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TO: Carl Nuechterlein

THROUGH: Bill Yake

FROM: Art Johnson, Dave Serdar, and Stuart Magoon

SUBJECT: First Progress Report on Ecology's Dioxin/Furan Survey in Lake Roosevelt

The Department of Ecology has undertaken an extensive survey of dioxin and furan concentrations in Lake Roosevelt, the Columbia River reservoir behind Grand Coulee Dam. The only known source of contamination is the Celgar bleached Kraft pulp mill in Castlegar, British Columbia, approximately 30 miles above the international border. Field work is being done between May and September 1990; the final report is anticipated in December 1990.

Chemical analysis has been conducted on muscle tissue samples from an initial collection of 80 Lake Roosevelt sportfish during May of this year. Sixteen composite samples from walleye, rainbow trout, lake whitefish, and kokanee - consisting of approximately 40 grams of muscle tissue from each of 5 individual fish - were analyzed for 2,3,7,8-tetrachlorodibenzodioxin (TCDD; commonly referred to as dioxin), and 2,3,7,8-tetrachlorodibenzofuran (TCDF; commonly referred to as furan). Collection sites were in the upper lake at Kettle Falls and lower lake at Seven Bays and the Keller Ferry-Sanpoil River Arm-Spring Canyon area (Figure 1). The fish were caught by electro-shocking or gill net through the generous assistance of the Upper Columbia United Tribes Fisheries Research Center.

We were successful in obtaining our target sample sizes for May except in the upper lake for rainbow trout (4 of 15) and kokanee (0 of 5). We are working to make up this shortfall by the end of the summer (six additional rainbow have since been collected in the Little Dalles below Northport).

Fifteen sturgeon samples were recently obtained in the Marcus Island area with the help of the Department of Wildlife, National Park Service, and University of Idaho. These will be analyzed with the remaining approximately 130 sportfish slated for collection

this year. Preliminary arrangements have also been made to do a laboratory inter-comparison on fish samples recently collected below the Celgar mill by Environment Canada and the B.C. Ministry of Environment.

Other Lake Roosevelt samples that have been collected but await analysis include a series of bottom sediment and fish samples (largescale suckers; to be analyzed whole) between the border and Grand Coulee Dam, as well as one station each in Rufus Woods Lake -the reservoir below Lake Roosevelt - and Long Lake (Spokane River). This survey was done June 26-28. The objective here is to assess attenuation of TCDD/TCDF through the lake and, secondarily, to evaluate the Spokane River as a potential source. These samples have been shipped to the EPA Environmental Research Laboratory in Duluth, Minnesota.

The study plan also calls for obtaining an estimate of TCDD/TCDF loads to the lake. This will be done through collection of suspended matter samples by continuous centrifuge in conjunction with similar work being done by Environment Canada. This is tentatively scheduled for late September.

Results for the May sportfish collection in Lake Roosevelt are summarized in Table 1. TCDD/TCDF concentrations are expressed in terms of parts per trillion (ppt) on a wet weight basis. The samples were analyzed by Triangle Laboratories Inc., Research Triangle Park, North Carolina. The data were reviewed for qualitative and quantitative accuracy by William Luksemburg of Alta Analytical Laboratory, El Dorado Hills, California.

TCDD concentrations in Lake Roosevelt sportfish were low to moderate ranging from undetectable to 2.5 ppt. Walleye consistently had the lowest TCDD levels. TCDF concentrations exceeded TCDD in all samples and ranged from 1.2 ppt to 174 ppt. The high TCDF concentrations were restricted to lake whitefish (120 - 174 ppt). TCDF concentrations in walleye, rainbow, and kokanee were 1.2 - 6.5 ppt, 6.2 - 35.6 ppt, and 63.3 ppt (one sample), respectively. The results appear to be in good agreement with the most recent data reported by the Ministry of Environment (1) for Columbia River sportfish below Celgar (Table 2).

These first Lake Roosevelt data suggest that TCDD/TCDF levels in the lake's sportfish are distinguished from those in fish from the lower Columbia River analyzed by EPA (2) and the Northwest Pulp & Paper Association (3,4) primarily in the high concentrations of TCDF in lake whitefish. The TCDD concentrations do not, at this juncture, appear particularly high. However, relatively few samples have so far been analyzed from Lake Roosevelt, especially the upper reaches. We anticipate submitting a second set of samples for analysis in August and should be able to report these results in a second progress report in October.

These data have been provided to the Washington State Department of Health for their assessment of implications for human health due to ingestion of Lake Roosevelt sportfish.

References:

(1). British Columbia Ministry of Environment. 1990 (draft no. 3). Analysis of preliminary results of dioxin/furan survey of Columbia River fishes. Toxicology Unit, Environmental Protection Division.

(2). Tetra Tech Inc. 1989 (draft). Bioaccumulative pollutants in fish, a national study. for EPA, Office of Marine and Estuarine Protection. Washington, D.C.

(3). Keenan, R.E., A.H. Parsons, E. S. Ebert, P.D. Boardman, S.L. Huntley, and M.M. Sauer. 1990. Assessment of the human health risks related to the presence of dioxins in Columbia River fish. for Northwest Pulp & Paper Assoc. by ChemRisk, Portland, ME.

(4). Beak Consultants Inc. 1989. Columbia River fish study: fish collection, fish tissue sampling, and age of fish sampled. for Northwest Pulp & Paper Assoc.

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Attachments

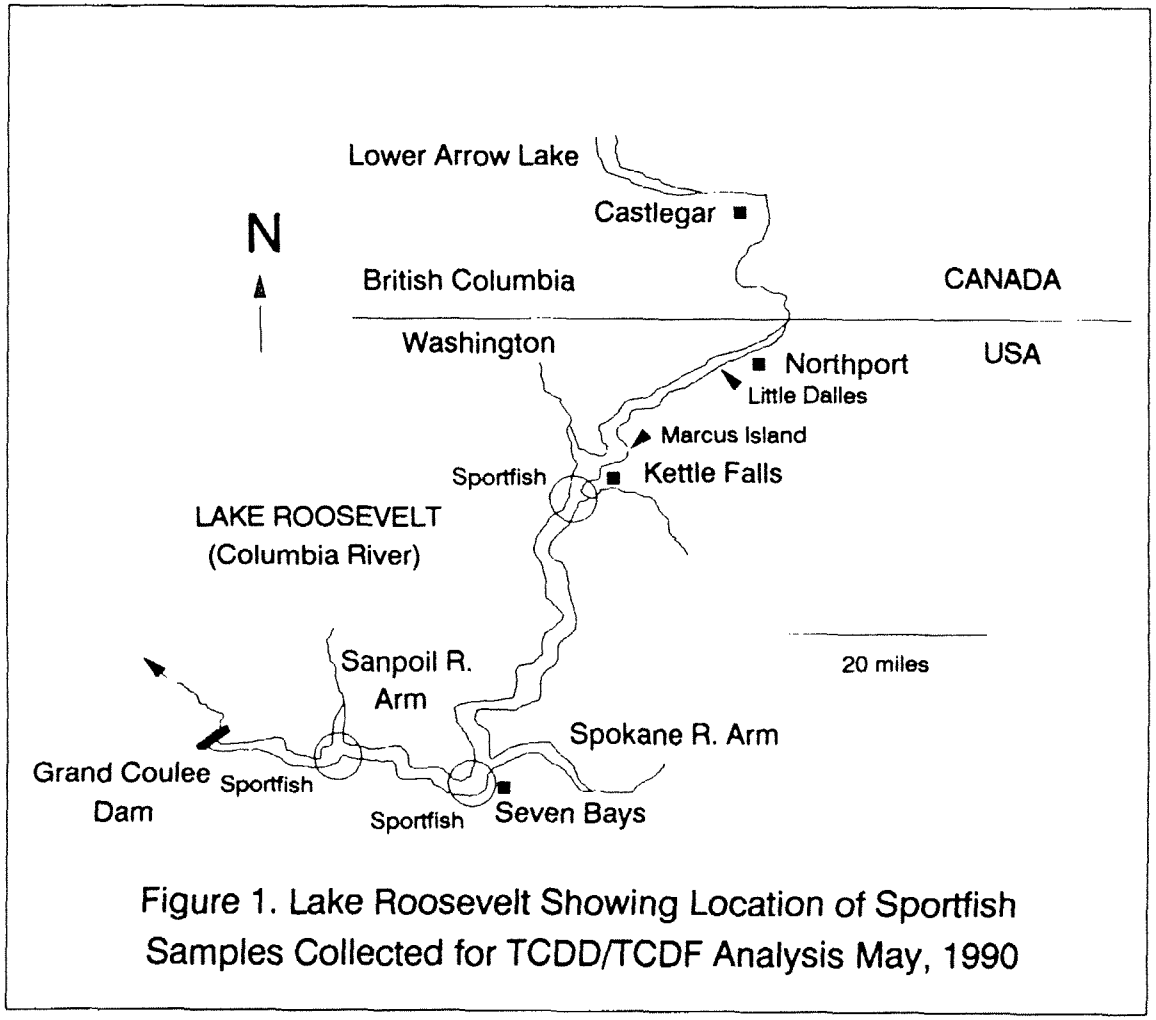

Figure 1. Lake Roosevelt Showing Location of Sportfish Samples Collected for TCDD/TCDF Analysis May, 1990

Table 1. TCDD/TCDF analysis of muscle tissue samples from Lake Roosevelt sportfish collected by Ecology, May 1-10, 1990 (parts per trillion on a wet weight basis; each sample a composite from 5 individual fish)

Sample No. (1882-)	Aproximate Location	Species	Mean Length (mm)	Mean Weight (g)	2,3,7,8-TCDD	2,3,7,8-TCDF	TEQ
		UPPER LAKE ROOSEVELT					
34	Kettle Falls	Walleye	427	693	ND(0.6)	5.5	0.8
34*	" "	"	-	-	ND(0.7)	6.5	1.0
35	" "	"	434	686	0.31	4.1	0.7
36	" "	"	427	678	ND(0.23)	2.8	0.4
						mean =	0.7
43	" "	Lake Whitefish	450	1050	2.1	143	16
43*	" "	" "	-	-	2.5	164	19
44	" "	" "	458	1066	1.9	131	15
45	" "	" "	435	1060	1.9	120	14
						mean =	16
		LOWER LAKE ROOSEVELT					
40	Seven Bays	Walleye	451	788	0.32 EMPC	4.9	0.8
41	" "	"	426	685	0.21 EMPC	2.2	0.4
42	" "	"	428	678	0.15 EMPC	1.2	0.3
						mean =	0.5
37	" "	Lake Whitefish	458	1115	2.3	174	20
38	" "	" "	481	1138	1.5	133	15
39	" "	" "	478	1138	**	**	-
						mean =	18
30	Seven Bays/ Sanpoil Arm	Rainbow Trout	393	816	ND(0.2)	6.2	0.7
31	" "	" "	419	801	0.69 EMPC	35.6	4.2
32	" "	" "	430	798	1.1	9.7	2.1
						mean =	2.3
33	Spring Canyon	Kokanee	421	720	0.88	63.3	7.2

TEQ = 2,3,7,8-TCDD Toxic Equivalents (TCDD+0.1xTCDF)
ND = not detected; detection limit shown in parenthesis
EMPC = estimated maximum possible concentration
*duplicate sample
**results did not meet quality control criteria; sample will be re-analyzed
Note: 1) TCDD data based on DB-5 column; TCDF data based on DB-225 column
2) 1/2 detection limit used to calculate TEQ for samples where TCDD not detected
3) duplicate results averaged before calculating TEQ

Table 2. TCDD/TCDF analysis of muscle tissue samples from Columbia River sportfish collected by B.C. Ministry of Environment November, 1989 (parts per trillion on a wet weight basis; individual fish analyzed)

Location	Species	Weight (g)	2,3,7,8-TCDD	2,3,7,8-TCDF
	COLUMBIA RIVER BELOW CELGAR			
Castlegar Ferry	Walleye	450	ND(8.4)	ND(8.4)
" "	"	625	ND(8.4)	ND(8.4)
Robson Ferry Ramp	Walleye	510	ND(2.0)	10
" " "	"	605	ND(2.0)	13
" " "	"	430	ND(2.0)	13
" " "	"	510	ND(2.0)	31
" " "	"	430	ND(2.0)	16
" " "	"	365	ND(2.0)	26
" " "	Mountain Whitefish*	188	ND(4.0)	170
" " "	Mountain Whitefish	385	ND(3.0)	170
" " "	" "	320	ND(3.0)	125
" " "	" "	205	ND(2.0)	90
" " "	" "	260	ND(2.0)	10
" " "	Rainbow Trout	470	ND(3.0)	34
" " "	" "	830	ND(3.0)	16
" " "	" "	425	ND(3.0)	37
" " "	" "	750	ND(2.0)	40
" " "	" "	645	ND(2.0)	10
" " "	" "	150	ND(2.0)	ND(4.0)
" " "	" "	570	ND(1.0)	ND(8.0)
	COLUMBIA RIVER ABOVE CELGAR			
Lower Arrow Lake	Mountain Whitefish	unknown	ND(5.0)	ND(3.0)

ND = not detected; detection limit shown in parenthesis
*this sample a composite of 2 fish weighing 186 and 190 grams; species most probably whitefish