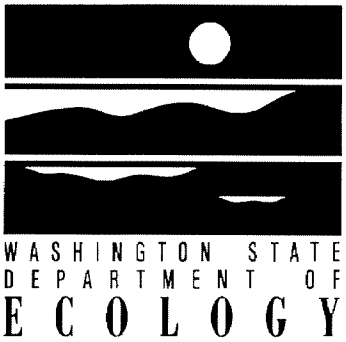

BOISE CASCADE CORPORATION (VANCOUVER) CLASS II INSPECTION, FEBRUARY 22-24, 1993

Water Body No. WA-CR-1010
94-22

February 1994

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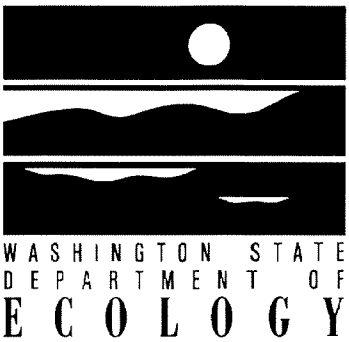

BOISE CASCADE CORPORATION (VANCOUVER) CLASS II INSPECTION, FEBRUARY 22-24, 1993

By
Guy Hoyle-Dodson

Environmental Investigations and Laboratory Services Program
Toxics, Compliance and Ground Water Investigations Section
Olympia, Washington 98504-7710

February 1994

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ABSTRACT

A Class II Inspection was conducted on February 22-24, 1993, at the Boise Cascade Corporation paper mill wastewater treatment facility in Vancouver, Washington. The Boise Cascade Corporation operates a primary clarified aeration pond facility to treat paper production wastewater. Inspection data found that Boise Cascade was meeting NPDES permit effluent limits. Plant operation appeared to be effective and all oxygen demand and solids parameters were substantially reduced. Low nutrient concentrations in the influent required the addition of nutrients and these additions were effective and appropriate. Flow measurements by Ecology suggest that Boise Cascade's flow measurement techniques require an evaluation for effectiveness. Relatively high fecal coliform concentrations may pose problems for receiving water quality. Dioxin/Furans were detected in influent and primary clarifier sludge samples, but not in effluent samples. Effluent displayed some acute toxicity to rainbow trout in 100% effluent and no chronic toxicity. Split samples found generally good correspondence between Ecology and Boise Cascade samples and analyses. Concentrations of metals in the receiving water sediment were deemed typical to that area and did not exceed applicable guidelines.

INTRODUCTION

A Class II Inspection was conducted February 22-24, 1993, at the Boise Cascade Corporation paper mill in Vancouver, Washington. Guy Hoyle-Dodson and Rebecca Inman of the Washington State Department of Ecology (Ecology) Toxics, Compliance and Groundwater Investigations Section conducted the inspection. Robert Carruthers, Permit Coordinator for the Ecology Industrial Section, assisted during the inspection and provided background information. Fredrick (Rick) J. Weber, Boise Cascade Corporation Vancouver Plant Environmental Engineer also furnished on-site assistance.

The Boise Cascade Corporation operates a paper mill producing a variety of paper products. A treatment facility provides primary and secondary treatment of wastewater generated by their production process. Production is generally continuous with variations in loading to the treatment facility dependent on variations in production runs. The discharge to the Columbia River is regulated under NPDES permit No. WA 000026-4. The permit was issued February 1990 and has an expiration date of February 1995. A companion compliance order No. DE 92-WQI018 was issued by mutual agreement in June 1992. This order served as part of a settlement of a dispute concerning Ecology's program for monitoring the permittee's discharge.

The Class II Inspection was requested by the Ecology Industrial Section. Specific objectives of the inspection included:

1. assess NPDES permit compliance;
2. assess wastewater toxicity with priority pollutant scans and effluent bioassays;
3. evaluate treatment plant performance;
4. assess sediment toxicity with priority pollutant scans and bioassays; and
5. assess sludge and sludge leachate toxicity with priority pollutant scans.

SETTING

The Vancouver Boise Cascade (BC) paper mill is located on the shore of the Columbia River just downstream from the I-5 highway bridge (*Figure 1*). The mill produces a fine quality paper from bleached kraft pulp and decolored recycled paper. Recycled paper (mostly computer paper) accounts for approximately 40% of the raw material with the remaining 60% being purchased kraft pulp. Production of paper ranges from 3 to 400 tons/day.

Wastewater from the process contains varying amounts of paper fiber, dissolved organic material, and inorganic clays. The paper is produced in a variety of colors and the dye residuals are also part of the wastestream. Additional compounds used in the manufacturing process include NaOH (bleaching and cleaning compound), organic polymers (retention aids), surfactants (decoloring compounds), and ClO_2 (slimacide). Discharge of treated effluent into the Columbia River (Class A surface water) averages between 7-9 MGD (million gallons per day.

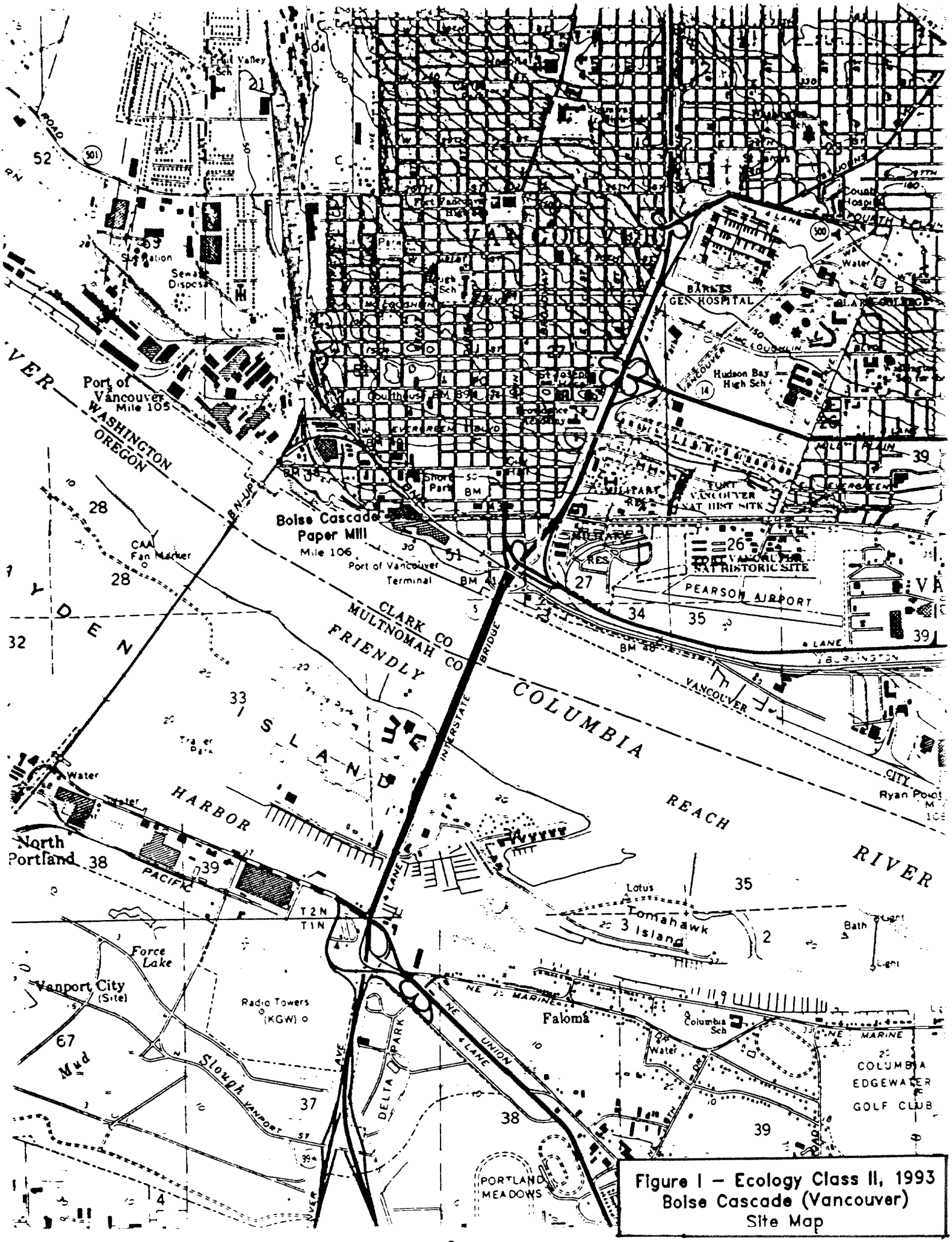

Figure 1 – Ecology Class II, 1993
Boise Cascade (Vancouver)
Site Map

The BC wastewater treatment plant consists of headworks, primary clarifier, aeration basin, and submerged outfall (*Figure 2*). The facility is unusual in that wastewater is pumped 10,000 feet from the clarifier to the aeration basin, and then is returned the same distance to the outfall.

Flow of wastewater at the headworks passes through a mechanical screen to remove course material. The wastewater is held briefly in a wet well before being pumped to the primary clarifier. In the past a venturi meter in the pipe connecting the headworks with the clarifier had been used to measure flow, but currently it is inoperable. During the inspection Boise Cascade estimated total flow through the system by summing all plant intake volumes and subtracting estimated process losses. Since the inspection, in June of 1993, BC installed a new effluent flow meter and no longer estimates effluent flow.

The primary clarifier is a 2.25 million gallon center-feed sedimentation tank with a six- to seven-hour retention time at a 7.5 MGD flow. A flocculating agent is used to enhance sedimentation. The clarifier effluent is discharged to a clearwell and pumped to the aeration basin. Foaming in the clearwell is suppressed by a water spray. An underground 20- inch pipe transports the wastewater to the aeration basin.

The aeration basin provides secondary treatment for the facility. Wastewater enters the aeration basin through four ports located at the north end of the pond. A 15 by 15 aerator grid mixes the wastewater in an aeration zone which comprises approximately 1/3 of the basin area. Granular urea (640 lbs/day) and phosphoric acid (20 cc/min) are added as nutrients to support biological action. Herbicides (glyphosate - brand name: Rodeo) have been used in the past to control plant growth on the perimeter of the pond, but were not being used at the time of the inspection. The basin outlet is at one corner opposite the inflow. The treated wastewater is then pumped back to the paper mill site and discharged.

The outfall is via a 36-inch diameter wood-stave pipe, lined with polymer and bound by stainless steel bands. Discharge was originally 475 feet offshore at a depth of 39 feet; but damage to the pipe has open breaches much closer to shore. A 1992 inspection of the pipe revealed a breach 190 feet offshore at a depth of 30 feet which discharges approximately 40% of the total flow. BC reported that the damage was probably caused by channel dredging operations. The inspection also revealed a sunken log jam which crushed the last 164 feet of pipe leaving another opening 311 feet offshore at a depth of 39 feet. The remaining 60% of effluent flow is discharged at this point. In October 1993, approximately seven months after the inspection, the first breach was inspected and repaired and effluent is now discharged solely through the second breach.

Primary clarifier sludge is compressed with screw presses to remove moisture. Sludge cake is then trucked to a permanent on-site landfill. Leachate collected from the landfill is pumped to the aeration basin for treatment.

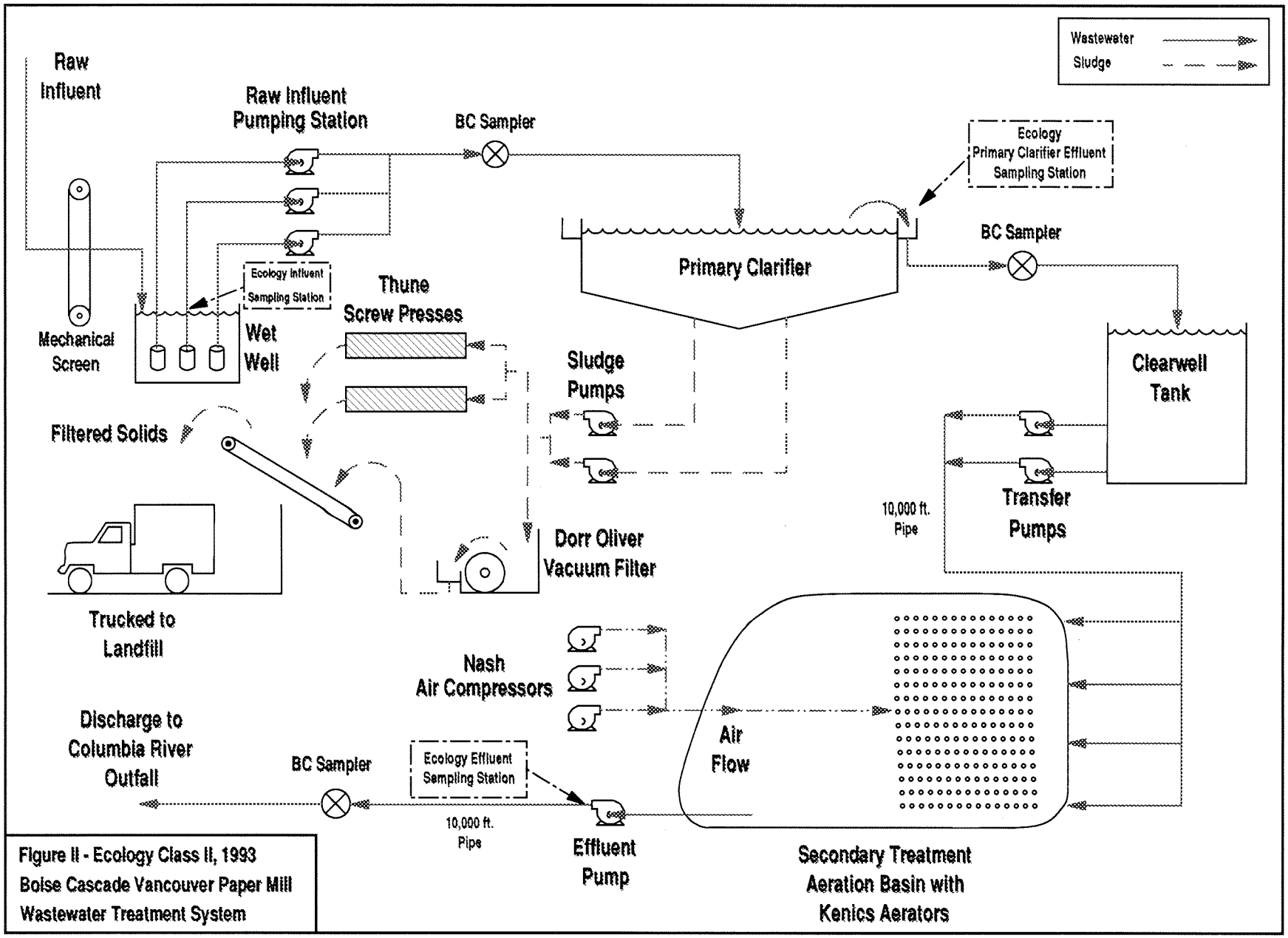

Figure II - Ecology Class II, 1993
Boise Cascade Vancouver Paper Mill
Wastewater Treatment System

PROCEDURE

Ecology collected both grab and composite samples at the BC treatment plant. Composite samples were collected from wastewater at three stations (*Figure 2 & Appendix A*) including influent, primary clarifier effluent, and aeration basin effluent. All composite samples were collected using Ecology ISCO composite samplers with equal volumes of the sample collected every 30 minutes over a 24-hour period.

Pairs of grab samples were collected at the same locations as the composite samples. Other grabs were taken of the plant's sludge cake and of the leachate from the sludge landfill. Sediment samples were taken from three locations in the Columbia River (*Appendix A*).

Boise Cascade personnel collected composite samples from the influent just prior to the primary clarifier and from the aeration basin effluent just prior to the outfall (*Figure 2 & Appendix A*). BC's sampling location for plant effluent differed somewhat from Ecology's, being separated by the 10,000 foot pipe connecting aeration basin and outfall. Flow travel time in the pipe was approximately 14.7 minutes. BC compositor samples were also collected from plastic containers kept overflowing from taps in the appropriate lines. The BC compositors were set to collect samples approximating those collected by Ecology's composite samplers.

Ecology and BC composite samples were split for analysis by both Ecology and BC laboratories. Parameters analyzed, samples collected, and schedules appear in Appendix B.

Samples designated for Ecology analysis were delivered to the Ecology Manchester Laboratory. Chain of custody procedures were observed throughout the inspection. Analytic procedures and laboratories performing the analyses are summarized in Appendix C.

QUALITY ASSURANCE/QUALITY CONTROL

Sampling

Sampling quality assurance included priority pollutant cleaning of sampling equipment (*Appendix D*). Sampling in the field followed all protocols for holding times, preservation, and chain-of-custody set forth in the Manchester Laboratory User's Manual (Ecology, 1991).

General Chemistry

All data are acceptable for use. Necessary qualifiers are noted in the data tables.

Metals Analysis

All analyses were performed within specified holding times. Spike and duplicate spike sample analyses for water matrices were within acceptable limits. Some sediment and sludge

samples showed poor spike recoveries and were appropriately qualified. Relative percent difference (RPD) and laboratory control samples (LCS) were within acceptable limits. Procedural blanks showed no analytically significant levels of analytes.

VOAs, BNA, and Pesticides/PCBs

Most sample extractions and holding times were within EPA protocol restrictions except for volatile organics analyses. Sludge and water samples for VOA analyses were held up to 10 days after the recommended 14 day holding time. This data has been qualified by a "J" qualifier.

Matrix spike and matrix spike duplicates recoveries were generally within acceptable limits. The laboratory qualified those outside acceptable limits with a "J" qualifier (estimated value).

Surrogate spike recoveries were generally within advisory QC limits. The one exception was sample #098289 analyzed for pesticide/PCB. Low recoveries may indicate a low bias for all target analytes in this area. The affected compounds have been qualified with a "UJ" (estimated detection limit).

Procedural blanks were generally acceptable. Low levels of some target compounds were detected in some laboratory blanks. The EPA "five times rule" was applied to these samples. This rule stipulates that detected compounds are considered real and not the result of contamination if levels in the samples are greater than or equal to five times the levels detected in the blanks.

Dioxins/Furans

All samples were received in good condition. All analyses were performed within specified holding times. Instrument calibration and internal standard recoveries were all within appropriate control limits. Isotopic abundance ratios met the criteria for positive identification. Method blanks were generally acceptable.

Chlorate, AOXs, and EOXs

All analyses were performed within specified holding times. Precision data, instrument calibration, spike recoveries, and standard reference material recoveries were all within appropriate control limits. Procedural blanks were acceptable.

Bioassays

For water samples negative control results, positive control results, and test environment data were generally within acceptable ranges for rainbow trout, fathead minnow, *Ceriodaphnia dubia*, and *Daphnia magna* bioassays.

QA/QC data for *Hyalella azteca* sediment bioassays generally supported the data produced. The reference toxicant produced unacceptable mortality. However, since test and control sediment toxicity was not observed this may be regarded as irrelevant.

RESULTS AND DISCUSSION

Flow Measurements

Boise Cascade estimated 24-hour effluent flow for February 22 and February 23 to be 8.55 MGD and 7.78 MGD, respectively. A Venturi meter near the headworks was not functioning properly during the inspection. Estimations were based upon intake flows to the plant and estimated losses within the plant. Intake included water from the City of Vancouver water supply and water from on-site wells. Losses were derived from evaporation rates inherent to the paper making process.

Ecology measured flow at the aeration basin outlet using a Polysonics Ultrasonic Flowmeter. Measurements were taken through a 15-inch inner diameter pipe approximately 30 feet downstream from the aeration basin effluent pumping station. Continuous measurements with the meter were not possible due to power limitations (battery operation was necessary). Measurements were taken over two periods, 2.4 and 3.8 hours in duration, on February 23 and February 24. Ecology flow rates for the two periods were 8.97 MGD and 8.87 MGD, respectively. The Ecology measurements exceeded the BC daily flow estimates by about 13%. The difference may be due to instrument variability or flow fluctuation over time, but could reflect a genuine underestimation by the BC method. BC's installation of a new effluent flowmeter since the inspection should provide accurate flow measurements.

General Chemistry

General chemistry data are reported in Table 1. The plant appeared to be operating effectively with significant reductions in most pertinent parameters. Individual components of the treatment plant appeared to be functioning adequately.

Treatment of oxygen demand substances (BOD_5, COD, and TOC) across the plant was generally acceptable (*Table 2*). Ecology results showed a BOD_5 reduction from 322 mg/L in the influent to 34 mg/L in the effluent. Some sludge leachate was also added to the aeration pond. Leachate BOD_5 concentration was 721 mg/L, but the small volume did not appear to appreciably impact treatment.

Ecology composite samples showed 97% removal in total suspended solids (TSS) (*Table 2*). Ecology grabs displayed equivalent reductions in TSS.

Initial nutrient concentrations in the influent were low (NH_3-N:0.206 mg/L, NO_2+NO_3-N: 1.78 mg/L, and Total-P:0.148 mg/L - Table 1). To ensure suitable biological activity, Boise

Table 1 – Ecology General Chemistry Results – Boise Cascade (Vancouver), 1993

Parameter	Location:	Pri–Inf–1	Pri–Inf–2	Pri–Inf–E	Pri–Inf–B	Pri–Ef–1	Pri–Ef–2	Pri–Ef–E	EF–1	EF–2	EF–E	EF–B
	Type:	grab	grab	comp	comp	grab	grab	comp	grab	grab	comp	comp
	Date:	2/23	2/23	2/23–24	2/23–24	2/23	2/23	2/23–24	2/23	2/23	2/23–24	2/23–24
	Time:	1105	1610	@	@	1130	1625	@	0945	1545	@	@
	Lab Log #:	098280	098281	098282	098283	098284	098285	098286	098287	098288	098289	098290
GENERAL CHEMISTRY												
Conductivity (umhos/cm)		584	386	588	722	697	654	698	706	707	702	705
Alkalinity (mg/L CaCO3)				572	555			211			237	239
Hardness (mg/L CaCO3)				488	567			206			220	221
SOLIDS												
TS (mg/L)				1870				636			552	
TNVS (mg/L)				774				384			389	
TSS (mg/L)		5650	230	1480	1300	34	30	60	41	30	44	37
TNVSS (mg/L)				LAC				LAC			15	
% Solids												
% Volatile Solids												
OXYGEN DEMAND PARAMETERS												
BOD5 (mg/L)				322	346			157			34	29
COD (mg/L)				1610	1210			315			121	116
TOC (water mg/L)		141 E	36.7	183	154	114	100	116	47.6	46.6	47.5	48
TOC (soil/sed ppm C)												
NUTRIENTS												
NH3–N (mg/L)				0.206	0.338			0.426			0.483	0.629
NO2+NO3–N (mg/L)				1.78	0.735			0.397			0.001	0.083
Total–P (mg/L)				0.148	0.045			0.071			0.232	0.242
MISCELLANEOUS												
Oil and Grease (mg/L)		13 J	2 J			2 J	2 J		2 J	1 UJ		
F–Coliform MF (#/100mL)												
% Klebsiella (KES)												
Cyanide total (mg/L)				0.006	0.002			0.002			0.003	0.002 U
Cyanide (wk & dis mg/L)				0.002 U	0.002 U			0.002 U			0.002 U	0.002 U
Cyanide total (sed mg/kg dry wt)												
Cyanide (sed wk & dis mg/kg dry wt)												
Cholrate (ug/L ClO3)								30			30	
FIELD OBSERVATIONS												
Temperature (°C)		22.9	18.9		9.2	22.2	20.9		17.4	15.6		6.6
Temperature cooled (°C)+				3.0				2.9			2.1	
pH		8.63	7.89	8.47	7.79	7.74	7.63	7.46	7.68	7.44	7.71	7.25
Conductivity (umhos/cm)		551	366	581	609	679	656	680	709	714	737	711
Total Chlorine Residual (mg/L)		<0.1	<0.1				<0.1	<0.1	<0.1	<0.1	<0.1	

E Ecology sample
B Boise Cascade sample
grab grab sample
comp Composite sample
grab/comp Grab composite sample

Pri–Inf Primary clarifier influent
Pri–Ef Primary clarifier effluent
@ Composite sample collection period: 08:00–08:00.
+ Cooled composite sample
LAC Lab Accident – Data lost.

E Reported result is an estimate because of the presence of interference.
J The analyte was positively identified. The assocoated numerical value is an estimate.
U The analyte was not detected at or above the reported result.
UJ The analyte was not detected at or above the reported estimated result.

Table 1 – Ecology General Chemistry Results – Boise Cascade (Vancouver), 1993

Parameter II	Locatn:	EF–3	EF–4	Ef–GC	Sludge	Leachate	Sed–1	Sed–2	Sed–3
	Type:	grab	grab	grab/comp	grab	grab	grab/comp	grab	grab
	Date:	2/24	2/24	2/23–24	2/23	2/23	2/23	2/23	2/23
	Time:	0955	1355	0945&1625	1330	1420	1145&1220	1240	1320
	Lab Log #:	098291	098292	098293	098294	098295	098296	098297	098298
GENERAL CHEMISTRY									
Conductivity (umhos/cm)						2480			
Alkalinity (mg/L CaCO3)						1380			
Hardness (mg/L CaCO3)						1610			
SOLIDS									
TS (mg/L)									
TNVS (mg/L)									
TSS (mg/L)						43			
TNVSS (mg/L)									
% Solids					25		83.9	84.5	70.7 J
% Volatile Solids					55.4		0.65	0.7	0.67 J
OXYGEN DEMAND PARAMETERS									
BOD5 (mg/L)						721			
COD (mg/L)						1370			
TOC (water mg/L)						447			
TOC (soil/sed ppm C)					90		1360	1670	2180
NUTRIENTS									
NH3–N (mg/L)						0.2			
NO2+NO3–N (mg/L)						0.014			
Total–P (mg/L)						0.067			
MISCELLANEOUS									
Oil and Grease (mg/L)									
F–Coliform MF (#/100mL)		11000 X	9700 X						
% Klebsiella (KES)		55	55						
Cyanide total (mg/L)						0.002			
Cyanide (wk & dis mg/L)						0.002 U			
Cyanide total (sed mg/kg dry wt)					0.002 U				
Cyanide (sed wk & dis mg/kg dry wt)					0.002 U				
Cholrate (ug/L ClO3)									
FIELD OBSERVATIONS									
Temperature (°C)				16.5 *		10.2			
Temperature cooled (°C) +									
pH				7.56 *		670			
Conductivity (umhos/cm)				712 *		2510			
Total Chlorine Residual (mg/L)						<0.1			

E	Ecology sample	Sludge	Sludge sample	J	The analyte was positively identified. The assocoated numerical value is an estimate.
B	Boise Cascade sample	Sed	Sediment sample	U	The analyte was not detected at or above the reported result.
grab	grab sample	Leachate	Sludge landfill leachate	X	High background count.
comp	Composite sample	Ef–GC	Bioassay grab composite	*	Average of two composite grabs.
Ef	Effluent	grab/comp	Grab composite sample	+	Cooled composite sample

Table 2 – General Chemistry Percent Reduced – Boise Cascade (Vancouver), 1993

Parameter	Location:	Pri–Inf–E	Pri–Ef–E	Ecology	EF–E	Ecology	Pri–Inf–B	EF–B	Boise Cascade
	Type:	comp	comp	Primary Clarifier	comp	Effluent	comp	comp	Effluent
	Date:	2/23–24	2/23–24	Percent	2/23–24	Percent	2/23–24	2/23–24	Percent
	Time:	@	@	Reduced	@	Reduced	@	@	Reduced
	Lab Log #:	098282	098286		098289		098283	098290	
GENERAL CHEMISTRY									
Conductivity (umhos/cm)		588	698	–19%	702	–19%	722	705	2%
Alkalinity (mg/L CaCO3)		572	211	63%	237	59%	555	239	57%
Hardness (mg/L CaCO3)		488	206	58%	220	55%	567	221	61%
SOLIDS 4									
TSS (mg/L)		1480	60	96%	44	97%	1300	37	97%
OXYGEN DEMAND PARAMETERS									
BOD5 (mg/L)		322	157	51%	34	89%	346	29	92%
COD (mg/L)		1610	315	80%	121	92%	1210	116	90%
TOC (water mg/L)		183	116	37%	47.5	74%	154	48	69%
NUTRIENTS									
NH3–N (mg/L)		0.206	0.426	–107%	0.483	–134%	0.338	0.629	–86%
NO2+NO3–N (mg/L)		1.78	0.397	78%	0.1	94%	0.735	0.083	89%
Total–P (mg/L)		0.148	0.071	52%	0.232	–57%	0.045	0.242	–438%
MISCELLANEOUS									
Cyanide total (mg/L)		0.006	0.002	67%	0.003	50%	0.002	0.002	0%
Cyanide (wk & dis mg/L)		0.002 U	0.002 U	0%	0.002 U	0%	0.002	0.002	0%

E Ecology sample
B Boise Cascade sample
comp Composite sample
Inf Influent
Ef Effluent
Pri Primary clarifier

@ Composite collection period: 08:00–08:00
U Analyte was not detected at the reported estimate.

Cascade personnel routinely add granular urea and phosphoric acid to the aeration basin. Nutrient concentrations in the effluent were also low, indicating that the quantities added to the aeration basin were appropriate.

Effluent fecal coliform counts of 11,000 #/100mL and 9,700 #/100mL (*Table 1*). These concentrations may pose some problems in terms of receiving water quality, particularly since the geometric mean is more than 100 times the fresh water fecal coliform criteria for Class A waters (Ecology, 1992). The Klebsiella test indicated that 55% of the test organisms detected were Klebsiella. The fecal coliform counts are directly applicable to water quality standards regardless of species composition in the sample.

Total cyanide was detected in Ecology's effluent sample at 3 µg/L (*Table 1*), which is below the EPA ambient freshwater quality criteria for receiving waters. The EPA criteria are 5.2 µg/L and 22.0 µg/L as four-day and one-hour averages, respectively (EPA, 1984). The effluent sample total cyanide concentration represented a 50% reduction from the influent sample concentration (*Table 2*). Weak and disassociable cyanide was not detected above a detection limit of 2 µg/L in both influent and effluent samples.

Most sludge general chemistry concentrations appeared reasonable. Percent total solids (25%) was enhanced due to screwpress dewatering. Cyanide was undetected.

NPDES Permit Compliance

Effluent inspection results were less than NPDES permit daily maximums and monthly averages (*Table 3*). BOD_5 effluent load (2,515 lbs/day) and TSS effluent load (3,255 lbs/day), calculated with Ecology's higher flow measurements, were both less than 75% of monthly average permit limits. The pH for all effluent samples fell within the range specified by the permit.

Sample Splits

Ecology analysis of splits from Ecology and Boise Cascade influent and effluent composite samples found the results to be similar (*Table 4*). A non-parametric Wilcoxon Signed Ranks analysis found the difference between split samples was not significant. Composite sampling appears acceptable.

Comparison of Ecology and Boise Cascade laboratory analysis of split samples found a fairly close match for most parameters (*Table 4*). A non-parametric test for TSS found that Boise Cascade's sample results are significantly less than the Ecology results at a 90% confidence limit. Review of the procedures for TSS analysis is recommended. Analysis of sets of pH and BOD_5 data found that the Boise Cascade results are not significantly different than the Ecology results at a 90% confidence limit.

Table 3 – Effluent NPDES Limits/Inspection Results – Boises Cascade (Vancouver), 1993

	NPDES Permit Limits		Inspection Data				
Parameter	Monthly Average	Daily Maximums		Ecology Composite	STP Composite	Grab Samples	
			Location:	EF–E	EF–B	EF–1	EF–2
			Type:	comp	comp	grab	grab
			Date:	2/23–24	2/23–24	2/23	2/23
			Time:	@	@	0945	1545
			Lab Log #:	098289	098290	098287	098288
BOD5	3400	6550					
Ecolgy Flow (lbs/D)				2515	2145		
B.C. Flow (lbs/D)				2206	1882		
TSS	4700	8800					
Ecolgy Flow (lbs/D)				3255	2737	3033	2219
B.C. Flow (lbs/D)				2855	2401	2660	1947
pH (S.U.)	6.0 < pH < 9.0			7.71	7.25	7.68	7.44
Flow (Ecology) (MGD)				8.87	8.87	8.87	8.87
Flow (Boise Cascade) (MGD)				7.78	7.78	7.78	7.78

B.C. Flow Lbs/day derived from Boise Cascade influent flow estimations.
Ecology Flow Lbs/day derived from Ecology ultrasonic effluent flow measurements.
Ef Efluent flow
E Ecology samples
B Boise Cascade samples
comp Composite sample
grab grab sample

@ Compositor sample period: 08:00–08:00.

Table 4 – Split Sample Result Comparison – Boise Cascade, 1993

Parameter		Location:	Pri–Inf–E	Pri–Inf–B	Pri–Ef–E	EF–E	EF–B
		Type:	comp	comp	comp	comp	comp
		Date:	2/23–24	2/23–24	2/23–24	2/23–24	2/23–24
		Time:	@	@	@	@	@
		Lab Log #:	098282	098283	098286	098289	098290
	Laboratory						
TSS (mg/L)	Ecology		1480	1300	60	44	37
	Boise Cascade		1260	1140	36	44	35
BOD5 (mg/L)	Ecology		322	346	157	34	29
	Boise Cascade		420	408	185	45	37
pH	Ecology		8.47	7.79	7.46	7.71	7.25
	Boise Cascade		8.40	7.80	7.80	8.20	7.60

@ 24 hour composite. Collection period: 0800 – 0800.
Inf Influent samples.
Ef STP effluent
Comp composite sample
grab grab sample

E Ecology Sample
B Boise Cascade Sample

Detected VOA, BNA, Pesticides/PCB, and Metals Results - Water

Table 5 summarizes concentrations of VOA, BNA, and Pesticide/PCB compounds detected during the inspection. Table 6 summarizes priority pollutant metals. Appendix E contains results of all targeted compounds, including detection limits. Tentatively identified compounds are presented in Appendix F.

Several volatile compounds were detected in the effluent, but none exceeded either the acute or chronic EPA water quality criteria for receiving waters (*Table 5*). Chloroform was found in the highest effluent concentration (47-49 µg/L), but was still less than 4% of chronic criteria. 2-butanone (MEK) was detected in the return leachate at 160 µg/L, however, it was not detected in the effluent.

A number of semi-volatile compounds were also identified in the effluent (*Table 5*). None exceeded either the acute or chronic EPA water quality criteria for receiving waters. 2,4,6-trichlorophenol was the BNA found at the highest concentration (8.2 µg/L), but was well below its chronic criteria. 4-methylphenol was found in the return leachate at 234 µg/L, but concentrations were only 1.9 µg/L in the effluent.

No pesticides or PCBs were detected in either the effluent or the sludge (*Appendix F*).

Three metals (arsenic, copper, and zinc) were detected in the effluent (*Table 6*). None exceeded hardness adjusted water quality criteria for receiving waters (EPA, 1986; Ecology, 1992).

Several substituted biphenyl compounds were tentatively identified in unexpectedly large concentrations (Effluent: 26.8 and 17.0 µg/L) and due to their potential toxic nature may be of some concern (*Appendix G*). Substituted biphenyls are identified in the Merck manual as heat transfer compounds (Merck, 1983). The BC environmental engineer suggested their presence in the effluent and sludge may be a residual from the plant's production of carbon copy paper. It may be of value to positively identify these compounds and their concentrations.

Detected Dioxins/Furans, Organic Halides, Chlorates, and Guaiacols - Water

Dioxins and furans were undetected in the effluent (*Table 7*). Several dioxins and one furan were detected in the influent. Total HxCDDs (150 pg/L) and OCDD (160 pg/L) were detected in the largest concentrations and were also present in the sludge (1.6 pg/g dry-wt and 20 pg/g dry-wt, respectively). Most of the other compounds detected in the influent were also detected in the sludge, suggesting these compounds are settled with solids in the clarifier.

Organic halides (AOX) were detected in two effluent grab samples at 6.3 mg/L and 0.32 mg/L (*Table 7*). Interestingly, influent grabs revealed lower concentrations (2.2 mg/L

Table 5 – VOA and BNA Detected – Boise Cascade (Vancouver), 1993.

Parameter	Location:	Pri–Inf–1	Pri–Inf–2	Pri–Ef–1	Pri–Ef–2	EF–1	EF–2	Leachate	EPA Water Quality Criteria Summary		Sludge
	Type:	grab	grab	grab	grab	grab	grab	grab			grab
	Date:	2/23	2/23	2/23	2/23	2/23	2/23	2/23	Acute	Chronic	2/23
	Time:	1105	1610	1130	1625	0945	1545	1420	Fresh	Fresh	1330
	Lab Log#:	098280	098281	098284	098285	098287	098288	098295			098294
VOA Compounds		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Chloromethane		0.02 J	2 UJ	0.2 J	0.2 J	0.4 UJ	1 UJ	4 UJ	11,000 *(a)		7 UJ
Dichlorodifluoromethane		2 UJ	3 UJ	2 UJ	3 J	2 UJ	3 UJ	4 J	11,000 *(a)		7 UJ
Bromomethane		2 J	1 J	1 J	1 J	0.4 UJ	1 UJ	4 UJ	11,000 *(a)		4 UJ
Chloroethane		0.2 J	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ			7 UJ
Trichlorofluoromethane		2 J	2 UJ	0.4 UJ	0.1 J	0.4 UJ	1 UJ	4 UJ	11,000 *(a)		16 J
Methylene Chloride		24 UJ	21 UJ	19 UJ	18 J	5 UJ	12 UJ	15 UJ	11,000 *(a)		170 UJ
Carbon Disulfide		4 J	2 UJ	1 J	4 J	0.5 J	1 UJ	1 UJ			26 J
trans–1,2–Dichloroethene		0.4 UJ	2 UJ	0.5 J	0.4 J	0.4 UJ	1 UJ	4 UJ	11,600 *(b)		7 UJ
Chloroform		160 J	10 J	240 UJ	180 J	49 J	47 J	4 UJ	28,900 *	1,240 *	150 J
2–Butanone (MEK)		4 UJ	6 UJ	2 UJ	4 UJ	6 UJ	9 UJ	160 J			46 UJ
1,1,1–Trichloroethane		0.4 J	2 UJ	0.4 UJ	0.6 J	0.4 J	1 UJ	4 UJ	18,000 *(c)		5 J
Bromodichloromethane		2 J	1 J	4 J	3 J	1 J	1 J	4 UJ	11,000 *(a)		7 UJ
1,2–Dichloropropane		0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.04 J	4 UJ	23,000 *(d)	5,700 *(d)	7 UJ
Trichloroethene		0.3 J	2 UJ	0.3 J	0.3 J	0.4 UJ	1 UJ	4 UJ	45,000 *	21,900 *	7 UJ
Dibromochloromethane		0.5 J	1 J	1 J	0.8 J	0.4 J	1 UJ	4 UJ	11,000 *(a)		7 UJ
Benzene		0.4 UJ	2 UJ	0.2 J	0.6 J	0.4 UJ	1 UJ	4 UJ	5,300 *		7 UJ
Bromoform		0.2 J	2 UJ	0.4 UJ	0.2 J	0.4 UJ	1 UJ	4 UJ	11,000 *(a)		7 UJ
4–Methyl–2–Pentanone (MIBI		0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	4 J	1 UJ	4 UJ			7 UJ
Tetrachloroethene		0.5 J	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	5,280 *	840 *	7 UJ
Toluene		0.4 UJ	2 UJ	0.4 UJ	4 J	4 J	4 J	4 UJ	17,500 *		8 UJ
Ethylbenzene		0.4 UJ	2 UJ	0.3 J	3 J	0.3 J	1 UJ	4 UJ	32,000 *		7 J
Styrene		0.3 J	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ			7 UJ
Total Xylenes		0.4 UJ	2 UJ	1 UJ	18 J	0.7 UJ	1 UJ	4 UJ			41 J
1,2,4–Trimethylbenzene		0.7 J	1 J	2 J	19 J	2 J	2 J	4 UJ			210 J
1,3,5–Trimethylbenzene		0.2 J	2 UJ	0.7 J	6 J	0.8 J	1 UJ	4 UJ			69 J
sec–Butylbenzene		0.4 UJ	2 UJ	0.4 UJ	0.8 J	0.4 UJ	1 UJ	4 UJ			24 J
p–Isopropyltoluene		0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ			10 J
Butylbenzene		0.4 UJ	2 UJ	0.4 UJ	3 UJ	0.4 UJ	1 UJ	4 UJ			110 J
Isopropylbenzene		0.4 UJ	2 UJ	0.2 J	1 J	0.1 J	1 UJ	4 UJ			10 J
Propylbenzene		0.4 UJ	2 UJ	0.4 J	4 J	0.4 J	1 UJ	4 UJ			50 UJ
Naphthalene		0.4 UJ	2 UJ	1 UJ	9 J	2 UJ	2 UJ	4 UJ	2,300 *	620 *	44 UJ

J The analyte was positively identified. The associated numerical result is an estimate.
U The analyte was not detected at or above the reported result.
UJ The analyte was not detected at or above the reported estimated result.
grab grab sample
comp Composite sample
E Ecology sample

Leachate Sludge landfill leachate
Sludge Sludge sample
Pri–Inf Primary clarifier influent
Pri–Ef Primary clarifier effluent
@ Composite sample collection period: 07:00 – 07:00.
Ef Effluent sample
a Total Halomethanes
c Total Trichloroethanes
d Total Dichloropropanes

Table 5 – VOA and BNA Detected – Boise Cascade (Vancouver), 1993.

Parameter	Location:	Pri–Inf–E	Pri–Ef–E	EF–E	Leachate	EPA Water Quality Criteria Summary		Sludge
	Type:	comp	comp	comp	grab			grab
	Date:	2/23–24	2/23–24	2/23–24	2/23	Acute	Chronic	2/23
	Time:	@	@	@	1420	Fresh	Fresh	1330
	Lab Log#:	098282	098286	098289	098295			098294
BNA Compounds		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(ug/L)	(ug/L)	(µg/L)
Aniline		4.1 J	0.3 U	0.33 U	0.48 U			1960 U
Benzoic Acid		22.6 J	0.74 U	0.83 U	112 J			9780 U
Hexachlorocyclopentadiene		31.2 J	1.5 UJ	1.6 UJ	2.4 UJ	7 *	5.2 *	NAR U
Phenanthrene		23.4	2.7	0.81	0.48 U			2250
Butylbenzyl Phthalate		6.2 U	0.28 J	0.33 U	0.48 U	940 *(i)	3 *(i)	1960 U
Fluorene		53.2	6.9	2.8	1.5			3970
2,4,6–Trichlorophenol		11.4	13.5	8.2	0.48 U		970 *	4890 U
2–Nitrophenol		15.6 U	0.74 U	0.83 U	1.2	230 *(l)	150 *(l)	4890 U
1–Methylnaphthalene		4.9 J	3.4	1.8	0.29 J			1960 U
Naphthalene		2.5 J	2.4	1.2	0.48 U	2,300 *	620 *	1960 U
2–Methylnaphthalene		4.2 J	2.6	1	0.29 J			1960 U
2–Methylphenol		6.2 U	0.3 U	0.14 J	0.48 U			1960 U
Benzyl Alcohol		6.2 U	5.2	0.88	0.48 U			4890 U
4–Methylphenol		6.2 U	2.9	1.9	234			1960 U
2,4–Dichlorophenol		6.2 U	0.8	0.52	0.48 U	2,020 *	365 *	1960 U
Dibenzofuran		6.2 U	0.12 J	0.33 U	0.48 U			1960 U
2–Flourophenol			25	53				

J The analyte was positively identified. The associated numerical result is an estimate.
U The analyte was not detected at or above the reported result.
UJ The analyte was not detected at or above the reported estimated result.
grab grab sample
comp Composite sample
E Ecology sample

Leachate Sludge landfill leachate
Sludge Sludge sample
Pri–Inf Primary clarifier influent
Pri–Ef Primary clarifier effluent
@ Composite sample collection period: 07:00 – 07:00.
Ef Effluent sample
i Total Phthalate Esters
l Total Nitrophenols

Table 6 – Metals Detected – Boise Cascade (Vancouver), 1993

Parameter	Location:	Pri–Inf–E	Pri–Ef–E	EF–E	Leachate	EPA and Ecology Water Quality Criteria Summary		Sludge	Sed–1	Sed–2	Sed–3
	Type:	comp	comp	comp	grab			grab	grab/comp	grab	grab
	Date:	2/23–24	2/23–24	2/23–24	2/23	Acute	Chronic	2/23	2/23	2/23	2/23
	Time:	@	@	@	1420	Fresh	Fresh	1330	1145&1220	1240	1320
	Lab Log#:	098282	098286	098289	098295			098294	098296	098297	098298
Metals** Hardness =	220	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/Kg–dry)	(mg/Kg–dry)	(mg/Kg–dry)	(mg/Kg–dry)
Arsenic (total)		1.8 P	1.2 P	1.6 P	5.6	360 c	190 d	0.3 UN	1.39	1.52	1.46
Beryllium		1 U	1 U	1 U	1 U	130 *	5 *	0.1 U	0.12 P	0.11 P	0.12
Cadmium		0.41 P	0.1 U	0.1 U	0.1 U	8 +c	2 +d	0.094	0.16	0.28 P	0.19
Chromium (total)		5 U	5 U	5 U	5 U			6.16 J	4.75 PJ	4.01 PJ	5.43
Hexavalent						16 c	11 d				
Trivalent						3,312 +c	394.8 +d				
Copper		12 P	4.9 P	5.7 P	3 U	32.1 +c	20.0 +d	25	5.13	5.02	5.06
Lead		5.6 P	1 U	1 U	1 U	153.0 +c	6.0 +d	2.46	3.36	3.33	3.25
Mercury		0.05 U	0.05 U	0.05 U	0.05 U	2.4 c	0.012 d	0.0125 UN	0.0092 P	0.0042 U	0.0045
Nickel		10 U	10 U	10 U	15 P	2,625 +c	292 +d	5.36 P	7.43 P	6.11 P	7.59
Zinc		126 U	22 P	13 P	22 P	203.4 +c	184.2 +d	102 J	47	44	48

J The analyte was positively identified. The associated numerical result is an estimate.
N The spike sample recovery is not within control limits.
P The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.
U The analyte was not detected at or above the reported result.
UJ The analyte was not detected at or above the reported estimated result.
E Ecology sample
B Boise Cascade sample
grab grab sample
comp Composite sample
* Insufficient data to develop criteria. Value presented is the LOEL – Lowest Observed Effect Level.
** Analysis for metals data were total metals.
+ Hardness dependent criteria (220 mg/L used)

Sludge Sludge sample
Sed Sediment sample
Leachate Sludge landfill leachate
Ef–GC Bioassay grab composite
Pri–Inf Primary clarifier influent
Pri–Ef Primary clarifier effluent
@ Composite sample collection period: 07:00–07:00.
Ef Effluent sample
Inf Influent sample
grab/comp Grab composite sample
c A 1–hour average concentration not to be exceeded more than once every three years on the average.
d A 4–day average concentration not to be exceeded more than once every three years on the average.

Table 7 – Furan, Dioxin, Organic Halide, and Chlorate Results – Boise Cascade (Vancouver), 1993

Parameter	Location:	Pri–Inf–1	Pri–Inf–2	Pri–Inf–E	Pri–Ef–1	Pri–Ef–2	Pri–Ef–E	EF–1	EF–2	EF–E
	Type:	grab	grab	comp	grab	grab	comp	grab	grab	comp
	Date:	2/23	2/23	2/23–24	2/23	2/23	2/23–24	2/23	2/23	2/23–24
	Time:	1105	1610	@	1130	1625	@	0945	1545	@
	Lab Log #:	098280	098281	098282	098284	098285	098286	098287	098288	098289
Furans				(pg/L)			(pg/L)			(pg/L)
TCDFs (Total)				34			3.6 U			3.8 U
2,3,7,8–TCDF				34 g			3.6 U			2.1 U
PeDCFs (Total)				19 U			1.7 U			2.2 U
1,2,3,7,8–PeCDF				19 U			1.7 U			2.2 U
2,3,4,7,8–PeCD				18 U			1.5 U			1.9 U
HxCDFs (Total)				22 U			5.2 U			4.9 U
1,2,3,4,7,8–HxCDF				17 U			0.73 U			2 U
1,2,3,6,7,8–HxCDF				16 U			0.97 U			1.9 U
2,3,4,6,7,8–HxCDF				19 U			5 U			4.7 U
1,2,3,7,8,9–HxCDF				17 U			1.2 U			1.4 U
HpCDFs (Total)				23 U			1.8 U			5.1 U
1,2,3,4,6,7,8–HpCDF				20 U			1.4 U			1.6 U
1,2,3,4,7,8,9–HpCDF				16 U			0.69 U			5.1 U
OCDF				40 U			3.8 U			3.7 U
Dioxins				(pg/L)			(pg/L)			(pg/L)
TCDDs (Totals)				11			2 U			2 U
2,3,7,8–TCDD				11			2 U			1.7 U
PeCDDs (Total)				17 U			1.4 U			1.4 U
1,2,3,7,8–PeCDD				17 U			1.4 U			1.4 U
HxCDDs (Total)				150			19 U			2.7 U
1,2,3,4,7,8–HxCDD				16 U			1.7 U			0.67 U
1,2,3,6,7,8–HxCDD				20 U			3 U			0.95 U
1,2,3,7,8,9–HxCDD				15 U			1.9 U			1.2 U
HpCDDs (Total)				29			3.8 U			3.5 U
1,2,3,4,6,7,8–HpCDD				29 UJ			3.8 U			3.5 U
OCDD				160			26 U			20 U
Organic Halides		(mg/L)	(mg/L)		(mg/L)	(mg/L)		(mg/L)	(mg/L)	
AOX (water)		2.2	0.13		0.17	0.3		6.3	0.32	
EOX (Soil/sed)										
Chlorate							(mg/L)			(mg/L)
(ClO3)							0.3			0.3

U The analyte was not detected at or above the reported value.
Pri–Inf Primary clarifier influent sample.
Pri–Ef Primary clarifier effluent sample.
g Results confirmed on DB–225 column.
EF Effluent sample.
comp Composite sample.
grab Grab sample.
@ Composite sampling period: 08:00–08:00.
E Ecology sample.

Table 7 – Furan, Dioxin, Organic Halide, and Chlorate Results – Boise Cascade (Vancouver), 1993

Parameter	Location:	Sludge	Leachate	Sed–1	Sed–2	Sed–3
	Type:	grab	grab	grab/comp	grab	grab
	Date:	2/23	2/23	2/23	2/23	2/23
	Time:	1330	1420	1145&1220	1240	1320
	Lab Log #:	098294	098295	098296	098297	098298
Furans		(pg/g–dry wt)	(pg/L)	(pg/g–dry wt)	(pg/g–dry wt)	(pg/g–dry wt)
TCDFs (Total)		6.3	16	0.65 U	0.27 U	0.37 U
2,3,7,8–TCDF		2.2 g	3.0 U	0.44 U	0.17 U	0.18 U
PeDCFs (Total)		0.19 U	4.3 U	0.65 U	0.29 U	0.35 U
1,2,3,7,8–PeCDF		0.18 U	4.3 U	0.65 U	0.20 U	0.35 U
2,3,4,7,8–PeCD		0.19 U	3.3 U	0.62 U	0.29 U	0.34 U
HxCDFs (Total)		0.38 U	3.7 U	1.3 U	1.0 U	1.2 U
1,2,3,4,7,8–HxCDF		0.16 U	1.1 U	0.50 U	0.16 U	0.35 U
1,2,3,6,7,8–HxCDF		0.12 U	1.2 U	0.77 U	0.18 U	0.34 U
2,3,4,6,7,8–HxCDF		0.35 U	3.7 U	1.3 U	1.0 U	0.57 U
1,2,3,7,8,9–HxCDF		0.38 U	1.8 U	1.1 U	0.33 U	1.2 U
HpCDFs (Total)		1.3	2.4 U	1.9 U	0.57 U	0.85 U
1,2,3,4,6,7,8–HpCDF		1.3 UJ	1.4 U	1.5 U	0.57 U	0.27 U
1,2,3,4,7,8,9–HpCDF		0.25 U	2.4 U	1.9 U	0.34 U	0.85 U
OCDF		2.3 U	22 U	4.4 U	1.0 U	1.5 U
Dioxins		(pg/g–dry wt)	(pg/L)	(pg/g–dry wt)	(pg/g–dry wt)	(pg/g–dry wt)
TCDDs (Totals)		0.63	4.7 U	0.83 U	0.37 U	0.41 U
2,3,7,8–TCDD		0.63	4.7 U	0.67 U	0.11 U	0.28 U
PeCDDs (Total)		0.15 U	2.8 U	0.79 U	0.14 U	0.27 U
1,2,3,7,8–PeCDD		0.13 U	2.8 U	0.79 U	0.21 U	0.27 U
HxCDDs (Total)		1.6	3.5 U	0.92 U	0.35 U	0.99 U
1,2,3,4,7,8–HxCDD		0.12 U	3.2 U	0.83 U	0.21 U	0.40 U
1,2,3,6,7,8–HxCDD		0.68 U	3.5 U	0.80 U	0.35 U	0.39 U
1,2,3,7,8,9–HxCDD		0.30 U	3.2 U	0.92 U	0.27 U	0.41 U
HpCDDs (Total)		5.5	8.8 U	2.4 U	0.85 U	0.78 U
1,2,3,4,6,7,8–HpCDD		3.3	8.8 U	2.5 U	0.85 U	0.78 U
OCDD		20	47 U	16	4.6 U	3.5 U
Organic Halides		(mg/Kg–dry wt)	(mg/L)	(mg/Kg–dry wt)	(mg/Kg–dry wt)	(mg/Kg–dry wt)
AOX (water)			2.3			
EOX (Soil/sed)		34		10 U	10 U	10 U

Leachate	Leachate from sludge landfill.
Sed	Sediment sample from Columbia River.
Sludge	Sludge sample
grab	Grab sample.
grab/comp	Grab composite.

U	The analyte was not detected at or above the reported value.
g	Results confirmed on DB–225 column.
UJ	Estimated value that is below lower calibration limit, but above the target detection limit.

and 0.13 mg/L). This discrepancy may be due to a slug of higher concentration passing through the basin or release from the sludge. The concentration in the sludge was 34 mg/Kg dry-wt.

Chlorate (ClO_3) was detected in the plant effluent and in the primary clarifier effluent at concentrations of 0.3 mg/L (*Table 7*). Recently, Canada's British Columbia Department of Fisheries and Oceans investigated the toxic impact of chlorate on freshwater lotic diatom communities. The study's results indicate that ClO_3 concentrations up to 0.5 mg/L had no effect on the growth rates or biomass of these organisms (Limnotek, 1992). Although the toxic impact of this compound on aquatic organisms is not fully known, the concentrations detected in the BC effluent do not appear to be toxic.

Three guaiacols were detected in the effluent (*Table 8*). 2,3,4-trichlorophenol was detected at the highest concentration (7 µg/L). No known biological effect for this compound is available in the literature, although the closely related 2,3,5-trichlorophenol has a 24-hr LC_{50} of 1,600 µg/L for guppies (*Poecilia recticulata*) at a pH of 7.3 (Verschueren, 1983).

Bioassays

Bioassay results for rainbow trout and *Daphnia magna* exhibited some slight acute effects in the effluent (*Table 9*). Rainbow trout 96-hour survival test found 67% survival at 100% effluent concentration compared to a control with 100% survival. The *Daphnia magna* 48-hour survival test produced a NOEC of 50% effluent.

The effluent exhibited no chronic effects (*Table 9*). *Ceriodaphnia dubia* results for survival and reproduction produced NOECs of 100% effluent. Similarly, fathead minnow results for survival and growth also produced NOECs of 100% effluent.

Sludges and Sediments

The primary clarifier sludge sample was analyzed for VOA, BNA, Pesticide/PCBs, and metals. The sediment samples were analyzed for metals only.

Several volatile compounds were identified in the sludge sample (*Table 5*). Three with the highest concentrations include 1,3,5-trimethylbenzene (210 µg/Kg-dry wt), chloroform (150 µg/Kg-dry wt), and butylbenzene (110 µg/Kg-dry wt). No identified toxic effects are associated with these concentrations (Verschueren, 1983). Tentatively identified compounds at concentrations up to 3,700 µg/Kg-dry were also detected (*Appendix F*).

Two semi-volatile compounds, fluorene (3,970 µg/Kg-dry wt) and phenanthrene (2,250 µg/Kg-dry wt) were detected in the sludge (*Table 5*). No identified toxic effects are associated with these concentrations (Verschueren, 1983). There were also numerous tentatively identified compounds found. A biphenyl compound was found at the highest concentration (483,000 µg/Kg-dry).

Table 8 – Guaiacols/Catechols/Phenolics scans – Boise Cascade (Vancouver), 1993

Parameters	Location:	Ef–E
	Type:	comp
	Date:	2/23–24
	Time:	@
	Lab Log#:	098289
		(µg/L)
Guaiacols		
Pentachlorophenol		6.7 U
2,4,6–Trichlorophenol		6.7 U
Guaiacol (2–methoxyphenol)		6.7 U
2–Methylphenol		6.7 U
o–chlorophenol		6.7 U
4–Allylguaiacol (eugenol)		6.7 U
3–CYCLOHEXENE–1–METHAN+		0.31 J
2,4,5–Trichlorophenol		6.7 U
2,4–Dimethylphenol		0.18 J
4–Methylphenol		6.7 U
Phenol		6.7 U
2,4–Dichlorophenol		6.7 U
3–Methyl–4–chlorophenol		6.7 U
2,3,5–Trichlorophenol		6.7 U
Isoeugenol		6.7 U
Tetrachlorocatechol		6.7 U
4–Chlorocatechol		6.7 U
4,5–Dichloroguaiacol		6.7 U
Tetrachloroguaiacol		6.7 U
Trichlorosyringol		6.7 U
4,5,6–Trichloroguaiacol		6.7 U
4,5–Dichlorocatechol		6.7 U
2,3,4–Trichlorophenol		7
4–Chloroguaiacol		6.7 U
6–Chlorovanillin		6.7 U
5–Chlorovanillin (AC)		6.7 UJ
3,4,5–Trichloroguaiacol		6.7 U

J	The analyte was positively identified. The associated numerical value is an estimate.
U	The analyte was not detected above the reported value.
UJ	The analyte was not detected above the reported estimated result.
EF–E	Ecology effluent sample
comp	Composite sample
@	Composite sampling period: 07:00–07:00
	Compound detected

Table 9 – Bioassay Results – Bosie Cascade (Vancouver), 1993

NOTE: First four tests were run on the effluent (Ef–GC sample) – lab log # 098293
Hyallela test was run on sediment samples 098296, 098297, and 098298

Daphnia magna – 48 hour survival test (acute)

(Daphnia magna)

Sample	# Tested *	Average Percent Survival (%)
Control	20	100
6.25 % Effluent	20	90
12.5 % Effluent	20	90
25 % Effluent	20	95
50 % Effluent	20	90
100 % Effluent	20	70

Acute
LC50 > 100% effluent
NOEC = 50% effluent

* 4 replicates of 5 organisms

Ceriodaphnia dubia – 7–day survival and growth test (acute & chronic)

(Ceriodaphnia dubia)

Sample	# Tested	Average Percent Survival (%)	Mean # Young per Original Female
Control	10	90	18.4
6.25 % Effluent	10	90	24.4
12.5 % Effluent	10	90	24.0
25 % Effluent	10	100	28.0
50 % Effluent	10	100	22.8
100 % Effluent	10	90	21.0

	Survival	Reproduction
	LOEC > 100% effluent	NOEC = 100 % effluent
	NOEC = 100% effluent	LOEC > 100% effluent
	LC50 > 100% effluent	

Fathead Minnow – 7 day survival and growth test (acute & chronic)

(Pimephales promelas)

Sample	# Tested *	Average Percent Survival (%)	Average weight per Fish (mg)
Control	40	100	0.355
6.25 % Effluent	40	92.5	0.423
12.5 % Effluent	40	100	0.378
25 % Effluent	40	97.5	0.470
50 % Effluent	40	95	0.475
100 % Effluent	40	92.5	0.450

	Survival	Growth
	LOEC > 100 % effluent	NOEC = 100 % effluent
	NOEC = 100 % effluent	LOEC > 100 % effluent
	LC50 > 100 % effluent	

* four replicates of 10 organisms

Rainbow Trout – 96 hour survival test (acute)

(Oncorhynchus mykiss)

Sample	# Tested	Average Percent Survival (%)
Control	30	100
100% Effluent	30	67

Hyallela – 10–day suvival test (acute)

(Hyallela azteca)

Sample	# Tested	Average Percent Survival (%)
Control	50	88
Sediment #1	50	94
Sediment #2	50	92
Sediment #3	50	98

NOEC – no observable effects concentration
LOEC – lowest observable effects concentration
LC50 – lethal concentration for 50% of the organisms
EC50 – effect concentration for 50% of the organisms

Cadmium, chromium, copper, lead, nickel, and zinc were detected in the sludge (*Table 6*).

A number of metals were also detected in the sediments (*Table 6*). Concentrations were fairly uniform across all three sediment sampling locations with no substantial difference between the outfall and upstream from the outfall stations. This would indicate that the concentrations observed are not necessarily due to Boise Cascade discharge. None of these concentrations exceeded the guidelines for the protection of freshwater sediments prepared by the Water Resources Branch, Ontario Ministry of the Environment (*Table 10* - OME, 1992). The sediment had no adverse effect on Hyallela survival (*Table 9*).

CONCLUSIONS AND RECOMMENDATIONS

Flow Measurements

Ecology daily effluent flows estimated from flow measurements collected over 2.4 and 3.8 hour periods somewhat exceeded Boise Cascade daily flow estimates. The accuracy of the Boise Cascade flow estimation technique needed verification. Since the inspection, BC has installed a new flowmeter.

NPDES Permit Compliance

All pertinent parameter concentrations (TSS, BOD_5, and pH) were within NPDES permit effluent limits.

General Chemistry

The plant provided good reductions in BOD_5 and TSS. Low influent nutrient concentrations required the addition of granular urea and phosphoric acid to the aeration pond. Effective BOD_5 reductions and the absence of excessive nutrient concentrations in the effluent indicate that the quantities added were appropriate. Effluent cyanide concentrations were within EPA ambient water quality criteria for receiving waters.

Effluent fecal coliform concentrations were elevated and may be detrimental to receiving water quality. Klebsiella accounted for 55% of the organisms observed.

Sample Splits

Ecology laboratory analysis found a reasonable correspondence between Ecology's and Boise Cascade's samples. Comparisons between the two laboratories' analyses of split samples found an acceptable match for all parameters except TSS. Review of Boise Cascade's analysis procedures for TSS is recommended.

Table 10 – Comparison to Ontario Provential Sediment Quality Guidelines – Boise Cascade (Vancouver), 1993.

Parameter	Location:	Sed–1	Sed–2	Sed–3	Ontaria Criteria*	
	Type:	grab/comp	grab	grab		
	Date:	2/23	2/23	2/23	Lowest Effect	Severe Effect
	Time:	1145&1220	1240	1320	Level	Level
	Lab #:	098296	098297	098298		
METALS		(mg/Kg–dry wt)	(mg/Kg–dry wt)	(mg/Kg–dry wt)	(mg/Kg–dry wt)	(mg/Kg–dry wt)
Arsenic		1.39	1.52	1.46	6	13
Cadmium		0.16	0.28	0.19	0.6	10
Chromium		4.75 PJ	4.01 PJ	5.43 J	26	110
Copper		5.13	5.02	5.06	16	110
Lead		3.36	3.33	3.25	31	250
Mercury		0.009 P	0.004 U	0.005 P	0.2	2
Nickel		7.43 P	6.11 P	7.59 P	16	75
Zinc		47	44	48	120	820
Oxygen Demand Parameters		(% C)	(% C)	(% C)	(% C)	(% C)
TOC		0.13	0.16	0.21	1	10

Sed–1 Outfall sediment sample
Sed–2 Downstream sediment sample
Sed–3 Upstream sediment sample
grab/comp Grab–composite sample
grab Grab sample

J The analyte was positively identified. The associated numerical result is an estimate.
P The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.
U The analyte was not detected at or above the reported result.
* OME, 1993.

Detected VOA, BNA, Pesticide/PCB, and Metals Results - Water

Several priority pollutant compounds were detected in the effluent. No volatile organic, semi-volatile organic, pesticide/PCB, or priority pollutant metal exceeded EPA and WAC acute or chronic water quality criteria for receiving waters. Several substituted biphenyl compounds were tentatively identified in the influent, effluent, and the primary clarifier sludge. Confirmation of their presence and identification of their source may be of value.

Detected Dioxins, Furans, Organic Halogens, Chlorate and Guaiacols - Water

Organic halides, chlorates, and guaiacols were detected in the effluent. The total impact of these compounds on the receiving water is unknown, but the concentrations detected do cause toxicity in the aquatic environment. These compounds also appear in the sludge.

Dioxins and furans were not detected in the effluent, but were detected in the influent. Dioxins and furans appeared in the sludge, indicating these compounds settled with solids in the primary clarifier.

Bioassays

Effluent bioassays found no chronic toxicity to the two species tested. Some acute toxicity was demonstrated by rainbow trout (67% survival in 100% effluent) and *Daphnia magna* (NOEC of 50% effluent).

Sludges and Sediments

Sludge samples concentrations were not associated with a known toxic effect or an applicable criteria.

Sediment sample results indicate that metal concentrations were generally typical to that portion of the Columbia River and not a direct result of BC discharge. Also, no concentration exceeded Ontario Ministry of the Environment guidelines for the protection of freshwater sediments. The sediment had no adverse effect on Hyallela survival.

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APPENDICES

Appendix A - Sampling Stations Descriptions - Boise Cascade (Vancouver), 1993

Pri-Inf-# Grab sample of influent paper mill wastewater collected from the headwork's pump wet well just after the mechanical screen - Collected in both A.M. and P.M..

Pri-Inf-E Ecology 24-hour composite sample of influent paper mill wastewater collected from the headwork's pump wet well just after the mechanical screen.

Pri-Inf-B Boise Cascade 24-hour composite sample of influent wastewater collected from a plastic garbage can after being tapped from the primary clarifier influent pipe.

Pri-Ef-# Grab sample of primary clarifier effluent collected from the overflow of the primary clarifier's peripheral weir just prior to channel into the clearwell - Collected in both A.M. and P.M..

Pri-Ef-E Ecology 24-hour composite sample of primary clarifier effluent collected from the overflow of the primary clarifier's peripheral weir just prior to channel into the clearwell.

Ef-# Grab sample of effluent from aeration basin collected from the weir overflow just prior to effluent pump station wet well.

Ef-E Ecology 24-hour composite sample of effluent from aeration basin collected from the weir overflow just prior to effluent pump station wet well.

Ef-B Boise Cascade 24-hour composite sample collected from a plastic jug after being filled by a tap from the effluent pipe just prior to outfall discharge.

Ef-GC Fecal coliform grab from the tap hose into plastic jug used in Boise Cascade's effluent composite sampling system.

Sludge Sample of dewatered primary clarifier sludge collected from between the screws of the sludge screwpress.

Leachate Grab sample collected from the sludge landfill leachate collection system - taken just prior to discharge into aeration pond.

Sed-1 Composite grabs collected from the sediment in the Columbia River at the discharge pipe's 1st breach (190 ft from shore) and at the discharge pipe's 2nd breach (300ft from shore.) - (1st breach: Long: 122°- 40.867′ W., Lat: 45°- 37.468′ N.; 2nd breach: Long: 122°- 40.909′ W., Lat: 45°- 37.425′ N.).

Sed-2 Grabs collected from Columbia River sediment 200 ft downstream from 1st breach - (Long: 122°- 40.979′ W., Lat: 45°- 37.473′ N.).

Sed-3 Grabs collected from Columbia River sediment 400 ft upstream from 1st breach - (Long: 122°- 40.673′ W., Lat: 45°- 37.352′ N.)

Appendix B – Sample Schedule – Boise Cascade (Vancouver), 1993

Location:	Pri–Inf–1	Pri–Inf–2	Pri–Inf–E	Pri–Inf–B	Pri–Ef–1	Pri–Ef–2	Pri–Ef–E	EF–1	EF–2	EF–E	EF–B
Type:	grab	grab	comp	comp	grab	grab	comp	grab	grab	comp	comp
Date:	2/23	2/23	2/23–24	2/23–24	2/23	2/23	2/23–24	2/23	2/23	2/23–24	2/23–24
Time:	1105	1610	@	@	1130	1625	@	0945	1545	@	@
Lab Log :	098280	098281	098282	098283	098284	098285	098286	098287	098288	098289	098290
GENERAL CHEMISTRY											
Conductivity	E	E	E	E	E	E	E	E	E	E	E
Alkalinity			E	E			E			E	E
Hardness			E	E			E			E	E
SOLIDS											
TS			E				E			E	
TNVS			E				E			E	
TSS	E	E	EB	EB	E	E	EB	E	E	EB	EB
TNVSS			E				E			E	
% Solids											
% Volatile Solids											
OXYGEN DEMAND PARAMETERS											
BOD5			EB	EB			EB			EB	EB
COD			E	E			E			E	E
TOC (water)	E	E	E	E	E	E	E	E	E	E	E
TOC (soil/sed)											
NUTRIENTS											
NH3–N			E	E			E			E	E
NO2+NO3– N			E	E			E			E	E
Total–P			E	E			E			E	E
MISCELLANEOUS											
Oil and Grease (water)	E	E			E	E		E	E		
F–Coliform MF											
% Klebsiella (KES)											
Cyanide (total)			E	E			E			E	E
Cyanide (wk & dis)			E	E			E			E	E
Cyanide (total soil/sed)											
Cyanide (wk & dis soil/sed)											
Chlorate			E				E			E	
ORGANICS											
AOX	E	E			E	E		E	E		
EOX (soil/sed)											
VOC (water)	E	E			E	E		E	E		
VOC (soil/sed)											
BNAs (water)			E				E			E	
BNAs (soil/sed)											
Pest/PCB (water)										E	
Pest/PCB (soil/sed)											
Guaiacols (effluent)										E	
Dioxin/Furans			E				E			E	
METALS											
PP Metals (water)			E				E			E	
PP Metals (soil/sed)											
BIOASSAYS											
Salmonid (acute 100%)											
Daphnia magna (acute)											
Ceriodaphnia (chronic)											
Fathead Minnow (chronic)											
Hyallela (solid acute)											
FIELD OBSERVATIONS											
Temperature	E	E	E	E	E	E	E	E	E	E	E E
pH	E	E	EB	EB	E	E	EB	E	E	EB	EB E
Conductivity	E	E	E	E	E	E	E	E	E	E	E E
Chlorine								E	E	E	E

E Ecology lab analysis
B Boise Cascade lab analysis
grab grab sample
comp Composite sample

Pri Primary clarifier sample
Ef Effluent sample
Inf Influent sample

Parameter II	Locatn:	EF–3	EF–4	Ef–GC	Sludge	Leachate	Sed–1	Sed–2	Sed–3
	Type:	grab	grab	grab/comp	grab	grab	grab	grab	grab
	Date:	2/23	2/23	2/23–24	2/23	2/23	2/23	2/23	2/23
	Time:	0955	1355	0945&1625	1330	1420	1145&1220	1240	1320
	Lab Log #:	098291	098292	098293	098294	098295	098296	098297	098298
GENERAL CHEMISTRY									
Conductivity						E			
Alkalinity						E			
Hardness						E			
SOLIDS									
TS									
TNVS									
TSS						E			
TNVSS									
% Solids					E		E	E	E
% Volatile Solids					E		E	E	E
OXYGEN DEMAND PARAMETERS									
BOD5						E			
COD						E			
TOC (water)						E			
TOC (soil/sed)					E		E	E	E
NUTRIENTS									
NH3–N						E			
NO2+NO3– N						E			
Total–P						E			
MISCELLANEOUS									
Oil and Grease (water)									
F–Coliform MF		E	E						
% Klebsiella (KES)		E	E						
Cyanide (total)						E			
Cyanide (wk & dis)						E			
Cyanide (total soil/sed)					E				
Cyanide (wk & dis soil/sed)					E				
Chlorate									
ORGANICS									
AOX						E			
EOX (soil/sed)					E		E	E	E
VOC (water)						E			
VOC (soil/sed)					E				
BNAs (water)						E			
BNAs (soil/sed)					E				
Pest/PCB (water)									
Pest/PCB (soil/sed)					E				
Guaiacols (effluent)									
Dioxin/Furans					E	E	E	E	E
METALS									
PP Metals (water)						E			
PP Metals (soil/sed)					E		E	E	E
BIOASSAYS									
Salmonid (acute 100%)				E					
Daphnia magna (acute)				E					
Ceriodaphnia (chronic)				E					
Fathead Minnow (chronic)				E					
Hyallela (solid acute)							E	E	E
FIELD OBSERVATIONS									
Temperature		E	E		E	E			
pH		E	E		E	E			
Conductivity		E	E		E	E			
Chlorine		E	E			E			

E Ecology lab analysis
B Boise Cascade lab analysis
grab grab sample
comp Composite sample
Pri Primary clarifier sample
Ef Effluent sample
Inf Influent sample
Sludge Sludge sample
grab/comp Grab composite sample
Sed Sediment sample
Leachate Sludge landfill leachate sample

Appendix C – Analytical Methods – Boise Cascade (Vancouver), 1993

Parameter	MANCHESTER_METHODS	Lab Used
GENERAL CHEMISTRY		
Conductivity	EPA, Revised 1983: 120.1	Ecology
Alkalinity	EPA, Revised 1983: 310.1	Ecology
Hardness	EPA, Revised 1983: 130.2	Ecology
SOLIDS		
TS	EPA, Revised 1983: 160.3	Ecology
TNVS	EPA, Revised 1983: 160.3	Ecology
TSS	EPA, Revised 1983: 160.2	Ecology
TNVSS	EPA, Revised 1983: 160.2	Ecology
% Solids	APHA, 1989: 2540G.	Ecology
% Volatile Solids	EPA, Revised 1983: 160.4	Ecology
OXYGEN DEMAND PARAMETERS		
BOD5	EPA, Revised 1983: 405.1	Ecology
COD	EPA, Revised 1983: 410.1	Analytic Resources, Inc.
TOC (water)	EPA, Revised 1983: 415.1	Analytic Resources, Inc.
TOC (soil/sed)	EPA, Revised 1983: 415.1	Analytic Resources, Inc.
NUTRIENTS		
NH3–N	EPA, Revised 1983: 350.1	Ecology
NO2+NO3–N	EPA, Revised 1983: 353.2	Ecology
Total–P	EPA, Revised 1983: 365.3	Ecology
MISCELLANEOUS		
Oil and Grease (water)	EPA, Revised 1983: 413.1	Ecology
F–Coliform MF	APHA, 1989: 9222D.	Ecology
% Klebsiella (KES)	APHA, 1989: 9222F.	Ecology
Cyanide (total)	EPA, Revised 1983: 335.2	Ecology
Cyanide (wk & dis)	APHA, 1989: 4500–CNI.	Ecology
Cyanide (total soil/sed)	EPA, Revised 1983: 335.2	Ecology
Cyanide (wk & dis soil/sed)	APHA, 1989: 4500–CNI.	Ecology
Chlorate	EPA, 1979: 300.0	Laucks Testing Laboratory, Inc.
ORGANICS		
AOX	EPA, 1986: 9020	Sound Analytical Services, Inc.
EOX (soil/sed)	EPA, 1986: 9020	Sound Analytical Services, Inc.
VOC (water)	EPA, 1986: 8260	Ecology
VOC (soil/sed)	EPA, 1986: 8240	Ecology
BNAs (water)	EPA, 1986: 8270	Ecology
BNAs (soil/sed)	EPA, 1986: 8270	Ecology
Pest/PCB (water)	EPA, 1986: 8080	Weyerhaeuser Analytical & Testing Services
Pest/PCB (soil/sed)	EPA, 1986: 8080	Weyerhaeuser Analytical & Testing Services
Guaiacols (effluent)	NCASI, 1986: 498B.	Ecology
Dioxin/Furans	EPA, 1986: 8280	Enseco California Analytical Laboratory
METALS		
PP Metals (water)	EPA, Revised 1983: 200–299	Ecology
PP Metals (soil/sed)	EPA, Revised 1983: 200–299	Ecology
BIOASSAYS		
Salmonid (acute 100%)	Ecology, 1981.	Parametrix, Inc.
Daphnia magna (acute)	EPA 1985	Parametrix, Inc.
Ceriodaphnia (chronic)	EPA 1989: 1002.0	Parametrix, Inc.
Fathead Minnow (chronic)	EPA,1989: 1000	Parametrix, Inc.
Hyallela (solid acute)	Nebeker, 1984	Parametrix, Inc.

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Appendix D - Priority Pollutant Cleaning - Boise Cascade (Vancouver), 1993.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO_3 solution
4. Rinse three (3) times with distilled/deionized water
5. Rinse with high purity methylene chloride
6. Rinse with high purity acetone
7. Allow to dry and seal with aluminum foil

Appendix E - VOA, BNA, Pesticide/PCB and Metals Scan Results - Boise Cascade (Vancouver), 1993.

Location:	Pri-Inf-1	Pri-Inf-2	Pri-Ef-1	Pri-Ef-2	EF-1	EF-2	Leachate	Sludge
Type:	grab	grab	grab	grab	grab	grab	grab	grab
Date:	2/23	2/23	2/23	2/23	2/23	2/23	2/23	2/23
Time:	1105	1610	1130	1625	0945	1545	1420	1330
Lab Log#:	098280	098281	098284	098285	098287	098288	098295	098294
VOA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L	(µg/L)	(µg/L)	(µg/L)	(µg/Kg-dry wt)
Chloromethane	0.02 J	2 UJ	0.2 J	0.2 J	0.4 UJ	1 UJ	4 UJ	7 UJ
Dichlorodifluoromethane	2 UJ	3 UJ	2 UJ	3 J	2 UJ	3 UJ	4 J	7 UJ
Bromomethane	2 J	1 J	1 J	1 J	0.4 UJ	1 UJ	4 UJ	4 UJ
Vinyl Chloride	0.04 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Chloroethane	0.2 J	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Trichlorofluoromethane	2 J	2 UJ	0.4 UJ	0.1 J	0.4 UJ	1 UJ	4 UJ	16 J
Methylene Chloride	24 UJ	21 UJ	19 UJ	18 J	5 UJ	12 UJ	15 UJ	170 UJ
Acetone	20 UJ	24 UJ	12 UJ	20 UJ	270 UJ	120 UJ	200 UJ	68 UJ
Carbon Disulfide	4 J	2 UJ	1 J	4 J	0.5 J	1 UJ	1 UJ	26 J
1,1-Dichloroethene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,1-Dichloroethane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
trans-1,2-Dichloroethene	0.4 UJ	2 UJ	0.5 J	0.4 J	0.4 UJ	1 UJ	4 UJ	7 UJ
cis-1,2-Dichloroethene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
2,2-Dichloropropane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Bromochloromethane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Chloroform	160 J	10 J	240 UJ	180 J	49 J	47 J	4 UJ	150 J
1,2-Dichloroethane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
2-Butanone (MEK)	4 UJ	6 UJ	2 UJ	4 UJ	6 UJ	9 UJ	160 J	46 UJ
1,1,1-Trichloroethane	0.4 J	2 UJ	0.4 UJ	0.6 J	0.4 J	1 UJ	4 UJ	5 J
Carbon Tetrachloride	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,1-Dichloropropene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Bromodichloromethane	2 J	1 J	4 J	3 J	1 J	1 J	4 UJ	7 UJ
1,2-Dichloropropane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.04 J	4 UJ	7 UJ
Dibromomethane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
trans-1,3-Dichloropropene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Trichloroethene	0.3 J	2 UJ	0.3 J	0.3 J	0.4 UJ	1 UJ	4 UJ	7 UJ
Dibromochloromethane	0.5 J	1 J	1 J	0.8 J	0.4 J	1 UJ	4 UJ	7 UJ
1,2-Dibromoethane (EDB)	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,1,2-Trichloroethane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,3-Dichloropropane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Benzene	0.4 UJ	2 UJ	0.2 J	0.6 J	0.4 UJ	1 UJ	4 UJ	7 UJ
cis-1,3-Dichloropropene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Bromoform	0.2 J	2 UJ	0.4 UJ	0.2 J	0.4 UJ	1 UJ	4 UJ	7 UJ
2-Hexanone	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	7 UJ	7 UJ
4-Methyl-2-Pentanone	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	4 J	1 UJ	4 UJ	7 UJ
Tetrachloroethene	0.5 J	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,1,2,2-Tetrachloroethane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	2 UJ	4 UJ	7 UJ
1,1,1,2-Tetrachloroethane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Toluene	0.4 UJ	2 UJ	0.4 UJ	4 J	4 J	4 J	4 UJ	8 UJ
Chlorobenzene	0.4 UJ	2 UJ	0.5 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Ethylbenzene	0.4 UJ	2 UJ	0.3 J	3 J	0.3 J	1 UJ	4 UJ	7 J
Styrene	0.3 J	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Bromobenzene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,2,3-Trichloropropane	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ

J	The analyte was positively identified. The associated numerical value is an estimate.	E	Ecology sample	comp	Composite sample
U	The analyte was not detected at or above the reported value.	B	Boise Cascade sample	Sludge	Sludge sample
UJ	The analyte was not detected at or above the estimated result.	grab	grab sample	Leachate	Sludge landfill leachate
		Ef	Effluent sample	Inf	Influent sample

Appendix E - (cont.) - Boise Cascade (Vancouver), 1993.

Location:	Pri-Inf-1	Pri-Inf-2	Pri-Ef-	Pri-Ef-2	EF-1	EF-2	Leachate	Sludge
Type:	grab	grab	grab	grab	grab	grab	grab	grab
Date:	2/23	2/23	2/23	2/23	2/23	2/23	2/23	2/23
Time:	1105	1610	1130	1625	0945	1545	1420	1330
Lab Log#:	098280	098281	098284	098285	098287	098288	098295	098294
VOA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/Kg-dry wt)
2-Chlorotoluene	0.4 UJ	2 UJ	0.04 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
4-Chlorotoluene	0.4 UJ	2 UJ	0.04 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Total Xylenes	0.4 UJ	2 UJ	1 UJ	18 J	0.7 UJ	1 UJ	4 UJ	41 J
1,2,4-Trimethylbenzene	0.7 J	1 J	2 J	19 J	2 J	2 J	4 UJ	210 J
tert-Butylbenzene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,3,5-Trimethylbenzene	0.2 J	2 UJ	0.7 J	6 J	0.8 J	1 UJ	4 UJ	69 J
sec-Butylbenzene	0.4 UJ	2 UJ	0.4 UJ	0.8 J	0.4 UJ	1 UJ	4 UJ	24 J
p-Isopropyltoluene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	10 J
Butylbenzene	0.4 UJ	2 UJ	0.4 UJ	3 UJ	0.4 UJ	1 UJ	4 UJ	110 J
1,2-Dibromo-3-Chloropropane	2 UJ	10 UJ	2 UJ	2 UJ	2 UJ	5 UJ	20 UJ	7 UJ
1,2,3-Trichlorobenzene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Isopropylbenzene	0.4 UJ	2 UJ	0.2 J	1 J	0.1 J	1 UJ	4 UJ	10 J
Propylbenzene	0.4 UJ	2 UJ	0.4 J	4 J	0.4 J	1 UJ	4 UJ	50 UJ
1,3-Dichlorobenzene	0.4 UJ	2 UJ	0.8 UJ	0.4 UJ	0.4 UJ	3 UJ	5 UJ	7 UJ
1,4-Dichlorobenzene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,2-Dichlorobenzene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
1,2,4-Trichlorobenzene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ
Naphthalene	0.4 UJ	2 UJ	1 UJ	9 J	2 UJ	2 UJ	4 UJ	44 UJ
Hexachlorobutadiene	0.4 UJ	2 UJ	0.4 UJ	0.4 UJ	0.4 UJ	1 UJ	4 UJ	7 UJ

Location:	Pri-Inf-E	Pri-Ef-E	EF-E	Leachate	Sludge
Type:	comp	comp	comp	grab	grab
Date:	2/23-24	2/23-24	2/23-24	2/23	2/23
Time:	@	@	@	1420	1330
Lab Log#:	098282	098286	098289	098295	098294
BNA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/Kg-dry wt)
Benzo(a)Pyrene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
2,4-Dinitrophenol	62.5 UJ	3 U	3.3 U	4.8 UJ	39100 U
Dibenzo(a,h)Anthracene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Benzo(a)Anthracene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
4-Chloro-3-Methylphenol	6.2 U	0.3 U	0.33 U	0.48 U	1960 UJ
Aniline	4.1 J	0.3 U	0.33 U	0.48 U	1960 U
Benzoic Acid	22.6 J	0.74 U	0.83 U	112 J	9780 U
Hexachloroethane	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Hexachlorocyclopentadiene	31.2 J	1.5 UJ	1.6 UJ	2.4 UJ	NAR U
Isophorone	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Acenaphthene	6.2 U	0.3 U	0.33 U	0.48 U	1960 UJ
Diethyl Phthalate	6.2 U	2 U	1.4 U	0.48 U	1960 U
Di-n-Butyl Phthalate	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Phenanthrene	23.4	2.7	0.81	0.48 U	2250
Butylbenzyl Phthalate	6.2 U	0.28 J	0.33 U	0.48 U	1960 U
N-Nitrosodiphenylamine	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Fluorene	53.2	6.9	2.8	1.5	3970

J	The analyte was positively identified. The associated numerical value is an estimate.	E	Ecology sample	comp	Composite sample	Pri-Inf	Primary clarifier influent
U	The analyte was not detected at or above the reported value.	B	Boise Cascade sample	Sludge	Sludge sample	Pri-Ef	Primary clarifier effluent
UJ	The analyte was not detected at or above the estimated result.	grab	grab sample	Leachate	Sludge landfill leachate	@	Composite sample collection period: 07:00-07:00.
		Ef	Effluent sample	Inf	Influent sample		

Appendix E - (cont.) - Boise Cascade (Vancouver), 1993.

Location:	Pri-Inf-E	Pri-Ef-E	EF-E	Leachate	Sludge
Type:	comp	comp	comp	grab	grab
Date:	2/23-24	2/23-24	2/23-24	2/23	2/23
Time:	@	@	@	1420	1330
Lab Log#:	098282	098286	098289	098295	098294
BNA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/Kg-dry wt)
Carbazole	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Hexachlorobutadiene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Pentachlorophenol	6.2 U	0.3 U	0.33 U	0.48 UJ	19600 U
2,4,6-Trichlorophenol	11.4	13.5	8.2	0.48 U	4890 U
2-Nitroaniline	6.2 U	0.3 U	0.33 U	0.48 U	4890 U
2-Nitrophenol	15.6 U	0.74 U	0.83 U	1.2	4890 U
1-Methylnaphthalene	4.9 J	3.4	1.8	0.29 J	1960 U
Naphthalene	2.5 J	2.4	1.2	0.48 U	1960 U
2-Methylnaphthalene	4.2 J	2.6	1	0.29 J	1960 U
2-Chloronaphthalene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
3,3'-Dichlorobenzidine	12.5 U	0.59 U	0.66 U	0.96 U	3910 U
Benzidine	12.5 UJ	0.59 UJ	0.33 U	0.96 UJ	3910 UJ
2-Methylphenol	6.2 U	0.3 U	0.14 J	0.48 U	1960 U
1,2-Dichlorobenzene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
o-Chlorophenol	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
2,4,5-Trichlorophenol	6.2 U	0.3 U	0.33 U	0.48 U	4890 U
Nitrobenzene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
3-Nitroaniline	6.2 U	0.3 U	0.33 U	0.48 U	4890 U
4-Nitroaniline	15.6 U	0.74 U	0.83 U	1.2 U	4890 U
4-Nitrophenol	15.6 U	0.74 U	0.83 U	1.2 U	9780 UJ
Benzyl Alcohol	6.2 U	5.2	0.88	0.48 U	4890 U
4-Bromophenyl Phenylether	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
2,4-Dimethylphenol	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
4-Methylphenol	6.2 U	2.9	1.9	234	1960 U
1,4-Dichlorobenzene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
4-Chloroaniline	6.2 U	0.3 U	0.33 U	0.48 UJ	NAR U
Phenol	6.2 U	0.3 U	0.33 U	0.48 U	1960 UJ
Bis(2-Chloroethyl)Ether	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Bis(2-Chloroethoxy)Methane	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Bis(2-Ethylhexyl)Phthalate	6.2 U	0.74 U	0.33 U	0.48 U	3120 U
Di-n-Octyl Phthalate	15.6 UJ	0.74 U	0.83 U	1.2 UJ	1960 U
Hexachlorobenzene	6.2 UJ	0.3 U	0.33 U	0.48 U	1960 U
Anthracene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
1,2,4-Trichlorobenzene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
2,4-Dichlorophenol	6.2 U	0.8	0.52	0.48 U	1960 U
2,4-Dinitrotoluene	15.6 U	0.74 U	0.83 U	1.2 U	4890 UJ
Pyrene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Dimethyl Phthalate	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Dibenzofuran	6.2 U	0.12 J	0.33 U	0.48 U	1960 U
Benzo(g,h,i)Perylene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Indeno(1,2,3-cd)Pyrene	15.6 U	0.74 U	0.83 U	1.2 U	1960 U
Benzo(b)Fluoranthene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Fluoranthene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Benzo(k)Fluoranthene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Acenaphthylene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
Chrysene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U

J	The analyte was positively identified. The associated numerical value is an estimate.	E	Ecology sample	comp	Composite sample	Pri-Inf	Primary clarifier influent
U	The analyte was not detected at or above the reported value.	B	Boise Cascade sample	Sludge	Sludge sample	Pri-Ef	Primary clarifier effluent
UJ	The analyte was not detected at or above the estimated result.	grab	grab sample	Leachate	Sludge landfill leachate	@	Composite sample collection period: 07:00-07:00.
NAR	No Analytical Results	Ef	Effluent sample	Inf	Influent sample		

Appendix E - (cont.) - Boise Cascade (Vancouver), 1993.

Location:	Pri-Inf-E	Pri-Ef-E	EF-E	Leachate	Sludge
Type:	comp	comp	comp	grab	grab
Date:	2/23-24	2/23-24	2/23-24	2/23	2/23
Time:	@	@	@	1420	1330
Lab Log#:	098282	098286	098289	098295	098294
BNA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/Kg-dry wt)
2-Flourophenol		25	53		
Retene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
4,6-Dinitro-2-Methylphenol	15.6 U	0.74 U	0.83 U	1.2 U	19600 U
1,3-Dichlorobenzene	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
2,6-Dinitrotoluene	15.2 U	0.74 U	0.83 U	1.2 U	4890 U
N-Nitroso-di-n-Propylamine	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
4-Chlorophenyl Phenylether	6.2 U	0.3 U	0.33 U	0.48 U	1960 U
1,2-Diphenylhydrazine	12.5 U	0.59 U	0.66 U	0.96 U	3910 U
Bis(2-Chloroisopropyl)Ether	6.2 U	0.3 U	0.33 U	0.48 U	1960 UJ

Location:	EF-E	Sludge
Type:	comp	grab
Date:	2/23-24	2/23
Time:	@	1330
Lab Log#:	098289	098294
Pesticide/PCB Compounds	(µg/L)	(µg/Kg-dry wt)
alpha-BHC	0.14 U	88 U
beta-BHC	0.05 U	88 U
delta-BHC	0.05 U	88 U
gamma-BHC (Lindane)	0.05 U	88 U
Heptachlor	0.05 U	88 U
Aldrin	0.05 U	88 U
Heptachlor Epoxide	0.05 U	88 U
Endosulfan I	0.05 U	88 U
Dieldrin	0.1 U	180 U
4,4'-DDE	0.1 U	180 U
Endrin	0.1 UJ	180 U
Endosulfan II	0.1 UJ	180 U
4,4'-DDD	0.1 UJ	180 U
Endosulfan Sulfate	0.1 UJ	180 U
4,4'-DDT	0.1 UJ	180 U
Methoxychlor	0.5 UJ	880 U
Endrin Ketone	0.1 UJ	180 U
Endrin Aldehyde	0.1 UJ	180 U
alpha-Chlordane	0.1 UJ	90 U
gamma-Chlordane	0.1 UJ	88 U
Toxaphene	5 UJ	8800 U
Aroclor-1016	1 UJ	1700 U
Aroclor-1221	2 UJ	3500 U
Aroclor-1232	1 UJ	1700 U
Aroclor-1242	1 UJ	1700 U
Aroclor-1248	1 UJ	1700 U
Aroclor-1254	1 UJ	1700 U
Aroclor-1260	1 UJ	1700 U

J	The analyte was positively identified. The associated numerical value is an estimate.	E	Ecology sample	comp	Composite sample
U	The analyte was not detected at or above the reported value.	B	Boise Cascade sample	Sludge	Sludge sample
UJ	The analyte was not detected at or above the estimated result.	grab	grab sample	Leachate	Sludge landfill leachate
		Ef	Effluent sample	Inf	Influent sample

Pri-Inf	Primary clarifier influent
Pri-Ef	Primary clarifier effluent
@	Composite sample collection period: 07:00-07:00.

Appendix E - (cont.) - Boise Cascade (Vancouver), 1993.

Location:		Pri-Inf-E	Pri-Ef-E	EF-E	Leachate	Sludge	Sed-1	Sed-2	Sed-3
Type:		comp	comp	comp	grab	grab	grab/com	grab	grab
Date:		2/23-24	2/23-24	2/23-24	2/23	2/23	2/23	2/23	2/23
Time:		@	@	@	1420	1330	1145&122	1240	1320
Lab Log#:		098282	098286	098289	098295	098294	098296	098297	098298
Metals	Hardness = 220	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/Kg-dry	(mg/Kg-dry)	(mg/Kg-dry)	(mg/Kg-dry)
Antimony		30 U	30 U	30 U	30 U	3 UJ	3 UJ	3 UJ	3 UJ
Arsenic (total)		1.8 P	1.2 P	1.6 P	5.6	0.3 UN	1.39	1.52	1.46
Beryllium		1 U	1 U	1 U	1 U	0.1 U	0.12 P	0.11 P	0.12 P
Cadmium		0.41 P	0.1 U	0.1 U	0.1 U	0.094	0.16	0.28 P	0.19
Chromium (total)		5 U	5 U	5 U	5 U	6.16 J	4.75 PJ	4.01 PJ	5.43 J
Copper		12 P	4.9 P	5.7 P	3 U	25	5.13	5.02	5.06
Lead		5.6 P	1 U	1 U	1 U	2.46	3.36	3.33	3.25
Mercury		0.05 U	0.05 U	0.05 U	0.05 U	0.0125 UN	0.0092 P	0.0042 U	0.0045 P
Nickel		10 U	10 U	10 U	15 P	5.36 P	7.43 P	6.11 P	7.59 P
Selenium		2 U	2 U	2 U	2 U	0.4 UN	0.4 U	0.4 U	0.4 U
Silver		0.5 U	0.5 U	0.5 U	0.5 U	0.1 UJ	0.1 U	0.1 U	0.1 U
Thallium		2.5 U	2.5 U	2.5 U	2.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Zinc		126 U	22 P	13 P	22 P	102 J	47	44	48

J	The analyte was positively identified. The associated numerical result is an estimate.	Sludge	Sludge sample
N	The spike sample recovery is not within control limits.	Sed	Sediment sample
P	The analyte was detected above the instrument dewtection limit, but	Leachate	Sludge landfill leachate
	below the established minimum quantitation limit.	Ef-GC	Bioassay grab composite
U	The analyte was not detected at or above the reported result.	Pri-Inf	Primary clarifier influent
UJ	The analyte was not detected at or above the reported estimated result.	Pri-Ef	Primary clarifier effluent
E	Ecology sample	@	Composite sample collection period: 07:00-07:00.
B	Boise Cascade sample	Ef	Effluent sample
grab	grab sample	Inf	Influent sample
comp	Composite sample	grab/comp	Grab composite sample

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location: Pri-Inf-1
Type: grab
Date: 2/23
Time: 1105
Sample ID: 098280

Volatile Organics:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Cyclohexane	27	NJ
2. Isothiocyanatomethane	17	NJ
3. Butylester-2-Propenoic acid	4.5	NJ
4. 2,4,6-Trimethyloctane	13	NJ
5. Unknown Hydrocarbon	1.2	NJ

Sample Location: Pri-Inf-2
Type: grab
Date: 2/23
Time: 1610
Sample ID: 098281

Volatile Organics:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Trimethoxyboroxin	12	NJ
2. Isothiocyanatomethane	14	NJ

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location: Pri-Ef-1
Type: grab
Date: 2/23
Time: 1130
Sample ID: 098284

Volatile Organics:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Unknown Compound 1	0.012	NJ
2. Isothiocyanatomethane	7.6	NJ
3. Unknown Compound 2	18	NJ
4. Unknown Compound 3	14	NJ

Sample Location: Pri-Ef-2
Type: grab
Date: 2/23
Time: 1625
Sample ID: 098285

Volatile Organics:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Trimethoxyboroxin	1.5	NJ
2. Cyclohexane	9.8	NJ
3. Isothiocyanatomethane	11	NJ
4. 1-Ethyl-3-Methyl-Benzene	17	NJ
5. Indan	8.5	NJ
6. 2,4,6-Trimethyloctane	12	NJ
7. 1H-Inene, 2,3-Dihydro-4-Met	5.7	NJ
8. 1H-Inene, 2,3-Dihydro-5-Met	5.7	NJ
9. 3,4-Hexanedione, 1,2,3,4-Tetrahy	7.0	NJ
10. Naphthalene, 1,2,3,4-Tetrahy	7.0	NJ
11. Furan	1.3	NJ
12. 1,2,3-Trimethylbenzene	8.5	NJ

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location: EF-1
Type: grab
Date: 2/23
Time: 0945
Sample ID: 098287

Volatile Organics:

Compound Name	Estimated Concentration (µg/L)	Qualifier
1. Isothiocyanatomethane	3.4	NJ
2. Trimethoxyboroxin	2.0	NJ
3. Thiobis Methane	7.2	NJ

Sample Location: Sludge
Type: grab
Date: 2/23
Time: 1330
Sample ID: 098294

Volatile Organics:

Compound Name	Estimated Concentration (µg/L)	Qualifier
1. Ethanol	74	NJ
2. 1-Propanol	160	NJ
3. Methylcyclohexane	24	NJ
4. Cyclohexane	540	NJ
5. Octane	36	NJ
6. Decane	1100	NJ
7. Naphthalene, Decahydro+	360	NJ
8. Naphthalene, Decahydro+	1600	NJ
9. Benzene, 1-Ethyl-2-Met	400	NJ
10. Tetradecane	3000	NJ
11. Unknown Hydrocarbon	430	NJ
12. Heptane, 3-Ethyl-5-Met	510	NJ
13. Cyclopentane, 1-Methyl+	710	NJ
14. Octane, 2,4,6-Trimethyl+	720	NJ
15. Octane, 2,4,6-Trimethyl+	3700	NJ

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location:	Pri-Inf-E
Type:	comp
Date:	2/23-24
Time:	24 hours
Sample ID:	098282

BNAs:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Benzene, 1,1-Methyle+	152	J
2. Unknown Hydrocarbon 1	218	J
3. Unknown Hydrocarbon 2	259	J
4. Unknown Hydrocarbon 3	335	J
5. Unknown Hydrocarbon 4	465	J
6. Unknown Hydrocarbon 5	1080	J
7. Unknown Hydrocarbon 6	165	J
8. Unknown Hydrocarbon 7	174	J
9. Unknown Hydrocarbon 8	979	J
10. Unknown Hydrocarbon 9	312	J
11. Unknown Compound 1	136	J
12. Unknown Compound 2	129	J
13. Unknown Compound 3	263	J
14. Unknown Compound 4	463	J
15. Unknown Compound 5	524	J
16. Unknown Compound 6	115	J
17. Unknown Compound 7	181	J
18. 1,1-Biphenyl 2,2-Di+	4900	NJ
19. 1,1-Biphenyl 2,2-Di+	6580	NJ
20. Benzene, 1,2-Dimethyl-+	105	NJ

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location:	Pri-Inf-E
Type:	comp
Date:	2/23-24
Time:	24 hours
Sample ID:	098286

BNAs:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Ethanol, 2-Butoxy-	33.9	NJ
2. Phosphoric Acid, Tribut+	20.0	NJ
3. Unknown Hydrocarbon 1	4.6	NJ
4. Unknown Hydrocarbon 2	8.7	NJ
5. Unknown Hydrocarbon 3	7.6	NJ
6. Unknown Hydrocarbon 4	77.8	NJ
7. Unknown Compound 1	16.9	NJ
8. Unknown Compound 2	18.0	NJ
9. Unknown Compound 3	28.2	NJ
10. Unknown Compound 4	48.6	NJ
11. Unknown Compound 5	55.3	NJ
11. Unknown Compound 6	18.4	NJ
13. Unknown Compound 7	55.9	NJ
14. Unknown Compound 8	20.5	NJ
15. 2-Propanol, 1-(2-ethox+	4.8	NJ
16. Benzene, 1,1'-Ethylide+	15.7	NJ
17. 1,1'-Biphenyl 2,2'-Di+	349	NJ
18. 1,1'-Biphenyl 2,2'-Di+	340	NJ
19. Benzene, 1-methyl-3-[(+	16.4	NJ
20. Ethanol, 1-(2-Butoxyet+	210	NJ

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location: Ef-E
Type: comp
Date: 2/23-24
Time: 24 hours
Sample ID: 098289

BNAs:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Benzene, 1,1'-[1,2-Eth+	5.6	NJ
2. Ethanol, 2-(2-Butoxyet+	6.8	NJ
3. Ethanol, 2-(2-Butoxyet+	86.4	NJ
4. Acetamide, N,N-dimethyl	18.3	NJ
5. 9-Hexadecenoic Acid	17.8	NJ
6. Unknown Hydrocarbon 1	8.4	NJ
7. Unknown Compound 1	8.3	NJ
8. Unknown Compound 2	6.8	NJ
9. Unknown Compound 3	7.1	NJ
10. Unknown Compound 4	2.0	NJ
11. Unknown Compound 5	2.6	NJ
11. Unknown Compound 6	2.1	NJ
13. Unknown Compound 7	8.1	NJ
14. Unknown Compound 8	6.6	NJ
15. 1,1'-Biphenyl 2,2'-Di+	17.0	NJ
16. 1,1'-Biphenyl 2,2'-Di+	26.8	NJ
17. 2H-Indol-2-one, 1,3-Di+	5.2	NJ
18. 2-Propanol, 1-(2-Metho+	7.4	NJ
19. 2-Propanol, 1-(2-Metho+	9.0	NJ
20. 2-Propanol, 1-[2-(2-Me+	9.9	NJ

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location: Sludge
Type: grab
Date: 2/23
Time: 1330
Sample ID: 098294

BNAs:

Compound Name	Estimated Concentration (μg/Kg)	Qualifier
1. Hexadecanoic acid	84800	NJ
2. Octadecanoic acid	47000	NJ
3. Linoleic acid	15700	NJ
4. 1,1'-Biphenyl, 2-Ethyl	11400	NJ
5. Benzene, (1-Methyunde+	34600	NJ
6. Benzene, (1-Pentylocty+	11500	NJ
7. Benzene, (1-Butylnonyl+	5690	NJ
8. Benzene, (1-propyldecy+	7960	NJ
9. Benzene, (1-hexyloctyl)	8450	NJ
10. Unknown Hydrocarbon 02	30700	NJ
11. Unknown Hydrocarbon 03	33600	NJ
12. Unknown Hydrocarbon 04	164000	NJ
13. Unknown Hydrocarbon 05	47800	NJ
14. Unknown Hydrocarbon 06	51400	NJ
15. Unknown Hydrocarbon 07	64500	NJ
16. Unknown Hydrocarbon 08	52400	NJ
17. Unknown Hydrocarbon 09	99900	NJ
18. Unknown Hydrocarbon 10	53800	NJ
19. Unknown Hydrocarbon 11	35300	NJ
20. Unknown Hydrocarbon 12	16600	NJ
21. Unknown Hydrocarbon 13	29000	NJ
22. Unknown Hydrocarbon 14	22300	NJ
23. Unknown Hydrocarbon 15	41000	NJ
24. Unknown Hydrocarbon 18	74000	NJ
25. Unknown Compound 2	85900	NJ
26. Unknown Compound 3	59100	NJ
27. Unknown Compound 4	66900	NJ
28. Unknown Compound 5	55300	NJ
29. Unknown Compound 6	61400	NJ
30. Unknown Compound 7	100000	NJ

Appendix F - Tentatively Identified Compounds - Boise Cacade, 1993

Sample Location:	Sludge (Cont.)
Type:	grab
Date:	2/23
Time:	1330
Sample ID:	098294

BNAs:

Compound Name	Estimated Concentration (μg/Kg)	Qualifier
31. Unknown Compound 8	5770	NJ
32. Unknown Compound 9	34200	NJ
33. Unknown Compound 10	13800	NJ
34. Unknown Compound 11	60100	NJ
35. Unknown Compound 12	19100	NJ
36. Unknown Compound 13	39400	NJ
37. Unknown Compound 14	70600	NJ
38. Benzene, 1,1'-Ethylide+	18200	NJ
39. 1,1'-Biphenyl, 2,2'-Di+	405000	NJ
40. 1,1'-Biphenyl, 2,2'-Di+	483000	NJ
41. Benzene, 1,2-Dimethyl-+	22900	NJ

Appendix G - Tentatively Identified Substituted Biphenyl Compounds

Sample#	Name	CAS#	RT	Amount (μg/L)	Qual
93-098282	Benzene,1,1'-methylene bis 4-methyl-	4957-14-6	16.708	152	NJ
	Benzene, 1,2-dimethyl-4-(phenylmethyl)-	13540-56-2	17.072	105	NJ
	1,1'-Biphenyl, 2,2-diethy-isomer	13049-35-9	17.740	6580	NJ
	1,1'-Biphenyl, 2,2-diethy-isomer	13049-35-9	18.159	4900	NJ
93-098286	Benzene, 1-methyl-3-[(4-methylphenyl)methyl]-	21895-16-9	16.708	16.4	NJ
	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	17.695	340	NJ
	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	18.137	349	NJ
93-098295	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	17.671	23.4	NJ
	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	18.084	6.9	NJ
93-098289	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	17.657	26.8	NJ
	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	18.079	17.0	NJ
				(μg/Kg)	
93-098294	1,1'-Biphenyl, 2-ethyl-	1812-51-7	17.317	11400	NJ
	Benzene, 1,2-dimethyl-4-(phenylmethyl)-	13540-56-2	17.659	22900	NJ
	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	18.684	483000	NJ
	1,1'-Biphenyl, 2,2'-diethyl-isomer	13049-35-9	19.123	405000	NJ
	Benzene, (1-methylundecyl)-	2719-61-1	19.597	34600	NJ
	Benzene, (1-pentyloctyl)-	4534-49-0	19.773	11500	NJ
	Benzene, (1-butylnonyl)-	4534-50-3	19.843	5690	NJ

Appendix H - GLOSSARY

ABN	Acid base-neutral, semivolatile organics, see BNA
AED	Atomic Emission Detector
BNA	Base-neutral acids, semivolatiles, see ABN
BOD	Biological Oxygen Demand
CLP	Contract Laboratory Program
COD	Chemical Oxygen Demand
co-elutants	When two or more compounds have the same chromatographic retention time
CVAA	Cold Vapor Atomic Absorption
d-deuterium	An isotope of hydrogen
DL	Detection Limit
DOC	Dissolved Organic Carbon
DW	Dangerous Waste
ECD	Electron Capture Detector-Sensitive to halogen compounds - use: halogenated hydrocarbons
EHW	Extremely Hazardous Waste
ELD	Electrolytic Detector - Hall
EP TOX	Extraction Procedure Toxicity
Fatty Acid	Monobasic organic acids derived from hydrocarbons; include both saturated and unsaturated acids
FID	Flame Ionization Detector-Sensitive to carbon compounds, used in the determination of hydrocarbons
Flash Point	Minimum temperature that will enable combustion or explosions to take place
FTIR	Fourier Transform Infra-Red
GC	Gas Chromatography
GCMS	Gas Chromatography Mass Spectrometry, also GC/MS
HC	Hydrocarbon
HDPE	High Density Polyethylene
HH	Halogenated Hydrocarbon
HPLC	High Performance Liquid Chromatography
HSD	Halogen-Specific Detector - use: halogenated hydrocarbons
HW	Hazardous Waste
HWPAH	Hazardous Waste Polynuclear Aromatic Hydrocarbon
ICP	Inductively Coupled Plasma
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
IDL	Instrument Detection Limit
isomer	One of two or more substances which have the same elementary composition but differ in structure and hence in properties
isotope	One of two or more nuclides having the same atomic number, but differing in mass number

Isotopically labelled	The substitution of one or more isotopes for elements in a compound
kg	kilogram (1 X 10^3 grams)
L	Liter (1 X 10^3 milliliters)
LC50	Concentration which is lethal to 50% of the test organisms
LOD	Limit of Detection
LOEC	Lowest Observable Effect Concentration
m^3	Cubic meter (1 X 10^3 liters)
MBAS	Methylene Blue Active substances
metalloids	Elements that exhibit transitional characteristics between metals and non-metals, examples include silver, selenium, antimony
MF	Membrane Filter
mg	milligram (1 X 10^{-3} grams)
mL	Milliliter (1 X 10^{-3} liters)
MPN	Most Probable Number
ng	Nanogram (1 X 10^{-9} grams)
nm	Nanometer (1 X 10^{-9} meters)
NOEC	No Observable Effect Concentration
NPDES	National Pollution Discharge Elimination System
NPOC	Non-Purgeable Organic Carbon
NTU	Nephelometric Turbidity Unit
OSHA	Occupation Safety and Health Administration
OSW	Office of Solid Waste
PCB	Polychlorinated Biphenyl
PE	Polyethylene
pg	Picogram (1 X 10^{-12} grams)
pH	Hydrogen Ion Concentration
PID	Photoionization Detector - use: aromatic hydrocarbons
PLM	Polarized Light Microscopy
POC	Purgeable Organic Carbon
Polyvalent	Capable of having more than one valance state
PP	Priority Pollutant
ppb	Parts per billion (1 X 10^{-9} ug/L or ug/kg)
ppm	Parts per million (1 X 10^{-6} ug/L or ug/kg)
ppt	Parts per thousand (1 X 10^{-3} ug/L or ug/kg)
PQL	Practical Quantitation Limit
PUF	Polyurethane Foam
SDWA	State Drinking Water Act
SOW	Statement of Work
SW	Solid Waste

TC	Target Compounds or Total Carbon
TCD	Thermal Conductivity Detector
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TIC	Total Inorganic Carbon or for GCMS Tentatively Identified Compound
TNVS	Total Non-Volatile Solids
TNVSS	Total Non-Volatile Suspended Solids
TOC	Total Organic Carbon
TP	Total Phosphorous
TPH	Total Petroleum Hydrocarbons
TS	Total Solids
TSS	Total Suspended Solids
TVS	Total Volatile Solids
ug	Microgram (1×10^{-6} grams)
ug/m^3	Microgram per cubic meter
VOA	Volatile Organic Analysis
VOC	Volatile Organic Carbon
ZHE	Zero Headspace Extractor