Reconnaissance Survey of Dioxins and Furans in Dillenbaugh Creek and the Chehalis River near the American Crossarm Site

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Reconnaissance Survey of Dioxins and Furans in Dillenbaugh Creek and the Chehalis River near the American Crossarm Site

by
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WA-23-1020 (Chehalis River)

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Abstract

Sediment and fish from Dillenbaugh Creek, located in Chehalis, Washington, were analyzed for polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDFs) in June 1998 by the Washington State Department of Ecology (Ecology). The analysis was part of a screening-level study to determine if residual PCDD/PCDFs exist in the vicinity of the American Crossarm and Conduit Company (ACC) Superfund site, cleaned up in the late 1980s.

PCDD/PCDF concentrations in sediments downstream of the ACC site were significantly higher than background areas in Dillenbaugh Creek and the Chehalis River. PCDD/PCDFs in sediments in Dillenbaugh Creek near the ACC exceeded guidelines for the protection of aquatic life and wildlife. Sediment concentrations are not a likely concern for human health, with the exception of one area just below the old ACC stormwater lagoon. Downstream transport of PCDD/PCDF-laden sediments into the Chehalis River from Dillenbaugh Creek did not appear to be significant.

PCDD/PCDF concentrations were significantly higher in fish tissue from Dillenbaugh Creek than from the Chehalis River. PCDD/PCDF levels in fish tissue from both Dillenbaugh Creek and the Chehalis River may be a concern for the protection of human health, based on the National Toxics Rule fish tissue criterion and EPA screening values for recreational and subsistence fishers.

As a secondary objective to the study, a screening method for PCDD/PCDFs called the Reporter Gene System (RGS) was evaluated for feasibility of use for future PCDD/PCDF studies. It was found to more accurately screen for PCDD/PCDFs in sediments and fish tissue at higher concentrations, than at the low to moderate concentrations commonly found in the environmental studies conducted by Ecology.

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Laboratory staff for their work in analyzing samples:

- Stuart Magoon, Pam Covey, Bob Carrell, Debbie Lacroix, and other staff from the Ecology/EPA Manchester Environmental Laboratory.
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- Staff from Soil Technology Laboratories.
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Introduction

The American Crossarm and Conduit Company (ACC) operated a wood preserving facility in Chehalis, Washington from the 1930s to 1983. In 1988 the ACC site was added to the U.S. Environmental Protection Agency (EPA) National Priorities (Superfund) List due to chemical contamination from four decades of handling and disposal of wood preservatives. Major contaminants included polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDFs), polycyclic aromatic hydrocarbons (PAHs), and pentachlorophenol (PCP).

Site contamination occurred primarily from the discharge of contaminated process liquids and wastewater, as well as from disposal of contaminated sludges to an on-site landfill. More widespread contamination resulted from flooding, most notably in 1986 when flooding from the Chehalis River spread approximately 10,000 gallons of PCP-diesel mixture to neighboring residences. Nearby Dillenbaugh Creek and wetlands also were contaminated during this flooding event.

Field investigations of the site were conducted by an EPA contractor (Weston Inc.) during 1990-1991 to determine the nature and extent of contamination following the remedial cleanup, which had begun several years earlier. In addition to detecting contaminated soils on the site, Weston found extremely high concentrations, up to 0.8 ng/L (pptr) of PCDD/PCDFs (reported as 2,3,7,8-TCDD toxic equivalents or TEQs), in some Dillenbaugh Creek surface water samples. High PCDD/PCDFs concentrations, up to 0.6 ng/L, were also reported for surface waters from a nearby stormwater lagoon and the Chehalis River downstream of the Newaukum River confluence (Weston, 1992).

The Weston remedial investigation found high concentrations of PCDD/PCDFs, PAHs, and PCP in sediments from Dillenbaugh Creek. A study conducted by the Washington State Department of Ecology (Ecology) (Yake, 1987) in 1986 found PCDD/PCDF concentrations in Dillenbaugh Creek sediments as high as 600 ng/Kg (pptr). Weston also found PCP concentrations in Chehalis River sediments as high as 400 µg/Kg (ppb), but PAH levels were generally much lower (≤ 100 µg/Kg).

Since the cleanup and the Weston remedial investigation, concerns have been raised about residual contamination of the aquatic environment in the area of contamination identified by the Weston study. Transport of soil-bound contaminants could have occurred within Dillenbaugh Creek and the Chehalis River. In this case, contaminants may have concentrated in depositional areas of these waterbodies.

Bioaccumulation of PCDD/PCDFs by fish from Dillenbaugh Creek and the Chehalis River downstream of the ACC site was never addressed in previous studies. The high concentrations of PCDD/PCDFs reported in surface waters and sediments, combined with the tendency of these compounds to accumulate in fish tissues, suggest that fish from the area could potentially contain significant concentrations of PCDD/PCDFs.

Study Goals and Objectives

Based on the above concerns, Ecology's Environmental Assessment Program conducted a screening level survey during June 1998 to meet the following primary objectives:

- Determine if residual levels of PCDD/PCDFs in sediment and fish downstream of the ACC cleanup site were at concentrations of concern to the aquatic environment and human health. This survey was not intended to support a formal assessment of risk to human health.

- Assess the persistence and downstream transport of PCDD/PCDFs in sediments and the need for additional sampling of sediment and fish tissue.

A secondary objective of this study was to assess the use of an alternative screening tool called the Reporter Gene System (RGS) for quantifying PCDD/PCDFs in environmental samples.

Methods

Station Selection

Sediment

Sediment sample locations were selected to represent various conditions: the most contaminated areas found during the 1991 remedial investigation, lesser contaminated areas downstream of the ACC cleanup site in both Dillenbaugh Creek and the Chehalis River, and uncontaminated (background areas) upstream of the ACC site. Chehalis River Station CHEHALS2 and Dillenbaugh Creek Station DILLEN1 are the background stations. Sediment sample locations are shown in Figures 1 and 2. Location descriptions and positions are provided in Appendix A-1.

Wherever possible, sample locations were selected in depositional areas to help gauge the level of transport of contaminants from the ACC site to downstream locations. Some of the sediment samples were collected in approximately the same areas sampled by Weston during the remedial investigation.

Fish Tissue

Fish sampling locations also were selected to represent conditions ranging from contaminated to background. Fish were collected from three locations in the Chehalis River and one location in Dillenbaugh Creek. Chehalis River Station CHEHAL1F is the background station. Fish sampling locations are shown in Figure 3. Location descriptions and positions are also provided in Appendix A-1.

A strategy recommended by EPA for conducting screening level studies for contaminants in fish tissue is to obtain one composite sample each of a bottom-feeding species and a predator species (EPA, 2000a). Largescale suckers and mountain whitefish were selected as the target bottom-feeding and predator species. These two species were also chosen because of their availability of data in recent studies, their tendency to accumulate certain persistent organo-chlorine compounds (Davis et al., 1995; Serdar et al., 1991), and known low-ranging migratory patterns. Hildebrand (1991) found that 70% of both species migrated less than 1 kilometer from locations where they were tagged in the upper Columbia River.

For the Chehalis River, one composite of the target predator species (mountain whitefish - *Prosopium williamsoni*) and two composites of the target bottom-feeder species (largescale sucker - *Catostomus macrocheilus*) were obtained from three sampling locations. For Dillenbaugh Creek, one composite of a predator species (cutthroat trout - *Oncorhynchus clarki*) and a single fish for a bottom-feeder (brown bullhead - *Ameriurus nebulosus*) were obtained from one sampling location.

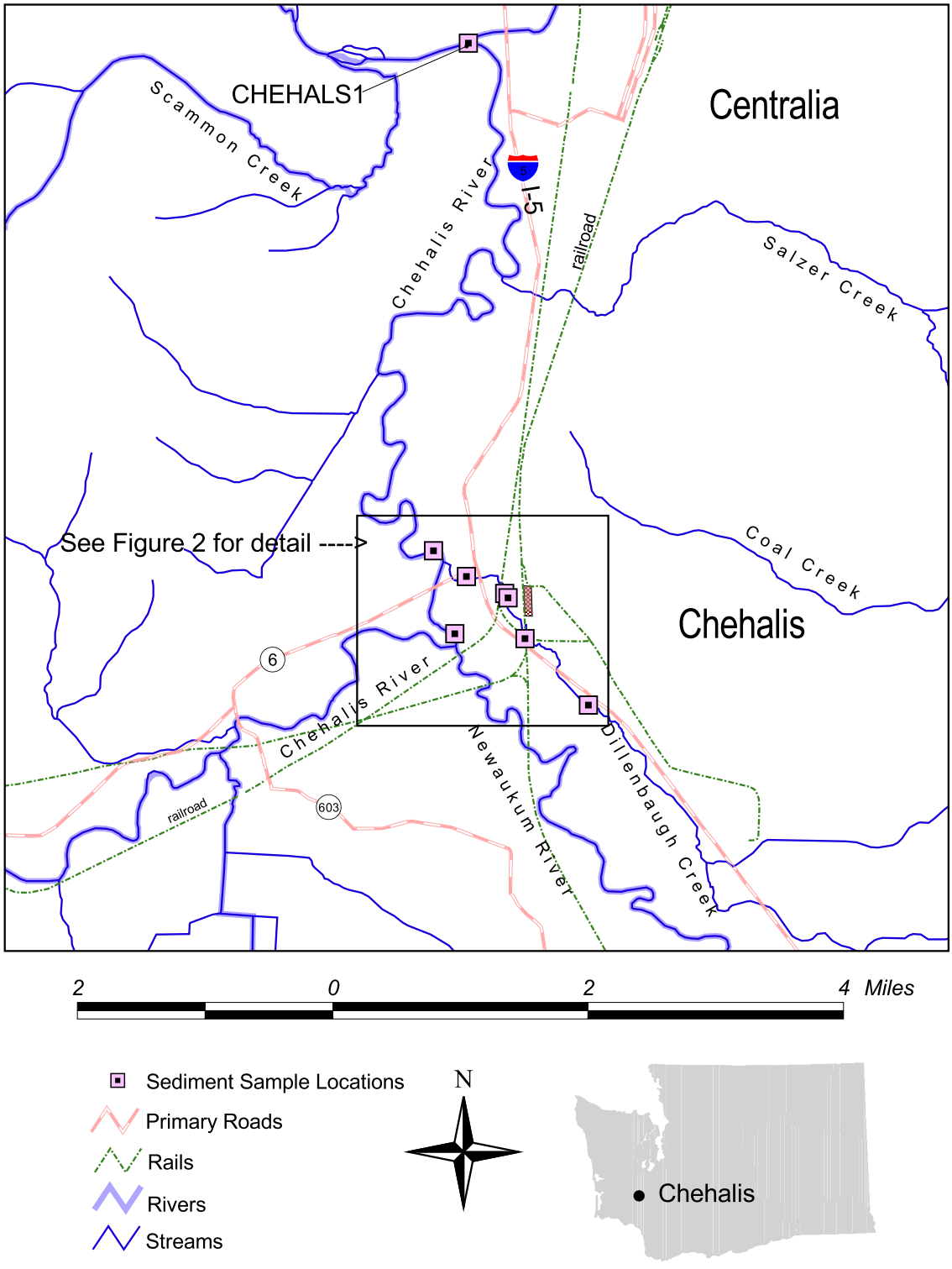

Figure 1. Study Area Showing Sediment Sampling Locations

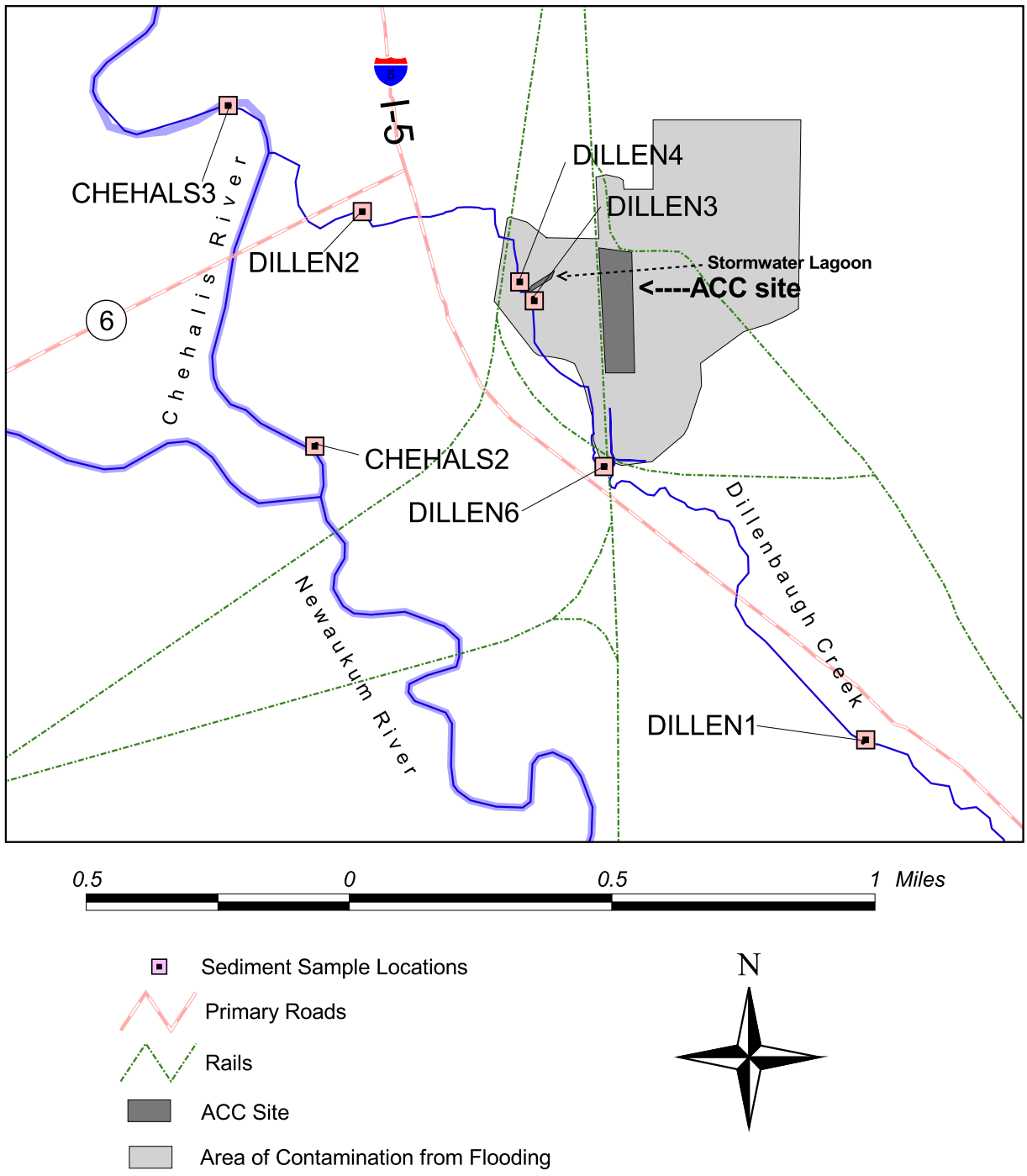

Figure 2. Central Study Area Showing Sediment Sampling Locations

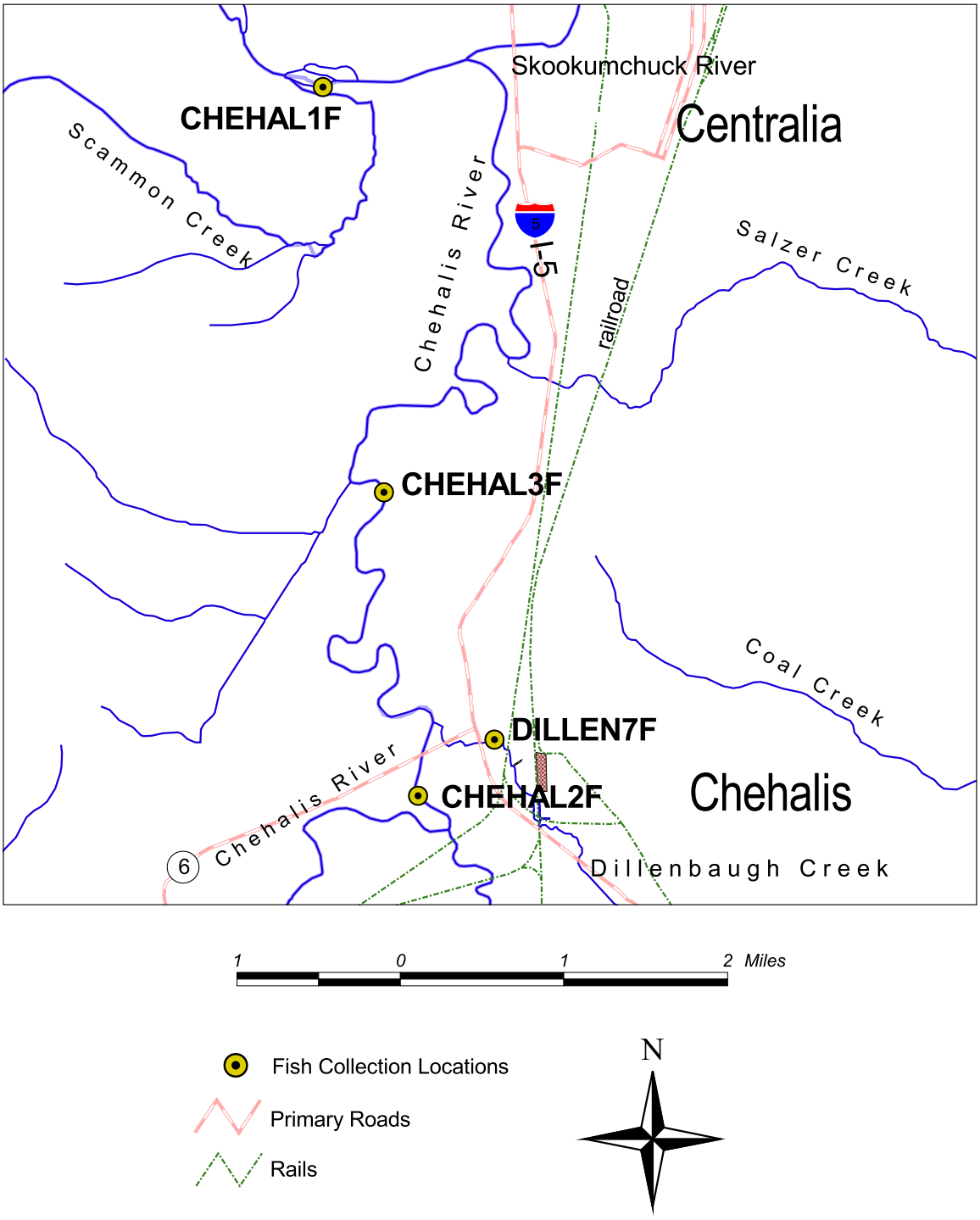

Figure 3. Fish Collection Locations

Sample Collection and Preparation

All sampling equipment was stainless steel and was cleaned prior to sampling by scrubbing with Liquinox® detergent, followed by sequential rinses with hot tap water, deionized water, acetone, and hexane. All equipment was covered with aluminum foil to maintain cleanliness before field use.

Sediment

Sediment samples were collected from the top two centimeters of sediment using either a 0.02 m^2 or a 0.05 m^2 Ponar grab sampling device, a 4-inch diameter pipe dredge, or by spooning sediments directly off of the stream bottom. At least three grabs were collected at each location, composited, then homogenized by stirring with a stainless steel spoon. Sediment collection information is presented in Appendix A-2. Sediment was placed into amber glass jars cleaned for trace organics analysis. Samples were then labeled and placed in an ice cooler and later refrigerated at 4° C.

Fish Tissue

Fish were collected by backpack electrofishing or from a 16-ft Smith-Root electrofishing boat.

In the field, desired specimens were killed by a sharp blow to the head, assigned a sample number, measured, weighed, double-wrapped in aluminum foil, placed in zip-loc polyethylene bags, and put in iced coolers. Fish were transferred to a freezer at Ecology's Lacey lab upon returning from the field.

All but one fish tissue sample were composites consisting of three to five individual fish. One sample from Dillenbaugh Creek consisted of a single brown bullhead, because additional fish from this reach could not be found. Fish tissue sample information is presented in Appendix A-3.

Fish samples were processed for analysis at Ecology's Lacey lab. Mountain whitefish and cutthroat trout were de-scaled and then both sides filleted from the gill arch to the caudal peduncle with the skin on. Samples from the largescale suckers and brown bullheads consisted of whole fish. The entire frozen fish were cut into rounds several centimeters thick and then chopped into cubes small enough to be placed into a commercial meat grinder.

Individual and composite fish tissue samples were homogenized by three passes through a pre-cleaned Kitchen Aide® grinder. Ground tissue was thoroughly mixed after each pass through the grinder. All equipment used for tissue preparation was decontaminated as described above prior to processing each sample. Prepared fish tissue samples were placed in organics-free glass jars for transport to the laboratory for analysis.

Laboratory Procedures

Table 1 is a summary of analytical methods and reporting limits. Analysis of sediment and fish tissue for 2,3,7,8-substituted PCDD/PCDF congeners and percent lipids was performed by Triangle Laboratories Inc., Durham, North Carolina. The organics screen (hydrocarbon identification) and total organic carbon (TOC) for sediments was conducted at the Ecology/EPA Manchester Environmental Laboratory, Manchester, Washington. Grain size fraction analysis was performed by Soil Technology Laboratories, Bainbridge Island, Washington. Triangle, Manchester, and Soil Technology laboratories all conducted a percent solids analysis for sediments; however, only the percent solids results obtained by Triangle (as part of method 1613b) are reported here.

Table 1. Analytical Methods, Reporting Limits, and Laboratories

Parameter	Reporting Limit	Method	Laboratory
2,3,7,8-PCDD/PCDFs	0.1 ng/Kg (pptr)	HRGC/MS - EPA 1613b, 1997	Triangle
2,3,7,8-PCDD/PCDFs	Fish Tissue: 240 pg/g lipid (pptr) Sediment: 13 pg/g	P450 RGS - EPA 4425	Columbia Analytical
Organics Screen	50 µg/Kg (ppb)	Capillary GC/FID and GC/ITD	Manchester
Grain Size*	0.1%	Sieve & Pipet - PSEP, 1986	Soil Technology
TOC	0.1%	Combustion/CO_2 - PSEP, 1986	Manchester
% Solids	0.1%	Gravimetric - EPA 1613b (section 11.2.2), 1997	Triangle
% Lipids	0.1%	Gravimetric - EPA 1613b, 1997	Triangle

* Gravel, sand, silt, and clay fractions

Columbia Analytical Services (CAS) performed the P450 RGS analysis on the sediment and fish tissue samples. Methods used by CAS in 1998 were APHA Standard Method 8070/ASTM E1853-96. Current methods used are EPA 4425, ASTM E 1853M-98, and APHA Standard Method 8070.

A schematic of the P450 RGS method is shown in Figure 4. The method was developed by combining the firefly luciferase gene with the human CYP1A1 gene and then integrating the modified gene into the human liver cell HepG2, thus creating a new cell line called the 101L cell. When cancer-causing organics like PCDD/PCDFs, coplanar PCBs, and some PAHs

are introduced to the cell, a series of chemical reactions induce the production of the luminescent enzyme, luciferase. The intensity of the light is then measured by an illuminometer, and the results are reported as benzo(a)pyrene (B[a]P) and dioxin (TEQ) equivalents. TEQ equivalents include the sum of PCDD/PCDFs and coplanar PCB concentrations (Anderson, personal communication).

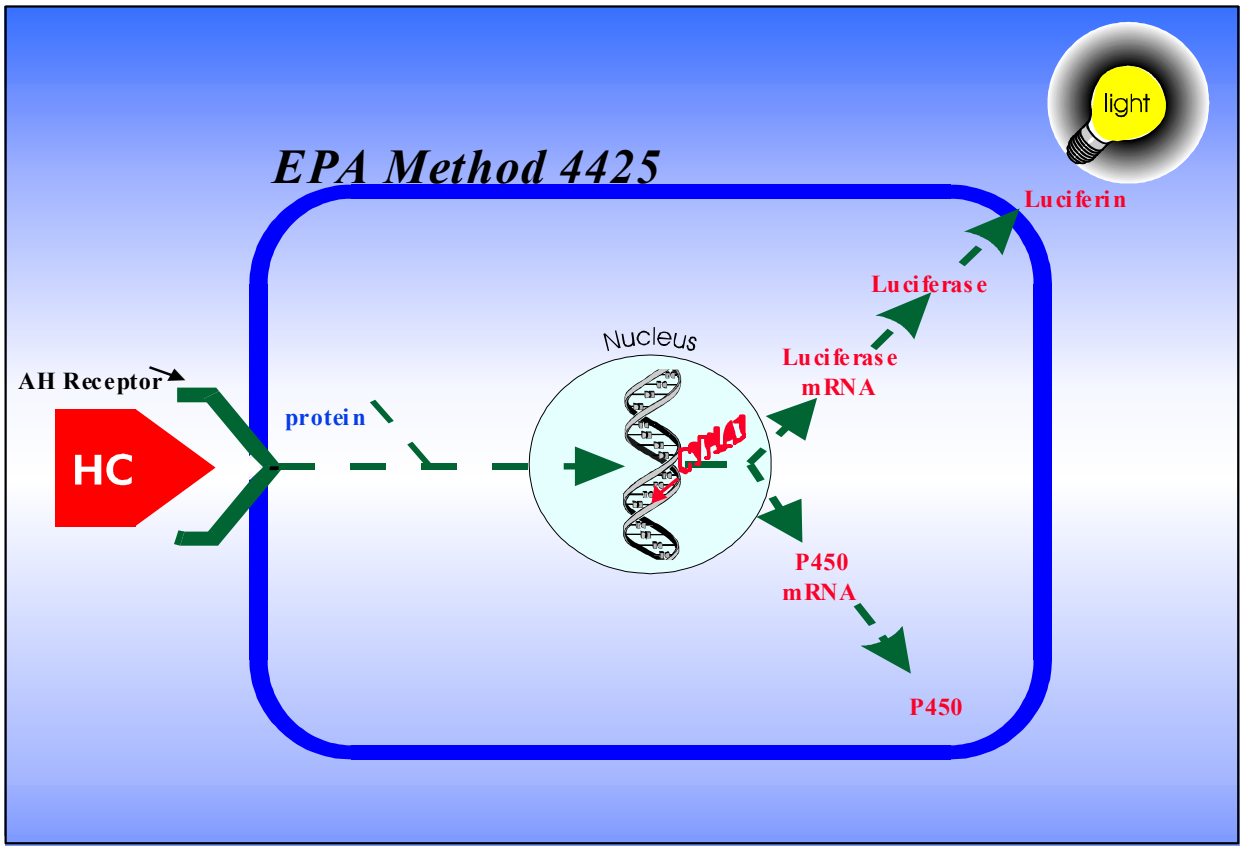

Figure 4. P450 Reporter Gene System Method (courtesy of Columbia Analytical Services)

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Data Quality

Triangle Laboratory Inc. transmitted their results and data review for the PCDD/PCDF analysis directly to Manchester Laboratory for review by Stuart Magoon, an organic chemist and director of the laboratory. All data were deemed acceptable for use as amended by Manchester Laboratory. Amendments by Manchester Laboratory included the assignment of an Estimated Maximum Possible Concentration (EMPC) for some results and the assignment of data qualifiers to some results. Details of the quality assurance reviews are found in Appendix B.

The rapid organics screen analyses (hydrocarbon identification), TOC, and grain size analyses results were considered acceptable for use as reported. All of the TOC data, with the exception of one sample, were qualified as estimates ("J") due to concerns about sample containers which broke when frozen. Results were based on a temperature of 70° C.

Precision and Accuracy

One sediment and one fish tissue sample were sent to the lab as duplicate samples and analyzed for PCDD/PCDFs. The sediment sample was a replicate sample taken from station DILLEN4. The fish tissue sample was created by splitting the processed composite sample from station CHEHALF3 into two containers. The results of these duplicate samples are compared in Appendix C-1. All results for these samples were within target limits described in the Quality Assurance (QA) Project Plan for this project (Serdar, 1998).

Precision for PCDD/PCDFs, defined as relative percent difference (RPD), ranged from 0% to 32% (with an average of 10%) for sediments, and from 0% to 105% (with an average of 29%) for fish tissue. For fish tissue, non-detected PCDD/PCDFs were not used to calculate the average RPD values. The average values for sediments and fish tissue were within target limits ($\leq$ 40%). Isotope recoveries for the PCDD/PCDFs analysis were well within method control limits stated in the QA Project Plan, thus representing an acceptable level of accuracy for the results.

TOC and percent solids for the sediment sample had RPDs of 5% and 20%, respectively. The RPD for percent lipids was 6%. The RPDs for grain size fractions were all less than 29%, with the exception of 200% RPD for gravel derived from the values 0% and 1%.

TEQ Calculation

Values of PCDD/PCDFs for the 1986 (Ecology), 1991 (Weston), and present (1998, Ecology) studies are reported as toxic equivalent (TEQ) in ng/Kg (pptr) dry weight, except for fish tissue results from the present study which are reported as TEQ in ng/Kg wet weight.

The PCDD/PCDF congeners that are considered toxic have different levels of toxicity as compared to congener 2,3,7,8,-TCDD, the most toxic form. In order to simplify assessment of

various risks to human and environmental health, PCDD/PCDF congener concentrations are converted to equivalent concentrations of 2,3,7,8,-TCDD using congener-specific toxicity equivalency factors (TEFs). The TEQs were calculated for the three different studies using the "International TEFs/88" which were developed through a North Atlantic Treaty Organization committee (Barnes et al, 1989). However, the EPA Office of Research and Development is currently in the process of re-evaluating TEF values. During the interim, EPA is using TEFs developed in 1998 to calculate TEQs for risk assessments to humans and wildlife (Van den Berg et al, 1998). Both sets of TEFs are shown in Appendix C-2.

The EMPC results and other results qualified as estimates ("J") were used to calculate TEQs for the present study. Non-detected dioxin/furan congeners were assigned half the detection limit value to calculate the TEQs used for reporting purposes. TEQs were also calculated using the Van den Berg-1998 TEFs and non-detects at either full or half detection limit to see if there were any major differences in TEQ values using different calculation methods. These TEQ values are shown in Appendix C-3. The differences between TEQ values were found to be minor and do not change the conclusions of the study.

Results

Conventional Sediment Analysis

Sediment grain size, percent solids, and TOC are summarized in Table 2 and Appendix D-1. Figure 5 shows grain size fraction percentages from the most upstream station (DILLEN1) to the Chehalis River stations. Sediment samples from the Chehalis River were mostly sand, while Dillenbaugh Creek sediment samples were mostly silt and clay with a higher TOC content than Chehalis River samples. The higher TOC may be due to the presence of reeds, grass, and other organic matter noted in some of the Dillenbaugh Creek sediment samples.

Table 2. Sediment Sample Grain Size, Percent Solids, and TOC Content

Station Name	Lab ID No.	% solids	% TOC (70° C)	Grain Size (%)			
				Gravel ≥ 2000µm	Sand < 2000µm- 62µm	Silt < 62µm- 3.9µm	Clay < 3.9 µm
CHEHALS1	98238080	50.8	1.5 J	0	73	23	4
CHEHALS2	98238081	48.4	1.4 J	0	65	28	7
CHEHALS3	98238082	49.1	1.4 J	0	69	26	5
DILLEN1	98238083	26.7	5.0 J	5	25	51	19
DILLEN2	98238084	39.9	4.4 J	1	67	22	10
DILLEN3	98238085	19.6	7.1 J	4	41	38	17
DILLEN4*	98238086/7	22.7	7.0 J	1	11	62	28
DILLEN6	98238088	24.5	6.8	5	18	61	16

* Mean of replicate samples 98238086 and 98238087; the most conservative qualifier is reported here

J Analyte was positively identified and the associated numerical result is an estimate

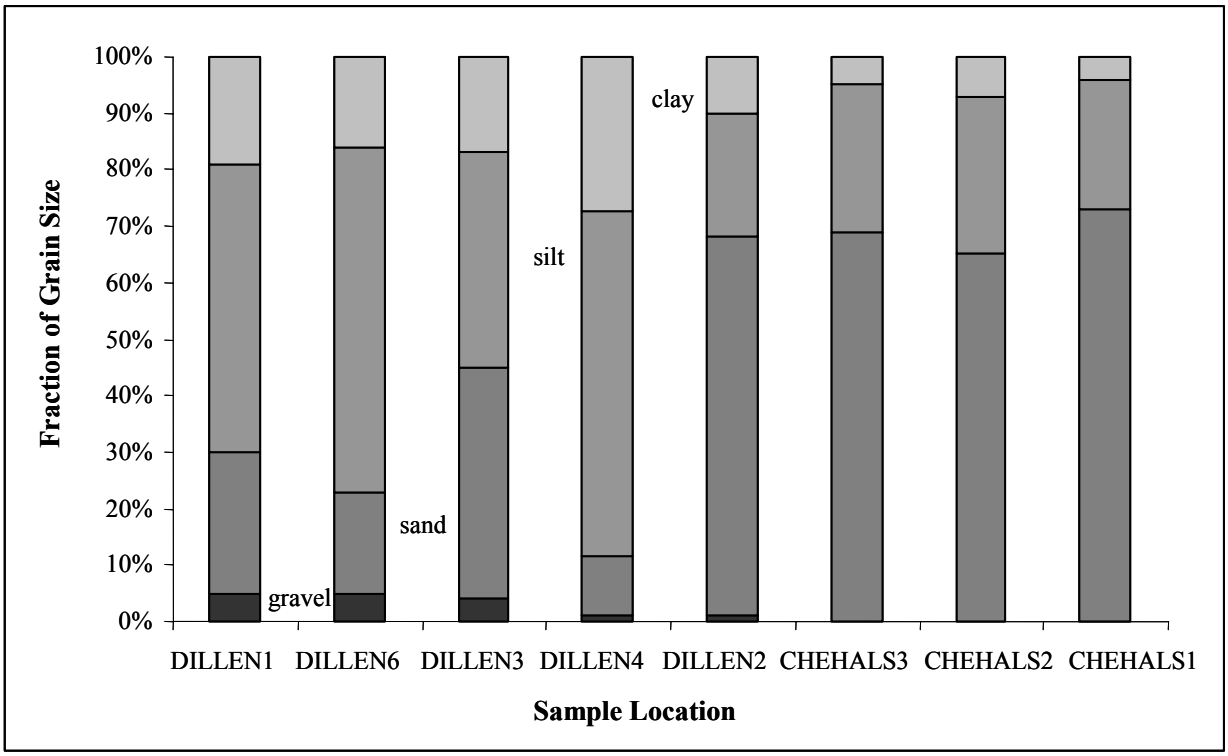

Figure 5. Grain Size Characteristics of Sediment Samples

PCDD/PCDF Concentrations in Sediment

PCDD/PCDF sediment concentrations are shown in Table 3 and Appendix D-1. Target compounds were detected at all locations but varied widely, with TEQ concentrations ranging from 0.8 to 1156 ng/Kg dw. The three locations in the Chehalis River and the background station (upstream of ACC) for Dillenbaugh Creek (DILLEN1) all contained TEQ concentrations ≤ 8.2 ng/Kg dw. The two Dillenbaugh Creek stations located within the known area of contamination and downstream of the stormwater lagoon (DILLEN2 and DILLEN4) were up to three orders of magnitude higher (369 and 1156 ng/Kg dw) than the Chehalis and Dillenbaugh background stations. The DILLEN3 station, located within the contaminated area, but upstream of the stormwater lagoon, was 11.8 ng/Kg dw.

The TEQ values for the majority of the samples, especially those with higher TEQs, were influenced largely by the dioxin congeners 1,2,3,6,7,8-HxCDD, 1,2,3,4,6,7,8-HpCDD, and OCCD.

Table 3. PCDD/PCDF Concentrations in Dillenbaugh Creek and Chehalis River Sediments (ng/Kg dry weight basis)

		Station Name and Lab ID Number							
Compound	TEF	CHEHALS1 98238080	CHEHALS2 98238081	CHEHALS3 98238082	DILLEN1 98238083	DILLEN2 98238084	DILLEN3 98238085	DILLEN4* 98238086/87	DILLEN6 98238088
2,3,7,8-TCDD	1	0.28 J	0.2 U	0.3 J	0.51 J	1.3	0.53 J	1.9	0.6 U
1,2,3,7,8-PeCDD	0.5	0.5 J	0.3 NJ	0.88 J	1.2 J	19.2	1.6 J	41.9	1.9 J
1,2,3,4,7,8-HxCDD	0.1	0.53 J	0.37 J	1.3 J	2.2 J	72.5	2.8 J	147.5	3.1 J
1,2,3,6,7,8-HxCDD	0.1	2.2 J	0.8 UJ	9	8.7	700	12.4	2865 J	15.4
1,2,3,7,8,9-HxCDD	0.1	1.9 J	1.2 UJ	3.9 J	5.6 J	159	7.8 J	362	10.8
1,2,3,4,6,7,8-HpCDD	0.01	31.5	6.8	171	164	11340 J	256	39370 J	542
OCDD	0.001	216	46.7	1190	1260	67800 J	2210	168810 J	5080 J
2,3,7,8-TCDF	0.1	0.68	0.7 U	0.92	1.7	5.4	3.3	25.05	3.8
1,2,3,7,8-PeCDF	0.05	0.46	0.35	0.6 NJ	1.2 J	18.4	1.6 J	87.5	2 NJ
2,3,4,7,8-PeCDF	0.5	0.55 UJ	0.46 UJ	0.8 NJ	1.6 J	21.4	2.4 J	84.8	5.8
1,2,3,4,7,8-HxCDF	0.1	1.3 UJ	0.8 UJ	3.2 UJ	3.6	142	4.7 J	493.5	7.9
1,2,3,6,7,8-HxCDF	0.1	0.53 UJ	0.36 UJ	1.3 UJ	1.9	49.8	2.2 UJ	178.5	3.1 J
2,3,4,6,7,8-HxCDF	0.1	0.68	0.3 NJ	2.3	3.2	128	3.9 J	443	7.2
1,2,3,7,8,9-HxCDF	0.1	0.2 U	0.2 U	0.41	0.5 NJ	22.3 J	1.6 J	44.6 J	47.5
1,2,3,4,6,7,8-HpCDF	0.01	9.4	1.7 UJ	59.6	42.1	2610 J	47.2	5215 J	63.4
1,2,3,4,7,8,9-HpCDF	0.01	0.63	0.24	3.5	2.7 J	165	3 J	394	3.7 J
OCDF	0.001	29.2	3 J	201	130	9600 J	112	11815 J	135
TEQ		**2.1**	**0.8**	**6.9**	**8.2**	**369.0**	**11.8**	**1156.0**	**25.4**
% 2,3,7,8 TCDD		12%	17%	4%	6%	<1%	4%	<1%	2%
% PCDDs		67%	58%	71%	69%	77%	71%	80%	58%
% PCDFs		33%	42%	29%	31%	23%	29%	20%	42%

* Mean of replicate samples 98238086 and 98238087; the most conservative qualifier is reported her

TEF Toxicity equivalency factor (Barnes, 1989)

TEQ 2,3,7,8-TCDD toxicity equivalent

J Analyte was positively identified and the associated numerical result is an estimate

NJ There is evidence that the analyte is present and the associated numerical result is an estimate

U Analyte was not detected at or above the reported result

UJ Analyte was not detected at or above the reported estimated result

Background and Far-field Concentrations

Stations DILLEN1 and CHEHALS2 were considered the background stations for the present 1998 study, because they are located upstream of the ACC area of contamination. DILLEN1 had a higher TEQ than CHEHALS2 (8.2 vs 0.8 ng/Kg dw). However, DILLEN1 had a greater proportion of finer grained sediment (< 62µm) and a higher TOC value. After normalizing the TEQ concentrations to TOC and percent fines for both samples, the TEQ concentrations were much closer in value (234 vs 163 ng/Kg OC).

Concentrations of PCDD/PCDFs in the Chehalis River downstream of its confluence with Dillenbaugh Creek were low, comparable to levels found at the background stations. Station CHEHALS3, 0.2 river miles downstream of the Dillenbaugh confluence, had a TEQ of 7.1 ng/Kg dw. Farther downstream of the Dillenbaugh confluence (8.6 river miles) at station CHEHALS1, the TEQ was 2.3 ng/Kg dw. While transport of contaminated sediments from Dillenbaugh Creek to the Chehalis River may seem minimal given these concentrations, other factors such as TOC, grain size distribution, and dilution of contaminated sediments by upstream "clean" sediments may be influencing these lower concentrations.

Studies conducted by Ecology in 1999 showed average background PCDD/PCDF TEQ levels in various surface soil types (agricultural, urban, open, and forestland) throughout Washington State ranging from 0.14 to 4.1 ng/Kg dw (Rogowski et al., 1999; Rogowski and Yake, 1999). These levels are comparable to background sediment concentrations for the present study, although there are some likely differences in comparing non-aquatic soils to aquatic sediments.

Hydrocarbon Identification in Sediments

Sediment from stations CHEHALS3, DILLEN4, and DILLEN6 was screened for hydrocarbons to determine if residual amounts of polycyclic aromatic hydrocarbons (PAHs) and pentachlorophenol (PCP) remain in sediments. The 1991 remedial investigation conducted by Weston found high concentrations of PAHs and PCP in sediments. The hydrocarbon screening analysis is considered to be qualitative; therefore, the associated numerical results are considered to be estimates. The laboratory case narrative is presented in Appendix B.

No hydrocarbons were found in sediments from station CHEHALS3. Heavily weathered #2 diesel was found at both DILLEN4 (250 mg/Kg [ppm] ww) and DILLEN6 (700 mg/Kg ww). DILLEN6 also contained phenanthrene (9 ug/Kg [ppb] ww), fluoranthene (39 ug/Kg ww), pyrene (25 ug/Kg ww), and chrysene (13 ug/Kg ww), as well as small amounts of several alkyl substituted PAH compounds and PCP. These results are consistent with the PCDD/PCDF findings in that low contaminant levels were found at CHEHALS3 and higher contaminant levels were found at DILLEN4 and DILLEN6. The heavily weathered #2 diesel and PCP found at the Dillenbaugh Creek stations may be a result of the PCP-diesel mixture contamination from the 1986 flooding.

PCDD/PCDF Concentrations in Fish Tissue

Table 4 shows results for PCDD/PCDF concentrations and percent lipids in fish tissue samples. Results are also listed in Appendix D-1. PCDD/PCDFs were detected in all fish tissue samples. Concentrations in fish from Dillenbaugh Creek (DILLEN7F) were 5 to 12 times higher than in fish from the Chehalis River. DILLEN7F is located near the PCDD/PCDF enriched DILLEN2 sediments, while fish from the Chehalis River appear to reflect the much less contaminated Chehalis River sediments.

It does not appear that species differences or lipid content of samples account for the differences in TEQ concentrations among sites. The lowest concentrations are in mountain whitefish and largescale suckers, two species known to accumulate appreciable levels of hydrophobic organic chemicals (Davis et al., 1995; Ecology, 1995). Little is known about PCDD/PCDF accumulation by cutthroat trout and brown bullhead, although feeding habits are probably similar to mountain whitefish and largescale suckers, respectively. Differences in PCDD/PCDF TEQs remain when concentrations are normalized to lipid content.

A review of background PCDD/PCDF concentrations in fish tissue from Washington State and the United States (Table 5) suggests that concentrations from the Chehalis River (mountain whitefish and largescale sucker) are similar to locations unaffected by point-source discharges. Tissue concentrations from Dillenbaugh Creek (cutthroat trout and brown bullhead) are an order of magnitude higher than background concentrations.

Table 4. PCDD/PCDF Concentrations in Fish Tissue (ng/Kg wet weight basis)

		Station Name, Lab ID Number, and Fish Species									
		DILLEN7F		DILLEN7F		CHEHAL1F		CHEHAL2F		CHEHAL3F*	
		98238090		98238091		98238092		98238093		98238094/5	
Compound	TEF	Cutthroat Trout skin on fillet		Brown Bullhead whole body		Mt Whitefish skin on fillet		Lgscale Sucker whole body		Lgscale Sucker whole body	
% lipids		1.7	%	3.2	%	5.4	%	1.8	%	2	%
2,3,7,8-TCDD	1	0.26	J	0.48	J	0.17	J	0.29	J	0.095	NJ
1,2,3,7,8-PeCDD	0.5	1.3	J	2	J	0.23	J	0.29	J	0.115	NJ
1,2,3,4,7,8-HxCDD	0.1	0.7	NJ	1.6	J	0.1	U	0.19	J	0.1	U
1,2,3,6,7,8-HxCDD	0.1	7.9		14.3		0.35	J	0.1	U	0.535	NJ
1,2,3,7,8,9-HxCDD	0.1	0.7	J	1.1	NJ	0.1	U	0.1	U	0.1	U
1,2,3,4,6,7,8-HpCDD	0.01	8.3		14.5		0.41	NJ	0.68	J	1.9	J
OCDD	0.001	8.9		16.3		1.9	J	5.3		10.45	
2,3,7,8-TCDF	0.1	0.65		0.71		0.7		0.42	J	0.315	J
1,2,3,7,8-PeCDF	0.05	0.43	J	0.8	J	0.08	J	0.06	U	0.06	U
2,3,4,7,8-PeCDF	0.5	0.87	J	1.4	J	0.15	NJ	0.07	U	0.145	NJ
1,2,3,4,7,8-HxCDF	0.1	0.78	J	1.5	J	0.08	J	0.07	U	0.065	U
1,2,3,6,7,8-HxCDF	0.1	0.33	J	0.6	NJ	0.05	U	0.06	U	0.065	U
2,3,4,6,7,8-HxCDF	0.1	0.5	NJ	0.99	J	0.09	NJ	0.09	U	0.08	NJ
1,2,3,7,8,9-HxCDF	0.1	0.1	U	0.2	U	0.06	U	0.1	U	0.08	U
1,2,3,4,6,7,8-HpCDF	0.01	1.5	J	2.1	J	0.06	U	0.1	U	0.5	NJ
1,2,3,4,7,8,9-HpCDF	0.01	0.2	U	0.3	U	0.08	U	0.2	U	0.1	U
OCDF	0.001	0.93	J	1.9	J	0.1	U	0.4	U	1.5	J
TEQ		**2.64**		**4.50**		**0.51**		**0.55**		**0.38**	
% 2,3,7,8 TCDD		10%		11%		32%		48%		24%	
% PCDDs		73%		74%		66%		81%		64%	
% PCDFs		27%		26%		34%		19%		36%	
TEQ-lipid		155		141		9		31		19	

* Mean of duplicate (split) samples 98239094 and 98239095; the most conservative qualifier is reported here
TEF Toxicity equivalency factor (Barnes, 1989)
TEQ 2,3,7,8-TCDD toxicity equivalent
J Analyte was positively identified and the associated numerical result is an estimate
NJ There is evidence that the analyte is present and the associated numerical result is an estimate
U Analyte was not detected at or above the reported result
UJ Analyte was not detected at or above the reported estimated result

Table 5. Background PCDD/PCDF Levels in Fish Tissue (TEQ ng/Kg ww)

Location	Species	Feeding Habit	Muscle Fillet	Whole Fish
Nationwide - Pristine[a,b]	various	Predator	0.02	--
"	"	Bottom	--	0.39
Nationwide - Non-Pristine[a,b]	"	Predator	0.74	--
"	"	Bottom	--	0.55
Columbia River Fishing Areas, WA[c,d]	Largescale Sucker	Bottom	--	0.33
"	Mountain Whitefish	Predator	0.85	--
"	Channel Catfish	Bottom	--	2
"	Salmonids	Predator	0.24	--
Columbia River, WA[e]	various	Predator	0.2	--
Lake Wenatchee, WA[e]	"	Predator	0.1	--
Slocan River, Canada[f]	Mountain Whitefish	Predator	0.29	--

-- Data not available

a EPA, National Study of Chemical Residues in Fish, 1992. TEQs calculated using Barnes-1989 TEFs and non-detects (ND) = 0; Octadioxin/furans were not analyzed for.

b Pristine background defined as areas with minimal point/non-point source influence. Non-Pristine Background defined as areas with some point/non-point source influence.

c EPA, Columbia River Basin Fish Contaminant Survey, 2000b. TEQs calculated using Van den Berg-1998 TEFs and ND = detection limits (DL).

d The areas where fish were collected for this study were not intended to represent general background dioxin concentrations, but may be indicative of background concentrations in the Washington portion of the Columbia River as the Columbia River is influenced by industry and other sources of dioxins.

e Serdar et al., 1991. Washington State Department of Ecology, Polychlorinated Dioxins and Furans in Columbia River Sportfish. TEQs calculated using Barnes-1989 TEFs and ND = 1/2 DL

f Department of Fisheries and Oceans (DFO), Dioxin and Furan Data on Muscle Tissue of Rocky Mountain Whitefish from the Columbia River, 1992. TEQs calculated using Barnes-1989 TEFs and ND = 1/2 DL.

P450 Reporter Gene System

A comparison of sediment and fish tissue PCDD/PCDF results for the P450 RGS assay and EPA 1613b analysis are shown in Table 6. The P450 results range from one to two orders of magnitude difference from the EPA 1613b results, although the results are closer on the high end of the concentration range.

Background levels of CYP1A1-inducing compounds, including some PAHs, may have been picked up as part of the dioxin quantification and caused a higher response than due solely to dioxin-like compounds. The CAS method used in 1998 did not include cleanup of PAHs. Current P450 RGS methods include a vigorous PAH cleanup method for isolating dioxin-like compounds (Anderson, personal communication).

Table 6. Comparison of PCDD/PCDF Results from P450 RGS Assay and EPA 1613b Methods

	Station Name and Laboratory ID Number for Sediment							
	CHEHALS1	CHEHALS2	CHEHALS3	DILLEN1	DILLEN2	DILLEN3	DILLEN4	DILLEN6
Method	98238080	98238081	98238082	98238083	98238084	98238085	98238086	98238088
P450 RGS TEQ pptr dw	300	200	200	400	600	600	1800	900
EPA 1613b TEQ pptr dw	2	1	7	8	369	12	1164	25
RPD	200%	200%	190%	190%	50%	190%	40%	190%

	Station Name and Laboratory ID Number for Fish Tissue				
	DILLEN7F	DILLEN7F	CHEHAL1F	CHEHAL2F	CHEHAL3F
	98238090	98238091	98238092	98238093	98238094
Method	Cutthroat Trout	Brown Bullhead	Mountain Whitefish	Largescale Sucker	Largescale Sucker
P450 RGS TEQ pptr lipid	400	300	100	200	200
EPA 1613b TEQ pptr lipid*	155	141	9	31	17
RPD	90%	70%	170%	150%	170%

* Values were normalized to percent lipids for comparison with P450 RGS values
RPD Relative percent difference

Discussion

Comparison of Sediment Results to Previous Studies

Figure 6 displays PCDD/PCDF sediment concentrations (TEQs) from the 1986 (Ecology), 1991 (Weston), and present (1998, Ecology) studies. Results for conventional analysis and TEQ concentrations for the 1986 and 1991 studies are shown in Appendix D-2.

PCDD/PCDF concentrations for the 1986 and 1991 studies followed a similar pattern as the 1998 study, with concentrations generally being higher near the ACC area of contamination identified by the 1991 study. The highest PCDD/PCDF levels in Dillenbaugh Creek for all three studies were located just downstream of the old stormwater lagoon.

The 1986 and 1998 Ecology results are generally higher than those found during the 1991 study. Due to their sampling techniques, the 1991 study probably underestimated PCDD/PCDF sediment concentrations. The Ecology sediment samples were collected from the top two centimeters of the substrate, whereas Weston reported sampling to a depth of 5 to 10 inches (about 12 to 25 centimeters). The technique used by Weston may have included a large fraction of deeper sediment that had not been contaminated by ACC. The fraction of deeper uncontaminated sediment would act to dilute the contaminated layer (presumably the upper several centimeters) and thus yield a smaller TEQ concentration.

Other potential explanations are related to environmental factors. Differences in PCDD/PCDF sediment concentrations between the studies may be due to contaminated stormwater lagoon sediments continuing to make their way downstream in significant quantities. Spatial variation in contaminant concentration may be due to the effects of sediment grain size and TOC. Depositional and erosional (scouring) processes over time and in relation to the contamination events may also contribute to spatial variation.

PCDD/PCDF Concentrations in Comparison to Sediment Quality Guidelines

The 1998 PCDD/PCDF data were compared to various sediment quality guidelines from other sources to determine if residual levels of PCDD/PCDFs in sediments near the ACC cleanup site are of concern. Table 7 shows a comparison between PCDD/PCDF sediment concentrations from the present study and various sediment quality guidelines. These guidelines range from highly conservative to less conservative for the protection of aquatic life, wildlife, and human health. Currently there are no Washington State standards or EPA national criteria for chemical contaminants in freshwater sediments.

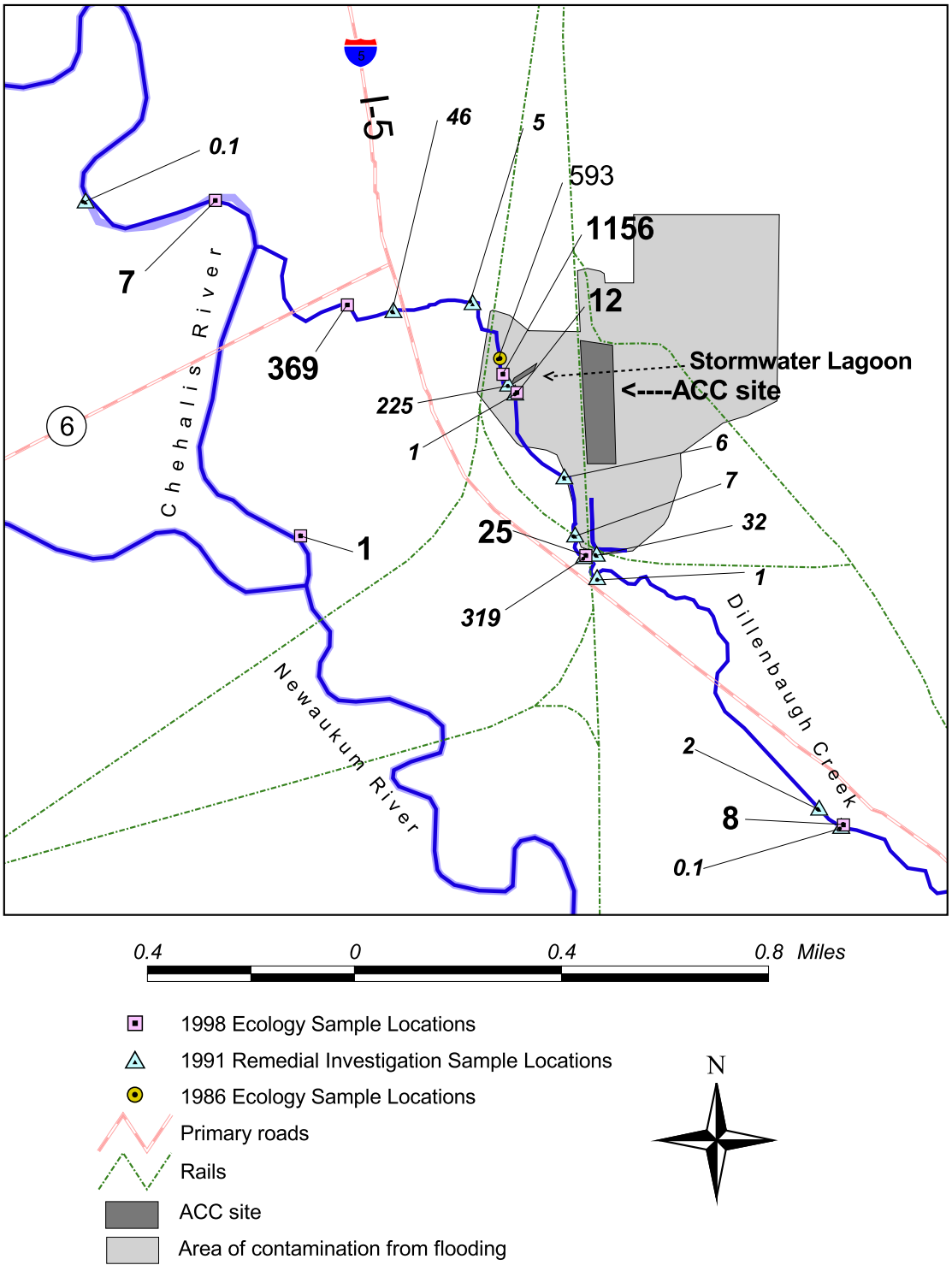

Figure 6. PCDD/PCDF Concentrations (TEQ pptr dry weight) in Sediment Samples from the 1986, 1991, and 1998 Studies

Table 7. Sediment PCDD/PCDF Concentrations Compared to Sediment Quality Guidelines

Station Name	TEQ ng/Kg dw (pptr)	TOC %	TEQ-OC ng/Kg dw (pptr)	Protection of Human Health		Protection of Wildlife			Protection of Aquatic Life			
				NY DEC[a]	CSWRCB SQO[b]	NY DEC[c]	US EPA SQG[d]	US EPA SQG[e]	US EPA SQG[f]	CCMOE PEL[g]	WA FSQV AET[h]	NY DEC Dredge[i]
	guideline value (pptr)			*10,000**	*0.07*	*200**	*2.5*	*210*	*100*	*21.5*	*8.8*	*4.5 - 50*
DILLEN1	8.2	5.0	163.8		X		X					X
DILLEN6	25.4	6.8	373.5		X	X	X			X	X	X
DILLEN3	11.8	7.1	166.2		X		X				X	X
DILLEN4	1156.0	7.1	16281.7	X	X	X	X	X	X	X	X	X
DILLEN2	369.0	4.4	8385.7		X	X	X	X	X	X	X	X
CHEHALS3	6.9	1.4	492.9		X	X	X					X
CHEHALS2	0.8	1.4	57.1		X							
CHEHALS1	2.1	1.5	140.0		X							

* TEQ values normalized to % TOC

X Exceeds guideline value

a New York Department of Environmental Conservation (NY DEC), Technical Guidance for Screening Contaminated Sediments, 1993 (revised 1999). Values developed for protection of human health from toxic effects of bioaccumulation.

b California State Water Resources Control Board (CSWRB), 1993. Sediment Quality Objective (SQO) for protection of human health.

c NY DEC, Technical Guidance for Screening Contaminated Sediments, 1993 (revised 1999). Values developed for protection of wildlife from toxic effects of bioaccumulation.

d U.S. Environmental Protection Agency (EPA), 1993. Interim Assessment Concentration for low risk to mammalian wildlife.

e EPA, 1993. Interim Assessment Concentration for high risk to sensitive species and avian wildlife.

f EPA, 1993. Interim Assessment Concentration for high risk to sensitive species and fish.

g Canadian Council of Ministers of the Environment (CCMOE), 1999 (revised 2001). Sediment Quality Guidelines for Protection of Aquatic Life. Probable Effects Levels (PELs).

h Washington State Department of Ecology, 1997. Freshwater Sediment Quality Values (FSQVs) - Apparent Effects Threshold (AET) developed to predict adverse biological effects in freshwater sediments.

i NY DEC, 1994. Interim Guidance for Freshwater Navigational Dredging, accepted levels for moderate contamination.

Four of the five Dillenbaugh Creek stations (DILLEN6, DILLEN3, DILLEN4, and DILLEN2) exceed at least half of the guidelines for the protection of aquatic life. The background station, DILLEN1, failed only one aquatic life guideline. For protection of wildlife, DILLEN6, DILLEN4, and DILLEN2, and CHEHALS3 exceeded most of the guidelines, although the value for CHEHALS3 may have been inflated by normalization to a low TOC value (1.4%) for NY DEC wildlife guidelines. Only DILLEN4 exceeds both guidelines for human health protection. The remaining Chehalis stations (CHEHALS2 and CHEHALS1) have no more than one exceedance for aquatic life, wildlife, and human health protection guidelines.

All of the Dillenbaugh Creek stations that exceed guidelines are in close proximity to the ACC area of contamination or downstream of the old ACC stormwater lagoon. These sediments from Dillenbaugh Creek are likely to be harmful to both aquatic organisms and wildlife, but not likely to be of concern to human health.

PCDD/PCDF Concentrations in Comparison to Fish Tissue Quality Guidelines

Table 8 compares PCDD/PCDF fish tissue concentrations to various fish tissue criteria and guidelines. Whole fish samples and muscle fillet samples were compared to human health protection criteria and guidelines, because some human populations are known to consume whole fish (EPA, 2000a).

Ecology uses the National Toxics Rule criterion of 0.07 pptr 2,3,7,8-TCDD in muscle fillet tissue to evaluate violations of Washington State water quality standards (WAC 173-201A). The muscle fillet samples from both Dillenbaugh Creek and the Chehalis River exceed the NTR fish tissue criterion. They also exceed EPA's screening values for recreational and subsistence fishers. The PCDD/PCDF concentration in the Dillenbaugh Creek muscle fillet sample is 37 times higher than the NTR criterion. Although the PCDD/PCDF concentration in the Chehalis River muscle fillet sample is similar to background fish tissue concentrations found nationwide, it is still seven times higher than the NTR criterion.

Fish-eating wildlife would probably not be protected from the carcinogenic and non-carcinogenic effects of eating Dillenbaugh Creek fish, whereas Chehalis River fish appear to have PCDD/PCDF levels safe for consumption by wildlife.

Table 8. Fish Tissue PCDD/PCDF Concentrations Compared to Fish Tissue Quality Criteria and Guidelines

Station Name	Species	Tissue Type	TEQ ng/Kg ww (pptr)	Protection of Human Health					Protection of Wildlife	
				NTR[a]	EPA[b]	EPA[c]	US FDA[d]	HWC[e]	NY DEC[f]	NY DEC[g]
		guideline value (pptr)		***0.07***	*0.0315*	*0.256*	*1.0*	*20*	*2.3*	*3.0*
DILLEN7F	Cutthroat Trout	Fillet	2.6	X	X	X	X		X	
DILLEN7F	Brown Bullhead	Whole	4.5	X	X	X	X		X	X
CHEHAL1F	Mountain Whitefish	Fillet	0.5	X	X	X				
CHEHAL2F	Largescale Sucker	Whole	0.6	X	X	X				
CHEHAL3F	Largescale Sucker	Whole	0.4	X	X	X				

X Exceeds guideline value

a National Toxics Rule (40 CFR 131.36) Criterion for Human Health based on 10E-06 risk level.

b U.S. Environmental Protection Agency (EPA), 2000a. Screening value for subsistence fisher based on a 10E-05 risk level and a consumption rate of 142.4 grams per day.

c EPA, 2000a. Screening value for recreational fisher based on a 10E-05 risk level and a consumption rate of 17.5 grams per day.

d U.S. Food and Drug Administration (FDA), 1997. Level of concern for dioxin in farmed catfish.

e Health and Welfare Canada (H&WC), 1990. Maximum level in fish tissue; stipulated in Canadian Food and Drug Administration.

f New York Department of Environmental Conservation (NY DEC), 1987. 10E-02 cancer risk criterion for piscivorous wildlife.

g NY DEC, 1987. Non-carcinogenic final fish flesh criterion for piscivorous wildlife.

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Conclusions

Results of this screening-level survey showed that PCDD/PCDF concentrations in sediments within the ACC area of contamination were higher than background stations in Dillenbaugh Creek and the Chehalis River. The highest PCDD/PCDF sediment concentrations were found within the ACC contaminated area below the old stormwater lagoon. Residual levels of PCDD/PCDFs in sediments in Dillenbaugh Creek near the ACC facility and cleanup site exceed guidelines for the protection of aquatic life and wildlife. Residual levels in most sediments are not a likely concern for human health, the exception being at one station directly below the old stormwater lagoon.

Both the 1986 and 1998 Ecology studies found higher overall sediment TEQ concentrations than the 1991 remedial investigation conducted by Weston Inc. Differences in sediment sampling techniques, as well as temporal and spatial variations among the samples, may explain the disparity, although it is possible that contaminated sediments from the ACC site and old stormwater lagoon continue to move downstream and persist in Dillenbaugh Creek. Downstream transport of PCDD/PCDF-laden sediments into the Chehalis River from Dillenbaugh Creek does not appear to be significant.

PCDD/PCDF concentrations in fish tissue from Dillenbaugh Creek were between 5 and 12 times higher (2.6 and 4.5 pptr TEQ) than concentrations in the Chehalis River (<1 pptr TEQ). PCDD/PCDF sediment concentrations were also much higher in Dillenbaugh Creek than the Chehalis River, which may help explain why PCDD/PCDF concentrations were higher in Dillenbaugh Creek Fish.

PCDD/PCDF concentrations in fish muscle fillets and whole fish from both Dillenbaugh Creek and the Chehalis River may be a concern for the protection of human health, based upon both the NTR fish tissue criterion and EPA's screening values for recreational and subsistence fishers. Muscle fillet and whole fish samples from Dillenbaugh Creek contain PCDD/PCDF concentrations high enough to cause concern for the protection of wildlife.

The P450 RGS method was found to more accurately screen for PCDD/PCDFs in sediments and fish tissue at high concentrations, than at the low to moderate concentrations commonly found in the environmental studies conducted by Ecology. Because the RGS method is less expensive than the conventional dioxin chemical analysis ($200 vs. $1,000 or more per sample) and captures high PCDD/PCDF concentrations better than low concentrations, it may be a good tool to assess highly contaminated sites such as potential Superfund sites.

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Recommendations

- Ecology's Water Quality Program should review the muscle fillet data from this 1998 Dillenbaugh Creek study to determine if waterbodies in the study merit listing on the 2002 federal Clean Water Act Section 303(d) list for PCDD/PCDF contamination. There are no listings for dioxins or furans for Dillenbaugh Creek and nearby sections of the Chehalis River on the 1998 Section 303(d) list of impaired waterbodies.

- Ecology's Toxic Cleanup Program should review results of this 1998 study to determine if further remedial actions are needed at the ACC site, especially in the vicinity of the stormwater lagoon. They should also evaluate the potential for ongoing contamination of Dillenbaugh Creek from the ACC site. A reassessment of contamination of Dillenbaugh Creek also would be prudent, considering the length of time that has passed since the data for this study were collected.

- The P450 RGS (EPA 4425) screening method should not be considered an accurate screening tool for future Ecology dioxin studies. The method appears to have some potential for screening areas of high PCDD/PCDF contamination.

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Appendices

Appendix A

Station and Sample Information

Appendix A-1. Sample Station Location Information

Station Name	Sediment Sample Location Description	Latitude North	Longitude West
CHEHALS1	1,000 ft upstream of boat ramp by high school	46.71950	122.98150
CHEHALS2	700 ft downstream from Newaukum River confluence	46.65270	122.98070
CHEHALS3	Downstream of Dillenbaugh Creek confluence	46.66183	122.98583
DILLEN1	13th St exit overpass culvert	46.64510	122.95830
DILLEN2	Downstream of Riverside Drive overpass	46.65920	122.97910
DILLEN3	200 ft upstream of stormwater lagoon	46.65690	122.97210
DILLEN4	200 ft downstream of stormwater lagoon	46.65740	122.97270
DILLEN6	Off BNRR bridge	46.65240	122.96910

Station Name	Fish Sample Location Description	Latitude North	Longitude West
DILLEN7F	Between river-side drive overpass & old RR	46.65940	122.97500
CHEHAL1F	Half-mile downstream of boat ramp by high school	46.71670	122.99970
CHEHAL2F	Between RR bridge & Hwy 6 bridge	46.65401	122.98583
CHEHAL3F	Between Dillenbaugh Creek confluence & boat ramp	46.68100	122.99020

☐ Background Stations

Appendix A-2. Sediment Sample Collection Information

Station Name	Date Collected	Laboratory Sample ID No.	Collection Method	Sampling Technique
CHEHALS1	6/2/98	98238080	large ponar, top 2 cm	composite of 3 grabs
CHEHALS2	6/2/98	98238081	large ponar, top 2 cm	composite of 3 grabs
CHEHALS3	6/2/98	98238082	large ponar, top 2 cm	composite of 3 grabs
DILLEN1	6/3/98	98238083	petite ponar, top 2 cm	composite of 4 grabs
DILLEN2	6/3/98	98238084	4" pipe dredge	composite of 5 grabs
DILLEN3	6/3/98	98238085	spoon from bottom, top 2 cm	until volume adequate
DILLEN4*	6/3/98	98238086/7	4" pipe dredge & spoon from bottom	until volume adequate
DILLEN6	6/4/98	98238088	petite ponar, top 2 cm	composite of 10 grabs

* Replicate sample

Appendix A-3. Fish Tissue Sample Information

Station Name	Date Collected	Laboratory Sample ID No.	Species and Processing	Fish Length (mm)	Fish Weight (g)
DILLEN7F	6/2/98	98238090	Cutthroat Trout	253	156
			- 3-fish composite	181	64
			- scaled, filleted with skin on	190	75
			mean value	208	98
DILLEN7F	6/2/98	98238091	Brown Bullhead	220	166
			- single whole fish		
CHEHAL1F	6/2/98	98238092	Mountain Whitefish	260	176
			- 5-fish composite	240	147
			- scaled, filleted with skin on	272	180
				196	68
				260	155
			mean value	246	145
CHEHAL2F	6/3/98	98238093	Largescale Sucker	396	580
			- 5-fish composite	400	547
			- whole fish	470	977
				422	645
				379	504
			mean value	413	651
CHEHAL3F*	6/3/98	98238094/5	Largescale Sucker	386	585
			- 5-fish composite	463	947
			- whole fish	425	706
				386	668
				383	564
			mean value	409	694

Common name	Scientific name
cutthroat trout	*Oncorhynchus clarki*
brown bullhead	*Ameiurus nebulosus*
mountain whitefish	*Prosopium williamsoni*
largescale sucker	*Catostomus macrocheilus*

* Duplicate (split) sample

Appendix B

Quality Assurance Reviews

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

Data Review
August 11, 1998

Project: Dillenbaugh Creek

Samples: 98238080, 98238081, 98238082, 98238083, 98238084, 98238085, 98238086, 98238087, 98238088,

Laboratory: Triangle Laboratories Inc.

By: Stuart Magoon

Data Review for Polychlorodibenzo-p-dioxin and furan
(2,3,7,8 substituted tetra - octa PCDD/PCDF)

Data from these analyses were reviewed for qualitative and quantitative accuracy, validity, and usefulness, following the National Functional Guidelines for Organic Data Review adapted for high resolution dioxin analysis.

This sample was prepared and analyzed according to EPA method 1613b.

These samples have been reported in nanograms per kilogram (ng/Kg); parts per trillion dry weight.

Triangle Laboratories Inc. has developed their own data "flags". Definitions of the "flags" and qualifiers have been included in the report.

Flags are added by the laboratory performing the analysis, usually the analyst. Qualifiers are added by the data reviewer as part of addressing the usability of the data. Generally the flags signal the reviewer to access the results and determine what to do about the fact that flags were added. For your reporting purposes the "flags" should not be considered part of the final result. The qualifiers, however, are to be considered part of the final result.

There is a number reported for each analyte that appears in one or two columns. If the number appears in the column labeled "CONC" then this analyte has been detected at the concentration reported. The number in the column labeled "DL", is the estimated detection limit as defined in EPA method 8290, at or above which the analyte was not detected. There is an "ND", short for

not detected, that appears in the "CONC" column whenever an analyte is not detected. In order to be consistent with Manchester Environmental Laboratory's reporting convention, a result reported as ND with an associated number in the Detection Limit column, e.g. 4.6, should be considered synonymous with 4.6 U, where "U" is a qualifier.

PCDD/PCDF Analysis

Holding Times

EPA method 1613b specifies a holding time of one year from the date of collection to the date of extraction; and forty (40) days from extraction to analysis.

Sample no.	Collect date	Extraction date	#days from Collection to Extraction	Analysis date	#days from Extraction to Analysis
98238080	06/02/98	06/23/98	21	06/28/98	5
98238081	06/02/98	06/23/98	21	06/29/98	6
98238082	06/03/98	06/23/98	22	06/29/98	6
98238083	06/03/98	06/23/98	22	06/29/98	6
98238084	06/03/98	06/23/98	22	06/29/98	6
98238085	06/03/98	06/23/98	22	06/29/98	6
98238086	06/03/98	06/23/98	22	06/29/98	6
98238086 Dil	06/03/98	06/23/98	22	07/06/98	13
98238087	06/03/98	06/23/98	22	06/29/98	6
98238087 Dil	06/03/98	06/23/98	22	07/06/98	13
98238088	06/04/98	06/23/98	23	06/29/98	6

These samples were extracted and analyzed within holding times.

Method Blank

Nine of the seventeen congeners were detected in the associated method blank at concentrations below that of the lowest calibration standard. According to the method re-analysis is not required when a target congener is detected below the lowest calibration standard. These congeners were also detected in all of the samples. If the concentration of a congener in a sample was less than five times that of the method blank a "U" or "UJ" qualifier was added to the result. In cases where the sample concentration for a congener was greater than five times that of the method blank, the method blank result is considered insignificant relative to the concentrations detected in the samples. No qualification iw warranted in these situations.

Calibration

The calibration standards were within 20% relative standard deviations (RSD) for all target analytes and 30% for all the reference compounds. All the ion abundance ratios were within +/- 15% of the theoretical value.

Internal Standard Recoveries

Internal standard recoveries for the all the undiluted extract analyses were within the QC limits established for each congener. Two of the three internal standards from the analysis of the diluted extracts (samples 98238086 and 98238087) were not within control limits. Responses from these internal standards were well below the calibration range leading to poor accuracy, and in two out of three cases, ion abundance ratios that were out of specification. Results associated with these internal standards have been qualified as estimates.

Ion Abundance Ratios

Each dioxin and furan isomer reported as detected met the isotopic abundance ratio and retention time criteria for positive identification.

Summary

This data is acceptable for use as amended. A number of congeners were qualified with a "J" because the concentration detected was below the lowest calibration standard; results derived from responses outside the calibration range are considered estimates.

Using the procedure from Section 7.9.5.2.1 of method 8290 I have added an estimated maximum possible concentration (EMPC) result for several congeners reported as not detected ("ND"). These congeners were reported as ND, because there was a peak in the retention time window for the analyte matching the expected masses, but the ion ratios were not within specification needed for positive identification. While there is some evidence these congeners may be present, positive identification could not be established in accordance with the method. When calculating toxic equivalents I recommend using these EMPC values rather than the detection limit.

Use results from the DB-225 column for all the positively identified 2,3,7,8-TCDF congeners.

State of Washington Department of Ecology
Manchester Environmental Laboratory
7411 Beach Dr. East Port Orchard WA. 98366

Data Review
August 4, 1998

Project: Dillenbaugh Creek

Samples: 98238090, 98238091, 98238092, 98238093, 98238094, 98238095

Laboratory: Triangle Laboratories Inc.

By: Stuart Magoon

Data Review for Polychlorodibenzo-p-dioxin and furan
(2,3,7,8 substituted tetra - octa PCDD/PCDF)

Data from these analyses were reviewed for qualitative and quantitative accuracy, validity, and usefulness, following the National Functional Guidelines for Organic Data Review adapted for high resolution dioxin analysis.

This sample was prepared and analyzed according to EPA method 1613b.

These samples have been reported in nanograms per kilogram (ng/Kg); parts per trillion wet weight.

Triangle Laboratories Inc. has developed their own data "flags". Definitions of the "flags" and qualifiers have been included in the report.

Flags are added by the laboratory performing the analysis, usually the analyst. Qualifiers are added by the data reviewer as part of addressing the usability of the data. Generally the flags signal the reviewer to access the results and determine what to do about the fact that flags were added. For your reporting purposes the "flags" should not be considered part of the final result. The qualifiers, however, are to be considered part of the final result.

There is a number reported for each analyte that appears in one or two columns. If the number appears in the column labeled "CONC" then this analyte has been detected at the concentration reported. The number in the column labeled "DL", is the estimated detection limit as defined in EPA method 8290, at or above which the analyte was not detected. There is an "ND", short for not detected, that appears in the "CONC" column whenever an analyte is not detected. In order

to be consistent with Manchester Environmental Laboratory's reporting convention, a result reported as ND with an associated number in the Detection Limit column, e.g. 4.6, should be considered synonymous with 4.6 U, where "U" is a qualifier.

PCDD/PCDF Analysis

Holding Times

EPA method 1613b specifies a holding time of one year from the date of collection to the date of extraction; and forty (40) days from extraction to analysis.

Sample no.	Collect date	Extraction date	#days from Collection to Extraction	Analysis date	#days from Extraction to Analysis
98238090	06/03/98	06/24/98	21	06/27/98	3
98238091	06/03/98	06/24/98	21	06/27/98	3
98238092	06/02/98	06/24/98	22	06/28/98	4
98238093	06/02/98	06/24/98	22	06/27/98	3
98238094	06/02/98	06/24/98	22	06/27/98	3
98238095	06/02/98	06/24/98	22	06/27/98	3

These samples were extracted and analyzed within holding times.

Method Blank

OCDD was detected in the method blank at a level below the lowest calibration standard. According to the method re-analysis is not required when a target congener is detected below the lowest calibration standard. OCDD was also detected in all of the samples; but at a level far above that of the method blank. The OCDD detected in the method blank is considered insignificant relative to the concentrations detected in the samples, therefore any OCDD contribution possibly attributed from lab contamination should be considered insignificant.

Calibration

The calibration standards were within 20% relative standard deviations (RSD) for all target analytes and 30% for all the reference compounds. All the ion abundance ratios were within +/- 15% of the theoretical value.

Internal Standard Recoveries

Internal standard recoveries for the all of the internal standards were within the QC limits established for each congener.

Isotopic Abundance Ratios

Each dioxin and furan isomer reported as detected met the isotopic abundance ratio and retention time criteria for positive identification.

Summary

This data is acceptable for use as amended. A number of congeners were qualified with a "J" because the concentration detected was below the lowest calibration standard; results derived from responses outside the calibration range are considered estimates.

Using the procedure from Section 7.9.5.2.1 of method 8290 I have added an estimated maximum possible concentration (EMPC) result for several congeners reported as not detected ("ND"). These congeners were reported as ND, because there was a peak in the retention time window for the analyte matching the expected masses, but the ion ratios were not within specification needed for positive identification. While there is some evidence these congeners may be present, positive identification could not be established in accordance with the method. When calculating toxic equivalents I recommend using the EMPC values as the detection limit.

Manchester Environmental Laboratory

7411 Beach Dr E, Port Orchard Washington 98366

CASE NARRATIVE

June 17, 1998

Subject: Dioxins in Dillenbaugh Creek Project

Sample(s): 98238082, 86-88

Officer(s): Dave Serdar

By: Bob Carrell
Organics Analysis Unit

RAPID ORGANICS SCREEN ANALYSIS

ANALYTICAL METHOD(S):

A portion of each of these sediment samples for the rapid organics screen analysis was extracted with methylene chloride and analyzed, along with various petroleum product, PAH and phenolic standards, by capillary Gas Chromatography and Flame Ionization Detection (GC/FID). Since these extracts proved to have a considerable amount of biogenic organic compounds which co-extracted with the compounds of interest, a portion of each of the extracts was treated with concentrated sulfuric acid and silica gel to aid in the removal of this material. This treated extract was then analyzed in the same manner as the untreated extracts.

Confirmation of the identity of any petroleum products found in the samples is performed by hydrocarbon component pattern matching to the product standards analyzed the same day as the samples. Confirmation of the PAH's were provided by analysis of the sample extracts by GC with ion trap mass spectroscopy detection (GC/ITD). Quantitation was performed using single point petroleum and PAH calibration standards and the results are thus qualified as an estimate.

BLANKS:

No target compounds were detected in the laboratory blanks. Hence, the blanks demonstrate the system was free from contamination.

HOLDING TIMES:

All samples were extracted and analyzed within the method holding times.

COMMENTS:

Sample 98238082 contained few component peaks and of these, none were recognizable as any petroleum product nor as target analytes. The results of the analyses of samples 98238086-88 showed that hydrocarbons were present that were consistent with those of a heavily weathered #2 diesel oil (or #2 fuel oil). In addition, sample 98238088 showed the presence of four relatively large peaks which were later identified (by GC/ITD) as phenanthrene, fluoranthene, pyrene and chrysene. Numerous smaller peaks were also seen, the bulk of which appear to be alkyl substituted PAH's. An extremely small amount of what was tentatively identified as pentachlorophenol was observed in sample 98238088, but confirmation by GC/ITD could not be made due to the small quantity in the presence of relatively large quantities of petroleum.

Manchester Environmental Laboratory

Department of Ecology

Analysis Report for

Hydrocarbon Identification

Project Name: Dioxins in Dillenbaugh Creek **LIMS Project ID:** 1798-98

Project Officer: Dave Serdar
Date Reported: 17-JUN-98

Method: HYDRO-ID
Matrix: Sediment/Soil
Analyte: Hydrocarbon identification

	Sample	QC	Field ID	Result	Qualifier	Units	Received	Analyzed
*	98238082		CHEHALS3		NC	mg/Kg ww	06/08/98	06/09/98
*	98238086		DILLEN4		NC	mg/Kg ww	06/08/98	06/09/98
*	98238087		DILLEN5		NC	mg/Kg ww	06/08/98	06/09/98
*	98238088		DILLEN6		NC	mg/Kg ww	06/08/98	06/09/98
	OBS8161HC				NC	mg/Kg ww		06/09/98

Comments:

98238082 - No detectable quantities of petroleum present

98238086 - Heavily weathered #2 diesel present at approximately 100 mg/kg

98238087 - Heavily weathered #2 diesel present at approximately 400 mg/kg

98238088 - Heavily weathered #2 diesel oil found at approximately 700 mg/kg PAH's found at approximate concentrations (ug/kg): Phenanthrene (9), fluoranthene (39), pyrene (25), chrysene (13).

* See comments

Authorized By: Barrett Release Date: 6-17-98 Page: 1

Appendix C

Data Quality and Toxic Equivalency Calculations

Appendix C-1. Precision of Duplicate Sediment and Fish Tissue Results

	Sediment			Fish Tissue		
Station Name	DILLEN4			CHEHAL3F		
Sample Lab ID No	98238086	98238087		98238094	98238095	
Parameter	Result (ug/Kg dw)	Result (ug/Kg dw)	RPD	Result (ug/Kg ww)	Result (ug/Kg ww)	RPD
2,3,7,8-TCDD	1.6	2.2	32%	0.1 J	0.09 NJ	11%
1,2,3,7,8-PeCDD	39.9	43.9	10%	0.07 U	0.16 NJ	--
1,2,3,4,7,8-HxCDD	133	162	20%	0.1 U	0.1 U	--
1,2,3,6,7,8-HxCDD	2810 J	2920 J	4%	0.6 NJ	0.47 J	24%
1,2,3,7,8,9-HxCDD	336	388	14%	0.1 U	0.1 U	--
1,2,3,4,6,7,8-HpCDD	42290 J	36450 J	15%	1.9 J	1.9 J	0%
OCDD	162190 J	175430 J	8%	11	9.9	11%
2,3,7,8-TCDF	22.9	27.2	17%	0.35 J	0.28 J	22%
1,2,3,7,8-PeCDF	81.3	93.7	14%	0.05 U	0.07 U	--
2,3,4,7,8-PeCDF	78.5	91.1	15%	0.13 NJ	0.16 J	21%
1,2,3,4,7,8-HxCDF	497	490	1%	0.06 U	0.07 U	--
1,2,3,6,7,8-HxCDF	176	181	3%	0.06 U	0.07 U	--
2,3,4,6,7,8-HxCDF	436	450	3%	0.07 U	0.09 NJ	--
1,2,3,7,8,9-HxCDF	43.5 J	45.7	5%	0.08 U	0.08 U	--
1,2,3,4,6,7,8-HpCDF	5180 J	5250 J	1%	0.5 NJ	0.5 J	0%
1,2,3,4,7,8,9-HpCDF	418	396	5%	0.1 U	0.1 U	--
OCDF	12760 J	10870 J	16%	1.4 J	1.6 J	13%
Total TCDD	194	162	18%	0.1	0.2 U	--
Total PeCDD	880	669	27%	0.07 U	0.2 U	--
Total HxCDD	8020 J	8300 J	3%	0.21	0.67	105%
Total HpCDD	63030 J	60220 J	5%	3.1	3.1	0%
Total TCDF	199	211	6%	0.35	0.47	29%
Total PeCDF	2490	2500	0%	0.16	0.38	81%
Total HxCDF	14250 J	13210 J	8%	0.86	0.83	4%
Total HpCDF	21370 J	20480 J	4%	1.2	1.9	45%
TEQ	**1164.1**	**1148.0**	**1%**	**0.34**	**0.39**	**15%**
Average RPD for PCDD/PCDF			**10%**			**29%**
% TOC (70C)	7.13	6.77	5%			
% solids	24.9	20.4	20%			
% lipids				1.6	1.7	6%
% gravel	1	0	200%			
% sand	12	9	29%			
% silt	60	63	5%			
% clay	27	28	4%			

-- RPDs not calculated for non-detected (U) compounds

RPD Relative Percent Difference

TEQ 2,3,7,8-TCDD Toxicity Equivalent

J The analyte was positively identified and the associated numerical result is an estimate

NJ There is evidence that the analyte is present and the associated numerical result is an estimate

U The analyte was not detected at or above the estimated result

Appendix C-2. Toxicity Equivalency Factors

Compound	TEF 1989[a]	TEF 1998[b]	
2,3,7,8-TCDD	1	1	
1,2,3,7,8-PeCDD	0.5	1	*
1,2,3,4,7,8-HxCDD	0.1	0.1	
1,2,3,6,7,8-HxCDD	0.1	0.1	
1,2,3,7,8,9-HxCDD	0.1	0.1	
1,2,3,4,6,7,8-HpCDD	0.01	0.01	
OCDD	0.001	0.0001	*
2,3,7,8-TCDF	0.1	0.1	
1,2,3,7,8-PeCDF	0.05	0.05	
2,3,4,7,8-PeCDF	0.5	0.5	
1,2,3,4,7,8-HxCDF	0.1	0.1	
1,2,3,6,7,8-HxCDF	0.1	0.1	
2,3,4,6,7,8-HxCDF	0.1	0.1	
1,2,3,7,8,9-HxCDF	0.1	0.1	
1,2,3,4,6,7,8-HpCDF	0.01	0.01	
1,2,3,4,7,8,9-HpCDF	0.01	0.01	
OCDF	0.001	0.0001	*

* TEFs that have changed

[a] Toxicity Equivalency Factors from Barnes, et. al, 1989

[b] Toxicity Equivalency Factors from Van den Berg, et. al, 1998

Appendix C-3. Comparison of Toxic Equivalent (TEQ) Calculation Methods for PCDD/PCDF Concentrations in Sediment and Fish Tissue Samples from the Chehalis River and Dillenbaugh Creek

	Detection Limit	TEF	Sediment Station Name and Lab ID No.							
			CHEHALS1 98238080	CHEHALS2 98238081	CHEHALS3 98238082	DILLEN1 98238083	DILLEN2 98238084	DILLEN3 98238085	DILLEN4 98238086/7*	DILLEN6 98238088
TEQ 2,3,7,8 TCDD ng/Kg dw	half	1989[a]	**2.1**	**0.8**	**6.9**	**8.2**	**369.0**	**11.8**	**1156.0**	**25.4**
"	half	1998[b]	2.1	0.9	6.1	7.5	308.9	10.5	1014.5	21.7
"	full	1989	2.3	1.2	7.1	8.2	369.0	11.9	1156.0	25.7
"	full	1998	2.3	1.3	6.3	7.5	309.0	10.6	1014.3	22.0

	Detection Limit	TEF	Fish Tissue Station Name and Lab ID No.				
			DILLEN7F 98238090	DILLEN7F 98238091	CHEHAL1F 98238092	CHEHAL2F 98238093	CHEHAL3F 98238094/5*
TEQ 2,3,7,8 TCDD ng/Kg ww	half	1989	**2.6**	**4.5**	**0.5**	**0.6**	**0.4**
"	half	1998	3.3	5.5	0.6	0.7	0.4
"	full	1989	2.6	4.5	0.5	0.6	0.4
"	full	1998	3.3	5.5	0.6	0.7	0.5

* Mean of duplicate or replicate samples

a Toxicity Equivalency Factors from Barnes et al., 1989

b Toxicity Equivalency Factors from Van den Berg et al., 1998

Bolded values used for the present study

Appendix D

Data Tables

Appendix D-1. Sediment and Fish Tissue Data

Station Name	Matrix	Collection Date	Parameter	Result		Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
CHEHAL1F	Fish Tissue	6/2/98	# Fish in Composite	5		#	Measured in Field	WESNUMBERF	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Fish Weight	145		g	Measured in Field	WESWEIGHTM	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Fish Length	246		mm	Measured in Field	WESLENGTHM	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Lipids	5.4		%	Triangle Labs Inc	LIPIDS	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	2,3,7,8-TCDD	0.17	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDD	0.23	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDD	0.35	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDD	0.41	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	OCDD	1.9	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total TCDD	0.17		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total PeCDD	0.23		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total HxCDD	0.35		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total HpCDD	0.5	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	2,3,7,8-TCDF	0.7		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDF	0.08	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	2,3,4,7,8-PeCDF	0.15	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDF	0.08	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDF	0.05	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	2,3,4,6,7,8-HxCDF	0.09	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDF	0.06	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDF	0.06	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	1,2,3,4,7,8,9-HpCDF	0.08	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	OCDF	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total TCDF	1.2		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total PeCDF	0.27		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total HxCDF	0.5		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL1F	Fish Tissue	6/2/98	Total HpCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238092	No
CHEHAL2F	Fish Tissue	6/2/98	# Fish in Composite	5		#	Measured in Field	WESNUMBERF	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Fish Weight	651		g	Measured in Field	WESWEIGHTM	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Fish Length	413		mm	Measured in Field	WESLENGTHM	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Lipids	1.8		%	Triangle Labs Inc	LIPIDS	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	2,3,7,8-TCDD	0.29	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDD	0.29	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDD	0.19	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDD	0.68	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	OCDD	5.3		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total TCDD	0.29		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total PeCDD	0.29		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total HxCDD	0.44		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total HpCDD	1.7		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	2,3,7,8-TCDF	0.42	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDF	0.06	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	2,3,4,7,8-PeCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDF	0.06	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	2,3,4,6,7,8-HxCDF	0.09	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDF	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDF	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	1,2,3,4,7,8,9-HpCDF	0.2	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	OCDF	0.4	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total TCDF	0.53		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total PeCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total HxCDF	0.09	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL2F	Fish Tissue	6/2/98	Total HpCDF	0.2	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238093	No
CHEHAL3F	Fish Tissue	6/2/98	# Fish in Composite	5		#	Measured in Field	WESNUMBERF	98238094	No

Station Name	Matrix	Collection Date	Parameter	Result		Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
CHEHAL3F	Fish Tissue	6/2/98	Fish Weight	694		g	Measured in Field	WESWEIGHTM	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Fish Length	409		mm	Measured in Field	WESLENGTHM	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Lipids	1.6		%	Triangle Labs Inc	LIPIDS	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	2,3,7,8-TCDD	0.1	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDD	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDD	0.6	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDD	1.9	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	OCDD	11		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total TCDD	0.1		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total PeCDD	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total HxCDD	0.21		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total HpCDD	3.1		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	2,3,7,8-TCDF	0.35	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDF	0.05	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	2,3,4,7,8-PeCDF	0.13	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDF	0.06	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDF	0.06	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	2,3,4,6,7,8-HxCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDF	0.08	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDF	0.5	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,7,8,9-HpCDF	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	OCDF	1.4	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total TCDF	0.35		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total PeCDF	0.16		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total HxCDF	0.86		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	Total HpCDF	1.2		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238094	No
CHEHAL3F	Fish Tissue	6/2/98	# Fish in Composite	5		#	Measured in Field	WESNUMBERF	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Fish Weight	694		g	Measured in Field	WESWEIGHTM	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Fish Length	409		mm	Measured in Field	WESLENGTHM	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Lipids	1.7		%	Triangle Labs Inc	LIPIDS	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	2,3,7,8-TCDD	0.09	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDD	0.16	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDD	0.47	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDD	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDD	1.9	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	OCDD	9.9		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total TCDD	0.2	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total PeCDD	0.2	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total HxCDD	0.67		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total HpCDD	3.1		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	2,3,7,8-TCDF	0.28	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8-PeCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	2,3,4,7,8-PeCDF	0.16	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,7,8-HxCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,6,7,8-HxCDF	0.07	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	2,3,4,6,7,8-HxCDF	0.09	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,7,8,9-HxCDF	0.08	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,6,7,8-HpCDF	0.5	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	1,2,3,4,7,8,9-HpCDF	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	OCDF	1.6	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total TCDF	0.47		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total PeCDF	0.38		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total HxCDF	0.83		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
CHEHAL3F	Fish Tissue	6/2/98	Total HpCDF	1.9		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238095	Yes
DILLEN7F	Fish Tissue	6/3/98	# Fish in Composite	3		#	Measured in Field	WESNUMBERF	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Fish Weight	98		g	Measured in Field	WESWEIGHTM	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Fish Length	208		mm	Measured in Field	WESLENGTHM	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Lipids	1.7		%	Triangle Labs Inc	LIPIDS	98238090	No

Station Name	Matrix	Collection Date	Parameter	Result		Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
DILLEN7F	Fish Tissue	6/3/98	2,3,7,8-TCDD	0.26	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8-PeCDD	1.3	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,7,8-HxCDD	0.7	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,6,7,8-HxCDD	7.9		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8,9-HxCDD	0.7	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,6,7,8-HpCDD	8.3		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	OCDD	8.9		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total TCDD	0.26		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total PeCDD	1.3		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total HxCDD	9.4		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total HpCDD	8.3		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	2,3,7,8-TCDF	0.65		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8-PeCDF	0.43	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	2,3,4,7,8-PeCDF	0.87	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,7,8-HxCDF	0.78	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,6,7,8-HxCDF	0.33	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	2,3,4,6,7,8-HxCDF	0.5	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8,9-HxCDF	0.1	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,6,7,8-HpCDF	1.5	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,7,8,9-HpCDF	0.2	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	OCDF	0.93	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total TCDF	0.65		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total PeCDF	3.7		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total HxCDF	12.1		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Total HpCDF	4.3		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238090	No
DILLEN7F	Fish Tissue	6/3/98	Fish Weight	166		g	Measured in Field	WESWEIGHTM	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Fish Length	220		mm	Measured in Field	WESLENGTHM	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Lipids	3.2		%	Triangle Labs Inc	LIPIDS	98238091	No
DILLEN7F	Fish Tissue	6/3/98	2,3,7,8-TCDD	0.48	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8-PeCDD	2	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,7,8-HxCDD	1.6	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,6,7,8-HxCDD	14.3		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8,9-HxCDD	1.1	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,6,7,8-HpCDD	14.5		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	OCDD	16.3		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total TCDD	0.63		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total PeCDD	2.5		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total HxCDD	18.6		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total HpCDD	16.5		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	2,3,7,8-TCDF	0.71		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8-PeCDF	0.8	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	2,3,4,7,8-PeCDF	1.4	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,7,8-HxCDF	1.5	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,6,7,8-HxCDF	0.6	NJ	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	2,3,4,6,7,8-HxCDF	0.99	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,7,8,9-HxCDF	0.2	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,6,7,8-HpCDF	2.1	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	1,2,3,4,7,8,9-HpCDF	0.3	U	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	OCDF	1.9	J	ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total TCDF	1.6		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total PeCDF	7.6		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total HxCDF	24.4		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
DILLEN7F	Fish Tissue	6/3/98	Total HpCDF	6.4		ng/Kg ww	Triangle Labs Inc	EPA1613B	98238091	No
CHEHALS1	Sediment	6/2/98	Gravel >=2.0mm	0		%	Soil Technology	PSEP1986	98238080	No
CHEHALS1	Sediment	6/2/98	Sand <2.0 >=0.062mm	73		%	Soil Technology	PSEP1986	98238080	No
CHEHALS1	Sediment	6/2/98	Silt <0.062 >=0.004mm	23		%	Soil Technology	PSEP1986	98238080	No
CHEHALS1	Sediment	6/2/98	Clay <0.004mm	4		%	Soil Technology	PSEP1986	98238080	No
CHEHALS1	Sediment	6/2/98	Total Organic Carbon	1.46	J	%	Manchester Lab	PSEP-TOC	98238080	No
CHEHALS1	Sediment	6/2/98	Solids	50.4		%	Manchester Lab	EPA160.3	98238080	Yes
CHEHALS1	Sediment	6/2/98	Solids	50.8		%	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Solids	51		%	Soil Technology	EPA/CE81-1	98238080	No

Station Name	Matrix	Collection Date	Parameter	Result		Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
CHEHALS1	Sediment	6/2/98	Solids	50.4		%	Manchester Lab	EPA160.3	98238080	No
CHEHALS1	Sediment	6/2/98	Solids	50.8		%	Manchester Lab	EPA160.3	98238080	Yes
CHEHALS1	Sediment	6/2/98	2,3,7,8-TCDD	0.28	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,7,8-PeCDD	0.5	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,4,7,8-HxCDD	0.53	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,6,7,8-HxCDD	2.2	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,7,8,9-HxCDD	1.9	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,4,6,7,8-HpCDD	31.5		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	OCDD	216		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total TCDD	1.6		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total PeCDD	3.6		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total HxCDD	18.5		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total HpCDD	54.7		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	2,3,7,8-TCDF	0.68		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,7,8-PeCDF	0.46		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	2,3,4,7,8-PeCDF	0.55	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,4,7,8-HxCDF	1.3	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,6,7,8-HxCDF	0.53	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	2,3,4,6,7,8-HxCDF	0.68		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,7,8,9-HxCDF	0.2	U	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,4,6,7,8-HpCDF	9.4		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	1,2,3,4,7,8,9-HpCDF	0.63		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	OCDF	29.2		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total TCDF	8.5		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total PeCDF	6.3		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total HxCDF	12.2		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS1	Sediment	6/2/98	Total HpCDF	31.1		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238080	No
CHEHALS2	Sediment	6/2/98	Gravel >=2.0mm	0		%	Soil Technology	PSEP1986	98238081	No
CHEHALS2	Sediment	6/2/98	Sand <2.0 >=0.062mm	65		%	Soil Technology	PSEP1986	98238081	No
CHEHALS2	Sediment	6/2/98	Silt <0.062 >=0.004mm	28		%	Soil Technology	PSEP1986	98238081	No
CHEHALS2	Sediment	6/2/98	Clay <0.004mm	7		%	Soil Technology	PSEP1986	98238081	No
CHEHALS2	Sediment	6/2/98	Total Organic Carbon	1.38	J	%	Manchester Lab	PSEP-TOC	98238081	No
CHEHALS2	Sediment	6/2/98	Solids	45.1		%	Manchester Lab	EPA160.3	98238081	No
CHEHALS2	Sediment	6/2/98	Solids	48.4		%	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Solids	57		%	Soil Technology	EPA/CE81-1	98238081	No
CHEHALS2	Sediment	6/2/98	2,3,7,8-TCDD	0.2	U	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,7,8-PeCDD	0.3	NJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,4,7,8-HxCDD	0.37	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,6,7,8-HxCDD	0.8	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,7,8,9-HxCDD	1.2	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,4,6,7,8-HpCDD	6.8		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	OCDD	46.7		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total TCDD	1.8		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total PeCDD	2.1		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total HxCDD	9		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total HpCDD	15.9		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	2,3,7,8-TCDF	0.7	U	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,7,8-PeCDF	0.35		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	2,3,4,7,8-PeCDF	0.46	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,4,7,8-HxCDF	0.8	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,6,7,8-HxCDF	0.36	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	2,3,4,6,7,8-HxCDF	0.3	NJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,7,8,9-HxCDF	0.2	U	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,4,6,7,8-HpCDF	1.7	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	1,2,3,4,7,8,9-HpCDF	0.24		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	OCDF	3	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total TCDF	7.2		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total PeCDF	3.3		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total HxCDF	3.1		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS2	Sediment	6/2/98	Total HpCDF	3.8		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238081	No
CHEHALS3	Sediment	6/2/98	Gravel >=2.0mm	0		%	Soil Technology	PSEP1986	98238082	No

Station Name	Matrix	Collection Date	Parameter	Result		Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
CHEHALS3	Sediment	6/2/98	Sand <2.0 >=0.062mm	69		%	Soil Technology	PSEP1986	98238082	No
CHEHALS3	Sediment	6/2/98	Silt <0.062 >=0.004mm	26		%	Soil Technology	PSEP1986	98238082	No
CHEHALS3	Sediment	6/2/98	Clay <0.004mm	5		%	Soil Technology	PSEP1986	98238082	No
CHEHALS3	Sediment	6/2/98	Total Organic Carbon	1.42	J	%	Manchester Lab	PSEP-TOC	98238082	No
CHEHALS3	Sediment	6/2/98	Solids	47.6		%	Manchester Lab	EPA160.3	98238082	No
CHEHALS3	Sediment	6/2/98	Solids	49.1		%	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Solids	54		%	Soil Technology	EPA/CE81-1	98238082	No
CHEHALS3	Sediment	6/2/98	2,3,7,8-TCDD	0.3	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,7,8-PeCDD	0.88	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,4,7,8-HxCDD	1.3	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,6,7,8-HxCDD	9		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,7,8,9-HxCDD	3.9	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,4,6,7,8-HpCDD	171		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	OCDD	1190		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total TCDD	3.6		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total PeCDD	8.4		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total HxCDD	44.3		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total HpCDD	275		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	2,3,7,8-TCDF	0.92		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,7,8-PeCDF	0.6	NJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	2,3,4,7,8-PeCDF	0.8	NJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,4,7,8-HxCDF	3.2	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,6,7,8-HxCDF	1.3	UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	2,3,4,6,7,8-HxCDF	2.3		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,7,8,9-HxCDF	0.41		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,4,6,7,8-HpCDF	59.6		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	1,2,3,4,7,8,9-HpCDF	3.5		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	OCDF	201		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total TCDF	6.8		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total PeCDF	11.7		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total HxCDF	62.5		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
CHEHALS3	Sediment	6/2/98	Total HpCDF	213		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238082	No
DILLEN1	Sediment	6/3/98	Gravel >=2.0mm	5		%	Soil Technology	PSEP1986	98238083	No
DILLEN1	Sediment	6/3/98	Sand <2.0 >=0.062mm	25		%	Soil Technology	PSEP1986	98238083	No
DILLEN1	Sediment	6/3/98	Silt <0.062 >=0.004mm	51		%	Soil Technology	PSEP1986	98238083	No
DILLEN1	Sediment	6/3/98	Clay <0.004mm	19		%	Soil Technology	PSEP1986	98238083	No
DILLEN1	Sediment	6/3/98	Total Organic Carbon	5.01	J	%	Manchester Lab	PSEP-TOC	98238083	No
DILLEN1	Sediment	6/3/98	Solids	25.1		%	Manchester Lab	EPA160.3	98238083	No
DILLEN1	Sediment	6/3/98	Solids	26.7		%	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Solids	27		%	Soil Technology	EPA/CE81-1	98238083	No
DILLEN1	Sediment	6/3/98	2,3,7,8-TCDD	0.51	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,7,8-PeCDD	1.2	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,4,7,8-HxCDD	2.2	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,6,7,8-HxCDD	8.7		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,7,8,9-HxCDD	5.6	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDD	164		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	OCDD	1260		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Total TCDD	6.9		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Total PeCDD	8.4		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Total HxCDD	52.1		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Total HpCDD	282		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	2,3,7,8-TCDF	1.7		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,7,8-PeCDF	1.2	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	2,3,4,7,8-PeCDF	1.6	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,4,7,8-HxCDF	3.6		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,6,7,8-HxCDF	1.9		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	2,3,4,6,7,8-HxCDF	3.2		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,7,8,9-HxCDF	0.5	NJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDF	42.1		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	1,2,3,4,7,8,9-HpCDF	2.7	J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	OCDF	130		ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No

Station Name	Matrix	Collection Date	Parameter	Result	Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
DILLEN1	Sediment	6/3/98	Total TCDF	24.7	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Total PeCDF	29.5	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Total HxCDF	51.1	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN1	Sediment	6/3/98	Total HpCDF	130	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238083	No
DILLEN2	Sediment	6/3/98	Gravel >=2.0mm	1	%	Soil Technology	PSEP1986	98238084	No
DILLEN2	Sediment	6/3/98	Sand <2.0 >=0.062mm	67	%	Soil Technology	PSEP1986	98238084	No
DILLEN2	Sediment	6/3/98	Silt <0.062 >=0.004mm	22	%	Soil Technology	PSEP1986	98238084	No
DILLEN2	Sediment	6/3/98	Clay <0.004mm	10	%	Soil Technology	PSEP1986	98238084	No
DILLEN2	Sediment	6/3/98	Total Organic Carbon	4.44 J	%	Manchester Lab	PSEP-TOC	98238084	No
DILLEN2	Sediment	6/3/98	Solids	34.3	%	Manchester Lab	EPA160.3	98238084	No
DILLEN2	Sediment	6/3/98	Solids	37	%	Soil Technology	EPA/CE81-1	98238084	No
DILLEN2	Sediment	6/3/98	Solids	39.9	%	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	2,3,7,8-TCDD	1.3	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,7,8-PeCDD	19.2	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,4,7,8-HxCDD	72.5	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,6,7,8-HxCDD	700	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,7,8,9-HxCDD	159	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDD	11340 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	OCDD	67800 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total TCDD	25.7	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total PeCDD	125	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total HxCDD	2190	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total HpCDD	17750 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	2,3,7,8-TCDF	5.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,7,8-PeCDF	18.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	2,3,4,7,8-PeCDF	21.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,4,7,8-HxCDF	142	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,6,7,8-HxCDF	49.8	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	2,3,4,6,7,8-HxCDF	128	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,7,8,9-HxCDF	22.3 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDF	2610 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	1,2,3,4,7,8,9-HpCDF	165	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	OCDF	9600 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total TCDF	57.9	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total PeCDF	604	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total HxCDF	3970 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN2	Sediment	6/3/98	Total HpCDF	10930 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238084	No
DILLEN3	Sediment	6/3/98	Gravel >=2.0mm	4	%	Soil Technology	PSEP1986	98238085	No
DILLEN3	Sediment	6/3/98	Sand <2.0 >=0.062mm	41	%	Soil Technology	PSEP1986	98238085	No
DILLEN3	Sediment	6/3/98	Silt <0.062 >=0.004mm	38	%	Soil Technology	PSEP1986	98238085	No
DILLEN3	Sediment	6/3/98	Clay <0.004mm	17	%	Soil Technology	PSEP1986	98238085	No
DILLEN3	Sediment	6/3/98	Total Organic Carbon	7.11 J	%	Manchester Lab	PSEP-TOC	98238085	No
DILLEN3	Sediment	6/3/98	Solids	19.6	%	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Solids	17	%	Soil Technology	EPA/CE81-1	98238085	No
DILLEN3	Sediment	6/3/98	Solids	16.6	%	Manchester Lab	EPA160.3	98238085	No
DILLEN3	Sediment	6/3/98	2,3,7,8-TCDD	0.53 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,7,8-PeCDD	1.6 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,4,7,8-HxCDD	2.8 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,6,7,8-HxCDD	12.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,7,8,9-HxCDD	7.8 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDD	256	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	OCDD	2210	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total TCDD	11.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total PeCDD	17.2	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total HxCDD	92.6	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total HpCDD	699	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	2,3,7,8-TCDF	3.3	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,7,8-PeCDF	1.6 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	2,3,4,7,8-PeCDF	2.4 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,4,7,8-HxCDF	4.7 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,6,7,8-HxCDF	2.2 UJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No

Station Name	Matrix	Collection Date	Parameter	Result	Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
DILLEN3	Sediment	6/3/98	2,3,4,6,7,8-HxCDF	3.9 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,7,8,9-HxCDF	1.6 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDF	47.2	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	1,2,3,4,7,8,9-HpCDF	3 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	OCDF	112	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total TCDF	26.6	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total PeCDF	36.9	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total HxCDF	66.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN3	Sediment	6/3/98	Total HpCDF	140	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238085	No
DILLEN4	Sediment	6/3/98	Gravel >=2.0mm	1	%	Soil Technology	PSEP1986	98238086	No
DILLEN4	Sediment	6/3/98	Sand <2.0 >=0.062mm	12	%	Soil Technology	PSEP1986	98238086	No
DILLEN4	Sediment	6/3/98	Silt <0.062 >=0.004mm	60	%	Soil Technology	PSEP1986	98238086	No
DILLEN4	Sediment	6/3/98	Clay <0.004mm	27	%	Soil Technology	PSEP1986	98238086	No
DILLEN4	Sediment	6/3/98	Total Organic Carbon	7.13 J	%	Manchester Lab	PSEP-TOC	98238086	No
DILLEN4	Sediment	6/3/98	Solids	24.9	%	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Solids	19.1	%	Manchester Lab	EPA160.3	98238086	No
DILLEN4	Sediment	6/3/98	Solids	19	%	Soil Technology	FOLK_SOLID	98238086	No
DILLEN4	Sediment	6/3/98	2,3,7,8-TCDD	1.6	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,7,8-PeCDD	39.9	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,4,7,8-HxCDD	133	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,6,7,8-HxCDD	2810 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,7,8,9-HxCDD	336	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDD	42290 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	OCDD	162190 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total TCDD	194	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total PeCDD	880	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total HxCDD	8020 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total HpCDD	63030 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	2,3,7,8-TCDF	22.9	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,7,8-PeCDF	81.3	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	2,3,4,7,8-PeCDF	78.5	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,4,7,8-HxCDF	497	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,6,7,8-HxCDF	176	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	2,3,4,6,7,8-HxCDF	436	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,7,8,9-HxCDF	43.5 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDF	5180 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	1,2,3,4,7,8,9-HpCDF	418	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	OCDF	12760 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total TCDF	199	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total PeCDF	2490	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total HxCDF	14250 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Total HpCDF	21370 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238086	No
DILLEN4	Sediment	6/3/98	Gravel >=2.0mm	0	%	Soil Technology	PSEP1986	98238087	Yes
DILLEN4	Sediment	6/3/98	Sand <2.0 >=0.062mm	9	%	Soil Technology	PSEP1986	98238087	Yes
DILLEN4	Sediment	6/3/98	Silt <0.062 >=0.004mm	63	%	Soil Technology	PSEP1986	98238087	Yes
DILLEN4	Sediment	6/3/98	Clay <0.004mm	28	%	Soil Technology	PSEP1986	98238087	Yes
DILLEN4	Sediment	6/3/98	Total Organic Carbon	6.67 J	%	Manchester Lab	PSEP-TOC	98238087	Yes
DILLEN4	Sediment	6/3/98	Total Organic Carbon	5.57 J	%	Manchester Lab	PSEP-TOC	98238087	Yes
DILLEN4	Sediment	6/3/98	Total Organic Carbon	6.77 J	%	Manchester Lab	PSEP-TOC	98238087	Yes
DILLEN4	Sediment	6/3/98	Solids	20.4	%	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Solids	22	%	Soil Technology	FOLK_SOLID	98238087	Yes
DILLEN4	Sediment	6/3/98	Solids	18.5	%	Manchester Lab	EPA160.3	98238087	Yes
DILLEN4	Sediment	6/3/98	2,3,7,8-TCDD	2.2	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,7,8-PeCDD	43.9	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,4,7,8-HxCDD	162	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,6,7,8-HxCDD	2920 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,7,8,9-HxCDD	388	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDD	36450 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	OCDD	175430 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Total TCDD	162	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Total PeCDD	669	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes

Station Name	Matrix	Collection Date	Parameter	Result	Unit of Measure	Laboratory Name	Analysis Method	Lab ID No.	Replicate Result
DILLEN4	Sediment	6/3/98	Total HxCDD	8300 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Total HpCDD	60220 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	2,3,7,8-TCDF	27.2	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,7,8-PeCDF	93.7	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	2,3,4,7,8-PeCDF	91.1	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,4,7,8-HxCDF	490	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,6,7,8-HxCDF	181	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	2,3,4,6,7,8-HxCDF	450	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,7,8,9-HxCDF	45.7	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,4,6,7,8-HpCDF	5250 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	1,2,3,4,7,8,9-HpCDF	396	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	OCDF	10870 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Total TCDF	211	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Total PeCDF	2500	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Total HxCDF	13210 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN4	Sediment	6/3/98	Total HpCDF	20480 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238087	Yes
DILLEN6	Sediment	6/4/98	Gravel >=2.0mm	5	%	Soil Technology	PSEP1986	98238088	No
DILLEN6	Sediment	6/4/98	Sand <2.0 >=0.062mm	18	%	Soil Technology	PSEP1986	98238088	No
DILLEN6	Sediment	6/4/98	Silt <0.062 >=0.004mm	61	%	Soil Technology	PSEP1986	98238088	No
DILLEN6	Sediment	6/4/98	Clay <0.004mm	16	%	Soil Technology	PSEP1986	98238088	No
DILLEN6	Sediment	6/4/98	Total Organic Carbon	6.75	%	Manchester Lab	PSEP-TOC	98238088	No
DILLEN6	Sediment	6/4/98	Solids	24.5	%	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Solids	23	%	Soil Technology	EPA/CE81-1	98238088	No
DILLEN6	Sediment	6/4/98	Solids	20.8	%	Manchester Lab	EPA160.3	98238088	No
DILLEN6	Sediment	6/4/98	2,3,7,8-TCDD	0.6 U	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,7,8-PeCDD	1.9 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,4,7,8-HxCDD	3.1 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,6,7,8-HxCDD	15.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,7,8,9-HxCDD	10.8	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,4,6,7,8-HpCDD	542	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	OCDD	5080 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total TCDD	11.5	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total PeCDD	24.2	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total HxCDD	201	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total HpCDD	2490	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	2,3,7,8-TCDF	3.8	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,7,8-PeCDF	2 NJ	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	2,3,4,7,8-PeCDF	5.8	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,4,7,8-HxCDF	7.9	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,6,7,8-HxCDF	3.1 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	2,3,4,6,7,8-HxCDF	7.2	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,7,8,9-HxCDF	47.5	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,4,6,7,8-HpCDF	63.4	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	1,2,3,4,7,8,9-HpCDF	3.7 J	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	OCDF	135	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total TCDF	42.6	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total PeCDF	138	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total HxCDF	130	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No
DILLEN6	Sediment	6/4/98	Total HpCDF	175	ng/Kg dw	Triangle Labs Inc	EPA1613B	98238088	No

J Analyte was positively identified and the associated numerical result is an estimate

NJ There is evidence that the analyte is present and the associated numerical result is an estimate

U Analyte was not detected at or above the reported result

UJ Analyte was not detected at or above the reported estimated result

Appendix D-2. Sediment PCDD/PCDF and Conventional Results for 1986 and 1991 Dillenbaugh Creek Studies

Station Name	Study	TEQ total (ng/Kg dw)	% TOC	% solids	% gravel ≥ 2000µm	% sand < 2000µm-62µm	% silt < 62µm-3.9µm	% clay < 3.9 µm
SD-2	Ecology, 1987	592.7	3.1	60	0	11	55	34
91-SD-C-13	Weston, 1992	ND (0.1)	0.7	--	--	--	--	--
91-SD-C-01	Weston, 1992	ND (0.1)	0.6	--	--	--	--	--
91-SD-C-12	Weston, 1992	2.3	3.7	--	--	--	--	--
91-SD-C-03	Weston, 1992	32.0	10.4	--	--	--	--	--
91-SD-C-02	Weston, 1992	1.1	3.1	--	--	--	--	--
91-SD-C-04/04B*	Weston, 1992	319.0	5.9	--	--	--	--	--
91-SD-C-09/10*	Weston, 1992	6.6	1.7	--	--	--	--	--
91-SD-C-05	Weston, 1992	5.6	3.4	--	--	--	--	--
91-SD-C-06	Weston, 1992	1.7	0.9	--	--	--	--	--
91-SD-C-07	Weston, 1992	225.0	1.0	--	--	--	--	--
91-SD-C-11	Weston, 1992	5.2	4.1	--	--	--	--	--
91-SD-C-08/08B[a]	Weston, 1992	46.0	1.4	--	--	--	--	--
91-SD-H-01/02/03[b]	Weston, 1992	ND (0.1)	0.3	--	--	--	--	--

* Mean of duplicate analysis
-- Data not available
ND Not Detected
a Value for 91-SD-09 only
b Value for 91-SD-H-03 only