

Chemistry Data Summary
Open Water Remediation Area
Esquimalt Graving Dock Waterlot
Public Works and Government Services Canada

							CSR Soil Standards ³						CSR Schedule 7 Standards Triggering Contaminated Soil Relocation Agreements ⁶				BC Hazardous Waste Regulation (HWR) ⁷
Parameter	Units ¹	Mean	Maximum	Minimum	Remedial Action Objective ²		Residential Land Use (RL) ⁴	MCS ⁵	Commercial Land Use (CL) ⁴	MCS ⁵	Industrial Land Use (IL) ⁴	MCS ⁵	Nonagricultural Land	Agricultural Land	Waste Disposal Prohibited without Authorization		
Polycyclic Aromatic Hydrocarbons							Aquatic Life and Drinking Water						Column II	Column III	Column IV		
acenaphthene	ug/g	0.35	14.9	< MDL	0.0889	PEL											
acenaphthylene	ug/g	0.07	0.73	< MDL	0.128	PEL											
anthracene	ug/g	0.46	17.7	< MDL	0.245	PEL											
benzo(a)anthracene	ug/g	0.74	17.8	< MDL	0.693	PEL	1		10		10		1	0.1	10		
benzo(a)pyrene	ug/g	0.83	14.4	< MDL	0.763	PEL	1	T	10	T	10	T	1	0.1	10		
benzo(b)fluoranthene	ug/g	1.13	14.7	0.005			1		10		10		1	0.1	10		
benzo(k)fluoranthene	ug/g	0.41	5.35	0.005			1		10		10		1	0.1	10		
chrysene	ug/g	0.86	19.7	< MDL	0.846	PEL											
dibenz(a,h)anthracene	ug/g	0.14	1.98	< MDL	0.135	PEL	1		10		10		1	0.1	10		
fluoranthene	ug/g	1.58	25.1	< MDL	1.494	PEL											
fluorene	ug/g	0.32	12.4	< MDL	0.144	PEL											
indeno(1,2,3-c,d)pyrene	ug/g	0.50	4.77	0.005			1		10		10		1	0.1	10		
2-methylnaphthalene	ug/g	0.23	10.5	< MDL	0.201	PEL											
naphthalene	ug/g	0.43	15.4	< MDL	0.391	PEL	5		50		50		5	0.1	50		
phenanthrene	ug/g	1.71	59	< MDL	0.544	PEL	5		50		50		5	0.1	50		
pyrene	ug/g	2.11	37	< MDL	1.398	PEL	10		100		100		10	0.1	100		
total PAHs ⁸	ug/g	9.82	236.66	0.0545	20	SQCs											
PAH TEQ ⁹	ug/g	1.31	21.317	<MDL												100	
Extractable Petroleum Hydrocarbons																	
EPH10-19 ¹⁰	ug/g	181.5	820	< MDL			1000		2000		2000		1000	1000	2000		
EPH19-32 ¹⁰	ug/g	635.3	4170	< MDL			1000		5000		5000		1000	1000	5000		
LEPH	ug/g	178.5	800	< MDL			1000		2000		2000		1000	1000	2000		
HEPH	ug/g	625.6	4120	< MDL			1000		5000		5000		1000	1000	5000		
EPH10-19 + EPH19-32 ¹¹	ug/g	816.7	4990	<MDL												30000	
LEPH + HEPH ¹¹	ug/g	804.2	4920	<MDL												30000	
Polychlorinated Biphenyls																	
PCB-1254 (arochlor)	ug/g	0.21	4.09	< MDL	0.709	PEL							5	0.5	50		
polychlorinated biphenyls (PCB-total) ¹²	ug/g	0.31	8.45	< MDL	0.189	PEL	5	I/T	15	I	50	T	5	0.5	50	50	
Total Metals																	
antimony	ug/g	21.88	1090	0.2			20		40		40		20	20	40		
arsenic	ug/g	50.79	3970	< MDL	41.6	PEL	15 - 20	DW - F	15 - 20	DW - F	15 - 20	DW - F	15	15	15		
barium	ug/g	90.54	452	10.1			400 - 1000	DW - T	400 - 1500	DW - T	400 - 1500	DW - T	400	400	400		
beryllium	ug/g	0.26	0.7	0.25			4		8		8		4	4	4		
cadmium	ug/g	1.46	6.24	< MDL	4.2	PEL	1.5-35	DW/F/I, pH	1.5-100	DW/F/I, pH	1.5-150	DW/F, pH	1.5	1.5	1.5		
chromium (total)	ug/g	42.04	234	12	160	PEL	60 / (60 ^{VI} , 65 ^{III})	DW / F/M/V	60 / (60 ^{VI} , 65 ^{III})	DW / F/M/V	60 / (60 ^{VI} , 65 ^{III})	DW / F/M/V	60	50	60		
cobalt	ug/g	10.15	192	2			50		300		300		50	40	300		
copper	ug/g	167.84	2320	8.7	108	PEL	90-150	AW/T, pH	90-250	AW/T, pH	90-250	AW/T, pH	90	90	90		
lead	ug/g	139.66	4910	< MDL	112	PEL	100-500	DW/AW/I, pH	100-1000	DW/AW/I, pH	100-2000	DW/AW/T, pH	100	100	100		
mercury	ug/g	2.02	24.6	< MDL	0.7	PEL	15	I	40	I	150	T	15	0.6	150		
molybdenum	ug/g	5.84	213	0.63			10		40		40		10	5	40		
nickel	ug/g	27.42	239	5			100		500		500		100	150	500		
selenium	ug/g	1.00	2	0.21			3		10		10		3	2	10		
silver	ug/g	1.09	8.9	0.1			20		40		40		20	20	40		
tin	ug/g	15.80	302	1			50		300		300		50	5	300		
uranium	ug/g	0.87	2.34	0.103			16	S	200	S	200	S					
vanadium	ug/g	59.99	157	9.1			200						200	200			
zinc	ug/g	293.08	10700	20.4	271	PEL	150-450	F/M/T, pH	150-600	F/M/T, pH	150-600	F/M/T, pH	150	150	150		
Organometals																	
tributyltin	ug/g	0.23	3.49	< MDL	0.75	SSLR											
Dioxins and Furans																	
Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans TEQ ¹⁴	pg/g	6.75	23.90	0.24	21.5	PEL											
Dioxins TEQ ¹⁴	pg/g	9.10	32.99	0.23	260	SQCs	350	I	1000	I	2500	T	350	10	2500	100000	
Pesticides																	
Lindane (gamma - BHC)	ug/g	< MDL	< MDL	< MDL	0.00099	PEL	4.4	S	17	S	17	S					
Total Chlordane	ug/g	< MDL	< MDL	< MDL	0.00479	PEL	16	S	65	S	65	S					
DDD ¹⁵ (total)	ug/g	0.02	0.145	< MDL	0.00781	PEL											
DDE ¹⁶ (total)	ug/g	0.02	0.090	< MDL	0.374	PEL											
DDT ¹⁷ (total)	ug/g	0.06	0.787	< MDL	0.00477	PEL	10	T	15	T	15	T	10	10	15		
dieldrin	ug/g	< MDL	< MDL	< MDL	0.0043	PEL	0.3	S	1.1	S	1.1	S					
endrin	ug/g	< MDL	< MDL	< MDL	0.0624	PEL	18	S	180	S	180	S					
heptachlor	ug/g	< MDL	< MDL	< MDL	0.0033	SQCs	1.1	S	3.8	S	3.8	S					
heptachlor epoxide	ug/g	< MDL	< MDL	< MDL	0.00274	PEL	0.53	S	1.9	S	1.9	S					
Volatile Organic Compounds																	
Benzene	ug/g	< MDL	<MDL	<MDL			0.04 - 2.5	DW - M	0.04 - 2.5	DW - M	0.04 - 2.5	DW - M	0.04	0.04	0.04		
Ethylbenzene	ug/g	< MDL	<MDL	<MDL			1	T	7 - 20	DW - T	7 - 20	DW - T	1	1	20		
Methyl t-butyl ether (MTBE)	ug/g	< MDL	<MDL	<MDL			320	S	700	S	700	S					
Styrene	ug/g	< MDL	<MDL	<MDL			5		50		50		5	0.1	50		
Toluene	ug/g	< MDL	<MDL	<MDL			1.5	T	2.5 - 25	DW - T	2.5 - 25	DW - T	1.5	1.5	2.5		
Xylenes	ug/g	< MDL	<MDL	<MDL			5	T	20 - 50	DW - T	20 - 50	DW - T	5	0.1	20		
Saturated Paste Extractables																	
Chloride (Cl)	ug/g	9400	13000	5800			90 - 350	DW - T	90 - 550	DW - AW	90 - 550	DW - AW	35	35	90		
Sodium (Na)	ug/g	5220	6730	3710			200	T	1000	T	1000	T	200	200	1000		
Toxicity Characteristic Leaching Procedure																	
Benzo(a)pyrene	mg/L	<MDL	N/A	<MDL												0.001	
Arsenic (As)-Leachable	mg/L	<MDL	<MDL	<MDL												2.5	
Barium (Ba)-Leachable	mg/L	<MDL	<MDL	<MDL												100.0	
Boron (B)-Leachable	mg/L	0.763	1.79	<MDL												500.0	
Cadmium (Cd)-Leachable	mg/L	<MDL	<MDL	<MDL												0.5	
Chromium (Cr)-Leachable	mg/L	<MDL	<MDL	<MDL												5.0	
Copper (Cu)-Leachable	mg/L	<MDL	<MDL	<MDL												100.0	
Lead (Pb)-Leachable	mg/L	<MDL	<MDL	<MDL												5.0	
Mercury (Hg)-Leachable	mg/L	<MDL	<MDL	<MDL												0.1	
Selenium (Se)-Leachable	mg/L	<MDL	<MDL	<MDL												1.0	
Silver (Ag)-Leachable	mg/L	<MDL	<MDL	<MDL												5.0	
Zinc (Zn)-Leachable	mg/L	<MDL	1.56	<MDL												500.0	

Assumptions:
- Data used from Golder investigations conducted from 2009 to 2012 (i.e. historical data not included).
- Duplicate samples have been included.
- When concentrations were less than laboratory detection limits, half the value of the detection limit was used for summation calculations and statistical analyses.

- Notes:**
- Results are expressed in micrograms per gram (ug/g), except for dioxins and furans which are expressed in picograms per gram (pg/g) and leachability results which are expressed in milligrams per litre (mg/L).
 - Remedial Action Objective shown is the most conservative of:
 - Canadian Council of Ministers of the Environment (CCME) Probable Effects Levels (PEL) for marine sediments (1999; Canadian Environmental Quality Guidelines [Update 2002]);
 - Contaminated Sites Regulation (CSR) Schedule 9 - Sediment Quality Criteria for typical contaminated sites (SQCs) (marine) (BC Reg 375/96, including amendments up to BC Reg. 6/2013, January 24, 2013); or
 - the dry weight sediment tributyltin (TBT) site-specific low risk threshold derived as part of Golder's TBT Assessment (updated draft report dated March 2011).
 - Soil standards shown from the BC Contaminated Sites Regulation (CSR) (BC Reg. 375/96, including amendments up to BC Reg. 6/2013, January 24, 2013), Schedules 4, 5, and 10.
 - Land Use abbreviations: RL (Residential Land); CL (Commercial Land); IL (Industrial Land)
 - MCS = most conservative standard: I = Intake of Contaminated Soil; T = Toxicity to Invertebrates and Plants; AW = Groundwater Flow to Surface Water used by Aquatic Life (F = Fresh Water Aquatic Life and M = Marine Aquatic Life); DW = Groundwater used for Drinking Water; S = Schedule 10; V = standard is valence dependent.
 - Soil standards shown from the BC Contaminated Sites Regulation (CSR) (B.C. Reg. 375/96, including amendments up to B.C. Reg. 6/2013, January 24, 2013) Schedule 7 - Standards Triggering Contaminated Soil Relocation Agreements.
 - Standards shown from the BC Hazardous Waste Regulation (HWR) (BC Reg 63/88, O.C. 268/88, including amendments up to BC Reg 63/2009, April 1, 2009).
 - Total PAH calculation includes the sum of 13 of 18 PAHs analyzed (CSR Schedule 9). When constituent concentrations were less than detection limits, half of the detection limit was used in the calculation.
 - PAH TEQ = [BaA]*0.1+[BaP]*1+[BbF]*0.1+[BkF]*0.1+[D(a,h)A]*1.1+[I(1,2,3-cd)P]*0.2, where the value in the square brackets is the PAH constituent concentration (in ug/g).
 - No standards exist for EPH10-19 or EPH19-32; for comparison purposes, standards for LEPH and HEPH have been identified. EPH = Extractable Petroleum Hydrocarbons; LEPH = Light Extractable Petroleum Hydrocarbons; HEPH = Heavy Extractable Petroleum Hydrocarbons.
 - Waste is considered hazardous if the concentration of waste oil exceeds 3% by weight as shown in the HWR. Therefore, the sum of LEPH and HEPH (and EPH10-19 and EPH19-32) is shown for comparison purposes only.
 - PCB-total calculation includes the sum of four to seven arochlor mixtures (1016, 1221, 1232, 1242, 1248, 1254 and/or 1260) (CSR Schedule 9).
 - Concentrations are expressed as toxicity equivalency quotient (TEQ) units, based on WHO 1998 TEF values for fish. When constituent concentrations were less than detection limits, half of the detection limit was used in the calculation.