2	44	GL151160	30-JUL-2015	1.2	2	2		1	1	1		1	2	2	1	5	2
Storm Sewer C (D/S)	5	2	44	GL151161	30-JUL-2015	0.84	2	2		1	1	1		1	2	2	1	5	2
Storm Sewer C (D/S)	5	2	44	GL151162	30-JUL-2015	0.89	2	2		1	1	1		1	2	2	1	5	2
OCC 003	5	2	42	GL151166	30-JUL-2015	0.82	2	2		1	1	1		1	2	2	1	5	2
OCC 003	5	2	42	GL151167	30-JUL-2015	0.72	2	2		1	1	1		1	2	2	1	5	2
OCC 003	5	2	42	GL151168	30-JUL-2015	0.9	2	2		1	1	1		1	2	2	1	5	2
Gill Creek (U/S mouth)	5	2	98	GL151169	30-JUL-2015	0.79	2	2		1	1	1		1	2	2	1	5	2
Gill Creek (U/S mouth)	5	2	98	GL151170	30-JUL-2015	1	2	3	<T	1	1	1		1	2	2	1	5	2
Gill Creek (U/S mouth)	5	2	98	GL151171	30-JUL-2015	1	2	3	<T	1	1	1		1	2	2	1	5	2
Gill Creek (mouth)	5	2	37	GL151175	31-JUL-2015	1.1	2	2		1	1	1		1	2	2	1	5	2
Gill Creek (mouth)	5	2	37	GL151176	31-JUL-2015	0.99	2	2		1	1	1		1	2	2	1	5	2
Gill Creek (mouth)	5	2	37	GL151177	31-JUL-2015	0.79	2	2		1	1	2	<T	1	2	2	1	5	2
BRC (U/S)	11	2	18	GL151233	31-JUL-2015	0.53	2	2		1	1	1		1	2	2	1	5	2
BRC (U/S)	11	2	18	GL151235	31-JUL-2015	0.66	2	2		1	1	1		1	2	2	1	5	2
BRC (U/S)	11	2	18	GL151235	31-JUL-2015	0.57	2	2		1	1	1		1	2	2	1	5	2
BRC (4th_5th pole) U/S stn 131	11	2	132	GL151237	31-JUL-2015	0.58	2	2		1	1	1		1	2	2	1	5	2
BRC (4th_5th pole) U/S stn 131	11	2	132	GL151238	31-JUL-2015	0.74	2	2		1	1	1		1	2	2	1	5	2
BRC (4th_5th pole) U/S stn 131	11	2	132	GL151239	31-JUL-2015	0.65	2	2		1	1	1		1	2	2	1	5	2
BRC (7TH + 8TH POBT FROM S)	11	2	131	GL151186	31-JUL-2015	0.8	2	2		1	1	1		1	2	2	1	5	2
BRC (7TH + 8TH POBT FROM S)	11	2	131	GL151187	31-JUL-2015	1.2	2	2		1	1	1		1	2	2	1	5	2
BRC (7TH + 8TH POBT FROM S)	11	2	131	GL151188	31-JUL-2015	0.84	2	2		1	1	1		1	2	2	1	5	2
Bloody Run Creek	11	2	17	GL151182	31-JUL-2015	0.92	2	4	<T	1	1	1		1	2	2	1	5	2
Bloody Run Creek	11	2	17	GL151183	31-JUL-2015	1.3	2	2		1	1	1		1	2	2	1	5	2
Bloody Run Creek	11	2	17	GL151184	31-JUL-2015	1.2	2	4	<T	1	1	1		1	2	2	1	5	2
Bloody Run Creek (BRC) D/S	11	2	25	GL151178	31-JUL-2015	0.9	2	2		1	1	1		1	2	2	1	5	2
Bloody Run Creek (BRC) D/S	11	2	25	GL151179	31-JUL-2015	0.72	2	2		1	1	1		1	2	2	1	5	2
Bloody Run Creek (BRC) D/S	11	2	25	GL151180	31-JUL-2015	0.87	2	3	<T	1	1	1		1	2	2	1	5	2
Canadian Sites																			
Fort Erie	11	2	203	GL151241	31-JUL-2015	0.71	2	4	<T	1	1	1		1	2	2	1	5	2
Fort Erie	11	2	203	GL151241	31-JUL-2015	0.72	2	16		1	1	1		1	2	2	1	5	2
Fort Erie	11	2	203	GL151241	31-JUL-2015	0.62	2	3	<T	1	1	1		1	2	2	1	5	2
NOTL	11	2	9	GL151247	31-JUL-2015	0.48	2	2		1	1	1		1	2	2	1	5	2
NOTL	11	2	9	GL151248	31-JUL-2015	0.8	2	3	<T	1	1	1		1	2	2	1	5	2
NOTL	11	2	9	GL151249	31-JUL-2015	0.65	2	2		1	1	1		1	2	2	1	5	2
Balsam Lake	18	1	1	GL151253	06-JUL-2015	0.89	2	4	<T	1	1	1		1	2	2	1	5	2
Balsam Lake	18	1	1	GL151254	06-JUL-2015	0.58	2	2		1	1	1		1	2	2	1	5	2
Balsam Lake	18	1	1	GL151255	06-JUL-2015	0.74	2	2		1	1	1		1	2	2	1	5	2
Balsam Lake	18	1	1	GL151259	06-JUL-2015	0.81	2	2		1	1	1		1	2	2	1	5	2
Balsam Lake	18	1	1	GL151260	06-JUL-2015	0.62	2	2		1	1	1		1	2	2	1	5	2

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PS1=PCB resembled mixture of Aroclor 1248,1254,1260; PS40= resemble Aroclor 1254 AND 1260; MCP= max poss. Conc'n due to chromatographic overlap

Station Description	op-DDT	Total PCB		Photomirex	pp-DDD	pp-DDE		pp-DDT	Toxaphene	Total Technical Chlordane	trans-nonachlor	Hexachloro-butadiene		1,2,3-trichlorobenzene		1,2,3,4-tetrachlorobenzene		1,2,3,5-tetrachlorobenzene	
	ng/g wet	ng/g wet		ng/g wet	ng/g wet	ng/g wet		ng/g wet	ng/g wet	ng/g wet	ng/g wet	ng/g wet		ng/g wet		ng/g wet		ng/g wet	
	<=W	<=W		<=W	<=W	<=W		<=W	<=W	<=W	<=W	<=W		<=W		<=W		<=W	
	5	20		4	5	1		5	50	2	2	1		2		1		1	
American Sites																			
Two Mile Creek (mouth)	5	88	PS1	4	5	1		5	50	2	2	1		2		1		1	
Two Mile Creek (mouth)	5	100	PS1	4	5	1		5	50	2	2	1		2		1		1	
Two Mile Creek (mouth)	5	110	PS1	4	5	1		5	50	2	2	1		2		1		1	
Pettit Flume (U/S)	5	27	PS1	4	5	1		5	50	2	2	1		2		1		1	
Pettit Flume (U/S)	5	29	PS1	4	5	1		5	50	2	2	1		2		1		1	
Pettit Flume (U/S)	5	28	PS1	4	5	1		5	50	2	2	1		2		1		1	
Pettit Flume Cove	5	43	PS1	4	5	2	<T	5	50	2	2	1		5	<T	12		9	MPC
Pettit Flume Cove	5	45	P40	4	5	2	<T	5	50	2	2	1		5	<T	10		6	MPC
Pettit Flume Cove	5	37	P40	4	5	2	<T	5	50	2	2	1		6	<T	12		7	MPC
Pettit Flume (D/S)	5	40	PS1	4	5	1		5	50	2	2	1		2		1		1	
Pettit Flume (D/S)	5	26	PS1	4	5	1		5	50	2	2	1		2		1		1	
Pettit Flume (D/S)	5	24	PS1	4	5	2	<T	5	50	2	2	1		2		1		1	
102 nd St (@outfall U/S of landfill)	5	20		4	5	1		5	50	2	2	1		2		1		1	
102 nd St (@outfall U/S of landfill)	5	20		4	5	1		5	50	2	2	1		2		1		1	
102 nd St (@outfall U/S of landfill)	5	20		4	5	1		5	50	2	2	1		2		1		1	
U/S Occidental Chem.	5	23	PS1	4	5	1		5	50	2	2	1		2		1		1	
U/S Occidental Chem.	5	20		4	5	3	<T	5	50	2	2	1		2		1		1	
U/S Occidental Chem.	5	27	PS1	4	5	1		5	50	2	2	1		2		1		1	
Storm Sewer A (D/S)	5	26	PS1	4	5	4	<T	5	50	2	2	1		2		1		1	
Storm Sewer A (D/S)	5	26	PS1	4	5	1		5	50	2	2	1		2		1		1	
Storm Sewer A (D/S)	5	27	PS1	4	5	1		5	50	2	2	1		2		1		1	
Storm Sewer B (D/S)	5	31	PS1	4	5	3	<T	5	50	2	2	1		2		1		1	
Storm Sewer B (D/S)	5	35	PS1	4	5	1		5	50	2	2	1		2		1		1	
Storm Sewer B (D/S)	5	36	PS1	4	5	1		5	50	2	2	1		2		1		1	
Storm Sewer C (D/S)	5	37	PS1	4	5	1		5	50	2	2	1		2		1		1	
Storm Sewer C (D/S)	5	26	PS1	4	5	1		5	50	2	2	1		2		1		1	
Storm Sewer C (D/S)	5	33	PS1	4	5	1		5	50	2	2	1		2		1		1	
OCC 003	5	52	PS1	4	5	1		5	50	2	2	10		2		4	<T	1	
OCC 003	5	40	PS1	4	5	1		5	50	2	2	8	<T	2		6	<T	1	
OCC 003	5	51	PS1	4	5	1		5	50	2	2	8	<T	2		5	<T	1	
Gill Creek (U/S mouth)	5	20		4	5	1		5	50	2	2	1		2		1		1	
Gill Creek (U/S mouth)	5	20		4	5	3	<T	5	50	2	2	1		2		1		1	
Gill Creek (U/S mouth)	5	20		4	5	3	<T	5	50	2	2	1		2		1		1	
Gill Creek (mouth)	5	36	PS1	4	5	1		5	50	2	2	10		2		1		1	
Gill Creek (mouth)	5	37	PS1	4	5	1		5	50	2	2	9	<T	2		1		1	
Gill Creek (mouth)	5	29	PS1	4	5	1		5	50	2	2	7	<T	2		1		1	
BRC (U/S)	5	20		4	5	1		5	50	2	2	1		2		1		1	
BRC (U/S)	5	20		4	5	1		5	50	2	2	1		2		1		1	
BRC (U/S)	5	20		4	5	1		5	50	2	2	1		2		1		1	
BRC (4th_5th pole) U/S stn 131	5	20		4	5	1		5	50	2	2	1		2		1		1	
BRC (4th_5th pole) U/S stn 131	5	20		4	5	1		5	50	2	2	1		2		1		1	
BRC (4th_5th pole) U/S stn 131	5	20		4	5	1		5	50	2	2	1		2		1		1	
BRC (7TH + 8TH POBT FROM S)	5	23	PS1	4	5	1		5	50	2	2	1		2		1		1	
BRC (7TH + 8TH POBT FROM S)	5	30	PS1	4	5	2	<T	5	50	2	2	2	<T	2		2	<T	1	
BRC (7TH + 8TH POBT FROM S)	5	20		4	5	1		5	50	2	2	1		2		1		1	
Bloody Run Creek	5	20		4	5	4	<T	5	50	2	2	1		2		1		1	
Bloody Run Creek	5	20		4	5	1		5	50	2	2	1		2		1		1	
Bloody Run Creek	5	27	PS1	4	5	4	<T	5	50	2	2	2	<T	2		1		1	
Bloody Run Creek (BRC) D/S	5	20		4	5	1		5	50	2	2	1		2		1		1	
Bloody Run Creek (BRC) D/S	5	20		4	5	1		5	50	2	2	1		2		1		1	
Bloody Run Creek (BRC) D/S	5	20		4	5	3	<T	5	50	2	2	1		2		1		1	
Canadian Sites																			
Fort Erie	5	20		4	5	4	<T	5	50	2	2	1		2		1		1	
Fort Erie	5	20		4	5	16		5	50	2	2	1		2		1		1	
Fort Erie	5	20		4	5	3	<T	5	50	2	2	1		2		1		1	
NOTL	5	20		4	5	1		5	50	2	2	1		2		1		1	
NOTL	5	20		4	5	3		5	50	2	2	1		2		1		1	
NOTL	5	20		4	5	1		5	50	2	2	1		2		1		1	
Balsam Lake	5	20		4	5	4	<T	5	50	2	2	1		2		1		1	
Balsam Lake	5	20		4	5	1		5	50	2	2	1		2		1		1	
Balsam Lake	5	20		4	5	1		5	50	2	2	1		2		1		1	
Balsam Lake	5	20		4	5	1		5	50	2	2	1		2		1		1	
Balsam Lake	5	20		4	5	2	<T	5	50	2	2	1		2		1		1	

Appendix D1: Tissue concentrations (ng/g wet wt.) of organic compounds in caged mussels, Niagara River, 2015. <W= no measurable response; <T= measurable trace amount;
PS1=PCB resembled mixture of Aroclor 1248,1254,1260; PS40= resemble Aroclor 1254 AND 1260; MCP= max poss. Conc'n due to chromatographic overlap

Station Description	1,2,4-trichlorobenzene		1,2,4,5-tetrachlorobenzene		1,3,5-trichlorobenzene	Hexachlorobenzene		Hexachloroethane	Octachlorostyrene		Pentachlorobenzene		2,3,6-trichlorotoluene		2,4,5-trichlorotoluene	
	ng/g wet		ng/g wet		ng/g wet	ng/g wet		ng/g wet	ng/g wet		ng/g wet		ng/g wet		ng/g wet	
	<=W		<=W		<=W	<=W		<=W	<=W		<=W		<=W		<=W	
	2		1		2	1		1	1		1		1		1	
American Sites																
Two Mile Creek (mouth)	2		1		2	1		1	1		1		1		1	
Two Mile Creek (mouth)	2		1		2	1		1	1		1		1		1	
Two Mile Creek (mouth)	2		1		2	1		1	1		1		1		1	
Pettit Flume (U/S)	2		1		2	1		1	1		1		1		1	
Pettit Flume (U/S)	2		1		2	1		1	1		1		1		1	
Pettit Flume (U/S)	2		1		2	1		1	1		1		1		1	
Pettit Flume Cove	5	<T	9	MPC	2	26		1	1		17		1		1	
Pettit Flume Cove	5	<T	6	MPC	2	14		1	1		11		1		1	
Pettit Flume Cove	4	<T	7	MPC	2	21		1	1		15		1		1	
Pettit Flume (D/S)	2		1		2	1		1	1		1		1		1	
Pettit Flume (D/S)	2		1		2	1		1	1		1		1		1	
Pettit Flume (D/S)	2		1		2	1		1	1		1		1		1	
102 nd St (@outfall U/S of landfill)	2		1		2	1		1	1		1		1		1	
102 nd St (@outfall U/S of landfill)	2		1		2	1		1	1		1		1		1	
102 nd St (@outfall U/S of landfill)	2		1		2	1		1	1		1		1		1	
U/S Occidental Chem.	2		1		2	1		1	1		1		1		1	
U/S Occidental Chem.	2		1		2	1		1	1		1		1		1	
U/S Occidental Chem.	2		1		2	1		1	1		1		1		1	
Storm Sewer A (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer A (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer A (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer B (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer B (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer B (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer C (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer C (D/S)	2		1		2	1		1	1		1		1		1	
Storm Sewer C (D/S)	2		1		2	2	<T	1	1		1		1		1	
OCC 003	3	<T	1		2	3	<T	1	1		3	<T	5	<T	3	<T
OCC 003	4	<T	1		2	3	<T	1	1		4	<T	5	<T	3	<T
OCC 003	4	<T	1		2	3	<T	1	1		3	<T	4	<T	3	<T
Gill Creek (U/S mouth)	2		1		2	1		1	1		1		1		1	
Gill Creek (U/S mouth)	2		1		2	1		1	1		1		1		1	
Gill Creek (U/S mouth)	2		1		2	1		1	1		1		1		1	
Gill Creek (mouth)	2		1		2	1		1	1		1		1		1	
Gill Creek (mouth)	2		1		2	1		1	1		1		1		1	
Gill Creek (mouth)	2		1		2	2	<T	1	1		1		1		1	
BRC (U/S)	2		1		2	1		1	1		1		1		1	
BRC (U/S)	2		1		2	1		1	1		1		1		1	
BRC (U/S)	2		1		2	1		1	1		1		1		1	
BRC (4th_5th pole) U/S stn 131	2		1		2	8	<T	1	1		5		1		2	<T
BRC (4th_5th pole) U/S stn 131	2		1		2	5	<T	1	1		3		1		1	
BRC (4th_5th pole) U/S stn 131	2		1		2	7	<T	1	1		3		1		2	<T
BRC (7TH + 8TH POBT FROM S)	2		1		2	11		1	1		7	<T	1		1	
BRC (7TH + 8TH POBT FROM S)	2		1		2	36		1	2	<T	28		8	MPC	8	MPC
BRC (7TH + 8TH POBT FROM S)	2		1		2	12		1	1		11		4	MPC	3	<T
Bloody Run Creek	2		1		2	7	<T	1	1		3	<T	1		1	
Bloody Run Creek	2		1		2	2	<T	1	1		2	<T	2	MPC	2	MPC
Bloody Run Creek	2		1		2	22		1	2	<T	16		3	MPC	3	MPC
Bloody Run Creek (BRC) D/S	2		1		2	5	<T	1	1		3	<T	2	MPC	1	
Bloody Run Creek (BRC) D/S	2		1		2	3	<T	1	1		1		1		1	
Bloody Run Creek (BRC) D/S	2		1		2	5	<T	1	1		2	<T	2	MPC	1	
Canadian Sites																
Fort Erie	2		1		2	1		1	1		1		1		1	
Fort Erie	2		1		2	1		1	1		1		1		1	
Fort Erie	2		1		2	1		1	1		1		1		1	
NOTL	2		1		2	1		1	1		1		1		1	
NOTL	2		1		2	1		1	1		1		1		1	
NOTL	2		1		2	1		1	1		1		1		1	
Balsam Lake	2		1		2	1		1	1		1		1		1	
Balsam Lake	2		1		2	1		1	1		1		1		1	
Balsam Lake	2		1		2	1		1	1		1		1		1	
Balsam Lake	2		1		2	1		1	1		1		1		1	
Balsam Lake	2		1		2	1		1	1		1		1		1	

Appendix D2: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2015. <MDL= method detection limit

Station Description	BOW	Stn type	Station Number	Retrieval Date	Samp No	LIPID	P1PCBT	PCB018	PCB019		PCB022		PCB033	PCB044	PCB049	
						%	ng/g	ng/g	ng/g		ng/g		ng/g	ng/g	ng/g	
Two Mile Creek (mouth)	5	2	197	28-JUL-2015	GL151106	4.6	390	5	1		2		6	17	21	
Two Mile Creek (mouth)	5	2	197	28-JUL-2015	GL151107	4.4	320	5	1		2		6	15	19	
Two Mile Creek (mouth)	5	2	197	28-JUL-2015	GL151108	4.9	390	6	1	<MDL	3		8	18	22	
Rattlesnake Creek	5	15	38	28-JUL-2015	GL151109	4.8	570	23	7		5		23	48	53	
Rattlesnake Creek	5	15	38	28-JUL-2015	GL151110	4.3	480	19	6		4		19	41	53	
Rattlesnake Creek	5	15	38	28-JUL-2015	GL151111	4.2	450	18	6		4		17	36	40	
Two Mile Creek (N of Hwy 290)	5	15	42	28-JUL-2015	GL151112	4.9	200	4	1	<MDL	1		3	6	6	
Two Mile Creek (N of Hwy 290)	5	15	42	29-JUL-2015	GL151113	5	190	4	1	<MDL	1		3	6	7	
Two Mile Creek (N of Hwy 290)	5	15	42	29-JUL-2015	GL151114	4.8	200	4	1	<MDL	1		4	6	7	
Two Mile Creek (Sheridan Rd)	5	15	36	29-JUL-2015	GL151115	4.5	80	4	1	<MDL	1		3	3	2	
Two Mile Creek (Sheridan Rd)	5	15	36	29-JUL-2015	GL151116	5.3	83	4	1	<MDL	1		3	3	2	
Two Mile Creek (Sheridan Rd)	5	15	36	29-JUL-2015	GL151117	4	30	2	1	<MDL	1		1	2	1	
Gratwick Riverside Park (GRP) (U/S)	5	2	31	29-JUL-2015	GL151118	4.5	220	9	2		3		6	12	20	
Gratwick Riverside Park (GRP) (U/S)	5	2	31	29-JUL-2015	GL151119	3.9	230	8	2		2		6	11	20	
Gratwick Riverside Park (GRP) (U/S)	5	2	31	29-JUL-2015	GL151120	4.2	210	9	1	<MDL	3		8	12	17	
GRP (U/S Marina)	5	2	213	29-JUL-2015	GL151121	3.8	980	34	6		12		27	58	87	
GRP (U/S Marina)	5	2	213	29-JUL-2015	GL151122	3.2	600	19	3		7		16	36	55	
GRP (U/S Marina)	5	2	213	29-JUL-2015	GL151123	4	780	23	3		8		19	44	70	
GRP (Marina)	5	2	122	29-JUL-2015	GL151124	4.3	720	32	5		9		22	40	65	
GRP (Marina)	5	2	122	29-JUL-2015	GL151125	5.3	1000	42	6		14		29	55	89	
GRP (Marina)	5	2	122	29-JUL-2015	GL151126	5.1	1000	38	5		14		29	57	92	
GRP (Mid Park)	5	2	214	29-JUL-2015	GL151127	4.6	190	8	2		3		8	11	15	
GRP (Mid Park)	5	2	214	29-JUL-2015	GL151128	4.4	180	7	2		2		5	8	16	
GRP (Mid Park)	5	2	214	29-JUL-2015	GL151129	4.7	200	9	2		3		6	9	17	
GRP (D/S)	5	2	199	29-JUL-2015	GL151130	4.4	160	7	2		2		4	7	14	
GRP (D/S)	5	2	199	29-JUL-2015	GL151131	4.3	110	5	1	<MDL	2		4	6	8	
GRP (D/S)	5	2	199	29-JUL-2015	GL151132	3.6	100	5	1		1		3	5	7	
102nd St. (U/S)	5	2	93	29-JUL-2015	GL151133	4.4	130	6	1		2		4	6	10	
102nd St. (U/S)	5	2	93	29-JUL-2015	GL151134	4.4	110	4	1		1		3	5	8	
102nd St. (U/S)	5	2	93	29-JUL-2015	GL151135	4.5	84	3	1	<MDL	1	<MDL	3	4	7	
Little Niagara River (LNR) (D/S 102nd St.)	5	2	95	29-JUL-2015	GL151139	4.8	120	3	1	<MDL	1		3	5	8	
Little Niagara River (LNR) (D/S 102nd St.)	5	2	95	29-JUL-2015	GL151140	4.8	130	4	1	<MDL	2		3	6	8	
Little Niagara River (LNR) (D/S 102nd St.)	5	2	95	29-JUL-2015	GL151141	3.9	120	4	1	<MDL	2		4	5	7	
LNR D/S Cayuga Creek	5	2	96	29-JUL-2015	GL151142	4.2	94	3	1	<MDL	1		3	5	7	
LNR D/S Cayuga Creek	5	2	96	30-JUL-2015	GL151143	3.7	84	3	1	<MDL	1		3	4	6	
LNR D/S Cayuga Creek	5	2	96	30-JUL-2015	GL151144	4.9	97	3	1	<MDL	1	<MDL	2	5	7	
Cayuga Creek	5	15	31	30-JUL-2015	GL151145	4.8	120	6	1	<MDL	1	<MDL	4	6	5	
Cayuga Creek	5	15	31	30-JUL-2015	GL151146	4.7	99	2	1	<MDL	1	<MDL	2	4	5	
Cayuga Creek	5	15	31	30-JUL-2015	GL151147	4.3	78	2	1	<MDL	1	<MDL	2	3	4	
U/S Occidental Chem.	5	2	97	30-JUL-2015	GL151148	4.3	97	3	1	<MDL	1	<MDL	3	5	8	
U/S Occidental Chem.	5	2	97	30-JUL-2015	GL151149	4.6	84	3	1	<MDL	1		2	4	6	
U/S Occidental Chem.	5	2	97	30-JUL-2015	GL151150	4.1	72	3	1	<MDL	1	<MDL	2	4	1	<MDL
OCC 003	5	2	42	30-JUL-2015	GL151163	4.1	190	14	2		5		11	18	21	
OCC 003	5	2	42	30-JUL-2015	GL151164	4.8	200	13	1	<MDL	4		9	21	21	
OCC 003	5	2	42	30-JUL-2015	GL151165	3.7	160	10	1	<MDL	4		7	16	16	
Gill Creek (mouth)	5	2	37	30-JUL-2015	GL151172	4	70	3	1	<MDL	1	<MDL	2	5	6	
Gill Creek (mouth)	5	2	37	31-JUL-2015	GL151173	4.1	76	3	1	<MDL	1	<MDL	2	5	7	
Gill Creek (mouth)	5	2	37	31-JUL-2015	GL151174	4.4	110	5	1	<MDL	1		4	7	9	

Appendix D2: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2015. <MDL= method detection limit

	PCB052	PCB054		PCB070		PCB074		PCB087		PCB095	PCB099	PCB104		PCB105		PCB110	PCB114		PCB118
	ng/g	ng/g		ng/g		ng/g		ng/g		ng/g	ng/g	ng/g		ng/g		ng/g	ng/g		ng/g
Two Mile Creek (mouth)	34	1	<MDL	10		9		17		30	22	1	<MDL	8		29	1	<MDL	16
Two Mile Creek (mouth)	30	1	<MDL	7		7		14		27	18	1	<MDL	5		24	1	<MDL	11
Two Mile Creek (mouth)	35	1	<MDL	11		10		16		29	22	1	<MDL	9		28	1	<MDL	17
Rattlesnake Creek	94	1	<MDL	18		9		21		59	26	1	<MDL	5		33	1	<MDL	11
Rattlesnake Creek	80	1	<MDL	14		7		17		49	21	1	<MDL	4		27	1	<MDL	8
Rattlesnake Creek	69	1	<MDL	13		7		17		45	22	1	<MDL	4		27	1	<MDL	8
Two Mile Creek (N of Hwy 290)	14	1	<MDL	5		2		9		15	10	1	<MDL	4		15	1	<MDL	10
Two Mile Creek (N of Hwy 290)	14	1	<MDL	5		2		8		15	10	1	<MDL	4		14	1	<MDL	10
Two Mile Creek (N of Hwy 290)	14	1	<MDL	5		2		9		16	10	1	<MDL	1	<MDL	15	1	<MDL	10
Two Mile Creek (Sheridan Rd)	5	1	<MDL	1		1		2		4	2	1	<MDL	1		4	1	<MDL	2
Two Mile Creek (Sheridan Rd)	5	1	<MDL	2		1		2		4	3	1	<MDL	1		4	1	<MDL	3
Two Mile Creek (Sheridan Rd)	3	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2	1	1	<MDL	1	<MDL	2	1	<MDL	1
Gratwick Riverside Park (GRP) (U/S)	24	1	<MDL	13		10		7		12	11	1	<MDL	4		13	1	<MDL	8
Gratwick Riverside Park (GRP) (U/S)	22	1	<MDL	13		9		7		12	12	1	<MDL	4		13	1	<MDL	9
Gratwick Riverside Park (GRP) (U/S)	22	1	<MDL	12		9		6		12	10	1	<MDL	4		12	1	<MDL	8
GRP (U/S Marina)	110	2		79		54		34		49	46	1	<MDL	23		55	2		40
GRP (U/S Marina)	68	1		47		32		22		31	29	1	<MDL	14		36	1	<MDL	26
GRP (U/S Marina)	86	1		62		41		29		40	40	1	<MDL	18		48	2		35
GRP (Marina)	85	3		45		26		16		37	31	1	<MDL	7		35	1	<MDL	22
GRP (Marina)	120	3		68		39		24		48	46	1	<MDL	11		51	1		34
GRP (Marina)	120	3		70		40		25		52	48	1	<MDL	12		54	1		36
GRP (Mid Park)	20	1	<MDL	9		7		5		10	8	1	<MDL	3		10	1	<MDL	6
GRP (Mid Park)	18	1	<MDL	10		7		5		8	8	1	<MDL	3		9	1	<MDL	7
GRP (Mid Park)	19	1	<MDL	10		7		6		9	9	1	<MDL	4		11	1	<MDL	7
GRP (D/S)	15	1	<MDL	8		6		4		8	8	1	<MDL	3		8	1	<MDL	6
GRP (D/S)	11	1	<MDL	4		4		3		5	5	1	<MDL	2		6	1	<MDL	4
GRP (D/S)	9	1	<MDL	5		3		3		5	5	1	<MDL	2		5	1	<MDL	4
102nd St. (U/S)	11	1	<MDL	5		4		4		6	6	1	<MDL	3		7	1	<MDL	5
102nd St. (U/S)	9	1	<MDL	4		3		3		6	5	1	<MDL	2		7	1	<MDL	5
102nd St. (U/S)	9	1	<MDL	3		3		2		6	2	1	<MDL	1	<MDL	3	1	<MDL	4
Little Niagara River (LNR) (D/S 102nd St.)	12	1	<MDL	4		4		3		7	3	1	<MDL	3		8	1	<MDL	8
Little Niagara River (LNR) (D/S 102nd St.)	12	1	<MDL	5		5		3		7	3	1	<MDL	3		8	1	<MDL	8
Little Niagara River (LNR) (D/S 102nd St.)	11	1	<MDL	4		4		3		7	3	1	<MDL	3		8	1	<MDL	7
LNR D/S Cayuga Creek	9	1	<MDL	4		3		2		6	2	1	<MDL	2		6	1	<MDL	5
LNR D/S Cayuga Creek	8	1	<MDL	3		3		2		5	2	1	<MDL	2		6	1	<MDL	4
LNR D/S Cayuga Creek	9	1	<MDL	4		3		3		6	3	1	<MDL	2		6	1	<MDL	6
Cayuga Creek	9	1	<MDL	3		2		4		8	6	1	<MDL	2		8	1	<MDL	6
Cayuga Creek	7	1	<MDL	3		2		4		8	3	1	<MDL	3		8	1	<MDL	7
Cayuga Creek	5	1	<MDL	2		1		3		6	2	1	<MDL	2		6	1	<MDL	5
U/S Occidental Chem.	9	1	<MDL	4		3		3		6	3	1	<MDL	2		6	1	<MDL	5
U/S Occidental Chem.	7	1	<MDL	3		3		2		5	2	1	<MDL	2		6	1	<MDL	5
U/S Occidental Chem.	8	1	<MDL	3		3		2		4	2	1	<MDL	2		5	1	<MDL	4
OCC 003	28	1	<MDL	15		9		5		8	7	1	<MDL	3		7	1	<MDL	4
OCC 003	30	1	<MDL	13		11		5		7	4	1	<MDL	4		8	1	<MDL	6
OCC 003	23	1	<MDL	10		8		4		5	3	1	<MDL	3		6	1	<MDL	5
Gill Creek (mouth)	9	1	<MDL	4		3		2		5	2	1	<MDL	2		4	1	<MDL	4
Gill Creek (mouth)	9	1	<MDL	4		3		3		5	2	1	<MDL	2		5	1	<MDL	4
Gill Creek (mouth)	12	1	<MDL	5		4		4		6	5	1	<MDL	2		6	1	<MDL	4

Appendix D2: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2015. <MDL= method detection limit

	PCB119		PCB123		PCB128		PCB138	PCB149		PCB151		PCB153		PCB155		PCB156		PCB157	
	ng/g		ng/g		ng/g		ng/g	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Two Mile Creek (mouth)	1		1	<MDL	5		28	20		8		23		1	<MDL	2		1	<MDL
Two Mile Creek (mouth)	1		1	<MDL	4		23	18		6		19		1	<MDL	1		1	<MDL
Two Mile Creek (mouth)	1		1	<MDL	5		26	19		7		22		1	<MDL	2		1	<MDL
Rattlesnake Creek	2		1	<MDL	4		18	17		6		16		1	<MDL	1	<MDL	1	<MDL
Rattlesnake Creek	2		1	<MDL	3		14	15		5		13		1	<MDL	1	<MDL	1	<MDL
Rattlesnake Creek	2		1	<MDL	3		17	15		5		14		1	<MDL	1		1	<MDL
Two Mile Creek (N of Hwy 290)	1	<MDL	1	<MDL	3		16	12		4		14		1	<MDL	1		1	<MDL
Two Mile Creek (N of Hwy 290)	1	<MDL	1	<MDL	3		16	11		4		14		1	<MDL	1		1	<MDL
Two Mile Creek (N of Hwy 290)	1	<MDL	1	<MDL	3		17	12		4		13		1	<MDL	1		1	<MDL
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1		7	6		2		7		1	<MDL	1	<MDL	1	<MDL
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1		8	6		3		7		1	<MDL	1	<MDL	1	<MDL
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1	<MDL	3	3		1		3		1	<MDL	1	<MDL	1	<MDL
Gratwick Riverside Park (GRP) (U/S)	1		1	<MDL	1		7	7		3		7		1	<MDL	1	<MDL	1	<MDL
Gratwick Riverside Park (GRP) (U/S)	1		1	<MDL	1		9	7		3		8		1	<MDL	1	<MDL	1	<MDL
Gratwick Riverside Park (GRP) (U/S)	1		1	<MDL	1	<MDL	7	7		3		7		1	<MDL	1	<MDL	1	<MDL
GRP (U/S Marina)	3		1	<MDL	3		19	16		7		18		1	<MDL	2		1	<MDL
GRP (U/S Marina)	2		1	<MDL	2		12	10		5		12		1	<MDL	1		1	<MDL
GRP (U/S Marina)	2		1	<MDL	3		17	14		6		16		1	<MDL	1		1	<MDL
GRP (Marina)	2		1	<MDL	3		20	18		8		22		1	<MDL	2		1	<MDL
GRP (Marina)	3		1	<MDL	5		29	26		11		31		1	<MDL	2		1	
GRP (Marina)	4		1	<MDL	5		31	26		11		33		1	<MDL	2		1	
GRP (Mid Park)	1		1	<MDL	1	<MDL	7	7		1	<MDL	7		1	<MDL	1	<MDL	1	<MDL
GRP (Mid Park)	1		1	<MDL	1		7	6		3		8		1	<MDL	1		1	<MDL
GRP (Mid Park)	1	<MDL	1	<MDL	1		9	7		3		9		1	<MDL	1		1	<MDL
GRP (D/S)	1	<MDL	1	<MDL	1		6	5		2		7		1	<MDL	1	<MDL	1	<MDL
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	5	4		2		5		1	<MDL	1	<MDL	1	<MDL
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	5	4		2		5		1	<MDL	1	<MDL	1	<MDL
102nd St. (U/S)	1	<MDL	1	<MDL	1		8	6		2		7		1	<MDL	1	<MDL	1	<MDL
102nd St. (U/S)	1	<MDL	1	<MDL	1		7	5		2		7		1	<MDL	1	<MDL	1	<MDL
102nd St. (U/S)	1	<MDL	1	<MDL	1	<MDL	5	3		1		4		1	<MDL	1	<MDL	1	<MDL
Little Niagara River (LNR) (D/S 102nd S	1	<MDL	1	<MDL	2		7	3		2		6		1	<MDL	1	<MDL	1	<MDL
Little Niagara River (LNR) (D/S 102nd S	1	<MDL	1	<MDL	2		8	3		2		6		1	<MDL	1		1	<MDL
Little Niagara River (LNR) (D/S 102nd S	1	<MDL	1	<MDL	2		7	3		2		6		1	<MDL	1	<MDL	1	<MDL
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	6	3		2		5		1	<MDL	1	<MDL	1	<MDL
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	5	2		2		5		1	<MDL	1	<MDL	1	<MDL
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	7	3		2		5		1	<MDL	1	<MDL	1	<MDL
Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	10	8		1	<MDL	9		1	<MDL	1	<MDL	1	<MDL
Cayuga Creek	1	<MDL	1	<MDL	1		9	4		2		6		1	<MDL	1	<MDL	1	<MDL
Cayuga Creek	1	<MDL	1	<MDL	1		7	3		2		5		1	<MDL	1	<MDL	1	<MDL
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	6	3		2		5		1	<MDL	1	<MDL	1	<MDL
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	5	3		1		4		1	<MDL	1	<MDL	1	<MDL
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	5	2		1		4		1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	2	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	2	1	<MDL	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	3	1		1	<MDL	2		1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	3	2		1	<MDL	3		1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	5	4		1	<MDL	5		1	<MDL	1	<MDL	1	<MDL

Appendix D2: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2015. <MDL= method detection limit																				
	PCB158		PCB167		PCB168		PCB170		PCB171		PCB177		PCB178		PCB180		PCB183		PCB187	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Two Mile Creek (mouth)	2		1		1	<MDL	4		1		3		1		10		2		7	
Two Mile Creek (mouth)	2		1	<MDL	1	<MDL	3		1	<MDL	2		1		8		2		6	
Two Mile Creek (mouth)	2		1	<MDL	1	<MDL	4		1		3		1	<MDL	9		2		6	
Rattlesnake Creek	1		1	<MDL	1	<MDL	2		1	<MDL	1		1	<MDL	4		1	<MDL	3	
Rattlesnake Creek	1		1	<MDL	1	<MDL	2		1	<MDL	1		1	<MDL	3		1		2	
Rattlesnake Creek	1		1	<MDL	1	<MDL	2		1	<MDL	1		1		4		1		3	
Two Mile Creek (N of Hwy 290)	2		1		1	<MDL	3		1		1		1	<MDL	6		1		4	
Two Mile Creek (N of Hwy 290)	3		1	<MDL	1	<MDL	3		1		2		1	<MDL	6		1		4	
Two Mile Creek (N of Hwy 290)	2		1		1	<MDL	2		1		2		1	<MDL	6		2		4	
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	1		1	<MDL	4		1	<MDL	3	
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	1		1	<MDL	4		1		3	
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	
Gratwick Riverside Park (GRP) (U/S)	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1		1		4		1		3	
Gratwick Riverside Park (GRP) (U/S)	1		1	<MDL	1	<MDL	2		1	<MDL	1		1		4		1		4	
Gratwick Riverside Park (GRP) (U/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	4		1	<MDL	3	
GRP (U/S Marina)	2		1		1	<MDL	3		1		3		2		10		3		10	
GRP (U/S Marina)	1		1	<MDL	1	<MDL	2		1	<MDL	2		1	<MDL	6		1		5	
GRP (U/S Marina)	2		1	<MDL	1	<MDL	3		1		2		2		10		2		8	
GRP (Marina)	2		1	<MDL	1	<MDL	4		1		3		2		12		3		8	
GRP (Marina)	3		1		1	<MDL	6		2		4		3		17		4		11	
GRP (Marina)	3		1		1	<MDL	6		2		4		3		18		5		12	
GRP (Mid Park)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	4		1	<MDL	3	
GRP (Mid Park)	1		1	<MDL	1	<MDL	1		1	<MDL	1		1		4		1		3	
GRP (Mid Park)	1		1	<MDL	1	<MDL	2		1	<MDL	1		1	<MDL	5		1		4	
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1		1		3		1		3	
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
102nd St. (U/S)	1		1	<MDL	1	<MDL	1		1	<MDL	1		1	<MDL	4		1		3	
102nd St. (U/S)	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1		1	<MDL	4		1		3	
102nd St. (U/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	2	
Little Niagara River (LNR) (D/S 102nd St.)	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
Little Niagara River (LNR) (D/S 102nd St.)	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	3	
Little Niagara River (LNR) (D/S 102nd St.)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	2	
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	2	
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	3	
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	3		1	<MDL	2	
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	2	
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	1	<MDL

Appendix D2: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2015. <MDL= method detection limit																				
	PCB188		PCB189		PCB191		PCB194		PCB199		PCB201		PCB202		PCB205		PCB206		PCB208	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Two Mile Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1		3		1	<MDL	1	<MDL	1	<MDL	2		1	<MDL
Two Mile Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	2		1	<MDL
Two Mile Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1		3		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Rattlesnake Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Rattlesnake Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Rattlesnake Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Two Mile Creek (N of Hwy 290)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Two Mile Creek (N of Hwy 290)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Two Mile Creek (N of Hwy 290)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	2		1	<MDL
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	2		1	<MDL
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Two Mile Creek (Sheridan Rd)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Gratwick Riverside Park (GRP) (U/S)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Gratwick Riverside Park (GRP) (U/S)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
Gratwick Riverside Park (GRP) (U/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
GRP (U/S Marina)	1	<MDL	1	<MDL	1	<MDL	2		5		1	<MDL	1		1	<MDL	2		1	
GRP (U/S Marina)	1	<MDL	1	<MDL	1	<MDL	1		3		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
GRP (U/S Marina)	1	<MDL	1	<MDL	1	<MDL	2		4		1		1		1	<MDL	2		1	<MDL
GRP (Marina)	1	<MDL	1	<MDL	1		2		4		3		1		1	<MDL	2		1	
GRP (Marina)	1	<MDL	1	<MDL	2		3		5		4		2		1	<MDL	3		2	
GRP (Marina)	1	<MDL	1		2		3		5		5		2		1		3		1	<MDL
GRP (Mid Park)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
GRP (Mid Park)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
GRP (Mid Park)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	2		1	<MDL
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	2		1	<MDL
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
GRP (D/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
102nd St. (U/S)	1	<MDL	1	<MDL	1	<MDL	1		2		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
102nd St. (U/S)	1	<MDL	1	<MDL	1	<MDL	1		1		1	<MDL	1	<MDL	1	<MDL	1		1	<MDL
102nd St. (U/S)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Little Niagara River (LNR) (D/S 102nd St	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Little Niagara River (LNR) (D/S 102nd St	1	<MDL	1	<MDL	1	<MDL	1	<MDL	2		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Little Niagara River (LNR) (D/S 102nd St	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
LNR D/S Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1		1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Cayuga Creek	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
U/S Occidental Chem.	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
OCC 003	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL
Gill Creek (mouth)	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL	1	<MDL

Appendix D2: Congener specific PCB tissue concentrations (ng/g **dry** wt.) in caged mussels, Niagara River, 2015. <MDL= method detection limit

Station Description	BOW	Stn type	Station Number	Retrieval Date	Samp No	LIPID	PCBTOT		PCB018		PCB019		PCB022		PCB028		PCB033		PCB037		PCB044	
						%	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Fort Erie	11	2	203	31-JUL-2015	GL151244	3	5	<=W	2	<=W	2	<=W	0.5	<=W	0.5	<=W	0.5	<=W	1	<=W	0.3	<T
Fort Erie	11	2	203	31-JUL-2015	GL151245	3.5	5	<=W	2	<=W	2	<=W	0.5	<=W	0.5	<=W	0.5	<=W	1	<=W	0.1	<=W
Fort Erie	11	2	203	31-JUL-2015	GL151246	3.7	5	<=W	2	<=W	2	<=W	0.5	<=W	0.5	<=W	0.5	<=W	1	<=W	0.1	<=W
NOTL	11	2	9	31-JUL-2015	GL151250	3.9	10	<T	2	<=W	2	<=W	0.5	<=W	0.5	<=W	0.5	<=W	1	<=W	0.4	<T
NOTL	11	2	9	31-JUL-2015	GL151251	3	15	<T	2	<=W	2	<=W	0.5	<=W	1	<T	0.5	<=W	1	<=W	1.3	
NOTL	11	2	9	31-JUL-2015	GL151252	3.4	15	<T	2	<=W	2	<=W	0.5	<=W	1	<T	0.5	<=W	1	<=W	1.1	
Balsam Lake	18	1	1	06-JUL-2015	GL151256	3.8	5	<=W	2	<=W	2	<=W	0.5	<=W	0.5	<=W	0.5	<=W	1	<=W	0.1	<=W
Balsam Lake	18	1	1	06-JUL-2015	GL151257	2.2	5	<=W	2	<=W	2	<=W	0.5	<=W	0.5	<=W	0.5	<=W	1	<=W	0.1	<=W
Balsam Lake	18	1	1	06-JUL-2015	GL151258	3.2	5	<=W	2	<=W	2	<=W	0.5	<=W	0.5	<=W	0.5	<=W	1	<=W	0.1	<=W

Station Description	PCB049		PCB052		PCB054		PCB070		PCB074		PCB077		PCB081		PCB087		PCB095		PCB099		PCB101	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Fort Erie	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.5	<=W	0.1	<=W	0.3	<T	0.1	<=W	0.5	<T
Fort Erie	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.5	<=W	0.1	<=W	0.2	<T	0.1	<=W	0.4	<T
Fort Erie	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.5	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W
NOTL	0.2	<T	0.1	<=W	0.2	<=W	0.3	<T	0.1	<=W	0.4	<T	0.5	<=W	0.1	<=W	1		0.1	<=W	0.4	<T
NOTL	0.8	<T	0.5	<T	0.2	<=W	0.8	<T	0.4	<T	0.4	<T	0.5	<=W	0.1	<=W	1.4		0.5	<T	1	
NOTL	0.8	<T	0.5	<T	0.2	<=W	0.9	<T	0.5	<T	0.4	<T	0.5	<=W	0.1	<=W	1.7		0.6	<T	1.1	
Balsam Lake	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.5	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W
Balsam Lake	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.5	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W
Balsam Lake	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.5	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W

Station Description	PCB104		PCB105		PCB110		PCB114		PCB118		PCB119		PCB123		PCB126		PCB128		PCB138		PCB149	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Fort Erie	0.1	<=W	0.4	<T	0.6	<T	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	1	<T	0.2	<=W
Fort Erie	0.1	<=W	0.4	<T	0.5	<T	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	1	<T	0.2	<=W
Fort Erie	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.6	<T	0.2	<=W
NOTL	0.1	<=W	0.8	<T	1.1		0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	1.2	<T	0.2	<=W
NOTL	0.1	<=W	0.6	<T	1		0.1	<=W	0.4	<T	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	1.2	<T	1	<T
NOTL	0.1	<=W	0.6	<T	1.1		0.1	<=W	0.6	<T	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	1.4	<T	1.2	<T
Balsam Lake	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W

Station Description	PCB151		PCB153		PCB155		PCB156		PCB157		PCB158		PCB167		PCB168		PCB169		PCB170		PCB171	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Fort Erie	0.1	<=W	0.7	<T	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.4	MPC	0.1	<=W	0.2	<=W	0.2	<=W
Fort Erie	0.1	<=W	0.5	<T	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.2	MPC	0.1	<=W	0.2	<=W	0.2	<=W
Fort Erie	0.1	<=W	0.2	<T	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W
NOTL	0.1	<=W	0.7	<T	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.2	MPC	0.1	<=W	0.2	<=W	0.2	<=W
NOTL	0.2	<T	0.8	<T	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.4	MPC	0.1	<=W	0.2	<=W	0.2	<=W
NOTL	0.1	<=W	1.2		0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.6	MPC	0.1	<=W	0.4	<T	0.2	<=W
Balsam Lake	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.1	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W

Station Description	PCB177		PCB178		PCB180		PCB183		PCB187		PCB188		PCB189		PCB191		PCB194		PCB199		PCB201	
	ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g		ng/g	
Fort Erie	0.1	<=W	0.2	<=W	0.4	<T	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Fort Erie	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Fort Erie	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
NOTL	0.1	<=W	0.2	<=W	0.4	<T	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
NOTL	0.1	<=W	0.2	<=W	0.4	<T	0.2	<=W	0.2	<T	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
NOTL	0.1	<=W	0.2	<=W	0.6	<T	0.2	<=W	0.3	<T	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.1	<=W	0.1	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W

Station Description	PCB202		PCB205		PCB206		PCB208	
	ng/g		ng/g		ng/g		ng/g	
Fort Erie	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Fort Erie	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Fort Erie	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
NOTL	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
NOTL	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
NOTL	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W
Balsam Lake	0.2	<=W	0.2	<=W	0.2	<=W	0.2	<=W

Appendix D3: Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in caged mussels (pg/g wet wt.) deployed in the Niagara River, and sediment (ng/g dry wt), 2015. For mussels n=1 composite of four mussels. For sediment n=1 composite of 3 surface samples.

Table D3. Dioxin and Furan concentrations, and percent lipid in caged mussels deployed in the Niagara River, 2015

Submission: C224871																	
Mussels			FISHERMANS PARK			FISHERMANS PARK			PETTIT FLUME			PETTIT FLUME			PETTIT FLUME		
			U/S Inlet			D/S Inlet			Upstream			Downstream			Outer Site		
	Field ID		GL151089			GL151090			GL151094			GL151098			GL151102		
	Sample Number		C224871-0001			C224871-0002			C224871-0006			C224871-0010			C224871-0014		
	Station Number		500020001			500020002			500020185			500020187			500020186		
	Collection Date		28-JUL-2015			28-JUL-2015			28-JUL-2015			28-JUL-2015			28-JUL-2015		
Parameter Name	Test Code	Units															
Percent Lipid	LIPID	%	0.85			1.2			0.99			1.2			1.2		
2378-tetrachlorofuran	P4F378	pg/g dry	1.2		DB5	0.88		DB5	0.17	<		0.7		DB5	18		DB5
12378-pentachlorofuran	P5F378	pg/g dry	0.25	<		0.3	<		0.11	<		0.12	<		2.7		
23478-pentachlorofuran	P5F478	pg/g dry	0.57			0.41	<		0.11	<		0.41			7.8		
123478-hexachlorofuran	P6F478	pg/g dry	1.7		DB5	1.1		DB5	0.058	<		1.3		DB5	30		DB5
123678-hexachlorofuran	P6F678	pg/g dry	0.35			0.27	<		0.057	<		0.23	<		5		
123789-hexachlorofuran	P6F789	pg/g dry	0.091	<		0.079	<		0.058	<		0.068	<		0.11	<	
234678-hexachlorofuran	P6F234	pg/g dry	0.11	<		0.13	<		0.062	<		0.079	<		1.6		
1234678-heptachlorofuran	P7F678	pg/g dry	2.5			1.5			0.07	<		1.6			48		
1234789-heptachlorofuran	P7F789	pg/g dry	0.13	<		0.08	<		0.076	<		0.07	<		1.5		
Octachlorofuran	P98CDF	pg/g dry	2.1			1			0.14	<		1.5			35		
2378-tetrachlorodioxin	P4D378	pg/g dry	0.13	<		0.15	<		0.15	<		0.14	<		0.88		
12378-pentachlorodioxin	P5D378	pg/g dry	0.13	<		0.11	<		0.16	<		0.14	<		0.88		
123478-hexachlorodioxin	P6D478	pg/g dry	0.11	<		0.1	<		0.13	<		0.081	<		0.23		
123678-hexachlorodioxin	P6D678	pg/g dry	0.12	<		0.11	<		0.14	<		0.083	<		0.65		
123789-hexachlorodioxin	P6D789	pg/g dry	0.12	<		0.11	<	DB5	0.14	<		0.085	<		0.51		DB5
1234678-heptachlorodioxin	P7D678	pg/g dry	0.39	<		0.23	<		0.12	<		0.22	<		1.9		
Octachlorodioxin	P98CDD	pg/g dry	1.5			0.77			0.37	<		0.66	<		5.5		
Sum Furans		pg/g dry	8			4						6			150		
Sum dioxins		pg/g dry	2			1						0			11		
Sum Dioxins + Furans		pg/g dry	10			5						6			160		
TEQ (WHO 2005) Mammals		pg TEQ/g dry	0.4			0.2						0.3			10		
TEQ (WHO) Fish		pg TEQ/g dry	**0.3**			**0.2**						**0.4**			**11**		
TEQ (WHO) Birds		pg TEQ/g dry	1.4			1.0						1.3			32		
TEQ (WHO) Fish (corrected for % Lipid)			68			14						32			916		

DB5: SAMPLES ANALYSED ON DB-5 COLUMN ONLY
SRL: RECOVERY LOWER THAN LOWER CONTROL LIMIT
< : ACTUAL RESULT IS LESS THAN THE REPORTED VALUE - a value of 0 was applied to calculate TEQs

Table D3. Dioxin and Furan concentrations, and percent lipid in caged mussels deployed in the Niagara River, 2015																	
Submission: C224871																	
Mussels			BLOODY RUN CREEK (US)			BLOODY RUN CREEK			BLOODY RUN CREEK			BLOODY RUN CREEK			BLOODY RUN CREEK		
			BRC (U/S)						BRC (7th_ 8th pole)			BRC (4th_5th pole) U/S stn 131			BRC D/S		
	Field ID		GL151236			GL151185			GL151189			GL151240			GL151181		
	Sample Number		C224870-0004			C224871-0097			C224871-0101			C224870-0008			C224871-0093		
	Station Number		1100020018			110020017			110020131			1100020132			110020025		
	Collection Date		31-JUL-2015			31-JUL-2015			31-JUL-2015			31-JUL-2015			31-JUL-2015		
Parameter Name	Test Code	Units															
Percent Lipid	LIPID	%	0.77			0.95			0.88			1.1			0.82		
2378-tetrachlorofuran	P4F378	pg/g dry	0.23	<		0.13	<		0.39	<		0.42	<		0.18	<	
12378-pentachlorofuran	P5F378	pg/g dry	0.079	<		0.1	<		0.1	<		0.14	<		0.13	<	
23478-pentachlorofuran	P5F478	pg/g dry	0.08	<		0.1	<		0.17	<		0.15	<		0.13	<	
123478-hexachlorofuran	P6F478	pg/g dry	0.051	<		0.1	<		0.39	<		0.53		DB5	0.2		
123678-hexachlorofuran	P6F678	pg/g dry	0.051	<		0.076	<		0.06	<		0.15	<		0.065	<	
123789-hexachlorofuran	P6F789	pg/g dry	0.05	<		0.078	<		0.04	<		0.11	<		0.071	<	
234678-hexachlorofuran	P6F234	pg/g dry	0.053	<		0.083	<		0.044	<		0.13	<		0.07	<	
1234678-heptachlorofuran	P7F678	pg/g dry	0.1	<		0.11	<		0.24	<		0.44			0.15	<	
1234789-heptachlorofuran	P7F789	pg/g dry	0.058	<		0.067	<		0.091	<		0.16	<		0.082	<	
Octachlorofuran	P98CDF	pg/g dry	0.1	<		0.22	<		0.64			1.5			0.34	<	
2378-tetrachlorodioxin	P4D378	pg/g dry	0.14	<		2.2			6.5			3.5			1		
12378-pentachlorodioxin	P5D378	pg/g dry	0.079	<		0.11	<		0.12	<		0.17	<		0.13	<	
123478-hexachlorodioxin	P6D478	pg/g dry	0.076	<		0.17	<		0.19	<		0.085	<		0.12	<	
123678-hexachlorodioxin	P6D678	pg/g dry	0.08	<		0.18	<		0.63			0.85			0.19	<	
123789-hexachlorodioxin	P6D789	pg/g dry	0.081	<		0.18	<		0.53			0.66		DB5	0.13	<	
1234678-heptachlorodioxin	P7D678	pg/g dry	0.12	<		0.42	<		2.9			4.2			0.42	<	
Octachlorodioxin	P98CDD	pg/g dry	0.3	<		0.46	<		2.3			3.8			0.63	<	
Sum Furans		pg/g dry				0			1			2			0		
Sum dioxins		pg/g dry				2			13			13			1		
Sum Dioxins + Furans		pg/g dry				2			14			15			1		
TEQ (WHO 2005) Mammals		pg TEQ/g dry				2			7			4			1		
TEQ (WHO) Fish		pg TEQ/g dry				**2**			**7**			**4**			**1**		
TEQ (WHO) Birds		pg TEQ/g dry				2			7			4			1		
TEQ (WHO) Fish (corrected for % Lipid)						232			740			325			124		
DB5: SAMPLES ANALYSED ON DB-5 COLUMN ONLY																	
SRL: RECOVERY LOWER THAN LOWER CONTROL LIMIT																	
< : ACTUAL RESULT IS LESS THAN THE REPORTED VALUE - a value of 0 was applied to calculate TEQs																	

Table D3. Dioxin and Furan concentrations, particle size and total organic carbon concentrations in sediment collected from the Niagara River, 2015

Submission: C222580																							
Sediment			**FISHERMANS PARK**			**FISHERMANS PARK**			**PETTIT FLUME**			**PETTIT FLUME**			**PETTIT FLUME**			**TWO MILE CK**			**TWO MILE CK**		
			U/S Inlet			**D/S Inlet**			**Upstream**			**Downstream**			**Outer Site**			**(NEAR HWY 290)**			**(NEAR SHERIDAN ROAD)**		
	Field ID		GL51193			GL51194			GL51195			GL51196			GL51197			GL51198			GL51199		
	Sample Number		C222580-0001			C222580-0002			C222580-0003			C222580-0004			C222580-0005			C222580-0006			C222580-0007		
	Station Number		**500020001**			**500020002**			**500020185**			**500020187**			**500020186**			**500150042**			**500150036**		
	Collection Date		28-JUL-2015			28-JUL-2015			28-JUL-2015			28-JUL-2015			28-JUL-2015			28-JUL-2015			28-JUL-2015		
Parameter Name	Test Code	Units																					
% <62 um, >2.63 um, sum	silt	%	35			35			10			45			50			64	<T		56		
% <1000 um, >62 um, sum	sand	%	57			58			66			43			39			0			26		
% <2.63 um, >0.10 um, sum	clay	%	8			7			3			13			11			36			18		
Carbon; total organic	TOC	mg/g dry	83			49			35			22			100			9.8			82		
2378-tetrachlorofuran	P4F378	pg/g dry	210		DB5	130		DB5	12	<		270			4000			1.6	<		26		
12378-pentachlorofuran	P5F378	pg/g dry	130			82			2.9			110			1200			0.38	<		6		
23478-pentachlorofuran	P5F478	pg/g dry	260			130			4.3			350			2900			0.58	<		14		
123478-hexachlorofuran	P6F478	pg/g dry	3800		DB5	1700		DB5	29		DB5	4000			43000			0.84	<		21		
123678-hexachlorofuran	P6F678	pg/g dry	590			310			6.7			520			6900			0.72	<		23	<	
123789-hexachlorofuran	P6F789	pg/g dry	5.1			4.1			0.24	<		3.6			49			0.14			0.64		
234678-hexachlorofuran	P6F234	pg/g dry	190			87			4.5			140		DB5	1800		DB5	0.77	<		33		DB5
1234678-heptachlorofuran	P7F678	pg/g dry	12000			5700			99			11000			100000			4.9	<		200		
1234789-heptachlorofuran	P7F789	pg/g dry	430			190			3			370		SRL	4500			0.34			11		
Octachlorofuran	P98CDF	pg/g dry	23000			8300			88			24000			260000			6.1			320		
2378-tetrachlorodioxin	P4D378	pg/g dry	77			19			0.77			13		DB5	220		DB5	0.16		DB5	1.6		DB5
12378-pentachlorodioxin	P5D378	pg/g dry	21			16			1.3			28			430			0.34	<		4.2		
123478-hexachlorodioxin	P6D478	pg/g dry	23			16			0.97			32			410			0.33			6.6		
123678-hexachlorodioxin	P6D678	pg/g dry	55			32			3.8			60		DB5	880		DB5	1.5		DB5	19		DB5
123789-hexachlorodioxin	P6D789	pg/g dry	37		DB5	25		DB5	3.2		DB5	45			590			1.3			20		
1234678-heptachlorodioxin	P7D678	pg/g dry	580			440			47			470			6100			21			410		
Octachlorodioxin	P98CDD	pg/g dry	3100			2900			370			1400		SRL	18000			180			3700		
Sum Furans		pg/g dry	40615			16633			244			40764			424349			11			644		
Sum dioxins		pg/g dry	3893			3448			427			2048			26630			204			4161		
Sum Dioxins + Furans		pg/g dry	44508			20081			671			42812			450979			216			4805		
TEQ (WHO 2005) Mammals		pg TEQ/g dry	810			370			11			780			8500			1			31		
TEQ (WHO) Fish		pg TEQ/g dry	840			390			10			840			8800			1			27		
TEQ (WHO) Birds		pg TEQ/g dry	1200			580			18			1300			14000			2			59		
TEQ (WHO) Fish (corrected for % TOC)			10,000			7,900			300			38,000			88,000			90			330		

DB5: SAMPLES ANALYSED ON DB-5 COLUMN ONLY

SRL: RECOVERY LOWER THAN LOWER CONTROL LIMIT

< : ACTUAL RESULT IS LESS THAN THE REPORTED VALUE - 1/2 detection limit was applied to calculate TEQs

Table D3. Dioxin and Furan concentrations, particle size and total organic carbon concentrations in sediment collected from the Niagara River, 2015

			U/S BLOODY RUN CREEK		BLOODY RUN CREEK		BLOODY RUN CREEK		BLOODY RUN CREEK		BLOODY RUN CREEK		BLOODY RUN CREEK	BLOODY RUN CREEK
Sediment			25 m upstream of Historical U/S Station		Upstream		Upstream		65M U/S of Stn. 132		25M U/S of stn. 132		BRC (4th_5th pole) U/S of stn 131	BRC (4th_5th pole) U/S stn 131
					Historical Stn		Historical Stn		27 m D/S of station 18's big flat rock					
	Field ID		GL151084		GL151082		GL151082		GL151203		GL151202		GL151081	GL151081
	Sample Number		C224881-0004		C224881-0002		C224881-0002		C224882-0003		C224882-0002		C224881-0001	C224881-0001
	Station Number		1100020026		1100020018		1100020018		1100020027		1100020028		1100020132	1100020132
	Collection Date		10-Jul-15		05-Aug-83		05-Aug-83		31-JUL-2015		31-JUL-2015		10-Jul-15	10-Jul-15
			screening method		screening method		routine method		routine method		routine method		screening method	routine method
	Test Code	Units												
% <62 um, >2.63 um, sum	Silt	%	70		70				68		69		65	
% <1000 um, >62 um, sum	Sand	%	7		2				9		10		17	
% <2.63 um, >0.10 um, sum	Clay	%	23		28				23		21		18	
Carbon; total organic	TOC	mg/g dry	22		21				15		14		24	
2378-tetrachlorofuran	P4F378	pg/g dry	2.7		3		6.7	< <	2.8	DB5	52	DB5	170	360
12378-pentachlorofuran	P5F378	pg/g dry	0.58		0.79		1.1		0.54		13		77	150
23478-pentachlorofuran	P5F478	pg/g dry	1.5		2.3		3.4		1.5		49		180	470
123478-hexachlorofuran	P6F478	pg/g dry	9.2		12		21		7.8	DB5	460	DB5	1100	3100
123678-hexachlorofuran	P6F678	pg/g dry	1.4		2.3		3.7		1.2		71		340	610
123789-hexachlorofuran	P6F789	pg/g dry	0.41	< <	0.51	< <	0.24	< <	0.39	<	1.9		8.3	13
234678-hexachlorofuran	P6F234	pg/g dry	0.77		0.95		0.97		0.56		16		70	150
1234678-heptachlorofuran	P7F678	pg/g dry	14		13		21		4.4		240		770	3200
1234789-heptachlorofuran	P7F789	pg/g dry	2.3		2.3		5.1		1.2		59		180	510
Octachlorofuran	P98CDF	pg/g dry	39		28		92		12		1100		5000	8400
2378-tetrachlorodioxin	P4D378	pg/g dry	14		52		80		39		1400		3500	9700
12378-pentachlorodioxin	P5D378	pg/g dry	0.51	< <	2.1		1.1		1	<	18		63	160
123478-hexachlorodioxin	P6D478	pg/g dry	0.97		1.3		2.3		1.1		47		240	590
123678-hexachlorodioxin	P6D678	pg/g dry	8.9		16		32		1.1		890		3200	8100
123789-hexachlorodioxin	P6D789	pg/g dry	4.6		8.6		16		0.61	DB5	430	DB5	1500	4600
1234678-heptachlorodioxin	P7D678	pg/g dry	39		79		180		60		4200		15000	33000
Octachlorodioxin	P98CDD	pg/g dry	45		85		140		59		3100		12000	28000
Sum Furans		pg/g dry	72		65		155		32		2062		7895	16963
Sum dioxins		pg/g dry	113		244		451		162		10085		35503	84150
Sum Dioxins + Furans		pg/g dry	185		309		607		194		12147		43398	101113
TEQ (WHO 2005) Mammals		pg TEQ/g dr	18		60		92		42		1700		4400	12000
TEQ (WHO) Fish		pg TEQ/g dr	17		58		88		42		1500		4000	11000
TEQ (WHO) Birds		pg TEQ/g dr	20		62		93		45		1600		4300	12000
TEQ (WHO) Fish (corrected for % TOC)			779		2768		4175		2805		107143		166667	458333

< : ACTUAL RESULT IS LESS THAN THE REPORTED VALUE - 1/2 detection limit was applied to calculate TEQs

Table D3. Dioxin and Furan concentrations, particle size and total organic carbon concentrations in sediment collected from the Niagara River, 2015

Sediment			BLOODY RUN CREEK Btwn stn 132 and stn 17	BLOODY RUN CREEK (on shore 10m E of Stn 0017)	BLOODY RUN CREEK 18 m U/S of station 25			BLOODY RUN CREEK (Downstream)		
	Field ID		GL151083	GL151085	GL151204			GL151201		
	Sample Number		C224881-0003	C224881-0005	C224882-0004			C224882-0001		
	Station Number		1100020030	1100020029	1100020031			1100020025		
	Collection Date		10-Jul-15	10-Jul-15	31-JUL-2015			31-JUL-2015		
			screening method	screening method	routine method			routine method		
	Test Code	Units								
% <62 um, >2.63 um, sum	Silt	%	70	65	63			62		
% <1000 um, >62 um, sum	Sand	%	5	13	0			18		
% <2.63 um, >0.10 um, sum	Clay	%	25	22	37			20		
Carbon; total organic	TOC	mg/g dry	21	20	7.8			12		
2378-tetrachlorofuran	P4F378	pg/g dry	320	46	14		DB5	6.4		DB5
12378-pentachlorofuran	P5F378	pg/g dry	65	19	1.3			1.6		
23478-pentachlorofuran	P5F478	pg/g dry	300	60	6.3			4.4		
123478-hexachlorofuran	P6F478	pg/g dry	2200	560	31		DB5	38		DB5
123678-hexachlorofuran	P6F678	pg/g dry	510	75	4.5			5.5		
123789-hexachlorofuran	P6F789	pg/g dry	12	2	0.42	<		0.23	<	
234678-hexachlorofuran	P6F234	pg/g dry	160	12	1.9			1.6		
1234678-heptachlorofuran	P7F678	pg/g dry	2700	270	27			23		
1234789-heptachlorofuran	P7F789	pg/g dry	400	64	4.1			5		
Octachlorofuran	P98CDF	pg/g dry	15000	490	65			52		
2378-tetrachlorodioxin	P4D378	pg/g dry	2900	1600	150			130		
12378-pentachlorodioxin	P5D378	pg/g dry	110	15	2.7			2.3		
123478-hexachlorodioxin	P6D478	pg/g dry	380	53	3.2			3.7		
123678-hexachlorodioxin	P6D678	pg/g dry	4900	1100	42			70		
123789-hexachlorodioxin	P6D789	pg/g dry	2400	550	18		DB5	33		DB5
1234678-heptachlorodioxin	P7D678	pg/g dry	23000	5500	160			400		
Octachlorodioxin	P98CDD	pg/g dry	19000	4000	100			280		
Sum Furans		pg/g dry	21667	1598	156			138		
Sum dioxins		pg/g dry	52690	12818	476			919		
Sum Dioxins + Furans		pg/g dry	74357	14416	631			1057		
TEQ (WHO 2005) Mammals		pg TEQ/g dry	4500	1900	170			150		
TEQ (WHO) Fish		pg TEQ/g dry	**3800**	**1800**	**160**			**140**		
TEQ (WHO) Birds		pg TEQ/g dry	4300	1900	180			150		
TEQ (WHO) Fish (corrected for % TOC)			180952	90000	20000			11667		

< : ACTUAL RESULT IS LESS THAN THE REPORTED VALUE - 1/2 detection limit was applied to calculate TEQs

Appendix E. Total TEQ pg/g* and TEQ for Dioxin-Like (DL) PCBs(pg/g)** in caged mussels (wet wt.) and sediment (dry wt.) collected from the Niagara River (1987-2015).

NR-Niagara River; ND-below the detection limit

STATION	YEAR	Mussels Total TEQ	Mussels DL-PCB TEQ	Sediment Total TEQ	Sediment DL-PCB TEQ	TOC (mg/g)
Canadian Sites						
NR - Fort Erie	1995	ND		0.9		
	1997			10		20
	2000	0.01	0.01	2	0.01	9
NR - Chippawa Channel	2000	ND	ND	0.01	0.01	5
Niagara-on-the-Lake	1993	ND		13		
	1995	ND		14		
	1997	ND				
	2000	0.01	0.01			
	2003			8	0.05	7
American Sites						
Tonawanda Channel (U/S Two Mile Ck.)	2009	0.01				
Scajaquada Creek	2009	0.03		13		45
Rattlesnake Creek	2009	0.11		13		30
Two Mile Creek	2000			30	3.3	39
	2003			52	1.4	65
Two Mile Creek (near HWY 290)	**2015**			**1**		**10**
Two Mile Creek (near Sheridan Rd.)	**2015**			**27**		**82**
Exalon (upstream) in Erie Canal	2003	0.04	0.04	77	0.2	33
NR - Gratwick /Riverside Park	1991	15				
NR - Wheatfield	1987	ND				
Little Niagara River (downstream 102nd St.)	2006	16		300	2.1	43
Cayuga Creek	1995	18		18		
	2003	0.16	0.05	59	0.3	82
Little Niagara River (downstream Cayuga Ck.)	2006	8		140	0.6	110
Occidental Sewer 003	1991	ND				
Gill Creek (upstream in Creek)	2000			71	0.8	14
	2003	0.44	0.08	88	1.0	17
	2006	1		28	0.3	8
NR - 102nd Street	1991	70				
	1993	96		230		
	1995	130		500		
	1997	1		ND		ND
Pettit Flume (upstream)	1991	5				
	1993	ND		26		
	2000	ND	0.05	13	0.3	23
	2003	ND	ND	37	0.3	34
	2006	0.03		15		
	2009	0.010		21		44
	2012	0.10				
	2015	**ND**		**10**		**35**
Pettit Flume Cove (site A)	1991	960				
	1993	200		48000		
Pettit Flume Cove (site B)	1997	46		20000		110
	2000	74	ND	30000	2.6	120
	2003	60	0.05	11000	1.4	120
	2006	190		15000		
	2009	46		3800		71
	2012	4		25500		83
	2015	**11**		**8800**		**100**
Pettit Flume (downstream)	2000	3	0.03	490	0.2	33
	2003	0.36	0.01	2000	0.3	20
	2006	5		680		
	2009	1		7200		47
	2012	8		380		26
	2015	**0.4**		**840**		**22**
Fisherman's Park (upstream inlet)	2012	3		330		37
	2015	**0.3**		**840**		**83**
Fisherman's Park (downstream inlet)	2012	0.4		210		41
	2015	**0.2**		**390**		**49**
NR - upstream of Bloody Run Creek	2000	ND	ND	43	0.3	5
	2003			180	0.4	5
	2004	0.01	0.01			
	2006	2		36		12
	2009	ND		44		9
	2012			346		10
	2015	**ND**		**88**		**21**
NR- Bloody Run Creek (BRC)	1993	270		120000		
	1994	56				
	1995	120		61000		
	1997	84		52000		29
	2000	23	0.04	3300		7
	2003			110000	6.2	22
	2004	46	0.06			
	2006	45		4200		14
	2009	18		48000		16
	2012	9		4000		5
	2015	**7**		**11000**		**24**
Bloody Run Creek (downstream)	2004	9	0.02			
	2006	6		220		7
	2009	6		2200		22
	2012	1				
	2015	**1**		**150**		**12**

*Dioxin, furan and dioxin-like PCB concentrations were multiplied by the WHO Toxicity *Equivalency Factors (TEF) for protection of fish to express their respective toxicity* on a common basis and then summed to yield a total toxic equivalent (TEQ).

** Analysis for dioxin-like PCBs was not available prior to 2000

Appendix F1-F4: SPMD Data

AXYS Data Qualifiers

U or ND = not detected above the reporting limit

K or NDR = peak detected, but did not meet quantification criteria, result reported represents the estimated maximum possible concentration.

This flag indicates that for one of several reasons (low level interferences, poor peak shape, etc) the peak for this compound was detected but did not meet all the criteria required by the method, please treat the value as an estimated maximum.

D = Dilution data. Either due to matrix interferences of analyte levels out of linear range of the instrument. Extract was diluted and instrumentally re-analyzed.

J = Concentration was found to be below the linear range of the instrument, the value should be considered to be estimated

V = Surrogate recovery is not within method/contract control limits

NQ = Data not quantifiable

E = Exceeds calibrated linear range, see dilution data

X = results reported separately (original report and separate reports)

H = concentration is estimated (information only value)

T = Data recalculated using an alternate surrogate

C = compound co-elutes with at least one other compound, the result is only reported once for each coelution

MAX = Concentration should be considered to be an estimated maximum

Q = Maximum concentration, single GC column result, not confirmed by second column

Appendix F1: SPMD data for Lab Blank and Spiked Matrix - concentrations represent ng/SPMD unless noted otherwise

CLIENT_ID		Lab Blank (101)			Lab Blank (101)			Lab Blank (101)			Lab Blank (101)			Lab Blank (101)			Lab Blank (101)	
Axys ID		WG53086-101 i			WG52369-101 i			WG52371-101 i			WG52400-101			WG52449-101			WG52450-101 i	
WORKGROUP		WG53086			WG52369			WG52371			WG52400			WG52449			WG52450	
Sample Size		1sample			1sample			1sample			1sample			1sample			1sample	
UNITS	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
1,3-Dichlorobenzene	ND H		3.93	J	2.71	0.86		3.26	0.74	NQ			J	2.22	1.06	NDR J	1.29	1.01
1,4-Dichlorobenzene	H	8.08	4.01		16.2	0.925		13.4	0.755	NQ				10.9	1.05		9.52	1.03
1,2-Dichlorobenzene	ND H		3.77	J	2.84	0.905	NDR J	2.04	0.748	NQ			NDR J	1.16	0.887	J	1.82	1.02
1,3,5-Trichlorobenzene	ND		1.79	ND		0.614	ND		0.67	ND		0.827	ND		0.483	ND		0.708
1,2,4-Trichlorobenzene	ND		1.86	ND		0.628	ND		0.712	ND		0.842	ND		0.491	ND		0.753
1,2,3-Trichlorobenzene	ND		1.92	NDR J	2.11	0.638	NDR J	0.872	0.731	ND		0.846	ND		0.494	ND		0.773
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ND		0.599	ND		0.177	ND		0.153	ND		0.267	ND		0.177	ND		0.182
1,2,3,4-Tetrachlorobenzene	ND		0.611	ND		0.18	ND		0.155	ND		0.272	ND		0.18	ND		0.185
Hexachlorobutadiene	ND		0.611	ND		0.18	NDR J	0.596	0.155	NDR J	0.324	0.272	ND		0.18	ND		0.185
Pentachlorobenzene	ND		0.858	ND		0.231	ND		0.327	ND		0.506	ND		0.208	ND		0.643
Hexachlorobenzene	NDR J	0.5	0.435	J	0.425	0.2	J	0.426	0.359	J	0.472	0.141	J	0.484	0.143	J	0.514	0.338
HCH, alpha	ND		1.02	ND		0.612	ND		0.678	ND		0.822	ND		0.807	ND		0.967
HCH, beta	ND		1.71	ND		0.617	ND		1.31	ND		1.26	ND		0.867	ND		1.19
HCH, gamma	ND		1.29	ND		0.807	ND		0.904	ND		0.928	ND		0.728	ND		1.14
Heptachlor	ND		0.672	ND		0.796	ND		1.18	ND		0.757	ND		0.42	ND		1.41
Aldrin	ND		0.624	ND		0.414	ND		0.672	ND		0.587	ND		0.477	ND		0.793
Chlordane, gamma (trans)	ND		0.284	ND		0.159	ND		0.345	ND		0.174	ND		0.153	ND		0.337
Chlordane, alpha (cis)	ND		0.332	ND		0.189	ND		0.411	ND		0.209	ND		0.183	ND		0.401
Octachlorostyrene	ND		0.348	ND		0.147	ND		0.264	ND		0.251	ND		0.215	ND		0.446
Chlordane, oxy-	ND		1.28	ND		1.4	ND		1.1	ND		1.72	ND		1.21	ND		1.24
Nonachlor, trans-	ND		0.125	ND		0.154	ND		0.142	ND		0.108	ND		0.107	ND		0.117
Nonachlor, cis-	ND		0.146	ND		0.175	ND		0.165	ND		0.128	ND		0.126	ND		0.136
Mirex	ND		0.369	ND		0.302	ND		0.15	ND		0.164	ND		0.204	ND		0.211
2,4'-DDE	ND		0.106	ND		0.103	ND		0.11	ND		0.0848	ND		0.0853	ND		0.129
4,4'-DDE	ND		0.148	NDR J	0.19	0.144	NDR J	0.224	0.153	NDR J	0.202	0.119	NDR J	0.171	0.119	ND		0.18
2,4'-DDD	ND		0.145	ND		0.17	ND		0.144	ND		0.13	ND		0.135	ND		0.122
4,4'-DDD	ND		0.195	ND		0.178	ND		0.184	ND		0.146	ND		0.145	ND		0.181
2,4'-DDT	ND		0.19	ND		0.183	ND		0.176	ND		0.129	ND		0.128	ND		0.172
4,4'-DDT	ND		0.221	ND		0.213	ND		0.214	ND		0.157	ND		0.156	ND		0.21
13C-1,4-Dichlorobenzene (% Recovery)	H	4.08			19.3			10.2		NQ				10.2			10.3	
13C-1,2,3-Trichlorobenzene (% Recovery)		6.15			44.8			24.7			11			20.3			22.1	
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		11.8			51.1			33.4			19			28.8			29.2	
13C-Pentachlorobenzene (% Recovery)	V	20.3			52.5			38.8		V	27.8			37.3			31.6	
13C-Hexachlorobenzene (% Recovery)		38.4			58.6			52.8			47.8			52			39	
13C-beta-HCH (% Recovery)		52.5			63.1			50.9			51.4			51.9			42.8	
13C-gamma-HCH (% Recovery)		57.7			67.9			59.8			60.6			66.1			43	
13C-Heptachlor (% Recovery)		63.6			57.4			73.9			64.4			62.6			42.1	
13C-Aldrin (% Recovery)		65.4			67.1			67.7			68.4			69.7			45.7	
13C-Chlordane, gamma (trans) (% Recovery)		84.9			76.7			82.4			86.9			86.3			70.3	
13C-Nonachlor, trans- (% Recovery)		85.1			74			85			85.3			85			68.5	
13C-4,4'-DDE (% Recovery)		95.3			80.5			83.1			93.5			94.7			81.1	
13C-4,4'-DDT (% Recovery)		88.3			78.9			83			93.5			92.7			75.3	
13C-4,4'-DDD (ng/sample)																		

CLIENT_ID		Lab Blank DB17			Spiked Matrix DB17			Lab Blank DB5			Spiked Matrix DB5			Spiked Matrix DB5			Lab Blank DB5	
Axys ID		WG53086-101 i			WG53086-102 i			WG52369-101			WG52369-102			WG52371-102			WG52400-101	
WORKGROUP		WG53086			WG53086			WG52369			WG52369			WG52371			WG52400	
Sample Size		1sample						1sample								1sample		
UNITS	flag	ng/sample	ng/sample (RL)	flag	% Recovery	-		flag	ng/sample	flag	% Recovery	-	flag	% Recovery	-	flag	ng/sample	ng/sample (RL)
HCH, delta	ND		0.15		69.5			ND			102			106		ND		0.076
Heptachlor Epoxide	ND		0.0893		79.2			ND			90.8			94.5		ND		0.0751
Dieldrin	ND		0.127		128			ND			113			112		ND		0.157
Endrin	ND		0.131		126			ND			115			114		ND		0.161
Endrin Aldehyde	ND		0.171		77			ND			89.7			84		ND		0.254
Endrin Ketone	ND		0.0629		89			ND			98.9			119		ND		0.108
Methoxychlor	ND		0.137		89.4			ND			88.4			115		ND		0.236
alpha-Endosulphan	J	0.12	0.105		110			ND			93.7			92.3		ND		0.146
beta-Endosulphan	ND		0.124		110			ND			102			90.4		ND		0.154
Endosulphan Sulphate	ND		0.151		86.3			ND			94.1			111		ND		0.199
D4-alpha-Endosulphan (% Recovery) DB5									99.1		101			87.1			82.8	
D4-beta-Endosulphan (% Recovery) DB5									79.6		87.6			80.6			76.8	
D4-alpha-Endosulphan (% Recovery) DB17		89.6			106													
D4-beta-Endosulphan (% Recovery) DB17		88.4			67.7													

CLIENT_ID		Spiked Matrix DB5			Lab Blank DB17			Lab Blank DB17			Lab Blank DB5			Lab Blank DB17			Lab Blank DB5	
Axys ID		WG52400-102			WG52369-101			WG52371-101			WG52371-101			WG52449-101			WG52449-101	
WORKGROUP		WG52400			WG52369			WG52371			WG52371			WG52449			WG52449	
Sample Size					1sample			1sample			1sample			1sample			1sample	
UNITS	flag	% Recovery	-	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)	flag	ng/sample	ng/sample (RL)
HCH, delta		105		ND		0.0659	ND		0.097	ND		0.172	ND		0.098	ND		0.132
Heptachlor Epoxide		93.4		ND		0.0555	ND		0.135	ND		0.0203	ND		0.149	ND		0.0762
Dieldrin		109		ND		0.0656	ND		0.0385	ND		0.132	ND		0.213	ND		0.254
Endrin		109		ND		0.0854	ND		0.0397	ND		0.134	ND		0.219	ND		0.259
Endrin Aldehyde		72.6		ND		0.0289	ND		0.0517	ND		0.212	ND		0.286	ND		0.41
Endrin Ketone		88.4		ND		0.0134	ND		0.0451	ND		0.0358	ND		0.0247	ND		0.0295
Methoxychlor		84.3		ND		0.0291	ND		0.098	ND		0.078	ND		0.0537	ND		0.0644
alpha-Endosulphan		90.7		ND		0.102	ND		0.0263	ND		0.0955	ND		0.193	ND		0.231
beta-Endosulphan		91.2		ND		0.0546	ND		0.0376	ND		0.129	ND		0.208	ND		0.249
Endosulphan Sulphate		85.6		ND		0.0629	ND		0.0456	ND		0.166	ND		0.252	ND		0.321
D4-alpha-Endosulphan (% Recovery) DB5		97.5									83.3						88.1	
D4-beta-Endosulphan (% Recovery) DB5		89									69						90	

Appendix F1: SPMD data for Lab Blank and Spiked Matrix - concentrations represent ng/SPMD unless noted otherwise

CLIENT_ID		Spiked Matrix (102)			Spiked Matrix (102)			Spiked Matrix (102)			Spiked Matrix (102)			Spiked Matrix (102)			Spiked Matrix (102)	
Axys ID		WG53086-102 i			WG52369-102 i2			WG52371-102 i			WG52400-102 i			WG52449-102			WG52450-102 i	
WORKGROUP		WG53086			WG52369			WG52371			WG52400			WG52449			WG52450	
Sample Size																		
UNITS	flag	% Recovery	-	flag	% Recovery	-	flag	% Recovery	-	flag	% Recovery	-	flag	% Recovery	-	flag	% Recovery	-
1,3-Dichlorobenzene		97.3			113			73.3			97.1			111			130	
1,4-Dichlorobenzene		113			114			81			109			108			105	
1,2-Dichlorobenzene		83.1			91.7			60.9			90.4			110			121	
1,3,5-Trichlorobenzene		99.3			86.9			67.5			87.8			78.7			97.9	
1,2,4-Trichlorobenzene		98.3			92.9			79.6			95			89			104	
1,2,3-Trichlorobenzene		114			96.6			90.7			99.9			93.7			110	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		93			99			99.3			95.5			91.5			96.1	
1,2,3,4-Tetrachlorobenzene		101			101			105			96.8			98.9			99.6	
Hexachlorobutadiene																		
Pentachlorobenzene		99.9			100			103			99			99.5			99.8	
Hexachlorobenzene		94.2			95.1			94.2			91.8			92.6			92.4	
HCH, alpha		79.5			86.4			82.4			82.7			81.7			85.1	
HCH, beta		99.2			101			101			99.4			97			99.8	
HCH, gamma		93.7			98.8			93.3			97.5			91.7			101	
Heptachlor		97.9			89.7			90.2			95.4			94			87.6	
Aldrin		98.1			94.9			103			98.2			97.7			98.6	
Chlordane, gamma (trans)		99.7			98.5			104			98			96.9			99.3	
Chlordane, alpha (cis)		99.5			99.7			108			100			102			103	
Octachlorostyrene		94			92.3			98			91.2			89			92	
Chlordane, oxy-		95.5			104			90.3			91.8			91.7			85.4	
Nonachlor, trans-		97.4			98.6			103			98.6			97.3			99.6	
Nonachlor, cis-		107			103			113			115			108			116	
Mirex		114			95.3			106			103			100			99.8	
2,4'-DDE		93.9			99.6			96.6			90.9			94.3			94.2	
4,4'-DDE		93.7			96.9			94.3			93.8			93.9			93	
2,4'-DDD		91.1			98.9			98.9			95			94.8			95.3	
4,4'-DDD		96.7			103			106			102			99.9			96.8	
2,4'-DDT		94.2			102			103			90.8			93.3			97.8	
4,4'-DDT		96.6			97.5			104			98.4			97.4			97.2	
13C-1,4-Dichlorobenzene (% Recovery)		5.33			11.8			2.87			9.1			5.61			7.54	
13C-1,2,3-Trichlorobenzene (% Recovery)		10.5			33.2			9.47			16.9			13.7			15.1	
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		16.5			39.4			16.2			22.6			23.1			20	
13C-Pentachlorobenzene (% Recovery)	V	25.7			46.1			31.9		V	26.6			33		V	25.9	
13C-Hexachlorobenzene (% Recovery)		42.2			59.3			56.8			39.8			46.4			41	
13C-beta-HCH (% Recovery)		47.3			69.6			53.4			45.5			58.3			50.2	
13C-gamma-HCH (% Recovery)		55.8			72.4			62.6			51.7			64.2			48.5	
13C-Heptachlor (% Recovery)		60.6			63.6			74.1			53.7			54.6			48.6	
13C-Aldrin (% Recovery)		63.1			77			71.5			59.1			62.3			54.2	
13C-Chlordane, gamma (trans) (% Recovery)		82.4			83.5			84.2			80			80.3			75.5	
13C-Nonachlor, trans- (% Recovery)		83.9			83.3			88.8			81.7			81.6			77.2	
13C-4,4'-DDE (% Recovery)		91.2			90.1			85.8			91.5			89.6			84.2	
13C-4,4'-DDT (% Recovery)		86.3			93.1			85.7			98.9			88.8			81.2	
13C-4,4'-DDD (ng/sample)																		

CLIENT_ID		Lab Blank DB5			Spiked Matrix DB5				Spiked Matrix DB17			Spiked Matrix DB17			Lab Blank DB17			Spiked Matrix DB17	
Axys ID		WG53086-101 i			WG53086-102 i				WG52369-102			WG52371-102			WG52400-101			WG52400-102	
WORKGROUP		WG53086			WG53086				WG52369			WG52371			WG52400			WG52400	
Sample Size		1sample													1sample				
UNITS	flag	ng/sample	ng/sample (RL)	flag	% Recovery	-	ng/sample (RL)	flag	% Recovery	-	flag	% Recovery	-	flag	ng/sample	ng/sample (RL)	flag	% Recovery	-
HCH, delta	J	0.92	0.2		88.9		0.0786		99.7			105		ND		0.219		100	
Heptachlor Epoxide	ND		0.0596		93.1		0.0226		92.8			97.3		ND		0.128		96.9	
Dieldrin	ND		0.141		103		0.0998		121			122		ND		0.0998		120	
Endrin	ND		0.144		105		0.0465		117			119		ND		0.103		117	
Endrin Aldehyde	ND		0.228		66.5		0.0634		88.7			99.8		ND		0.134		75.6	
Endrin Ketone	ND		0.059		89.6		0.0304		99.7			121		ND		0.0581		88.3	
Methoxychlor	ND		0.129		92.2		0.0662		88.2			116		ND		0.126		85.2	
alpha-Endosulphan	ND		0.123		93.6		0.0859		97.7			96		ND		0.0847		111	
beta-Endosulphan	ND		0.138		94.5		0.107		111			98		ND		0.0975		97.8	
Endosulphan Sulphate	ND		0.178		81.6		0.0496		105			120		ND		0.141		93.5	
D4-alpha-Endosulphan (% Recovery) DB5		94			98.2														
D4-beta-Endosulphan (% Recovery) DB5		92.4			86.9														
D4-alpha-Endosulphan (% Recovery) DB17									101			85.5			83.1			98.5	
D4-beta-Endosulphan (% Recovery) DB17									85.4			75.3			80.7			83.5	

CLIENT_ID		Spiked Matrix DB17			Spiked Matrix DB5			Lab Blank DB17		Lab Blank DB5		Spiked Matrix DB17			Spiked Matrix DB5	
Axys ID		WG52449-102			WG52449-102			WG52450-101		WG52450-101		WG52450-102			WG52450-102	
WORKGROUP		WG52449			WG52449			WG52450		WG52450		WG52450			WG52450	
Sample Size								1sample		1sample						
UNITS	flag	% Recovery	-	flag	% Recovery	-	flag	ng/sample	ng/sample (RL	g/sam	ng/sample (RL	Reco	-	flag	Reco	-
HCH, delta		87.9			104		ND		0.152	D	0.319	92			104	
Heptachlor Epoxide		87.5			89.7		ND		0.21	D	0.0788	90			89	
Dieldrin		110			102		ND		0.137	D	0.157	100			94	
Endrin		107			105		ND		0.141	D	0.16	95			91	
Endrin Aldehyde		79.6			72.8		ND		0.184	D	0.254	71			61	
Endrin Ketone		110			104		ND		0.0236	D	0.0339	104			103	
Methoxychlor		119			105		ND		0.0513	D	0.0739	96			97	
alpha-Endosulphan		96.1			91		ND		0.203	D	0.223	98			94	
beta-Endosulphan		99.8			92.9		ND		0.134	D	0.154	99			91	
Endosulphan Sulphate		106			95.7		ND		0.162	D	0.199	103			92	
D4-alpha-Endosulphan (% Recovery) DB5					75					71					87	
D4-beta-Endosulphan (% Recovery) DB5					75					94					98	
D4-alpha-Endosulphan (% Recovery) DB17		74.5						67.3				82				
D4-beta-Endosulphan (% Recovery) DB17		71.1						90.3				90				

Appendix F2: SPMD data for American deployments - concentrations represent ng/SPMD

Gratwick Riverside Park (GRP)

Little Niagara River (LNR)

Niagara-on-the-Lake (NOTL)

CLIENT_ID	GRP		Bloody Run Ck		Ushers Ck		Two Mile Ck		Two Mile Ck		Two Mile Ck		Pettit Flume		Pettit Flume		Pettit Flume		Pettit Flume		Pettit Flume		Pettit Flume	
	(Middle of Park) Field Blank		Field Blank		Field Blank		(Mouth)-1		(Mouth)-2		(Mouth)-3		(D/S)-1		(D/S)-2		(D/S)-3		(Outer Site B)-1		(Outer Site B)-2		(Outer Site B)-3	
Axys ID	L23776-1 i		L23776-2 i		L23776-4 i		L23776-5 L		L23776-6 L		L23776-7 L		L23776-8 i		L23776-9 L		L23776-10 L		L23776-11 L		L23776-12 L		L23776-13 L	
WORKGROUP	WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369	
Sample Size	1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample	
UNITS	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene	J	2.62	J	2.38	J	1.8	J	2.84	J	1.79	J	1.94		6.71		4.79		4.71		311		373	NQ	
1,4-Dichlorobenzene		14.4		12.2		11		21.6		18		17.6		24		32.3		32.1		608		848	NQ	
1,2-Dichlorobenzene		3.22	J	2.84	J	1.71	J	2.47	J	2.48	J	2.66	J	2.87		4.46		4.67		150		199	NQ	
1,3,5-Trichlorobenzene	ND		ND		ND		J	2.57	J	1.73	J	1.96		6.61		6.51		6.76		336		326		378
1,2,4-Trichlorobenzene	ND		ND		NDR J	0.651		10.4		7.55		8.06		15.6		14.4		17		1400		1250		1560
1,2,3-Trichlorobenzene	ND		NDR J	2.11	ND			3.61	J	2.34	J	2.82		6.43		6.56		7.57		880		762		968
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ND		ND		ND		J	3.45	J	3.1	J	3.03		16.1		16.4		17.1		897		980		965
1,2,3,4-Tetrachlorobenzene	J	0.24	ND		ND			3.33		3.02		3.3		19.9		20		21.4	D	1440	D	1530	D	1630
Hexachlorobutadiene	ND		ND		ND		J	1.61	NDR J	1.09	J	0.992	J	0.391	NDR J	0.404	J	0.352		10.5		13.7		10.4
Pentachlorobenzene	ND		J	0.554	ND			12		11.3		11.6		28.2		27.6		29.7	D	1160	D	1230	D	1150
Hexachlorobenzene	J	0.606	J	0.866	J	0.556		25.5		24.1		26.2		29.1		27.2		29.2	D	542	D	558	D	527
HCH, alpha	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, beta	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, gamma	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Heptachlor	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Aldrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chlordane, gamma (trans)	ND		ND		ND			14.8		14.8		15.9	J	2.6	J	2.69	J	2.74		13.5		14.5		14.2
Chlordane, alpha (cis)	ND		ND		ND			23.9		24		26.2	J	3.4	J	3.84	J	3.99		23		22.9		23
Octachlorostyrene	ND		ND		ND		ND		J	0.416	ND		ND		ND		ND		J	1.57	J	1.6	J	1.39
Chlordane, oxy-	NDR	24.8	NDR	20.6	NDR	21.6	NDR	23.1	NDR	22	NDR	22.6	NDR	19.3	NDR	15.3	NDR	20.9	NDR	28.8	NDR	26.3	NDR	29.7
Nonachlor, trans-	ND		ND		ND			9.64		9.76		10.2	J	1.88	J	1.84	J	2.31		8.42		8.39		8.14
Nonachlor, cis-	ND		ND		ND		J	2.57	J	2.56	J	2.82	J	0.624	J	0.58	J	0.669	J	2.3	J	2.11	J	2.21
Mirex	ND		ND		ND		NDR	18.1	NDR	8.26		10.7	ND		ND		ND		ND		ND		NDR	10.5
2,4'-DDE (o,p' DDE)	ND		ND		ND		ND		J	2.01	NDR J	2.4	NDR J	1.44	NDR J	0.846	ND		NDR J	2.22	NDR J	2.41	NDR J	2.63
4,4'-DDE (p,p' DDE)	ND		ND		ND			14.9		15.5		14.7		5.75		4.79		5.48		14.3		14.8		15.2
2,4'-DDD (o,p' DDD)	ND		ND		ND			11.3		10.3		10.6	J	1.26	J	1.67	J	1.43		12		11.3		11.5
4,4'-DDD (p,p' DDD)	ND		ND		ND			39.9		38.5		39.8		6.16		5.93		6.19		53.7		50.2		48.7
2,4'-DDT (o,p' DDT)	ND		ND		ND		NDR	5.74	NDR	5.63	NDR	6.15	NDR J	3.25	NDR J	2.31	NDR J	2.68	NDR	3.9	NDR	6.36	ND	
4,4'-DDT (p,p' DDT)	ND		ND		ND			7.03		5.89		7.97	ND		ND		ND		ND			4.15		5.2
HCH, delta	J Q	0.182	J Q	0.158	J Q	0.207	J Q	0.4	ND		J Q	0.659	ND		J Q	0.294	J Q	0.305	ND		ND		J	0.615
Heptachlor Epoxide	ND		ND		ND			9.17	Q	9.35	Q	9.68	Q	3.47		3.25	Q	3.47	Q	3.89	Q	4.84	Q	4.05
Dieldrin	ND		J Q	0.053	J Q	0.036		29.6		27.6		30.6	Q	6.18		5.51		5.48		10.5		9.88		10.7
Endrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Ketone	ND		ND		J Q	0.066	ND		ND		ND		J	2	ND		ND		ND		ND		ND	
Methoxychlor	ND		ND		ND		ND			7.4	Q	3.76	ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		J Q	1.02	ND		ND		ND		ND		ND		ND		ND	
beta-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endosulphan Sulphate	ND		ND		ND		ND		ND		J Q	1.17	ND		ND		ND		J Q	1.73	J Q	1.56	ND	
13C-1,4-Dichlorobenzene (% Recovery)		8.3		9.08		26.5		10.3		10.9		5.06		8.8		5.78		5.01		5.84		9.57	NQ	
13C-1,2,3-Trichlorobenzene (% Recovery)		20.4		22.1		58.4		31.9		32.4		21.7		23.1		20.9		18.5		20.5		32.7		18.4
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		29.1		30.1		64.9		38.3		43.6		36.7		33.6		26.4		28	NDR	35	NDR	35.4	NDR	33.4
13C-Pentachlorobenzene (% Recovery)		41.4		38.2		69.5		55.2		64.7		59.6		49.3		39.8		42.8	NDR	101	NDR	89	NDR	92.9
13C-Hexachlorobenzene (% Recovery)		61.3		59.1		77.3		80		84.1		83.4		69.9		66.7		68.1		96		87		90
13C-beta-HCH (% Recovery)		63.9		71		70.2		72		74.6		65.7		69.1		68.1		72.1		86.2		81.1		72.4
13C-gamma-HCH (% Recovery)		67.9		67.4		79.1		83.1		82.8		86		82.5		73.5		75.9	NDR	69.2	NDR	97.8	NDR	92.6
13C-Heptachlor (% Recovery)		61.3		63.5		74.4		71.3		79.1		82		69.5		71.7		71.8		73.4		74.4		76
13C-Aldrin (% Recovery)		70.9		68.5		77.6		74.1		82.1		84.6		68.6		71.8		75.6		81		77.9		79.8
13C-Chlordane, gamma (trans) (% Recovery)		80.3		78.3		86.2		86.9		92.5		93.7		82.7		92.5		89.2		92.6		88.7		90.9
13C-Nonachlor, trans- (% Recovery)		77.4		76.5		83.6		83.9		90.9		95.2		76.8		91.1		87.1		90.7		87.5		90.3
13C-4,4'-DDE (% Recovery)		87.6		84.1		90.5		90.7		97.2		103		81.9		97.6		90.7		94		92.2		94.5
13C-4,4'-DDT (% Recovery)		87.4		84.2		91.1		88.2		96.7		101		85.5		87.4		82.6		86.5		86.7		90.5
13C-4,4'-DDD (ng/sample)		98.9		99.1		103.2		91.3		97.7		90.5		87.5		90.3		93.8		86.6		88.1		89.5
D4-alpha-Endosulphan (% Recovery) DB5		102		98.3		104		144	V	145	V	146		119		101		102		111		108		106
D4-beta-Endosulphan (% Recovery) DB5		97.8		92.3		101		98.2		102		99		97.6		89.6		88.4		105		99.2		93.9
D4-alpha-Endosulphan (% Recovery) DB17		98.4		94.1		101		90.3		91.8		94.3		105		95.4		93.1		92.9		91.8		87.7
D4-beta-Endosulphan (% Recovery) DB17		97.3		90.2		103		86.7		90		89.3		101		90.7		90.3		83.8		82.6		74

Appendix F2: SPMD data for US deployments - concentrations represent ng/SPMD

Gratwick Riverside Park (GRP)

Little Niagara River (LNR)

Niagara-on-the-Lake (NOTL)

CLIENT_ID	Pettit Flume		Pettit Flume		Pettit Flume		Fisherman's Park		Fisherman's Park		Fisherman's Park		Fisherman's Park		Fisherman's Park		Fisherman's Park		GRP		GRP		GRP	
Axys ID	(U/S)-1		(U/S)-2		(U/S)-3		(D/S)-1		(D/S)-2		(D/S)-3		(U/S)-1		(U/S)-2		(U/S)-3		(U/S of Marina)-1		(U/S of Marina)-2		(U/S of Marina)-3	
WORKGROUP																								
Sample Size	L23776-14 Li2		L23776-15 L		L23776-16 L		L23776-17 L		L23776-18 L		L23776-19 i		L23776-20 i		L23776-21 i		L23776-22 i		L23776-23 i		L23776-24 i		L23776-25 i	
UNITS	WG52369		WG52369		WG52369		WG52369		WG52369		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371	
	1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample	
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene	NQ		J	2.13	NQ		NQ			6.65		8.22		4.69		4.35		4.47		3.32		6.81		4.07
1,4-Dichlorobenzene	NQ			17.7	NQ		NQ			51		37.3		20		19.4		18		14.3		21.1		14.6
1,2-Dichlorobenzene	NQ			3.15	NQ		NQ			6.11		3.69	J	2.6		3.19	J	2.63	J	2.03	ND		J	2.02
1,3,5-Trichlorobenzene	J	0.68	ND		ND			7.57		6.9		6.54		4.22		4.22		4.28	J	2.48	J	2.3	J	2.48
1,2,4-Trichlorobenzene		5.11		3.79		4.39		39.6		40.3		39.9		7.76		7.52		6.89		4.23		4.66		4.52
1,2,3-Trichlorobenzene	NDR J	1.85	NDR J	2	NDR J	1.48		15.2		12.2		13.6	J	1.23	J	1.19	J	1.3	ND		NDR J	2.54	ND	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	J	2.79	J	2.57	J	2.37		16.9		18.1		18.9		7.42		7.58		8.05	J	4.12	J	4.02	J	4.71
1,2,3,4-Tetrachlorobenzene	J	1.28	J	1.02	J	0.88		21.8		21.5		22.1		3.14	J	2.94	J	2.92	J	2.29	J	2.26	J	2.49
Hexachlorobutadiene	NDR J	0.358	ND		ND		ND		J	0.4	NDR J	0.493	ND		J	0.263	J	0.278	NDR J	0.355	NDR J	0.798	J	0.273
Pentachlorobenzene		5.46		5.2		5.27		40.9		39.1		42.1		13.4		14.3		14.2		10.2		10.4		11.7
Hexachlorobenzene		4.45		4.66		4.58		44.3		42.1		47.6		24.7		25.1		24.8		20.8		15.6		17.7
HCH, alpha	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, beta	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, gamma	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Heptachlor	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Aldrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chlordane, gamma (trans)	J	2.07	J	1.87	J	1.99	J	1.97	J	1.96	J	2.49	J	2.41	J	2.36	J	2.39	J	2.14	J	2.3	J	2.35
Chlordane, alpha (cis)	J	3.09	J	2.93	J	2.66	J	3.07	J	3	J	3.5	J	3.5	J	3.41	J	3.6	J	2.75	J	3.06	J	3.07
Octachlorostyrene	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chlordane, oxy-	NDR	20.3	NDR	21.6	NDR	26.4	NDR	28.1	NDR	22.8	NDR	17.2	ND		NDR	16.9	NDR	12.1	ND		ND		NDR	20.4
Nonachlor, trans-	J	1.61	J	1.69	J	1.62	J	1.8	J	1.84	J	1.97	J	1.92	J	1.9	J	1.81	J	1.54	J	1.63	J	1.8
Nonachlor, cis-	J	0.596	J	0.53	J	0.501	J	0.482	J	0.502	J	0.548	J	0.623	J	0.618	J	0.603	J	0.468	J	0.438	J	0.532
Mirex	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
2,4'-DDE (o,p' DDE)	NDR J	1.29	J	0.773	NDR J	1.35	ND		ND		NDR J	1.08	NDR J	1.47	ND		ND		ND		NDR J	2.04	NDR J	1.46
4,4'-DDE (p,p' DDE)		5.35		4.74		4.72		6.14		6.68		7.39		6.39		6.93		6.4		5.29		5.54		6.37
2,4'-DDD (o,p' DDD)	ND		J	1.54	NDR J	1.31	ND		J	1.66	NDR J	1.9	ND		ND		ND		ND		ND		ND	
4,4'-DDD (p,p' DDD)		5.27		4.72		4.18		5.84		5.39		6.59		5.52		6.97		5.63		5.61		5.99		5.34
2,4'-DDT (o,p' DDT)	NDR	4.62	NDR J	2.95	NDR J	3.11	NDR J	3.09	NDR J	2.03	NDR	3.77	ND		NDR	5.28	NDR	3.62	NDR	5.76	NDR	6.43	ND	
4,4'-DDT (p,p' DDT)	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, delta	J	0.339	J	0.565	J	0.767	J Q	0.222	J Q	0.186	flag	ng/sample	J	0.5	ND		ND		ND		ND		ND	
Heptachlor Epoxide	Q	3.35	Q	3.21	Q	3.57	J	2.26	J Q	1.03	ND		Q	3.04	Q	3.38	Q	3.05		4.65		4.63		4.46
Dieldrin		6.22		6.88		7.52		6.61		6.23		2.53		6.59		6.64		7.05		8.02		8.24		7.28
Endrin	ND		J Q	0.122	ND		ND		ND			6.32	ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Ketone	J Q	0.913	J Q	1.25	J	1.53	J Q	0.098	ND		ND		ND		ND		J Q	0.232	J Q	0.239	ND		J Q	0.299
Methoxychlor	ND		ND		ND			2.88	ND		ND		ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
beta-Endosulphan	ND		J Q	0.058	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endosulphan Sulphate	ND		J Q	0.133	ND		J Q	0.352	ND		ND		ND		ND		ND		ND		ND		ND	
13C-1,4-Dichlorobenzene (% Recovery)	NQ			6.55	NQ		NQ			9.46		11.9		6.44		6.08		15.3		9.57		3.03		12.3
13C-1,2,3-Trichlorobenzene (% Recovery)		13.3		18.9		15.2		9.83		31.9		28.6		17.9		19.3		40.4		23.7		11.6		32.7
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		25.8		26.4		25.7		17.5		38.4		46.2		28		32.2		55.1		35.3		24.7		43.7
13C-Pentachlorobenzene (% Recovery)		39.5		41.2		41		36.3		51.8		64.8		43		46.1		65		50.3		42.1		55.7
13C-Hexachlorobenzene (% Recovery)		65.8		69.8		70.2		68		75.9		85.5		64		62.8		83.3		74.8		66.2		76
13C-beta-HCH (% Recovery)		74.7		75.2		78.2		76.1		84.3		62.8		50.6		48.4		64.9		71.7		59.7		69.9
13C-gamma-HCH (% Recovery)		72.6		75.5		77.3		79.8		82.8		83.6		61.4		60.6		80.9		80.3		65		82.3
13C-Heptachlor (% Recovery)		66.1		76.4		75.1		65.3		83.3		92.8		68.5		66.6		96		74.6		68.3		79.2
13C-Aldrin (% Recovery)		68.9		71.4		75.9		70.6		73.4		61.8		64		56.6		84.1		66		61.3		67.1
13C-Chlordane, gamma (trans) (% Recovery)		89.5		90		90.3		91.3		96.1		97.1		80.6		74.7		99.1		88.8		83.4		90
13C-Nonachlor, trans- (% Recovery)		86.8		87.5		86		87.9		91.8		98.8		83		75.8		102		90.7		85.9		88.8
13C-4,4'-DDE (% Recovery)		89.6		90.6		90.5		94.2		97.2		95.6		79		71.8		94.1		86		84.1		86.7
13C-4,4'-DDT (% Recovery)		94.6		84.1		87.3		79.9		90.8		78.6		71.9		66.5		102		82.9		70		77.5
13C-4,4'-DDD (ng/sample)		91.7		96.1		98.5		104.1		98.7		96.0		90.1		84.1		76.3		95.4		100.1		103.2
D4-alpha-Endosulphan (% Recovery) DB5		106		113		102		108		97.4	ND			82.2		86.1		113		116		105		119
D4-beta-Endosulphan (% Recovery) DB5		86.7		85.6		83.1		95.1		81		95.8		72.6		76.2		91.3		96.6		85.6		98.9
D4-alpha-Endosulphan (% Recovery) DB17		97.5		99.8		92.6		96.2		91.9		86.6		75.8		79.2		100		103		95.8		106
D4-beta-Endosulphan (% Recovery) DB17		89.1		96.1		86.6		92.3		81.7		86.8		71.5		76.7		90.4		91.4		81.9		94.2

Appendix F2: SPMD data for US deployments - concentrations represent ng/SPMD

Gratwick Riverside Park (GRP)

Little Niagara River (LNR)

Niagara-on-the-Lake (NOTL)

CLIENT_ID	GRP		GRP		GRP		GRP		GRP		GRP		GRP		GRP		GRP		GRP		GRP		GRP		102nd St		102nd St		102nd St	
Axys ID	(in Marina)-1		(in Marina)-2		(in Marina)-3		(U/S of Dump)-1		(U/S of Dump)-2		(U/S of Dump)-3		(Middle of Park)-1		(Middle of Park)-2		(Middle of Park)-3		(D/S)-1		(D/S)-2		(D/S)-3		(U/S)-1		(U/S)-2		(U/S)-3	
WORKGROUP																														
Sample Size	L23776-26 L		L23776-27 L		L23776-28 L		L23776-29 i		L23776-30 i		L23776-31 i		L23776-32 i		L23776-33 i		L23776-34 i		L23776-35 i		L23776-36 i		L23776-37		L23776-38		L23776-39		L23776-40	
UNITS	WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52400		WG52400		WG52400		WG52400	
	1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample	
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene		34.1		32.5		23		7.83		4.55		6.69		4.84		4.8		8.05		4.53		5.28	NQ			5.91		4.99		4.18
1,4-Dichlorobenzene		93.8		115		77.4		25		22.4		31.4		22.8		27.5		28.2		28.2		23.4	NQ			20		20.2		18
1,2-Dichlorobenzene		10.2		15.4		10.1	J	2.58		3.2		4.92		3.05		4.27		5.41		3.97		3.94	NQ		J	2.16	J	2.29	J	2.66
1,3,5-Trichlorobenzene		13.6		11.6		12	J	2.66	J	2.61	J	2.81	J	2.45	J	2.37	J	2.05	J	2.26	J	1.97	J	2.2	J	2.29	J	2.52	J	2.29
1,2,4-Trichlorobenzene		31.9		29.2		27.4		7.18		5.38		5.77		14.7		13.1		13.8		5.21		4.6		4.64		7.03		6.12		6.14
1,2,3-Trichlorobenzene		4.76	NDR	8.67		5.21	J	2.85	J	1	J	1.37	J	2.86		3.26	J	3.01	ND		J	1.2	J	1.09	NDR J	0.975	J	0.961	NDR J	0.659
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		17.3		17		17.4	J	6.05	J	4.98	J	4.98	J	4.71	J	4.99	J	4.78	J	4.01	J	3.83	J	3.43		18.7		13.9		14.4
1,2,3,4-Tetrachlorobenzene		13.2		13.4		13.2		6.14	J	2.45	J	2.49		3.06		3.27		3.18	J	2.15	J	2.15	J	2.14		3.15		3.08		3.23
Hexachlorobutadiene	NDR J	0.566	ND		NDR J	0.518	ND		ND		ND		NDR J	0.71	J	0.383	J	0.325	ND		ND		NDR J	0.249	NDR J	0.295	J	0.295	NDR J	0.288
Pentachlorobenzene		16.9		17.6		18.4		13.8		11.3		11.6		9.83		9.76		10.3		10.3		10.8		10.2		10.8		10.7		10.3
Hexachlorobenzene		17.1		17.7		19.2		20.1		17.1		17.5		16.8		16.2		14.9		14.5		16.5		15.4		18.8		18.2		18
HCH, alpha	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		NDR J	1.95	ND		ND	
HCH, beta	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, gamma	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		NDR J	5.1	ND	
Heptachlor	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		NDR J	0.57	NDR J	1.01	ND		ND	
Aldrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		NDR J	0.483	ND		ND		ND	
Chlordane, gamma (trans)	J	4.76	J	4.6	J	4.77	J	2.18	J	2.06	J	2	J	2.26	J	2.33	J	2.52	J	2.48	J	2.43	J	2.26	J	2.43	J	2.25	J	2.4
Chlordane, alpha (cis)	J	5.76	J	5.88		6.34	J	3.21	J	2.99	J	3.17	J	3.51	J	3.3	J	3.19	J	3.4	J	3.85	J	3.35	J	3.57	J	3.42	J	3.39
Octachlorostyrene	NDR J	0.568	J	0.558	J	0.496	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chlordane, oxy-	NDR	29.7	NDR	23.9	ND		ND		NDR	14	NDR	24.5	ND		ND		NDR	21.9	ND		NDR	17.8	NDR	16.3	NDR	19.8	NDR	15.2	NDR	21.8
Nonachlor, trans-	J	1.8	J	1.8	J	2.14	J	1.67	J	1.54	J	1.55	J	1.88	J	1.74	J	1.79	J	2.1	J	2.08	J	2.05	J	2.06	J	1.99	J	1.9
Nonachlor, cis-	J	1.16	J	1.2	J	1.29	J	0.49	J	0.56	J	0.519	J	0.568	J	0.501	J	0.517	J	0.652	J	0.887	NDR J	0.715	J	0.679	J	0.615	NDR J	0.683
Mirex	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		NDR J	0.924	ND		ND		NDR J	1.39
2,4'-DDE (o,p' DDE)	NDR	11.3	NDR	8.5	ND		ND		NDR J	1.51	ND		ND		NDR J	1.94	ND		NDR J	1.16	NDR J	1.7	NDR J	1.56	NDR J	1.13	NDR J	1.02	NDR J	1.03
4,4'-DDE (p,p' DDE)		18.2		19.1		19		5.82		5.5		5.75		6.39		5.97		5.96		6.02		7.63		6.95		5.75		6.05		5.66
2,4'-DDD (o,p' DDD)	ND		ND		ND		ND		J	1.99	J	2.23	ND			3.27	ND		ND		J	1.98	J	1.42	J	1.82	J	1.99	J	1.61
4,4'-DDD (p,p' DDD)		19.6	NDR	19.8		19.8		7.09		7.59		7.17		4.81		5.34		5.8		6.87		8.01		6.42		6.46		5.99		5.56
2,4'-DDT (o,p' DDT)	NDR	26.6	NDR	17	NDR	14.5	NDR	5.38	ND		NDR	5.57	NDR	3.82	ND		ND		NDR	4.49	NDR	4.36	NDR	3.3	NDR J	2.64	NDR J	2.07	NDR J	2.42
4,4'-DDT (p,p' DDT)	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		J	1.12	J	1.07	ND		NDR J	1.01
HCH, delta	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		J	0.859
Heptachlor Epoxide	J	2.11	ND		J Q	1.22		4.16		4.26		4.13	Q	4.72	Q	4.41	Q	4.27	Q	4.17	Q	4.45		4.58	Q	3.42	Q	3.78	Q	3
Dieldrin		4.62		4.94		5.14		7.11		7.21		6.83		6.93		7.21		6.86		8.16		9.54		8.25		7.66		7.07		7.41
Endrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Ketone	ND		ND		ND		J Q	0.39	ND		ND		ND		J Q	1.65	J Q	1.01	ND		ND		ND		ND		J Q	0.226	J Q	0.332
Methoxychlor	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
beta-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endosulphan Sulphate	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
13C-1,4-Dichlorobenzene (% Recovery)		3.98		2.01		4.51		3.67		7.32		3.82		9.57		12.1		3.88		6.24		4.65	NQ			6.29		13.1		10.8
13C-1,2,3-Trichlorobenzene (% Recovery)		13.2		8.43		15.7		14		19		12.4		25.3		30.4		17		15.2		14.7		13.8		14		24.8		20.2
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		26		25.4		28.2		29.8		35.6		25.3		35.5		42.2		30.9		23.5		32.2		27.2		26.1		35.7		30.6
13C-Pentachlorobenzene (% Recovery)		48.2		52		48.3		49		56.3		46.2		47.8		52.2		45.6		33.9		53.1		41.3		37.1		44.9		44.2
13C-Hexachlorobenzene (% Recovery)		79.4		80.7		78.4		75		80.6		75		71.3		63.6		68.6		50.5		81.2		61.1		57		65		65.1
13C-beta-HCH (% Recovery)		88.4		61.5		81.6		74.6		73.1		73.6		71.8		41.8		63.3		34.9		81.6		68.2		67.8		77.3		64.6
13C-gamma-HCH (% Recovery)		90.5		76.7		85.3		77		90.5		79.5		77.6		58.2		73.3		44.5		86.8		77.9		77.8		88.7		82.1
13C-Heptachlor (% Recovery)		58.1		61.8		79.3		92.5		94.5		82.3		82.5		70.5		74.8		56.4		87.9		75		74.4		80.4		70.3
13C-Aldrin (% Recovery)		59.6		56.7		67.4		58		65.2		61.7		71.6		70.8		71.5		57		75.1		69.6		46.1		67.4		69.8
13C-Chlordane, gamma (trans) (% Recovery)		96.9		91.2		98.1		96.9		102		96.5		88.8		72.3		82.6		62.7		100		92.3		87.6		97.5		94.1
13C-Nonachlor, trans- (% Recovery)		95.3		90.5		99.6		97		103		97.6		89		74.6		84.1		66.7		100		91.2		84.8		93.8		90.8
13C-4,4'-DDE (% Recovery)		97.9		92.3		98.2		93.6		99.1		93.6		84.9		68.3		80.6		63.3		95.7		94.4		86.4		94.9		94
13C-4,4'-DDT (% Recovery)		89.2		78.7		100		89.2		85.5		82		84.2		66.1		77.8		58.4		95.9		110		101		116		102
13C-4,4'-DDD (ng/sample)		78.7		77.9		81.2		97.7		100.1		102.4		91.7		89.1		92.4		84.0		91.3		79.3		86.1		80.4		80.9
D4-alpha-Endosulphan (% Recovery) DB5		117		89.2		76		110		107		108		92.3		80.5		87.6		80.7		105		112		63.9		105		103
D4-beta-Endosulphan (% Recovery) DB5		103		84.2		68.1		94.9		91.2		94.6		81.3		64.2		78		64.8		86.7		103		58.5		103		90.3
D4-alpha-Endosulphan (% Recovery) DB17		110		89.2		74.4		100		95.8		98.7		81.3		78.4		80.6		78.1		96		99.3		53.2		93.4		87.8
D4-beta-Endosulphan (% Recovery) DB17		97.5		83.1		66.8		91.9		86.8		90.1		78.1		69.5		78.8		69.5		89.2		98.2		55.3		104		89.3

Appendix F2: SPMD data for US deployments - concentrations represent ng/SPMD

Gratwick Riverside Park (GRP)
Little Niagara River (LNR)
Niagara-on-the-Lake (NOTL)

CLIENT_ID	LNR		LNR		LNR		Cayuga Creek		Cayuga Creek		Cayuga Creek		LNR		LNR		LNR		U/S Occidental		U/S Occidental		U/S Occidental	
Axys ID	(Near 102nd St)-1		(Near 102nd St)-2		(Near 102nd St)-3		(Within the creek)-1		(Within the creek)-2		(Within the creek)-3		(D/S Cayuga Creek)-1		(D/S Cayuga Creek)-2		(D/S Cayuga Creek)-3		Facility-1		Facility-2		Facility-3	
WORKGROUP																								
Sample Size	L23776-41		L23776-42		L23776-43		L23776-44 L		L23776-45 L		L23776-46 L		L23776-47		L23776-48		L23776-49		L23776-50		L23776-51		L23776-52	
UNITS	WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400	
	1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample	
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene	NQ			21.9		15	NQ			9.01		5.82	NQ		NQ			6.41		5.78	NDR	4.49		5.23
1,4-Dichlorobenzene	NQ			41.4		38.9	NQ			30.7		27.6	NQ		NQ			24.1		17.7		18.9		19.2
1,2-Dichlorobenzene	NQ			3.39	J	2.63	NQ			6.58		4.71	NQ		NQ		J	1.7	J	1.68	ND		J	2.44
1,3,5-Trichlorobenzene		14.6		14.7		14.6		14.1		16.2		15.7		5.93		4.21		5.13	J	3	J	2.92		3.12
1,2,4-Trichlorobenzene		47		47.2		46.9		33.2		35.8		35.3		6.77		6.76		8.71		4.04		3.61		3.86
1,2,3-Trichlorobenzene		12.6		11.4		11.7		4.91		3.6		3.62	J	2.23	J	1.84	J	2.38	ND		J	0.802	NDR J	0.926
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		70.8		71.2		72.4		51		52.7		55.8		17.5		17.2		18.7		7.68		7.29		7.71
1,2,3,4-Tetrachlorobenzene		247		230		225		80.5		76.9		80.9		29.5		27.7		27.6		8.02		8.38		8.51
Hexachlorobutadiene	NDR J	0.333	NDR J	0.381	J	0.432	J	1.33	NDR J	2.02	J	1.9	NDR J	0.694	NDR J	0.281	J	0.34	J	0.545	NDR J	0.479	J	0.416
Pentachlorobenzene		260		222		213		69		67.9		70.9		38.1		37.1		36.8		20.5		20.1		20.8
Hexachlorobenzene		61.4		56		54.7		23.7		22.8		22.1		19.9		19.8		20.1		19.4		18.5		20.1
HCH, alpha	NDR J	2.24	NDR J	2.05	J	2.64		335		333		344		13		11.5		14.7		9.77		9.23		8.41
HCH, beta	ND		ND		ND			82.5		85	NDR	87.1	NDR J	4.9	NDR J	3.61	NDR	6.12	ND		NDR J	2.14	ND	
HCH, gamma	ND		NDR J	2.23	NDR J	2.68		18.2		18.8	NDR	16.3	ND		NDR J	2.5	ND		ND		ND		NDR J	1.98
Heptachlor	ND		ND		ND		ND		ND		ND		ND		NDR J	0.911	ND		ND		ND		NDR J	0.698
Aldrin	NDR J	0.57	NDR J	0.604	ND		ND		ND		ND		ND		NDR J	0.83	ND		ND		NDR J	0.73	ND	
Chlordane, gamma (trans)	J	2.31	J	2.22	J	2.1	J	5.57		5.97		6.01	J	3.7	J	4.36	J	4.78	J	3.17	J	3.17	J	3.13
Chlordane, alpha (cis)	J	3.65	J	3.59	J	3.2		10.1		10.2		9.97		5.96		6.81		7.1	J	4.96	J	4.8	J	4.92
Octachlorostyrene	ND		ND		ND		J	0.378	J	0.311	NDR J	0.219	ND		NDR J	0.231	J	0.248	J	0.366	J	0.446	J	0.482
Chlordane, oxy-	NDR	16.5	NDR	16.8	NDR	17.7	NDR	20.2	NDR	23.9	ND		NDR	18.5	NDR	12.3	NDR	15	NDR	18.3	NDR	16.6	NDR	13.9
Nonachlor, trans-	J	1.97	J	1.81	J	1.74	J	4.03	J	4.1	J	3.84	J	3.72	J	4.04	J	4.22	J	2.45	J	2.48	J	2.32
Nonachlor, cis-	NDR J	0.583	J	0.651	J	0.539	J	1.21	J	1.26	J	1.19	J	1.25	J	1.45	J	1.27	J	0.837	J	0.8	J	0.835
Mirex	ND		ND		NDR J	0.676	NDR	7.87	NDR	6.29	NDR	5.65		3.71		4.01		4.19	NDR J	1.81	J	1.68	J	1.77
2,4'-DDE (o,p' DDE)	NDR J	1.22	NDR J	1.36	NDR J	1	NDR J	2.34	NDR J	2.48	NDR J	2.37	NDR J	1.97	NDR J	2.41	NDR J	2.36	NDR J	2.29	NDR J	2.21	NDR J	2.25
4,4'-DDE (p,p' DDE)		5.95		6.34		6.43		18.8		18.7		17.1		10.6		10.7		11.6		8.31		8.3		8.71
2,4'-DDD (o,p' DDD)		7.16		6.32		5.75		5.98		5.9		5.39		4.4		4.64		4.48		3.22		3.5	J	2.93
4,4'-DDD (p,p' DDD)		27.1		24.6		22.5		26.9		29.1		26.7		17.3		17.2		16.7		10.4		10.7		9.43
2,4'-DDT (o,p' DDT)	NDR J	2.62	NDR J	2.61	NDR J	2.05	NDR	4.51	NDR	5.06	NDR	5.45	NDR	5.81	NDR	6.58	NDR	5.8	NDR	4.89	NDR	5.48	NDR	4.74
4,4'-DDT (p,p' DDT)	J	1.33	J	1.4	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, delta	J	1.12	J	1.01	J	0.954		33.7		39.3		47.7	J	2.01	J	2.3	J	2.61	J	0.879	J	1.03	J	0.849
Heptachlor Epoxide	Q	3.6	Q	3.02	Q	2.94	Q	2.97		3.84		4.08		3.57		3.12	Q	2.99		4.57		4.22		4.51
Dieldrin		7		6.42	Q	6.12		6.99		7.74		6.39		6.47		6.04		5.99		7.53		7.85		7.56
Endrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Ketone	ND		ND		ND		J Q	0.431	ND		ND		ND		ND		ND		ND		ND		ND	
Methoxychlor	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
beta-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endosulphan Sulphate	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
13C-1,4-Dichlorobenzene (% Rec	NQ			8.14		7.26	NQ			6.05		10.6	NQ		NQ			9.86	NDR	15.2		6.98		6.71
13C-1,2,3-Trichlorobenzene (% Recovery		9.34		16.7		13.2		11.6		14.9		24.7		6.54		13.3		24.7		36.3		18.1		13.4
13C-1,2,3,4-Tetrachlorobenzene (% Reco		23.9		27.3		19.3		26.1		22.3		32.7		13.5		32.4		37.3		49.5		33.9		23.2
13C-Pentachlorobenzene (% Recovery)		47		46.8		31.5		50.5		39.1		48.3		33.9		51.6		47.1		56.1		48.8		38.2
13C-Hexachlorobenzene (% Recovery)		65.2		65.1		54.4		78.1		67.6		71		63.6		69.1		63.8		69.3		68.8		58.1
13C-beta-HCH (% Recovery)		67.2		81.9		68.6		76.8		65.7		75.5		66.5		64.2		65.8		65.1		72		56.8
13C-gamma-HCH (% Recovery)		84.4		90.9		72.8		84.1		69.2		75.9		69.6		82.7		76.3		83.5		84.5		72.3
13C-Heptachlor (% Recovery)		63.8		70.2		63.7		76.6		59.6		57.1		47.2		53.5		54.3		57.4		55.8		65.3
13C-Aldrin (% Recovery)		73.9		77.3		64.3		59.6		53.5		36.5		66.8		69.6		71.1		75.1		73.2		64.5
13C-Chlordane, gamma (trans) (% Recov		95.2		98.8		93.7		98.9		90.8		85.7		87.8		88.2		87.2		91.8		87.2		86.2
13C-Nonachlor, trans- (% Recovery)		91.2		95		92.4		95		86.4		80.7		83.1		85.5		83.7		88.1		82.4		83.9
13C-4,4'-DDE (% Recovery)		96.9		101		96.4		99.7		95		90.1		91.7		91.3		88.5		92.5		87.4		86.6
13C-4,4'-DDT (% Recovery)		98.4		106		110		99.6		90.7		92.2		77.4		82.7		86.3		96.1		87.7		102
13C-4,4'-DDD (ng/sample)		93.7		89.8		79.0		93.3		95.1		95.5		102.6		86.6		91.6		84.5		87.9		82.5
D4-alpha-Endosulphan (% Recovery) DB5		96.7		90.4		96		106		117		104		89.8		92.7		111		106		111		102
D4-beta-Endosulphan (% Recovery) DB5		98.6		88.6		101		102		96.3		91.9		87.8		95.5		103		102		104		99.8
D4-alpha-Endosulphan (% Recovery) DB1		80.7		77.5		80.9		87.1		99		86.7		76		75		95.4		87.4		84.3		75.3
D4-beta-Endosulphan (% Recovery) DB1		94.7		85.2		98		95.3		92.5		90.6		83.4		85.5		98.8		98.8		85		113

Appendix F2: SPMD data for US deployments - concentrations represent ng/SPMD
Gratwick Riverside Park (GRP)
Little Niagara River (LNR)
Niagara-on-the-Lake (NOTL)

CLIENT_ID	D/S Storm Sewer		D/S Storm Sewer		D/S Storm Sewer		D/S Storm Sewer		D/S Storm Sewer		D/S Storm Sewer		At Storm Sewer		At Storm Sewer		At Storm Sewer		Occidental Sewer		Occidental Sewer		Occidental Sewer	
Axys ID	A-1		A-2		A-3		B-1		B-2		B-3		C-1		C-2		C-3		003-1		003-2		003-3	
WORKGROUP																								
Sample Size	L23776-53		L23776-54		L23776-55		L23776-56		L23776-57		L23776-58		L23776-59		L23776-60		L23776-61		L23776-62		L23776-63		L23776-64	
UNITS	WG52400		WG52400		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449	
	1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample	
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene		4.65		7.6	NQ		ND			3.1		5.62		6.69	ND			4.65		197		178		166
1,4-Dichlorobenzene		19.5		15.6	NQ			16.4		16.2		20.5		18.2		14.2		16.6		113		119		107
1,2-Dichlorobenzene	J	2.35	J	2.16	NQ		ND		J	2.76	ND		J	2.54	ND		J	2.24		13.3		13.3		12.4
1,3,5-Trichlorobenzene	J	2.86	J	2.53	ND			3.81		3.97		3.65		6.25		5.05		5.6	T	68.2	T	68.7	T	58.5
1,2,4-Trichlorobenzene		4.86		4.76		3.54		5.17		4.52		4.95		8.21		6.67		6.85	T	836	T	838	T	727
1,2,3-Trichlorobenzene	J	1.36	J	1.22	NDR J	1.88	J	1.79	NDR J	1.85	J	1.32	NDR J	1.99	ND		J	1.62	T	139	T	142	T	125
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		10.8		9.88		9.14		13		12.5		12.2		25		22.2		26.4		326		312		292
1,2,3,4-Tetrachlorobenzene		26.9		24.6		23.1		26.8		26.9		25.7		34.2		32.4		34.9						1080
Hexachlorobutadiene	J	2.44	J	1.56	NDR J	2.19	NDR J	2.84	J	2.25	J	1.86		5.13		3.26		3.8	D	1900	D	1730		1190
Pentachlorobenzene		44		48		34.9		55		56.1		49.2		73		75.8		79.3	D T	1010	D T	926	T	748
Hexachlorobenzene		19.7		19.5		18.4		21.8		23.2		20.2		97.7		98.3		111		442		459		402
HCH, alpha		7.96	NDR	5.89	J	5.2	J	4.61	J	5.71	J	4.62	J	4.55	J	4.62	J	4.37		8.66		7.85		6.93
HCH, beta	ND		NDR J	1.9	NDR J	2.4	ND		ND		ND		J	3.52	J	3.29	J	4.57		7.73	NDR	6.65	J	4.98
HCH, gamma	ND		ND		ND		ND		ND		ND		ND		ND		NDR J	2.35	J	2.99	J	2.03	ND	
Heptachlor	ND		NDR J	0.809	ND		ND		ND		ND		ND		ND		ND		ND		NDR J	1.36	ND	
Aldrin	ND		NDR J	0.53	ND		ND		ND		ND		ND		ND		NDR J	0.443	ND		NDR J	0.716	ND	
Chlordane, gamma (trans)	J	2.71	J	2.46	J	2.52	J	2.28	J	2.46	J	2.25	J	1.77	J	1.64	J	1.75	J	2.3	J	2.27	J	2.52
Chlordane, alpha (cis)	J	4.2	J	3.69	J	3.7	J	3.18	J	3.74	J	3.44	J	2.66	J	2.14	J	2.5	J	3.71	J	3.73	J	3.86
Octachlorostyrene	J	0.841	J	0.664	NDR J	0.503	J	0.709	J	0.722	J	0.347		5.86		5.58		6.47		21.6		21.9		18
Chlordane, oxy-	NDR	19.5	NDR	14.9	NDR	9.87	ND		ND		ND		NDR	14.2	NDR	12.1	NDR	9.66	ND		ND		NDR	7.99
Nonachlor, trans-	J	2.25	J	2.02	J	1.97	J	1.8	J	2.23	J	1.74	J	1.59	J	1.46	J	1.46	J	2.12	J	2.17	J	2.19
Nonachlor, cis-	J	0.715	J	0.778	J	0.627	J	0.706	J	0.854	J	0.648	J	0.534	J	0.483	J	0.635	J	0.736	J	0.632	J	0.626
Mirex	NDR J	2.18	NDR J	1.66	ND		ND		ND		ND			8.87		9.51		9.83		70.9		76.4		147
2,4'-DDE (o,p' DDE)	NDR J	2.08	NDR J	1.86	ND		ND		ND		ND		ND		ND		ND		ND		NDR J	1.49	ND	
4,4'-DDE (p,p' DDE)		6.93		6.73		6.85		6.09		6.71		5.69		4.81		4.39		4.97		7.03		6.55		6.21
2,4'-DDD (o,p' DDD)	J	2.26	J	2.22	ND		J	1.95	ND		ND		ND		ND		J	1.31	ND		J	1.65	J	2.3
4,4'-DDD (p,p' DDD)		6.64		7.82		6.69		6.06		6.52		5.51		5.37		4.76		4.94		5.92		6.55		6.32
2,4'-DDT (o,p' DDT)	NDR	3.8	NDR	3.92	ND		NDR	3.49	ND		ND		ND		ND		ND		ND		NDR	3.44	NDR J	3.18
4,4'-DDT (p,p' DDT)	J	1.44	J	1.65	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, delta	J	1.19	J	0.846	J Q	0.647	J Q	0.511	J	0.694	J	0.799	J	0.751	J Q	0.491	J Q	0.514	J	1.54	J	1.49	J	1.3
Heptachlor Epoxide	Q	4.42		4.53		4.6		4.03		4.24		4.3		3.12		2.69		2.81		4.61		4.86		4.99
Dieldrin		8.73		7.81		9		7.76		7.86		7.98		6.33		5.8		5.92		7.27		7.12		7.42
Endrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Ketone	J Q	0.277	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		J Q	0.478
Methoxychlor	ND		ND		ND		ND		J	2.3	ND		ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
beta-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endosulphan Sulphate	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
13C-1,4-Dichlorobenzene (% Recovery)		12.3		5.82	NQ			10.7		8.65		5.74		11.1		5.95		8.1		9.3		11.8		5.72
13C-1,2,3-Trichlorobenzene (% Recovery)		32.8		15.6		12.8		21.7		19.8		19.4		28.8		15.1		18.8	NQ		NQ		NQ	
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		42.3		27.7		21.7		26.6		29.4		30.8		37.8		23.8		26.8		29.5		45		26.3
13C-Pentachlorobenzene (% Recovery)		50.6		45.3		35.1	V	29.3		44.9		43.1		50.2		36.6		31.8	NDR D T	41.6	NDR D T	55.4	NDR	46
13C-Hexachlorobenzene (% Recovery)		68		67.8		54.8		33.9		64.1		62.2		66.6		55.1		38.1		44.7		66.9		65.7
13C-beta-HCH (% Recovery)		71		71.9		55.5		34.8		72.4		68.1		70.2		58.9		40.8		43.9		77.5		70.3
13C-gamma-HCH (% Recovery)		81.6		81.1		70.6		45		87.3		81.6		81.6		68.9		49.7		62.8		105		111
13C-Heptachlor (% Recovery)		75.5		74.2		59.2		35.4		73.6		67.7		73		64.5		44.1		50.3		77.6		75.1
13C-Aldrin (% Recovery)		77.7		75.3		63.4		38.5		74.8		75.9		77.2		66.4		45.1		47.2		69.6		76.1
13C-Chlordane, gamma (trans) (% Recovery)		93.2		95.3		79.6		43.8		92.9		91.5		90.8		84.6		55.3		55.9		84.2		90.2
13C-Nonachlor, trans- (% Recovery)		89.9		90.4		76.6		41.6		90		89.4		87.3		83.7		52.3		55.3		82.1		89.5
13C-4,4'-DDE (% Recovery)		94.2		94.3		80.4		45.2		96.5		96.1		92.7		89		56.6		57.2		88.8		95.7
13C-4,4'-DDT (% Recovery)		114		113		96.3		50.3		116		116		112		105		65		67.2		112		117
13C-4,4'-DDD (ng/sample)		75.8		82.8		82.8		82.7		82.1		84.6		89.8		88.6		82.1		81.7		85.8		87.6
D4-alpha-Endosulphan (% Recovery) DB5		120		108		85.7		97.9		109		95.8		95.3		44.8		94.3		98.5		86.8		92.3
D4-beta-Endosulphan (% Recovery) DB5		110		102		81.6		93		104		93.5		94.4		43.1		94.9		99.8		90		90.8
D4-alpha-Endosulphan (% Recovery) DB17		66.9		97.1		70.5		81.3		82.5		87.3		75.7		41.5		70.1		84.2		73.1		73.9
D4-beta-Endosulphan (% Recovery) DB17		83.3		99.5		72.1		88.7		86.1		93.2		88.6		42.3		87.8		89.6		78.5		79

Appendix F2: SPMD data for US deployments - concentrations represent ng/SPMD

Gratwick Riverside Park (GRP)

Little Niagara River (LNR)

Niagara-on-the-Lake (NOTL)

CLIENT_ID	U/S Gill Creek Mouth		U/S Gill Creek Mouth		U/S Gill Creek Mouth		Gill Ck		Gill Ck		Gill Ck		Bloody Run Ck		Bloody Run Ck		Bloody Run Ck-1		Bloody Run Ck-2		Bloody Run Ck		Bloody Run Ck	
Axys ID	(in Niagara River)-1		(in Niagara River)-2		(in Niagara River)-3		(Mouth)-1		(Mouth)-2		(Mouth)-3		(U/S)-1		(U/S)-2						(D/S)-1		(D/S)-2	
WORKGROUP																								
Sample Size	L23776-65 i		L23776-66		L23776-67		L23776-68		L23776-69		L23776-70		L23776-71		L23776-72		L23776-74		L23776-75 i		L23776-77 i		L23776-78 i	
UNITS	WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52450		WG52450		WG52450	
	1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample	
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene		3.47	J	2.45	NQ			41.3		37.7		34		3.24		3.37	J	2.72	NDR	3.26		4.96		4.01
1,4-Dichlorobenzene		10.6		9.9	NQ			89.3		85.1		77.1		12.2		11.6		15.2		11.8		10.3		10.3
1,2-Dichlorobenzene	J	1.9	J	1.58	NQ			41.1		36.1		34.3	J	2.67	ND			3.18	ND		J	2.7	J	2.75
1,3,5-Trichlorobenzene	J	0.912	J	0.763	NQ		T	7.19	T	7.12	T	5.87	ND		ND		J	2.35	T	8.56	T	3.96	T	4.13
1,2,4-Trichlorobenzene	J	2.1	J	1.57	NQ		T	158	T	155	T	137		4.55		4.64		3.59	T	11.3	T	14.1	T	14.5
1,2,3-Trichlorobenzene	J	0.484	J	0.499	NQ		T	45.5	T	45.1	T	40.5	NDR J	3.08	NDR J	2.77	J	1.32	NDR T	5.51	T	4.61	T	5.37
1,2,4,5-/1,2,3,5-Tetrachlorobenzene		7.58		6.7	NDR J	4.71		44.1		44.7		44.1		10.3		9.59		50.9		59.1		36.9		37.6
1,2,3,4-Tetrachlorobenzene	J	3.09	J	2.48	J	2.61		24.8		24.8		24.1		17.5		17.2		62.2		67.1		48.6		48.3
Hexachlorobutadiene	J	0.646	J	0.633	NDR J	1.9	D	1080		907		790	NDR	5.07		4.88		39.8		53.5		24.2		23.5
Pentachlorobenzene		5.38		4.84		4.74		36.9		36.2		38.7		36.8		37.5		434		609		277		273
Hexachlorobenzene		7.8		7.27		7.33		35		35.5		35		93		104	D	378		395		271		263
HCH, alpha	ND		ND		ND			153		150		151	ND		ND		NDR J	1.77	J	1.95	ND		ND	
HCH, beta	ND		ND		ND		NDR	20	NDR	21.3	NDR	23.1	ND		ND		ND		ND		ND		ND	
HCH, gamma	ND		ND		ND			27.7		27	NDR	29.5	ND		J	3.66	NDR	11.5	NDR J	5.66	ND			9.97
Heptachlor	ND		ND		ND		ND		ND		ND		ND		NDR J	0.777	ND		ND		ND		ND	
Aldrin	ND		ND		ND		NDR J	0.613	ND		ND		ND		ND		NDR J	1.49	NDR J	1.8	ND		ND	
Chlordane, gamma (trans)	J	0.736	J	0.614	J	0.746	J	0.918	J	0.907	J	0.954	J	0.883	J	0.907	J	0.733	J	0.883	J	0.974	J	0.828
Chlordane, alpha (cis)	J	1.24	J	0.986	J	1.17	J	1.47	J	1.38	J	1.54	J	1.39	J	1.45	J	1.1	J	1.38	J	1.42	J	1.39
Octachlorostyrene	J	0.585	J	0.502	NDR J	0.384	J	0.896	J	1.03	J	0.805		8.95		10.2		8.65		9.9		10.6		10.3
Chlordane, oxy-	NDR	14.6	NDR	14.4	NDR	14	NDR	12	NDR	16.2	NDR	18.6	NDR	15.7	NDR	10.6	NDR	10.6	NDR	18.5	NDR	26.6	NDR	17.2
Nonachlor, trans-	J	0.781	J	0.72	J	0.747	J	0.874	J	0.984	J	0.888	J	0.986	J	1.03	J	1.08	J	1.28	J	0.95	J	0.858
Nonachlor, cis-	NDR J	0.247	J	0.263	J	0.252	J	0.347	J	0.34	J	0.349	J	0.286	J	0.326	J	0.415	J	0.506	J	0.358	J	0.387
Mirex	ND		ND		ND		ND		ND		ND		ND		ND		J	2.7	J	2.91	J	1.83	J	1.57
2,4'-DDE (o,p' DDE)	NDR J	0.443	ND		ND		ND		ND		ND		ND		ND		NDR J	0.299	ND		ND		ND	
4,4'-DDE (p,p' DDE)	J	2.34	NDR J	2.55	J	2.28		3.28		3.35		3.36	J	3.08		3.33		6.88		9.3		3.84		3.42
2,4'-DDD (o,p' DDD)	ND		ND		ND		ND		ND		ND		ND		ND		J	0.638	J	0.482	ND		J	0.598
4,4'-DDD (p,p' DDD)	J	1.98	J	1.7	J	1.8	J	2.92	J	2.81		3.44	J	2.33	J	2.42	J	2.67	J	2.86	J	2.21	J	2.89
2,4'-DDT (o,p' DDT)	ND		NDR J	1.16	J	1.12	ND		J	1.32	NDR J	1.61	ND		J	1.2	ND		ND		J	1.12	ND	
4,4'-DDT (p,p' DDT)	ND		ND		ND		ND		ND		ND		ND		ND		J	1.43	J	1.5	J	1.46	ND	
HCH, delta	J	0.784	J Q	0.388	J	0.776		12.6		11.2		12.3	J	0.721	ND		J Q	0.911	ND		ND		J Q	0.645
Heptachlor Epoxide		4.09		3.48	Q	3.57		3.36		3.45		3.92		3.55		3.52		3.08	J Q	1.57	Q	3.14	Q	2.87
Dieldrin		6.81		6.21		7.06		6.73		6.88		7.32		8.54		8.85		6.73		6.7		8.64		7.55
Endrin	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Ketone	ND		ND		ND		J Q	0.206	ND		ND		ND		ND		ND		ND		J Q	0.343	J	0.254
Methoxychlor	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		J	1.52	J	1.27	ND		ND	
beta-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND		J	0.579	ND		ND	
Endosulphan Sulphate	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
13C-1,4-Dichlorobenzene (% Recovery)		10.9		17	NQ			9.34		10.2		5.96		5.69		6.49		5.14		5.02		13.7		11.7
13C-1,2,3-Trichlorobenzene (% Recovery)		25		35.4	NQ		NQ		NQ		NQ			17.8		17.1	NDR	38.9	NQ		NQ		NQ	
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		36.4		47.3		6.94		35.8		35.1		25.6		26		25.2		24.5		20.7		37.9		35.1
13C-Pentachlorobenzene (% Recovery)		49		55.1	V	25.8		47.5		45.2		38.6		39		38.7	NDR	45.5	V	28.7		50.1		45.3
13C-Hexachlorobenzene (% Recovery)		69.7		69.6		49.6		65.5		61.2		59.3		58		61		59.7		52.9		57.7		56.1
13C-beta-HCH (% Recovery)		71.5		72.3		59.1		68.7		61.7		72.6		74.9		71.6		73.4		60.3		65.2		65.8
13C-gamma-HCH (% Recovery)		81		81.7		62.2		82.3		75.7		72		79.6		77.8		77.6		59.8		65.1		66.6
13C-Heptachlor (% Recovery)		87.3		83.4		59.7		77.7		70.5		67.7		76.3		71.9		71.7		64		67.7		65.7
13C-Aldrin (% Recovery)		80.1		78.7		71.3		80.1		76.3		71.5		67.9		55.3		53.9		42.9		58.9		42.5
13C-Chlordane, gamma (trans) (% Recovery)		97.6		95.4		85.6		93.8		89.4		92.2		98.3		93.6		94.5		86.8		90.1		90.2
13C-Nonachlor, trans- (% Recovery)		93.7		90		82.7		91		86.7		88		93.8		92.2		91.9		84.3		87.4		87.5
13C-4,4'-DDE (% Recovery)		96		92.2		88.8		95.4		92.5		95.5		96.9		95.3		95.6		89.2		89.1		90.3
13C-4,4'-DDT (% Recovery)		110		98.4		90.9		101		90.1		95.7		97.3		90.8		90.5		91.4		96.7		93
13C-4,4'-DDD (ng/sample)		90.8		82.7		89.9		88.8		84.0		89.6		90.5		93.3		91.6		88.4		90.3		96.6
D4-alpha-Endosulphan (% Recovery) DB5		75.3		81		97.4		83.2		83.8		92.6		91.7		94.4		85.9		88.7		48.5		92.8
D4-beta-Endosulphan (% Recovery) DB5		79.4		82.5		91.2		90		88.5		93.8		90		93.6		87.6		96.5		45.7		95.1
D4-alpha-Endosulphan (% Recovery) DB17		68.3		75.3		87.7		77.8		79.3		86		85.5		90.4		80.7		80.4		44.6		83.7
D4-beta-Endosulphan (% Recovery) DB17		76.6		79.9		89.8		90.4		88.7		89.4		87.1		90.9		85.1		90.4		46.1		92.6

Appendix F2: SPMD data for Canadian deployments - concentrations represent ng/SPMD

Niagara-on-the-Lake (NOTL)

CLIENT_ID	Fort Erie		Fort Erie		Fort Erie		Ushers Ck-1		Ushers Ck-2		Ushers Ck-3		Niagara River		Niagara River		Niagara River	
Axys ID	at Robertson St-1		at Robertson St-2		at Robertson St-3								U/S of		U/S of		U/S of	
WORKGROUP													Chippawa Channel-1		Chippawa Channel-2		Chippawa Channel-3	
Sample Size	L23776-80 i		L23776-81 i		L23776-82 i		L23776-83 i		L23776-84		L23776-85 RXi		L23776-86		L23776-87		L23776-88	
UNITS	WG52450		WG52450		WG52450		WG52450		WG52450		WG53086		WG52450		WG52450		WG52450	
	1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample		1sample	
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene	J	1.5	J	1.83	ND		J	1.92	ND		ND		NQ		ND		J	2.2
1,4-Dichlorobenzene		10.5		11.3		10.2		9.56		8.38	NDR	11	NQ			8.47		11.1
1,2-Dichlorobenzene	J	1.39	J	1.29	ND		J	1.62	ND		J	3.39	NQ		ND		J	1.3
1,3,5-Trichlorobenzene	ND		ND		ND		NDR J	0.607	ND		ND		ND		ND		ND	
1,2,4-Trichlorobenzene	ND		ND		ND		ND		ND		ND		ND		ND		ND	
1,2,3-Trichlorobenzene	ND		ND		ND		ND		NDR J	2.02	ND		NDR J	1.37	ND		NDR J	1.6
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ND		J	0.28	ND		J	1.72	J	1.62	ND		ND		J	0.329	ND	
1,2,3,4-Tetrachlorobenzene	J	0.28	J	0.258	J	0.305	J	0.473	J	0.458	ND		ND		ND		ND	
Hexachlorobutadiene	ND		ND		ND		ND		NDR J	0.672	ND		NDR J	0.753	ND		ND	
Pentachlorobenzene	J	1.55	J	1.31	J	1.52		5.64		5.61	J	5.57	NDR J	0.946	J	1.37	J	1.07
Hexachlorobenzene		3.76		3.58		3.34	J	1.6	J	1.72	J	1.76	J	2.44	J	2.52	J	2.53
HCH, alpha	ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, beta	ND		ND		ND		ND		ND		ND		ND		ND		ND	
HCH, gamma	ND		NDR J	4.74	ND		ND		ND		ND		ND		ND		ND	
Heptachlor	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Aldrin	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chlordane, gamma (trans)	J	0.997	J	1.06	J	0.951	J	1.38	J	1.53	J	1.34	J	0.64	J	0.604	J	0.696
Chlordane, alpha (cis)	J	1.75	J	1.67	J	1.69	J	2.47	J	2.21	J	1.95	J	0.972	J	1.04	J	1.06
Octachlorostyrene	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Chlordane, oxy-	NDR	28	NDR	18.5	NDR	15.9	NDR	22.2	NDR	28.1	NDR	32.1	NDR	14.2	NDR	27.9	NDR	19.4
Nonachlor, trans-	J	1.19	NDR J	1.15	J	1.19	J	3.25	J	3.03	J	2.63	J	0.72	J	0.592	J	0.779
Nonachlor, cis-	J	0.385	J	0.342	J	0.479	NDR J	1.45	J	1.1	NDR J	0.794	J	0.277	ND		J	0.27
Mirex	ND		ND		ND		ND		ND		ND		ND		ND		ND	
2,4'-DDE (o,p' DDE)	J	1.24	J	1.41	J	1.25	ND		ND		ND		ND		ND		ND	
4,4'-DDE (p,p' DDE)		90.6		104		104		13.8		13.2		12.1		6.89		6.4		6.67
2,4'-DDD (o,p' DDD)		5.78		5.75		5.32	J	0.988	J	1.25	J	0.873	J	0.629	J	0.636	J	0.497
4,4'-DDD (p,p' DDD)		24.8		28.9		28.2		5.1		4.92	J	4.02		3.66		3.5	J	3.29
2,4'-DDT (o,p' DDT)	J	1.34	J	1.57	J	1.77	NDR J	0.388	ND		ND		ND		ND		ND	
4,4'-DDT (p,p' DDT)		5.21		6.03		6.15	J	1.05	J	1.17	J	0.887	J	0.96	J	0.88	J	1.02
HCH, delta	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Heptachlor Epoxide	Q	2.95	Q	2.93	Q	2.82	J Q	1.3	J Q	1.5	J	1.47	J Q	2.35	J Q	2.34	J Q	2.46
Dieldrin		8.65		7.85		7.54		3.33		3.47		3.41		6.3		6.29		5.85
Endrin	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endrin Ketone	J	0.912	J Q	0.311	J Q	0.31	ND		ND		ND		ND		ND		ND	
Methoxychlor	ND		ND		ND		ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND	
beta-Endosulphan	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Endosulphan Sulphate	ND		ND		ND		ND		ND		ND		ND		ND		ND	
13C-1,4-Dichlorobenzene (% Recovery)		14		19.7		10.7		10.5		5.92		5.06	NQ			12.5		15
13C-1,2,3-Trichlorobenzene (% Recovery)		25.9		38.3		20.5		29		14.2		10.4		12.4		29.2		29
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		33.4		46.6		27.2		39.9		21.9		18		22.7		37.7		33.9
13C-Pentachlorobenzene (% Recovery)		39.7		49.3		33.9		46.9	V	29.8	V	29.3		32.9		40.7		38.6
13C-Hexachlorobenzene (% Recovery)		56.3		59.5		53.1		56.4		46.8		51		50.9		55		53.6
13C-beta-HCH (% Recovery)		60.4		59.7		58.4		55.7		48.3		57		62.8		67.7		72.3
13C-gamma-HCH (% Recovery)		59.8		61.2		56.4		58.9		48.5		62.7		64.3		64.1		67
13C-Heptachlor (% Recovery)		46.7		52.9		51.1		51.9		49.3		69.1		63.9		63.7		68.6
13C-Aldrin (% Recovery)		65.9		68.7		63.4		60.7		58.2		71.8		50.7	NDR	63.3	NDR	53.9
13C-Chlordane, gamma (trans) (% Recovery)		78.1		85.4		86.4		80.9		74.1		85.9		90.7		89.2		92.2
13C-Nonachlor, trans- (% Recovery)		74.4		82.5		82.6		77.1		71.9		88.5		86.2		87.3		92.5
13C-4,4'-DDE (% Recovery)		86.6		90.4		92.5		84.7		82		92		89.5		90.8		94.1
13C-4,4'-DDT (% Recovery)		68.8		77.2		78.6		76.8		72.4		92		94.5		93.4		100
13C-4,4'-DDD (ng/sample)		99.6		97.9		97.8		96.8		89.7		94.9		89.0		83.5		89.3
D4-alpha-Endosulphan (% Recovery) DB5		92		94.1		91.7		85.8		86.6		103		79.5		95		88.1
D4-beta-Endosulphan (% Recovery) DB5		90.4		94.1		95.6		85		79.1		88.4		92		87.8		91.3
D4-alpha-Endosulphan (% Recovery) DB17		78.3		79.9		72.3		87		77.5		90.9		73.8		79.8		72.7
D4-beta-Endosulphan (% Recovery) DB17		95.3		91.1		93.9		92.6		79.3		79.9		84		102		88.1

Appendix F2: SPMD data for Canadian deployments - concentrations represent ng/SPMD

Niagara-on-the-Lake (NOTL)

CLIENT_ID	NOTL-1		NOTL-2		NOTL-3		Balsam Lake		Balsam Lake		Balsam Lake	
Axys ID							Control-1		Control-2		Control-3	
WORKGROUP												
Sample Size	L23776-89		L23776-90		L23776-91		L23776-92 RXi		L23776-93		L23776-94	
UNITS	WG52450		WG52450		WG52450		WG53086		WG52450		WG52450	
	1sample		1sample		1sample		1sample		1sample		1sample	
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
1,3-Dichlorobenzene		3.89	J	2.68		3.25	J	2.05		3.13	J	1.72
1,4-Dichlorobenzene		14.5		12.5		13.5		10.8		11.3		8.11
1,2-Dichlorobenzene	ND		J	2.12	ND		J	3.05	ND		J	2.09
1,3,5-Trichlorobenzene	ND		NDR J	0.749	ND		ND		ND		ND	
1,2,4-Trichlorobenzene		4.28		3.98		3.94	ND		ND		ND	
1,2,3-Trichlorobenzene	NDR J	2.97	ND		ND		ND		ND		ND	
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	J	4.03	J	4.44	J	3.99	ND		ND		ND	
1,2,3,4-Tetrachlorobenzene		9.58		10.6		9.59	ND		ND		ND	
Hexachlorobutadiene	J	2.34	J	1.91	J	1.92	ND		ND		ND	
Pentachlorobenzene		10.1		10.6		9.88	ND		J	0.56	NDR J	0.532
Hexachlorobenzene		13.5		14.5		13.3	J	1.56	J	1.74	J	1.53
HCH, alpha	ND		ND		ND		ND		ND		ND	
HCH, beta	ND		ND		ND		ND		ND		ND	
HCH, gamma	ND		ND		ND		ND		ND		ND	
Heptachlor	ND		NDR	3.74	ND		ND		NDR	7.38	NDR	7.54
Aldrin	ND		ND		ND		ND		ND		ND	
Chlordane, gamma (trans)	J	0.897	J	0.822	J	0.822	ND		J	0.47	NDR J	0.316
Chlordane, alpha (cis)	J	1.29	J	1.21	J	1.12	ND		J	0.513	J	0.507
Octachlorostyrene	J	2.6	J	2.66	J	2.34	ND		ND		ND	
Chlordane, oxy-	NDR	20.8	NDR	20.9	NDR	17.3	NDR	17.4	NDR	24.7	NDR	26.9
Nonachlor, trans-	NDR J	0.774	NDR J	0.887	J	0.919	J	0.348	J	0.367	J	0.407
Nonachlor, cis-	ND		J	0.368	J	0.269	ND		ND		ND	
Mirex	ND		ND		ND		ND		ND		ND	
2,4'-DDE (o,p' DDE)	ND		ND		ND		ND		ND		ND	
4,4'-DDE (p,p' DDE)	J	2.96	J	2.78	J	2.7	J	1.91	J	2.22	NDR J	2.12
2,4'-DDD (o,p' DDD)	ND		ND		ND		ND		ND		ND	
4,4'-DDD (p,p' DDD)	J	2.56	J	1.6	J	2.14	J	0.746	ND		ND	
2,4'-DDT (o,p' DDT)	ND		NDR J	1.34	ND		ND		ND		ND	
4,4'-DDT (p,p' DDT)	ND		ND		ND		ND		ND		ND	
HCH, delta	J	0.759	ND		ND		ND		ND		ND	
Heptachlor Epoxide	Q	2.96	Q	2.84	J Q	2.32	J	1.28	J Q	1.19	J Q	1.21
Dieldrin		6.25		6.01		5.33	J Q	1.44	J	2.23	J	2.34
Endrin	ND		ND		ND		ND		ND		ND	
Endrin Aldehyde	ND		ND		ND		ND		ND		ND	
Endrin Ketone	ND		ND		ND		ND		ND		ND	
Methoxychlor	ND		ND		ND		ND		ND		ND	
alpha-Endosulphan	ND		ND		ND		ND		ND		ND	
beta-Endosulphan	ND		ND		ND		ND		ND		ND	
Endosulphan Sulphate	ND		ND		ND		ND		ND		ND	
13C-1,4-Dichlorobenzene (% Recovery)		5.73		7.72		7.06		11.1		9.53		12.9
13C-1,2,3-Trichlorobenzene (% Recovery)		13.5		24.2		20.2		24.2		21.1		28.2
13C-1,2,3,4-Tetrachlorobenzene (% Recovery)		20		35		29.5		32		29.7		35.2
13C-Pentachlorobenzene (% Recovery	V	27.5		42.3		38.5		40.3		38.8		41.8
13C-Hexachlorobenzene (% Recovery)		49.9		57.3		57.6		58.6		56.2		55.4
13C-beta-HCH (% Recovery)		63.3		58.4		67.4		58.4		58.6		52.9
13C-gamma-HCH (% Recovery)		59.7		60.3		61.3		68.9		61.3		57.4
13C-Heptachlor (% Recovery)		51.6		56.8		54.6		76.7		57		59.2
13C-Aldrin (% Recovery)		62.9		67		65.2		76.9		64.4		62
13C-Chlordane, gamma (trans) (% Recovery)		87.2		86.7		85.2		89.4		76.8		75
13C-Nonachlor, trans- (% Recovery)		83.4		84.6		84.2		88.2		73.6		74.3
13C-4,4'-DDE (% Recovery)		91.7		88.6		89.3		93.3		85.2		80.1
13C-4,4'-DDT (% Recovery)		77.3		91.1		80.2		95.3		76		82.6
13C-4,4'-DDD (ng/sample)		91.1		78.0		90.7		92.8		88.2		82.3
D4-alpha-Endosulphan (% Recovery) DB5		94.1		94.7		88.8		139		84.5		115
D4-beta-Endosulphan (% Recovery) DB5		102		90.9		94.3		120		87		115
D4-alpha-Endosulphan (% Recovery) DB17		80.5		86.5		81.4		130		79		98.5
D4-beta-Endosulphan (% Recovery) DB17		97.1		91.7		92.8		112		83.9		109

F3: Dioxin and furan concentrations in SPMD

CLIENT ID		Bloody Run Ck (U/S)-3			Bloody Run Ck-3			Bloody Run Ck (D/S)-3			Lab Blank (101)			Bloody Run Ck BLANK 2 OF 2			Spiked Matrix (102)	
Axys ID		L23776-73			L23776-76			L23776-79			WG52451-101			L23776-3			WG52451-102	
WORKGROUP		WG52451			WG52451			WG52451			WG52451			WG52451			WG52451	
Sample Size		1sample			1sample			1sample			1sample			1sample				
UNITS	flag	pg/sample	pg/sample (RL)	flag	pg/sample	pg/sample (RL)	flag	pg/sample	pg/sample (RL)	flag	pg/sample	pg/sample (RL)	flag	pg/sample	pg/sample (RL)	flag	% Recovery	-
2,3,7,8-TCDD	J	5.81	0.762		128	1.46		40.8	0.76	U		0.757	U		0.762		97.1	
1,2,3,7,8-PECDD	U		0.762	J	1.64	0.801	U		0.76	U		0.757	U		0.762		103	
1,2,3,4,7,8-HXCDD	U		0.762	J	1.24	0.917	K J	0.825	0.76	U		0.757	U		0.762		91.6	
1,2,3,6,7,8-HXCDD	U		0.762	K J	13.4	0.917	J	5.25	0.76	U		0.757	U		0.762		94.3	
1,2,3,7,8,9-HXCDD	J	1.34	0.762	J	7.25	0.917	J	3.52	0.76	U		0.757	U		0.762		86.9	
1,2,3,4,6,7,8-HPCDD	J	4.37	0.762	J	23.1	1.46	J	12.2	0.84	U		1.49	K J	1.26	0.937		90.5	
OCDD	J	15.3	0.762	J	15.9	1.98	J	15.5	1.29	K J	1.53	1.36	J	2.59	0.762		90.7	
2,3,7,8-TCDF (225)	K J	3.01	0.762	J	1.86	0.758	J	2.03	0.76									
2,3,7,8-TCDF	K J	3.37	0.762	J	8.18	1.44	K J	5.01	0.76	U		0.757	U		0.762		89.2	
1,2,3,7,8-PECDF	U		0.762	K J	2.3	1.66	U		0.76	U		0.757	U		0.762		93	
2,3,4,7,8-PECDF	J	1.32	0.762	J	3.51	1.66	J	1.97	0.76	U		0.757	U		0.762		94.4	
1,2,3,4,7,8-HXCDF	K J	1.29	0.762	K J	6.05	1.47	J	3.2	0.76	U		0.757	U		0.762		93.8	
1,2,3,6,7,8-HXCDF	K J	0.836	0.762	U		1.47	J	0.907	0.76	U		0.757	U		0.762		92.8	
1,2,3,7,8,9-HXCDF	U		0.762	U		1.47	U		0.76	U		0.757	U		0.762		98.2	
2,3,4,6,7,8-HXCDF	U		0.762	U		1.47	U		0.76	U		0.757	U		0.762		93.7	
1,2,3,4,6,7,8-HPCDF	J	2.07	0.762	J	3.26	1.14	J	3.48	0.76	U		1.06	U		0.762		96.7	
1,2,3,4,7,8,9-HPCDF	U		0.762	U		1.14	U		0.76	U		1.06	U		0.762		97.1	
OCDF	K J	4.97	0.762	J	5.32	0.758	J	8.01	0.762	U		1.14	U		0.762		118	
TOTAL TETRA-DIOXINS		7.64	0.762		128	1.46		42.8	0.76	U		0.757	U		0.762			
TOTAL PENTA-DIOXINS	U		0.762		9.1	0.801		2.25	0.76	U		0.757	U		0.762			
TOTAL HEXA-DIOXINS		1.34	0.762		42.9	0.917		21.9	0.76	U		0.757	U		0.762			
TOTAL HEPTA-DIOXINS		10.1	0.762		36.3	1.46		18.2	0.84	U		1.49		1.47	0.937			
OCDD	J	15.3	0.762	J	15.9	1.98	J	15.5	1.29	K J	1.53	1.36	J	2.59	0.762		90.7	
TOTAL TETRA-FURANS		29.4	0.762		81.4	1.44		16.2	0.76	U		0.757	U		0.762			
TOTAL PENTA-FURANS		4.34	0.762		29.7	1.66		12	0.76	U		0.757	U		0.762			
TOTAL HEXA-FURANS	U		0.762		5.51	1.47		6.64	0.76	U		0.757	U		0.762			
TOTAL HEPTA-FURANS		2.07	0.762		3.26	1.14		3.48	0.76	U		1.06	U		0.762			
OCDF	K J	4.97	0.762	J	5.32	0.758	J	8.01	0.762	U		1.14	U		0.762		118	
13C-2,3,7,8-TCDD (% Recovery)		78.2			84.9			64.5			59.6			71.8			57	
13C-1,2,3,7,8-PECDD (% Recovery)		100			92.8			93			69.5			90.2			79.2	
13C-1,2,3,4,7,8-HXCDD (% Recovery)		82.1			83.9			82.6			61.2			75.5			68.6	
13C-1,2,3,6,7,8-HXCDD (% Recovery)		84.8			86.9			86.6			61.3			76.2			70.1	
13C-1,2,3,4,6,7,8-HPCDD (% Recovery)		75.7			92.2			72.7			56			68.7			69	
13C-OCDD (% Recovery)		70.1			75.2			39			50.6			65.9			47.2	
13C-2,3,7,8-TCDF (% Recovery)		79			89.8			89.8			60.4			73.8			65.8	
13C-1,2,3,7,8-PECDF (% Recovery)		76.1			81.5			76.6			59.2			69.5			62.9	
13C-2,3,4,7,8-PECDF (% Recovery)		67.3			76.1			76.1			51.5			61.2			57	
13C-1,2,3,4,7,8-HXCDF (% Recovery)		84			87.3			89.2			66.7			79			70.5	
13C-1,2,3,6,7,8-HXCDF (% Recovery)		88.5			88.2			86.2			68.3			81.2			73.7	
13C-1,2,3,7,8,9-HXCDF (% Recovery)		77.3			84.8			82			61.1			72.7			68.6	
13C-2,3,4,6,7,8-HXCDF (% Recovery)		78.8			88			88.2			58.3			74.3			65.9	
13C-1,2,3,4,6,7,8-HPCDF (% Recovery)		78.4			84.3			42.7			59.4			70.7			55	
13C-1,2,3,4,7,8,9-HPCDF (% Recovery)		72.1			85.8			74.3			58			70.4			66.4	
37CL-2,3,7,8-TCDD (% Recovery)		69.2			79.5			62.5			56.3			60.8			60.1	
13C6-1,2,3,4-TCDD (pg/sample)		1296			1212			1753						1495				

Appendix F4: Homologue data, ng/SPMD. Individual congener data can be obtained on request
Gratwick Riverside Park (GRP)
Little Niagara River (LNR)
Niagara-on-the-Lake (NOTL)

CLIENT_ID			Two Mile Ck (Mouth)-1		Two Mile Ck (Mouth)-2		Two Mile Ck (Mouth)-3		Pettit Flume (D/S)-1		Pettit Flume (D/S)-2		Pettit Flume (D/S)-3		Pettit Flume (Outer Site B)-1		Pettit Flume (Outer Site B)-2		Pettit Flume (Outer Site B)-3
Axys ID			L23776-5 L		L23776-6 L		L23776-7 L		L23776-8 i		L23776-9 L		L23776-10 L		L23776-11 LNK		L23776-12 LNK		L23776-13 LNK
WORKGROUP			WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369		WG52369
UNITS		flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls	Mono	ND		ND		ND			116		93.3		98		14200		15200		14400
Total Dichloro Biphenyls	Di		28.8		21.2		23		79.2		77.2		77		3048		2976.1		2896
Total Trichloro Biphenyls	Tri		151.1		145.4		155		102.3		95.9		108		45.9		44.9		47
Total Tetrachloro Biphenyls	Tetra		642.8		599.2		640		118.9		103.9		116		45.7		43.8		42
Total Pentachloro Biphenyls	Penta		326		312		340		36.3		37.1		40		59.4		60.5		59
Total Hexachloro Biphenyls	Hexa		112		106		111		14.5		14		15		64.8		69.5		66
Total Heptachloro Biphenyls	Hepta		21.3		20.6		20		3.91		3.44		4		18.2		19.9		18
Total Octachloro Biphenyls	Octa		2.19		2.39		3		0.284	ND			1		1.95		1.33		1
Total Nonachloro Biphenyls	Nona	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Decachloro Biphenyl	Deca	ND		ND		ND		ND		ND		ND		ND			0.142		0.129
Total PCB=TOTAL PCBs			**1282**		**1202**		**1286**		**470**		**424**		**457**		**17469**		**18367**		**17566**

CLIENT_ID			Pettit Flume (U/S)-1		Pettit Flume (U/S)-2		Pettit Flume (U/S)-3		Fisherman's Park (D/S)-1		Fisherman's Park (D/S)-2		Fisherman's Park (D/S)-3		Fisherman's Park (U/S)-1		Fisherman's Park (U/S)-2		Fisherman's Park (U/S)-3
Axys ID			L23776-14 Li2		L23776-15 L		L23776-16 L		L23776-17 L		L23776-18 L		L23776-19 i		L23776-20 i		L23776-21 i		L23776-22 i
WORKGROUP			WG52369		WG52369		WG52369		WG52369		WG52369		WG52371		WG52371		WG52371		WG52371
UNITS		flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls	Mono		9		4.37		3		18.7		10.5		12		13.1		8.66		11
Total Dichloro Biphenyls	Di		52.9		50.4		52		46.8		35.3		37		52.5		53.9		50
Total Trichloro Biphenyls	Tri		116.2		133.2		131		103.2		102.5		133		143.3		151.3		155
Total Tetrachloro Biphenyls	Tetra		133.5		127.9		131		135.7		134.7		155		190.7		190.6		197
Total Pentachloro Biphenyls	Penta		45		41.9		40		46.5		47.1		56		63.6		63.5		62
Total Hexachloro Biphenyls	Hexa		13.5		13.8		14		17.4		17.8		20		20.9		20.1		20
Total Heptachloro Biphenyls	Hepta		3.44		3.07		3		4.24		4.52		5		5.22		4.64		5
Total Octachloro Biphenyls	Octa		0.236	ND		ND		ND		ND			1		0.364		0.669		1
Total Nonachloro Biphenyls	Nona	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Decachloro Biphenyl	Deca	ND		ND		ND		ND		ND			0.142		0.197		0.111	ND	
Total PCB=TOTAL PCBs			**375**		**374**		**374**		**373**		**354**		**418**		**491**		**493**		**499**

CLIENT_ID			GRP (U/S of Marina)-1		GRP (U/S of Marina)-2		GRP (U/S of Marina)-3		GRP (in Marina)-1		GRP (in Marina)-2		GRP (in Marina)-3		GRP (U/S of Dump)-1		GRP (U/S of Dump)-2		GRP (U/S of Dump)-3
Axys ID			L23776-23 i		L23776-24 i		L23776-25 i		L23776-26 L		L23776-27 L		L23776-28 L		L23776-29 i		L23776-30 i		L23776-31 i
WORKGROUP			WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371		WG52371
UNITS		flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls	Mono		35.8		33.1		32		10.7		11.6	ND			61.4		20.8		18
Total Dichloro Biphenyls	Di		591.7		523.9		546		296.6		304.1		313		183.2		175.5		113
Total Trichloro Biphenyls	Tri		2395.1		2460.3		2273		1162		1221		1359		553.8		541		509
Total Tetrachloro Biphenyls	Tetra		4024.4		3645		3594		1647.1		1734.3		1895		751.2		757.4		739
Total Pentachloro Biphenyls	Penta		960		859		835		460		471		509		194		198		197
Total Hexachloro Biphenyls	Hexa		110		99.6		102		107		108		118		35.6		35.1		40
Total Heptachloro Biphenyls	Hepta		28		25.9		28		25.8		25.6		28		8.87		8.91		12
Total Octachloro Biphenyls	Octa		6.16		5.73		6		3.63		3.35		4		1.43		1.04		3
Total Nonachloro Biphenyls	Nona		0.338		0.417	ND		ND			0.283		0.294		0.224	ND			0.323
Decachloro Biphenyl	Deca	ND			0.169	ND			0.236		0.269		0.258		0.107		0.11		0.132
Total PCB=TOTAL PCBs			**8161**		**7656**		**7417**		**3711**		**3877**		**4225**		**1790**		**1737**		**1627**

Appendix F4: Homologue data, ng/SPMD. Individual congener data can be obtained on request

Gratwick Riverside Park (GRP)
Little Niagara River (LNR)
Niagara-on-the-Lake (NOTL)
Storm Sewer (SS)

CLIENT_ID		GRP (Middle of Park)-1		GRP (Middle of Park)-2		GRP (Middle of Park)-3		GRP (D/S)-1		GRP (D/S)-2		GRP (D/S)-3		102nd St (U/S)-1		102nd St (U/S)-2		102nd St (U/S)-3
Axys ID		L23776-32 i		L23776-33 i		L23776-34 i		L23776-35 i		L23776-36 i		L23776-37		L23776-38		L23776-39		L23776-40
WORKGROUP		WG52371		WG52371		WG52371		WG52371		WG52371		WG52400		WG52400		WG52400		WG52400
UNITS	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls		17.2		17		16		20.2		22.5		20		7.76		12		7
Total Dichloro Biphenyls		122		112.8		114		112.2		123.9		112		75.1		77.9		91
Total Trichloro Biphenyls		371.3		382.5		372		326.1		394.5		335		252.1		254.5		239
Total Tetrachloro Biphenyls		454.5		453		436		366.5		430.6		381		293.9		290.9		283
Total Pentachloro Biphenyls		116		113		110		99.5		116		104		97		88.7		94
Total Hexachloro Biphenyls		27.1		26.1		25		22.6		26.9		26		30.1		27.5		29
Total Heptachloro Biphenyls		6.99		6.86		7		4.91		6.64		5		5.88		5		6
Total Octachloro Biphenyls		0.483		0.472		1		0.403		0.564		0.461		0.306	ND			0.315
Total Nonachloro Biphenyls	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Decachloro Biphenyl	ND		ND			0.102	ND			0.129		0.157		0.086	ND		ND	
Total PCB=TOTAL PCBs		**1115**		**1112**		**1082**		**953**		**1123**		**979**		**763**		**756**		**750**
CLIENT_ID		LNR (Near 102nd St)-1		LNR (Near 102nd St)-2		LNR (Near 102nd St)-3		Cayuga Creek -1		Cayuga Creek-2		Cayuga Creek-3		LNR (D/S Cayuga)-1		LNR (D/S Cayuga)-2		LNR (D/S Cayuga)-3
Axys ID		L23776-41		L23776-42		L23776-43		L23776-44 L		L23776-45 L		L23776-46 L		L23776-47		L23776-48		L23776-49
WORKGROUP		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400		WG52400
UNITS	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls		17		12.4		12	ND		ND		ND		ND			3.88	ND	
Total Dichloro Biphenyls		149.2		144.4		144		11.3		18		9		82.1		70.5		14.6
Total Trichloro Biphenyls		316.9		303.8		308		62.3		53.3		46		209.4		198.4		171.6
Total Tetrachloro Biphenyls		321.8		305.4		286		100.8		94.6		91		256.3		264.9		226.4
Total Pentachloro Biphenyls		107		103		98		73.8		72		68		79.8		83		84.7
Total Hexachloro Biphenyls		30.4		28.2		29		29.5		28.9		28		24.1		25.1		25.8
Total Heptachloro Biphenyls		5.23		4.66		4		4.28		4.06		4		4.17		4.48		4.55
Total Octachloro Biphenyls		0.507		0.681		0.143		0.265		0.225	ND			0.297		0.573		0.633
Total Nonachloro Biphenyls	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Decachloro Biphenyl	ND		ND			0.092	ND		ND		ND			0.14	ND		ND	
Total PCB=TOTAL PCBs		**950**		**908**		**877**		**283**		**271**		**247**		**656**		**651**		**660**
CLIENT_ID		U/S OCC.-1		U/S OCC. -2		U/S OCC.-3		D/S Storm Sewer (SS) A-1		D/S SS A-2		D/S SS A-3		D/S SS B-1		D/S SS B-2		D/S SS B-3
Axys ID		L23776-50		L23776-51		L23776-52		L23776-53		L23776-54		L23776-55		L23776-56		L23776-57		L23776-58
WORKGROUP		WG52400		WG52400		WG52400		WG52400		WG52400		WG52449		WG52449		WG52449		WG52449
UNITS	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls		1.96		5.1		5		6.5		5.44		5		5.5		4.96		9
Total Dichloro Biphenyls		100.3		95.8		96		94.6		75.2		101		80.7		83.2		85
Total Trichloro Biphenyls		305.9		272		297		249.6		259.4		230		235.3		219.6		220
Total Tetrachloro Biphenyls		357		353.5		337		312		300.9		296		278.4		288		245
Total Pentachloro Biphenyls		105		99.1		105		91.4		87.9		87		83.9		88.7		75
Total Hexachloro Biphenyls		28.7		27.9		29		24.9		25.1		23		22.8		25		19
Total Heptachloro Biphenyls		5.84		5.91		6		5.67		5.26		6		3.68		5.66		4
Total Octachloro Biphenyls	ND			0.14		0.135		0.638	ND			0.356		0.495		0.333		1
Total Nonachloro Biphenyls	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Decachloro Biphenyl	ND		ND		ND			0.164		0.131	ND		ND			0.161		0.111
Total PCB=TOTAL PCBs		**902**		**860**		**875**		**786**		**759**		**748**		**710**		**717**		**659**

Appendix F4: Homologue data, ng/SPMD. Individual congener data can be obtained on request

Gratwick Riverside Park (GRP)
Little Niagara River (LNR)
Niagara-on-the-Lake (NOTL)
Bloody Run Creek (BRC)

CLIENT_ID	SS C-1		SS C-2		SS C-3		OCC 003-1		OCC 003-2		OCC 003-3		U/S Gill Creek (in NR)-1		U/S Gill Creek (NR)-2		U/S Gill Creek (in NR)-3	
Axys ID	L23776-59		L23776-60		L23776-61		L23776-62		L23776-63		L23776-64		L23776-65 i		L23776-66		L23776-67	
WORKGROUP	WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52449	
UNITS	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls		4.94		3.8		2		7		6.05	ND		ND		ND		ND	
Total Dichloro Biphenyls		61.8		57.1		44		234.2		239.2		174	ND			1.2		1
Total Trichloro Biphenyls		165.8		152.7		162		3887.4		4619.9		2702		10.6		8.2		8
Total Tetrachloro Biphenyls		282.3		255.7		262		9593.8		11663.4		6056		14		12.9		12
Total Pentachloro Biphenyls		83.5		74.9		80		2150		2890		1340		9.31		7.83		7
Total Hexachloro Biphenyls		17.7		15.8		16		138		199		95		5		3.74		4
Total Heptachloro Biphenyls		3.77		2.68		3		14		21.2		10		1.24		0.845		1
Total Octachloro Biphenyls		0.651		0.402		0.347		2.98		5.2		1	ND		ND		ND	
Total Nonachloro Biphenyls	ND		ND		ND		ND			0.559	ND		ND		ND		ND	
Decachloro Biphenyl		0.167		0.141		0.177		0.504		0.495		0.391	ND		ND		ND	
Total PCB=TOTAL PCBs		**620**		**564**		**570**		**15978**		**19671**		**10376**		**40**		**34**		**32**

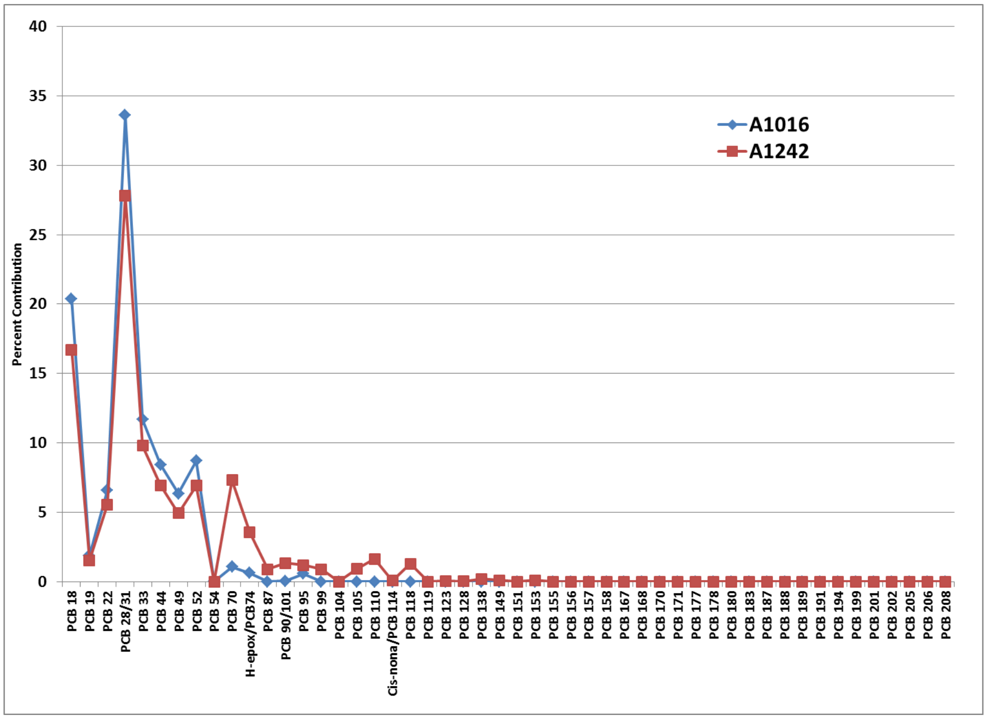
CLIENT_ID	Gill Ck (Mouth)-1		Gill Ck (Mouth)-2		Gill Ck (Mouth)-3		BRC (U/S)-1		BRC (U/S)-2		BRC-1		BRC-2		BRC (D/S)-1		BRC (D/S)-2	
Axys ID	L23776-68		L23776-69		L23776-70		L23776-71		L23776-72		L23776-74		L23776-75 i		L23776-77 i		L23776-78 i	
WORKGROUP	WG52449		WG52449		WG52449		WG52449		WG52449		WG52449		WG52450		WG52450		WG52450	
UNITS	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls	ND			1.88		2	ND		ND		ND		ND		ND		ND	
Total Dichloro Biphenyls		14.5		13.5		13		2.5		1		4.4		2		2.6		1
Total Trichloro Biphenyls		161.3		179.3		167		15.1		15		76.7		65		40.5		42
Total Tetrachloro Biphenyls		339		351.2		303		28.2		27		138.5		125		73.8		64
Total Pentachloro Biphenyls		93.9		97.6		81		13.5		13		48.3		46		26.8		25
Total Hexachloro Biphenyls		16.2		17.3		15		5.79		6		15.7		19		7.75		8
Total Heptachloro Biphenyls		2.89		3.05		3		1.39		2		4.17		6		1.12		1
Total Octachloro Biphenyls		0.191		0.298	ND		ND		ND			0.541		1	ND		ND	
Total Nonachloro Biphenyls	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Decachloro Biphenyl	ND		ND		ND		ND		ND			0.101	ND			0.129	ND	
Total PCB=TOTAL PCBs		**628**		**664**		**583**		**67**		**64**		**289**		**264**		**153**		**140**

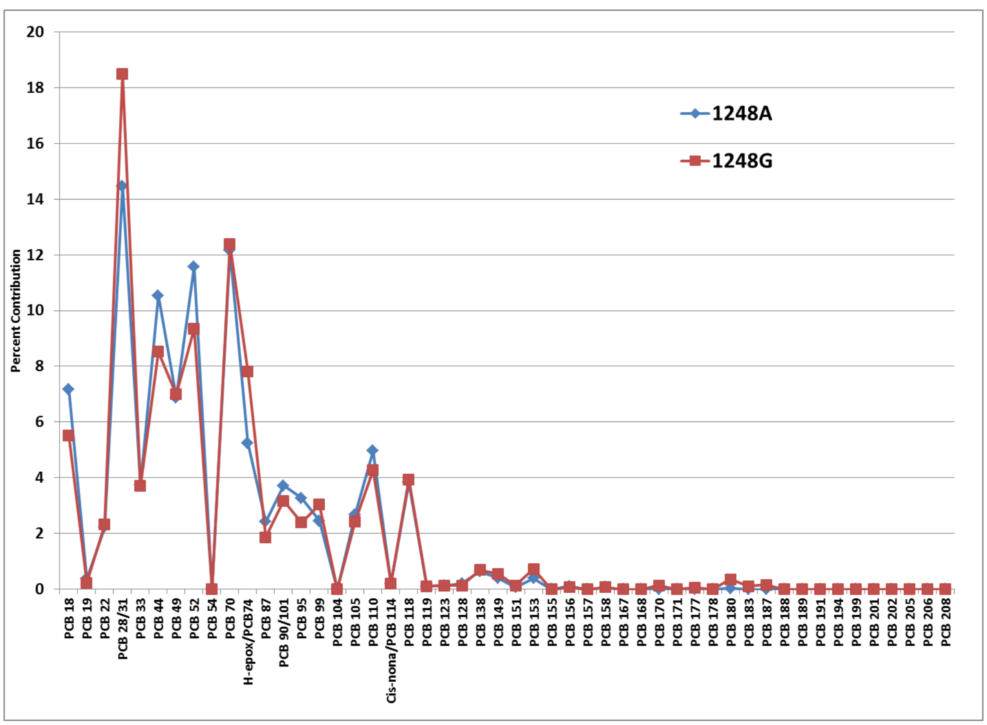
Appendix F4: Homologue data, ng/SPMD. Individual congener data can be obtained on request

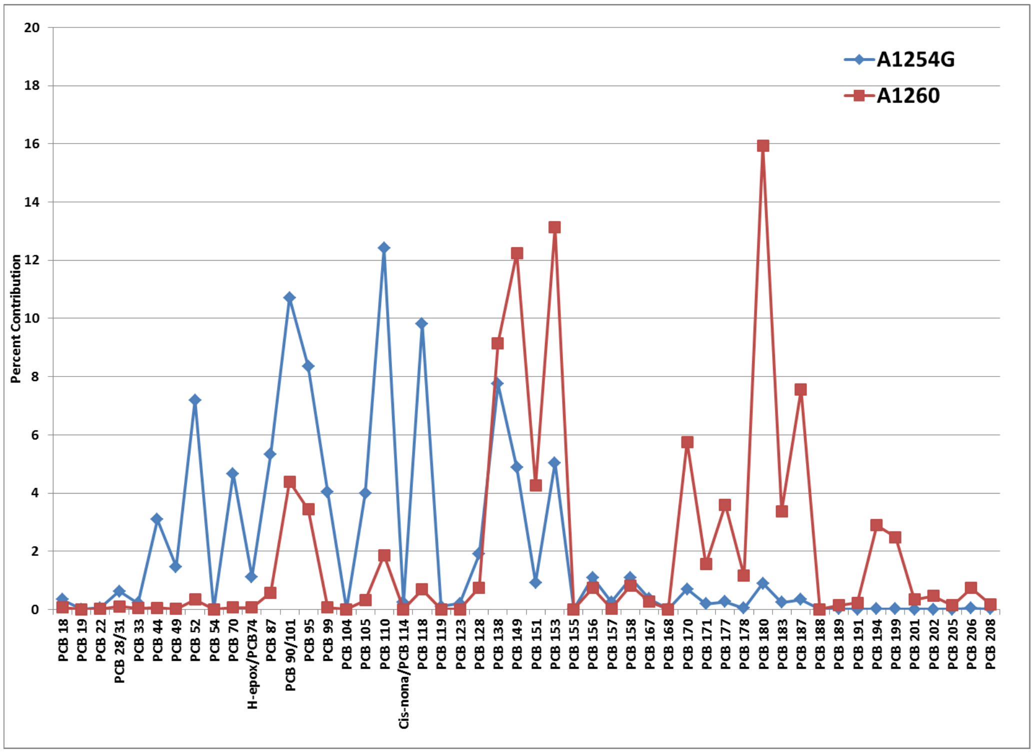
Niagara-on-the-Lake (NOTL)

CLIENT_ID		Fort Erie -1		Fort Erie -2		Fort Erie -3		Ushers Ck-1		Ushers Ck-2		Ushers Ck-3		Chippawa Channel-1		Chippawa Channel-2		Chippawa Channel-3
Axys ID		L23776-80 i		L23776-81 i		L23776-82 i		L23776-83 i		L23776-84		L23776-85 RXi		L23776-86		L23776-87		L23776-88
WORKGROUP		WG52450		WG52450		WG52450		WG52450		WG52450		WG53086		WG52450		WG52450		WG52450
UNITS	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample
Total Monochloro Biphenyls	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Total Dichloro Biphenyls		2.3		1.9	ND		ND		ND		ND			1.3	ND			1
Total Trichloro Biphenyls		6.2		6.7		6		3.8		4.5		4		4.5		3.8		5
Total Tetrachloro Biphenyls		9.3		8.6		9		4.8		0.8		3		3.5		0.9		6
Total Pentachloro Biphenyls		7.84		7.98		8		1.9		2		2		3.46		3.06		3
Total Hexachloro Biphenyls		3.36		4.32		4		2.09		1.51		2		2.32		1.66		2
Total Heptachloro Biphenyls	ND			0.485		0.255		0.503		0.529	ND			0.232		0.214		0.408
Total Octachloro Biphenyls	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Total Nonachloro Biphenyls	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Decachloro Biphenyl	ND		ND		ND		ND		ND		ND		ND		ND		ND	
Total PCB=TOTAL PCBs		**29**		**30**		**28**		**13**		**9**		**11**		**15**		**9**		**18**
CLIENT_ID																		
Axys ID		NOTL-1		NOTL-2		NOTL-3		Balsam Lake Control-1		Balsam Lake Control-2		Balsam Lake Control-3						
WORKGROUP		L23776-89		L23776-90		L23776-91		L23776-92 RXi		L23776-93		L23776-94						
UNITS		WG52450		WG52450		WG52450		WG53086		WG52450		WG52450						
	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample	flag	ng/sample						
Total Monochloro Biphenyls																		
Total Dichloro Biphenyls	ND		ND		ND		ND		ND		ND							
Total Trichloro Biphenyls		2.3		6.2		3	ND		ND		ND							
Total Tetrachloro Biphenyls		24.9		25.8		26		3.2		3.1		3						
Total Pentachloro Biphenyls		34.7		39.1		33		1.4		1.9		1						
Total Hexachloro Biphenyls		14.2		13.9		13	ND			0.34	ND							
Total Heptachloro Biphenyls		5.42		5.97		3	ND			0.701		0.457						
Total Octachloro Biphenyls		0.718		0.724		1	ND		ND		ND							
Total Nonachloro Biphenyls	ND		ND		ND		ND		ND		ND							
Decachloro Biphenyl	ND		ND		ND		ND		ND		ND							
Total PCB=TOTAL PCBs	ND		ND		ND		ND		ND		ND							
		83		**91**		**80**		**5**		**6**		**5**						

Appendix G: Aroclor Profiles for PCBC3485






Percent Contribution
A1254G
A1260
PCB 18
PCB 19
PCB 22
PCB 28/31
PCB 33
PCB 44
PCB 49
PCB 52
PCB 54
PCB 70
H-epox/PCB74
PCB 87
PCB 90/101
PCB 95
PCB 99
PCB 104
PCB 105
PCB 110
Cis-nona/PCB 114
PCB 118
PCB 119
PCB 123
PCB 128
PCB 138
PCB 149
PCB 151
PCB 153
PCB 155
PCB 156
PCB 157
PCB 158
PCB 167
PCB 168
PCB 170
PCB 171
PCB 177
PCB 178
PCB 180
PCB 183
PCB 187
PCB 188
PCB 189
PCB 191
PCB 194
PCB 199
PCB 201
PCB 202
PCB 205
PCB 206
PCB 208