



Summary Report

Metals and PAH Verification Study—2008 Sinclair Inlet, Washington

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Summary

Current (2007) sediment contaminant levels were determined in Sinclair Inlet following the screening approach used to assess sediment contamination in samples collected in 2003. Approximately 100 sediment samples from Sinclair Inlet were rapidly screened for total polynuclear aromatic hydrocarbons (PAHs), copper, lead, zinc, and iron. The screening results were used to select a subset of 30 samples for confirmatory analysis of organic compounds (PAHs and phthalates) and a number of heavy metals (arsenic, copper, lead, zinc, chromium, cadmium, nickel, silver). If a reasonable regression relationship was found to exist between the screening and confirmatory concentrations of an analyte, that regression relationship was used to estimate sediment concentrations of that analyte in the samples that did not receive confirmatory analysis. Confirmatory and estimated sediment concentrations were compared with state sediment quality standards to assess the present level of sediment contamination in Sinclair Inlet. Where the screening results could not be used to estimate a more definitive sediment concentration for an analyte, only the confirmatory data were compared with state sediment quality standards

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Introduction

The Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) is located on Sinclair Inlet, segments of which are listed as impaired by the Washington State Department of Ecology because some metals and toxic organic compounds in the sediment have been found to exceed Washington State sediment quality standards (SQS). This study, conducted in support of the PNSL & IMF Project ENVironment inVESTment (ENVVEST), is a brief followup to the ENVVEST Metals Verification Study (Kohn et al. 2004) and Organics Verification Study (Kohn et al. 2006), which addressed the of sediment contamination in samples from Sinclair and Dyes Inlets collected in 2003. The present study uses a similar approach to address sediment contamination in samples collected in 2007, but it is geographically limited to Sinclair Inlet. Both the 2003 and 2007 were collected for the Installation Restoration monitoring program for Operable Unit B (OUB) and thus represent the same locations in both years. The OUB monitoring program provided aliquots of sediment to ENVVEST for the metals and organics verification study presented here

Methods

Sample Collection and Screening Analyses

Sinclair Inlet sediment samples were collected by URS in May 2007 as part of the post-remedial monitoring of Operable Unit B (OUB). Sinclair Inlet is represented by two different sized grids: a 500-ft grid inside the OUB-Marine boundary (OUBM), and a 1500-ft grid outside of the OUB-Marine boundary (OOUB). There are 71 OUBM grid cells and 32 OOUB grid cells, each represented by a composite sample composed of sediment from three stations in the grid cell, for a total of 103 samples. Under the post-remedial monitoring program, sediment samples are analyzed for PCBs and mercury. However, the water body is on the Washington State 303(d) list of impaired waters because several other contaminants exceed sediment quality standards, and aliquots of the 2007 OUBM and OOUB samples were preserved frozen for other metal and organic contaminant determination under the ENVVEST program.

Following methods consistent with the earlier Sinclair and Dyes Inlets verification studies (Kohn et al. 2004, 2006), each sample was screened for metals, total PAHs, and total PCBs by the Space and Naval Warfare Systems Center, San Diego, CA (SSC-SD). Rapid screening of metals was done by X-ray fluorescence spectrometry (XRF); rapid screening for PAHs and PCBs was done by an immunoassay method.

Verification Sample Selection

A subset of samples were selected following the procedures developed by Kohn et al. (2005, 2006) for confirmatory metals analysis using ICP/MS and confirmatory organics analysis by GC/MS. Organics sample analysis in this task was limited to PAHs and phthalates; PCBs were analyzed in all samples under the OUB monitoring program and are not reported here. The verification sample selection process for the 2007 samples is detailed in a March 2008 ENVVEST document entitled “*Recommended Confirmatory Samples, Metals and PAH Verification Study—2008, Sinclair Inlet, Washington*” (Kohn 2008). A brief description is provided below.

Organics Verification Sample Selection

Several criteria were used to identify appropriate confirmatory samples for confirmatory organics analysis. Immunoassay screening data (Table 1) were examined against several criteria to select a subset of approximately 30 samples for confirmatory PAH analysis by gas chromatography/mass spectrometry (GC/MS). Screening results (reported as total PAH) were normalized to organic carbon using the TOC values measured in the same samples during the OUB Marine Monitoring program, then compared to 90% of the sum of low molecular weight PAH (LPAH) and high molecular weight PAH (HPAH) state sediment quality standard (SQS) values. The Northwest Sediment Evaluation Framework also provides sediment quality guidelines for PAHs on a dry weight basis; the equivalent to the SQS is called screening level 1 (SL1). Samples from Sinclair Inlet with immunoassay screening results $\geq 90\%$ LPAH+HPAH SQS or SL1 were flagged for potential confirmatory analysis. Samples with immunoassay screening results $< 90\%$ SQS but > 10 mg/kg dry weight were also identified, thus including samples with moderate to high PAH concentrations.

Sample location relative to water body segments on the 303(d) list for phthalates was another criterion used to select confirmatory samples. Because screening methods are not available for phthalates, we selected at least 3 confirmatory samples in each segment listed for phthalates, considering their physical location relative to samples already selected for confirmatory PAH analysis. Other criteria for sample selection were apparent large differences between the 2007 and 2003 screening results and a representative spatial distribution throughout Sinclair Inlet. In general, preference was given to samples that had also been analyzed in the prior Organics Verification Study (Kohn et al. 2006). The 2007 samples selected for GC/MS analysis of PAHs and phthalates are listed in

Table 2 along with the selection rationale. Eight proposed confirmatory samples are OOUB (1500-ft grid) samples, 22 are OUBM (500-ft grid) samples.

Table 1. Immunoassay Screening Results for Total PAH

Station or OUB Grid	Total PAH (µg/kg dry weight) ^a	TOC (% dry weight)	Total PAH (mg/Kg OC) ^b	Selected for Confirmatory Analysis?
OOUB-G01	1600 J ^c	2.0	80	Yes
OOUB-G02	980 U ^d	0.88	111	
OOUB-G03	1012 J	1.1	92	
OOUB-G04	962 U	0.60	160	
OOUB-G05	2622	3.4	77	
OOUB-G06	2727	3.9	70	
OOUB-G07	3001	4.1	73	
OOUB-G08	2553	3.9	65	
OOUB-G09	3374	4.0	84	Yes
OOUB-G10	2402	3.4	71	
OOUB-G11	3762	3.6	105	
OOUB-G12	1457 J	1.0	146	
OOUB-G13	3361	3.2	105	
OOUB-G14	3339	3.7	90	Yes
OOUB-G15	2902	4.0	73	
OOUB-G16	4507	4.2	107	
OOUB-G17	3078	3.4	91	Yes
OOUB-G18	3238	3.4	95	Yes
OOUB-G19	3010	3.6	84	
OOUB-G20	2944	3.1	95	

Table 1 (continued)

Station or OUB Grid	Total PAH (µg/kg dry weight)	TOC (% dry weight)	Total PAH (mg/Kg OC) ^a	Selected for Confirmatory Analysis?
OOUB-G21	3237	3.3	98	Yes
OOUB-G22	3137	3.0	105	Yes
OOUB-G23	2669	3.2	83	
OOUB-G24	3184	2.9	110	
OOUB-G25	2267	2.6	87	
OOUB-G26	915	0.37	247	
OOUB-G27	2738	2.9	94	
OOUB-G28	2832	3.3	86	Yes
OOUB-G29	2585	1.7	152	
OOUB-G30	1228 J	0.39	315	
OOUB-G31	3079	2.6	118	
OOUB-G32	4247	1.4	303	
OUBM-G01	10612	3.0	354	Yes
OUBM-G02	3385	3.3	103	
OUBM-G03	2759	1.8	153	
OUBM-G04	3496	2.9	121	
OUBM-G05	3565	2.9	123	
OUBM-G06	3089	2.9	107	
OUBM-G07	3473	2.8	124	
OUBM-G08	3497	2.6	134	
OUBM-G09	3020	2.6	116	
OUBM-G10	3146	1.3	242	
OUBM-G11	3446	2.3	150	
OUBM-G12	3043	2.4	127	
OUBM-G13	3280	2.8	117	
OUBM-G14	2134	0.90	237	
OUBM-G15	NS ^e	2.2	NS	
OUBM-G16	2827	2.7	105	
OUBM-G17	3083	2.8	110	Yes
OUBM-G18	8193	1.3	630	Yes
OUBM-G19	3869	2.5	155	
OUBM-G20	3556	2.8	127	
OUBM-G21	2668	2.0	133	
OUBM-G22	4014	3.2	125	
OUBM-G23	4418	3.0	147	
OUBM-G24	5908	3.4	174	
OUBM-G25	4241	3.4	125	
OUBM-G26	5004	3.5	143	
OUBM-G27	4123	3.4	121	
OUBM-G28	7416	3.0	247	Yes
OUBM-G29	5066	3.6	141	
OUBM-G30	4924	2.9	170	
OUBM-G31	4663	3.0	155	
OUBM-G32	3605	2.8	129	
OUBM-G33	8121	3.5	232	
OUBM-G34	5012	2.9	173	Yes

Table 1 (continued)

Station or OUB Grid	Total PAH (µg/kg dry weight)	TOC (% dry weight)	Total PAH (mg/Kg OC) ^a	Selected for Confirmatory Analysis?
OUBM-G35	5600	2.5	224	
OUBM-G36	6458	3.0	215	Yes
OUBM-G37	7358	2.9	254	
OUBM-G38	3850	2.1	183	
OUBM-G39	19895	1.6	1243	Yes
OUBM-G40	13284	3.0	443	
OUBM-G41	10507	2.8	375	Yes
OUBM-G42	12214	2.6	470	
OUBM-G43	7556	2.6	291	Yes
OUBM-G44	4968	3.0	166	
OUBM-G45	11985	3.7	324	Yes
OUBM-G46	3424	1.2	285	
OUBM-G47	4947	2.6	190	
OUBM-G48	6078	3.1	196	Yes
OUBM-G49	6717	1.5	448	
OUBM-G50	6110	2.8	218	Yes
OUBM-G51	4407	2.9	152	
OUBM-G52	10881	2.8	389	
OUBM-G53	6132	2.7	227	
OUBM-G54	5600	3.0	187	
OUBM-G55	8714	3.3	264	Yes
OUBM-G56	12488	2.9	431	Yes
OUBM-G57	8549	3.5	244	
OUBM-G58	5740	3.0	191	
OUBM-G59	16033	2.6	617	Yes
OUBM-G60	21452	2.3	933	Yes
OUBM-G61	23252	1.7	1368	Yes
OUBM-G62	8738	2.9	301	
OUBM-G63	11440	3.2	358	Yes
OUBM-G64	13548	3.6	376	Yes
OUBM-G65	6521	2.4	272	
OUBM-G66	10888	3.0	363	Yes
OUBM-G67	29692	2.1	1414	Yes
OUBM-G68	7684	3.0	256	
OUBM-G69	12468	2.4	519	Yes
OUBM-G70	6725	2.6	259	
OUBM-G71	5505	0.89	619	
a. Yellow highlight with bold type indicates dry weight screening result is greater than the sum of LPAH and HPAH SL1 values or 17,200 µg/kg dry weight; bold type alone indicates result is >90% of the combined LPAH and HPAH SL1 value or 15,480 µg/kg dry weight. b. Yellow highlight with bold type indicates organic carbon-normalized screening result is greater than the sum of LPAH and HPAH SQS values or 1330 mg/kg OC; bold type alone indicates result is >90% of the combined LPAH and HPAH SQS value or 1197 mg/kg OC. c. J = estimated value. d. U = undetected above given concentration. e. NS = no sample.				

Table 2. Proposed 2007 Sinclair Inlet Samples for PAH/phthalate Confirmatory GC/MS Analysis

Station or OUB Grid	303(d) Segment	Quantitative Analysis		Selection Comments
		PAH 2008	PAH 2003 (OVS)	
OOUB-G1	F6C9	Y	Y	Spatial distribution, Sinclair Inlet, confirmed in OVS
OOUB-G9	F6D6	Y	Y	Spatial distribution, Sinclair Inlet, confirmed in OVS
OOUB-G14	F6E5	Y	N	F6E5 representation, spatial distribution, confirmed in OVS
OOUB-G17	F6E5	Y	Y	F6E5 representation, spatial distribution, confirmed in OVS
OOUB-G18	F6E4	Y	N	F6E4 representation
OOUB-G21	F6E4	Y	Y	F6E4 representation, spatial distribution, confirmed in OVS
OOUB-G22	F6E4	Y	N	F6E4 representation, large difference from OVS screen
OOUB-G28	F6F2	Y	Y	Spatial distribution, Sinclair Inlet, confirmed in OVS
OUBM-G1	F6E6	Y	N	Screened >10 ppm, large difference from OVS screen
OUBM-G17	F6E5	Y	N	F6E5 representation
OUBM-G18	F6F5	Y	N	Spatial distribution, large difference from OVS screen
OUBM-G28	F6F5	Y	Y	Large difference from OVS screen, confirmed in OVS
OUBM-G34	F6F4	Y	Y	F6F4 representation, confirmed in OVS
OUBM-G36	F6F4	Y	N	Large difference from OVS screen
OUBM-G39	F6F5	Y	Y	>90%SQS, confirmed in OVS
OUBM-G41	F6F4	Y	Y	Screened >10 ppm, confirmed in OVS
OUBM-G43	F6F4	Y	N	Large difference from OVS screen
OUBM-G45	F6F4	Y	Y	Screened >10 ppm, confirmed in OVS
OUBM-G48	F6F3	Y	N	Large difference from OVS screen
OUBM-G50	F6F3	Y	N	Large difference from OVS screen
OUBM-G55	F6F3	Y	Y	Large difference from OVS screen, confirmed in OVS
OUBM-G56	F6F3	Y	Y	Screened >10 ppm, confirmed in OVS
OUBM-G59	F6F3	Y	N	>90%SQS, large difference from OVS screen
OUBM-G60	F6F3	Y	Y	>90%SQS, confirmed in OVS
OUBM-G61	F6F2, F6F3	Y	Y	>90%SQS, confirmed in OVS
OUBM-G63	F6F3	Y	Y	Screened >10 ppm, confirmed in OVS
OUBM-G64	F6F3	Y	N	Screened >10 ppm, ~60% higher than in OVS
OUBM-G66	F6F2	Y	Y	Screened >10 ppm, confirmed in OVS
OUBM-G69	F6F2	Y	N	Screened >10 ppm
OUBM-G67	F6F3	Y	N	>90% SQS, large difference from OVS screen

Metals Verification Sample Selection

As with organics sample selection, several criteria were used to identify appropriate samples for confirmatory metals analysis by inductively coupled plasma/mass spectrometry (ICP-MS). XRF screening concentrations were compared directly to SQS values (Table 3), and any samples with screening results $\geq 90\%$ SQS for copper, lead, or zinc were flagged as possible confirmatory samples. Predicted concentrations, estimated by applying the regression relationship between XRF and ICP/MS results for Cu, Pb, and Zn obtained during the 2003 Metals Verification Study (Kohn 2005), were similarly compared with SQS.

Several Sinclair Inlet water body segments are on the state 303(d) list for silver and/or cadmium, which are not reliably measured by XRF. Confirmatory ICP-MS data will include silver and cadmium, so at least three samples from each listed segment were selected. The remaining confirmatory samples were rounded out by samples in which a substantial difference between 2003 and 2007 screening results was observed, and samples to obtain a representative spatial distribution throughout Sinclair Inlet. Again, preference was given to samples that had also been analyzed in the Metals Verification Study (Kohn et al. 2004). The 2007 samples selected for ICP-MS analysis of metals are listed in Table 4 along with the selection rationale. Twelve proposed confirmatory samples are OUB (1500-ft grid) samples, 18 are OUBM (500-ft grid) samples.

Table 3. XRF Screening Results for Metals in Sinclair Inlet Samples

Station or OUB Grid Cell	Cu (mg/kg dry weight)	Pb (mg/kg dry weight)	Zn (mg/kg dry weight)	Selected for Confirmatory Analysis?
SQS	390	450	410	
MCUL	390	530	960	
OOUB-G01	21	20	79	Yes
OOUB-G02	16	40	29	
OOUB-G03	17	15	31	
OOUB-G04	16	15	36	
OOUB-G05	54	46	115	
OOUB-G06	68	56	132	
OOUB-G07	73	79	161	Yes
OOUB-G08	102	71	148	
OOUB-G09	96	69	145	
OOUB-G10	63	51	121	
OOUB-G11	62	47	140	
OOUB-G11 dup	58	70	137	
OOUB-G12	17	7	81	
OOUB-G13	65	82	161	Yes
OOUB-G14	43	67	132	Yes
OOUB-G15	60	49	126	
OOUB-G15 dup	55	71	145	
OOUB-G16	100	52	166	
OOUB-G17	84	96	122	Yes
OOUB-G18	76	72	152	
OOUB-G19	57	82	131	
OOUB-G20	82	62	143	
OOUB-G21	65	65	142	Yes
OOUB-G22	70	58	132	
OOUB-G23	76	46	119	

Table 3 (continued)

Station or OUB Grid Cell	Cu (mg/kg dry weight)	Pb (mg/kg dry weight)	Zn (mg/kg dry weight)	Selected for Confirmatory Analysis?
SQS	390	450	410	
MCUL	390	530	960	
OOUB-G24	80	90	124	Yes
OOUB-G25	4	55	360	Yes
OOUB-G26	0	8	41	Yes
OOUB-G27	66	72	124	Yes
OOUB-G28	47	68	129	Yes
OOUB-G29	0	32	90	
OOUB-G30	1	14	69	
OOUB-G31	28	88	109	Yes
OOUB-G32	33	63	96	
OUBM-G01	111	69	184	
OUBM-G02	54	47	135	
OUBM-G03	70	56	139	
OUBM-G04	75	95	143	
OUBM-G05	91	86	136	
OUBM-G06	82	86	163	
OUBM-G07	54	64	139	
OUBM-G08	83	85	113	
OUBM-G09	69	48	118	
OUBM-G09 dup	26	83	115	
OUBM-G10	27	44	117	Yes
OUBM-G11	73	44	112	
OUBM-G12	23	46	118	Yes
OUBM-G13	55	78	121	
OUBM-G14	24	29	103	
OUBM-G15	NS	NS	NS	
OUBM-G16	39	33	105	
OUBM-G17	72	62	130	Yes
OUBM-G18	28	64	95	
OUBM-G19	71	57	209	Yes
OUBM-G20	32	64	113	
OUBM-G21	49	36	119	
OUBM-G22	90	71	133	
OUBM-G23	54	62	114	
OUBM-G24	116	63	172	
OUBM-G25	150	95	173	
OUBM-G26	113	72	185	
OUBM-G27	91	76	177	
OUBM-G27 dup	75	125	142	
OUBM-G28	137	72	200	
OUBM-G29	191	98	225	
OUBM-G30	128	142	422^a	Yes
OUBM-G31	80	97	154	
OUBM-G32	48	84	145	
OUBM-G33	153	107	182	
OUBM-G34	132	79	226	
OUBM-G29	191	98	225	
OUBM-G29	191	98	225	

Table 3 (continued)

Station or OUB Grid Cell	Cu (mg/kg dry weight)	Pb (mg/kg dry weight)	Zn (mg/kg dry weight)	Selected for Confirmatory Analysis?
SQS	390	450	410	
MCUL	390	530	960	
OUBM-G29	191	98	225	
OUBM-G30	128	142	422^a	Yes
OUBM-G31	80	97	154	
OUBM-G32	48	84	145	
OUBM-G33	153	107	182	
OUBM-G34	132	79	226	
OUBM-G35	114	91	152	
OUBM-G36	171	110	185	
OUBM-G37	167	115	176	
OUBM-G38	144	78	171	
OUBM-G39	135	144	273	Yes
OUBM-G40	169	120	174	
OUBM-G41	141	77	191	
OUBM-G42	108	112	190	
OUBM-G43	90	115	219	Yes
OUBM-G44	97	68	163	
OUBM-G45	180	103	170	
OUBM-G46	75	58	152	
OUBM-G46 dup	69	69	146	
OUBM-G47	47	67	153	
OUBM-G48	68	78	174	
OUBM-G49	92	83	202	
OUBM-G50	82	78	170	
OUBM-G51	71	78	134	
OUBM-G52	153	135	289	Yes
OUBM-G52 dup	189	145	304	
OUBM-G53	15	51	155	Yes
OUBM-G54	50	61	123	
OUBM-G55	137	120	277	Yes
OUBM-G56	115	99	217	
OUBM-G57	117	102	214	
OUBM-G58	48	30	152	
OUBM-G59	192	144	306	Yes
OUBM-G60	254	413^b	718^a	Yes
OUBM-G61	164	130	315	Yes
OUBM-G62	68	61	129	
OUBM-G63	268	148	324	Yes
OUBM-G64	182	85	207	
OUBM-G65	119	62	272	Yes
OUBM-G66	74	90	164	
OUBM-G67	1225^a	319	669^a	Yes
OUBM-G68	184	114	299	Yes
OUBM-G69	53	68	121	
OUBM-G70	53	86	148	
OUBM-G71	9	12	79	Yes
a. Yellow highlight and bold type indicates value exceeds SQS value.				
b. Bold type indicates value is >90% SQS.				

Table 4. Proposed 2007 Sinclair Inlet Samples for Confirmatory Analysis of Metals by ICP-MS

Station or OUB Grid	303(d) Segment	Quantitative Analysis		2008 Selection Comments
		Metals 2008	Metals 2003 (MVS)	
OOUB-G1	F6C9	Y	Y	Spatial distribution, large difference from MVS screen
OOUB-G7	F6D7	Y	Y	Spatial distribution, confirmed in MVS
OOUB-G13	F6E6	Y	Y	Spatial distribution, confirmed in MVS
OOUB-G14	F6E5	Y	N	F6E5 representation, spatial distribution
OOUB-G17	F6E5	Y	N	F6E5 representation, difference from MVS Pb screen, spatial distribution
OOUB-G18	F6E4	N	Y	
OOUB-G21	F6E4	Y	Y	Spatial distribution, confirmed in MVS
OOUB-G24	F6F3	Y	Y	Spatial distribution, confirmed in MVS
OOUB-G25	F6E3	Y	N	Predicted Zn>90% SQS, large differences from MVS screen
OOUB-G26	F6E2	Y	Y	Spatial distribution, confirmed in MVS
OOUB-G27	F6F3	Y	Y	Spatial distribution, difference from MVS Pb screen, confirmed in MVS
OOUB-G28	F6F2	Y	Y	F6F2 representation, confirmed in MVS
OOUB-G31	F6F2	Y	N	F6F2 representation, large difference from MVS screen
OUBM-G10	F6E6	Y	N	Spatial representation, difference from MVS Cu screen
OUBM-G12	F6E5	Y	N	F6E5 representation, difference from MVS Cu, Pb screen
OUBM-G17	F6E5	Y	N	F6E5 representation, difference from MVS Pb screen
OUBM-G19	F6F5	Y	N	large difference from MVS Pb, Zn screens
OUBM-G30	F6F4, F6F5	Y	N	XRF>90% SQS for Zn, large difference from MVS Pb, Zn screens
OUBM-G34	F6F4	N	Y	
OUBM-G36	F6F4	N	Y	
OUBM-G39	F6F5	Y	Y	Predicted Zn >90%SQS, confirmed in MVS
OUBM-G40	F6F4	N	Y	
OUBM-G42	F6F4	N	Y	
OUBM-G43	F6F4	Y	Y	Large difference from MVS Pb screen
OUBM-G45	F6F4	N	Y	
OUBM-G46	F6F4, F6F3	N	Y	
OUBM-G52	F6F3	Y	Y	Predicted Zn >90%SQS, confirmed in MVS
OUBM-G53	F6F3	Y	N	Spatial representation, large difference from MVS Cu screen
OUBM-G55	F6F3	Y	N	Predicted Zn >90%SQS
OUBM-G56	F6F3	N	Y	
OUBM-G59	F6F3	Y	Y	Predicted Zn >90%SQS, confirmed in MVS
OUBM-G60	F6F3	Y	Y	XRF Zn, Pb and predicted Cu >90%SQS, confirmed in MVS
OUBM-G61	F6F3, F6F2	Y	N	Predicted Zn >90%SQS
OUBM-G63	F6F3	Y	N	Predicted Cu, Pb, Zn >90% SQS
OUBM-G64	F6F3	N	Y	
OUBM-G65	F6F2	Y	N	Predicted Zn >90%SQS, F6F2 representation
OUBM-G66	F6F2	N	Y	
OUBM-G67	F6F3	Y	Y	XRF Zn, Pb and predicted Cu >90%SQS, difference from MVS screen
OUBM-G68	F6F2	Y	Y	Predicted Zn >90%SQS, F6F2 representation, confirmed in MVS
OUBM-G71	F6F2	Y	N	F6F2 representation, large differences from MVS Cu, Pb screens

Quantitative Confirmatory Sample Analysis

The analytical methods used for confirmatory sample analysis were consistent with the previous ENVVEST metals and organics verification studies (Kohn et al. 2004, 2006). Confirmatory metals analysis was by inductively-coupled plasma-mass spectrometry (ICP-MS), a high-resolution multi-element determination method with detection levels well below Washington State SQS. This method is described in detail in the Metals Verification Study report (Kohn et al. 2004). QC samples to assess accuracy and precision of quantitative measurements included method blanks, laboratory duplicates, matrix spikes, standard reference materials, and laboratory control samples (blank spikes). Confirmatory organics analysis was conducted by Columbia Analytical Services of Kelso, WA, using EPA Method 8270C, *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*. This method was used for both PAH and phthalate compounds of interest. QC samples to assess accuracy and precision of quantitative measurements included method blanks, duplicates, matrix spikes, and laboratory control samples (blank spikes).

Results

The results of confirmatory GC/MS analysis for PAHs and phthalates and ICP-MS results for metals are presented in this section. Confirmatory results for PAHs and phthalates are reported on a dry weight basis. Total organic carbon (TOC) results are also reported with the organics data along with organic carbon-normalized concentrations of PAHs and phthalates to facilitate comparison with SQS. Confirmatory results for metals are reported on a dry weight basis only; SQS values are also on a dry weight basis. Complete analytical data including chain-of-custody records, quality control results, and case narratives are presented in Appendix A.

PAH Results

Results of confirmatory GC/MS analysis for individual PAH compounds on a dry weight basis are provided in Table 5; results on an organic carbon-normalized basis are provided in Table 6. Concentrations of all LPAH compounds in all 30 confirmatory samples were below SQS values. Concentrations of one or two HPAH compounds exceeded their SQS values in 4 confirmatory samples (Table 6): chrysene and indeno(1,2,3-cd) pyrene in OUBM-G39, chrysene and benz(a)-anthracene in OUBM-G67, and fluoranthene in OUBM-G56 and OUBM-G61. However, the sum total HPAH concentration is below the HPAH SQS value in all confirmatory samples including OUBM-G39, -G56, -G61, and -G67 (Table 7).

In most of the confirmatory samples, total PAH concentrations obtained by the immunoassay screening method were higher than total PAH obtained from summing concentrations of PAH compounds detected by GC/MS; however, the screening method underpredicted total PAH in several samples. The immunoassay screening method, while not quantitative for PAH compounds, was successful at identifying Sinclair Inlet samples that potentially exceeded SQS, especially when the dry weight screening level (SL1) was applied (Table 1). The samples selected for confirmatory analysis included any with total PAH >10 µg/kg dry weight and a representative number with total PAH screening between 5 and 10 µg/kg dry weight. Based on the comparison of screening and confirmatory PAH results, it is unlikely that the remaining (unconfirmed) Sinclair Inlet sediment samples would exceed PAH SQS.

Table 5. Confirmatory GC/MS Concentrations of PAHs in Sinclair Inlet Sediment

Station or OUB Grid Cell	TOC (% dry weight)	Sediment PAH Concentration (µg/kg dry weight)						
		Naphthalene	2-Methyl- naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
OOUB-G01	1.88	1.9 J ^a	1.5 J	0.87 J	0.8 J	1.5 J	14	3
OOUB-G09	4.6	6	4.9	3.9 J	2.9 J	4.4	52	10
OOUB-G14	4.26	7.5	6	5	2.7 J	4.5	38	13
OOUB-G17	3.77	7	5.1	6.4	3.6	6.1	64	22
OOUB-G18	3.84	5.6	4.1	5.4	2.3 J	3.8 J	33	13
OOUB-G21	3.04	6.2	4.1	7.7	2.7 J	5.2	43	19
OOUB-G22	3.38	6.3	4.7	7.8	3 J	5.9	49	23
OOUB-G28	2.62	8.1	5.9	10	3.2	5.6	45	32
OUBM-G01	5.23	15	21	6	3.3 J	6.2	52	21
OUBM-G17	2.99	5.8	3.9	4.3	2.5 J	4.7	33	13
OUBM-G18	1.16	4.5	2.7	3.5	3.1	5.8	52	15
OUBM-G28	3.49	47	19	10	57	47	200	71
OUBM-G34	3.45	12	11	9.3	22	28	370	63
OUBM-G36	3.53	9.9	6.9	7.7	4.9	10	80	37
OUBM-G39	3.3	68 D ^b	3.9 D	87 D	2.3 D	5 D	7.5 D	4.7 D
OUBM-G41	3.42	20	14	14	9.4	25	160	110
OUBM-G43	3.07	12	7.8	7	7.6	11	96	35
OUBM-G45	4.1	15	17	13	12	69	290	350
OUBM-G48	3.36	11	7.7	8.6	4.4	9	62	34
OUBM-G50	3.33	5.5	4.4	9.9	6.6	9.8	80	35
OUBM-G55	3.39	22	16	18	33	40	390	180
OUBM-G56	3.47	8	5.7	76	88	78	1500 D	280
OUBM-G59	3.99	28	17	30	26	38	290	170
OUBM-G60	4.48	33	32	23	86	110	760	250
OUBM-G61	4.18	21	12	61	78	150	38 D	310
OUBM-G63	4.2	23	13	22	23	39	380	180
OUBM-G64	3.78	14	8.7	15	10	23	170	120
OUBM-G66	3.37	15	13	15	11	55	300	250
OUBM-G67	3.5	53 D	3.9 D	2.4 D	57 D	730 D	7.5 D	24 D
OUBM-G69	1.75	15	13	14	52	60	530	210

Table 5 (continued)

Station or OUB Grid Cell	TOC (% dry weight)	Sediment PAH Concentration (µg/kg dry weight)								
		Fluoranthene	Pyrene	Benz(a)-anthracene	Chrysene	Benzo(b,k)-fluoranthene	Benzo(a)-pyrene	Indeno (1,2,3-cd)-pyrene	Dibenz (a,h)-anthracene	Benzo(g,h,i)-perylene
OOUB-G01	1.88	23	25	11	19	26.7	13	10	2.1 J ^a	11
OOUB-G09	4.6	170	150	53	100	145	60	46	9.6	47
OOUB-G14	4.26	94	120	54	77	132	72	54	11	57
OOUB-G17	3.77	130	150	81	130	165	92	64	13	67
OOUB-G18	3.84	97	110	62	85	135	80	53	11	56
OOUB-G21	3.04	120	150	74	110	175	110	75	14	81
OOUB-G22	3.38	150	170	78	110	173	100	72	16	81
OOUB-G28	2.62	160	200	100	130	187	130	81	16	91
OUBM-G01	5.23	150	320	140	170	251	140	77	20	85
OUBM-G17	2.99	85	100	50	76	115	66	45	9.2	48
OUBM-G18	1.16	110	130	58	72	149	83	57	13	60
OUBM-G28	3.49	490	490	210	300	490	230	160	39	170
OUBM-G34	3.45	550	470	240	420	610	280	180	40	170
OUBM-G36	3.53	250	250	120	260	298	140	91	20	89
OUBM-G39	3.3	31 D ^b	9200 D	4.8 D	7000 D	6600 D	2400 D	1200 D	280 D	6.4 D
OUBM-G41	3.42	440	570	260	570	690	310	190	50	190
OUBM-G43	3.07	240	240	120	220	284	130	82	18	78
OUBM-G45	4.1	550	470	320	670	710	310	180	50	170
OUBM-G48	3.36	160	200	98	160	215	120	84	16	91
OUBM-G50	3.33	220	260	120	210	267	140	86	19	86
OUBM-G55	3.39	6.1 D	3.7 D	690	1100	1280	620	350	90	330
OUBM-G56	3.47	19000 D	7.4 D	9.6 D	5 D	5203 D	2100 D	3.2 D	280	1000
OUBM-G59	3.99	980	1200	460	930	1090	480	260	62	240
OUBM-G60	4.48	3.1 D	2100 D	860	1400 D	1480 D	810	370	110	360
OUBM-G61	4.18	9700 D	6600 D	24 D	3200 D	2630 D	810	440	100	360
OUBM-G63	4.2	3.1 D	1600 D	520	1400 D	1560	550	370	92	340
OUBM-G64	3.78	550	580	310	600	700	320	190	49	180
OUBM-G66	3.37	620	640	410	850	870	410	250	63	240
OUBM-G67	3.5	31 D	7000 D	4300 D	5600 D	4800 D	2100 D	760 D	200 D	610 D
OUBM-G69	1.75	6.1 D	3.7 D	370	2.5 D	1050	400	290	77	290
a. J Estimated value less than method reporting limit but above method detection limit. b. D Result is from a diluted sample.										

Table 6. Organic Carbon-Normalized Confirmatory LPAH Concentrations in Sinclair Inlet Sediment

Station or OUB Grid Cell	TOC (% dry weight)	Organic Carbon-Normalized Sediment PAH Concentration (mg/kg OC)						
		Naphthalene	2-Methyl- naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
SQS		99	38	66	16	23	100	220
MCUL		170	64	66	57	79	480	1200
OOUB-G01	1.88	0.1 J ^a	0.1 J	0.0 J	0.0 J	0.1 J	0.7	0.2
OOUB-G09	4.6	0.1	0.1	0.1 J	0.1 J	0.1	1.1	0.2
OOUB-G14	4.26	0.2	0.1	0.1	0.1 J	0.1	0.9	0.3
OOUB-G17	3.77	0.2	0.1	0.2	0.1	0.2	1.7	0.6
OOUB-G18	3.84	0.1	0.1	0.1	0.1 J	0.1 J	0.9	0.3
OOUB-G21	3.04	0.2	0.1	0.3	0.1 J	0.2	1.4	0.6
OOUB-G22	3.38	0.2	0.1	0.2	0.1 J	0.2	1.4	0.7
OOUB-G28	2.62	0.3	0.2	0.4	0.1	0.2	1.7	1.2
OUBM-G01	5.23	0.3	0.4	0.1	0.1 J	0.1	1.0	0.4
OUBM-G17	2.99	0.2	0.1	0.1	0.1 J	0.2	1.1	0.4
OUBM-G18	1.16	0.4	0.2	0.3	0.3	0.5	4.5	1.3
OUBM-G28	3.49	1.3	0.5	0.3	1.6	1.3	6	2.0
OUBM-G34	3.45	0.3	0.3	0.3	0.6	0.8	11	1.8
OUBM-G36	3.53	0.3	0.2	0.2	0.1	0.3	2.3	1.0
OUBM-G39	3.3	2.1 D ^b	0.1 D	2.6 D	0.1 D	0.2 D	0.2 D	0.1 D
OUBM-G41	3.42	0.6	0.4	0.4	0.3	0.7	5	3.2
OUBM-G43	3.07	0.4	0.3	0.2	0.2	0.4	3.1	1.1
OUBM-G45	4.1	0.4	0.4	0.3	0.3	1.7	7	8.5
OUBM-G48	3.36	0.3	0.2	0.3	0.1	0.3	1.8	1.0
OUBM-G50	3.33	0.2	0.1	0.3	0.2	0.3	2.4	1.1
OUBM-G55	3.39	0.6	0.5	0.5	1.0	1.2	11.5	5.3
OUBM-G56	3.47	0.2	0.2	2.2	2.5	2.2	43 D	8.1
OUBM-G59	3.99	0.7	0.4	0.8	0.7	1.0	7	4.3
OUBM-G60	4.48	0.7	0.7	0.5	1.9	2.5	17.0	5.6
OUBM-G61	4.18	0.5	0.3	1.5	1.9	3.6	1 D	7.4
OUBM-G63	4.2	0.5	0.3	0.5	0.5	0.9	9.0	4.3
OUBM-G64	3.78	0.4	0.2	0.4	0.3	0.6	4	3.2
OUBM-G66	3.37	0.4	0.4	0.4	0.3	1.6	9	7.4
OUBM-G67	3.5	1.5 D	0.1 D	0.1 D	1.6 D	21 D	0.2 D	0.7 D
OUBM-G69	1.75	0.9	0.7	0.8	3.0	3.4	30.3	12

Table 6 (continued)

Station or OUB Grid Cell	TOC (% dry weight)	Organic Carbon-Normalized Sediment PAH Concentration (mg/kg OC)								
		Fluoranthene	Pyrene	Benz(a)- anthracene	Chrysene	Benzo(b,k)- fluoranthene	Benzo(a)- pyrene	Indeno (1,2,3-cd)- pyrene	Dibenz (a,h)- anthracene	Benzo(g,h,i)- perylene
SQS		160	1000	110	110	230	99	34	12	31
MCUL		1200	1400	270	460	450	210	88	33	78
OOUB-G01	1.88	1.2	1.3	0.6	1.0	1.4	0.7	0.5	0.1 J	0.6
OOUB-G09	4.6	3.7	3.3	1.2	2.2	3.2	1.3	1.0	0.2	1.0
OOUB-G14	4.26	2.2	2.8	1.3	1.8	3.1	1.7	1.3	0.3	1.3
OOUB-G17	3.77	3.4	4.0	2.1	3.4	4.4	2.4	1.7	0.3	1.8
OOUB-G18	3.84	2.5	2.9	1.6	2.2	3.5	2.1	1.4	0.3	1.5
OOUB-G21	3.04	3.9	4.9	2.4	3.6	5.8	3.6	2.5	0.5	2.7
OOUB-G22	3.38	4.4	5.0	2.3	3.3	5.1	3.0	2.1	0.5	2.4
OOUB-G28	2.62	6.1	7.6	3.8	5.0	7.1	5.0	3.1	0.6	3.5
OUBM-G01	5.23	2.9	6.1	2.7	3.3	4.8	2.7	1.5	0.4	1.6
OUBM-G17	2.99	2.8	3.3	1.7	2.5	3.8	2.2	1.5	0.3	1.6
OUBM-G18	1.16	9.5	11	5.0	6.2	13	7.2	4.9	1.1	5.2
OUBM-G28	3.49	14	14	6.0	8.6	14	6.6	4.6	1.1	4.9
OUBM-G34	3.45	16	14	7.0	12	18	8.1	5.2	1.2	4.9
OUBM-G36	3.53	7.1	7.1	3.4	7.4	8.4	4.0	2.6	0.6	2.5
OUBM-G39	3.3	0.9 D	279 D	0.1 D	212 D	200 D	73 D	36 D	8.5 D	0.2 D
OUBM-G41	3.42	13	17	7.6	17	20	9.1	5.6	1.5	5.6
OUBM-G43	3.07	7.8	7.8	3.9	7.2	9.3	4.2	2.7	0.6	2.5
OUBM-G45	4.1	13	11	7.8	16	17	7.6	4.4	1.2	4.1
OUBM-G48	3.36	4.8	6.0	2.9	4.8	6.4	3.6	2.5	0.5	2.7
OUBM-G50	3.33	6.6	7.8	3.6	6.3	8.0	4.2	2.6	0.6	2.6
OUBM-G55	3.39	0.2 D	0.1 D	20	32	38	18	10	2.7	10
OUBM-G56	3.47	548 D	0.2 D	0.3 D	0.1 D	150 D	61 D	0.1 D	8.1	29
OUBM-G59	3.99	25	30	12	23	27	12	6.5	1.6	6.0
OUBM-G60	4.48	0.1 D	47 D	19	31 D	33 D	18	8.3	2.5	8.0
OUBM-G61	4.18	232 D	158 D	0.6 D	77 D	63 D	19	11	2.4	8.6
OUBM-G63	4.2	0.1 D	38 D	12	33 D	37	13	8.8	2.2	8.1
OUBM-G64	3.78	15	15	8.2	16	19	8.5	5.0	1.3	4.8
OUBM-G66	3.37	18	19	12	25	26	12	7.4	1.9	7.1
OUBM-G67	3.5	0.9 D	200 D	123 D	160 D	137 D	60 D	22 D	5.7 D	17 D
OUBM-G69	1.75	0.3 D	0.2 D	21	0.1 D	60	23	17	4.4	17

a. J Estimated value less than method reporting limit but above method detection limit.
b. D Result is from a diluted sample.
c. Yellow highlight with bold type indicates organic carbon-normalized result is greater than the SQS value.

Table 7. Dry Weight and Organic Carbon-Normalized Concentrations of Total LPAH, Total HPAH, and Total PAH Concentrations in Sinclair Inlet Confirmatory Samples

Station or OUB Grid Cell	TOC (% dry weight)	Sediment PAH Concentration (µg/kg dry weight)			Sediment PAH Concentration (mg/kg OC)		
		Total LPAH	Total HPAH	Total PAH	Total LPAH	Total HPAH	Total PAH
SQS					370	960	1330 ^a
MCUL					780	5300	6080 ^a
OOUB-G01	1.88	24	141	164	1.3	7	9
OOUB-G09	4.60	84	781	865	1.8	17	19
OOUB-G14	4.26	77	671	748	1.8	16	18
OOUB-G17	3.77	114	892	1006	3.0	24	27
OOUB-G18	3.84	67	689	756	1.8	18	20
OOUB-G21	3.04	88	909	997	2.9	30	33
OOUB-G22	3.38	100	950	1050	2.9	28	31
OOUB-G28	2.62	110	1095	1205	4.2	42	46
OUBM-G01	5.23	125	1353	1478	2.4	26	28
OUBM-G17	2.99	67	594	661	2.2	20	22
OUBM-G18	1.16	87	732	819	7.5	63	71
OUBM-G28	3.49	451	2579	3030	13	74	87
OUBM-G34	3.45	515	2960	3475	15	86	101
OUBM-G36	3.53	156	1518	1674	4.4	43	47
OUBM-G39 ^b	3.30	178	26722	26901	5.4	810	815
OUBM-G41	3.42	352	3270	3622	10	96	106
OUBM-G43	3.07	176	1412	1588	5.7	46	52
OUBM-G45	4.10	766	3430	4196	19	84	102
OUBM-G48	3.36	137	1144	1281	4.1	34	38
OUBM-G50	3.33	151	1408	1559	4.5	42	47
OUBM-G55	3.39	699	4470	5169	21	132	152
OUBM-G56 ^b	3.47	2036	27608	29644	59	796	854
OUBM-G59	3.99	599	5702	6301	15	143	158
OUBM-G60	4.48	1294	7493	8787	29	167	196
OUBM-G61 ^b	4.18	670	23864	24534	16	571	587
OUBM-G63	4.20	680	6435	7115	16	153	169
OUBM-G64	3.78	361	3479	3840	10	92	102
OUBM-G66	3.37	659	4353	5012	20	129	149
OUBM-G67 ^b	3.50	878	25401	26279	25	726	751
OUBM-G69	1.75	894	2489	3383	51	142	193
a. There are no established SQS and MCUL values for total PAHs; the value is the sum of the LPAH and HPAH SQS or MCUL values. b. Total HPAH does not exceed SQS in these samples, but one or two individual HPAH compounds exceed SQS: chrysene and indeno(1,2,3-cd)pyrene in OUBM-G39, fluoranthene in OUBM-G56 and G61, and chrysene and benz(a)anthracene in OUBM-G67.							

Phthalate Results

The stations for confirmatory analysis were selected to include at least three stations in each Sinclair Inlet water body segment that was on the state 303(d) list for phthalates. The results of GC/MS analysis for phthalates are provided in Table 8, on both a dry weight and organic carbon-normalized basis. Table 8 shows that butylbenzyl phthalate exceeded SQS in three samples. OUBM-G01 is in Sinclair Inlet 303(d) segment F6E6 while OUBM-G55 and OUBM-G63 are in 303(d) segment F6F3.

Table 8. Confirmatory GC/MS Concentrations of Phthalates in Sinclair Inlet Sediment

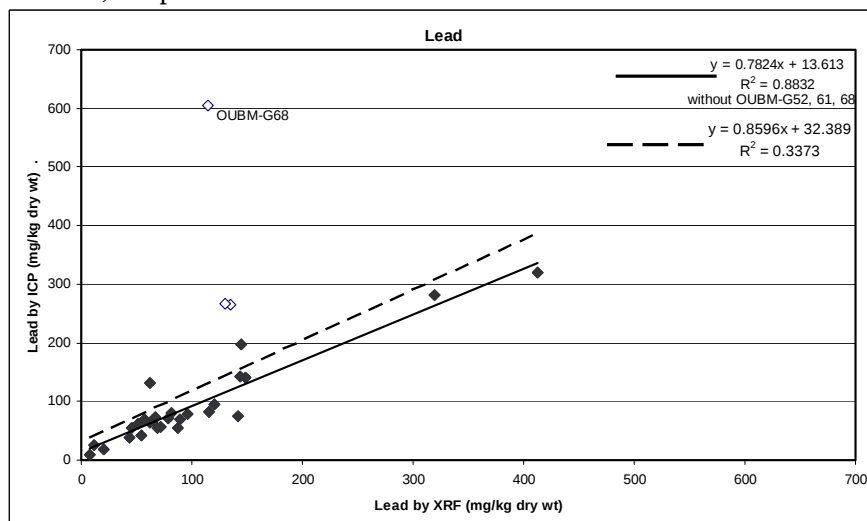
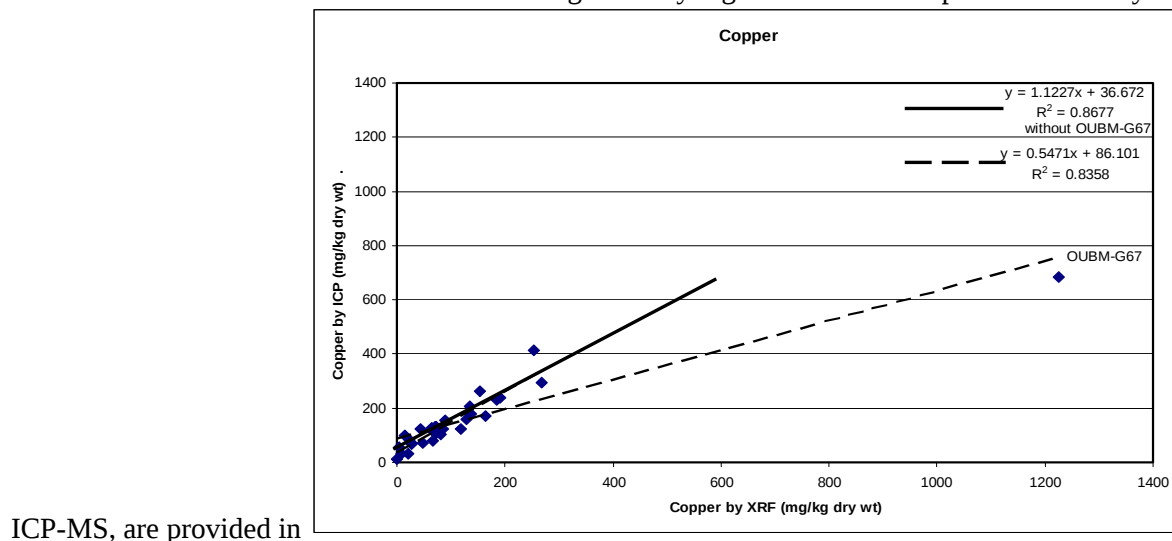
Station or OUB Grid Cell	Sediment Phthalate Concentration (µg/kg dry weight)			TOC (% dry weight)	Sediment Phthalate Concentration (mg/kg OC)		
	Di-n- butyl Phthalate	Butyl Benzyl Phthalate	Bis(2- ethylhexyl) Phthalate		Di-n-butyl Phthalate	Butyl Benzyl Phthalate	Bis(2- ethylhexyl) Phthalate
SQS					220	4.9	47
MCUL					1700	64	78
OOUB-G01	40 U ^a	70 D ^b	37 J ^c D	1.88	2.1 U	3.7 D	2.0 JD
OOUB-G09	63 U	26 U	56 U	4.60	1.4 U	0.6 U	1.2 U
OOUB-G14	65 U	26 U	57 U	4.26	1.5 U	0.6 U	1.3 U
OOUB-G17	62	29	91 J	3.77	1.6	0.8	2.4 J
OOUB-G18	81	55	110 J	3.84	2.1	1.4	2.9 J
OOUB-G21	50 U	21 U	68 JD	3.04	1.6 U	0.7 U	2.2 JD
OOUB-G22	51 U	21 U	93 JD	3.38	1.5 U	0.6 U	2.8 JD
OOUB-G28	49 U	20 U	52 JD	2.62	1.9 U	0.8 U	2.0 JD
OUBM-G01	72 JD	1200 D	680 D	5.23	1.4 JD	22.9 D ^d	13.0 D
OUBM-G17	51	28	83 J	2.99	1.7	0.9	2.8 J
OUBM-G18	40 U	16 U	50 JD	1.16	3.4 U	1.4 U	4.3 JD
OUBM-G28	55 JD	92 D	570 JD	3.49	1.6 JD	2.6 D	16.3 JD
OUBM-G34	67	53	380	3.45	1.9	1.5	11.0
OUBM-G36	51 U	21 U	200 JD	3.53	1.4 U	0.6 U	5.7 JD
OUBM-G39	40 U	120 D	590 D	3.30	1.2 U	3.6 D	17.9 D
OUBM-G41	67 JD	20 U	340 JD	3.42	2.0 JD	0.6 U	9.9 JD
OUBM-G43	71 JD	56 JD	680 D	3.07	2.3 JD	1.8 JD	22.1 D
OUBM-G45	63 JD	24 U	180 JD	4.10	1.5 JD	0.6 U	4.4 JD
OUBM-G48	59 JD	19 U	120 JD	3.36	1.8 JD	0.6 U	3.6 JD
OUBM-G50	92 JD	66 D	100 JD	3.33	2.8 JD	2.0 D	3.0 JD
OUBM-G55	160 D	280 D	350 JD	3.39	4.7 D	8.3 D ^d	10.3 JD
OUBM-G56	94 JD	68 D	190 JD	3.47	2.7 JD	2.0 D	5.5 JD
OUBM-G59	80 JD	22 U	270 JD	3.99	2.0 JD	0.6 U	6.8 JD
OUBM-G60	62 JD	18 U	1800 D	4.48	1.4 JD	0.4 U	40.2 D
OUBM-G61	59 JD	16 U	340 JD	4.18	1.4 JD	0.4 U	8.1 JD
OUBM-G63	210 D	280 D	330 JD	4.20	5.0 D	6.7 D ^d	7.9 JD
OUBM-G64	150 D	99 D	380 JD	3.78	4.0 D	2.6 D	10.1 JD
OUBM-G66	80 JD	23 U	300 JD	3.37	2.4 JD	0.7 U	8.9 JD
OUBM-G67	130 D	16 U	560 D	3.50	3.7 D	0.5 U	16.0 D
OUBM-G69	89 JD	16 U	130 JD	1.75	5.1 JD	0.9 U	7.4 JD
a. U Analyte not detected above given concentration (method detection limit).							
b. D Result is from a diluted sample.							
c. J Estimated value less than method reporting limit but above method detection limit.							
d. Yellow highlight and bold type indicates value exceeds SQS value.							

Metals Results

The results of confirmatory metals analysis by ICP-MS are provided in Table 9. In addition to the screening metals copper, lead, and zinc, ICP-MS results are provided for silver and cadmium, which were the basis for several Sinclair Inlet 303(d) listings. Stations for confirmatory metals analysis were selected to include at least three stations in each Sinclair Inlet water body segment that was on the state 303(d) list for silver or cadmium. Table 9 shows that silver and cadmium concentrations were below SQS in all confirmatory samples.

For the XRF screening metals copper, lead, and zinc, the relationship between screening and ICP-MS confirmatory concentrations was evaluated to determine if screening values could be used to estimate definitive concentrations for samples that were not analyzed by ICP-MS. This is consistent with the approach used in the earlier Metals Verification Study of Sinclair Inlet samples collected in 2003 (Kohn et al. 2004). The regression relationships used to estimate definitive concentrations for Sinclair Inlet samples collected in 2007 are shown in Figure 1. Results for all 30 confirmatory samples are plotted, but outlier results were excluded from the regression used for estimating definitive concentrations.

Definitive concentrations, defined as the confirmatory ICP-MS result if the sample was analyzed or the concentration estimated from the XRF screening result by regression if the sample was not analyzed by



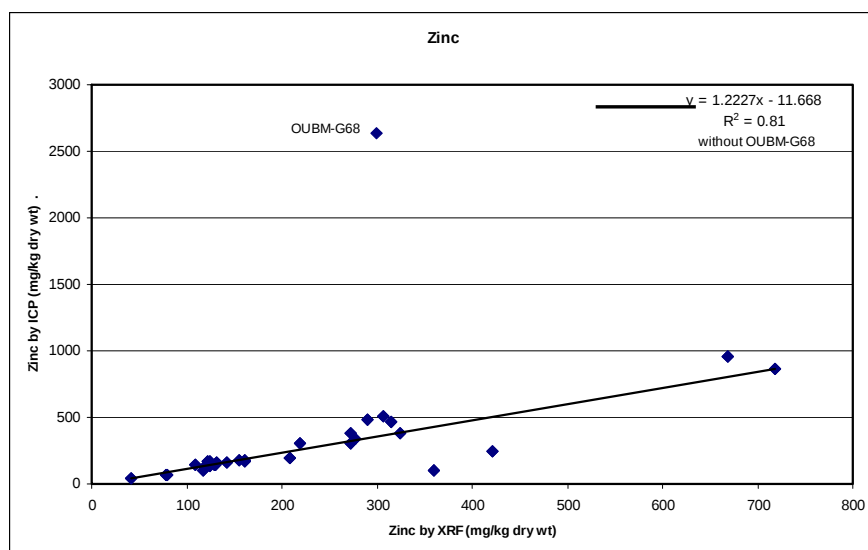


Figure 1. Relationship Between XRF Screening and Confirmatory ICP-MS Concentrations for Copper, Lead, and Zinc

Table 10. The definitive ICP-MS concentrations of copper, lead, or zinc exceeded SQS at several stations; all of these occurred in samples confirmed by ICP-MS. Similarly to the 2003 results, higher concentrations of copper, lead, and zinc occur in a few samples located close to shore and certain piers at the east end of the shipyard (OUBM-G60, OUBM-G67, OUBM-G68). For copper, lead, and zinc, the XRF screening values alone were not sufficient to identify whether SQS were likely to be exceeded, but using past screening-confirmatory regression relationships in the selection process improved our ability to predict whether a sample might exceed SQS (Table 4).

Conclusions

Confirmatory analysis of PAHs showed that organic carbon-normalized total LPAH and total HPAH in confirmatory samples were all below Washington State SQS, although one to two individual HPAH compounds were above the SQS concentration in four samples (OUBM-G39, G56, G61, G67). These results suggest improved sediment quality with respect to PAH concentrations near the shipyard, because samples representing the same locations collected in 2003 showed four stations where total LPAH or total HPAH concentrations exceeded SQS, as did a greater number of individual PAH concentrations (Kohn et al. 2006).

Definitive ICP-MS concentrations of silver and cadmium were below the silver and cadmium SQS concentrations in all confirmatory samples. Definitive copper, lead, and zinc concentrations (ICP-MS or estimated by regression) were more difficult to compare between years because relatively few samples received confirmatory analysis in both years, and the regression relationships between screening and confirmatory analyses vary between years. It is clear from the current dataset that the analyzed metals are all below SQS in Sinclair Inlet sediments outside of OUB (represented by OOUB samples). Compared with the prior verification study (Kohn et al. 2004), there were fewer instances of OUB samples exceeding SQS (seven vs. nine); however, several new instances of metals exceeding the MCUL (copper in OUBM-G60, lead and zinc in OUBM-G68) were observed in the present study. Consistent with the prior study, sediments with higher concentrations of copper, lead, and/or zinc are spatially limited to the east end of the shipyard close to shore and shipyard structures.

Table 9. Confirmatory ICP-MS Metal Concentrations in Sinclair Inlet Sediment

Station or OUB Grid Cell	Sediment Metals Concentration (mg/kg dry wt)							
	Cr	Ni	Zn	Ag	Cu	As	Cd	Pb
SQS	260		410	6.1	390	57	5.1	450
MCUL	270		960	6.1	390	93	6.7	530
OOUB-G01	117	36	71	0.31	32	7 B ^a	0.3	19
OOUB-G07	106	52	181	1.57	132	18	2.5	71
OOUB-G13	98	47	170	1.15	126	18	1.3	80
OOUB-G14	87	44	165	1.26	123	18	1.6	73
OOUB-G17	92	47	168	1.18	122	17	1.3	78
OOUB-G21	96	44	162	0.72	120	15	1.3	67
OOUB-G24	92	44	169	0.77	103	15	0.9	70
OOUB-G25	73	31	101	0.47	56	10 B	0.7	42
OOUB-G26	80	24	41	0.12	13	5 B	0.1	9
OOUB-G27	78	38	138	0.55	80	13	0.9	56
OOUB-G28	91	42	142	0.65	74	13	0.9	56
OOUB-G31	91	42	147	0.61	73	14	0.9	56
OUBM-G10	86	35	104	0.57	69	11 B	0.8	39
OUBM-G12	91	42	127	0.62	83	14	1.4	55
OUBM-G17	90	45	148	0.80	107	16	1.5	64
OUBM-G19	97	45	198	0.64	131	22	1.3	69
OUBM-G30	97	46	250	0.97	159	17	1.6	75
OUBM-G39	89	37	304	1.07	205	13	1.3	142
OUBM-G43	87	43	307	0.81	157	18	1.1	82
OUBM-G52	109	60	483^b	1.12	261	25	1.2	265
OUBM-G53	91	44	178	0.62	101	16	1.1	63
OUBM-G55	101	48	335	0.72	178	18	1.8	95
OUBM-G59	96	50	505	0.81	237	18	2.5	197
OUBM-G60	118	49	863	1.08	413	27	2.6	320
OUBM-G61	117	36	463	0.53	170	21	1.7	266
OUBM-G63	93	51	383	1.10	296	22	1.7	140
OUBM-G65	112	40	381	0.54	124	19	1.5	131
OUBM-G67	89	39	954	0.92	683	51	1.4	281
OUBM-G68	118	46	2632	0.87	230	26	3.0	605
OUBM-G71	52	23	67	0.22	30	7 B	0.4	26
a. B Analyte detected in blank at concentration greater than reporting limit, and sample concentration is <10X the amount detected in the blank.								
b. Yellow highlight and bold type indicates value exceeds SQS value.								

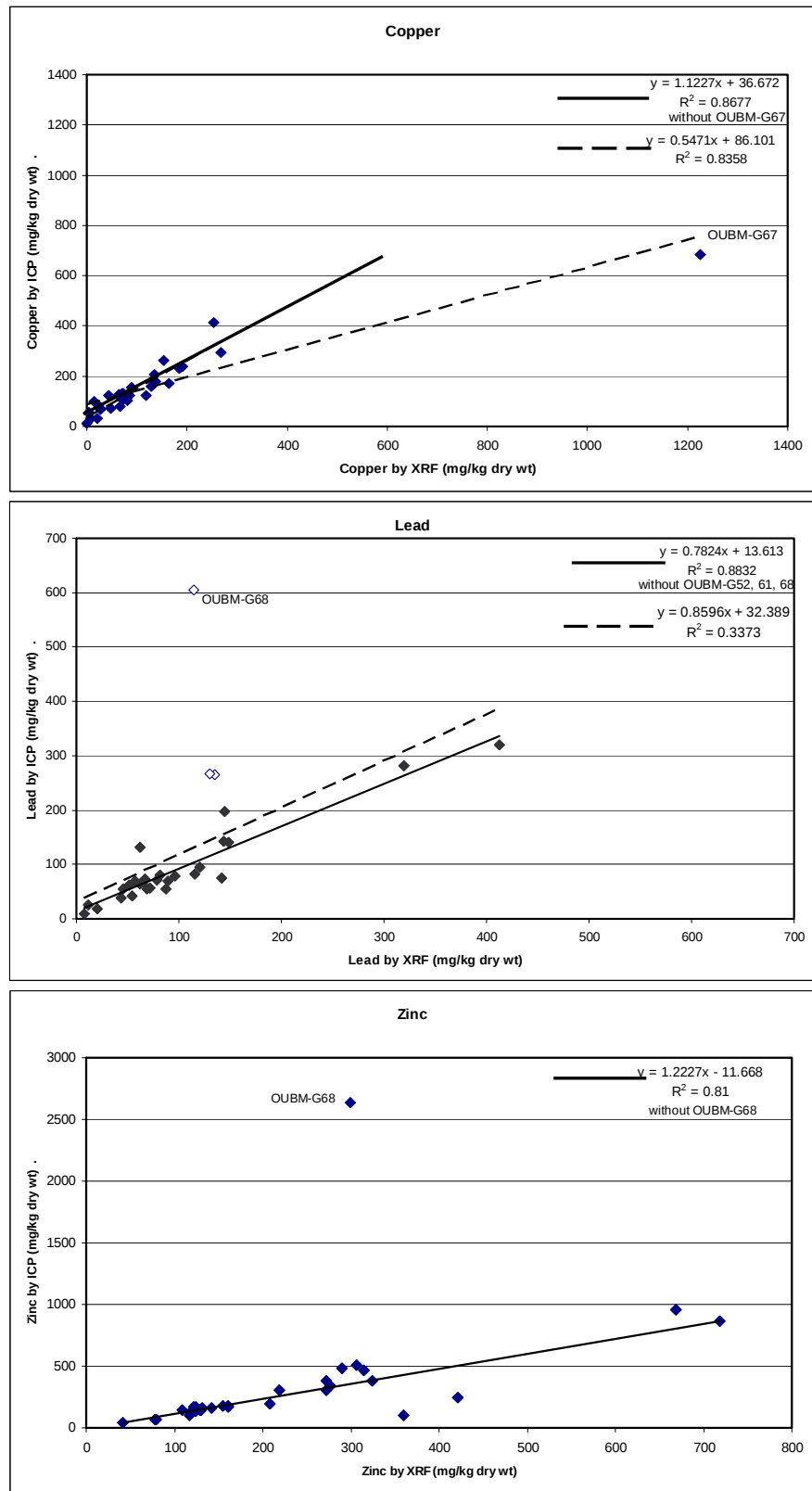


Figure 1. Relationship Between XRF Screening and Confirmatory ICP-MS Concentrations for Copper, Lead, and Zinc

Table 10. Definitive Concentrations (ICP-MS or estimated by regression) of Copper, Lead, and Zinc in Sinclair Inlet Sediment

Station or OUB Grid Cell	Confirmatory Analysis in 2008	Cu ^a (mg/kg dry weight)	Pb ^a (mg/kg dry weight)	Zn ^a (mg/kg dry weight)
		SQS	390	450
		MCUL	390	530
				410
OOUB-G01	Yes	32	19	71
OOUB-G02	No	55	45	23
OOUB-G03	No	56	25	26
OOUB-G04	No	55	25	33
OOUB-G05	No	97	49	129
OOUB-G06	No	113	58	149
OOUB-G07	Yes	132	71	181
OOUB-G08	No	151	69	170
OOUB-G09	No	145	68	165
OOUB-G10	No	107	54	136
OOUB-G11	No	106	50	160
OOUB-G11 dup	No	102	69	156
OOUB-G12	No	56	19	87
OOUB-G13	Yes	126	80	170
OOUB-G14	Yes	123	73	165
OOUB-G15	No	104	52	143
OOUB-G15 dup	No	99	69	166
OOUB-G16	Yes	122	78	168
OOUB-G17	No	131	89	138
OOUB-G18	No	122	70	174
OOUB-G19	No	100	78	148
OOUB-G20	No	128	62	163
OOUB-G21	Yes	120	67	162
OOUB-G22	No	115	59	149
OOUB-G23	No	122	50	134
OOUB-G24	Yes	103	70	169
OOUB-G25	Yes	56	42	101
OOUB-G26	Yes	13	9	41
OOUB-G27	Yes	80	56	138
OOUB-G28	Yes	74	56	142
OOUB-G29	No	37	39	98
OOUB-G30	No	37	25	73
OOUB-G31	Yes	73	56	147
OOUB-G32	No	74	63	106
OUBM-G01	No	161	67	213
OUBM-G02	No	98	50	153
OUBM-G03	No	115	57	158
OUBM-G04	No	121	88	163
OUBM-G05	No	139	81	155
OUBM-G06	No	128	81	188

Table 10 (continued)

Station or OUB Grid Cell	Confirmatory Analysis in 2008	Cu^a (mg/kg dry weight)	Pb^a (mg/kg dry weight)	Zn^a (mg/kg dry weight)
		SQS	390	450
		MCUL	390	530
OUBM-G07	No	98	64	159
OUBM-G08	No	130	80	126
OUBM-G09	No	114	51	133
OUBM-G09 dup	No	66	79	129
OUBM-G10	Yes	69	39	104
OUBM-G11	No	119	48	125
OUBM-G12	Yes	83	55	127
OUBM-G13	No	98	74	136
OUBM-G14	No	64	36	115
OUBM-G15	No	NA ^a	NA	NA
OUBM-G16	No	80	40	117
OUBM-G17	Yes	107	64	148
OUBM-G18	No	68	63	104
OUBM-G19	Yes	131	69	198
OUBM-G20	No	72	64	127
OUBM-G21	No	92	41	133
OUBM-G22	No	137	69	151
OUBM-G23	No	98	62	128
OUBM-G24	No	167	63	199
OUBM-G25	No	205	88	200
OUBM-G26	No	163	70	215
OUBM-G27	No	139	73	205
OUBM-G27 dup	No	121	111	162
OUBM-G28	No	191	70	233
OUBM-G29	No	251	90	263
OUBM-G30	Yes	159	75	250
OUBM-G31	No	126	89	177
OUBM-G32	No	91	80	165
OUBM-G33	No	209	97	211
OUBM-G34	No	185	75	265
OUBM-G35	No	165	85	174
OUBM-G36	No	228	100	214
OUBM-G37	No	225	104	204
OUBM-G38	No	198	75	197
OUBM-G39	Yes	205	142	304
OUBM-G40	No	226	107	201
OUBM-G41	No	195	74	222
OUBM-G42	No	158	101	220
OUBM-G43	Yes	157	82	307
OUBM-G44	No	145	67	188
OUBM-G45	No	239	94	196

Table 10 (continued)

Station or OUB Grid Cell	Confirmatory Analysis in 2008	Cu ^a (mg/kg dry weight)	Pb ^a (mg/kg dry weight)	Zn ^a (mg/kg dry weight)
		SQS	390	450
		MCUL	390	530
OUBM-G46	No	121	59	174
OUBM-G46 dup	No	115	68	167
OUBM-G47	No	89	66	176
OUBM-G48	No	113	75	202
OUBM-G49	No	140	79	235
OUBM-G50	No	129	75	196
OUBM-G51	No	116	75	152
OUBM-G52	Yes	261	265	483
OUBM-G52 dup	No	249	127	361
OUBM-G53	Yes	101	63	178
OUBM-G54	No	93	61	139
OUBM-G55	Yes	178	95	335
OUBM-G56	No	165	91	253
OUBM-G57	No	168	93	250
OUBM-G58	No	90	37	175
OUBM-G59	Yes	237	197	505
OUBM-G60	Yes	413	320	863
OUBM-G61	Yes	170	266	463
OUBM-G62	No	114	61	146
OUBM-G63	Yes	296	140	383
OUBM-G64	No	241	80	242
OUBM-G65	Yes	124	131	381
OUBM-G66	No	120	84	189
OUBM-G67	Yes	683	281	954
OUBM-G68	Yes	230	605	2632
OUBM-G69	No	97	67	137
OUBM-G70	No	96	81	170
OUBM-G71	Yes	30	26	67
a. Definitive concentrations are ICP-MS result for confirmatory samples; estimated by linear regression for non-confirmatory samples. b. NA Not applicable (no sample for OUBM-G15). c. Yellow highlight and bold type indicates value exceeds SQS value.				

References

Kohn, NP, MC Miller, JM Brandenberger, and RK Johnston. 2004. *Metals Verification Study for Sinclair and Dyes Inlet, Washington*. Prepared for Puget Sound Naval Shipyard & Intermediate Maintenance Facility Project ENVVEST, Bremerton, Washington. September, 2004. PNNL-14872. Pacific Northwest National Laboratory, Richland, Washington.

Kohn NP, LA Niewolny, JM Brandenberger, and RK Johnston. 2006. *Organics Verification Study for Sinclair and Dyes Inlets, Washington*. PNNL-16070, Pacific Northwest National Laboratory, Richland, WA.

APPENDIX A



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Page 1 of 2

Installation ID						Job No.												
BUC				33759512														
Site ID OUT-0UBM		Zone ID —		Sampling Co. URS														
Airbill Co./Number Hand Deliver				Shipping Date 5/17/07														
Sample Number	Sample Collection		Matrix Type	Sample Type	Analytical Methods													Remarks
	Date (mm/dd/yy)	Time (24 Hr.)																
232603	05/16/07	1335	SD	ES	X													1500-G13
232604		1417	SD	ES	X													1500-G14
232605		1456	SD	ES	X													1500-G15
232606		1456	SD	ES	X													1500-G15
232607		1543	SD	ES	X													1500-G16
232608		1640	SD	ES	X													1500-G3
232609		1722	SD	ES	X													1500-G4
232610		1821	SD	ES	X													1500-G1
232611		1832	SD	ES	X													1500-G2
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																		
Relinquished by Sampler: (Signature) <i>[Signature]</i>			Date 05/16/07	Time 1330	Received by: (Signature) <i>[Signature]</i>			Laboratory Name: MA										
Relinquished by: (Signature) <i>[Signature]</i>			Date 5/22/07	Time 1315	Received by: (Signature) <i>[Signature]</i>			Laboratory Contract No.: MA										
Relinquished by: (Signature)			Date	Time	Received by Lab: (Signature)			Samples Disposed by:	Date		Time							

Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy

Sample Types Types: ER - Equipment Rinsate; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank



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Installation ID		Job No.		Analytical Methods												Remarks			
Site ID	Zone ID	Sampling Co.		Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis			
Airbill Co./Number	Shipping Date																		
Sample Number	Sample Collection		Matrix Type	Sample Type															
	Date (mm/dd/yy)	Time (24 Hr.)																	
232612	05/17/07	0903	SD	ES	X													1500-G17 MS/MSD	
232613		0942	SD	ES	X													1500-G18	
232614		1017	SD	ES	X													1500-G19	
232615		1052	SD	ES	X													1500-G20	
232616		1201	SD	ES	X													1500-G31	
232617		1247	SD	ES	X													1500-G32	
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																			
Relinquished by Sampler: (Signature)		Date	Time	Received by: (Signature)		Laboratory Name:													
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Laboratory Contract No.:													
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:										Date	Time		

Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy

Sample Types Types: ER - Equipment Rinsate; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank

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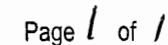
Chain of Custody

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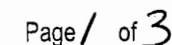
Contact: Josie Smith
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Page 1 of 1

Installation ID <u>BVL</u>		Job No. <u>33759512</u>		ANALYTICAL METHODS <u>Ernest</u>															
Site ID <u>OUBM</u>	Zone ID —	Sampling Co. <u>URS</u>																	
Airbill Co./Number <u>Hand Delivered</u>		Shipping Date <u>5/17/07</u>																	
Sample Number	Sample Collection Date (mm/dd/yy) Time (24 Hr.)	Matrix Type	Sample Type																
<u>232583</u>	<u>05/16/07</u> <u>1105</u>	<u>SD</u>	<u>ES</u>	NUMBER OF BOTTLES PER ANALYTICAL METHODS	<u>X</u>													Indicate Any Condition That Would Affect Sample Analysis Indicate Samples Containing Quantities for MS/MSD Analysis Remarks	
<u>232584</u>	<u>↓</u> <u>1143</u>	<u>SD</u>	<u>ES</u>		<u>X</u>														<u>500-624</u>
<u>232585</u>	<u>↓</u> <u>1220</u>	<u>SD</u>	<u>ES</u>		<u>X</u>														<u>500-625</u>
																			<u>500-626</u>
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																			
Relinquished by Sampler: (Signature) <u>[Signature]</u>		Date <u>5/17/07</u>	Time <u>1330</u>	Received by: (Signature) <u>[Signature]</u>		Laboratory Name: <u>MA</u>													
Relinquished by: (Signature) <u>[Signature]</u>		Date <u>5/22/07</u>	Time <u>1330</u>	Received by: (Signature) <u>[Signature]</u>		Laboratory Contract No.: <u>MA</u>													
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:						Date		Time					
Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy Sample Types Types: ER - Equipment Rinse; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank																			



2-27-09 APPENDIX A: Chain of Custody, Data Summaries, QA/QC Narratives



2-27-02 APPENDIX A: Chain of Custody, Data Summaries, QA/QC Narratives



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Installation ID		Job No.															
Site ID	Zone ID	Sampling Co.		Shipping Date												Indicate Any Condition That Would Affect Sample Analysis	
Airbill Co./Number		Sample Collection		Matrix Type												Indicate Samples Containing Quantities for MS/MSD Analysis	
Sample Number	Date (mm/dd/yy)	Time (24 Hr.)	Matrix Type	Sample Type											Remarks		
232572	05/15/07	0804	SD	ES	X												500-G10 ms/msd
232573		0842	SD	ES	X												500-G11
232574		0920	SD	ES	X												500-G12
232575		1015	SD	ES	X												500-G13
232576		1048	SD	ES	X												500-G15
232638		0935	WR	ER	(X) 5/15/07												
232577		1123	SD	ES	X												500-G16
232578		1241	SD	ES	X												500-G17
232579		1319	SD	ES	X												500-G18
232580		1354	SD	ES	X												500-G19
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																	
Relinquished by Sampler: (Signature)		Date	Time	Received by: (Signature)		Laboratory Name:											
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Laboratory Contract No.:											
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:								Date	Time		

Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy;

Sample Types Types: ER - Equipment Rinsate; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank



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Page 3 of 3

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Page 1 of 1

Installation ID		Job No.		Analytical Methods Indicate Any Condition That Would Affect Sample Analysis Indicate Samples Containing Quantities for MS/MSD Analysis																																			
Site ID	Zone ID	Sampling Co.														Envest Indicate Any Condition That Would Affect Sample Analysis Indicate Samples Containing Quantities for MS/MSD Analysis																							
Airbill Co./Number		Shipping Date																										Envest Indicate Any Condition That Would Affect Sample Analysis Indicate Samples Containing Quantities for MS/MSD Analysis											
Sample Collection		Sample Type																																					
Sample Number	Date (mm/dd/yy)	Time (24 Hr.)	Matrix Type	Sample Type	Envest Indicate Any Condition That Would Affect Sample Analysis Indicate Samples Containing Quantities for MS/MSD Analysis																																		
232587 ✓	5/11/07	0458	SD	ES	1500-65																																		
232588 ✓		1039	SD	ES	1500-66																																		
232589 ✓		1201	SD	ES	1500-67																																		
232590 ✓		1245	SD	ES	1500-68																																		
232591 ✓		1325	SD	ES	1500-69																																		
232592 ✓		1410	SD	ES	1500-610																																		
232593 ✓		1420	SD	ES	1500-611																																		
232594 ✓		1510	SD	ES	1500-611																																		
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																																							
Relinquished by Sampler: (Signature)		Date	Time	Received by: (Signature)		Laboratory Name:																																	
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Laboratory Contract No.:																																	
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:						Date	Time																										



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Installation ID		Job No.		Analytical Methods		Indicate Any Condition That Would Affect Sample Analysis											
Site ID	Zone ID	Sampling Co.		Shipping Date		Indicate Samples Containing Quantities for MS/MSD Analysis											
Sample Number	Sample Collection	Matrix Type	Sample Type	Remarks													
Date (mm/dd/yy)	Time (24 Hr.)																
232511 ✓	05/10/07 0830	SD	ES	X													500-G30
232512 ✓✓	0923	SD	ES	X													500-G34 ms/msd
232513 ✓	1006	SD	ES	X													500-G35
232514 ✓	1056	SD	ES	X													500-G36
232515 ✓	1240	SD	ES	X													500-G40
232516 ✓	1323	SD	ES	X													500-G42
232517 ✓	1420	SD	ES	X													500-G43
232518 ✓	1517	SD	ES	X													500-G01
232519 ✓	1618	SD	ES	X													500-G02
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																	
Relinquished by Sampler: (Signature)		Date	Time	Received by: (Signature)		Laboratory Name:											
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Laboratory Contract No.:											
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:						Date		Time			

Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy

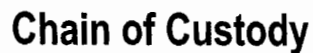
Sample Types Types: ER - Equipment Rinsate; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank



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Installation ID		Job No.		Analytical Methods												Remarks		
Site ID	Zone ID	Sampling Co.		Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis		
Airbill Co./Number	Shipping Date	Sample Collection		Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis		
Sample Number	Date (mm/dd/yy)	Time (24 Hr.)	Matrix Type	Sample Type	Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis	
232520 ✓	05/03/01	0832	SD	ES	X													500-G47
232521 ✓		0926	SD	ES	X													500-G49
232522 ✓		1009	SD	ES	X													500-G50
232523 ✓		1051	SD	ES	X													500-G52
232524 ✓		1051	SD	ES	X													500-G52
232525 ✓		1225	SD	ES	X													500-G53
232526 ✓		1307	SD	ES	X													500-G56
232527 ✓		1346	SD	ES	X													500-G57
232528 ✓		1433	SD	ES	X													500-G59
232529 ✓		1527	SD	ES	X													500-G70
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																		
Relinquished by Sampler: (Signature)		Date	Time	Received by: (Signature)		Laboratory Name:												
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Laboratory Contract No.:												
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:												
		Date	Time			Date												
		Date	Time			Time												



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Installation ID		Job No.		Analytical Methods												Remarks			
Site ID	Zone ID	Sampling Co.		Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis			
Airbill Co./Number	Shipping Date		Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis				
Sample Number	Sample Collection		Matrix Type	Sample Type	Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis		
	Date (mm/dd/yy)	Time (24 Hr.)			Indicate Any Condition That Would Affect Sample Analysis												Indicate Samples Containing Quantities for MS/MSD Analysis		
232537 ✓	05/07/07	0900	SD	ES	X													500-660	
232538 ✓		0941	SD	ES	X													500-664	
232539 ✓		1043	SD	ES	X													500-661	
232540 ✓		1154	SD	ES	X													500-667	
232541 ✓		1307	SD	ES	X													500-665	
232542 ✓		1350	SD	ES	X													500-668	
232543 ✓		1450	SD	ES	X													500-662	
232544 ✓		1524	SD	ES	X													500-671	
2326 (E) 5/7/07																			
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																			
Relinquished by Sampler: (Signature)		Date	Time	Received by: (Signature)		Laboratory Name:													
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Laboratory Contract No.:													
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:												Date	Time

Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy

Sample Types Types: ER - Equipment Rinsate; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank

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Installation ID <u>BML</u>		Job No. <u>33759512</u>		Analytical Methods Invest										Indicate Any Condition That Would Affect Sample Analysis Indicate Samples Containing Quantities for MS/MSD Analysis Remarks						
Site ID <u>OUBM</u>	Zone ID <u>-</u>	Sampling Co. <u>URS</u>																		
Airbill Co./Number <u>Hand Deliver</u>		Shipping Date <u>5/8/07</u>																		
Sample Number	Sample Collection		Matrix Type													Sample Type				
	Date (mm/dd/yy)	Time (24 Hr.)																		
232530 ✓✓	5/8/07	1014	SD	ES	X															500-641 MS/MSD
232531 ✓		1111	SD	ES	X															500-645
232532 ✓		1413	SD	ES	X															500-646
232533 ✓		1413	SD	ES	X															500-646
232534 ✓		1505	SD	ES	X															500-655
232535 ¹⁴⁰⁰ 5/11/07		1532	SD	ES	X															500-663
232537			SD	ES	X															500-648 5/11/07
232536 ✓		1634	SD	ES	X															500-648
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																				
Relinquished by Sampler: (Signature) <u>[Signature]</u>		Date <u>5/8/07</u>	Time <u>0840</u>	Received by: (Signature) <u>[Signature]</u>		Laboratory Name: <u>NA</u>														
Relinquished by: (Signature) <u>[Signature]</u>		Date <u>5/11/07</u>	Time <u>1425</u>	Received by: (Signature) <u>[Signature]</u>		Laboratory Contract No.: <u>NA</u>														
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:										Date	Time			
Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy																				
Sample Types Types: ER - Equipment Rinsate; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank																				

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Installation ID <u>BWL</u>		Job No. <u>33759512</u>		Analytical Methods <u>Ernest</u>															
Site ID <u>OU BM</u>	Zone ID <u>-</u>	Sampling Co. <u>URS</u>																	
Airbill Co./Number <u>Hand Delivered</u>		Shipping Date <u>5/10/07</u>																	
Sample Number	Sample Collection		Matrix Type	Sample Type	NUMBER OF BOTTLES PER ANALYTICAL METHODS													Indicate Any Condition That Would Affect Sample Analysis Indicate Samples Containing Quantities for MS/MSD Analysis Remarks	
	Date (mm/dd/yy)	Time (24 Hr.)																	
<u>232554</u> ✓	<u>05/10/07</u>	<u>0821</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-638</u> <u>ms/msd</u>
<u>232555</u> ✓		<u>1034</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-627</u>
<u>232556</u> ✓		<u>1034</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-627</u>
<u>232557</u> ✓		<u>1120</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-633</u>
<u>232558</u> ✓		<u>1141</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-631</u>
<u>232559</u> ✓		<u>1200</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-637</u>
<u>232560</u> ✓		<u>1224</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-644</u>
<u>232561</u> ✓		<u>1353</u>	<u>SD</u>	<u>ES</u>		<u>X</u>													<u>500-628</u>
<u>232562</u> ✓		<u>1434</u>	<u>SD</u>	<u>ES</u>													<u>500-629</u>		
Preservation: A = HCL to pH < 2; B = HNO ₃ to pH < 2; C = H ₂ SO ₄ to pH < 2; D = NaOH to pH < 12; E = Other (specify)																			
Relinquished by Sampler: (Signature) <u>E. L. Lippert</u>		Date <u>5/10/07</u>	Time <u>1520</u>	Received by: (Signature) <u>B. A. Beckwith</u>		Laboratory Name: <u>NA</u>													
Relinquished by: (Signature) <u>B. A. Beckwith</u>		Date <u>5/11/07</u>	Time <u>1425</u>	Received by: (Signature) <u>Gurleen Bhatia</u> <u>5/11/07</u>		Laboratory Contract No.: <u>NA</u>													
Relinquished by: (Signature)		Date	Time	Received by Lab: (Signature)		Samples Disposed by:										Date	Time		
Matrix Types: A - Air; PR - Product; SD - Sediment; SL - Soil; TI - Tissue WR - Water Distribution: White = Accompanies Shipment; Canary = Lab Copy; Pink = Field Copy; Goldenrod = URS Sample Control Copy Sample Types Types: ER - Equipment Rinsate; ES - Environmental Sample; FB - Field Blank; TB - Trip Blank																			

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SAMPLE LOGIN
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Project Manager: Brandenberger
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PROJECT: ENVVEST MVS_OVS

BATTELLE CODE	Site Description	SPONSOR CODE	MATRIX	STORAGE LOCATION	PARAMETERS REQUESTED	COLLECTION DATE	INITIALS	Rec'd @ MSL
2830-1	1500-G17	232612	SED	Freezer	TBD	05/17/07	CS	5/22/2007
2830-2	1500-G18	232613	SED	Freezer	TBD	05/17/07	CS	5/22/2007
2830-3	1500-G19	232614	SED	Freezer	TBD	05/17/07	CS	5/22/2007
2830-4	1500-G20	232615	SED	Freezer	TBD	05/17/07	CS	5/22/2007
2830-5	1500-G31	232616	SED	Freezer	TBD	05/17/07	CS	5/22/2007
2830-6	1500-G32	232617	SED	Freezer	TBD	05/17/07	CS	5/22/2007
2830-7	1500-G13	232603	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-8	1500-G14	232604	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-9	1500-G15	232605	SED	Freezer	TBD	05/16/07	CS	5/22/2007 BROKEN
2830-10	1500-G15	232606	SED	Freezer	TBD	05/16/07	CS	5/22/2007 BROKEN
2830-11	1500-G16	232607	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-12	1500-G3	232608	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-13	1500-G4	232609	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-14	1500-G1	232610	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-15	1500-G2	232611	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-16	500-G24	232583	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-17	500-G25	232584	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-18	500-G26	232585	SED	Freezer	TBD	05/16/07	CS	5/22/2007
2830-19	1500-G26	232586	SED	Freezer	TBD	05/21/07	CS	5/22/2007
2830-20	1500-G30	232618	SED	Freezer	TBD	05/21/07	CS	5/22/2007
2830-21	1500-G12	232619	SED	Freezer	TBD	05/21/07	CS	5/22/2007

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BATTELLE CODE	Site Description	SPONSOR CODE	MATRIX	STORAGE LOCATION	PARAMETERS REQUESTED	COLLECTION DATE	INITIALS	Rec'd @ MSL
2830-22	500-G20	232581	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-23	500-G21	232582	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-24	500-G10	232572	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-25	500-G11	232573	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-26	500-G12	232574	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-27	500-G13	232575	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-28	500-G15	232576	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-29	500-G16	232577	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-30	500-G17	232578	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-31	500-G18	232579	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-32	500-G19	232580	SED	Freezer	TBD	05/15/07	CS	5/22/2007
2830-33	500-G03	232563	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-34	500-G04	232564	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-35	500-G05	232565	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-36	500-G06	232566	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-37	500-G07	232567	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-38	500-G08	232568	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-39	500-G09	232569	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-40	500-G09	232570	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-41	500-G14	232571	SED	Freezer	TBD	05/14/07	CS	5/22/2007
2830-42	1500-G5	232587	SED	Freezer	TBD	05/01/07	CS	5/11/2007 BROKEN

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PROJECT: ENVVEST MVS_OVS

BATTELLE CODE	Site Description	SPONSOR CODE	MATRIX	STORAGE LOCATION	PARAMETERS REQUESTED	COLLECTION DATE	INITIALS	Rec'd @ MSL
2830-43	1500-G6	232588	SED	Freezer	TBD	05/01/07	CS	5/11/2007
2830-44	1500-G7	232589	SED	Freezer	TBD	05/01/07	CS	5/11/2007
2830-45	1500-G8	232590	SED	Freezer	TBD	05/01/07	CS	5/11/2007
2830-46	1500-G9	232591	SED	Freezer	TBD	05/01/07	CS	5/11/2007
2830-47	1500-G10	232592	SED	Freezer	TBD	05/01/07	CS	5/11/2007
2830-48	1500-G11	232593	SED	Freezer	TBD	05/01/07	CS	5/11/2007
2830-49	1500-G11	232594	SED	Freezer	TBD	05/01/07	CS	5/11/2007
2830-50	500-G30	232511	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-51	500-G34	232512	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-52	500-G35	232513	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-53	500-G36	232514	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-54	500-G40	232515	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-55	500-G42	232516	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-56	500-G43	232517	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-57	500-G01	232518	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-58	500-G02	232519	SED	Freezer	TBD	05/02/07	CS	5/11/2007
2830-59	500-G47	232520	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-60	500-G49	232521	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-61	500-G50	232522	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-62	500-G52	232523	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-63	500-G52	232524	SED	Freezer	TBD	05/03/07	CS	5/11/2007

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PROJECT: ENVVEST MVS_OVS

BATTELLE CODE	Site Description	SPONSOR CODE	MATRIX	STORAGE LOCATION	PARAMETERS REQUESTED	COLLECTION DATE	INITIALS	Rec'd @ MSL
2830-64	500-G53	232525	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-65	500-G56	232526	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-66	500-G57	232527	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-67	500-G59	232528	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-68	500-G70	232529	SED	Freezer	TBD	05/03/07	CS	5/11/2007
2830-69	500-G60	232537	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-70	500-G64	232538	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-71	500-G61	232539	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-72	500-G67	232540	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-73	500-G65	232541	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-74	500-G68	232542	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-75	500-G62	232543	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-76	500-G71	232544	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-77	500-G41	232530	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-78	500-G45	232531	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-79	500-G46	232532	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-80	500-G46	232533	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-81	500-G55	232534	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-82	500-G63	232535	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-83	500-G48	232536	SED	Freezer	TBD	05/07/07	CS	5/11/2007
2830-84	1500-G21	232595	SED	Freezer	TBD	05/08/07	CS	5/11/2007

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(SOP# MSL-A-001)

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PROJECT: ENVVEST MVS_OVS

BATTELLE CODE	Site Description	SPONSOR CODE	MATRIX	STORAGE LOCATION	PARAMETERS REQUESTED	COLLECTION DATE	INITIALS	Rec'd @ MSL
2830-85	1500-G22	232596	SED	Freezer	TBD	05/08/07	CS	5/11/2007
2830-86	1500-G23	232597	SED	Freezer	TBD	05/08/07	CS	5/11/2007
2830-87	1500-G24	232598	SED	Freezer	TBD	05/08/07	CS	5/11/2007
2830-88	1500-G25	232599	SED	Freezer	TBD	05/08/07	CS	5/11/2007
2830-89	1500-G27	232600	SED	Freezer	TBD	05/08/07	CS	5/11/2007
2830-90	1500-G28	232601	SED	Freezer	TBD	05/08/07	CS	5/11/2007
2830-91	1500-G29	232602	SED	Freezer	TBD	05/08/07	CS	5/11/2007
2830-92	500-G38	232554	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-93	500-G27	232555	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-94	500-G27	232556	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-95	500-G33	232557	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-96	500-G31	232558	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-97	500-G37	232559	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-98	500-G44	232560	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-99	500-G28	232561	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-100	500-G29	232562	SED	Freezer	TBD	05/10/07	CS	5/11/2007
2830-101	500-G39	232545	SED	Freezer	TBD	05/09/07	CS	5/11/2007
2830-102	500-G51	232546	SED	Freezer	TBD	05/09/07	CS	5/11/2007
2830-103	500-G69	232547	SED	Freezer	TBD	05/09/07	CS	5/11/2007
2830-104	500-G66	232548	SED	Freezer	TBD	05/09/07	CS	5/11/2007
2830-105	500-G58	232549	SED	Freezer	TBD	05/09/07	CS	5/11/2007

cc: Project Manager/Central File
Login File

SAMPLE LOGIN
(SOP# MSL-A-001)

Project Manager: Brandenberger
Date Received: 5/11/07, 5/22/07
Batch: 1
Logged in 11/28/07 after splitting

PROJECT: ENVVEST MVS_OVS

BATTELLE CODE	Site Description	SPONSOR CODE	MATRIX	STORAGE LOCATION	PARAMETERS REQUESTED	COLLECTION DATE	INITIALS	Rec'd @ MSL
2830-106	500-G54	232550	SED	Freezer	TBD	05/09/07	CS	5/11/2007
2830-107	500-G32	232551	SED	Freezer	TBD	05/09/07	CS	5/11/2007
2830-108	500-G23	232552	SED	Freezer	TBD	05/09/07	CS	5/11/2007
2830-109	500-G22	232553	SED	Freezer	TBD	05/09/07	CS	5/11/2007

SAMPLE CUSTODY RECORD

(SOP#: MSL-A-001 & MSL-A-002)

Date: 7/25/2008



... Putting Technology To Work

Pacific Northwest Division

Marine Sciences Laboratory

1529 West Sequim Bay Road

Sequim, Washington 98382

Project Name: ENVEST MVS_OVS

Project Manager: Brandenberger

Phone Number: 360-6814564

Shipment Method: Fed Ex

Preservation: Blue Ice - frozen Samples

3 Coolers K0807130
K080707/FA

Line	Field Sample ID		Collection Date/Time	Matrix	No. of Containers	Test Parameters					Laboratory ID	Observations/Comments
						Low level PAH's	Low level Pthalates					
1	232612	2830-1	05/17/07	sediment	1	*	*					
2	232613	2830-2	05/17/07	sediment	1	*	*					
3	232604	2830-8	05/16/07	sediment	1	*	*					
4	232610	2830-14	05/16/07	sediment	1	*	*					
5	232578	2830-30	05/15/07	sediment	1	*	*					
6	232579	2830-31	05/15/07	sediment	1	*	*					
7	232591	2830-46	05/01/07	sediment	1	*	*					
8	232512	2830-51	05/02/07	sediment	1	*	*					
9	232514	2830-53	05/02/07	sediment	1	*	*					
10	232517	2830-56	05/02/07	sediment	1	*	*					
11	232518	2830-57	05/02/07	sediment	1	*	*					
12	232522	2830-61	05/03/07	sediment	1	*	*					
13	232526	2830-65	05/03/07	sediment	1	*	*					
14	232528	2830-67	05/03/07	sediment	1	*	*					
15	232537	2830-69	05/07/07	sediment	1	*	*					

∞

Relinquished By:	Company:
<u>C. Sullivan</u> <u>C. Sullivan</u>	<u>Battelle MSL</u>
Signature/Printed Name	Date/Time
	<u>1500 7/31/08</u>

Received By:	Company:
<u>San Chan</u>	<u>CAS</u>
Signature/Printed Name	Date/Time
	<u>8/1/08 0930</u>

Relinquished By:	Company:
Signature/Printed Name	Date/Time

Received By:	Company:
Signature/Printed Name	Date/Time

SAMPLE CUSTODY RECORD

(SOP#: MSL-A-001 & MSL-A-002)

Date: 7/25/2008



... Putting Technology To Work

Pacific Northwest Division
Marine Sciences Laboratory
1529 West Sequim Bay Road
Sequim, Washington 98382

10807130
10807071 GA

Project Name: ENVEST MVS_OVS

Project Manager: Brandenberger

Phone Number: 360-6814564

Shipment Method:

Preservation:

Line	Field Sample ID		Collection Date/Time	Matrix	No. of Containers	Test Parameters					Laboratory ID	Observations/Comments
						Low level PAH's	Low level Phthalates					
1	232538	2830-70	05/07/07	sediment	1	*	*					
2	232539	2830-71	05/07/07	sediment	1	*	*					
3	232540	2830-72	05/07/07	sediment	1	*	*					
4	232530	2830-77	05/07/07	sediment	1	*	*					
5	232531	2830-78	05/07/07	sediment	1	*	*					
6	232534	2830-81	05/07/07	sediment	1	*	*					
7	232535	2830-82	05/07/07	sediment	1	*	*					
8	232536	2830-83	05/07/07	sediment	1	*	*					
9	232595	2830-84	05/08/07	sediment	1	*	*					
10	232596	2830-85	05/08/07	sediment	1	*	*					
11	232601	2830-90	05/08/07	sediment	1	*	*					
12	232561	2830-99	05/10/07	sediment	1	*	*					
13	232545	2830-101	05/09/07	sediment	1	*	*					
14	232547	2830-103	05/09/07	sediment	1	*	*					
15	232548	2830-104	05/09/07	sediment	1	*	*					

Relinquished By:	Company:
Signature/Printed Name	Date/Time

Received By:	Company:
Signature/Printed Name	Date/Time

Relinquished By:	Company:
Signature/Printed Name	Date/Time

Received By:	Company:
Signature/Printed Name	Date/Time

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

PC JKM

Client / Project: Battelle Service Request K08 07071 07130

Received: 8/1/08 Opened: 8/1/08 By: A.J.

1. Samples were received via? US Mail Red Ex UPS DHL GH GS PDX Courier Hand Delivered

2. Samples were received in: (circle) Cooler Box Envelope Other NA

3. Were custody seals on coolers? NA Y N If yes, how many and where? _____

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

4. Is shipper's air-bill filed? If not, record air-bill number: _____ NA Y N

5. Temperature of cooler(s) upon receipt (°C): -0.3 -0.6 -2.7

Temperature Blank (°C): _____

6. If applicable, list Chain of Custody Numbers: _____

7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N

8. Packing material used. Inserts Baggies Bubble Wrap Gel Packs Wet Ice Sleeves Other hard ice pks

9. Did all bottles arrive in good condition (unbroken)? Indicate in the table below. NA Y N

10. Were all sample labels complete (i.e. analysis, preservation, etc.)? Y N

11. Did all sample labels and tags agree with custody papers? Indicate in the table below. Y N

12. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N

13. Were the pH-preserved bottles tested* received at the appropriate pH? Indicate in the table below. NA Y N

14. Were VOA vials and 1631 Mercury bottles received without headspace? Indicate in the table below. NA Y N

15. Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection? NA Y N

6. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

*does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).

Additional Notes, Discrepancies, & Resolutions: _____

2007 MVS Sample Selection (METALS ONLY)

Station or OUB Grid	Site Description	SPONSOR CODE	BATTELLE CODE	COLLECTION DATE	303(d) Segment	Quantitative Analysis	
						Metals 2007	Metals 2003 (MVS)
OOUB-G17	1500-G17	232612	2830-1	5/17/2007	F6E5	Y	N
OOUB-G31	1500-G31	232616	2830-5	5/17/2007	F6F2	Y	N
OOUB-G13	1500-G13	232603	2830-7	5/16/2007	F6E6	Y	Y
OOUB-G14	1500-G14	232604	2830-8	5/16/2007	F6E5	Y	N
OOUB-G1	1500-G1	232610	2830-14	5/16/2007	F6C9	Y	Y
OOUB-G26	1500-G26	232586	2830-19	5/21/2007	F6E2	Y	Y
OUBM-G10	500-G10	232572	2830-24	5/15/2007	F6E6	Y	N
OUBM-G12	500-G12	232574	2830-26	5/15/2007	F6E5	Y	N
OUBM-G17	500-G17	232578	2830-30	5/15/2007	F6E5	Y	N
OUBM-G19	500-G19	232580	2830-32	5/15/2007	F6F5	Y	N
OOUB-G7	1500-G7	232589	2830-44	5/1/2007	F6D7	Y	Y
OUBM-G30	500-G30	232511	2830-50	5/2/2007	F6F4, F6F5	Y	N
OUBM-G43	500-G43	232517	2830-56	5/2/2007	F6F4	Y	Y
OUBM-G52	500-G52	232523	2830-62	5/3/2007	F6F3	Y	Y
OUBM-G53	500-G53	232525	2830-64	5/3/2007	F6F3	Y	N
OUBM-G59	500-G59	232528	2830-67	5/3/2007	F6F3	Y	Y
OUBM-G60	500-G60	232537	2830-69	5/7/2007	F6F3	Y	Y
OUBM-G61	500-G61	232539	2830-71	5/7/2007	F6F3, F6F2	Y	N
OUBM-G67	500-G67	232540	2830-72	5/7/2007	F6F3	Y	Y
OUBM-G65	500-G65	232541	2830-73	5/7/2007	F6F2	Y	N
OUBM-G68	500-G68	232542	2830-74	5/7/2007	F6F2	Y	Y
OUBM-G71	500-G71	232544	2830-76	5/7/2007	F6F2	Y	N
OUBM-G55	500-G55	232534	2830-81	5/7/2007	F6F3	Y	N
OUBM-G63	500-G63	232535	2830-82	5/7/2007	F6F3	Y	N
OOUB-G21	1500-G21	232595	2830-84	5/8/2007	F6E4	Y	Y
OOUB-G24	1500-G24	232598	2830-87	5/8/2007	F6F3	Y	Y
OOUB-G25	1500-G25	232599	2830-88	5/8/2007	F6E3	Y	N
OOUB-G27	1500-G27	232600	2830-89	5/8/2007	F6F3	Y	Y
OOUB-G28	1500-G28	232601	2830-90	5/8/2007	F6F2	Y	Y
OUBM-G39	500-G39	232545	2830-101	5/9/2007	F6F5	Y	Y

2007 OVS Sample Selection (ORGANICS ONLY)

	Station or OUB Grid	Site Description	SPONSOR CODE	BATTELLE CODE	COLLECTION DATE	303(d) Segment	Quantitative Analysis	
							PAH 2007	PAH 2003 (OVS)
1	OOUB-G1	1500-G1	232610	2830-14	5/16/2007	F6C9	Y	Y
2	OOUB-G9	1500-G9	232591	2830-46	5/1/2007	F6D6	Y	Y
3	OOUB-G14	1500-G14	232604	2830-8	5/16/2007	F6E5	Y	N
4	OOUB-G17	1500-G17	232612	2830-1	5/17/2007	F6E5	Y	Y
5	OOUB-G18	1500-G18	232613	2830-2	5/17/2007	F6E4	Y	N
6	OOUB-G21	1500-G21	232595	2830-84	5/8/2007	F6E4	Y	Y
7	OOUB-G22	1500-G22	232596	2830-85	5/8/2007	F6E4	Y	N
8	OOUB-G28	1500-G28	232601	2830-90	5/8/2007	F6F2	Y	Y
9	OUBM-G1	500-G01	232518	2830-57	5/2/2007	F6E6	Y	N
10	OUBM-G17	500-G17	232578	2830-30	5/15/2007	F6E5	Y	N
11	OUBM-G18	500-G18	232579	2830-31	5/15/2007	F6F5	Y	N
12	OUBM-G28	500-G28	232561	2830-99	5/10/2007	F6F5	Y	Y
13	OUBM-G34	500-G34	232512	2830-51	5/2/2007	F6F4	Y	Y
14	OUBM-G36	500-G36	232514	2830-53	5/2/2007	F6F4	Y	N
15	OUBM-G39	500-G39	232545	2830-101	5/9/2007	F6F5	Y	Y
16	OUBM-G41	500-G41	232530	2830-77	5/7/2007	F6F4	Y	Y
17	OUBM-G43	500-G43	232517	2830-56	5/2/2007	F6F4	Y	N
18	OUBM-G45	500-G45	232531	2830-78	5/7/2007	F6F4	Y	Y
19	OUBM-G48	500-G48	232536	2830-83	5/7/2007	F6F3	Y	N
20	OUBM-G50	500-G50	232522	2830-61	5/3/2007	F6F3	Y	N
21	OUBM-G55	500-G55	232534	2830-81	5/7/2007	F6F3	Y	Y
22	OUBM-G56	500-G56	232526	2830-65	5/3/2007	F6F3	Y	Y
23	OUBM-G59	500-G59	232528	2830-67	5/3/2007	F6F3	Y	N
24	OUBM-G60	500-G60	232537	2830-69	5/7/2007	F6F3	Y	Y
25	OUBM-G61	500-G61	232539	2830-71	5/7/2007	F6F2, F6F3	Y	Y
26	OUBM-G63	500-G63	232535	2830-82	5/7/2007	F6F3	Y	Y
27	OUBM-G64	500-G64	232538	2830-70	5/7/2007	F6F3	Y	N
28	OUBM-G66	500-G66	232548	2830-104	5/9/2007	F6F2	Y	Y
29	OUBM-G69	500-G69	232547	2830-103	5/9/2007	F6F2	Y	N
30	OUBM-G67	500-G67	232540	2830-72	5/7/2007	F6F3	Y	N

Client: Battelle
 Project Number: N/A
 Project Name: ENVVEST MVS_OVS 2007
 AMS Project Number: 8C1
 Date Received: 2/12/2008

Client Sample ID	Station ID	AMS ID	Date Sampled	TOC (%)
2830-1	--	8C1-1	5/17/2007	3.77
2830-2	--	8C1-2	5/17/2007	3.84
2830-3	--	8C1-3	5/17/2007	4.01
2830-4	--	8C1-4	5/17/2007	3.39
2830-5	--	8C1-5	5/17/2007	2.80
2830-6	--	8C1-6	5/17/2007	1.64
2830-7	--	8C1-7	5/16/2007	3.44
2830-8	--	8C1-8	5/16/2007	4.26
2830-9	--	8C1-9	5/16/2007	4.37
2830-10	--	8C1-10	5/16/2007	4.34
2830-11	--	8C1-11	5/16/2007	4.53
2830-12	--	8C1-12	5/16/2007	1.23
2830-13	--	8C1-13	5/16/2007	0.48
2830-14	--	8C1-14	5/16/2007	1.88
2830-15	--	8C1-15	5/16/2007	0.83
2830-15	--	8C1-15Q	5/16/2007	0.78
2830-16	--	8C1-16	5/16/2007	3.69
2830-17	--	8C1-17	5/16/2007	3.68
2830-18	--	8C1-18	5/16/2007	3.53
2830-19	--	8C1-19	5/21/2007	0.27
2830-20	--	8C1-20	5/21/2007	0.29
2830-21	--	8C1-21	5/21/2007	0.99
2830-22	--	8C1-22	5/15/2007	3.06
2830-23	--	8C1-23	5/15/2007	2.02
2830-24	--	8C1-24	5/15/2007	1.42
2830-25	--	8C1-25	5/15/2007	2.49
2830-26	--	8C1-26	5/15/2007	2.61
2830-27	--	8C1-27	5/15/2007	3.25
2830-28	--	8C1-28	5/15/2007	2.39
2830-29	--	8C1-29	5/15/2007	2.96
2830-30	--	8C1-30	5/15/2007	2.99
2830-30	--	8C1-30Q	5/15/2007	2.93
2830-31	--	8C1-31	5/15/2007	1.16
2830-32	--	8C1-32	5/15/2007	2.58
2830-33	--	8C1-33	5/14/2007	1.50
2830-34	--	8C1-34	5/14/2007	3.34
2830-35	--	8C1-35	5/14/2007	3.08
2830-36	--	8C1-36	5/14/2007	3.09
2830-37	--	8C1-37	5/14/2007	3.06
2830-38	--	8C1-38	5/14/2007	2.75
2830-39	--	8C1-39	5/14/2007	3.06
2830-40	--	8C1-40	5/14/2007	3.11

Client: Battelle
 Project Number: N/A
 Project Name: ENVVEST MVS_OVS 2007
 AMS Project Number: 8C1
 Date Received: 2/12/2008

Client Sample ID	Station ID	AMS ID	Date Sampled	TOC (%)
2830-41	--	8C1-41	5/14/2007	0.69
2830-42	--	8C1-42	5/1/2007	4.12
2830-43	--	8C1-43	5/1/2007	4.54
2830-44	--	8C1-44	5/1/2007	4.91
2830-45	--	8C1-45	5/1/2007	4.38
2830-45	--	8C1-45Q	5/1/2007	4.26
2830-46	--	8C1-46	5/1/2007	4.60
2830-47	--	8C1-47	5/1/2007	4.15
2830-48	--	8C1-48	5/1/2007	4.30
2830-49	--	8C1-49	5/1/2007	4.83
2830-50	--	8C1-50	5/2/2007	3.51
2830-51	--	8C1-51	5/2/2007	3.45
2830-52	--	8C1-52	5/2/2007	2.94
2830-53	--	8C1-53	5/2/2007	3.53
2830-54	--	8C1-54	5/2/2007	3.35
2830-55	--	8C1-55	5/2/2007	2.82
2830-56	--	8C1-56	5/2/2007	3.07
2830-57	--	8C1-57	5/2/2007	5.23
2830-58	--	8C1-58	5/2/2007	3.76
2830-59	--	8C1-59	5/3/2007	2.84
2830-60	--	8C1-60	5/3/2007	1.45
2830-60	--	8C1-60Q	5/3/2007	1.62
2830-61	--	8C1-61	5/3/2007	3.33
2830-62	--	8C1-62	5/3/2007	3.21
2830-63	--	8C1-63	5/3/2007	3.43
2830-64	--	8C1-64	5/3/2007	3.00
2830-65	--	8C1-65	5/3/2007	3.47
2830-66	--	8C1-66	5/3/2007	3.38
2830-67	--	8C1-67	5/3/2007	3.99
2830-68	--	8C1-68	5/3/2007	2.84
2830-69	--	8C1-69	5/7/2007	4.48
2830-70	--	8C1-70	5/7/2007	3.78
2830-71	--	8C1-71	5/7/2007	4.18
2830-72	--	8C1-72	5/7/2007	3.50
2830-73	--	8C1-73	5/7/2007	2.10
2830-74	--	8C1-74	5/7/2007	3.08
2830-75	--	8C1-75	5/7/2007	2.74
2830-75	--	8C1-75Q	5/7/2007	2.79
2830-76	--	8C1-76	5/7/2007	0.78
2830-77	--	8C1-77	5/7/2007	3.42
2830-78	--	8C1-78	5/7/2007	4.10
2830-79	--	8C1-79	5/7/2007	1.15

Client: Battelle
 Project Number: N/A
 Project Name: ENVVEST MVS_OVS 2007
 AMS Project Number: 8C1
 Date Received: 2/12/2008

Client	Station ID	AMS ID	Date Sampled	TOC (%)
Sample ID				
2830-80	--	8C1-80	5/7/2007	1.18
2830-81	--	8C1-81	5/7/2007	3.39
2830-82	--	8C1-82	5/7/2007	4.20
2830-83	--	8C1-83	5/7/2007	3.36
2830-84	--	8C1-84	5/8/2007	3.04
2830-85	--	8C1-85	5/8/2007	3.38
2830-86	--	8C1-86	5/8/2007	2.46
2830-87	--	8C1-87	5/8/2007	3.14
2830-88	--	8C1-88	5/8/2007	1.86
2830-89	--	8C1-89	5/8/2007	3.35
2830-90	--	8C1-90	5/8/2007	2.62
2830-90	--	8C1-90Q	5/8/2007	2.76
2830-91	--	8C1-91	5/8/2007	1.84
2830-92	--	8C1-92	5/10/2007	2.57
2830-93	--	8C1-93	5/10/2007	3.47
2830-94	--	8C1-94	5/10/2007	3.31
2830-95	--	8C1-95	5/10/2007	4.18
2830-96	--	8C1-96	5/10/2007	3.28
2830-97	--	8C1-97	5/10/2007	3.20
2830-98	--	8C1-98	5/10/2007	3.28
2830-99	--	8C1-99	5/10/2007	3.49
2830-100	--	8C1-100	5/10/2007	4.52
2830-101	--	8C1-101	5/9/2007	3.30
2830-102	--	8C1-102	5/9/2007	3.35
2830-103	--	8C1-103	5/9/2007	1.75
2830-104	--	8C1-104	5/9/2007	3.37
2830-105	--	8C1-105	5/9/2007	2.99
2830-105	--	8C1-105Q	5/9/2007	3.01
2830-106	--	8C1-106	5/9/2007	11.68
2830-107	--	8C1-107	5/9/2007	3.07
2830-108	--	8C1-108	5/9/2007	3.26
2830-109	--	8C1-109	5/9/2007	3.52
2830-109	--	8C1-109Q	5/9/2007	3.65

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ENVVEST Sinclair and Dyes Inlet
Metals Verification Study (MVS)
METALS IN SEDIMENT, Dry Weight
 (concentrations in µg/g dry wt)

MSL Code	Station or OUB Grid Cell	Sponsor Code	Collection Date	Percent Moisture	Al	Cr	Ni	Zn	Ag
Analysis Batch ID					<i>I081508A</i>	<i>I081508A</i>	<i>I081508A</i>	<i>I081508A</i>	<i>081908-6100</i>
CAS No.					7429-90-5	7440-47-3	7440-02-0	7440-66-6	7440-22-4
2830-1	1500-G17	232612	05/17/07	71.0	65681	91.6	47.1	168	1.18
2830-5	1500-G31	232616	05/17/07	65.5	66738	91.2	41.7	147	0.612
2830-7	1500-G13	232603	05/16/07	69.4	66617	97.7	47.2	170	1.15
2830-8	1500-G14	232604	05/16/07	76.1	60921	87.1	44.4	165	1.26
2830-14	1500-G1	232610	05/16/07	46.2	63393	117	36.4	71.2	0.312
2830-19	1500-G26	232586	05/21/07	25.4	65616	80.1	23.7	41.0	0.118
2830-24	500-G10	232572	05/15/07	50.9	64404	85.6	34.7	104	0.572
2830-26	500-G12	232574	05/15/07	65.2	65641	90.8	42.4	127	0.622
2830-30	500-G17	232578	05/15/07	69.0	66579	90.2	44.5	148	0.801
2830-32	500-G19	232580	05/15/07	63.9	66673	96.8	44.6	198	0.637
2830-44	1500-G7	232589	05/01/07	71.9	64113	106	52.1	181	1.57
2830-50	500-G30	232511	05/02/07	71.5	63740	97.5	45.9	250	0.967
2830-56	500-G43	232517	05/02/07	67.8	63837	86.8	43.3	307	0.806
2830-62	500-G52	232523	05/03/07	67.4	64420	109	60.4	483	1.12
2830-64	500-G53	232525	05/03/07	68.3	66099	91.0	43.6	178	0.624
2830-67	500-G59	232528	05/03/07	71.5	63396	95.8	49.6	505	0.813
2830-69	500-G60	232537	05/07/07	65.5	56187	118	49.3	863	1.08
2830-71	500-G61	232539	05/07/07	60.6	44244	117	36.2	463	0.533
2830-72	500-G67	232540	05/07/07	55.8	51821	89.4	39.4	954	0.916
2830-73	500-G65	232541	05/07/07	54.6	62718	112	40.5	381	0.540
2830-74	500-G68	232542	05/07/07	66.1	59926	118	46.2	2632	0.870
2830-76	500-G71	232544	05/07/07	38.3	60931	51.7	22.9	66.5	0.219
2830-81	500-G55	232534	05/07/07	65.0	62971	101	47.5	335	0.725
2830-82	500-G63	232535	05/07/07	68.1	57364	92.6	51.4	383	1.10
2830-84	1500-G21	232595	05/08/07	66.1	64587	95.8	44.2	162	0.716
2830-87	1500-G24	232598	05/08/07	65.5	67130	91.6	44.4	169	0.769
2830-88	1500-G25	232599	05/08/07	53.5	64961	73.0	31.3	101	0.470
2830-89	1500-G27	232600	05/08/07	67.4	58749	78.0	38.2	138	0.548
2830-90	1500-G28	232601	05/08/07	64.6	65752	91.4	41.6	142	0.647
2830-101	500-G39	232545	05/09/07	53.5	49387	89.4	37.4	304	1.07

Detection Limits

Laboratory Achieved Detection Limits	2	0.16	0.3	0.21	0.001
Reporting Limit (3.18 * MDL)	6	0.3	1.0	0.67	0.003

Procedural Blank

Blank 1 081208	MB	2 U	0.16 U	0.3 U	0.21 U	0.001 U
Blank 2 081208	MB	2 U	0.16 U	0.3 U	0.21 U	0.001 U
Mean Blank		2 U	0.16 U	0.3 U	0.21 U	0.001 U

Laboratory Control Sample Results (Blank Spike)

LCS R1081208	LCS	53.8	50.8	52.5	51.2	50.8
LCS R2081208	LCS	55.2	50.5	52.4	51.5	45.7
Mean Blank		2 U	0.16 U	0.3 U	0.21 U	0.001 U
Spike Concentration		50	50	50	50	50
Percent Recovery, R1		108%	102%	105%	102%	102%
Percent Recovery, R2		110%	101%	105%	103%	91%

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**ENVVEST Sinclair and Dyes Inlet
Metals Verification Study (MVS)
METALS IN SEDIMENT, Dry Weight**
(concentrations in µg/g dry wt)

MSL Code	Station or OUB Grid Cell	Sponsor Code	Collection Date	Percent Moisture	Al	Cr	Ni	Zn	Ag
Analysis Batch ID					<i>I081508A</i>	<i>I081508A</i>	<i>I081508A</i>	<i>I081508A</i>	<i>081908-6100</i>
CAS No.					7429-90-5	7440-47-3	7440-02-0	7440-66-6	7440-22-4
<u>Standard Reference Material (SRM)</u>									
PACS R1081208		SRM			63927	83.4	37.5	363	1.49
PACS R2081208		SRM			63694	84.7	37.4	368	1.11
Certified Value					66200	90.7	39.5	364	1.22
Range					± 3200	± 4.6	± 2.3	± 23	± 0.14
% Recovery					97%	92%	95%	100%	122% &
% Recovery					96%	93%	95%	101%	91%
<u>Matrix Spike/Matrix Spike Duplicate Results</u>									
2830-8 MS		MS			NS	110	68.2	372	5.24
2830-8 MSD		MSD			NS	113	68.7	374	5.31
2830-8	1500-G14	232604	05/16/07	76.1	60921	87.1	44.4	165	1.26
Spike Concentration, MS					NS	24.0	24.0	216	5.12
Spike Concentration, MSD					NS	23.7	23.7	213	5.07
Percent Recovery, MS					NS	94%	99%	96%	78%
Percent Recovery, MSD					NS	111%	103%	98%	80%
2830-76 MS		MS			NS	77.8	46.1	277	21.4
2830-76 MSD		MSD			NS	87.7	46.2	286	22.2
2830-76	500-G71	232544	05/07/07	38.3	60931	51.7	22.9	66.5	0.219
Spike Concentration, MS					NS	24.3	24.3	218	24.3
Spike Concentration, MSD					NS	24.9	24.9	224	24.9
Percent Recovery, MS					NS	107%	96%	97%	87%
Percent Recovery, MSD					NS	144% N	93%	98%	88%
<u>Replicate Analysis Results</u>									
2830-44	1500-G7	232589	05/01/07	71.9	64113	106	52.1	181	1.57
2830-44 DUP	1500-G7	232589	05/01/07	71.9	64033	101	52.3	179	1.58
MEAN					64073	103	52.2	180	1.57
RPD					0%	5%	0%	1%	1%
2830-88	1500-G25	232599	05/08/07	53.5	64961	73.0	31.3	101	0.470
2830-88 DUP	1500-G25	232599	05/08/07	53.5	63669	80.3	31.2	98.6	0.459
MEAN					64315	76.6	31.3	100	0.465
RPD					2%	10%	0%	3%	2%

U Concentration less than the MDL reported

J Estimated concentration > MDL, but less than the RL

B Blank >RL and sample concentration < 10 times detected blank.

NA Not applicable/available

NS Not spiked

N Spiked sample recovery outside QC criterion of ±30%

& Accuracy outside QC criterion of ±20% difference (SRMs)

* Precision outside QC criterion of ≤30% RPD

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**ENVVEST Sinclair and Dyes Inlet
 Metals Verification Study (MVS)
 METALS IN SEDIMENT, Dry Weight**
 (concentrations in µg/g dry wt)

MSL Code	Station or OUB Grid Cell	Sponsor Code	Collection Date	Percent Moisture	Cu	As	Cd	Pb
Analysis Batch ID					081908-6100	081908-6100	081908-6100	081908-6100
CAS No.					7440-50-8	7440-38-2	7440-43-9	7439-92-1
2830-1	1500-G17	232612	05/17/07	71.0	122	17.1	1.26	78.3
2830-5	1500-G31	232616	05/17/07	65.5	73.1	14.4	0.871	55.7
2830-7	1500-G13	232603	05/16/07	69.4	126	17.6	1.32	79.7
2830-8	1500-G14	232604	05/16/07	76.1	123	17.9	1.62	73.4
2830-14	1500-G1	232610	05/16/07	46.2	31.8	6.60 B	0.276	19.1
2830-19	1500-G26	232586	05/21/07	25.4	12.7	5.02 B	0.141	9.26
2830-24	500-G10	232572	05/15/07	50.9	69.2	11.1 B	0.787	38.5
2830-26	500-G12	232574	05/15/07	65.2	83.3	13.6	1.36	55.3
2830-30	500-G17	232578	05/15/07	69.0	107	15.8	1.50	64.1
2830-32	500-G19	232580	05/15/07	63.9	131	21.9	1.25	68.7
2830-44	1500-G7	232589	05/01/07	71.9	132	18.1	2.51	70.6
2830-50	500-G30	232511	05/02/07	71.5	159	17.4	1.59	74.6
2830-56	500-G43	232517	05/02/07	67.8	157	17.5	1.11	82.3
2830-62	500-G52	232523	05/03/07	67.4	261	24.8	1.24	265
2830-64	500-G53	232525	05/03/07	68.3	101	15.7	1.09	62.9
2830-67	500-G59	232528	05/03/07	71.5	237	18.3	2.55	197
2830-69	500-G60	232537	05/07/07	65.5	413	26.8	2.62	320
2830-71	500-G61	232539	05/07/07	60.6	170	20.5	1.72	266
2830-72	500-G67	232540	05/07/07	55.8	683	51.0	1.42	281
2830-73	500-G65	232541	05/07/07	54.6	124	19.3	1.53	131
2830-74	500-G68	232542	05/07/07	66.1	230	25.8	2.97	605
2830-76	500-G71	232544	05/07/07	38.3	30.0	7.32 B	0.352	26.0
2830-81	500-G55	232534	05/07/07	65.0	178	18.2	1.83	95.4
2830-82	500-G63	232535	05/07/07	68.1	296	22.2	1.67	140
2830-84	1500-G21	232595	05/08/07	66.1	120	14.6	1.25	67.1
2830-87	1500-G24	232598	05/08/07	65.5	103	15.2	0.878	69.9
2830-88	1500-G25	232599	05/08/07	53.5	55.9	9.75 B	0.740	42.1
2830-89	1500-G27	232600	05/08/07	67.4	80.2	12.7	0.850	55.8
2830-90	1500-G28	232601	05/08/07	64.6	73.5	12.8	0.892	55.7
2830-101	500-G39	232545	05/09/07	53.5	205	12.7	1.30	142

Detection Limits

Laboratory Achieved Detection Limits	0.1	0.18	0.0024	0.0048
Reporting Limit (3.18 * MDL)	0.3	0.57	0.008	0.015

Procedural Blank

Blank 1 081208	MB	0.313 J	1.16	0.00775 J	0.0345
Blank 2 081208	MB	0.556	1.14	0.0024 U	0.0232
Mean Blank		0.435	1.15	0.00507 J	0.0289

Laboratory Control Sample Results (Blank Spike)

LCS R1081208	LCS	52.4	55.6	49.4	48.9
LCS R2081208	LCS	50.2	50.4	47.2	47.6
Mean Blank		0.435	1.15	0.00507 J	0.0289
Spike Concentration		50	50	50	50
Percent Recovery, R1		104%	109%	99%	98%
Percent Recovery, R2		100%	98%	94%	95%

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Metals Verification Study (MVS)
METALS IN SEDIMENT, Dry Weight**
(concentrations in µg/g dry wt)

MSL Code	Station or OUB Grid Cell	Sponsor Code	Collection Date	Percent Moisture	Cu	As	Cd	Pb
Analysis Batch ID					081908-6100	081908-6100	081908-6100	081908-6100
CAS No.					7440-50-8	7440-38-2	7440-43-9	7439-92-1
Standard Reference Material (SRM)								
PACS R1081208		SRM			299	30.8	2.41	193
PACS R2081208		SRM			270	25.2	2.13	176
Certified Value					310	26.2	2.11	183
Range					± 12	± 1.5	± 0.2	± 8
% Recovery					97%	117%	114%	105%
% Recovery					87%	96%	101%	96%
Matrix Spike/Matrix Spike Duplicate Results								
2830-8 MS		MS			145	42.3	6.62	94.4
2830-8 MSD		MSD			144	41.3	6.74	94.9
2830-8	1500-G14	232604	05/16/07	76.1	123	17.9	1.62	73.4
Spike Concentration, MS					24.0	24.0	5.12	24.0
Spike Concentration, MSD					23.7	23.7	5.07	23.7
Percent Recovery, MS					92%	102%	98%	87%
Percent Recovery, MSD					87%	99%	101%	91%
2830-76 MS		MS			49.9	28.5	4.87	47.1
2830-76 MSD		MSD			50.3	28.8	4.95	47.7
2830-76	500-G71	232544	05/07/07	38.3	30.0	7.32 B	0.352	26.0
Spike Concentration, MS					24.3	24.3	4.73	24.3
Spike Concentration, MSD					24.9	24.9	4.79	24.9
Percent Recovery, MS					82%	87%	96%	87%
Percent Recovery, MSD					82%	86%	96%	87%
Replicate Analysis Results								
2830-44	1500-G7	232589	05/01/07	71.9	132	18.1	2.51	70.6
2830-44 DUP	1500-G7	232589	05/01/07	71.9	136	18.3	2.58	73.2
MEAN					134	18.2	2.55	71.9
RPD					3%	1%	3%	4%
2830-88	1500-G25	232599	05/08/07	53.5	55.9	9.75 B	0.740	42.1
2830-88 DUP	1500-G25	232599	05/08/07	53.5	53.3	9.53 B	0.693	40.6
MEAN					54.6	9.64 B	0.717	41.4
RPD					5%	2%	7%	4%

U Concentration less than the MDL reported

J Estimated concentration > MDL, but less than the RL

B Blank >RL and sample concentration < 10 times detected

NA Not applicable/available

NS Not spiked

N Spiked sample recovery outside QC criterion of ±30%

& Accuracy outside QC criterion of ±20% difference (SRM

* Precision outside QC criterion of ≤30% RPD

QA/QC NARRATIVE

PROJECT: MVS Sediment Confirmatory Analyses 2007 Samples

PARAMETER: Silver (Ag), aluminum (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), and zinc (Zn)

LABORATORY: Battelle Marine Sciences Laboratory, Sequim, Washington

MATRIX: Surface sediments (0-10 cm grabs)

SAMPLE CUSTODY AND PROCESSING: One hundred and nine sediment samples were received at MSL on 05/11/2007 and 05/22/07. The samples were archived frozen until a subset of thirty samples for confirmatory metals analyses was selected and analyzed at MSL. All samples were assigned a Battelle Central File (CF) identification number (2830) and were entered into Battelle's log-in and custody tracking system.

The following lists information on sample receipt and processing activities:

Lab Sample IDs:	2087*1, 5, 7, 8, 14, 19, 24, 26, 30, 32, 44, 50, 56, 62, 64, 67, 69, 71-74, 76, 81, 82, 84, 87-90, 101
Description:	Surface sediment grabs from 2007 OUB sampling
Sample collection dates	May 2007, see table for specific dates
Laboratory arrival date	05/11/2007 and 05/22/2007
Digestion (Boric Acid)	08/12/08
ICP-MS Analysis (Ag, Cu, As, Cd, Pb)	08/19/08
ICP-OES Analysis (Al, Cr, Ni, Zn)	08/15/08

DATA QUALITY OBJECTIVES:

Analyte	Analytical Method	Spike Range of Recovery	SRM Accuracy	Relative Precision	Achieved Detection Limit ⁽¹⁾ (µg/g dry wt.)	Reporting Limit ⁽²⁾ (µg/g dry wt.)
Ag	ICP-MS	70-130%	≤20% PD	≤30% RPD	0.001	0.003
Al	ICP-OES	70-130%	≤20% PD	≤30% RPD	2	6
As	ICP-MS	70-130%	≤20% PD	≤30% RPD	0.18	0.57
Cd	ICP-MS	70-130%	≤20% PD	≤30% RPD	0.0024	0.008
Cr	ICP-OES	70-130%	≤20% PD	≤30% RPD	0.16	0.3
Cu	ICP-MS	70-130%	≤20% PD	≤30% RPD	0.1	0.3
Ni	ICP-OES	70-130%	≤20% PD	≤30% RPD	0.3	1.0
Pb	ICP-MS	70-130%	≤20% PD	≤30% RPD	0.0048	0.015
Zn	ICP-OES	70-130%	≤20% PD	≤30% RPD	0.21	0.67

(1) Reported from the 2008 Sediment MDL summary.

(2) Determined as 3.18 times achieved MDL

QA/QC NARRATIVE

METHODS:	Sediment samples were analyzed for silver (Ag), aluminum (Al), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni) and zinc (Zn). Samples were freeze-dried and homogenized using a ball-mill prior to digestion according to Battelle SOP MSL-C-003, <i>Percent Dry Weight and Homogenizing Dry Sediment, Soil and Tissue</i>. Sediment samples were digested in accordance with Battelle SOP MSL-I-006, <i>Mixed Acid Sediment Digestion</i>. An approximately 300-mg (dry weight) aliquot of each sample was combined with nitric, hydrochloric, and hydrofluoric acids in a Teflon digestion vessel and heated in an oven at 130°C (±10°C) for a minimum of eight hours. After cooling, boric acid was added to the digestate to neutralize the hydrofluoric acid and deionized water was added to achieve analysis volume. Digested samples were analyzed for Al, Cr, Ni, and Zn using inductively coupled plasma optical emissions spectroscopy (ICP-OES) according to Battelle SOP MSL-I-033, <i>Determination of Elements in Aqueous and Digestate Samples by ICP-OES</i>. This procedure is based on two methods modified and adapted for analysis of low level samples: EPA Method 6010B and 200.7. Digested samples were analyzed for Ag, As, Cd, Cu, and Pb using inductively coupled plasma-mass spectrometry (ICP-MS) according to Battelle SOP MSL-I-022, <i>Determination of Elements in Aqueous and Digestate Samples by ICP/MS</i>. All results were reported in units of µg/g on a dry-weight basis.
HOLDING TIMES:	The recommended holding time for the reported analytes in sediment is 6 months from sample collection. This holding time was exceeded as screening results were used to select samples for confirmatory analyses. The samples were stored frozen and freeze dried, which is an accepted preservation method. Therefore, exceeding this holding time did not significantly impact the quality of the sample data.
DETECTION LIMITS:	Analytical results were reported to laboratory achieved detection limits derived from the 2008 Sediment MDL study. The MDL study was conducted in compliance with 40 CFR Part 136 Appendix B Revision 1.11, which entails the analyses of at least seven replicates of the matrix (quartz sand) to calculate the MDL value. Data were evaluated and flagged in accordance to the following criteria: - U Analyte not detected at or above laboratory achieved detection limit, MDL reported - J Value reported is below the RL, but above the MDL. & Accuracy results outside QC criteria of ≤20% PD (SRM). * Precision results outside QC criteria of ≤30% RPD. - N Spiked sample recovery not within the QC limits of 70-130%. - B Analyte detected in the method blank above the RL, sample concentration < 10 times detected blank value.

QA/QC NARRATIVE

METHOD BLANKS:	Two method blanks were analyzed with the sediment samples. The average blank was less than the RL for all metals, except for Cu, As, and Pb. The detected concentrations were less than 10 times the MDL. Data were flagged "B" if the sample concentration was less than 10 times the average blank. Only the As concentrations from five samples were B flagged. The impact to the overall data quality is negligible as the sample concentrations are at least one order of magnitude higher than the detected blank. Data are not blank corrected.
LABORATORY CONTROL SAMPLE ACCURACY:	Two laboratory control samples were analyzed with the samples. The LCS recoveries were within the QC acceptance criterion of $\pm 30\%$ recovery for all metals.
STANDARD REFERENCE MATERIAL ACCURACY:	The marine sediment reference material for trace metals (SRM) analyzed with the sediment samples was PACS-2. SRM accuracy is expressed as the percent difference (PD) between the certified and measured concentrations. Two replicates of PACS-2 were analyzed with the samples. The percent differences ranged were within the QC acceptance criterion of $\leq 20\%$ difference for all metals, except one replicate for Ag (22%). The QC criterion used by the Battelle SOP is $\leq 25\%$; therefore, no further corrective action was initiated.
MATRIX SPIKE ACCURACY:	Two sediment samples were selected and spiked in duplicate. Matrix spike recoveries were within the QC acceptance criterion of 70-130% recovery for all metals except one replicate for Cr (144%). The high spike recovery resulted from the high native sample concentration (51.7 ppm) relative to the spiking concentration (24.9 ppm). Acceptable accuracy for Cr was demonstrated in the alternate matrix spike, LCS and SRM samples. Since the crustal abundance of Al is 5-8% (~60,000ppm), the samples were not spiked for Al. Analytical accuracy was evaluated using the LCS and SRM samples.
LABORATORY PRECISION:	Laboratory precision was evaluated using two sets of duplicates and is expressed as the relative percent difference (RPD) of replicate results. The RPD values ranged from 0% to 10% and were within the QC criterion of $\leq 30\%$ RPD.

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360/681-4564

Client Code	1500-G17	1500-G18	1500-G14	1500-G1	500-G17
Lab Code	K0807130-001	K0807130-002	K0807130-003	K0807130-004	K0807130-005
Date Collected	5/17/2007	5/17/2007	5/16/2007	5/16/2007	5/15/2007
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/16/2008	8/16/2008	8/16/2008	8/16/2008	8/16/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry	Dry
Units	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Naphthalene	7.0	5.6	7.5	1.9 J	5.8
2-Methylnaphthalene	5.1	4.1	6.0	1.5 J	3.9
Acenaphthylene	6.4	5.4	5.0	0.87 J	4.3
Acenaphthene	3.6	2.3 J	2.7 J	0.80 J	2.5 J
Fluorene	6.1	3.8 J	4.5	1.5 J	4.7
Phenanthrene	64	33	38	14	33
Anthracene	22	13	13	3.0	13
Fluoranthene	130	97	94	23	85
Pyrene	150	110	120	25	100
Benz(a)anthracene	81	62	54	11	50
Chrysene	130	85	77	19	76
Benzo(b)fluoranthene	120	100	100	20	86
Benzo(k)fluoranthene	45	35	32	6.7	29
Benzo(a)pyrene	92	80	72	13	66
Indeno(1,2,3-cd)pyrene	64	53	54	10	45
Dibenz(a,h)anthracene	13	11	11	2.1 J	9.2
Benzo(g,h,i)perylene	67	56	57	11	48
<u>SURROGATE RECOVERIES (%Rec)</u>					
Fluorene-d10	72	62	69	77	64
Fluoranthene-d10	74	63	69	79	61
p-Terphenyl-d14	90	73	81	89	74
Date Analyzed	8/12/2008	8/12/2008	8/12/2008	8/12/2008	8/12/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	62	81	65 U	40 U	51
Butyl Benzyl Phthalate	29	55	26 U	70 D	28
Bis(2-ethylhexyl) Phthalate	91 J	110 J	57 U	37 JD	83 J
<u>SURROGATE RECOVERIES (%Rec)</u>					
p-Terphenyl-d14	100	91	68 D	74 D	87

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Client Code	500-G18	1500-G9	500-G34	500-G36	500-G43	500-G01
Lab Code	K0807130-006	K0807130-007	K0807130-008	K0807130-009	K0807130-010	K0807130-011
Date Collected	5/15/2007	5/1/2007	5/2/2007	5/2/2007	5/2/2007	5/2/2007
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/16/2008	8/16/2008	8/16/2008	8/16/2008	8/16/2008	8/16/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry	Dry	Dry
Units	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Naphthalene	4.5	6.0	12	9.9	12	15
2-Methylnaphthalene	2.7	4.9	11	6.9	7.8	21
Acenaphthylene	3.5	3.9 J	9.3	7.7	7.0	6.0
Acenaphthene	3.1	2.9 J	22	4.9	7.6	3.3 J
Fluorene	5.8	4.4	28	10	11	6.2
Phenanthrene	52	52	370	80	96	52
Anthracene	15	10	63	37	35	21
Fluoranthene	110	170	550	250	240	150
Pyrene	130	150	470	250	240	320
Benz(a)anthracene	58	53	240	120	120	140
Chrysene	72	100	420	260	220	170
Benzo(b)fluoranthene	110	110	450	220	210	190
Benzo(k)fluoranthene	39	35	160	78	74	61
Benzo(a)pyrene	83	60	280	140	130	140
Indeno(1,2,3-cd)pyrene	57	46	180	91	82	77
Dibenz(a,h)anthracene	13	9.6	40	20	18	20
Benzo(g,h,i)perylene	60	47	170	89	78	85
<u>SURROGATE RECOVERIES (%Rec)</u>						
Fluorene-d10	78	66	72	65	79	72
Fluoranthene-d10	82	63	72	68	80	74
p-Terphenyl-d14	87	75	81	75	90	78
Date Analyzed	8/12/2008	8/12/2008	8/12/2008	8/12/2008	8/12/2008	8/12/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	40 U	63 U	67	51 U	71 JD	72 JD
Butyl Benzyl Phthalate	16 U	26 U	53	21 U	56 JD	1200 D
Bis(2-ethylhexyl) Phthalate	50 JD	56 U	380	200 JD	680 D	680 D
<u>SURROGATE RECOVERIES (%Rec)</u>						
p-Terphenyl-d14	71 D	66 D	90	72 D	79 D	72 D

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Client Code	500-G50	500-G56	500-G59	500-G60	500-G64	500-G61
Lab Code	K0807130-012	K0807130-013	K0807130-014	K0807130-015	K0807130-016	K0807130-017
Date Collected	5/3/2007	5/3/2007	5/3/2007	5/7/2007	5/7/2007	5/7/2007
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/16/2008	8/16/2008	8/16/2008	8/16/2008	8/22/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry	Dry	Dry
Units	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Naphthalene	5.5	8.0	28	33	14	21
2-Methylnaphthalene	4.4	5.7	17	32	8.7	12
Acenaphthylene	9.9	76	30	23	15	61
Acenaphthene	6.6	88	26	86	10	78
Fluorene	9.8	78	38	110	23	150
Phenanthrene	80	1500 D	290	760	170	2600 D
Anthracene	35	280	170	250	120	310
Fluoranthene	220	19000 D	980	1500 D	550	9700 D
Pyrene	260	13000 D	1200	2100 D	580	6600 D
Benz(a)anthracene	120	2800 D	460	860	310	1200 D
Chrysene	210	4900 D	930	1400 D	600	3200 D
Benzo(b)fluoranthene	200	5200 D	820	1100 D	530	2000 D
Benzo(k)fluoranthene	67	1800 D	270	380	170	630
Benzo(a)pyrene	140	2100 D	480	810	320	810
Indeno(1,2,3-cd)pyrene	86	1400 D	260	370	190	440
Dibenz(a,h)anthracene	19	280	62	110	49	100
Benzo(g,h,i)perylene	86	1000	240	360	180	360

SURROGATE RECOVERIES (%Rec)

Fluorene-d10	74	60	69	75	66	70
Fluoranthene-d10	76	88	77	88	70	90
p-Terphenyl-d14	87	60	82	81	73	74

Date Analyzed	8/12/2008	8/12/2008	8/12/2008	8/12/2008	8/21/2008	8/21/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	92 JD	94 JD	80 JD	62 JD	150 D	59 JD
Butyl Benzyl Phthalate	66 D	68 D	22 U	18 U	99 D	16 U
Bis(2-ethylhexyl) Phthalate	100 JD	190 JD	270 JD	1800 D	380 JD	340 JD

SURROGATE RECOVERIES (%Rec)

p-Terphenyl-d14	75 D	64 D	68 D	73 D	77 D	82 D
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Client Code	500-G67	500-G41	500-G45	500-G55	500-G63
Lab Code	K0807130-018	K0807130-019	K0807130-020	K0807130-021	K0807130-022
Date Collected	5/7/2007	5/7/2007	5/5/2007	5/7/2007	5/7/2007
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/22/2008	8/23/2008	8/22/2008	8/23/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry	Dry
Units	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Naphthalene	53 D	20	15	22	23
2-Methylnaphthalene	130 D	14	17	16	13
Acenaphthylene	120 D	14	13	18	22
Acenaphthene	57 D	9.4	12	33	23
Fluorene	730 D	25	69	40	39
Phenanthrene	3300 D	160	290	390	380
Anthracene	11000 D	110	350	180	180
Fluoranthene	11000 D	440	550	1400 D	2000 D
Pyrene	7000 D	570	470	1500 D	1600 D
Benz(a)anthracene	4300 D	260	320	690	520
Chrysene	5600 D	570	670	1100	1400 D
Benzo(b)fluoranthene	3500 D	520	530	960	1200
Benzo(k)fluoranthene	1300 D	170	180	320	360
Benzo(a)pyrene	2100 D	310	310	620	550
Indeno(1,2,3-cd)pyrene	760 D	190	180	350	370
Dibenz(a,h)anthracene	200 D	50	50	90	92
Benzo(g,h,i)perylene	610 D	190	170	330	340
<u>SURROGATE RECOVERIES (%Rec)</u>					
Fluorene-d10	82 D	74	65	78	70
Fluoranthene-d10	94 D	82	69	87	74
p-Terphenyl-d14	98 D	81	74	82	76
Date Analyzed	8/21/2008	8/21/2008	8/21/2008	8/21/2008	8/21/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	130 D	67 JD	63 JD	160 D	210 D
Butyl Benzyl Phthalate	16 U	20 U	24 U	280 D	280 D
Bis(2-ethylhexyl) Phthalate	560 D	340 JD	180 JD	350 JD	330 JD
<u>SURROGATE RECOVERIES (%Rec)</u>					
p-Terphenyl-d14	94 D	85 D	76 D	85 D	74 D

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Client Code	500-G48	1500-G21	1500-G22	1500-G28
Lab Code	K0807130-023	K0807130-024	K0807130-025	K0807130-026
Date Collected	5/7/2007	5/8/2007	5/8/2007	5/8/2007
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/22/2008	8/22/2008	8/23/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry
Units	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Naphthalene	11	6.2	6.3	8.1
2-Methylnaphthalene	7.7	4.1	4.7	5.9
Acenaphthylene	8.6	7.7	7.8	10
Acenaphthene	4.4	2.7 J	3.0 J	3.2
Fluorene	9.0	5.2	5.9	5.6
Phenanthrene	62	43	49	45
Anthracene	34	19	23	32
Fluoranthene	160	120	150	160
Pyrene	200	150	170	200
Benz(a)anthracene	98	74	78	100
Chrysene	160	110	110	130
Benzo(b)fluoranthene	160	130	130	140
Benzo(k)fluoranthene	55	45	43	47
Benzo(a)pyrene	120	110	100	130
Indeno(1,2,3-cd)pyrene	84	75	72	81
Dibenz(a,h)anthracene	16	14	16	16
Benzo(g,h,i)perylene	91	81	81	91
<u>SURROGATE RECOVERIES (%Rec)</u>				
Fluorene-d10	70	74	62	66
Fluoranthene-d10	73	75	62	64
p-Terphenyl-d14	80	83	84	79
Date Analyzed	8/21/2008	8/21/2008	8/22/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	59 JD	50 U	51 U	49 U
Butyl Benzyl Phthalate	19 U	21 U	21 U	20 U
Bis(2-ethylhexyl) Phthalate	120 JD	68 JD	93 JD	52 JD
<u>SURROGATE RECOVERIES (%Rec)</u>				
p-Terphenyl-d14	78 D	81 D	92 D	76 D

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Client Code	500-G28	500-G39	500-G69	500-G66
Lab Code	K0807130-027	K0807130-028	K0807130-029	K0807130-030
Date Collected	5/10/2007	5/9/2007	5/9/2007	5/9/2007
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/23/2008	8/22/2008	8/23/2008	8/23/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry
Units	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Naphthalene	47	68 D	15	15
2-Methylnaphthalene	19	25 D	13	13
Acenaphthylene	10	87 D	14	15
Acenaphthene	57	150 D	52	11
Fluorene	47	220 D	60	55
Phenanthrene	200	2200 D	530	300
Anthracene	71	2800 D	210	250
Fluoranthene	490	14000 D	3400 D	620
Pyrene	490	9200 D	2000 D	640
Benz(a)anthracene	210	3600 D	370	410
Chrysene	300	7000 D	1100 D	850
Benzo(b)fluoranthene	370	4900 D	780	640
Benzo(k)fluoranthene	120	1700 D	270	230
Benzo(a)pyrene	230	2400 D	400	410
Indeno(1,2,3-cd)pyrene	160	1200 D	290	250
Dibenz(a,h)anthracene	39	280 D	77	63
Benzo(g,h,i)perylene	170	1000 D	290	240
<u>SURROGATE RECOVERIES (%Rec)</u>				
Fluorene-d10	59	69 D	73	75
Fluoranthene-d10	57	77 D	90	80
p-Terphenyl-d14	76	87 D	84	82
Date Analyzed	8/22/2008	8/22/2008	8/22/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	55 JD	40 U	89 JD	80 JD
Butyl Benzyl Phthalate	92 D	120 D	16 U	23 U
Bis(2-ethylhexyl) Phthalate	570 JD	590 D	130 JD	300 JD
<u>SURROGATE RECOVERIES (%Rec)</u>				
p-Terphenyl-d14	77 D	87 D	87 D	80 D

BATTELLE MARINE SCIENCE LABORATORIES

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Client Code	Method Blank	Method Blank
Lab Code	KWG0807586-5-1	KWG0807588-5-2
Date Collected	NA	NA
Date Extracted	8/6/2008	8/6/2008
Date Analyzed	8/16/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM
Basis	Dry	Dry
Units	ug/Kg	ug/Kg
Naphthalene	0.37 U	0.37 U
2-Methylnaphthalene	0.39 U	0.39 U
Acenaphthylene	0.24 U	0.24 U
Acenaphthene	0.23 U	0.23 U
Fluorene	0.50 U	0.50 U
Phenanthrene	0.75 U	0.75 U
Anthracene	0.47 U	0.47 U
Fluoranthene	0.61 U	0.61 U
Pyrene	0.37 U	0.37 U
Benz(a)anthracene	0.48 U	0.48 U
Chrysene	0.25 U	0.25 U
Benzo(b)fluoranthene	0.25 U	0.25 U
Benzo(k)fluoranthene	0.15 U	0.15 U
Benzo(a)pyrene	0.14 U	0.14 U
Indeno(1,2,3-cd)pyrene	0.16 U	0.16 U
Dibenz(a,h)anthracene	0.28 U	0.28 U
Benzo(g,h,i)perylene	0.64 U	0.64 U
<u>SURROGATE RECOVERIES (%Rec)</u>		
Fluorene-d10	68	79
Fluoranthene-d10	78	81
p-Terphenyl-d14	83	89
Date Analyzed	8/12/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541
Method	8270C	8270C
Di-n-butyl Phthalate	7.9 U	7.9 U
Butyl Benzyl Phthalate	3.3 J	3.2 U
Bis(2-ethylhexyl) Phthalate	7.0 U	7.0 U
p-Terphenyl-d14	99	95

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Client Code	500-G34 MS	500-G34 MSD	500-G48 MS	500-G48 MSD
Lab Code	KWG0807586-1	KWG0807586-2	KWG0807588-1	KWG0807588-2
Date Collected	5/2/2007	5/2/2007	5/7/2007	5/7/2007
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/16/2008	8/16/2008	8/22/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry
Units	PCT_REC	PCT_REC	PCT_REC	PCT_REC
Naphthalene	64	80	72	55
2-Methylnaphthalene	64	81	74	56
Acenaphthylene	63	79	71	52
Acenaphthene	61	77	73	53
Fluorene	64	81	75	56
Phenanthrene	-9 *	5 *	76	52
Anthracene	65	85	80	58
Fluoranthene	-27 *	-8 *	80	50
Pyrene	4 *	22	76	44
Benz(a)anthracene	44	67	80	55
Chrysene	25 *	43	81	48
Benzo(b)fluoranthene	9 *	38	85	48
Benzo(k)fluoranthene	56	76	84	59
Benzo(a)pyrene	35	58	80	50
Indeno(1,2,3-cd)pyrene	43	69	80	52
Dibenz(a,h)anthracene	65	86	78	57
Benzo(g,h,i)perylene	44	73	80	52
<u>SURROGATE RECOVERIES (%Rec)</u>				
Fluorene-d10	63	75	64	65
Fluoranthene-d10	64	78	64	66
p-Terphenyl-d14	71	85	69	72
Date Analyzed	8/12/2008	8/12/2008	8/22/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	99	105	95	91
Butyl Benzyl Phthalate	79	86	104	96
Bis(2-ethylhexyl) Phthalate	46	37	92	73
p-Terphenyl-d14	98	102	82 D	84 D

BATTELLE MARINE SCIENCE LABORATORIES

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Client Code	Lab Control Sample	Duplicate Lab Control Sample	Lab Control Sample	Duplicate Lab Control Sample
Lab Code	KWG0807586-3-1	KWG0807586-4-1	KWG0807588-3-2	KWG0807588-4-2
Date Collected	NA	NA	NA	NA
Date Extracted	8/6/2008	8/6/2008	8/6/2008	8/6/2008
Date Analyzed	8/20/2008	8/20/2008	8/22/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C SIM	8270C SIM	8270C SIM	8270C SIM
Basis	Dry	Dry	Dry	Dry
Units	PCT_REC	PCT_REC	PCT_REC	PCT_REC
Naphthalene	62	62	83	79
2-Methylnaphthalene	64	65	85	82
Acenaphthylene	60	60	82	78
Acenaphthene	61	62	84	80
Fluorene	61	63	87	83
Phenanthrene	59	64	85	81
Anthracene	67	69	89	86
Fluoranthene	67	69	89	88
Pyrene	91	92	86	83
Benz(a)anthracene	66	68	91	87
Chrysene	71	69	95	91
Benzo(b)fluoranthene	69	70	100	95
Benzo(k)fluoranthene	71	71	101	99
Benzo(a)pyrene	69	70	94	91
Indeno(1,2,3-cd)pyrene	69	70	91	86
Dibenz(a,h)anthracene	74	75	95	89
Benzo(g,h,i)perylene	71	72	96	92
<u>SURROGATE RECOVERIES (%Rec)</u>				
Fluorene-d10	54	56	78	72
Fluoranthene-d10	60	63	82	75
p-Terphenyl-d14	64	64	85	78
Date Analyzed	8/12/2008	8/12/2008	8/22/2008	8/22/2008
Extraction Method	EPA 3541	EPA 3541	EPA 3541	EPA 3541
Method	8270C	8270C	8270C	8270C
Di-n-butyl Phthalate	101	86	92	95
Butyl Benzyl Phthalate	88	78	84	84
Bis(2-ethylhexyl) Phthalate	93	80	86	88
p-Terphenyl-d14	92	86	76	91

COLUMBIA ANALYTICAL SERVICES, INC.

Client: Battelle Marine Sciences Lab
Project: ENVEST MVS_OVS
Sample Matrix: Sediment

Service Request No.: K0807130
Date Received: 8/1/08

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier III validation deliverables including summary forms and all of the associated raw data for each of the analyses. When appropriate to the method, method blank results have been reported with each analytical test.

Sample Receipt

Sediment samples were received for analysis at Columbia Analytical Services on 8/1/08. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored frozen at -20°C upon receipt at the laboratory.

Polynuclear Aromatic Hydrocarbons by EPA Method 8270C

Continuing Calibration Verification Exceptions:

The upper control criterion was exceeded for Indeno(1,2,3-cd)pyrene in Continuing Calibration Verification (CCV) MS11\0817F031.D. The field samples analyzed in this sequence were dilutions for analytes other than the Indeno(1,2,3-cd)pyrene. The measurement had no impact on the results. No further corrective action was required.

Matrix Spike Recovery Exceptions:

The matrix spike recovery of Phenanthrene, Fluoranthene, Pyrene, Chrysene, and Benzo(b)fluoranthene for sample 232512 was outside the CAS control criteria as a result of the heterogeneous character of the sample. The Relative Percent Difference (RPD) for the replicate analysis supports this. Since the unspiked samples contained high analyte concentrations relative to the amount spiked, the variability between replicates was sufficient to bias the percent recoveries outside normal CAS control criteria. The associated QA/QC results (e.g. control sample, calibration standards, etc.) indicate the analysis was in control. No further corrective action was appropriate.

No other anomalies associated with the analysis of these samples were observed.

Semivolatile Organic Compounds (Phthalates) by EPA Method 8270C

Elevated Detection Limits:

The detection limits are elevated for in most samples. The sample extracts were diluted prior to instrumental analysis due to relatively high levels of non-target background components. Clean-up of the extracts was performed within the scope of the method, but did not eliminate enough of the background components to prevent dilutions. Semi-quantitative screens were performed prior to final analysis. The results of the screening indicated the need to perform dilutions.

No other anomalies associated with the analysis of these samples were observed.

Approved by _____



Date _____

8/1