1277578 - R8 SDMS

ADMINISTRATIVE RECORD

SILVER BOW CREEK REMEDIAL INVESTIGATION
FISH TISSUE

ATTACHMENT I

METALS AND ORGANICS IN WARM SPRINGS PONDS FISH TISSUE
ANALYSIS DATA AND QA/QC DATA

TABLE I-1

ARSENIC IN WARM SPRINGS PONDS FISH TISSUE

Lab No.	Run 1 µg/g	Run 2 µg/g	DSA%
T050M	0.080	<0.143	<128%
T050L	<0.055	<0.160	<148%
T051M	0.235	0.146	76%
T051L	0.390	0.455	107%
T052M	0.088	<0.143	<144%
T052L	<0.055	--	--
T053M	<0.055	<0.143	<144%
T053L	<0.055	0.182	150%
T057M	<0.055	<0.144	<144%
T057L	<0.055	<0.144	<144%

QA/QC SUMMARY

Lab No.	Run 1	Run 2
Q961:Blank	<0.0072 mg/L	<0.011 mg/L
Q962:Blank	<0.0072 mg/L	NP(g)
Q963:Duplicate	DSA%(a) = 99	100
Q964:Duplicate	DSA%(a) = 74	NP
Q965:Standard	KSA%(b) = 5	101
Q966:Standard	KSA%(c) = 163	360
Q967:Standard	KSA%(d) = 143	40
Q968:Spike	SSR%(e) = 137	49
Q969:Duplicate	DSA%(f) = 102	NP

Analyst Replicates (DSA%)

Run 1	Run 2	Required Range
Q967-R 99	T051L-R 106	5-115 or ± 1 MDL
T051M-R 97	Q967-R 96	

Analyst Calibration Checks (KSA%)

Run 1	Run 2	Required Range
W5378 102	W5378 110	85-115 or ± 1 MDL
W5378 101	W5378 102	

TABLE I-1

ARSENIC IN WARM SPRINGS PONDS FISH TISSUE
(Continued)

Analyst Spikes (SSR%)				
Run 1		Run 2		Required Range
Q963-S	82	TO51M-S	94	75-125 or ± 1 MDL
TO37L-S	84	TO53L-S	101	

(a) Tissue Split
(b) EPA Metals in Fish
(c) NBS Metals in Bovine Liver
(d) EPA Metals in Water
(e) Predigestion Spike
(f) Digest Split
(g) NP = Not Performed

Note

$$DSA\% = \frac{M_2}{(M_1 + M_2)/2} * 100$$

$$KSA\% = \frac{\text{Measured Value}}{\text{True Value}} * 100$$

$$SSR\% = \frac{(\text{Spiked Sample}) - (\text{Sample})\ (\text{Dil. Factor})}{(\text{Spike})\ (\text{Dil. Factor})} * 100$$

TABLE I-2

CADMIUM IN WARM SPRINGS PONDS FISH TISSUE

Lab No.	Run 1 µg/g	Run 2 µg/g	DSA%
TO50M	0.019	0.174	180%
TO50L	1.05	0.50	64%
TO51M	0.028	0.082	<149%
TO51L	2.32	1.39	75%
TO52M	0.089	0.082	<96%
TO52L	2.51	1.54	76%
TO53M	0.020	<0.083	<161%
TO53L	1.36	0.427	48%
TO57M	0.010	<0.083	<178%
TO57L	0.688	<0.083	<21%

QA/QC SUMMARY

Lab No.	Run 1	Run 2
Q961:Blank	<0.001	0.010
Q962:Blank	<0.001	--
Q963:Duplicate	DSA%(a) = 175	100
Q964:Duplicate	DSA%(a) = 91	--
Q965:Standard	KSA%(b) = 58	103
Q966:Standard	KSA%(c) = 268	70
Q967:Standard	KSA%(d) = 270	60
Q968:Spike	SSR%(e) = 261	60
Q969:Duplicate	DSA%(f) = 100	--

Analyst Replicates (DSA%)

Run 1		Run 2		Required Range
TO52M-R	107	TO50L-R	107	85-115 or ± 1 MDL
Q965-R	99	TO50L-R	94	
TO52L-R	101	Q967-R	98	

Analyst Calibration Checks (KSA%)

Run 1		Run 2		Required Range
W5378	90	WP284 #2	108	85-115 or ± 1 MDL
W5378	94	WP284 #2	100	
0.1 ppm	110			

TABLE I-2

CADMIM IN WARM SPRINGS PONDS FISH TISSUE
(Continued)

Analyst Spikes (SSR%)			
Run 1		Run 2	Required Range
T053M-S	82	T051L-S	75-125 or ± 1 MDL
0963-S	89	0966-S	
T052L-S	123		

(a) Tissue Split
(b) EPA Metals in Fish
(c) NBS Metals in Bovine Liver
(d) EPA Metals in Water
(e) Predigestion Spike
(f) Digest Split

Note

$$DSA\% = \frac{M_2}{(M_1 + M_2)/2} * 100$$

$$KSA\% = \frac{\text{Measured Value}}{\text{True Value}} * 100$$

$$SSR\% = \frac{(\text{Spiked Sample}) - (\text{Sample})\ (\text{Dil. Factor})}{(\text{Spike})\ (\text{Dil. Factor})} * 100$$

TABLE I-3

COPPER IN WARM SPRINGS PONDS FISH TISSUE

Lab. No.	µg/g
TO50M	0.838
TO50L	194.
TO51M	0.675
TO51L	104.
TO52M	0.488
TO52L	200.
TO53M	<0.325
TO53L	202.
TO57M	0.463
TO57L	738.

OA/OC SUMMARY

Q961:Blank	<0.037 mg/L
Q962:Blank	<0.037 mg/L
Q963:Duplicate	DSA%[a] = 146
Q964:Duplicate	DSA%[a] = 92
Q965:Standard	KSA%[b] = 105
Q966:Standard	KSA%[c] = 116
Q967:Standard	KSA%[d] = 82
Q968:Spike	SSR%[e] = 100
Q969:Duplicate	DSA%[f] = 113

Analyst Replicates

Lab. No.	DSA%/RSA%	Required Range
TO51L-R	98	85-115 or ± 1 MDL
Q965-R	90	

Analyst Calibration Checks

Lab. No.	KSA%	Required Range
WP284 #2	94	85-115 or ± 1 MDL
WP284 #2	96	

TABLE I-3

COPPER IN WARM SPRINGS PONDS FISH TISSUE
(Continued)

Analyst Spikes

Lab. No.	SSR%	Required Range
T053L-S	99	75-125 or ± 1 MDL
Q963-S	89	

(a) Tissue Split
(b) EPA Metals in Fish
(c) NBS Metals in Bovine Liver
(d) EPA Metals in Water
(e) Predigestion Spike
(f) Digest Split

Note

$$DSA\% = \frac{M_2}{(M_1 + M_2)/2} * 100$$

$$KSA\% = \frac{\text{Measured Value}}{\text{True Value}} * 100$$

$$SSR\% = \frac{(\text{Spiked Sample}) - (\text{Sample})\ (\text{Dil. Factor})}{(\text{Spike})\ (\text{Dil. Factor})} * 100$$

TABLE I-4

ZINC IN WARM SPRINGS PONDS FISH TISSUE

Lab. No.	µg/g
T050M	3.74
T050L	32.2
T051M	6.18
T051L	62.2
T052M	6.12
T052L	51.9
T053M	5.31
T053L	45.9
T057M	3.96
T057L	39.8

QA/QC SUMMARY

Q961:Blank	<0.031 mg/L
Q962:Blank	<0.031 mg/L
Q963:Duplicate	DSA%[a] = 103
Q964:Duplicate	DSA%[a] = 100
Q965:Standard	KSA%[b] = 95
Q966:Standard	KSA%[c] = 109
Q967:Standard	KSA%[d] = 91
Q968:Spike	SSR%[e] = 112
Q969:Duplicate	DSA%[f] = 104

Analyst Replicates

Lab. No.	DSA%/RSA%	Required Range
T051L-R	98	85-115 or ± 1 MDL
Q965-R	91	

Analyst Calibration Checks

Lab. No.	KSA%	Required Range
WP284 #2	96	85-115 or ± 1 MDL
WP284 #2	101	

TABLE I-4

ZINC IN WARM SPRINGS PONDS FISH TISSUE
(Continued)

Analyst Spikes

Lab. No.	SSR%	Required Range
T053L-S	106	75-125 or ± 1 MDL
Q963-S	80	

(a) Tissue Split
(b) EPA Metals in Fish
(c) NBS Metals in Bovine Liver
(d) EPA Metals in Water
(e) Predigestion Spike
(f) Digest Split

Note

$$DSA\% = \frac{M_2}{(M_1 + M_2)/2} * 100$$

$$KSA\% = \frac{\text{Measured Value}}{\text{True Value}} * 100$$

$$SSR\% = \frac{(\text{Spiked Sample}) - (\text{Sample})\ (\text{Dil. Factor})}{(\text{Spike})\ (\text{Dil. Factor})} * 100$$

TABLE I-5
PCP CONCENTRATIONS OF WARM SPRINGS PONDS FISH

Species	Sex	Lab No.	Fillet (ppm)	Fillet[a] Lipid (ppm)	Reproductive[b] (ppm)	Reproductive Lipid[a,b] (ppm)
Salmo gairdneri	M	T049	0.012	0.408	0.020(T)	1.48(T)
Salmo gairdneri	F	T051	0.019	0.728	0.030(E)	2.79(E)
Salmo gairdneri	F	T054	0.008	0.301	0.054(E)	1.04(E)
Salmo gairdneri	M	T055	0.024	0.462	0.008(T)	6.58(T)
Salmo gairdneri	F	T058	0.012	0.577	0.042(E)	1.28(E)

QA Notes

Internal QA/QC sample data available in files of contract laboratory. Independent sample bank samples generated the following data:

Sample bank blank: Q970 <.005 ppm.

Sample bank duplicate: Q972
Whole Tissue DSA% = 114[c]

Sample bank standard: Q974
KSA% = 35%[d]

(a) ppm PCP on lipid basis calculated as $\frac{\text{mg PCP in Tissue}}{\text{kg lipid in Tissue.}}$

(b) T = Testes
E = Eggs

(c)
$$DSA\% = \frac{M_2}{(M_1 + M_2)/2} * 100$$

(d)
$$KSA\% = \frac{\text{Measured Value}}{\text{True Value}} * 100$$

TABLE I-6
PCB CONCENTRATIONS OF WARM SPRINGS PONDS FISH

Species	Sex	Lab No.	Fillet[a] (ppm)	Fillet[a,b] Lipid (ppm)	Reproductive[a,c] (ppm)	Reproductive Lipid[a,c] (ppm)
Salmo gairdneri	M	T049	0.330	11.2	0.183(T)	13.6(T)
Salmo gairdneri	F	T051	0.390	14.9	0.179(E)	16.7(E)
Salmo gairdneri	F	T054	0.355	13.3	0.717(E)	13.8(E)
Salmo gairdneri	M	T055	0.230	4.43	<0.05(T)	<41.0(T)
Salmo gairdneri	F	T058	0.386	13.2	0.433(E)	13.2(E)

QA Notes

Internal QA/QC sample data available in files of contract laboratory. Independent sample bank samples generated the following data:

Sample bank blank: Q971 <.0004 mg/sample

Sample bank duplicate: Q973

Whole Tissue DSA% = 54%[d]

Lipid Based DSA% = 98%[d]

Sample bank standard: Q975
KSA% = 69%[e]

(a) Values are for PCB 1260.

(b) ppm PCP on lipid basis calculated as $\frac{\text{mg PCP in Tissue}}{\text{kg lipid in Tissue.}}$

(c) T = Testes
E = Eggs

(d) $DSA\% = \frac{M_2}{(M_1 + M_2)/2} * 100$

(e) $KSA\% = \frac{\text{Measured Value}}{\text{True Value}} * 100$

SILVER BOW CREEK REMEDIAL INVESTIGATION
FISH TISSUE

ATTACHMENT II

CONCENTRATIONS OF ARSENIC, CADMIUM, COPPER, ZINC, PCP, AND PCB
IN FISH TISSUE-EXAMPLES FROM THE LITERATURE

TABLE II-1
ARSENIC IN FISH TISSUE-EXAMPLES FROM THE LITERATURE

Citation	Location	Species/Tissue	Exposure	Water Conc. (ppm)	Tissue Conc. µg/g ppm[a]
Gilderhus 1966[b]	Lab	Bluegill (*Lepomis macrochirus*) Adult and Immature	16 weeks	.3 - 9.0	.3 - 9.0
Dabrowski 1976[b]	Lab	Rainbow Trout (*Salmo gairdneri*) eggs.	40 days	.05	2.5 (max)
Ullman, *et. al.* 1961[b]	New York Lake	Calico bass (*Pomoxis nigromaculatus*)/ muscle fillet	Exposed to Sodium Arsenite used as herbicide		.10 - .47 No difference from before and after treatment.
Pakkala, *et. al.* 1972[b]	New York Lakes	Various muscle	Not Given	Not Given	.5 (max)
Sandhu 1977[b]	Not Given (Uncontaminated)	Various muscle	Not Given	2.5(max)	12.5(max)
Ellis, *et. al.* 1941[b]	S.E. US	Various whole fish	Life span	Not Given	.75
Wisconsin Department of Natural Resources 1974[b]	Natural	Various Edible Portion	Life Span	Not Given	<1.0
Kent and Johnson 1979	American Falls Reservoir (Snake River, Idaho)	Rainbow Trout (*Salmo gardneri*)/ Edible portion	Life Span	.0015-.033	Not detected.
Olsen and Schell	Puget Sound	Muscle/ English Sole Dover Sole	Life Span		22-41[c] <.05-51[c]
Greichus *et. al.* 1978	Lake McIlwaine, Rhodesia	Mixed/Whole carcass	Life Span	n=3, .003(x)[d]	n=3, .35 (x)[d]

(a) Wet weight.
(b) From Phillips and Russo 1978.
(c) Dry weight. W/D = 5.1.
(d) Dry weight divided by 4.

TABLE II-2
CADMIUM IN FISH TISSUE-EXAMPLES FROM THE LITERATURE

Citation	Location	Species/Tissue	Exposure	Water Conc. (ppm)	Tissue Conc. µg/g ppm[a]
Havre, et. al. 1973[b]	Marine-off Norway Coast	Various/ muscle?	Life span	Not Given	.002 - .033
Lovett et. al. 1972[b]	New York State Lakes	Various/ muscle?	Life span	Not Given	.02 - .10
Benait, et. al. 1976[b]	Lab	Brook trout (Salvelinus fontinalis)/various	38 weeks	.0034 (lowest damaging concentration)	kidney>liver> gill>muscle
Eaton, 1974[b]	Lab	Bluegill	11 months	.031-2.14 No effect between .031 and .080	Not Applicable
Kumada, et. al. 1973[b]	Lab	Rainbow trout (Salmo gairdneri)/ various	40 weeks	Various	liver=kidney> gills>muscle
Wisconsin Department of Natural Resources 1973[b]	Natural	Various/Edible Portion	Life Span	Not Given	Not Detected
Kent and Johnson 1974	American Falls Reservoir (Snake River, Idaho)	Rainbow Trout (Salmo gairdneri)/ Edible Portion	Life Span	.001-.024	x=.51 SD=.04 Range .32-.80
Mathias and Cummings 1973[c]	Illinois River	Various/Edible Portion	Life Span	.0001-.002	.03
Schroeder 1974[c]	Hudson River	Various/Edible Portion	Life Span	.003-.006	.2-304
Schroeder 1974[c]	Alabama River	Various/Edible Portion	Life Span	.006-.090	.8(max)

TABLE II-2
CADMIUM IN FISH TISSUE-EXAMPLES FROM THE LITERATURE (Cont.)

Citation	Location	Species/Tissue	Exposure	Water Conc. (ppm)	Tissue Conc. µg/g ppm[a]
Lucas, et. al. 1970[c]	Great Lakes	Various/Edible	Life Span	Not Given	.06 - 1.4
Olsen and Schell 1977	Puget Sound	Muscle English Sole Dover Sole	Life Span		 <.05[d] <.05[d]
Kneip and Hazen 1979	Foundry Cove, New York	Sunfish/Edible portion	Life Span	up to 10,000 mg/kg (dry) in sediment	.15
Kneip and Hazen 1979	Foundry Cove, New York	Sunfish/Liver	Life Span	up to 10,000 mg/kg (dry) in sediment	7.2
National Maine Fisheries Service 1975[e]	Atlantic	44 species/ Edible portion	Life Span	Not Given	<.025 one species exceeded .025
Greichus, et. al. 1978	Lake McIlwaine, Rhodesia	Mixed/whole carcass	Life Span	n=3, .001(x)	n=3, .03(x)[f]

(a) Wet Weight.
(b) From Phillips and Russo 1978.
(c) From Kent and Johnson 1979.
(d) Dry weight w/D - 5.1.
(e) From Kneip and Hazen 1979.
(f) Dry weight divided by 4.

TABLE II-3
COPPER IN FISH TISSUE-EXAMPLES FROM THE LITERATURE

Citation	Location	Species/Tissue	Exposure	Water Conc. (ppm)	Tissue Conc. µg/g ppm[a]
Goettl, et. al. 1972[b]	Lab (Research Hatchery)	Rainbow trout (Salmo gairdneri)			
		Bone	92 weeks	Not Given	7.3[c]
		eye	"	"	4.3[c]
		gill	"	"	4.9[c]
		intestine	"	"	9.6[c]
		kidney	"	"	12.9[c]
		muscle	"	"	1.7[c]
McKim and Benoit 1974[b]	Lab	Brook trout (Salvelinus fontinalis) gill, kidney, liver, muscle	Egg--Spawning	.0094(max)	Not Detected
Goett, et. al. 1974[b]	Lab	Rainbow trout (Salmo gairdneri) liver	107 weeks	.003	>.003
Olsen and Schell 1977	Puget Sound	Muscle	Life Span		
		English Sole			.25-2[d]
		Dover Sole			.20-.25[d]
Greichus et. al. 1978	Lake McIlwaine, Rhodesia	Mixed/whole carcass	Life Span	n=3,.010(x)	n=3, 5.4(x)[e]

(a) Wet weight.
(b) From Phillips and Russo 1978.
(c) Dry weight.
(d) Dry weight W/D = 5.1
(e) Dry weight divided by 4.

TABLE II-4
ZINC IN FISH TISSUE-EXAMPLES FROM THE LITERATURE

Citation	Location	Species/Tissue	Exposure	Water Conc. (ppm)	Tissue Conc. µg/g ppm[a]
Goettl, et. al. 1972[b]	Lab (Research Hatchery)	Rainbow trout (Salmo gairdneri)	92 weeks	Not Given	
		eye	"	"	4003[c]
		skin	"	"	90[c]
		gill	"	"	200[c]
		bone	"	"	195[c]
		stomach	"	"	1[c]
		liver	"	"	150[c]
		muscle	"	"	20[c]
		kidney	"	"	125[c]
		intenstine	"	"	190[c]
Slater 1961[b]	Lab	Various/Gill filaments	Not Given	Not Given	Brook trout (Salvelinus fontinalis)= cutthroat trout (Salmo clarkii)> Rainbow Trout (Salmo gairdneri)
Wisconsin Department of Natural Resources 1974[b]	Natural Waters	Various/Edible Portion	Ambient	Not Given	3.0 - 18.3
Olsen and Schell 1977	Puget Sound	Muscle/	Life Span	Not Given	
		English Sole			17-25[d]
		Dover Sole			14-17[d]
Greichus, et. al. 1978	Lake McIlwaine, Rhodesia	Mixed/whole carcass	Life Span	n=3, .012(x)	n=3, 12.0(x)[e]

(a) Wet weight
(b) From Phillips and Russo 1978.
(c) Dry weight.
(d) Dry weight W/D = 5.1
(e) Dry weight divided by 4.

TABLE II-5
BACKGROUND FISH TISSUE CONCENTRATIONS OF ARSENIC, CADMIUM, COPPER AND ZINC IN THE UNITED STATES

	1978-79				1980-81			
	GM	Min	Max	85 Percentile	GM	Min	Max	85 Percentile
As	.16	.04	2.08	.23	.14	.05	1.69	.22
Cd	.04	.01	.41	.09	.03	.01	.35	.06
Cu	.86	.29	38.75	1.14	.68	.25	24.10	.90
Zn	25.63	7.69	168.1	46.26	23.82	8.82	109.2	40.09

All data in µg/g wet weight. GM = geometric mean.

Source: Lowe, et. al. 1985.

TABLE II-6
PCP IN FISH TISSUE - EXAMPLES FROM THE LITERATURE

Citation	Location	Species/Tissue	Exposure	Water Concentration (ppm)	Tissue Concentration (ppm)
Fox and Joshi 1984	Lake Ontario	Mixed/whole carcass	Life Span	Various	Concentration Factor = 10^4
Huckins and Petty 1983	Lab	Fathead minnows (*Pimephales promelas*)/various	31 days	.050	Concentration Factor: 174-284
Niimi and Cho 1983	Lab	Rainbow trout (*Salmo gairdneri*)/ various	110 days	Dietary of 10 μg/kg	2-20
Niimi and Cho 1983	Lake Ontario	Various/Various	Life Span	Not Given	1-10
Pierce 1978	Lab	Bluegill (*Lepomis macrochirus*)/ various	Various	Various	Bile>Liver>Gills> Muscle

TABLE II-7
PCB'S IN FISH TISSUE - EXAMPLES FROM THE LITERATURE

Citation	Location	Species/Tissue	Exposure	Water Conc. (ppm)	Tissue Conc. ppm[a]
Greichus *et al.* 1978.	Lake McIlwaine, Rhodesia	Dwarf bream/ Whole carcass	Life Span	<.001[b]	n=50: A1254, 1.8(x)[b] A1260, .51(x)[b]
"	"	Spot Tail/Whole Carcass	"	"	n=50: A1254, 1.7(x)[b] A1260, <.5(x)[b]
"	"	Greenheaded bream/ Whole carcass	"	"	n=50: A1254, .98(x)[b] A1260, <.5(x)[b]
"	"	Greenheaded bream/ Whole carcass	"	"	n=5: A1254, .92(x)[b] A1260, <.5(x)[b]
Defoe *et al.* 1978	Lab	Fathead minnow (*Pimepholes promeles*) Various	30 days	Various: LC-50 for A1248 4.7 lg/l LC-50 for A1260 = 3.3 lg/l	
Defoe *et al.* 1978	Lab	Fathead minnows (*Pimepholes promeles*) Various		Various	Concentration factor = 126 for A1248 in females. Concentration factor = 2727 for A1260 in females.
Califano *et al.* 1980	Lab	Striped bass (*Morone saxitilis*/ muscle	48 hours	Various	5.9
Lisk *et al.* 1979	Cayuga Lake, New York	Lake trout (*Salvelinus namaycush*)/flesh	Life Span	Not Given	13.0
Veith *et al.* 1981	Watershed of Great Lakes	Various/Composite	Life Span	Not Given	.13 - 14.6 65% had at least 2.0

TABLE II-7
PCB'S IN FISH TISSUE - EXAMPLES FROM THE LITERATURE
(Continued)

Citation	Location	Species/Tissue	Exposure	Water Conc. (ppm)	Tissue Conc. ppm(a)
Veith 1975	Lake Michigan	Thirteen species/ composite	Life Span	Not Given	Rainbow smelt = 2.7(x) Lake Trout = 15.0 (x) Trout and Salmon >12 inches >5.0 ppm
Snarksi and Puglisi 1976	Lab	Brook trout (*Salvelinus fontinalis*)/fillet	71 Weeks	.00094	2.0
Snarski and Puglisi 1976	Lab	Brook trout (*Salvelinus fontinalis*)/whole body	71 Weeks	.00094	9.0
Haile, *et al.* 1975	Lake Ontario	Various/Whole Fish	Life Span	.055(x)	5.15(x)
Lieb *et al.* 1974	Lab	Rainbow Trout (*Salmo gairdneri*)/ Whole Fish	32 Weeks	15.0 ppm in diet	10.2(x)

(a) Wet Weight

(b) Dry Weight

TABLE II-8
BIOCONCENTRATION FACTORS OF CADMIUM

Species	Tissue	Chemical	Bioconcentration Factor	Duration (days)	Reference
Rainbow trout (*Salmo gairdneri*)	Whole body	--	540	140	Kumada, *et al.* 1973
Rainbow trout (*Salmo gairdneri*)	Whole body	Cadmium Chloride	33 at 4 µg/L	10 wks	Kumada, *et al.* 1980 (Cited in USEPA 1980)
Brook trout (*Salvelinus fontinallis*)	Muscle	Cadmium Chloride	3	490	Benoit, *et al.* 1976
Brook trout (*Salvelinus fontinallis*)	Muscle	Cadmium Chloride	151	84	Benoit, *et al.* 1976
Brook trout (*Salvelinus fontinallis*)	Muscle	Cadmium Chloride	10	93	Sangalang and Freeman, 1979

SILVER BOW CREEK REMEDIAL INVESTIGATION
FISH TISSUE

ATTACHMENT III

METALS IN THE FISH OF THE CLARK FORK RIVER - HISTORICAL DATA.
METALS AND ORGANICS IN WATER - RI DATA

TABLE III-1
METAL CONCENTRATIONS IN A BROWN TROUT (*Salmo trutta*) COLLECTED IN WARM SPRINGS POND NO. 3 IN 1976

Metal	Concentration (µg/g wet)
As	0.51
Cu	.825
Cd	<.05
Zn	5.43

Source: Dent 1977.

TABLE III-2
AVERAGE CONCENTRATIONS OF CADMIUM, COPPER, AND ZINC IN TROUT (*Salmo spp.*) MUSCLE AND LIVER FROM THE CLARK FORK DRAINAGE

Metal	Muscle µg/g	Liver µg/g
Cd	.19	.69
Cu	1.47	11.4
Zn	6.3	38

Source: Van Meter 1974.

TABLE III-3
AVERAGE CONCENTRATIONS OF CADMIUM AND COPPER IN TROUT (*Salmo* spp.) LIVER FROM THE UPPER CLARK FORK RIVER COMPARED TO AVERAGE CONCENTRATIONS OF CADMIUM AND COPPER FROM ROCK CREEK OF THE MIDDLE CLARK FORK DRAINAGE

Metal	UCFR(a) µg/g	RC(b) µg/g
Cd	1.1(3)	1.9(3)
Cu	14(3)	17(3)

(a) The Upper Clark Fork River sampling stations included three below the Warm Springs Ponds and one below the confluence with the Little Blackfoot River.

(b) The five Rock Creek stations were all on the main stem of Rock Creek.

(c) Numbers in parentheses are the number of samples used to calculate the average.

Source: Van Meter 1974.

TABLE III-4

MEANS, STANDARD DEVIATIONS AND RANGES OF LENGTH, WEIGHT, AND METAL, AND METAL CONCENTRATIONS IN BROWN TROUT FROM TWO SECTIONS OF THE CLARK FORK RIVER AND ONE ON THE LITTLE BLACKFOOT RIVER; SAMPLING CONDUCTED SEPTEMBER 18-19, 1978

Location	Age Class	No.	Length (mm)	Weight (gm)	Metal concentration (µg/g) Cu	Cd	As	Zn
Clark Fork-pH Shack[a]	I	17	234±23 (188-272)	136±50 (73-213)	0.10±0.27 (ND-0.83)	0.43±0.45 (ND-1.12)	0.16±0.08 (0.02-0.29)	4.45±1.85 (1.35-7.75)
Clark Fork-Williams-Tavenner[b]		12	241±15 (218-267)	154±18 (123-195)	0.25±0.76 (ND-2.41)	0.05±0.05 (ND-0.13)	0.10±0.05 (0.05-0.20)	4.81±1.10 (3.19-6.52)
Little Blackfoot		8	213±13 (198-239)	104±14 (91-136)	0.05±0.15 (ND-0.43)	0.21±0.23 (ND-0.56)	0.10±0.08 (0.01-0.26)	4.85± 0.68 (3.53-5.76)
Clark Fork-pH Shack	II	18	310±33 (246-371)	318±95 (181-599)	0.15±0.29 (ND-0.92)	0.56±0.49 (0.06-1.36)	0.12±0.08 (0.03-0.31)	4.15±2.04 (1.90-5.37)
Clark Fork-Williams-Tavenner		14	297±31 (249-343)	286±82 (163-440)	0.03±0.07 (ND-0.24)	0.11±0.12 (ND-0.45)	0.08±0.04 (0.02-0.17)	4.09±1.11 (2.60-6.60)
Little Blackfoot		15	285±23 (249-338)	240±68 (145-404)	0.02±0.04 (ND-0.06)	0.07±0.07 (ND-0.20)	0.15±0.13 (0.03-0.50)	3.55±1.29 (1.49-6.89)
Clark Fork-pH Shack	III	6	366±28 (335-414)	508±113 (377-694)	-- --	1.20±0.55 (0.22-1.41)	0.12±0.07 (0.03-0.24)	4.63±0.74 (3.79-5.58)
Clark Fork-Williams-Tavenner		15	361±25 (320-406)	531±118 (363-767)	0.12±0.15 (ND-0.43)	0.09±0.11 (ND-0.20)	0.05±0.04 (0.01-0.12)	3.83±1.20 (1.90-6.46)
Little Blackfoot		9	351±30 (310-399)	467±132 (331-690)	0.12±0.15 (ND-0.39)	0.21±0.41 (ND-1.10)	0.28±0.26 (0.05-0.83)	3.69±0.61 (2.88-4.89)
Clark Fork-pH Shack	IV	3	452±58 (412-518)	993±445 (735-1505)	-- --	0.83±0.64 (0.20-1.48)	0.01±0.02 (ND-0.03)	3.52±0.58 (3.12-4.18)
Clark Fork-Williams-Tavenner		6	432±38 (406-503)	984±667 (672-1716	0.25±0.22 (ND-0.53)	0.41±0.57 (ND-1.26)	0.13±0.16 (0.02-0.45)	3.92±1.04 (2.65-5.20)
Little Blackfoot		6	439±43 (394-498)	948±286 (721-1397)	0.28±0.37 (ND-0.97)	0.22±0.35 (0.02-0.93)	0.18±0.29 (0.02-0.76)	3.7610.39 (3.37-4.34)

(a) pH shack section on the upper Clark Fork River was just below the confluence of the outfall from the Warm Springs Ponds and Warm Springs Creek.

(b) Williams Tavenner section on the Upper Clark Fork River was below Deer Lodge.

Source: Phillips 1982.

TABLE III-5
CONCENTRATIONS OF ARSENIC, CADMIUM, COPPER, AND ZINC
IN THE DISCHARGE FROM THE WILDLIFE PONDS (PS-11A) DURING THE SBC RI

Date	As Total[a]	Cd Total[a]	Cu Diss[a]	Cu Total[a]	Zn Diss[a]	Zn Total[a]
12/05/84	.0096	<.0005	.010	.021	.015	.015
12/25/84	.0078	<.0008	<.031	<.031	.035	.042
1/30/85	.0062	<.0004	<.025	<.039	.102	.088
2/13/85	.012	<.0012	<.017	.032	.186	.202
2/13/85	.010	<.0012	<.026	.034	.163	.250
2/27/85	.012	<.0011	<.027	.072	.075	.101
3/13/85	.0081	<.0028	.076*	.065	.033	.044
3/27/85	.011	<.0015	.014	<.049	<.017	<.017
4/10/85	.0159	<.0011	<.019*	.043	<.014	.011
4/24/85	.014	<.0005	<.014*	<.013	.009	.011
5/08/85	.013	<.0003	.018	.022	<.017	.015
5/22/85	.013	<.00025	<.030	.038	<.011	.015
6/05/85	.011	<.00025	<.015	.0098	<.012	.021
6/19/85	.014	<.0010	<.021	.021	<.006	.023
7/24/85	.018	<.0002	<.023	.048	<.006	.019
8/29/85	.013	<.00025	<.021	<.005	<.017	.009

* Not Validated due to requested reruns being past holding time. Reruns were requested to lower the MDL.

(a) Values reported in mg/L.

TABLE III-6
CONCENTRATIONS OF ARSENIC, CADMIUM, COPPER, AND ZINC
IN THE WEST DECANT TOWER DISCHARGE DITCH

Date	As Total[a]	Cd Total[a]	Cu Diss.[a]	Cu Total[a]	Zn Diss.[a]	Zn Total[a]
12/05/84	0.0095	0.00070	0.019	0.044	0.148	0.206
12/28/84	0.0094	0.0013	<0.031	0.052	0.171	0.306
1/30/85	0.012	0.0018	<0.025	0.056	0.415	0.524
2/13/85	0.011	0.0012	0.027	0.063	0.388	0.449
2/27/85	0.014	0.0013	<0.027	0.065	0.308	0.379
3/13/85	0.0077	0.0014	<0.018*	0.106	0.403	0.341
3/27/85	0.016	<0.0015	0.065*	0.097	0.155	0.285
4/10/85	0.025	0.0017	0.047*	0.183	0.164	0.458
4/24/85	0.014	0.00080	<0.014	0.094	0.009	0.195
5/08/85	0.011	0.0013	<0.011	0.038	<0.015	0.108
5/22/85	<0.012	<0.00025	<0.030	0.072	0.015	0.102
6/05/85	0.014	0.00074	0.033	0.058	0.055	0.113
6/19/85	0.014	<0.0010	0.026	0.044	<0.006	0.084
7/24/85	0.012	<0.00020	<0.023	0.051	<0.0060	0.028
8/29/85	0.0057	<0.00025	<0.021	0.017	<0.017	0.047

(a) Values reported in mg/L.

TABLE III-7
PCP CONCENTRATIONS IN SURFACE WATER FOR SBC RI, 1984-1985

Station	Location	Dates	Concentrations (ppm)	Proposed WQ Criteria[a] (ppm)
SS-06	Just below Mt. Post and Pole above Colorado Tailings	12/03/84	0.054[b]	.048
SS-07	Downstream of Mt. Post and Pole several hundred yards. Below Colorado Tailings.	12/04/84	0.055[b]	.048
SS-06	See above.	2/25/85	0.200[b]	.048
SS-06 Dup.		2/25/85	0.240[b]	.048
SS-07	See above.	2/25/85	0.014[b]	.048
SS-06	See above.	4/22/85	0.025[b]	.048
SS-06 Dup.		4/22/85	0.027[b]	.048
SS-07	See above.	4/22/85	0.048[b]	.048
SS-05	Above Mt. Post and Pole, below Mt. Street Bridge.	7/22/85	<0.00044[b]	.048
SS-06	See above.	7/22/85	0.029	.048
SS-07	See above.	7/22/85	0.019	.048

(a) Hedtke and Arthur 1985.

(b) Analyzed past holding time.

FIGURE III-1

TOTAL ARSENIC CONCENTRATIONS IN THE DISCHARGE FROM THE WILDLIFE PONDS (PS-IIA) DURING THE SBC RI.

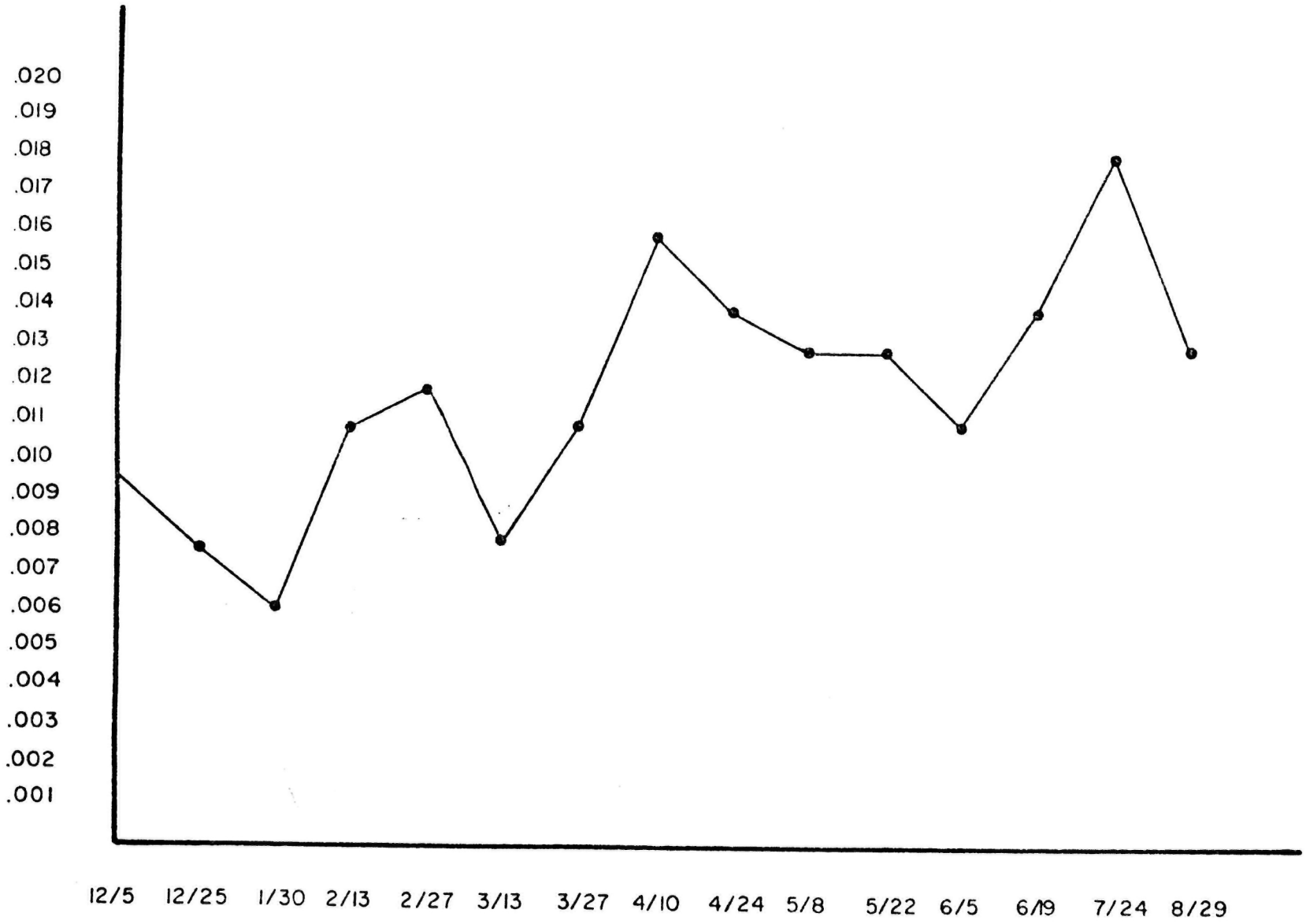


FIGURE III-2

TOTAL CADMIUM CONCENTRATIONS IN THE DISCHARGE FROM THE WILDLIFE PONDS (PS-11A) DURING THE SBC RI

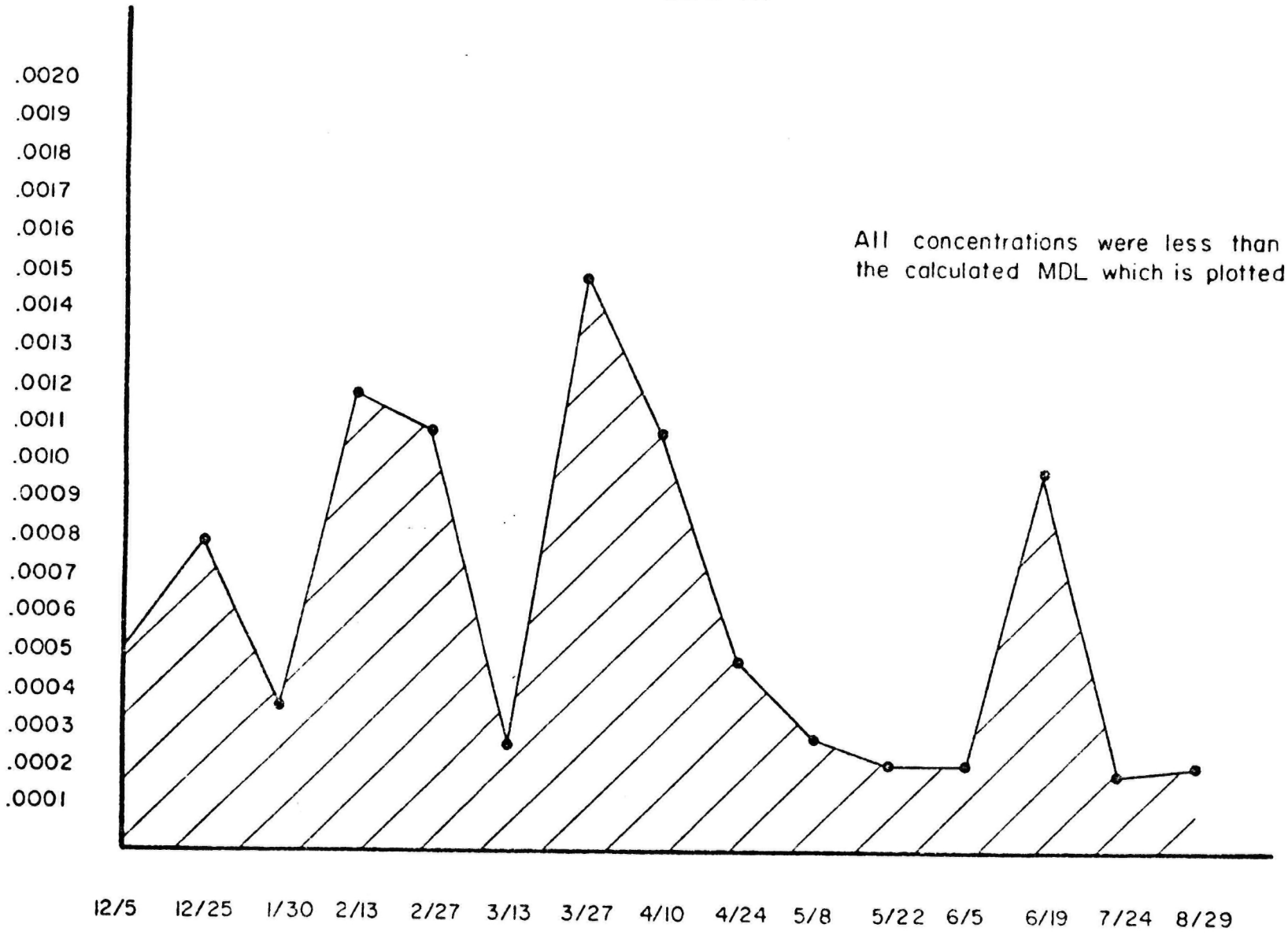


FIGURE III-3

TOTAL COPPER CONCENTRATIONS IN THE DISCHARGE FROM THE WILDLIFE PONDS (PS-11A) DURING THE SBC RI.

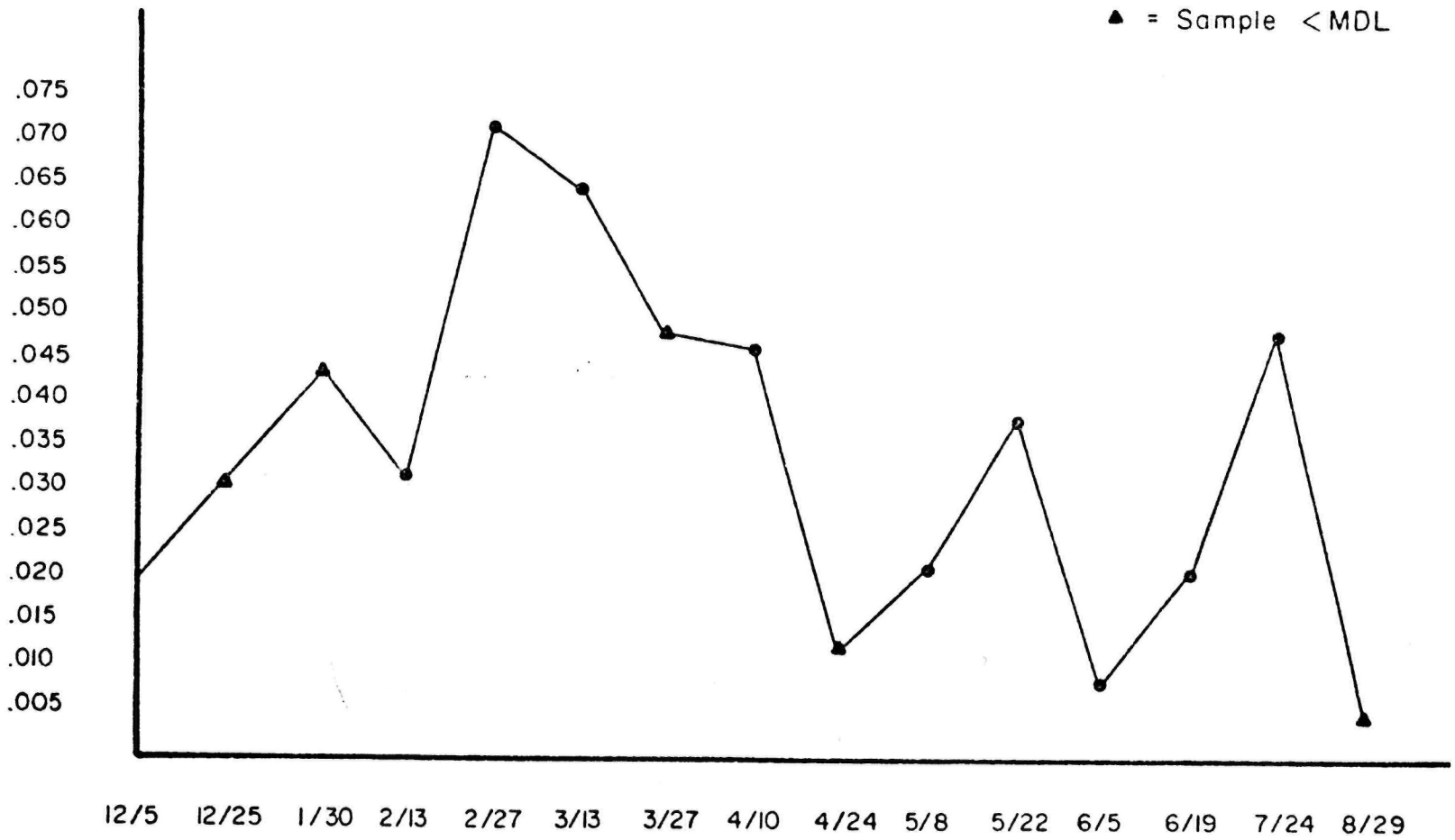
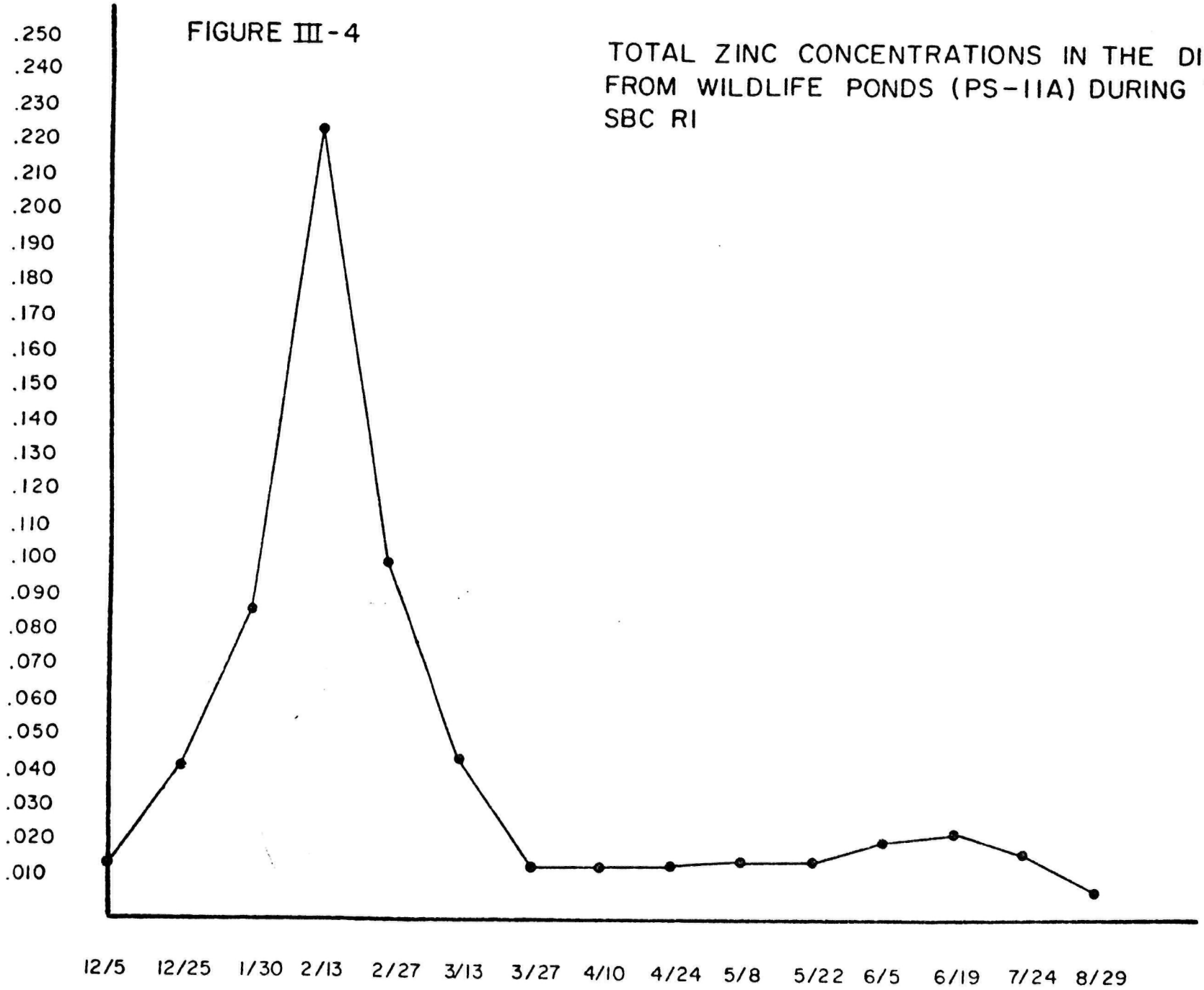


FIGURE III-4

TOTAL ZINC CONCENTRATIONS IN THE DISCHARGE FROM WILDLIFE PONDS (PS-11A) DURING THE SBC RI