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Water Body No. WA-49-1010
(Segment No. 22-49-02)

OKANOGAN WASTEWATER TREATMENT PLANT
CLASS II INSPECTION
OCTOBER 18-19, 1988

by
Don Reif

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Compliance Monitoring Section
Olympia, Washington 98504

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ABSTRACT

A Class II inspection was conducted at the Okanogan Wastewater Treatment Plant on October 18-19, 1988. The plant was experiencing very good effluent quality but exceeded allowable limits for fecal coliforms. Very few priority pollutants were found in the effluent. Bioassays indicated very little effluent toxicity. A few elevated compounds were detected in Okanogan's sludge. Recommendations were made concerning influent sampler repositioning, chlorination control, and further checks on lab procedures.

INTRODUCTION

A Class II inspection was conducted at the city of Okanogan's wastewater treatment plant (WTP) on October 18-19, 1988. The inspection was requested by Harold Porath of Ecology's Central Regional Office. Conducting the inspection was Don Reif and Carlos Ruiz of Ecology's Compliance Monitoring Section. Assistance was provided by John Moses, chief plant operator; Norm Butler, maintenance superintendent; and Harold Porath.

Objectives of the inspection were to:

1. Compare analytical results with permitted limits to determine compliance.

2. Assess analytical and sample collection procedures by conducting a laboratory survey and splitting samples.

3. Assess effluent toxicity by conducting a series of effluent bioassays.

4. Provide information on pollutants of concern, their reduction within the treatment system, and correlation with effluent bioassay results.

5. Provide chemical data on sludge.

6. Provide baseline data for future inspections.

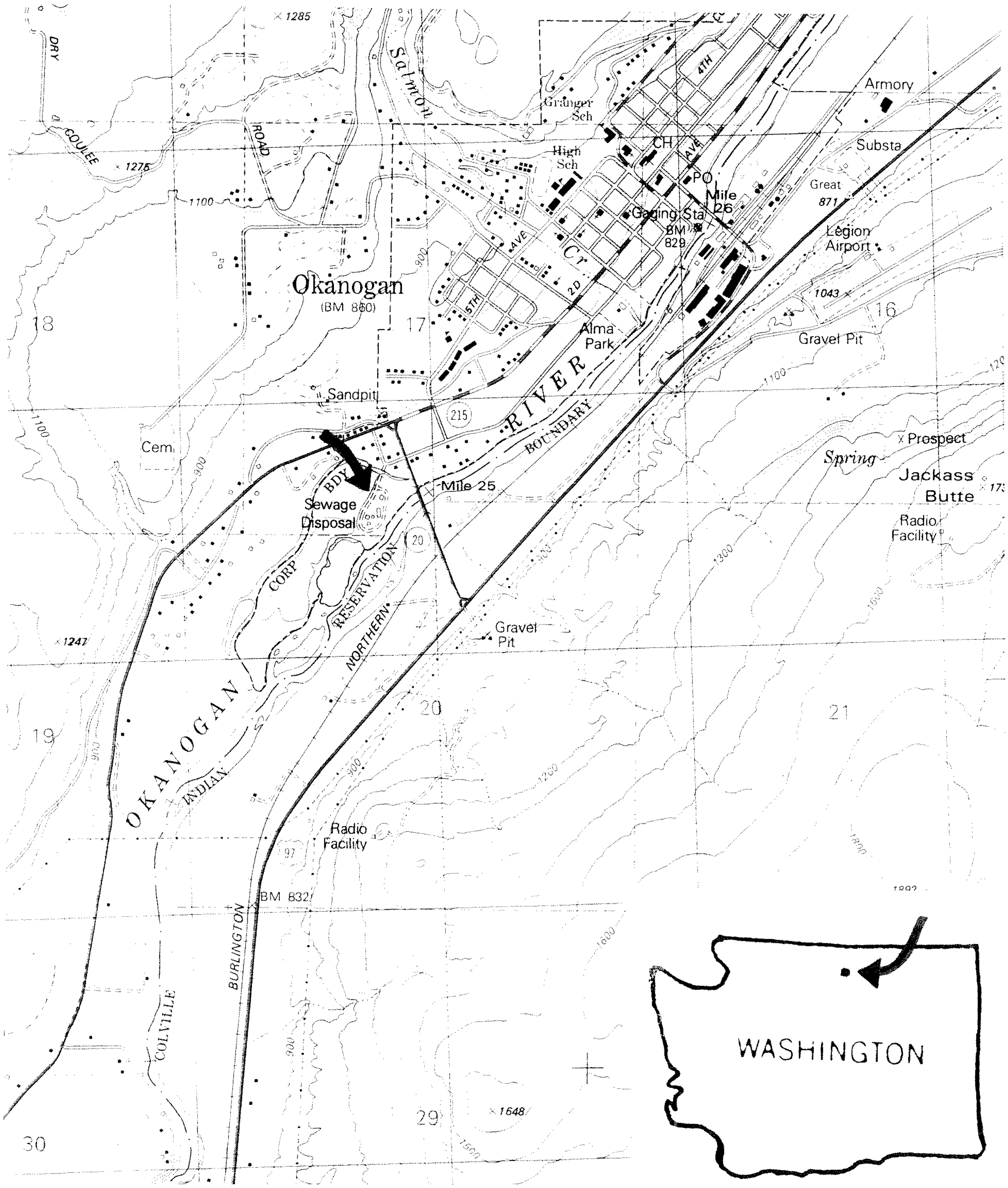
A receiving water study on the Okanogan River was performed at the same time. This report is available under separate cover (Carey, 1990).

LOCATION AND DESCRIPTION

Okanogan is a farming and ranching community in north-central Washington, about 60 miles from Canada (Figure 1). Okanogan's 0.54 MGD treatment facility was built in 1983 with 90 percent construction grant funds. The treatment scheme is as follows (Figure 2). Influent is pumped to the headworks by closed screw lift pumps. After comminution and aerated grit removal, the wastewater undergoes primary clarification. Secondary treatment consists of two rotating biological contactors (RBCs) in series, first a standard-density unit followed by a high-density shaft. Secondary clarification follows the biological treatment units. Effluent is disinfected in the chlorine contact chamber before final discharge to the Okanogan River.

Grit is separated by a cyclonic degritter and classifier, then disposed of by land-filling. Secondary sludge is returned to the grit chamber and then co-settled with primary sludge in the primary clarifier. The co-settled sludge is pumped to the aerobic digester for stabilization. Sludge is dried on asphalt drying beds prior to land disposal on city owned property.

Figure 1. Treatment Plant Location: Okanogan Class II Inspection-- October 18-19, 1988.



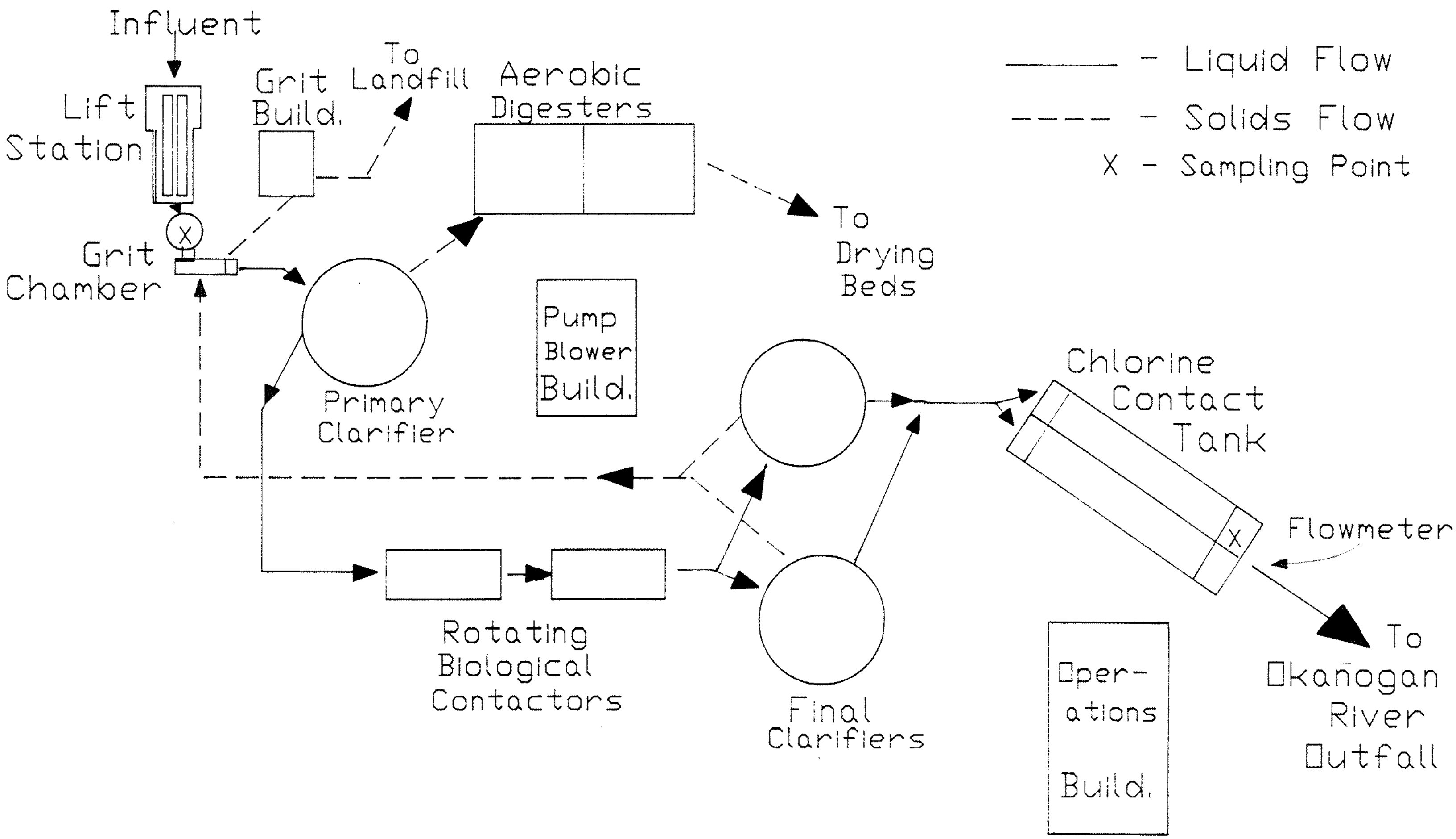


Figure 2. Plant Schematic With Sampling Points: Okanogan Class II Inspection- October 18-19, 1988.

METHODS

Ecology's sampling schedule is listed in Table 1. Appendix 3 lists references of analytical methods used. Sampling points are shown in Figure 2.

Both composite and grab samples were collected on the influent and effluent. For the composites, approximately 300 mL were collected with ISCO portable samplers at 30-minute intervals for 24 hours. Effluent bioassay samples were composites of three grab samples, collected at the same time as the other grab samples. This was necessary due to the large volume of sample required for the bioassays. The sludge sample was taken directly from the drying beds. All samples were iced during collection and transport to Ecology's Manchester Laboratory.

Flow rates were checked on the east side of the double-sided chlorine contact chamber. Instantaneous liquid depths over the weir were checked with a carpenter's square. Since the depth over both weirs showed no measurable difference, the flow rate for the east side was then doubled to estimate the total plant flow. Two instantaneous measurements were made with this method and compared to the instantaneous readout on the WTP meter. Also, a Sigma portable flow meter was set up on the east channel. The bubbler-type flow meter was used to check the accuracy of the WTP's totalized flow rate. Okanogan's flow meter is a sonic unit located in the manhole just downstream of the chlorine contact chambers.

RESULTS

Flow

Okanogan's flow meter appeared to be quite accurate. Ecology's measurement of two instantaneous flow rates and total flow during the inspection (as described in the "Methods" section) correlated very well with WTP readings (Table 2). Yearly calibrations by a factory-approved technician is recommended.

General Conditions

Effluent quality was very good during the inspection. Effluent biochemical oxygen demand (BOD) and suspended solids were low (10 and 8 mg/L, respectively). Substantial nitrification, roughly 50 percent, was occurring (Table 3). Also, some nitrite (0.62 and 0.68 mg/L) was found in the effluent grab samples. Nitrite tends to occur during periods of partial nitrification, especially when moving into or out of more complete nitrification. Furthermore, nitrite has been shown to build up in fixed-film systems under certain conditions (Huang, 1989). Disinfection problems can occur because nitrite ties up large amounts of chlorine (Manual of Water Utility Operations, 1975). If seasonal disinfection problems do occur, nitrite production could be the cause. Control strategies can be addressed at that time.

NPDES Permit Compliance

With the exception of fecal coliform, the plant was well within all permitted parameters (Table 4). High effluent quality is evidenced by BOD and total suspended solids (TSS) loads far below permit limits and high percent removals.

The WTP was out of compliance for fecal coliform count. Results of both Ecology samples (1200 and 480) exceeded the monthly and weekly average limits of 200 and 400 fecal coliforms per 100 mL of effluent, respectively. Okanogan's permit states that chlorine residuals "shall be sufficient to attain" the permitted limits but "chlorine concentrations in excess of that necessary to reliably achieve these limits shall be avoided." The first chlorine residual measured during the inspection, 0.8 mg/L total and 0.5 mg/L free (Table 3), was probably excessive. The chlorine feed rate was then lowered. The next two readings, 0.1 mg/L total and 0.0 mg/L free, were too low, as indicated by the two fecal coliform sample results. A modest chlorine residual e.g., 0.2 to 0.4 mg/L, is a normal range for sufficient disinfection.

A problem exists with the design of the plant. Several return flows and drain lines drain back to the influent wet well and are included in the influent sample. These include tank and floor drains, digester supernate, drying bed subnatent, and grit wash water. Therefore, a true raw influent sample is not taken. This affects plant loading and percent of design capacity calculations, as well as percent removals of BOD and TSS for the permit. How much these side streams affect the character of the raw influent is unknown. Plant personnel should explore the possibility of repositioning the influent sampler, if possible, so that side streams are not included.

Effluent Bioassays

No significant effluent toxicity was indicated by the suite of bioassays (Table 5). Survival was 100 percent for rainbow trout. Both daphnid tests recorded LC_{50}'s of greater than 100 percent and NOEC's of 100 percent.

Response of *Ceriodaphnia dubia* and *Daphnia magna* was very similar. In both tests, adult survival varied from 70 percent to 100 percent, with no apparent pattern relating mortality to effluent concentration. Reproduction increased with increasing effluent concentrations, probably due to added nutrients from the effluent. This response pattern is considered typical of *Ceriodaphnia* when exposed to a nutrient-rich effluent with limited or no toxicity. The *Daphnia* test was piloted as a possible substitute for *Ceriodaphnia*, which has endured criticism in several aspects of the tests' procedures and interpretation. The results were remarkably similar and the *Daphnia* test is at least as easy to interpret. *Daphnia magna* may prove to be a reasonable alternative to *Ceriodaphnia* as a chronic freshwater bioassay in Washington.

Effluent Chemistry

Only a few priority pollutant compounds were detected in the effluent, and were at very low concentrations (Table 6). None appeared to be present in toxic amounts, based on available information and effluent bioassay results. The source(s) of these compounds are not known. Phthalates are contained in plastics and are very common contaminants. Toluene and isophorone are used in solvents. Most of the detected compounds can also be used in either the food manufacturing, food preserving, or farming industries (Verschueren, 1983). Phthalates can be found in insecticides. Benzoic acid is a food preservative. Isophorone is used in pesticide manufacturing, and 4-methylphenol can be used as a food anti-oxidant. Dichlorobenzene is found in insecticides and fumigants.

Metals concentrations in Okanogan's effluent were very low (Table 7). Only three of the 13 priority pollutant metals were found above detectable limits. None of these exceeded Environmental Protection Agency's (EPA) water quality criteria for the protection of aquatic life in receiving waters (EPA, 1986).

Although no toxicity was noted by the bioassays, cyanide exceeded the chronic water quality criterion for protection of aquatic life (Table 7). Cyanide is usually associated with industrial processes, such as metals, mining, and chemical manufacturing (EPA, 1985). Its source(s) in Okanogan's effluent are unknown. Cyanide exceeded the chronic criterion by three times. Due to good dilution ratios--61:1 at 15 percent of the 7Q10 flow--and rapid mixing characteristics (Carey, 1990), cyanide would not have exceeded the water quality criterion in the Okanogan River.

A listing of tentatively identified compounds is included in Appendix 2. Many of these compounds are fatty acids and other materials associated with grease and oils and other common constituents of domestic wastewater. The source of other compounds is not known.

Sludge Analysis

Very few priority pollutants were detected in Okanogan's sludge. Chemical testing showed only low levels of several contaminants, with three exceptions. First, copper was high (1650 mg/Kg dry wt.) when compared to disposal criteria from the state of Wisconsin and previous state-wide inspections (Table 8). The concentration was greater than one standard deviation above the average from previous inspections, but less than the highest concentration found at similar plants (3100 mg/Kg dry wt.).

Also, bis(2-ethylhexyl)phthalate (BEHP) was rather high at 17 mg/Kg (Table 6). This phthalate is common, but the concentration was higher than has been seen in recent inspections; e.g., 2.9 and 4.4 mg/Kg. Its presence is generally associated with the ubiquitous nature of plastics.

Three chlorinated organopesticides--DDT, DDE, and DDD--were found in the sludge (Table 6). The concentrations of 110, 130, and 57 ug/Kg, respectively, were unexpectedly high. A review of past Class II inspections revealed few instances of organopesticide detection in municipal sludge. Also, the concentrations were, for the most part, higher than drainage ditch sediments entering the Yakima River in a 1985 study (Johnson *et al.*, 1986). Use of these pesticides has been disallowed since 1972, but they are known to have long half-lives, with DDE being the most persistent (Johnson *et al.*, 1986). Since DDE had the highest concentration, these levels may reflect historical use rather than recent applications. Evaluation of potential disposal concerns should be addressed by the local sludge management agency.

Comparison of Sample Splits

Overall, split-sample comparisons were not good between the Okanogan and Ecology labs (Table 9). Okanogan was lower than Ecology for all TSS values, especially on the influent samples. Possible reason(s) for this were not discerned from the on-site review of laboratory procedures. Influent BOD results compared well, but Okanogan's effluent values were quite high compared to Ecology. From the lab review, Okanogan's blank depletions were occasionally higher than the recommended maximum of 0.2 mg/L, going as high as 0.5 mg/L. This is generally due to contamination, perhaps inadequate cleaning of glassware. Also, the BOD of the seed (seed control) was not run properly. Related to this, secondary effluent was used for a seed source instead of primary effluent as recommended by Standard Methods. All these factors could affect final BOD results. Last, the fecal coliform split did not compare well. The incubator temperature should be maintained at 44.5 +/- 0.2 ^{O}C. Also, higher volumes of effluent are needed to get the recommended 20 to 60 fecal coliform colonies per plate.

Since the date of the inspection, a different operator has assumed laboratory duties at the Okanogan plant. A visit by Ecology's roving field operator consultant, Otis Hampton, is recommended to assure consistent use of approved lab methods.

SUMMARY

The Okanogan Wastewater Treatment Plant was running very well during the inspection. Effluent quality was very good, with a BOD of 10 mg/L and TSS of 8 mg/L. All NPDES permit parameters were met with the exception of fecal coliform limits, which were exceeded in both samples taken. Checks of the plant flow meter readings correlated very well with field measurements. However, many side streams and return flows enter the influent wet well and are picked up in the influent sample. This probably compromises the influent sample.

The Okanogan plant might experience seasonal disinfection problems due to elevated nitrite levels. If this problem is noted in the future, control strategies should be addressed.

Very few contaminants were found in Okanogan's effluent. The few compounds that were found, at very low concentrations, may be related to local industries. Effluent cyanide exceeded EPA's criterion for chronic (long-term) protection of aquatic life in the receiving water. Available dilution should eliminate the possibility of any adverse effects on the Okanogan River. No acute or appreciable chronic toxicities were noted by a suite of effluent bioassays.

From Okanogan's sludge sample, three types of compounds were found at elevated levels: copper, BEHP, and three organopesticides (DDT, DDE, DDD).

Split sample results did not compare well between Ecology's and Okanogan's labs. However, a new operator has since assumed the lab testing duties.

RECOMMENDATIONS

Chlorine feed rates need to be monitored closely so that sufficient, but not excessive, effluent disinfection occurs. Operation of the chlorinator in the flow-proportional mode is desirable.

Repositioning of the influent sampler line should be explored. If side streams can be avoided, the data from true raw influent samples will be valuable.

Sludge data from this inspection should be given to the local sludge authority so that any concerns can be addressed.

Ecology's roving operator should review proper lab protocols with Okanogan's current operator to assure consistent use of accepted procedures.

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Table 1. Ecology sampling schedule: Okanogan Class II inspection; October 18-19, 1988.

Station:	Influent				Effluent				Digester	
Type:	Grab			Composite	Grab			Composite	Sludge	Supernatent
Date:	11/15	11/15	11/16	11/15-16	11/15	11/15	11/16	11/15-16	10/18	10/19
Parameters — Time:	1150	1614	0855	0935-0935	1030	1550	0911	0910-0910	1400	0915
GENERAL CHEMISTRY										
Turbidity (NTU)	X	X	X	X	X	X	X	X		
pH (S.U.)	X	X	X	X	X	X	X	X		
Conductivity (umhos/cm)	X	X	X	X	X	X	X	X		
Alkalinity (mg/L as $CaCO_3$)	X	X	X	X	X	X	X	X		
Hardness (mg/L as $CaCO_3$)				X				X		
Cyanide (mg/L)				X				X	X	
Solids (mg/L)										
TS				X				X		
TNVS				X				X		
TSS	X	X	X	X	X	X	X	X		
TNVSS				X				X		
BOD_5 (mg/L)				X				X		
COD (mg/L)	X	X	X	X	X	X	X	X		X
Nutrients (mg/L)										
NH_3-N	X	X	X	X	X	X	X	X		
NO_3+NO_2-N	X	X	X	X	X	X	X	X		
NO_2-N	X	X			X	X				
T-Phosphate	X	X	X	X	X	X	X	X		
Fecal Coliform (#/100 mL)						X	X			
% Solids									X	
ORGANICS + METALS										
pp metals				X				X	X	
ABN (water)				X				X		
ABN (solids)									X	
VOA (water)				X				X		
Pest/PCB (water)				X				X		
Pest/PCB (solids)									X	
Phenols				X				X		
TOC									X	
BIOASSAYS										
Rainbow trout									X	
Daphnia magna								X		
Ceriodaphnia dubia								X		
FIELD ANALYSES										
Temperature (°C)	X	X	X	X	X	X	X	X		X
pH (S.U.)	X	X	X	X	X	X	X	X		X
Conductivity (umhos/cm)	X	X	X	X	X	X	X	X		X
Chlorine Residual (mg/L)										
Free						X	X			
Total						X	X			

Table 2. Summary of flow measurement calculations: Okanogan Class II inspection; October 18-19, 1988.

	Water depth, inches: East Weir	Ecology Calculated Flow, MGD*	Okanogan WTP meter readout, MGD
Instantaneous:			
10/18 1055	1.02 (avg.)	0.32	0.35
10/19 0927	1.13	0.37	0.38
Totalizer[1]:			
1016-1016		0.402	0.394
0745-0745			0.407

*Equation: Q = 2.15(L-0.2H)H1.5 x 2 weirs (from Grant, 1985)
where Q = Flow, MGD
L = weir length, feet
H = height of water above weir, feet

[1]Ecology's flowmeter was operational beginning at 1016 hrs. on 10/18. Okanogan's totalizer was recorded for this period as well as their normal 0745 hrs. reading.

Table 3. Ecology sample results: Okanogan Class II Inspection; October 18-19, 1988.

Station:	Influent				Effluent				Digester	
Type:	Grab			Composite	Grab			Composite	Sludge	Supernate
Date:	11/15	11/15	11/16	11/15-16	11/15	11/15	11/16	11/15-16	10/18	10/19
Time:	1150	1614	0855	0935-0935	1030	1550	0911	0910-0910	1400	0915
Parameters Lab ID #:	438180	438182	438185	438187	438181	438183	438186	438189	438184	438191
GENERAL CHEMISTRY										
Turbidity (NTU)	70	55	80	56	2	3	3	4		
pH (S.U.)	8.3	7.8	8.3	7.9	7.3	7.4	7.5	7.7		
Conductivity (umhos/cm)	1580	1280	1390	1650	1420	1590	1340	1490		
Alkalinity (mg/L as $CaCO_3$)	366	357	360	332	245	249	240	253		
Hardness (mg/L as $CaCO_3$)				337				316		
Cyanide (mg/L)				0.010				0.018		
Cyanide (mg/kg dw)									1.02	
Solids (mg/L)										
TS				1200				920		
TNVS				760				750		
TSS	220	180	270	230	13	11	10	8		
TNVSS				48				3		
BOD_5 (mg/L)				150				10		
COD (mg/L)	450	370	370	430	62	62	52	62		62
Nutrients (mg/L)										
NH_3-N	18	25	32	23	6.8	9.8	7.1	8.8		
NO_3+NO_2-N	0.38	0.26	0.19	0.19	8.8	8.1	10	8.2		
NO_2-N	0.12	0.06			0.62	0.68				
T-Phosphate	7.3	9.3	10	8.3	6.5	6.1	6.2	6.7		
Fecal Coliform (#/100mL)						2100	480			
% Solids									22	
FIELD ANALYSES										
Temperature (°C)	19.9	20.3	18.8	5.0	18.4	18.2	17.2	5.3		24.6
pH (S.U.)	9.42	8.2	8.66	8.3	7.68	7.51	7.61	7.75		7.38
Conductivity (umhos/cm)	1300	1120	1225	1456	1280	1445	1220	1285		2090
Chlorine Residual (mg/L)										
Free					0.5	0.0	0.0			
Total					0.8	0.1	0.1			

Table 4. Comparison of inspection results to NPDES permit limits: Okanogan Class II inspection; October 18-19, 1988.

Parameter	Monthly Average	Weekly Average	Inspection Results
BOD_5: mg/L	30	45	10
lbs/day	135	203	34
% removal	85		93
TSS: mg/L	30	45	8
lbs/day	135	203	27
% removal	85		97
Fecal Coliform, #/100 mL	200	400	2100, 480
pH	6.0-9.0		7.68, 7.51, 7.61
Flow, MGD	< or = 0.54		0.402

Table 5. Effluent bioassay results: Okanogan Class II inspection; October 18-19, 1988.

96-hour Rainbow trout (Oncorhyncus mykiss) - 65% concentration

	# of Live Test Organisms: Initial	Final	Percent Mortality
Effluent	30	30	0
Control	30	30	0

8-day Ceriodaphnia dubia

% Chlorinated Effluent:	% Adult Survival	Average No. Young /Adult
0 (control)	100	15.6
1	70	9.7
3	100	12.5
10	90	28.3
30	90	31.3
100	100	21.4

NOEC - 100%
LC_{50} - >100%

7-day Daphnia magna

% Chlorinated Effluent:	% Adult Survival	Average No. Young /Adult
0 (control)	100	1.1
1	70	2.0
3	90	1.8
10	100	3.4
30	90	10.1
100	100	19.7

NOEC - 100%
LC_{50} - >100%

NOEC = No Observed Effect Concentration: the highest concentration of effluent that did not cause an observable adverse effect.

LC_{50} = Concentration lethal to 50% of the organisms.

Table 6. VOA, BNA, and Pesticide compounds detected in water and sludge: Okanogan WTP Class II inspection; October 18-19, 1988.

		Influent	Effluent	Sludge
VOA COMPOUNDS		(ug/L)	(ug/L)	
Acetone		300	6.9 U	
Chloroform		6.4	1.9	
Toluene		1.3	1.7	
Cyanide, Total	(ug/L)	10	18	
	(ug/kg dw)			1020
Phenols, Total	(ug/L)	28	6 U	
BNA Compounds		(ug/L)	(ug/L)	(ug/kg dw)
Benzoic Acid		700 J	20 UJ	6000 U
Isophorone		20 U	4 U	700 J
Diethylphthalate		8 J	4 U	1200 U
Di-n-Butylphthalate		20 U	0.8 J	1200 U
1,2-Dichlorobenzene		2 J	0.7 J	84 J
4-Methylphenol		75 J	6 J	1200 U
Phenol		20 U	7 J	1200 U
bis(2-Ethylhexyl)Phthalate		58 B	32 B	17000
Di-n-Octyl Phthalate		20 U	14	1200 U
Pesticides		(ug/L)	(ug/L)	(ug/kg dw)
4,4'-DDE		0.06 U	0.06 U	130
4,4'-DDD		0.06 U	0.06 U	57
4,4'-DDT		0.06 U	0.06 U	110

"U" indicates compound was analyzed for but not detected at the given detection limit

"J" indicates an estimated value when result is less than specified detection limit

"B" is used when the analyte is found in the blank as well as the sample; Indicates possible/probable blank contamination

Table 7. Effluent metals and cyanide compared to EPA water quality criteria: Okanogan Class II Inspection; October 18-19, 1988.

Metal (ug/L)	Effluent	Criteria+	
		FW Acute	FW Chronic
Cyanide	18	22	5.2
Copper	24	52	32
Lead	2.7	350	14
Zinc	53	310	280
Hardness	316		

+ = from EPA, 1986.

Table 8. Sludge metals results: Okanogan Class II inspection; October 18-19, 1988. All units are mg/Kg d.w.

Metal	Criteria*	Previous Inspections:+		Okanogan Sludge
		Average	+1 std.dev.	
Cadmium	1.0	5.5	29	7.3
Chromium	100	41	176	66
Copper	100	532	1402	1650
Lead	50	284	545	224
Nickel	100	28.6	41	26.2
Zinc	100	1620	2310	1870

* = interim criteria for open-water disposal of dredged materials - Wisconsin Department of Natural Resources, 1985.

+ = Geometric mean of 17 digested sludge samples of fixed film plants from previous Ecology Class II inspections (Hallinan, 1988).

Table 9. Comparison of laboratory results: Okanogan Class II inspection; October 18-19, 1988.

Sample	Sampler	Laboratory	BOD_5 (mg/L)	TSS (mg/L)	Fecal Coliform (#/100 mL)
Influent:	Ecology	Ecology	150	230	
	Ecology	Okanogan	125	182	
	Okanogan	Ecology	150	290	
	Okanogan	Okanogan	150	192	
Effluent:	Ecology	Ecology	10	8	480
	Ecology	Okanogan	24	7	
	Okanogan	Ecology	11	9	
	Okanogan	Okanogan	27	6	116

APPENDICES

Appendix 1. Results of VOA, BNA, Pest/PCB and metal priority pollutant scans: Okanogan WTP Class II inspection; October 18-19, 1988.

Sample:	Inf-Eco	Eff-Eco	Sludge
Lab Log #:	438187	438189	438184
Type:	composite	composite	grab
Date:	10/18-19	10\18-19	10/18
Time:	0900-0830	0915-0845	1400
VOA COMPOUNDS	ug/L	ug/L	
Chloromethane	3.8 U	3.8 U	
Bromomethane	3.1 U	3.1 U	
Vinyl Chloride	2.0 U	2.0 U	
Chloroethane	3.3 U	3.3 U	
Methylene Chloride	3.3 U	3.3 U	
Acetone	300	6.9 U	
Carbon Disulfide	1.2 U	1.2 U	
1,1-Dichloroethene	0.7 U	0.7 U	
1,1-Dichloroethane	0.6 U	0.6 U	
1,2-Dichloroethene(total)	0.8 U	0.8 U	
Chloroform	6.4	1.9	
1,2-Dichloroethane	0.5 U	0.5 U	
2-Butanone	6.2 U	6.2 U	
1,1,1-Trichloroethane	0.6 U	0.6 U	
Carbon Tetrachloride	0.9 U	0.9 U	
Vinyl Acetate	3.1 U	3.1 U	
Bromodichloromethane	0.3 U	0.3 U	
1,2-Dichloropropane	0.7 U	0.7 U	
Trichloroethene	0.6 U	0.6 U	
Benzene	1.0 U	1.0 U	
Dibromochloromethane	0.7 U	0.7 U	
1,1,2-Trichloroethane	0.7 U	0.7 U	
Bromoform	2.5 U	2.5 U	
4-Methyl-2-Pentanone	3.5 U	3.5 U	
2-Hexanone	3.2 U	3.2 U	
1,1,2,2-Tetrachloroethane	2.7 U	2.7 U	
Tetrachloroethene	0.5 U	0.5 U	
Toluene	1.3	1.7	
Chlorobenzene	0.9 U	0.9 U	
trans-1,3-Dichloropropene	1.8 U	1.8 U	
Ethylbenzene	0.8 U	0.8 U	
cis-1,3-Dichloropropene	1.9 U	1.9 U	
Styrene	1.1 U	1.1 U	
Total Xylenes	1.8 U	1.8 U	
2-Chloroethylvinylether	2.7 U	2.7 U	
Cyanide, Total (mg/L)	0.010	0.018	1.02
Phenols, Total (ug/L)	28	6 U	
TOC, % dry basis			21

Appendix 1 - continued.

	Sample:	Inf-Eco	Eco-Eff	Sludge
	Lab Log #:	338090	438189	438184
	Type:	comp.	composite	grab
	Date:	08/10/88	10/18-19	10/18
BNA COMPOUNDS		ug/L	ug/L	ug/kg dw
Benzo(a)Pyrene		20 U	4 U	1200 U
2,4-Dinitrophenol		98 UJ	20 UJ	6000 U
Dibenz(a,h)Anthracene		20 U	4 U	1200 U
Benzo(a)Anthracene		20 U	4 U	1200 U
4-Chloro-3-Methylphenol		20 UJ	4 UJ	1200 U
Benzoic Acid		700 J	20 UJ	6000 U
Hexachloroethane		20 U	4 U	1200 U
Hexachlorocyclopentadiene		20 U	4 U	1200 U
Isophorone		20 U	4 U	700 J
Acenaphthene		20 U	4 U	1200 U
Diethylphthalate		8 J	4 U	1200 U
Di-n-Butylphthalate		20 U	0.8 J	1200 U
Phenanthrene		20 U	4 U	1200 U
Butylbenzylphthalate		20 U	4 U	1200 U
N-Nitrosodiphenylamine		20 U	4 U	1200 BU
Fluorene		20 U	4 U	1200 U
Carbazole		20 U	4 U	1200 U
Hexachlorobutadiene		20 U	4 U	1200 U
Pentachlorophenol		98 UJ	20 UJ	6000 U
2,4,6-Trichlorophenol		20 UJ	4 U	1200 U
2-Nitroaniline		98 U	20 U	6000 U
2-Nitrophenol		75 UJ	4 UJ	1200 U
Naphthalene, 1-Methyl-		20 U	4 U	1200 U
Naphthalene		20 U	4 U	1200 U
2-Methylnaphthalene		20 U	4 U	1200 U
2-Chloronaphthalene		20 U	4 U	1200 U
3,3'-Dichlorobenzidine		39 U	8 U	2500 U
2-Methylphenol		20 UJ	4 UJ	1200 U
1,2-Dichlorobenzene		2 J	0.7 J	84 J
o-Chlorophenol		20 UJ	4 UJ	1200 U
2,4,5-Trichlorophenol		98 UJ	20 UJ	6000 U
Nitrobenzene		20 U	4 U	1200 U
3-Nitroaniline		98 U	20 U	6000 U
4-Nitroaniline		98 U	20 U	6000 U
4-Nitrophenol		98 UJ	20 UJ	6000 U
Benzyl Alcohol		20 UJ	4 UJ	1200 U
4-Bromophenyl-phenylether		20 U	4 U	1200 U
2,4-Dimethylphenol		20 UJ	4 UJ	1200 U
4-Methylphenol		75 J	6 J	1200 U
1,4-Dichlorobenzene		20 U	4 U	1200 U
4-Chloroaniline		20 U	4 U	1200 U
Phenol		20 U	7 J	1200 U
bis(2-Chloroethyl)Ether		20 U	4 U	1200 U
bis(2-Chloroethoxy)Methane		20 U	4 U	1200 U
bis(2-Ethylhexyl)Phthalate		58 B	32 B	17000
Di-n-Octyl Phthalate		20 U	14	1200 U
Hexachlorobenzene		20 U	4 U	1200 U
Anthracene		20 U	4 U	1200 U

Appendix 1 - continued.

Sample:	Eco-Inf	Eco-Eff	Sludge
Lab Log #:	338090	438189	438184
Type:	comp.	composite	grab
Date:	08/10/88	10/18-19	10/18
1,2,4-Trichlorobenzene	20 U	4 U	1200 U
2,4-Dichlorophenol	20 UJ	4 UJ	1200 U
2,4-Dinitrotoluene	20 U	4 U	1200 U
Pyrene	20 U	4 U	1200 U
Dimethyl Phthalate	20 U	4 U	1200 U
Dibenzofuran	20 U	4 U	1200 U
Benzo(ghi)Perylene	20 U	4 U	1200 U
Indeno(1,2,3-cd)Pyrene	20 U	4 U	1200 U
Benzo(b)Fluoranthene	20 U	4 U	1200 U
Fluoranthene	20 U	4 U	1200 U
Benzo(k)Fluoranthene	20 U	4 U	1200 U
Acenaphthylene	20 U	4 U	1200 U
Chrysene	20 U	4 U	1200 U
Retene	20 U	4 U	1200 U
4,6-Dinitro-2-Methylphenol	98 UJ	4 U	6000 U
1,3-Dichlorobenzene	20 U	20 UJ	1200 U
2,6-Dinitrotoluene	20 U	4 U	1200 U
N-Nitroso-Di-n-Propylamine	20 U	4 U	1200 U
4-Chlorophenyl-phenylether	20 U	4 U	1200 U
bis(2-chloroisopropyl)ether	20 U	4 U	1200 U
Pest/PCB Compounds (ug/L)	(ug/L)	(ug/L)	(ug/kg dw)
alpha-BHC	0.06 U	0.06 U	40 U
beta-BHC	0.06 U	0.06 U	40 U
delta-BHC	0.06 U	0.06 U	40 U
gamma-BHC (Lindane)	0.06 U	0.06 U	40 U
Heptachlor	0.06 U	0.06 U	40 U
Aldrin	0.06 U	0.06 U	40 U
Heptachlor Epoxide	0.06 U	0.06 U	40 U
alpha-Endosulfan	0.06 U	0.06 U	40 U
Dieldrin	0.06 U	0.06 U	40 U
4,4'-DDE	0.06 U	0.06 U	130
Endrin	0.06 U	0.06 U	40 U
Endrin aldehyde	0.06 U	0.06 U	40 U
4,4'-DDD	0.06 U	0.06 U	57
Endosulfan Sulfate	0.06 U	0.06 U	40 U
4,4'-DDT	0.06 U	0.06 U	110
beta-Endosulfan	0.06 U	0.06 U	40 U
Chlordane	0.06 U	0.06 U	40 U
Toxaphene	0.09 U	0.9 U	600 U
Aroclor-1016 and 1242	0.30 U	0.3 U	200 U
Aroclor-1221	0.30 U	0.3 U	200 U
Aroclor-1232	0.30 U	0.3 U	200 U
Araclor-1242	0.30 U	0.3 U	200 U
Aroclor-1248	0.30 U	0.3 U	200 U
Aroclor-1254	0.30 U	0.3 U	200 U
Aroclor-1260	0.30 U	0.3 U	200 U

Appendix 1 - continued.

Sample:	Eco-Inf		Eco-Eff		Sludge
Lab Log #:	438187		438189		438184
Type:	composite		composite		grab
Date:	10/18-19		10/18-19		10/18
PRIORITY POLLUTANT METALS	(ug/L)		(ug/L)		(mg/kg dw)
Antimony	3	U	3	U	
Arsenic	4.6		4.4		
Beryllium	1	U	1	U	
Cadmium	6.3		5	U	7.29
Chromium	10	U	10	U	65.7
Copper	110		24		1650
Lead	32.3		2.7		224
Mercury	0.28		0.06	U	
Nickel	10	U	10	U	26.2
Selenium	2	U	2	U	
Silver	2.2		0.5	U	
Thallium	1	U	1	U	
Zinc	244		53		1870

"U" indicates compound was analyzed for but not detected at the given detection limit

"J" indicates an estimated value when result is less than specified detection limit

"B" is used when the analyte is found in the blank as well as the sample; indicates possible/probable blank contamination

Appendix 2. Tentatively identified BNA compounds: Okanogan Class II inspection - October 18-19, 1988.

	Influent (ug/L)	Effluent (ug/L)
Cyclohexene, 1-methyl-4-(1-	140 J	
a-Terpeneol	180 J	
Dodecanamide, N,N-bis(2-hyd	200 J	
Decane, 6-ethyl-2-methyl-	67 J	
Butyric Acid	11 J	
Pentanoic acid	37 J	
Pentanoic acid, methyl ester	12 J	
3-cyclohexen-1-ol, 1-methyl	8.7 J	
Octanoic acid	40 J	
Cyclohexanol, 2-methyl-5-(1	24 J	
Propanedioic acid, phenyl-	36 J	
Decanoic acid	37 J	
1-Tetradecanol	75 J	
Decanoic Acid, Tetra-	450 J	
Decanoic Acid, Penta-	76 J	
Caffeine	77 J	
Decanoic Acid, Hexa-	2800 J	
Oleic Acid	4000 J	
Octadecanoic Acid	850 J	
Cholestanol (van)	460 J	37 J
Heneicosane	310 J	
Cholesterol	390 J	22 J
9-octadecenoic acid (z)-, 2	130 J	
9-octadecenoic acid (z)-, 2	76 J	
Butanoic Acid, 3-methyl-		7.4 J
Butanoic Acid, 2-methyl-		3 J
Pentanoic Acid, 4-methyl-		5.3 J
2-Propanol, 1-(2-methoxy-1-		4.7 J
Hexanoic Acid, 2-ethyl		1.3 J
Cyclopentanol, 1,2-dimethyl		1.1 J
Ethanol, 1-(2-Butoxyethoxy)-		25 J
Ethanol, 2,2'-oxybis-, diac		1.1 J
Ethanol, 2-(2-butoxyethoxy)		950 J
Phenol, nonyl-		2.7 J
Hexanedioic acid, mono(2-et		4.4 J
Ethanol, 2-butxy-, phospha		8.7 J
1,2-Benzenedicarboxylic acid		17 J

"J" indicates an estimated value

Appendix 3. Analytical methods: Okanogan Class II inspection - October 18-19, 1988.

Analysis	Method	Laboratory
TOC (solids)	APHA, 1985: #505	Laucks Testing Labs; Seattle, Wa.
% Solids	APHA, 1985: #209F	Laucks Testing Labs; Seattle, Wa.
VOA (water)	EPA, 1984: #624	Ecology; Manchester, Wa.
BNA (water)	EPA, 1984: #625	Ecology; Manchester, Wa.
BNA (solids)	EPA, 1986: #8270	Ecology; Manchester, Wa.
Pest/PCB (water)	EPA, 1984: #608	Ecology; Manchester, Wa.
Pest/PCB (solids)	EPA, 1986: #8080	Ecology; Manchester, Wa.
Metals (water)	EPA, 1983: #200 series	Ecology; Manchester, Wa.
Metals (solids)	EPA, 1983: #200 series	Ecology; Manchester, Wa.
Total phenolics	EPA, 1983: #420.2	Ecology; Manchester, Wa.
Cyanide	EPA, 1983: #335.2-1	Ecology; Manchester, Wa.
Trout 96-hour	Ecology, 1981	Ecology; Manchester, Wa.
Daphnia magna 7-day	EPA, 1987	Ecology; Manchester, Wa.
Ceriodaphnia dubia	EPA, 1985	Ecology; Manchester, Wa.