

APPENDIX E.3

TOXICITY REFERENCE VALUES

TABLE E.3-1
COMPARISON OF TOXICITY REFERENCE VALUES FOR MUSKRAT

WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern ¹	Test Species	Body Weight (kg) ²	Exposure Route and Duration Class	Duration	System	Test TRV mg/kg - d ³	Test TRV Type	Source ⁴	Wildlife TRV (mg/kg-d) ^{5,6}
Arsenic									
Arsenite	mouse	0.03	oral in water (chronic)	3 gen	reproductive	1.26	LOAEL	Sample et al., 1996	0.55
Arsenate	mouse	0.03	oral in water (chronic)	26 months	tumors	0.07	LOAEL	Eisler, 2000	0.03
Arsenite	mouse	0.03	oral (chronic)	2 yr	growth	1	LOAEL	Eisler, 2000	0.44
Arsenite	rat	0.35	oral in water (subchronic)	6 wk	serum uric acid	1.2	LOAEL	Eisler, 2000	0.96
Arsenate	rat	0.35	oral in diet (subchronic)	10 wk	serum uric acid	50	LOAEL	Eisler, 2000	4.02
Asrenic trioxide	rat	0.35	oral in diet (subchronic)	21 d	systemic	50	LOAEL	Eisler, 2000	4.02
Asrenic trioxide	rat	0.35	single oral dose	96h	mortality	15.1	LD50 ^a	Eisler, 2000	1.21
Arsenite	rat	0.35	oral (subchronic)	23 d	growth	8	NOAEL	ATSDR, 2000	0.64
Arsenite	rat	0.35	oral (chronic)	2 yr	growth	4	LOAEL	ATSDR, 2000	0.32
Arsenate	rat	0.35	oral (chronic)	2 yr	growth	2	LOAEL	ATSDR, 2000	0.16
Arsenate	rat	0.35	oral (chronic)	27 months	growth	7	LOAEL	ATSDR, 2000	0.56
Arsenate	rat	0.35	oral (chronic)	27 months	growth	30	LOAEL	ATSDR, 2000	2.41
Arsenite	cotton rat	1.20	oral in water(intermediate)	6 wk	systemic, immune	5	LOAEL	Eisler, 2000	0.55
Cadmium									
Cadmium chloride	rat	0.30	oral gavage (chronic)	6 wk	reproductive	1.0	NOAEL	Sample et al., 1996	0.78
Cadmium chloride	rat	0.30	oral gavage (chronic)	6 wk	reproductive	10.0	LOAEL	Sample et al., 1996	7.76
Cadmium chloride	rat	0.35	oral in water (subchronic)	14 wk	reproductive	40	LOAEL	ATSDR, 1999	32.17
Cadmium chloride	rat	0.35	oral in water (subchronic)	12 wk	reproductive	8.58	LOAEL	ATSDR, 1999	6.90
Cadmium chloride	rat	0.35	oral in water (subchronic)	14 wk	reproductive	5.8	LOAEL	ATSDR, 1999	4.66
Cadmium chloride	rat	0.35	oral in water (subchronic)	14 wk	reproductive	11.6	LOAEL	ATSDR, 1999	9.33
Cadmium acetate	rat	0.35	oral in water (subchronic)	120 d	reproductive	12.6	LOAEL	ATSDR, 1999	10.13
Cadmium chloride	mouse	0.03	oral in water (chronic)	6 months	reproductive	2.5	LOAEL	ATSDR, 1999	1.09
Chromium									
Chromium oxide (Cr III)	rat	0.35	oral in food (subchronic)	90 d and 2 yr	reproductive	2737.00	NOAEL	Sample, 1996	2200.95
Chromium Chloride (Cr III)	rat	0.35	oral in food (subchronic)	20 weeks	systemic	9.00	NOAEL	ATSDR, 2000	7.24
Chromium Chloride (Cr III)	rat	0.35	oral in water (subchronic)	12 weeks	reproductive	40.00	LOAEL	ATSDR, 2000	32.17
Chromium Chloride (Cr III)	mouse	0.03	oral in water (subchronic)	12 weeks	reproductive	5.00	LOAEL	ATSDR, 2000	2.18
Chromium sulfate (Cr III)	mouse	0.03	oral in food (subchronic)	7 wk	reproductive	9.10	LOAEL	ATSDR, 2000	3.96
Potassium dichromate (Cr VI)	rat	0.35	oral in water (chronic)	1 yr	reproductive	3.28	NOAEL	Sample, 1996	2.64
Potassium dichromate (Cr VI)	rat	0.35	oral in food (subchronic)	20 d	reproductive	37	LOAEL	ATSDR, 2000	29.75
Potassium dichromate (Cr VI)	rat	0.35	oral in food (subchronic)	3 months	reproductive	45	LOAEL	ATSDR, 2000	36.19
Potassium dichromate (Cr VI)	rat	0.35	oral in water (subchronic)	12 wk	reproductive	42	LOAEL	ATSDR, 2000	33.77
Potassium dichromate (Cr VI)	rat	0.35	oral in water (subchronic)	90 d	reproductive	20	LOAEL	ATSDR, 2000	16.08
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	12 weeks	reproductive	6.00	LOAEL	ATSDR, 2000	2.61
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	20 d	reproductive	52.00	LOAEL	ATSDR, 2000	22.63
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	20 d	reproductive	60.00	LOAEL	ATSDR, 2000	26.11
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	19 d	reproductive	46.00	LOAEL	ATSDR, 2000	20.02
Potassium dichromate (Cr VI)	mouse	0.03	oral in food (subchronic)	7 wk	reproductive	15.20	LOAEL	ATSDR, 2000	6.61
Cr VI (form unknown)	rat	0.35	oral in food (subchronic)	3 months	mortality	80.00	LOAEL	Eisler, 2000	64.33
Copper									
Copper sulfate	mink	1.0	oral in diet (chronic)	357 d	reproductive	11.7	NOAEL	Sample et al., 1996	12.23
Copper sulfate	mink	1.0	oral in diet (chronic)	357 d	reproductive	15.1	LOAEL	Sample et al., 1996	15.83
Copper acetate	rat	0.35	oral in diet (chronic)	60-73 d	reproductive	130.0	LOAEL	ATSDR, 2002	104.54
Copper gluconate	mouse	0.03	oral in water (chronic)	850 d	life span	4.2	LOAEL	ATSDR, 2002	1.83
Lead									
Lead acetate	rat	0.35	oral in diet (chronic)	3 gen	reproductive	8.0	NOAEL	Sample et al., 1996	6.43
Lead acetate	rat	0.35	oral in diet (chronic)	3 gen	reproductive	80.0	LOAEL	Sample et al., 1996	64.33
Lead (form unknown)	rat	0.35	oral in water (subchronic)	6-7 wk	reproductive	0.3	LOAEL	Eisler, 2000	0.27
Lead (form unknown)	rat	0.35	oral in diet (subchronic)	3 wk	mortality	200.0	LOAEL	Eisler, 2000	160.83
Lead (form unknown)	rat	0.35	oral in water (chronic)	life time	mortality	0.1	LOAEL	Eisler, 2000	0.06
Lead (form unknown)	rat	0.35	oral in diet (subchronic)	130 d	reproductive	52.6	LOAEL	Eisler, 2000	42.30
Lead acetate	rat	0.35	oral in water (subchronic)	14 - 50 d	reproductive	502.0	LOAEL	ATSDR, 1999	403.68
Lead acetate	rat	0.35	oral in water (subchronic)	60 d	reproductive	90.0	LOAEL	ATSDR, 1999	72.37
Lead acetate	rat	0.35	oral in diet (subchronic)	30 d	reproductive	0.3	LOAEL	ATSDR, 1999	0.24
Lead acetate	mouse	0.03	oral in water (subchronic)	11 wk	reproductive	10.5	LOAEL	Eisler, 2000	4.57
Lead (form unknown)	mouse	0.03	oral in water (subchronic)	9 months	reproductive	13.1	NOAEL	Eisler, 2000	5.70
Lead acetate	mouse	0.03	oral in water (chronic)	multi-gen	mortality	605.0	NOAEL	ATSDR, 1999	263.24
Lead acetate	mouse	0.03	oral in water (subchronic)	12 wk	reproductive	141.0	NOAEL	ATSDR, 1999	61.35
Lead acetate	cotton rat	1.20	oral in water (subchronic)	7-13 wk	immune, systemic	0.1	LOAEL	Eisler, 2000	0.14
Mercury									
Methyl mercury chloride	rat	0.35	oral in diet (chronic)	3 gen	reproductive	0.032	NOAEL	Sample et al., 1996	0.03

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WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern ¹	Test Species	Body Weight (kg) ²	Exposure Route and Duration Class	Duration	System	Test TRV mg/kg - d ³	Test TRV Type	Source ⁴	Wildlife TRV (mg/kg-d) ^{5,6}
Methyl mercury chloride	rat	0.35	oral in diet (chronic)	3 gen	reproductive	0.16	LOAEL	Sample et al., 1996	0.13
Mercuric sulfide	mouse	0.03	oral in diet (chronic)	20 months	reproductive, systemic	13.2	NOAEL	Sample et al., 1996	5.74
Mercuric chloride	mink	1.0	oral in diet (chronic)	6 months	reproductive	1.0	NOAEL	Sample et al., 1996	1.05
Methyl mercury chloride	mink	1.0	oral in diet (subchronic)	93 d	mortality, growth	0.15	NOAEL	Sample et al., 1996	0.16
Methyl mercury chloride	mink	1.0	oral in diet (subchronic)	93 d	mortality, growth	0.25	LOAEL	Sample et al., 1996	0.26

d - day

wk - week

gen - generations

UF - Uncertainty Factor

COPC - Chemical of Potential Concern

TRV - Reference Toxicity Value

NOAEL - No Observed Adverse Effect Level

LOAEL - Lowest Observed Adverse Effect Level

1 COPC or COPC and analyte/compound used in toxicological testing

2 Body weight for mouse and rat based on USEPA (1985b *cited in* Sample *et al.*, 1996), other body weights are actual body weights of animals used in test

3 TRV s for studies in which dose was administered five times per week were multiplied for a factor of 0.7.

4 Documents cited are review documents (i.e., secondary sources). Citations for primary sources may be obtained from these documents.

5 The bold values were selected for use in calculating LOAEL HQ's

6 Test NOAELs and LOAELs were adjusted for wildlife species body weight using the following equation: $NOAEL_{wildlife} = NOAEL_{test} * (BW_{test}/BW_{wildlife})^{0.25}$ (Sample *et al.*, 1996)

a An LD₅₀ was divided by 10 to obtain a LOAEL

**TABLE E.3-2
COMPARISON OF TOXICITY REFERENCE VALUES FOR MALLARD**

WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern ¹	Test Species	Body Weight (kg) ²	Exposure Route and Duration Class	Duration	System	Test TRV mg/kg - d ⁵	Test TRV Type	Source ⁷	Wildlife TRV (mg/kg-d) ⁸
Antimony									
Potassium tartrate	rat	0.35	oral in water (subchronic)	lifetime, >1 year	lifespan	0.26	LOAEL	ATSDR, 1992	0.26
Potassium tartrate	mouse	0.03	oral in water (chronic)	lifetime, >1 year	lifespan	1.25	LOAEL	Sample et al., 1996	1.25
Potassium tartrate	mouse	0.03	oral in water (chronic)	lifetime, >1 year	lifespan	0.35	LOAEL	ATSDR, 1992	0.35
Arsenic									
Sodium arsenite	mallard	1.00	oral in diet (chronic)	128 d	mortality	5.14	NOAEL	Sample et al., 1996	5.14
Sodium arsenite	mallard	1.00	oral in diet (chronic)	128 d	mortality	12.84	LOAEL	Sample et al., 1996	12.84
Sodium arsenate	mallard	1.00	oral in diet (subchronic)	10 wk	growth	3	LOAEL	Camardese et al., 1990	3.00
Sodium arsenate	mallard	1.00	oral in diet (subchronic)	4 wk	growth	20	LOAEL	Eisler, 2000	20.00
Copper acetoarsenite	Brown-headed cowbird	0.05	oral in diet (chronic)	7 months	mortality	7.38	LOAEL	Sample et al., 1996	7.38
Chromium									
Chromic potassium sulfate (Cr III)	black duck	1.25	oral in diet (chronic)	10 months	reproductive	1.0	NOAEL	Sample et al., 1996	1.00
Chromic potassium sulfate (Cr III)	black duck	1.25	oral in diet (chronic)	10 months	reproductive	5.0	LOAEL	Sample et al., 1996	5.00
Chromium VI (form unknown)	chickens	1.50	oral in diet (subchronic)	32 d	growth	7.1	NOAEL	Eisler, 2000	7.07
Lead									
Lead acetate	Japanese quail	0.15	oral in diet (chronic)	12 wk	reproductive	1.1	NOAEL	Sample et al., 1996	1.13
Lead acetate	Japanese quail	0.15	oral in diet (chronic)	12 wk	reproductive	11.3	LOAEL	Sample et al., 1996	11.30
metallic	American kestrel	0.13	oral in diet (chronic)	7 months	reproductive	3.9	NOAEL	Sample et al., 1996	3.85
Lead nitrate	mallard	1.00	oral in diet (chronic)	12 wk	systemic, mortality	2.5	NOAEL	Eisler, 2000	2.50
Total lead, sediment	mallard	1.00	oral in diet (chronic)	15 wk	mortality	960.0	LOAEL	Eisler, 2000	960
Mercury									
Methyl mercury dicyandiamide	mallard	1.00	oral in diet (chronic)	3 gen	reproductive	0.064	LOAEL	Sample et al., 1996	0.06
methly mercury	mallard	1.00	oral in diet (chronic)	2 gen	reproductive	3.0	LOAEL	Eisler, 2000	3.00

d - day

wk - week

gen - generations

UF - Uncertainty Factor

COPC - Chemical of Potential Concern

TRV - Reference Toxicity Value

NOAEL - No Observed Adverse Effect Level

LOAEL - Lowest Observed Adverse Effect Level

1 COPC or COPC and analyte/compound used in toxicological testing

2 Body weight for mouse and rat based on USEPA (1985b cited in Sample *et al.*, 1996), other body weights are actual body weights of animals used in test

3 Lowest carcinogenic LOAEL from PAH toxicological data summarized in ATSDR, 1995b; test used benzo(a)pyrene. USEPA has classified benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, chrysene, and indeno(1,2,3-cd)pyrene as carcinogens (ATSDR, 1995b).

4 Lowest non-carcinogenic NOAEL from PAH toxicological data summarized in ATSDR (1995b); test used benzo(a)pyrene. USEPA has indicated that acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene and pyrene are not classifiable as carcinogens (ATSDR, 1995b). Carbazole and dibenzofuran were included in this group for the development of HQs.

5 TRV s for studies in which dose was administered five times per week were multiplied for a factor of 0.7.

6 LOAELs were divided by a UF of 10 to obtain NOAELs.
conversion and 10 for the LOAEL to NOAEL conversion)

7 Documents cited are review documents (i.e., secondary sources). Citations for primary sources may be obtained from these documents.

8 Test NOAELs from test species were not adjusted for body weight of mallard (Sample et al., 1996).

**TABLE E.3-3
COMPARISON OF TOXICITY REFERENCE VALUES FOR SHREW**

WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern ¹	Test Species	Body Weight (kg) ²	Exposure Route and Duration Class	Duration	System	Test TRV mg/kg - d ³	Test TRV Type	Source ⁴	Wildlife TRV (mg/kg-d) ^{5,6}
<u>Aroclor 1254</u>									
Aroclor 1254	mouse	0.03	oral in diet (chronic)	12 months	reproductive	0.7	LOAEL	Sample et al., 1996	0.81
<u>Antimony</u>									
Antimony potassium tartrate	mouse	0.03	oral in water (chronic)	lifetime, >1 year	lifespan	1.25	LOAEL	Sample et al., 1996	1.49
<u>Arsenic</u>									
Arsenite	mouse	0.03	oral in water (chronic)	3 gen	reproductive	1.26	LOAEL	Sample et al., 1996	1.50
Arsenate	mouse	0.03	oral in water (chronic)	26 months	tumors	0.07	LOAEL	Eisler, 2000	0.08
Arsenite	mouse	0.03	oral (chronic)	2 yr	growth	1	LOAEL	Eisler, 2000	1.19
Arsenite	rat	0.35	oral in water (subchronic)	6 wk	serum uric acid	1.2	LOAEL	Eisler, 2000	2.64
Arsenate	rat	0.35	oral in diet (subchronic)	10 wk	serum uric acid	50	LOAEL	Eisler, 2000	109.89
Arsenic trioxide	rat	0.35	oral in diet (subchronic)	21 d	systemic	50	LOAEL	Eisler, 2000	109.89
Arsenic trioxide	rat	0.35	single oral dose	96h	mortality	15.1	LD50 ⁷	Eisler, 2000	33.19
Arsenite	rat	0.35	oral (subchronic)	23 d	growth	8	NOAEL	ATSDR, 2000	17.58
Arsenite	rat	0.35	oral (chronic)	2 yr	growth	4	LOAEL	ATSDR, 2000	8.79
Arsenate	rat	0.35	oral (chronic)	2 yr	growth	2	LOAEL	ATSDR, 2000	4.40
Arsenate	rat	0.35	oral (chronic)	27 months	growth	7	LOAEL	ATSDR, 2000	15.38
Arsenate	rat	0.35	oral (chronic)	27 months	growth	30	LOAEL	ATSDR, 2000	65.93
Arsenite	cotton rat	1.20	oral in water(intermediate)	6 wk	systemic, immune	5	LOAEL	Eisler, 2000	14.95
<u>Cadmium</u>									
Cadmium chloride	rat	0.30	oral gavage (chronic)	6 wk	reproductive	1.0	NOAEL	Sample et al., 1996	2.12
Cadmium chloride	rat	0.30	oral gavage (chronic)	6 wk	reproductive	10.0	LOAEL	Sample et al., 1996	21.20
Cadmium chloride	rat	0.35	oral in water (subchronic)	14 wk	reproductive	40	LOAEL	ATSDR, 1999	87.91
Cadmium chloride	rat	0.35	oral in water (subchronic)	12 wk	reproductive	8.58	LOAEL	ATSDR, 1999	18.86
Cadmium chloride	rat	0.35	oral in water (subchronic)	14 wk	reproductive	5.8	LOAEL	ATSDR, 1999	12.75
Cadmium chloride	rat	0.35	oral in water (subchronic)	14 wk	reproductive	11.6	LOAEL	ATSDR, 1999	25.49
Cadmium acetate	rat	0.35	oral in water (subchronic)	120 d	reproductive	12.6	LOAEL	ATSDR, 1999	27.69
Cadmium chloride	mouse	0.03	oral in water (chronic)	6 months	reproductive	2.5	LOAEL	ATSDR, 1999	2.97
<u>Chromium</u>									
Chromium oxide (Cr III)	rat	0.35	oral in food (subchronic)	90 d and 2 yr	reproductive	2737.00	NOAEL	Sample, 1996	6015.46
Chromium Chloride (Cr III)	rat	0.35	oral in food (subchronic)	20 weeks	systemic	9.00	NOAEL	ATSDR, 2000	19.78
Chromium Chloride (Cr III)	rat	0.35	oral in water (subchronic)	12 weeks	reproductive	40.00	LOAEL	ATSDR, 2000	87.91
Chromium Chloride (Cr III)	mouse	0.03	oral in water (subchronic)	12 weeks	reproductive	5.00	LOAEL	ATSDR, 2000	5.95
Chromium sulfate (Cr III)	mouse	0.03	oral in food (subchronic)	7 wk	reproductive	9.10	LOAEL	ATSDR, 2000	10.82
Potassium dichromate (Cr VI)	rat	0.35	oral in water (chronic)	1 yr		3.28	NOAEL	Sample, 1996	7.21
Potassium dichromate (Cr VI)	rat	0.35	oral in food (subchronic)	20 d	reproductive	37	LOAEL	ATSDR, 2000	81.32
Potassium dichromate (Cr VI)	rat	0.35	oral in food (subchronic)	3 months	reproductive	45	LOAEL	ATSDR, 2000	98.90
Potassium dichromate (Cr VI)	rat	0.35	oral in water (subchronic)	12 wk	reproductive	42	LOAEL	ATSDR, 2000	92.31
Potassium dichromate (Cr VI)	rat	0.35	oral in water (subchronic)	90 d	reproductive	20	LOAEL	ATSDR, 2000	43.96
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	12 weeks	reproductive	6.00	LOAEL	ATSDR, 2000	7.14
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	20 d	reproductive	52.00	LOAEL	ATSDR, 2000	61.84
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	20 d	reproductive	60.00	LOAEL	ATSDR, 2000	71.35
Potassium dichromate (Cr VI)	mouse	0.03	oral in water (subchronic)	19 d	reproductive	46.00	LOAEL	ATSDR, 2000	54.70
Potassium dichromate (Cr VI)	mouse	0.03	oral in food (subchronic)	7 wk	reproductive	15.20	LOAEL	ATSDR, 2000	18.08
Cr VI (form unknown)	rat	0.35	oral in food (subchronic)	3 months	mortality	80.00	LOAEL	Eisler, 2000	175.83
<u>Lead</u>									
Lead acetate	rat	0.35	oral in diet (chronic)	3 gen	reproductive	8.0	NOAEL	Sample et al., 1996	17.58
Lead acetate	rat	0.35	oral in diet (chronic)	3 gen	reproductive	80.0	LOAEL	Sample et al., 1996	175.83
Lead (form unknown)	rat	0.35	oral in water (subchronic)	6-7 wk	reproductive	0.3	LOAEL	Eisler, 2000	0.73
Lead (form unknown)	rat	0.35	oral in diet (subchronic)	3 wk	mortality	200.0	LOAEL	Eisler, 2000	439.57
Lead (form unknown)	rat	0.35	oral in water (chronic)	life time	mortality	0.1	LOAEL	Eisler, 2000	0.15
Lead (form unknown)	rat	0.35	oral in diet (subchronic)	130 d	reproductive	52.6	LOAEL	Eisler, 2000	115.61
Lead acetate	rat	0.35	oral in water (subchronic)	14 - 50 d	reproductive	502.0	LOAEL	ATSDR, 1999	1103.31
Lead acetate	rat	0.35	oral in water (subchronic)	60 d	reproductive	90.0	LOAEL	ATSDR, 1999	197.80
Lead acetate	rat	0.35	oral in diet (subchronic)	30 d	reproductive	0.3	LOAEL	ATSDR, 1999	0.66
Lead acetate	mouse	0.03	oral in water (subchronic)	11 wk	reproductive	10.5	LOAEL	Eisler, 2000	12.49
Lead (form unknown)	mouse	0.03	oral in water (subchronic)	9 months	reproductive	13.1	NOAEL	Eisler, 2000	15.58
Lead acetate	mouse	0.03	oral in water (chronic)	multi-gen	mortality	605.0	NOAEL	ATSDR, 1999	719.47
Lead acetate	mouse	0.03	oral in water (subchronic)	12 wk	reproductive	141.0	NOAEL	ATSDR, 1999	167.68
Lead acetate	cotton rat	1.20	oral in water (subchronic)	7-13 wk	immune, systemic	0.1	LOAEL	Eisler, 2000	0.39

**TABLE E.3-3
COMPARISON OF TOXICITY REFERENCE VALUES FOR SHREW**

WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern ¹	Test Species	Body Weight (kg) ²	Exposure Route and Duration Class	Duration	System	Test TRV mg/kg - d ³	Test TRV Type	Source ⁴	Wildlife TRV (mg/kg-d) ^{5,6}
Mercury									
Methyl mercury chloride	rat	0.35	oral in diet (chronic)	3 gen	reproductive	0.032	NOAEL	Sample et al., 1996	0.07
Methyl mercury chloride	rat	0.35	oral in diet (chronic)	3 gen	reproductive	0.16	LOAEL	Sample et al., 1996	0.35
Mercuric sulfide	mouse	0.03	oral in diet (chronic)	20 months	reproductive, systemic	13.2	NOAEL	Sample et al., 1996	15.70
Mercuric chloride	mink	1.0	oral in diet (chronic)	6 months	reproductive	1.0	NOAEL	Sample et al., 1996	2.86
Methyl mercury chloride	mink	1.0	oral in diet (subchronic)	93 d	mortality, growth	0.15	NOAEL	Sample et al., 1996	0.43
Methyl mercury chloride	mink	1.0	oral in diet (subchronic)	93 d	mortality, growth	0.25	LOAEL	Sample et al., 1996	0.71

d - day

wk - week

gen - generations

UF - Uncertainty Factor

COPC - Chemical of Potential Concern

TRV - Reference Toxicity Value

NOAEL - No Observed Adverse Effect Level

LOAEL - Lowest Observed Adverse Effect Level

1 COPC or COPC and analyte/compound used in toxicological testing

2 Body weight for mouse and rat based on USEPA (1985b cited in Sample *et al.*, 1996), other body weights are actual body weights of animals used in test

3 TRVs for studies in which dose was administered five times per week were multiplied for a factor of 0.7.

4 Documents cited are review documents (i.e., secondary sources). Citations for primary sources may be obtained from these documents.

5 The bold values were selected for use in calculating LOAEL HQ's

6 Test NOAELs and LOAELs were adjusted for wildlife species body weight using the following equation: $NOAEL_{wildlife} = NOAEL_{test} * (BW_{test}/BW_{wildlife})^{0.25}$ (Sample *et al.*, 1996)

a An LD₅₀ was divided by 10 to obtain a LOAEL

APPENDIX E.4

BASELINE ECOLOGICAL RISK ASSESSMENT SUPPLEMENTAL DATA - SURFACE WATER

Appendix E.4

Evaluation of Additional Surface Water Data

After completion of the Aberjona River Study (Wells G&H Site OU-3) Baseline Ecological Risk Assessment (BERA), additional surface water data were compiled to address the fate and transport of contaminants through both the Industri-Plex Superfund site study area (north of Route 128) and the Aberjona River Study area (south of Route 128). These data were collected to provide the basis of the comprehensive RI along the Aberjona River and Hall's Brook Holding Area (HBHA) from the Industri-Plex site to the Mystic Lakes (merging both study areas). A subset of these data were collected within the Aberjona River Study area (south of Route 128) and qualitatively evaluated in this appendix to supplement the surface water data set evaluated in the BERA. The purpose of this evaluation is to supplement the data used in the BERA for the evaluation of the potential ecological risks to aquatic receptors associated with the exposure to COPCs in surface water within the Aberjona River Study area. This qualitative assessment of the data includes a comparison of maximum and average values against water quality benchmarks to evaluate potential adverse effects of surface water COPCs on aquatic organisms.

Surface water samples collected within the Aberjona River Study Area, south of Route 128, included samples from gauging stations SW-05 to SW-10, and location SW-MC-13 (Figure 2-31). Surface water at location SW-MC-13 was sampled by Menzie-Cura Associates on June 17, 1999. Gauging stations SW-05 to SW-10 were sampled during baseflow conditions, monthly from July 2001 to October 2002 for total metals, dissolved metals, and TSS. In addition, samples were collected at SW-05 to SW-10 during 6 storm events between April 26, 2002 and October 18, 2002. Analyses included total and filtered inorganics in all samples. Only one sample (SW-MC-13, June 1999), was analyzed for organics (VOCs, SVOCs, pesticides, and PCBs). Among the 127 organic analytes tested in the sample, there were no concentrations measured above detection limits. The organic analyte list and corresponding detection limits are presented in Table E.4-1. The results from the grab sample at SW-MC-13 were included with baseflow results from results at SW-05, since there was only one sample collected at SW-MC-13. As there were no detected organic compounds, the results of the organic analyses are not further evaluated.

Dissolved metals concentrations from all samples, both baseflow and storm events, are summarized in Tables E.4-2 to E.4-13. Only filtered samples were screened for metals, as described below.

Maximum detected levels of chemicals were compared to surface water quality criteria. The sets of criteria used in the screening, in order of selection, consisted of:

- USEPA Ambient Water Quality Criteria (AWQC) (USEPA, 2002);
- USEPA Ecotox Thresholds for Surface Water based on Great Lakes Water Quality Initiative Tier II methodology (USEPA, 1996), were used when a screening value from above was not available;
- Secondary Chronic Values (SCVs) for aquatic biota developed by Oak Ridge National Laboratory (Suter & Tsao, 1996), were used when a screening value from above was not available.

As presented in the AWQC document (USEPA, 2002), criteria for metals are based on a hardness value of 100 mg/L as CaCO_3 and are given as dissolved metals. When comparing metal concentrations to benchmarks, dissolved (filtered) concentrations were selected over total concentrations, because dissolved concentrations correspond to NAWQC and represent the most bioavailable form of the metal; thus total concentrations of metals were not used for screening purposes. Equations presented in the AWQC document (USEPA, 2002) were used to adjust criteria to site specific conditions, based on an average hardness for all of the filtered samples of 116 mg/L as CaCO_3 .

If a chemical was detected in 5% or fewer of all surface water samples, it was excluded from further consideration. Calcium, magnesium, potassium, and sodium were excluded from the screening process and eliminated as COPCs because they are nutrients and occur naturally at high concentrations. COPCs with maximum concentrations which were below screening levels were

also excluded from further consideration. Reasons for exclusion are shown in Table E.4-14.

Among the metals in surface water, maximum concentrations of seven were measured above ecological benchmarks, including barium, cadmium, copper, iron, lead, manganese, and silver. Each of these compounds, with the exception of silver, were identified as COPCs in surface water in the BERA. Site specific analytical data and toxicity values from the literature for each of these COPCs are presented below.

Barium. Barium was detected in 132 of 133 samples. The Tier II value (USEPA, 1996) for barium (4.0 µg/L) was exceeded by all concentrations detected in the surface water samples. The average concentration of total barium in the surface water samples (38.6 µg/L) was similar to that reported for regional reference locations (31 µg/L, BERA Table 4-5). Based on the comparable concentrations at reference locations, the incremental risk of barium to aquatic life in surface water in the study area is not substantially higher than reference water bodies.

Cadmium. Cadmium was detected in only 7 of 133 samples, however, the detection limits were generally 0.2 µg/L to 0.4 µg/L, some of which exceeded NAWQC for cadmium of 0.27µg/L (at 116 mg/L CaCO₃). This criterion continuous concentration (CCC) is an estimate of the highest concentration in surface water to which an aquatic community can be exposed indefinitely without adverse effects. The corresponding criterion maximum concentration (CMC) for cadmium is 2.3 µg/L (at 116 mg/L CaCO₃); this is an estimate of the highest concentrations to which an aquatic community can be exposed briefly without resulting in an unacceptable effect (EPA, 1999, 2001, 2002). Though the detection levels exceed the CCC, they are below the CMC.

The maximum detected concentration of 0.3 µg/L was an estimated value, observed at gauging station SW-09 during a storm event, and was the only detected value above the CCC (at 116 mg/L CaCO₃). All of the other 6 detected values ranged from 0.11 to 0.2 µg/L and were measured at SW-08 (reach 4) during storm events. None of the baseflow samples had detected cadmium concentrations above the NAWQC value of 0.27 µg/L (at 116 mg/L CaCO₃).

The literature review of cadmium effects by Eisler (1985) concluded that freshwater organisms were the most sensitive biota. Concentrations of 0.8 to 9.9 µg/L in water were lethal to several species of aquatic insects, crustaceans, and teleosts. Eisler (1985) also reported that cadmium concentrations ranging from 0.7 to 5.0 µg/L were associated with sublethal effects (decreased growth, inhibited reproduction, and population alterations) in these same groups. Cadmium has also been shown to be highly toxic to South African clawed frog (*Xenopus laevis*) embryos (Herkovits *et al.*, 1997). At the most sensitive embryonic stage, a concentration of 1 mg Cd (II)/L arrested development in 100% of exposed individuals. Mammals and birds are less sensitive to the biocidal properties of cadmium than freshwater biota (Eisler, 2000).

Although the CCC for cadmium was exceeded once during a storm event, the surface water data collected indicates that the baseflow conditions all had cadmium concentrations below detection (Tables E.4-2 to E.4-7). These comparisons indicate that the potential for adverse effects to the aquatic community due to exposure to cadmium in surface water is negligible.

Copper. Copper was detected in 56 of 133 of the filtered samples. The NAWQC CCC for copper is 10.2 µg/L (at 116 mg/L CaCO₃), and was exceeded in four samples. Three of the samples exceeding the CCC were all collected on April 26, 2002, during a storm event. The maximum concentration was observed at gauging station SW-06 (51.7 µg/L), with the other two values above the CCC collected in the same event downstream at gauging stations SW-07 (20.3 µg/L) and SW-08 (14.3 µg/L). One baseflow sample at SW-08 had a copper concentration above the NAWQC (12.4 µg/L). Two stormwater samples also exceeded the CMC of 15µg/L (at 116 mg/L CaCO₃).

Mean acute toxicity values for freshwater species range from 7.2 µg/L for the daphnid, *D. pulicaria*, to 10,200 µg/L for bluegill sunfish, *L. macrochirus* (USEPA, 1985). Chronic toxicity values for freshwater species range from 3.9 µg/L for brook trout to 60.4 µg/L for northern pike (USEPA, 1985). Site surface water data are generally below acute toxicity values and are on the low end of chronic toxicity values.

Overall there were few exceedences of ambient water quality standards for copper. The surface water data indicate that the risk to aquatic organisms from exposure to copper is low, but AWQC for dissolved copper values may be exceeded below reach 1 during storm events.

Iron. Iron was detected in 69 of 133 filtered samples. The NAWQC CCC for iron of 1,000 µg/L was exceeded in only one baseflow sample at SW-05 in July 2001. No other iron concentration in any other storm event or baseflow sample exceeded the NAWQC. Iron also exceeded the NAWQC at reference locations (Table 4-5) in total metal samples. Based on limited exceedences of the NAWQC, the data indicate that the potential for adverse effects to the aquatic community due to exposure to dissolved iron in surface water is negligible.

Lead. Lead was detected in only 8 of the 133 surface water samples. The maximum detected concentration of 3.8 µg/L was measured at SW-08 during a storm event on August 31, 2002 and was the only sample with lead concentrations exceeding the NAWQC CCC of 3.0 µg/L (at 116 mg/L CaCO₃). No baseflow samples exceeded the NAWQC value for lead.

Based on a review of toxicity testing literature, Eisler (1988b) reported adverse effects to aquatic biota associated with lead concentrations ranging from 1 to 5.1 µg/L. The CMC value for lead is 75µg/L (at 116 mg/L CaCO₃). Site surface water data are all below acute toxicity values and are on the low end of chronic toxicity values.

Based on the low detection frequency and the limited number of exceedences of ambient water quality standards for lead, the surface water data indicate that the risk to aquatic organisms from exposure to lead is low.

Manganese. The Tier II for manganese is 80 µg/L. The majority of the samples exceeded this Tier II screening value. Concentrations of filtered manganese in surface water samples were generally lower at SW-09 and SW-10 (Upper and Lower Mystic Lakes). The majority of the total manganese samples in the surface water samples reported for regional reference locations also exceeded the Tier II value.

Manganese is an essential nutrient for animals, important for growth and reproduction (NAS, 1980). Manganese toxicity can decrease with increasing water hardness (Davies, 1980; Lewis *et al.*, 1979) and be affected by pH (Lewis *et al.*, 1979). The permanganate forms of manganese are more toxic than the manganous salts (Doudoroff and Katz, 1953). However, permanganates are not persistent in aquatic environments and they are rapidly converted to relatively nontoxic substances through the oxidation of organic materials (USEPA, 1985). Most of the available toxicity information is for manganous salts.

Daphnia spp. exhibited 16% reproductive impairment after three weeks of exposure to 4,100 µg/L (Biesinger and Christensen, 1972 *cited in* Lewis *et al.*, 1979). The LCV for daphnids is <1,100 µg/L (Suter and Tsao, 1996). Davies (1980) reported that the acute toxicity of manganese to fish decreases with increasing water hardness, as well as increasing fish size. The 96-hour LC₅₀ for rainbow trout in soft water (hardness = 36 mg/L as CaCO₃) was 14,500 µg/L and the 144-hour LC₅₀ was 5,700 µg/L (Davies, 1980). England and Cummings (1971, *cited in* Lewis *et al.*, 1979) reported a 96-hour LC₅₀ in young rainbow trout of 16,00 µg/L.

For early life stages of brown trout (*Salmo trutta*), Stubblefield *et al.* (1997) reported 25% inhibition concentrations (IC₂₅s, based on combined endpoints of survival and body weight) of 5,590 µg/L at hardness levels of approximately 150 mg/L as CaCO₃. This work demonstrated an inverse relationship between water hardness and the toxicity of manganese to fish. Each of these studies indicates that the observed concentrations of manganese on site are generally lower than those associated with harm to sensitive aquatic species, consequently the risk from exposure to manganese in surface water in the study area is low. In addition, the maximum total manganese concentration observed for all of the storm event and baseflow data of 807 µg/L was lower than the maximum total manganese observed for regional reference locations of 1960 µg/L (BERA Table 4-5). These data indicate that the incremental risk of exposure of aquatic life to manganese in surface water is higher than reference water bodies.

Silver. Silver was above detection limits in slightly more than 5% (7 of 133) of the filtered metals samples. Silver was not detected in any baseflow samples, however, the detection limits generally

ranged from 0.5 µg/L to 1.0 µg/L, which are above the Tier II screening value of 0.12 µg/L. The detected values were from six storm event samples at SW-08 and one at SW-10. These detected concentrations ranged from 0.25 to 0.55 µg/L.

Acute toxicity values for freshwater invertebrates range from 0.25 µg/L for the water flea, *D. magna*, to 4,500 µg/L for the amphipod, *Gammarus pseudolimnaeus* (USEPA, 1985). Chronic toxicity values ranging from 2.6 µg/L to 29 µg/L have been reported for *D. magna* (USEPA, 1985). The observed concentrations in the study area of dissolved silver were at the levels associated with toxicity to the most sensitive organisms.

The observed concentrations of silver on site are at the site-specific detection limits, and are generally lower than those associated with harm to aquatic species. Consequently the risk from exposure to silver in surface water in the study area is low, and associated with moderate uncertainty.

Risk conclusions. Among the nine inorganics identified as surface water COPCs in the BERA, seven were detected at concentrations above screening values in the supplemental data set, including: barium, cadmium, copper, iron, lead, mercury, and silver. Three of the metals with NAWQC criteria available (cadmium, iron, and lead) were above the NAWQC values in only one of over 100 samples, with the cadmium and lead values occurring during storm events. Copper exceeded the NAWQC in four of the 133 samples, three of which occurred during a storm event. Based on the magnitude and frequency of these exceedences, the risk to aquatic organisms in the study area from exposure to metals in surface water is low.

TABLE E.4-1
SURFACE WATER ANALYTICAL RESULTS - MC-13
WELLS G&H SUPERFUND SITE (OU3)

Parameter	MC-13 6/17/1999
VOCs (ug/L)	
1,1,1-Trichloroethane	2 U
1,1,2,2-Tetrachloroethane	2 U
1,1,2-Trichloroethane	2 U
1,1-Dichloroethane	2 U
1,1-Dichloroethene	2 U
1,2-Dichloroethane	2 U
1,2-Dichloropropane	2 U
2-Butanone	2 U
2-Hexanone	2 U
4-Methyl-2-Pentanone	2 U
Acetone	5 U
Benzene	2 U
Bromodichloromethane	2 U
Bromoform	2 U
Bromomethane	2 UJ
Carbon Disulfide	2 U
Carbon Tetrachloride	2 U
Chlorobenzene	2 U
Chloroethane	2 U
Chloroform	2 U
Chloromethane	2 UJ
cis-1,2-Dichloroethene	2 U
cis-1,3-Dichloropropene	2 U
Dibromochloromethane	2 U
Ethylbenzene	2 U
Methylene Chloride	5 UJ
Styrene	2 U
Tetrachloroethene	2 U
Toluene	2 U
trans-1,2-Dichloroethene	2 U
trans-1,3-Dichloropropene	2 U
Trichloroethene	2 U
Vinyl Chloride	2 U
Xylene, m/p-	4 U
Xylene, o-	2 U
SVOCs (ug/L)	
1,2,4-Trichlorobenzene	5 U
1,2-Dichlorobenzene	5 U
1,3-Dichlorobenzene	5 U
1,4-Dichlorobenzene	5 U
2,4,5-Trichlorophenol	12 U
2,4,6-Trichlorophenol	5 U
2,4-Dichlorophenol	5 U
2,4-Dimethylphenol	5 U
2,4-Dinitrophenol	12 UJ
2,4-Dinitrotoluene	5 U
2,6-Dinitrotoluene	5 U
2-Chloronaphthalene	5 U
2-Chlorophenol	5 U
2-Methylnaphthalene	5 U
2-Methylphenol	5 U
2-Nitroaniline	12 U
2-Nitrophenol	5 U
3,3'-Dichlorobenzidine	5 U
3-Nitroaniline	5 U
4,6-Dinitro-2-methylphenol	12 UJ
4-Bromophenyl-phenylether	5 U
4-Chloro-3-methylphenol	5 U
4-Chloroaniline	5 U
4-Chlorophenyl-phenylether	5 U
4-Methylphenol	5 U
4-Nitroaniline	12 U
4-Nitrophenol	12 U
Acenaphthene	5 U
Acenaphthylene	5 U
Anthracene	5 U
Benzo(a)anthracene	5 U
Benzo(a)pyrene	5 U
Benzo(b)fluoranthene	5 U
Benzo(g,h,i)perylene	5 U
Benzo(k)fluoranthene	5 U

TABLE E.4-1
SURFACE WATER ANALYTICAL RESULTS - MC-13
WELLS G&H SUPERFUND SITE (OU3)

Parameter	MC-13 6/17/1999
Bis(2-Chloroethoxy)methane	5 U
Bis(2-Chloroethyl)ether	5 U
bis-(2-chloroisopropyl)ether	5 U
bis(2-Ethylhexyl)phthalate	5 U
Butylbenzylphthalate	5 U
Carbazole	5 U
Chrysene	5 U
Dibenz(a,h)anthracene	5 U
Dibenzofuran	5 U
Diethylphthalate	5 U
Dimethylphthalate	5 U
Di-n-Butylphthalate	5 U
Di-n-octylphthalate	5 U
Fluoranthene	5 U
Fluorene	5 U
Hexachlorobenzene	5 U
Hexachlorobutadiene	5 UJ
Hexachlorocyclopentadiene	12 UJ
Hexachloroethane	5 U
Indeno(1,2,3-cd)pyrene	5 U
Isophorone	5 U
Naphthalene	5 U
Nitrobenzene	5 U
N-Nitroso-di-n-propylamine	5 U
N-Nitrosodiphenylamine	5 U
Pentachlorophenol	12 U
Phenanthrene	5 U
Phenol	5 U
Pyrene	5 U
<u>PCB/Pesticides (ug/L)</u>	
4,4'-DDD	0.0089 U
4,4'-DDE	0.0089 U
4,4'-DDT	0.0089 U
Aldrin	0.0089 U
alpha-BHC	0.0089 U
alpha-Chlordane	0.0089 U
Aroclor-1016	0.044 U
Aroclor-1221	0.044 U
Aroclor-1232	0.044 U
Aroclor-1242	0.044 U
Aroclor-1248	0.044 U
Aroclor-1254	0.044 U
Aroclor-1260	0.044 U
beta-BHC	0.0089 U
delta-BHC	0.0089 U
Dieldrin	0.0089 U
Endosulfan I	0.0089 U
Endosulfan II	0.0089 U
Endosulfan Sulfate	0.0089 U
Endrin	0.0089 U
Endrin Aldehyde	0.0089 U
Endrin Ketone	0.0089 U
gamma-BHC	0.0089 U
gamma-Chlordane	0.0089 U
Heptachlor	0.0089 U
Heptachlor Epoxide	0.0089 U
Methoxychlor	0.044 U
Toxaphene	0.089 U

TABLE E.4-1
SURFACE WATER ANALYTICAL RESULTS - MC-13
WELLS G&H SUPERFUND SITE (OU3)

Parameter	MC-13 6/17/1999
<u>Total Metals (ug/L)</u>	
Aluminum	62.2 J
Antimony	18.3 UJ
Arsenic	26.7 J
Barium	43.4
Beryllium	0.22 U
Cadmium	0.78 U
Calcium	52400
Chromium	10.6 J
Cobalt	3 U
Copper	2.8 J
Iron	2710
Lead	1.4 J
Magnesium	8600
Manganese	749
Mercury	0.04 U
Nickel	2.7 J
Potassium	NA
Selenium	1.1 U
Silver	0.78 U
Sodium	NA
Thallium	1.2 U
Vanadium	5.4 J
Zinc	38.5 J
<u>Dissolved Metals (ug/L)</u>	
Aluminum	50 U
Antimony	100 U
Arsenic	5
Barium	38
Beryllium	4 U
Cadmium	1 U
Calcium	54000
Chromium	10 U
Cobalt	3 U
Copper	2 U
Iron	230
Lead	1 U
Magnesium	8800
Manganese	770
Mercury	0.2 U
Nickel	2 U
Potassium	NA
Selenium	2 U
Silver	2 U
Sodium	NA
Thallium	2 U
Vanadium	10 U
Zinc	21
Total Organic Carbon (mg/L)	7.94
Hardness (mg/L)	166

TABLE E.4-2
SURFACE WATER DATA SUMMARY - GAUGING STATION 05 - BASEFLOW
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 17	30.8 - 77.7	26
Antimony						0 / 17	1.2 - 100	4.1
Arsenic	3.8		11.4	J	IPSW-05-071401FT	13 / 17	5.2 - 13	5.6
Barium	27.7		44.4		IPSW-05-091002FT	17 / 17	N/A	35
Beryllium						0 / 17	0.2 - 4	0.28
Cadmium						0 / 17	0.2 - 1	0.21
Calcium	38000		58100		IPSW-05-111901FT	17 / 17	N/A	47800
Chromium	0.93	J	2.2		IPSW-05-091801FT	10 / 17	0.6 - 10	1.6
Cobalt	0.8	J	2.1		IPSW-05-102502FT	8 / 17	0.7 - 3	1.0
Copper	2.4	J	4		IPSW-05-102201FT	4 / 17	0.6 - 6	1.7
Iron	134		1480		IPSW-05-071401FT	14 / 17	8.7 - 23.8	507
Lead	1.6	J	1.6	J	IPSW-05-041702FT	1 / 17	0.7 - 2.7	0.82
Magnesium	6250		9280		IPSW-05-111901FT	17 / 17	N/A	7866
Manganese	308		770		SW-MC-13-0	17 / 17	N/A	553
Mercury						0 / 17	0.1 - 0.2	0.055
Nickel	1.3	J	2.3	J	IPSW-05-102201FT	11 / 17	0.9 - 3.5	1.5
Potassium	4840	J	7690	J	IPSW-05-021502FT	16 / 16	N/A	6369
Selenium	2.7	J	2.7	J	IPSW-05-062002FT	1 / 17	1.9 - 4.8	1.7
Silver						0 / 17	0.5 - 2	0.39
Sodium	55000		123000	J	IPSW-05-021502FT	16 / 16	N/A	77131
Thallium						0 / 17	2 - 6	1.8
Vanadium						0 / 17	0.4 - 10	0.63
Zinc	3.9	J	121		IPSW-05-121701FT	16 / 17	25.1	41

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-3
SURFACE WATER DATA SUMMARY - GAUGING STATION 06 - BASEFLOW
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 16	22 - 86.4	25
Antimony						0 / 16	1.2 - 4	1.2
Arsenic	2.1	J	7.1	J	IPSW-06-071401FT	8 / 16	1.3 - 8	2.7
Barium	29	J	42.2	J	IPSW-06-010402FT	16 / 16	N/A	36
Beryllium						0 / 16	0.2 - 0.75	0.16
Cadmium						0 / 16	0.2 - 1	0.19
Calcium	37000		52200		IPSW-06-071602FT	16 / 16	N/A	45988
Chromium	1	J	2		IPSW-06-071401FT	10 / 16	0.6 - 3.3	1.2
Cobalt	0.75	J	1.3	J	IPSW-06-021502FT	6 / 16	0.7 - 2.5	0.77
Copper	0.68	J	3.5	J	IPSW-06-050802FT	7 / 16	2 - 5.6	2.1
Iron	110		961		IPSW-06-071401FT	11 / 16	8.7 - 254	293
Lead						0 / 16	0.7 - 2.6	0.77
Magnesium	6210		8980		IPSW-06-071602FT	16 / 16	N/A	7859
Manganese	277		749		IPSW-06-071602FT	16 / 16	N/A	454
Mercury	0.13	J	0.17	J	IPSW-06-080602FT	3 / 16	0.1 - 0.14	0.072
Nickel	1	J	2.2	J	IPSW-06-071401FT	10 / 16	0.9 - 3.4	1.4
Potassium	4430	J	7660		IPSW-06-021502FT	16 / 16	N/A	5929
Selenium	1.9	J	1.9	J	IPSW-06-031202FT	1 / 16	2.1 - 4.8	1.7
Silver						0 / 16	0.5 - 1	0.35
Sodium	58800		144000	J	IPSW-06-021502FT	16 / 16	N/A	81856
Thallium	3.6		3.6		IPSW-06-102502FT	1 / 16	2.2 - 6	2.0
Vanadium	0.64	J	0.64	J	IPSW-06-071401FT	1 / 16	0.4 - 1.7	0.38
Zinc	19.7	J	102		IPSW-06-121701FT	16 / 16	N/A	45

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-4
SURFACE WATER DATA SUMMARY - GAUGING STATION 07 - BASEFLOW
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 16	19.6 - 74.4	25
Antimony						0 / 16	1.5 - 4	1.2
Arsenic	1.5	J	4.5	J	IPSW-07-071401FT	6 / 16	1.3 - 4.7	2.0
Barium	31.5	J	41.8	J	IPSW-07-010402FT	16 / 16	N/A	37
Beryllium						0 / 16	0.2 - 0.75	0.17
Cadmium						0 / 16	0.2 - 0.8	0.19
Calcium	36100		49600		IPSW-07-010402FT	16 / 16	N/A	43256
Chromium	0.66	J	2		IPSW-07-091801FT	9 / 16	0.6 - 2.5	0.90
Cobalt	0.7	J	0.82	J	IPSW-07-021502FT	2 / 16	0.44 - 2	0.49
Copper	0.93	J	4.9		IPSW-07-102201FT	8 / 16	2.6 - 6.4	2.5
Iron	143		699		IPSW-07-071401FT	11 / 16	15.6 - 163	247
Lead						0 / 16	0.7 - 2.5	0.77
Magnesium	6030		8720		IPSW-07-010402FT	16 / 16	N/A	7222
Manganese	188		531		IPSW-07-071602FT	16 / 16	N/A	313
Mercury						0 / 16	0.1 - 0.15	0.053
Nickel	1.2	J	2.2	J	IPSW-07-102201FT	12 / 16	1 - 3	1.4
Potassium	4420	J	7150		IPSW-07-021502FT	16 / 16	N/A	5709
Selenium						0 / 16	1.9 - 4.8	1.6
Silver						0 / 16	0.5 - 1	0.35
Sodium	58400		142000	J	IPSW-07-021502FT	16 / 16	N/A	82675
Thallium						0 / 16	2.2 - 6	1.9
Vanadium	0.57	J	0.57	J	IPSW-07-050802FT	1 / 16	0.4 - 1.7	0.39
Zinc	14.7	J	76.8		IPSW-07-121701FT	16 / 16	N/A	43

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-5
SURFACE WATER DATA SUMMARY - GAUGING STATION 08 - BASEFLOW
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 16	19.6 - 74.2	24
Antimony						0 / 16	1.2 - 4	1.2
Arsenic	1.6	J	3.25		IPSW-08-041702FT	6 / 16	1.3 - 5	1.7
Barium	36.75		63.05		IPSW-08-091002FT	16 / 16	N/A	47
Beryllium						0 / 16	0.2 - 0.74	0.17
Cadmium						0 / 16	0.2 - 0.77	0.18
Calcium	30100		47950		IPSW-08-111901FT	16 / 16	N/A	39753
Chromium	0.46	J	1.65	J	IPSW-08-102201FT	6 / 16	0.5 - 2.1	0.66
Cobalt	0.645	J	1.475	J	IPSW-08-021502FT	3 / 16	0.4 - 2	0.53
Copper	2.25	J	12.4		IPSW-08-062002FT	7 / 16	0.6 - 7.1	3.0
Iron	186.5		568		IPSW-08-071401FT	12 / 16	8.7 - 104	219
Lead						0 / 16	0.7 - 2.2	0.76
Magnesium	5050		8260		IPSW-08-111901FT	16 / 16	N/A	6730
Manganese	113.5	J	407		IPSW-08-071602FT	16 / 16	N/A	230
Mercury	0.1	J	0.1	J	IPSW-08-102201FT	1 / 16	0.1 - 0.15	0.056
Nickel	0.545	J	2	J	IPSW-08-102201FT	9 / 16	0.9 - 2.6	1.1
Potassium	3810	J	7160		IPSW-08-021502FT	16 / 16	N/A	5256
Selenium						0 / 16	1.9 - 4.8	1.6
Silver						0 / 16	0.5 - 1	0.35
Sodium	59550		140000	J	IPSW-08-021502FT	16 / 16	N/A	79463
Thallium						0 / 16	2.2 - 6	1.8
Vanadium	0.46	J	0.46	J	IPSW-08-091801FT	1 / 16	0.4 - 1.7	0.37
Zinc	4.95	J	58.35	J	IPSW-08-021502FT	15 / 16	13	27

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-6
SURFACE WATER DATA SUMMARY - GAUGING STATION 09 - BASEFLOW
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 16	19.6 - 82.2	25
Antimony	1.8	J	1.8	J	IPSW-09-071602FT	1 / 16	1.5 - 4	1.3
Arsenic	1.8	J	4.9		IPSW-09-080602FT	4 / 16	1.7 - 5.2	1.7
Barium	28.5		39.7		IPSW-09-121701FT	15 / 16	35.6	33
Beryllium						0 / 16	0.2 - 0.75	0.17
Cadmium						0 / 16	0.2 - 0.47	0.17
Calcium	23000		35200		IPSW-09-041702FT	16 / 16	N/A	29031
Chromium	0.98	J	1.2	J	IPSW-09-071401FT	2 / 16	0.5 - 1.5	0.49
Cobalt	1.3	J	1.6		IPSW-09-021502FT	2 / 16	0.4 - 2	0.54
Copper	2	J	5.9		IPSW-09-062002FT	7 / 16	2 - 5.2	2.5
Iron						0 / 16	9.5 - 205	17
Lead						0 / 16	0.7 - 2.2	0.76
Magnesium	3810		5790		IPSW-09-041702FT	16 / 16	N/A	4945
Manganese	1.3		78.8		IPSW-09-031202FT	10 / 16	1.2 - 4.7	19
Mercury						0 / 16	0.1 - 0.43	0.062
Nickel	0.94	J	2.7	J	IPSW-09-071401FT	3 / 16	0.7 - 1.9	0.83
Potassium	3290	J	6300		IPSW-09-021502FT	16 / 16	N/A	4251
Selenium						0 / 16	1.9 - 4.8	1.6
Silver						0 / 16	0.5 - 1	0.35
Sodium	49800		122000	J	IPSW-09-021502FT	16 / 16	N/A	74931
Thallium						0 / 16	2.2 - 6	1.8
Vanadium	0.48	J	2		IPSW-09-071401FT	2 / 16	0.4 - 1.7	0.50
Zinc	1.6	J	29.8	J	IPSW-09-021502FT	11 / 16	0.7 - 10.3	8.5

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-7
SURFACE WATER DATA SUMMARY - GAUGING STATION 10 - BASEFLOW
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 16	19.6 - 91.2	26
Antimony						0 / 16	1.2 - 4	1.2
Arsenic	1.5	J	3.9	J	IPSW-10-121701FT	3 / 16	1.2 - 4.2	1.4
Barium	30.6		43.6	J	IPSW-10-010402FT	16 / 16	N/A	38
Beryllium						0 / 16	0.2 - 0.61	0.16
Cadmium						0 / 16	0.2 - 0.68	0.18
Calcium	24100		33400		IPSW-10-050802FT	16 / 16	N/A	29431
Chromium	0.5	J	1.4	J	IPSW-10-071401FT	6 / 16	0.5 - 2	0.66
Cobalt						0 / 16	0.4 - 2	0.40
Copper	1.1	J	8.6		IPSW-10-102201FT	6 / 16	1.5 - 5	2.4
Iron	20.1	J	20.1	J	IPSW-10-082301FT	1 / 16	8.7 - 143	16
Lead						0 / 16	0.7 - 2.2	0.77
Magnesium	4490		7130		IPSW-10-121701FT	16 / 16	N/A	5926
Manganese	1.5		164		IPSW-10-021502FT	14 / 16	1.1 - 2.3	40
Mercury						0 / 16	0.1 - 0.16	0.053
Nickel	0.93	J	1.7	J	IPSW-10-071401FT	3 / 16	0.7 - 2.2	0.75
Potassium	3280	J	6020		IPSW-10-021502FT	16 / 16	N/A	4373
Selenium						0 / 16	1.9 - 4.8	1.6
Silver						0 / 16	0.5 - 1	0.35
Sodium	51000		118000	J	IPSW-10-021502FT	16 / 16	N/A	79044
Thallium						0 / 16	2.2 - 6	1.8
Vanadium						0 / 16	0.4 - 1.7	0.39
Zinc	1.2	J	71.4		IPSW-10-091801FT	7 / 16	0.7 - 10.5	7.9

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-8
SURFACE WATER DATA SUMMARY - GAUGING STATION 05 - STORM EVENT
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 6	7.6 - 95.1	21
Antimony	2.8	J	2.8	J	IPSW-05-051502FT	1 / 6	1.9 - 3.7	1.6
Arsenic	2.2	J	12.6		IPSW-05-051502FT	3 / 6	2.5 - 3	3.5
Barium	18.2		31.4		IPSW-05-092502FT	6 / 6	N/A	25
Beryllium						0 / 6	0.1 - 1	0.16
Cadmium						0 / 6	0.2 - 0.47	0.18
Calcium	18600		34700		IPSW-05-092502FT	6 / 6	N/A	26150
Chromium	1.35		1.9		IPSW-05-101802FT	3 / 6	1.3 - 1.8	1.2
Cobalt	1.8		1.8		IPSW-05-101802FT	1 / 6	0.44 - 0.7	0.56
Copper	4.5		4.5		IPSW-05-092502FT	1 / 6	2.3 - 4.3	2.2
Iron	60.7		968		IPSW-05-051502FT	5 / 6	88.4	300
Lead						0 / 6	0.7 - 2.3	0.75
Magnesium	2820		5240		IPSW-05-101802FT	6 / 6	N/A	3959
Manganese	70.3		498		IPSW-05-101802FT	6 / 6	N/A	192
Mercury						0 / 6	0.1	0.050
Nickel	1.4	J	2.2		IPSW-05-101802FT	4 / 6	1.3 - 1.4	1.4
Potassium	2740		5660		IPSW-05-092502FT	6 / 6	N/A	4022
Selenium						0 / 6	1.7 - 3.2	1.3
Silver						0 / 6	0.5 - 0.8	0.31
Sodium	23600		43650		IPSW-05-042602FT	6 / 6	N/A	34708
Thallium						0 / 6	2.2 - 5.1	1.6
Vanadium	1.1	J	1.1	J	IPSW-05-101802FT	1 / 6	0.3 - 0.89	0.41
Zinc	42.6	J	78.8		IPSW-05-083102FT	5 / 6	42.3	51

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-9
SURFACE WATER DATA SUMMARY - GAUGING STATION 06 - STORM EVENT
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 6	7.6 - 57.7	18
Antimony	1.7	J	1.7	J	IPSW-06-072502FT	1 / 6	1.2 - 4.9	1.6
Arsenic	2.5	J	11.8		IPSW-06-051502FT	5 / 6	2.5	4.2
Barium	22		34.3		IPSW-06-092502FT	6 / 6	N/A	27
Beryllium						0 / 6	0.1 - 0.5	0.12
Cadmium						0 / 6	0.2 - 0.4	0.18
Calcium	21200		36100		IPSW-06-092502FT	6 / 6	N/A	27592
Chromium	1.9		2.9		IPSW-06-042602FT	4 / 6	1.2 - 1.7	1.7
Cobalt						0 / 6	0.4 - 0.93	0.34
Copper	4.2		51.7		IPSW-06-042602FT	4 / 6	4.7 - 6.1	12
Iron	211		790		IPSW-06-051502FT	4 / 6	91.9 - 116	346
Lead						0 / 6	0.7 - 2.3	0.76
Magnesium	3090		5330		IPSW-06-092502FT	6 / 6	N/A	4331
Manganese	97.9		255		IPSW-06-101802FT	6 / 6	N/A	153
Mercury						0 / 6	0.1 - 0.11	0.051
Nickel	1.2	J	2.1		IPSW-06-092502FT	3 / 6	0.9 - 2.1	1.2
Potassium	3280		6190		IPSW-06-092502FT	6 / 6	N/A	4268
Selenium						0 / 6	1.7 - 3.2	1.3
Silver						0 / 6	0.5 - 0.8	0.31
Sodium	30100		60200		IPSW-06-042602FT	6 / 6	N/A	43350
Thallium						0 / 6	2.4 - 5.1	1.7
Vanadium						0 / 6	0.3 - 0.81	0.29
Zinc	33	J	60.5		IPSW-06-083102FT	6 / 6	N/A	47

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-10
SURFACE WATER DATA SUMMARY - GAUGING STATION 07 - STORM EVENT
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 6	7.6 - 57.7	20
Antimony						0 / 6	1.6 - 2.2	0.92
Arsenic	1.375	J	7.7		IPSW-07-051502FT	4 / 6	2 - 2.5	3.0
Barium	17.9		28.75		IPSW-07-072502FT	6 / 6	N/A	24
Beryllium						0 / 6	0.2	0.10
Cadmium						0 / 6	0.2 - 0.4	0.16
Calcium	19300		25500		IPSW-07-072502FT	6 / 6	N/A	22917
Chromium	1.5	J	2.2		IPSW-07-042602FT	3 / 6	0.82 - 1.7	1.2
Cobalt	0.74	J	0.74	J	IPSW-07-101802FT	1 / 6	0.4 - 0.7	0.34
Copper	4.6		20.3		IPSW-07-042602FT	3 / 6	4.5 - 5.5	6.4
Iron	74.225	J	722		IPSW-07-051502FT	5 / 6	49.5	236
Lead	2.5		2.5		IPSW-07-051502FT	1 / 6	0.7 - 2	0.93
Magnesium	3150		4230		IPSW-07-101802FT	6 / 6	N/A	3621
Manganese	27.5		164		IPSW-07-042602FT	6 / 6	N/A	98
Mercury						0 / 6	0.1	0.050
Nickel	1.03	J	1.3	J	IPSW-07-051502FT	3 / 6	1 - 1.6	0.89
Potassium	3140		3885		IPSW-07-092502FT	6 / 6	N/A	3521
Selenium						0 / 6	1.7 - 3	1.2
Silver						0 / 6	0.5 - 0.8	0.31
Sodium	29000		44300		IPSW-07-042602FT	6 / 6	N/A	38017
Thallium						0 / 6	2.2 - 5.3	1.6
Vanadium	0.88	J	0.88	J	IPSW-07-101802FT	1 / 6	0.4 - 0.84	0.36
Zinc	20.85	J	43.6		IPSW-07-083102FT	6 / 6	N/A	36

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-11
SURFACE WATER DATA SUMMARY - GAUGING STATION 08 - STORM EVENT
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum	9.919237		37.42364		IPSW-08-00-051602FT	6 / 6	N/A	24
Antimony	0.790265		1.947827		IPSW-08-00-083102FT	6 / 6	N/A	1.3
Arsenic	1.284979		3.447913		IPSW-08-00-051602FT	6 / 6	N/A	2.0
Barium	20.92433		30.87228		IPSW-08-00-072502FT	6 / 6	N/A	24
Beryllium	8.527594		0.248879		IPSW-08-00-072502FT	6 / 6	N/A	0.13
Cadmium	0.106465		0.2		IPSW-08-00-042602FT	6 / 6	N/A	0.16
Calcium	18014.16		23546.61		IPSW-08-00-072502FT	6 / 6	N/A	20674
Chromium	0.53157		1.857312		IPSW-08-00-042602FT	6 / 6	N/A	1.0
Cobalt	0.214466		0.402026		IPSW-08-00-051602FT	6 / 6	N/A	0.30
Copper	1.997159		14.31572		IPSW-08-00-042602FT	6 / 6	N/A	4.8
Iron	21.9226		315.4828		IPSW-08-00-051602FT	6 / 6	N/A	157
Lead	0.683201		3.835089		IPSW-08-00-083102FT	6 / 6	N/A	1.5
Magnesium	2823.025		3854.093		IPSW-08-00-072502FT	6 / 6	N/A	3318
Manganese	21.50218		158.9092		IPSW-08-00-042602FT	6 / 6	N/A	85
Mercury	0.05		5.928234		IPSW-08-00-092502FT	6 / 6	N/A	0.052
Nickel	0.541668		0.997435		IPSW-08-00-072502FT	6 / 6	N/A	0.73
Potassium	2899.858		3643.029		IPSW-08-00-042602FT	6 / 6	N/A	3251
Selenium	1.053069		1.5		IPSW-08-00-101802FT	6 / 6	N/A	1.3
Silver	0.25		0.4		IPSW-08-00-101802FT	6 / 6	N/A	0.32
Sodium	28558.86		51989.28		IPSW-08-00-042602FT	6 / 6	N/A	36931
Thallium	1.124162		2.1		IPSW-08-00-083102FT	6 / 6	N/A	1.5
Vanadium	0.239593		0.451874		IPSW-08-00-101802FT	6 / 6	N/A	0.33
Zinc	11.26868		34.05547		IPSW-08-00-042602FT	6 / 6	N/A	22

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-12
SURFACE WATER DATA SUMMARY - GAUGING STATION 09 - STORM EVENT
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 6	19.6 - 69.5	23
Antimony	4	J	4	J	IPSW-09-051502FT	1 / 6	1.2 - 4.8	1.6
Arsenic	1.025	J	3.55		IPSW-09-092502FT	4 / 6	2 - 3	1.9
Barium	29.9		34.1		IPSW-09-042602FT	6 / 6	N/A	33
Beryllium						0 / 6	0.2	0.10
Cadmium	0.305	J	0.305	J	IPSW-09-042602FT	1 / 6	0.2 - 0.4	0.18
Calcium	30000		34300		IPSW-09-042602FT	6 / 6	N/A	30992
Chromium						0 / 6	0.4 - 0.8	0.28
Cobalt						0 / 6	0.4 - 0.7	0.28
Copper	2.6		2.6		IPSW-09-083102FT	1 / 6	2.6 - 3.8	1.8
Iron						0 / 6	8.6 - 24.5	6.9
Lead						0 / 6	0.7 - 1.3	0.51
Magnesium	4950		5640		IPSW-09-042602FT	6 / 6	N/A	5223
Manganese	1.1		34.5		IPSW-09-051502FT	3 / 6	0.47 - 0.5	7.5
Mercury						0 / 6	0.1	0.050
Nickel	0.665	J	0.665	J	IPSW-09-072502FT	1 / 6	0.6 - 1.7	0.53
Potassium	3585		5600		IPSW-09-042602FT	6 / 6	N/A	4366
Selenium						0 / 6	2.1 - 3	1.3
Silver						0 / 6	0.5 - 0.8	0.31
Sodium	60100		108500		IPSW-09-042602FT	6 / 6	N/A	74692
Thallium						0 / 6	2.2 - 4.2	1.4
Vanadium	0.375	J	0.375	J	IPSW-09-072502FT	1 / 6	0.4 - 1.1	0.32
Zinc	2.975	J	2.975	J	IPSW-09-072502FT	1 / 6	0.7 - 16.4	3.2

N/A = Not Applicable or Not Available

J = Estimated Value

TABLE E.4-13
SURFACE WATER DATA SUMMARY - GAUGING STATION 10 - STORM EVENT
WELLS G&H SUPERFUND SITE (OU3)

Parameter	Minimum Detected Concentration	Minimum Qualifier	Maximum Detected Concentration	Maximum Qualifier	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Average Concentration
<u>Dissolved Metals - ug/L</u>								
Aluminum						0 / 6	7.6 - 69.4	17
Antimony						0 / 6	1.2 - 4	1.2
Arsenic	2.175	J	2.175	J	IPSW-10-083102FT	1 / 6	1.3 - 3	1.3
Barium	35.6		42.75		IPSW-10-101802FT	6 / 6	N/A	38
Beryllium						0 / 6	0.1 - 0.66	0.13
Cadmium						0 / 6	0.2 - 0.4	0.18
Calcium	28900		34200		IPSW-10-042602FT	6 / 6	N/A	31267
Chromium	0.56	J	1		IPSW-10-051502FT	3 / 6	0.4 - 1.2	0.60
Cobalt						0 / 6	0.4 - 0.7	0.29
Copper	1.1	J	1.7	J	IPSW-10-092502FT	2 / 6	1.8 - 3.7	1.4
Iron						0 / 6	8.6 - 15.3	5.8
Lead						0 / 6	0.7 - 2.3	0.64
Magnesium	5730		6995		IPSW-10-101802FT	6 / 6	N/A	6079
Manganese	0.32	J	7.8		IPSW-10-042602FT	2 / 6	0.33 - 1.7	1.6
Mercury						0 / 6	0.1	0.050
Nickel	0.515	J	0.81	J	IPSW-10-072502FT	2 / 6	0.9 - 1.6	0.60
Potassium	4090		5810		IPSW-10-042602FT	6 / 6	N/A	4648
Selenium						0 / 6	1.7 - 3.2	1.3
Silver	0.55	J	0.55	J	IPSW-10-051502FT	1 / 6	0.5 - 0.8	0.36
Sodium	55500	J	116000		IPSW-10-042602FT	6 / 6	N/A	77942
Thallium						0 / 6	2.4 - 5.1	1.8
Vanadium						0 / 6	0.3 - 0.7	0.27
Zinc						0 / 6	0.7 - 14.4	2.1

N/A = Not Applicable or Not Available

J = Estimated Value

**TABLE E.4-14
COMPARISON OF SURFACE WATER DATA TO SCREENING CRITERIA**

Parameter	Maximum Detected Conc. ¹ (u g/L)	Location of Maximum Concentration	Detection Frequency	Screening Criterion (u g/L)	Type	COPC? ²	Reason for Exclusion
Aluminum	37	IPSW-08-00-051602FT	6 / 133	87	Freshwater Chronic NAWQC	No	DF, BSV
Antimony	4	IPSW-09-051502FT	10 / 133	30	SCV	No	BSV
Arsenic	13	IPSW-05-051502FT	63 / 133	150	Freshwater Chronic NAWQC ³	No	BSV
Barium	63	IPSW-08-091002FT	132 / 133	4	Tier II	Yes	
Beryllium	0.25	IPSW-08-00-072502FT	6 / 133	5.3	Tier II	No	DF, BSV
Cadmium	0.31	IPSW-09-042602FT	7 / 133	0.27	Freshwater Chronic NAWQC ⁴	Yes	
Calcium	58,100	IPSW-05-111901FT	133 / 133	NA	NA	No	Nutrient
Chromium	2.9	IPSW-06-042602FT	62 / 133	83.7	Freshwater Chronic NAWQC ^{4,5}	No	BSV
Cobalt	2.1	IPSW-05-102502FT	29 / 133	3	Tier II	No	BSV
Copper	52	IPSW-06-042602FT	56 / 133	10.2	Freshwater Chronic NAWQC ⁴	Yes	
Iron	1,480	IPSW-05-071401FT	69 / 133	1,000	Freshwater Chronic NAWQC	Yes	
Lead	3.8	IPSW-08-00-083102FT	8 / 133	3.0	Freshwater Chronic NAWQC ⁴	Yes	
Magnesium	9,280	IPSW-05-111901FT	133 / 133	NA	NA	No	Nutrient
Manganese	770	SW-MC-13-0	118 / 133	80	Tier II	Yes	
Mercury	0.17	IPSW-06-080602FT	10 / 133	0.77	Freshwater Chronic NAWQC	No	BSV
Nickel	2.7	IPSW-09-071401FT	67 / 133	59	Freshwater Chronic NAWQC ⁴	No	BSV
Potassium	7,690	IPSW-05-021502FT	132 / 132	NA	NA	No	Nutrient
Selenium	2.7	IPSW-05-062002FT	8 / 133	4.61	Freshwater Chronic NAWQC	No	BSV
Silver	0.55	IPSW-10-051502FT	7 / 133	0.12	Tier II	Yes	
Sodium	144,000	IPSW-06-021502FT	132 / 132	NA	NA	No	Nutrient
Thallium	3.6	IPSW-06-102502FT	7 / 133	12	SCV	No	BSV
Vanadium	2.0	IPSW-09-071401FT	14 / 133	19	Tier II	No	BSV
Zinc	121	IPSW-05-121701FT	105 / 133	134	Freshwater Chronic NAWQC ⁴	No	BSV

¹ Dissolved (filtered) concentrations.

² Analytes with maximum detected concentrations exceeding screening criteria were included as Chemicals of Potential Concern (COPCs).

³ Value reported for arsenic³⁺.

⁴ Metals criteria were adjusted to a site-specific hardness value 116 mg/L as CaCO₃ using equations provided in USEPA, 2002.

⁵ Value reported for chromium³⁺, it is assumed that chromium in surface water is present in reduced form.

COPC - Chemical of Potential Concern

NAWQC - National Ambient Water Quality Criterion (USEPA 1986a,b; 1987; 1992a, 1998, 2002).

SCV - Secondary Chronic Value as presented in Suter and Tsao (1996).

Tier II - Ecotox Thresholds Great Lakes Water Quality Initiative Tier II Methodology (USEPA, 1996).

NA - Screening criterion not available

BSV - Below Screening Value

DF - Detection Frequency < 5%

A bolded value indicates that a maximum detected concentration exceeds screening benchmarks.

APPENDIX E.5

BASELINE ECOLOGICAL RISK ASSESSMENT SUPPLEMENTAL DATA - SEDIMENT

Appendix E.5

Evaluation of Additional Sediment Data

After completion of the Baseline Ecological Risk Assessment (BERA), two sets of additional sediment data were collected to fill data gaps in response to comments on the Draft document. The first set of data were collected in March and April 2004 to further evaluate the potential ecological exposure of receptors to the depositional area of the Aberjona River in the lower portion of reach 5. Prior to these data being collected, the only data evaluated in the BERA in reach 5 were four samples collected at station SD-05. To more comprehensively characterize this area, 15 sediment samples were collected from station AJRW, in Winchester, south of Bacon Street. Six samples were collected in the center of the channel and nine more were collected along the edge of the river.

The second set of data included nine sediment cores collected in February 2003 throughout the study area to primarily provide a limited understanding of the vertical distribution of contaminants to assist in the assessment of future cleanup alternative considerations (e.g., dredging). These data were also used to evaluate the ecological risk associated with the additional samples collected through the study area in comparison to the data used in the BERA calculations.

The assessment in this section consists of evaluating the potential risk of ecological communities to metals in the sediments. The concentration of the metals are compared to sediment screening benchmarks used in the BERA, and to concentrations of metals observed in samples collected in earlier sampling rounds which were evaluated in the BERA. As applicable, the concentrations in the additional samples are compared to levels of contaminants determined to be associated with potential risk to one or more ecological receptor in the study area.

Maximum detected levels of chemicals were compared to sediment benchmarks. The sets of criteria were the same as those used in the BERA screening, in order of selection, these consisted of:

- USEPA Office of Solid Waste and Emergency Response Ecotox Thresholds (ETs) - Sediment Quality Criteria (SQCs), Sediment Quality Benchmarks (SQBs), or NOAA- Effects Range Low (ERLs) were used preferentially (USEPA, 1996);
- Ontario Ministry of Environment and Energy (OMEE) Lowest Effect Levels (LELs) (Persaud *et al.*, 1993), were used when a screening value from above was not available;
- Oak Ridge National Laboratory (ORNL) Sediment Secondary Chronic Values (SCVs) (Jones *et al.*, 1997); were used when a screening value from above was not available; and
- National Oceanic and Atmospheric Administration (NOAA) Threshold Effects Level (TEL) (Buchman, 1999) were used when a screening value was not available in any of the above.

Ecological sediment screening criteria were unavailable for several chemicals. As with surface water data, potassium, sodium, calcium, and magnesium were excluded from the screening process because they are nutrients and occur naturally at high concentrations. In addition COCs exceeding screening criteria are compared to sitewide sediment concentrations, reference locations, and ecological threshold effects levels (TELs) established in the BERA. These comparisons allow an assessment of the potential risk of exposure to sediment contaminants, relative to ecological risks determined for the site in the BERA.

Each of the two data sets, the AJRW samples and the sediment core samples, are discussed in separate sections below.

AJRW Samples

Sediment samples were collected for metals and TOC at station AJRW, located in reach 5, upstream of the Mystic Lakes. Six deep sediment samples (SD-AJRW-01 through AJRW-06) were collected in March 2004, and nine shallow sediment samples (SD-AJRW-07, -09, -11, -13, -15, -17, -19, -21, and -23) were collected in April of 2004. All of these 15 samples were combined to compare to sediment screening criteria (Table E.5-1).

Among the metals in sediment, maximum concentrations of nine were measured above ecological benchmarks, including arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc.

Each of these compounds were identified as COPCs in sediment in the BERA. Among the remaining metals, aluminum, cobalt, and manganese were below screening values. Barium, beryllium, and vanadium were detected but lacked screening values. Selenium and thallium had no screening values, but were not detected. Silver and antimony were also below detection limits in all samples, however, the detection limits exceeded the screening values.

A comparison of data collected at AJRW to sitewide data from the BERA (Tables 4-16, 4-17, and 4-18 of the BERA) indicates that the concentrations of metals were generally lower in sediments from AJRW than those observed in samples collected throughout the Aberjona River study area (Table E.5-2). Average concentrations of aluminum, barium, beryllium, iron, manganese, nickel, and vanadium at AJRW were all below the average concentrations at reference locations. The only compounds with average concentrations at AJRW higher than average sitewide concentrations were compounds that were all below detection limits at AJRW, and whose average values were estimated as a mean of one-half the detection limits (selenium, silver, and thallium). None of the maximum detected COPC concentrations at AJRW were higher than maximums observed sitewide, and only a few of the maximum concentrations at AJRW (aluminum, barium, beryllium, cobalt, lead, nickel, above vanadium) were above sitewide averages (Table E.5-2).

The metals associated with ecological risk to one or more receptors in the Aberjona River Study area were arsenic, chromium, lead, and mercury, as identified in the BERA. The average concentrations of each of these COPCs at AJRW were below both sitewide average concentrations and the threshold effects levels (TELs) for all of the receptors identified as having adverse effects from exposure in the BERA (Table E.5-3). Comparison to shrew TEL was not applied, as these sediment locations were not considered to be shrew habitat. Based on these results, it can be concluded that there is no significant ecological risk associated with exposure of receptors at AJRW that exceeds thresholds established in the BERA. If these data had been incorporated into the BERA calculations, there would have been no changes in the conclusions for sitewide risks calculated for heron or mallard, nor would there have been risk associated with exposure to receptors at this station for semi-aquatic mammals (muskrat) or benthic invertebrates.

Sediment Cores

Sediment core samples were collected at each of nine locations (SC05 through SC13) throughout the study area and analyzed for metals, hexavalent chromium, and TOC in February 2003. SC05 through SC08 were collected from the Wells G&H 38-acre wetland, SC09 and SC10 from the former Cranberry Bog, SC11 from Davidson Park, SC12 from Judkins Pond, and SC13 from the outlet of the river as it flows into the upper forebay of Upper Mystic Lake (Figure 2-35). The samples collected at each location included one sample from each of the following depth intervals: 0 - 1 foot, 1 - 2 foot, 2 - 3 foot, and 3 - 4 foot. Metals concentrations from the surface sample (0-1 ft interval) were compared to sediment screening criteria (Tables E.5-4).

Among the metals in the sediment core samples, maximum concentrations of 13 were measured above ecological benchmarks, including antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, silver, and zinc. Each of these compounds were identified as COPCs in sediment in the BERA. Among the remaining metals, aluminum was below screening values in all of the cores. There were no screening values for barium, beryllium, selenium, thallium, and vanadium. Beryllium and thallium were not detected in most samples, and did not have a screening benchmark. Silver and antimony were also generally below detection limits in all samples, however, the detection limits usually exceeded the screening values.

With the exception of sediment core SC05 (located in reach 1 near SD-TT28) and SC12 (Judkins Pond), concentrations of metals of concern generally decreased with depth in the core (Figure 2-35). This indicates that the surface samples from 0-6 inch depth interval used to characterize risk in the BERA represented a higher exposure case than sediment at deeper depths.

The metals concentrations in the upper foot of the cores were within the range of concentrations observed in previous samples in the reach for each of the metals of ecological concern (arsenic, chromium, lead, and mercury), with the exception of lead in reach 4 (Tables E.5-5 to E.5-9). The observed concentration of lead of 520 mg/kg in core SC12 from Judkins Pond (reach 4) exceeded the average and maximum lead concentrations for reach 4 of 345 mg/kg and 455 mg/kg, respectively. Although the concentration of lead at SC12 slightly exceeded the sitewide average

of 478 mg/kg, the lead concentration in SC12 was below the threshold effects levels (TELs) for muskrat and mallard, and consequently consistent with the conclusion of negligible risk to receptors in reach 4.

Concentrations of arsenic were below the TELs for each of the ecological receptors (invertebrates, mallard, and muskrat) in all sediment core samples outside of reach 1. In reach 1, surface core samples (0-1 feet), arsenic concentrations ranged from 210 mg/kg in SC05 to 1,300 mg/kg in SC06. The maximum concentration of arsenic within each of the four cores collected in reach 1 was higher than both the average sediment concentration for the reach (439 mg/kg) and the 95% UCL for reach 1 (757 mg/kg), but did not exceed the maximum observed arsenic concentration in reach 1 of 4,550 mg/kg (Table E.5-5).

In conclusion, the metals concentrations in the sediment core data are consistent with sediment data previously collected in the Aberjona River Study Area in support of the BERA. The BERA conclusions regarding risk to ecological receptors was based on surface sediment samples (0 - 6 inches), as these represent the expected exposure point concentrations for ecological receptors. The surface core data for metals (0 - 1 foot) collected in the supplemental data set were consistent with risk conclusions in the BERA.

Risk conclusions. Among the inorganics identified as COPCs in sediment in the BERA, nine were detected at concentrations above screening values in the supplemental data set at station AJRW, including: arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc. Based on the magnitude and frequency of these exceedences, the risk to aquatic organisms in the study area from exposure to metals in sediment is low. Based on the data collected at station AJRW, there is no significant ecological risk associated with exposure of receptors exceeding thresholds established in the BERA. If these data had been incorporated into the BERA calculations, there would have been no changes in the conclusions for sitewide risks calculated for heron or mallard, nor would there have been risk associated with exposure to receptors at this station for semi-aquatic mammals (muskrat) or benthic invertebrates.

Sediment core data collected throughout the study area indicated that sediment metals concentrations generally decreased with depth. The metals concentrations in the sediment core data were consistent with sediment data previously collected in the Aberjona River Study area in support of the BERA.

**TABLE E.5-1
SEDIMENT DATA SUMMARY - AJRW
WELLS G&H SUPERFUND SITE (OU3)**

Parameter	Maximum Detected Concentration ¹	Location of Maximum Concentration	Range of Detection Limits	Average Concentration	Detection Frequency	Screening Criterion Level	Screening Type	Hazard Quotient
Metals - mg/kg								
Aluminum	14,000	SD-AJRW03	N/A	8,407	15 / 15	25,500	TEL	0.55
Antimony			9.4 - 11	4.9	0 / 15	2	ERL	N/A
Arsenic	57.5	SD-AJRW02	9.4 - 20	22	7 / 14	8.2	ERL	7.0
Barium	89.5	SD-AJRW02	N/A	52	15 / 15	N/A	N/A	N/A
Beryllium	0.98	SD-AJRW03	0.94 - 1.1	0.53	1 / 15	N/A	N/A	N/A
Cadmium	3.8	SD-AJRW05	2.8 - 3.3	1.9	3 / 15	1.2	ERL	3.2
Chromium	235	SD-AJRW09	N/A	89	15 / 15	81	ERL	2.9
Cobalt	17	SD-AJRW03	N/A	8.7	15 / 15	50	LEL*	0.34
Copper	190	SD-AJRW09	N/A	92	15 / 15	34	ERL	5.6
Iron	25,000	SD-AJRW02	N/A	14,553	15 / 15	20000	LEL	1.3
Lead	1,000	SD-AJRW04	N/A	259	15 / 15	47	ERL	21
Manganese	445	SD-AJRW02	N/A	221	15 / 15	460	LEL	0.97
Mercury	1.0	SD-AJRW09	0.025	0.51	14 / 15	0.15	ERL	7.0
Nickel	24	SD-AJRW02	N/A	14	15 / 15	21	ERL	1.1
Selenium			9.4 - 20	6.9	0 / 15	N/A	N/A	N/A
Silver			2.8 - 3.3	1.5	0 / 15	0.5	LEL*	N/A
Thallium			47 - 55	25	0 / 9	N/A	N/A	N/A
Vanadium	53	SD-AJRW03	N/A	30	15 / 15	N/A	N/A	N/A
Zinc	820	SD-AJRW03	N/A	334	15 / 15	120	LEL	6.8
Total Organic Carbon (mg/kg)	74,300	SD-AJRW02	6,410	39,924	14 / 15	N/A	N/A	

Notes:

¹ Bold values indicate maximum concentrations exceeding screening criteria

ERL - NOAA Effects Range-Low (Long *et al.* , 1995; Long and Morgan, 1990)

LEL - Ontario Ministry of Environment and Energy Lowest Effect Level (Persaud *et al.* , 1993)

LEL*- Ontario Ministry of Environment and Energy Lowest Effect Level (OME, 1996)

TEL - Threshold Effects Level (Buchman, 1999)

N/A = Not Applicable or Not Available

A blank cell indicates that the COC was not detected.

TABLE E.5-2
SEDIMENT DATA COMPARISON - AJRW, SITEWIDE AND REFERENCE
WELLS G&H SUPERFUND SITE (OU3)

Parameter	AJRW Maximum Concentration ¹	Sitewide Maximum Concentration ²	Reference Maximum Concentration ³	AJRW Average Concentration ¹	Sitewide Average Concentration ²	Reference Average Concentration ³
Metals - mg/kg						
Aluminum	14,000	34,400	20,200	8,407	10,109	8,581
Antimony		329	5.6	4.9	6.4	1.0
Arsenic	58	4,550	44.5	22	229	17
Barium	90	3420	173	52	84	57
Beryllium	0.98	2.9	1.3	0.53	0.64	0.56
Cadmium	3.8	38	6.1	1.9	5.8	1.3
Chromium	235	24,600	512	89	945	89
Cobalt	17	130	22	8.7	15	8.5
Copper	190	3,760	344	92	340	63
Iron	25,000	258,000	51,600	14,553	25,435	16,345
Lead	1,000	41,000	755	259	478	194
Manganese	445	3,060	1,980	221	468	368
Mercury	1.0	89	0.71	0.51	2.0	0.19
Nickel	24	177	32	14	21	15
Selenium		30	3.2	6.9	2.8	0.81
Silver		12	2.9	1.5	0.53	0.50
Thallium		18	2.2	25	1.20	0.50
Vanadium	53	180	148	30	43	35
Zinc	820	8,750	645	334	1,165	195
Total Organic Carbon (mg/kg)	74,300	912,000	427,000	39,924	195,505	109,001

Notes:

¹ AJRW maximum detected concentrations and ARJW average concentrations from Table E.5-1.

² Sitewide maximum detected concentrations and sitewide average concentrations from BERA Table 4-17.

³ Reference maximum detected concentrations and reference average concentrations from BERA Table 4-18.

A blank cell indicates that a contaminant of concern was not detected.

N/A = Not Applicable or Not Available

TABLE E.5-3
THRESHOLD EFFECTS LEVELS FOR RECEPTORS
WELLS G&H SUPERFUND SITE (OU3)

Parameter	AJRW Average Concentration ¹	Invertebrate TEL	Muskrat TEL	Mallard TEL
<u>Metals - mg/kg</u>				
Arsenic	22	220	150	N/A
Chromium	89	110	2,800	2,200
Lead	259	N/A	1,340	750
Mercury	0.51	2.0	6.5	17

Notes:

¹ AJRW average concentrations from Table E.5-1.

TEL - Threshold Effects Level - Corresponds to the concentration of the COPC in the sediment associated with adverse effects on the receptor

N/A = Not Applicable

**TABLE E.5-4
SEDIMENT CORE DATA SUMMARY
WELLS G&H SUPERFUND SITE (OU3)**

Parameter	SC0501	SC0601	SC0701	SC0801	SC0901	SC1001	SC1101	SC1201	SC1301	Screening Criterion Level	Screening Type
<u>Metals (mg/Kg)</u>											
Aluminum	15,000	18,000	NA	21,500	7,100	5,300	12,000	17,000	22,000	25,500	TEL
Antimony	12 U	50 U	34 U	50 U	10 U	11 U	8.5 U	7.6 U	6.4 U	2	ERL
Arsenic	210	1,300	440	1,250	89	67	100	130	120	8.2	ERL
Barium	66	150	95	93.5	19	19	100	140	120	na	na
Beryllium	1.2 U	5 U	3.4 U	5 U	1 U	1.1 U	0.85 U	1.1	1.5	na	na
Cadmium	4.2	19	25	22.4	1.5 U	1.6 U	4.2	10	12	1.2	ERL
Chromium	1,200	750	2,700	1,430	190	130	390	400	600	81	ERL
Cobalt	13	52	68	31.1	4.9	3.6	19	23	28	50	LEL*
Copper	510	770	910	1,410	160	47	230	370	460	34	ERL
Iron	24,000	120,000	59,000	58,200	13,000	11,000	30,000	37,000	32,000	20,000	LEL
Lead	390	590	570	676	69	28	260	520	810	47	ERL
Manganese	390	1,800	2,600	591	140	110	520	960	370	460	LEL
Mercury	3.5 J	8.2 J	3.7 J	14	1.2	0.18	1.7	2.6	2.1 J	0.15	ERL
Nickel	20	39	49	30 U	7.1	6.6 U	31	39	37	21	ERL
Selenium	24 U	100 U	68 U	50 U	10 U	11 U	8.5 U	7.6 U	13 U	na	na
Silver	1.8 U	7.5 U	NA	NA	1.5 U	1.6 U	1.3 U	1.2 U	1.8	0.5	LEL*
Thallium	24 U	100 U	68 U	100 U	20 U	22 U	17 U	15 U	13 U	na	na
Vanadium	43	64	72	66.9	19	11	50	64	87	na	na
Zinc	790	2,000	4,800	2,650	260	150	1,000	1,800	2,500	120	LEL
<u>Wet Chemistry (mg/Kg)</u>											
Chromium VI	13	8.0	29	15	2.0	1.4	4.2	4.3	6.4		
Total Organic Carbon	65,200	179,000	234,000	NA	39,800	23,000	119,000	112,000	115,000		

¹ Bold values indicate maximum detected concentrations exceeding screening criteria

ERL - NOAA Effects Range-Low (Long *et al.*, 1995; Long and Morgan, 1990)

LEL - Ontario Ministry of Environment and Energy Lowest Effect Level (Persaud *et al.*, 1993)

LEL*- Ontario Ministry of Environment and Energy Lowest Effect Level (OME, 1996)

TEL - Threshold Effects Level (Buchman, 1999)

N/A = Not Applicable or Not Available

A blank cell indicates that the COC was not detected.

TABLE E.5-5
SEDIMENT CORE DATA COMPARISON - REACH 1 SAMPLES
WELLS G&H SUPERFUND SITE (OU3)

Parameter	SC0501 Concentration ¹	SC0601 Concentration ¹	SC0701 Concentration ¹	SC0801 Concentration ¹	Sitewide Average Concentration ²	Sitewide Maxium Concentration ²	Reach 1 Average Concentration ³	Reach 1 Maximum Concentration ³
<u>Metals - mg/kg</u>								
Arsenic	210	1300	440	1250	229	4550	439	4550
Chromium	1200	750	2700	1430	945	24600	2040	24600
Lead	390	590	570	676	478	41000	879	41000
Mercury	3.50	8.20	3.70	14.00	2.02	89.20	3.10	45.00

Parameter	SC0501 Concentration ¹	SC0601 Concentration ¹	SC0701 Concentration ¹	SC0801 Concentration ¹	Invertebrate TEL	Muskrat TEL	Mallard TEL
<u>Metals - mg/kg</u>							
Arsenic	210	1300	440	1250	220	150	N/A
Chromium	1200	750	2700	1430	110	2,800	2,200
Lead	390	590	570	676	N/A	1,340	750
Mercury	3.50	8.20	3.70	14.00	2.0	6.5	17

Notes:

¹ Sediment core 0 to 1 foot sample concentration

² Sitewide maximum detected concentrations and sitewide average concentrations from BERA Table 4-17

³ Reach 1 maximum detected concentrations and average concentrations from BERA Table 4-252

TEL - Threshold Effects Level - Corresponds to the concentration of the COPC in the sediment associated with adverse effects on the receptor

N/A = Not Applicable

TABLE E.5-6
SEDIMENT CORE DATA COMPARISON - REACH 2 SAMPLES
WELLS G&H SUPERFUND SITE (OU3)

Parameter	SC0901 Concentration ¹	SC1001 Concentration ¹	Sitewide Average Concentration ²	Sitewide Maximum Concentration ²	Reach 2 Average Concentration ³	Reach 2 Maximum Concentration ³
<u>Metals - mg/kg</u>						
Arsenic	89	67	229	4550	120	1410
Chromium	190	130	945	24600	329	5310
Lead	69	28	478	41000	170	664
Mercury	1.2	0.2	2.0	89.2	1.9	89.0

Parameter	SC0901 Concentration ¹	SC1001 Concentration ¹	Invertebrate TEL	Muskrat TEL	Mallard TEL
<u>Metals - mg/kg</u>					
Arsenic	89	67	220	150	N/A
Chromium	190	130	110	2,800	2,200
Lead	69	28	N/A	1,340	750
Mercury	1.2	0.2	2.0	6.5	17

Notes:

¹ Sediment core 0 to 1 foot sample concentration

² Sitewide maximum detected concentrations and sitewide average concentrations from BERA Table 4-17

³ Reach 2 maximum detected concentrations and average concentrations from BERA Table 4-253

TEL - Threshold Effects Level - Corresponds to the concentration of the COPC in the sediment associated with adverse effects on the receptor

N/A = Not Applicable

TABLE E.5-7
SEDIMENT CORE DATA COMPARISON - REACH 3 SAMPLES
WELLS G&H SUPERFUND SITE (OU3)

Parameter	SC1101 Concentration ¹	Sitewide Average Concentration ²	Sitewide Maximum Concentration ²	Reach 3 Average Concentration ³	Reach 3 Maximum Concentration ³
<u>Metals - mg/kg</u>					
Arsenic	100	229	4550	69	485
Chromium	390	945	24600	156	918
Lead	260	478	41000	195	661
Mercury	1.70	2.02	89.20	1.10	5.70

Parameter	SC1101 Concentration ¹	Invertebrate TEL	Muskrat TEL	Mallard TEL
<u>Metals - mg/kg</u>				
Arsenic	100	220	150	N/A
Chromium	390	110	2,800	2,200
Lead	260	N/A	1,340	750
Mercury	1.70	2.0	6.5	17

Notes:

¹ Sediment core 0 to 1 foot sample concentration

² Sitewide maximum detected concentrations and sitewide average concentrations from BERA Table 4-17

³ Reach 3 maximum detected concentrations and average concentrations from BERA Table 4-254

TEL - Threshold Effects Level - Corresponds to the concentration of the COPC in the sediment associated with adverse effects on the receptor

N/A = Not Applicable

TABLE E.5-8
SEDIMENT CORE DATA COMPARISON - REACH 4 SAMPLES
WELLS G&H SUPERFUND SITE (OU3)

Parameter	SC1201 Concentration ¹	Sitewide Average Concentration ²	Sitewide Maximum Concentration ²	Reach 4 Average Concentration ³	Reach 4 Maximum Concentration ³
<u>Metals - mg/kg</u>					
Arsenic	130	229	4550	69	135
Chromium	400	945	24600	266	442
Lead	520	478	41000	345	455
Mercury	2.6	2.0	89.2	1.2	3.2

Parameter	SC1201 Concentration ¹	Invertebrate TEL	Muskrat TEL	Mallard TEL
<u>Metals - mg/kg</u>				
Arsenic	130	220	150	N/A
Chromium	400	110	2,800	2,200
Lead	520	N/A	1,340	750
Mercury	2.6	2.0	6.5	17

Notes:

¹ Sediment core 0 to 1 foot sample concentration

² Sitewide maximum detected concentrations and sitewide average concentrations from BERA Table 4-17

³ Reach 4 maximum detected concentrations and average concentrations from BERA Table 4-255

TEL - Threshold Effects Level - Corresponds to the concentration of the COPC in the sediment associated with adverse effects on the receptor

N/A = Not Applicable

TABLE E.5-9
SEDIMENT CORE DATA COMPARISON - REACH 6 SAMPLES
WELLS G&H SUPERFUND SITE (OU3)

Parameter	SC1301 Concentration ¹	Sitewide Average Concentration ²	Sitewide Maximum Concentration ²	Reach 6 Average Concentration ³	Reach 6 Maximum Concentration ³
<u>Metals - mg/kg</u>					
Arsenic	120	229	4550	117	1570
Chromium	600	945	24600	272	3000
Lead	810	478	41000	429	1290
Mercury	2.1	2.0	89.2	1.0	14.0

Parameter	SC1301 Concentration ¹	Invertebrate TEL	Muskrat TEL	Mallard TEL
<u>Metals - mg/kg</u>				
Arsenic	120	220	150	N/A
Chromium	600	110	2,800	2,200
Lead	810	N/A	1,340	750
Mercury	2.1	2.0	6.5	17

Notes:

¹ Sediment core 0 to 1 foot sample concentration

² Sitewide maximum detected concentrations and sitewide average concentrations from BERA Table 4-17

³ Reach 6 maximum detected concentrations and average concentrations from BERA Table 4-257

TEL - Threshold Effects Level - Corresponds to the concentration of the COPC in the sediment associated with adverse effects on the receptor

N/A = Not Applicable