

DEPARTMENT OF ECOLOGY

June 21, 1995

TO: Larry Goldstein

FROM: Art Johnson and Dale Davis

SUBJECT: Metals Concentrations in the 1994 WSPMP Samples

In response to your request, metals were analyzed in samples collected as part of the 1994 Washington State Pesticide Monitoring Program. The samples analyzed consisted of bottom sediments, whole largescale suckers, and fish fillets from Lake Chelan and Lake Sacajawea (Snake River), and the Okanogan, Soleduck and Entiat Rivers. Table 1 shows the samples that were analyzed. Detailed information on collection and preparation of these samples is provided in reports being written on the pesticide results.

Manchester Laboratory's data reports on the metals analyses are attached. No significant problems were encountered during this work. We have summarized the results in Tables 2 - 4. Overall, the findings were unremarkable, metals concentrations in most samples being typical of uncontaminated waterbodies. The lone finding of interest appears to be a modest elevation in arsenic levels in Okanogan River sediments and fish. For this reason, only a brief overview of the data was prepared.

As highlighted in Table 2, sediment concentrations of several metals -- zinc, chromium, nickel, arsenic, and cadmium -- were at or slightly above the Ontario "lowest effects levels" in one or more instances (Persaud et al., 1993). Because lowest effects levels are tolerated by most benthic organisms, these somewhat elevated concentrations -- which could be due to natural or human sources -- do not represent a significant concern. Severe effects levels for metals were not approached at any of the sampling sites.

Except for arsenic in the Okanogan River, none of the above metals appeared elevated in the fish samples, and here only slightly. The six metals detected in whole fish (Table 3) have been routinely analyzed in the USFWS National Contaminant Biomonitoring Program. In all but the Okanogan, concentrations in the WSPMP whole fish samples were comparable to or less than the national means reported by USFWS for zinc, copper, mercury, selenium, lead, and arsenic in U.S. freshwater fish during 1976-1984 (Schmitt and Brumbaugh, 1990). The arsenic concentration in one of the two Okanogan whole fish samples was about twice the national mean, 0.26 mg/Kg compared to 0.14 mg/Kg.

Only zinc, copper, mercury, and selenium were consistently detected in the fillet samples (Table 4). Arsenic and chromium were also detected once each, in Okanogan River carp and

Lake Chelan rainbow trout, respectively. Except for mercury in Palouse River squawfish, the concentrations were similar to those in fish fillets we have analyzed from other parts of the state (Johnson and Norton, 1990; Serdar et al., 1994). However, due to the extremely low edible fish flesh criteria of 0.006 mg/Kg in the National Toxics Rule (NTR), the detection of arsenic at 0.18 mg/Kg in the Okanogan carp fillet sample would qualify for addition to the 303(d) list.

Squawfish tend to accumulate mercury to a greater extent than many other species (Lowe et al., 1985). With the exception of squawfish, which have little use as a food fish, none of the WSPMP fish fillet samples approached NTR criteria or FDA action levels for human consumption due to mercury. The NTR and FDA values for mercury are 0.8 and 1.0 mg/Kg, respectively vs. 0.47 mg/Kg in the squawfish sample (EPA, 1993; FDA, 1979).

REFERENCES:

EPA. 1993. National Toxics Rule. 40 CFR Part 131.

FDA. 1979. Action Level for Mercury in Fish, Shellfish, Crustaceans, and other Aquatic Animals. Fed. Reg. 44(11):3990-3993.

Johnson, A. and D. Norton. 1990. 1989 Lakes and Reservoir Water Quality Assessment Program: Survey of Chemical Contaminants in Ten Washington Lakes. Wash. Dept. Ecology, Olympia.

Lowe T.P., T.W. May, W.G. Brumbaugh, and D.A. Kane. 1985. National Contaminant Biomonitoring Program: Concentrations of Seven Elements in Freshwater Fish, 1978-1981. 14:363-388.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of Environment and Energy. ISBN 0-7729-9248-7.

Schmitt, C.J. and W.G. Brumbaugh. 1990. National Contaminant Biomonitoring Program: Concentrations of Arsenic, Cadmium, Copper, Lead, Mercury, Selenium, and Zinc in U.S. Freshwater Fish, 1976-1984. Arch. Environ. Contam. Toxicol. 19:731-747.

Serdar, D., A. Johnson, and D. Davis. 1994. Survey of Chemical Contaminants in Ten Washington Lakes. Pub. No. 94-154.

AJ:jl
Attachment

cc: Jim Milton

Table 1. Location of 1994 WSPMP Sediment and Fish Samples

Site	Date	Latitude x Longitude*	Fish Species	N =	Length (mm)	Weight (gm)
Lake Chelan near Wapato Pt.	9/12	47 52 57 x 120 08 68	Kokanee	4	247-332	157-393
			Rainbow Trout	6	238-297	134-242
			Smallmouth Bass**	3	255-326	312-675
			Largescale Sucker	5	229-419	115-787
Lake Sacajawea @ Ice Harbor Dam	9/14	46 15 13 x 118 52 51	Channel Catfish	5	386-500	627-1221
			Largescale Sucker	5	459-525	1157-1579
Okanogan River near Monse	9/13	48 10 21 x 119 40 27	Carp	5	520-680	2325-5758
			Largescale Sucker	5	443-522	912-1522
			" "	5	443-555	866-1622
Soleduck River near Sappho	9/7	48 03 26 x 124 18 30	Mountain Whitefish	5	328-377	334-459
Entiat River near mouth	9/12	47 39 50 x 120 14 10	Largescale Sucker	5	454-556	899-1343
			" "	5	461-505	909-1118
Palouse River near Winona	9/14	no sediment sample	Northern Squawfish	5	332-376	260-540
			Largescale Sucker	4	229-473	333-1347

* for sediment samples

** not analyzed for metals

Table 2. Metals Concentrations in WSPMP Sediment Samples, 1994 (mg/Kg, dry weight)

Location: Sample No.:	Lake Chelan 378134	Okanogan River 378139	Soleduck River 368005	Lake Sacajawea 378145	Entiat River 378130
Gravel (%)	0	0	6	1	12
Sand "	20	27	89	72	81
Silt "	72	67	4	24	6
Clay "	8	6	1	3	1
TOC "	1.6	2.0	0.6	1.0	1.0
Zinc	<u>182</u> N	73 N	98 N	60 N	42 N
Chromium	<u>27</u>	<u>35</u>	<u>41</u>	12	17
Copper	29	63	34	16	9.4 B
Nickel	15	<u>23</u>	34	11	8.2 P
Lead	16	6.3	5.6	11	2.3
Arsenic	3.6 N	<u>13</u> N	4.4 N	4.2 N	0.49 NJ
Antimony	3.4 J	3.4 J	3 UJ	3 UJ	3 UJ
Cadmium	<u>0.77</u> P	0.3 U	0.3 U	0.3 U	0.3 U
Beryllium	<u>0.28</u> P	<u>0.45</u> P	<u>0.53</u> P	<u>0.37</u> P	<u>0.14</u> P
Mercury	<u>0.02</u> P	<u>0.02</u> P	<u>0.05</u> P	<u>0.01</u> P	0.01 U
Thallium	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Selenium	0.4 UN	0.4 UN	0.4 UN	0.4 UN	0.4 UN
Silver	0.3 UJ	0.3 UJ	0.3 UJ	0.3 UJ	0.3 UJ

Note: Underlined values exceed Persaud et al. (1993) lowest effects levels: 120 mg/Kg (Zn), 26 mg/Kg (Cr), 16 mg/Kg (Ni), 6 mg/Kg (As), and 0.6 mg/Kg (Cd).

N = spike recovery outside control limits

B = sample concentration less than 10 times procedural blank

P = sample concentration above instrument detection limit but below minimum quantitation limit

J = estimated value

U = not detected at or above reported value (i.e., less than)

Table 3 . Metals Concentrations in WSPMP Whole Largescale Sucker Samples, 1994 (mg/Kg, wet weight)

Location:	Lake Chelan	Okanogan River		Lake Sacajawea	Entiat River		Palouse River
Sample No.:	378135	378140	378141	378146	378131	378132	378143
Zinc	23.6	18.9	18.3	16.1	25.7	35.1	16.5
Copper	0.87 P	0.91 P	0.88 P	0.89 P	0.84 P	0.9 P	0.97 P
Mercury	0.03 P	0.13	0.14	0.08	0.16	0.11	0.18
Selenium	0.31 J	0.43 J	0.40 J	0.25 J	0.27 J	0.23 J	0.20 UJ
Lead	0.34	0.10	0.17	0.10 U	0.29	0.41	0.10 U
Arsenic	0.15 UJ	0.26 J	0.15 UJ	0.18 J	0.15 UJ	0.15 UJ	0.15 UJ
Antimony	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Nickel	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chromium	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Thallium	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Cadmium	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Silver	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Beryllium	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

P = sample concentration was above instrument detection limit but below minimum quantitation limit

J = estimated value

U = not detected at or above reported value (i.e., less than)

Table 4. Metals Concentrations in WSPMP Fish Fillet Samples, 1994 (mg/Kg, wet weight)

Location:	Lake Chelan		Okanogan River	Soleduck River	Lk. Sačajawea	Palouse River
Sample No.:	378136	378137	378142	368006	378147	378144
Species:	Kokanee	Rainbow Trout	Carp	Mountain Whitefish	Channel Catfish	Squawfish
Zinc	10.7	10.5	10.6	8.6	5.9 B	11.2
Copper	1.0 P	2.3 P	0.66 P	0.96 P	1.1 P	1.4 P
Mercury	0.03 P	0.02 P	0.12	0.03 P	0.17	0.47
Selenium	0.24 J	0.24 J	0.69 J	0.29 J	0.20 UJ	0.20 UJ
Chromium	0.5 U	0.8 P	0.5 U	0.5 U	0.5 U	0.5 U
Arsenic	0.15 UJ	0.15 UJ	0.18 J	0.15 UJ	0.15 UJ	0.15 UJ
Antimony	3 U	3 U	3 U	3 U	3 U	3 U
Nickel	1 U	1 U	1 U	1 U	1 U	1 U
Thallium	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ
Cadmium	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Silver	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Lead	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Beryllium	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

B = sample concentration less than 10 times procedural blank

P = sample concentration was above instrument detection limit but below minimum quantitation limit

J = estimated value

U = not detected at or above reported value (i.e., less than)