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WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

BREWSTER WASTEWATER TREATMENT PLANT CLASS II INSPECTION

by
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ABSTRACT

Ecology's Compliance Monitoring Section conducted a Class II inspection at the Town of Brewster's wastewater treatment plant (WTP) on March 6-7, 1990. The oxidation ditch plant was performing well and all permit conditions were met during the inspection. Very few priority pollutants were detected in the effluent. No toxicity was found in three effluent bioassays. Suggestions were made concerning influent sampler location and sampling frequency, repair of the effluent flowmeter, lab procedures, and sludge disposal considerations.

INTRODUCTION

Ecology's Compliance Monitoring Section conducted a Class II inspection at the Town of Brewster's wastewater treatment plant on March 6-7, 1990. Don Reif and Keith Seiders conducted the inspection with assistance from Brewster's plant operator, Lynn Lawson. The inspection was requested by Polly Zehm of Ecology's Central Regional Office.

Inspection objectives included the following:

1. Check for compliance with NPDES permit limits.
2. Chemically characterize influent, effluent, and sludge for priority pollutants.
3. Evaluate biological toxicity of Brewster's effluent with bioassays.
4. Briefly evaluate Brewster's wasting strategy and its possible effect on effluent quality.
5. Review sampling methods and lab procedures to determine adherence to accepted protocols.

LOCATION AND DESCRIPTION

Brewster is a town of about 1500 people located in north-central Washington on the west (north) bank of the Columbia River. The current NPDES permit (#WA-002100-8) expired June 9, 1990. The town's WTP was upgraded in 1983. The current plant is an oxidation ditch using extended aeration activated sludge for secondary treatment (Figure 1). Influent flow is intermittent, as sewage is collected at a pump station up the street. Upon arrival at the plant, the influent is pretreated with a rotating fine screen for removal of larger particles before secondary treatment. After biological treatment, the oxidation ditch effluent is clarified, disinfected with chlorine in the chlorine contact chambers, then discharged by outfall pipe to the Columbia River. Liquid sludge is pumped from the clarifier to a tanker truck, where it is currently applied to unused farmland.

METHODS

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

Both composites and grab samples were collected on the influent and effluent. For the composites, approximately 310 mL were collected with ISCO portable samplers at 30 minute intervals for 24 hours. Bioassay samples were taken from the effluent composite sample except for the trout test. Because of the large volume needed, this sample consisted of three grabs composited in equal parts simultaneously with the other grab samples. The sludge sample was taken from a spigot at the return sludge pump. All samples were iced immediately upon collection and transported to Ecology's Manchester Laboratory within 24 hours.

A Polysonics portable flowmeter was used to check the accuracy of Brewster's meters. Ecology's doppler-type flowmeter was attached externally to the eight-inch influent pipe at ground level on the vertical portion of the force main, approximately five feet below the invert. Brewster has two Manning 580A ultrasonic flowmeters located in manholes. The first is on the influent line about 20 linear feet before the headworks, and the second meter is between the clarifier and chlorine contact chamber.

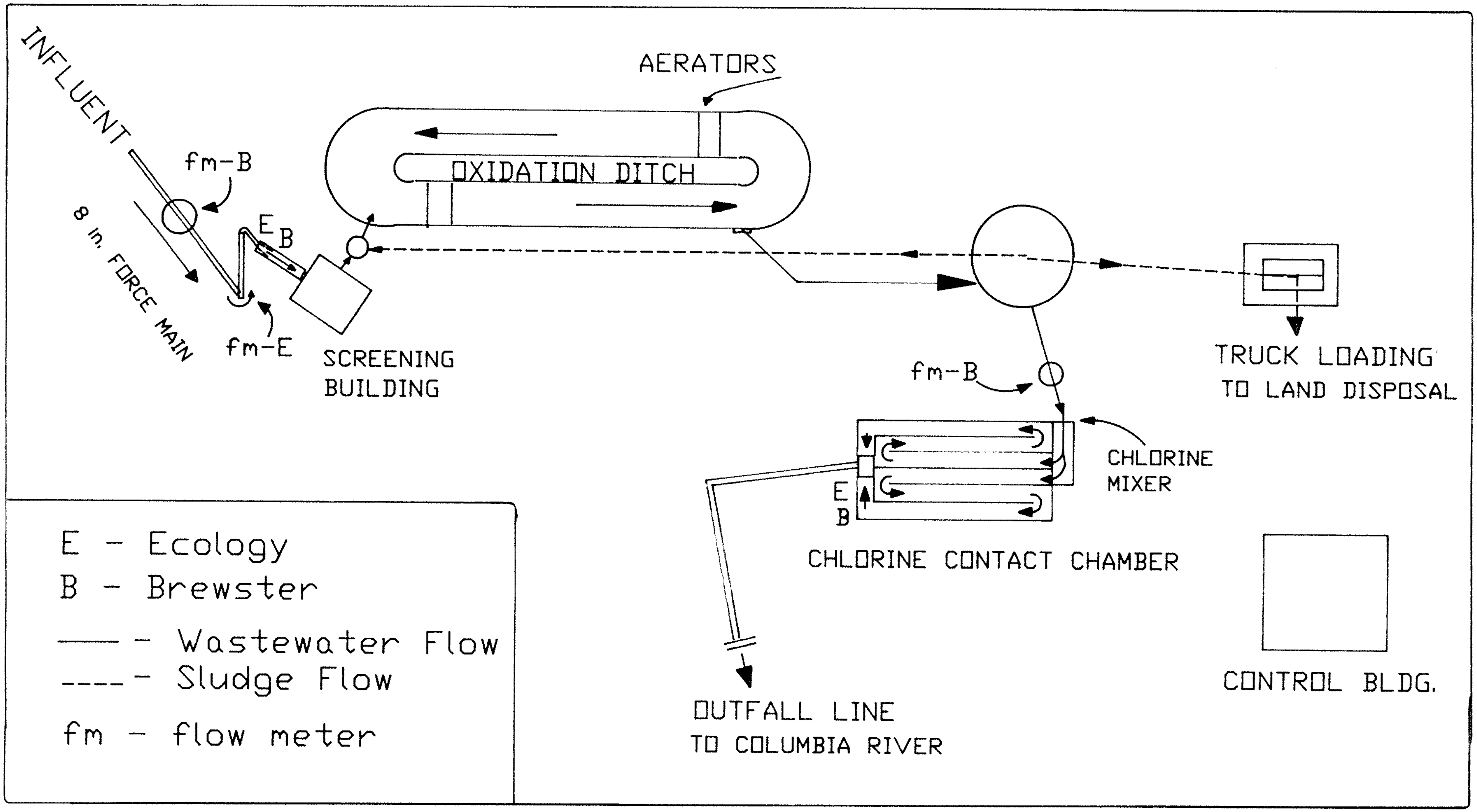

Figure 1. Plant schematic with sampling points: Brewster Class II inspection- March 6-7, 1990.

Table-1. Sampling Schedule: Brewster Class II Inspection-March 6-7, 1990.

Sample:	Influent	Influent	Influent	Inf-Eco	Inf-Brew	Effluent	Effluent	Effluent	Eff-Eco	Eff-Brew	Sludge	EPA PE	Eff-Eco
Date:	3/6/90	3/6/90	3/7/90	3/6-7/90	3/6-7/90	3/6/90	3/6/90	3/7/90	3/6-7/90	3/6-7/90	3/6/90	3/7/90	3/6-7/90
Time:	am	pm	am	8am-8am	8am-8am	am	pm	am	8am-8am	8am-8am	pm	am	8am-8am
Type:	grab	grab	grab	composite	composite	grab	grab	grab	composite	composite	grab		duplicate
Parameter / Lab Log #:	108155	108157	108159	108161	108162	108156	108158	108160	108163	108164	108165	108166	108167
Turbidity	E	E	E	E	E	E	E	E	E	E			
Conductivity	E	E	E	E	E	E	E	E	E	E			
Alkalinity	E	E	E	E	E	E	E	E	E	E			
Hardness				E					E				
Cyanide (Total)				E					E		E		
Solids(4)				E	E				E	E			
TSS	E	E	E	B	B	E	E	E	B	B		E B	E
BOD_5				E B	E B				E B	E B		E B	E
COD	E	E	E	E	E	E	E	E	E	E			
TOC (water)									E				
TOC (solids)											E		
NH_3-N	E	E	E	E	E	E	E	E	E	E			
NO_3+NO_2-N	E	E	E	E	E	E	E	E	E	E			
Total-P	E	E	E	E	E	E	E	E	E	E			
Fecal Coliform								E					
pp metals				E					E		E		
BNA (water)				E					E				
VOA (water)		E					E						
Pest/PCB (water)				E					E				
BNA (solids)											E		
Pest/PCB (solids)											E		
Grease & Oils						E	E						
% Solids											E		
EP Tox											E		
Trout									E				
Microtox									E				
Daphnia magna									E				
Field Analyses:													
pH	E	E	E	E	E	E	E	E	E	E			
Temperature	E	E	E	E	E	E	E	E	E	E			
Conductivity	E	E	E	E	E	E	E	E	E	E			
Chlorine Residual													
Free						E	E	E	E	E			
Total						E	E	E	E	E			

E - laboratory analyses performed by Ecology's lab
B - laboratory analyses performed by Brewster's lab

RESULTS

Flow

Brewster's influent flowmeter correlated very well with Ecology's portable flowmeter (Table 2). Three simultaneous flow readings varied from -7 to +6 percent of the Ecology meter. Ecology's total flow for the 24 hour period measured six percent less than Brewster's for the same period. Brewster's effluent meter, however, appeared to have lost proper calibration; it measured about twice the flow of the other two meters. This does not present an immediate problem, as Brewster's influent meter is sufficient for the short-term. However, the accuracy of the effluent flowmeter should be resolved so it can serve as a backup.

General Conditions

The Brewster Wastewater Treatment Plant (WTP) was running quite well at the time of the inspection. Effluent suspended solids and biochemical oxygen demand (BOD) were low (Table 3). Also, Brewsters' effluent was surprisingly well nitrified during the early March inspection, as indicated by the loss of ammonia and decreased alkalinity (Table 3).

The staffing level at the plant is marginal at best. One full-time person, along with a trained backup for vacation, sick leave, holidays, etc., was proposed in the plant's operations and maintenance (O&M) manual (Hammond, Collier, and Wade - Livingstone Associates, Inc., 1983). This seems to be a big assignment if the plant is to receive the level of attention to maintenance and process control necessary for effective and efficient long-term operation. Moreover, the O&M manual assumed that 2.5 hours per month were required for sludge disposal. With the current sludge-hauling practice, much more time than this is required of the operator. When this happens, shortcuts in other areas, e.g. preventive maintenance or process control, are inevitable.

In general, the plant equipment and grounds did not appear to be particularly well maintained. This observation could very well be related to short-staffing, as discussed above. Also, the PVC pipe sending return activated sludge to the manhole above the oxidation ditch is an above-ground arrangement that crossed the walkway at some steps. As such, it appeared to be a potential safety hazard and possibly prone to freezing. Therefore, this system should be considered as a temporary solution only. A permanent, preferably underground piping system should be arranged.

NPDES Permit Compliance

Brewster was well within all permitted parameters during the inspection (Table 4). Effluent loadings were well below permitted limits. Percent removals for BOD and total suspended solids (TSS) were 96 and 88 percent, respectively. Fecal coliform limits were not exceeded although chlorine residuals were relatively low (see Table 3). This indicates that chlorination levels were sufficient but not "in excess of that required" to achieve satisfactory disinfection, as stated in Brewster's permit. Also, the WTP's influent loadings were apparently (considering the possible underestimation of influent strength) well below 85 percent of the plants' design criteria (Table 4). This means that Brewster's WTP does not yet need to start planning for future plant needs, as required when 85 percent of plant capacity is reached.

Table 2. Summary of Flow Measurement Calculations: Brewster Class II Inspection, March 6-7, 1990.

	Ecology flowmeter	Brewster flowmeters: influent	% Diff.	effluent	% Diff.
Instantaneous (gpm):					
3/6:					
1000	400	384	+4%	-	-
1614	408	430	-7%	-	-
3/7:					
1100	400	376	+6%	-	-
Totalizer (MGD):					
0955-0955	0.1693	0.1797	-6%	0.3427	-51%

Table 3. General Chemistry Results - Brewster Class II Inspection: March 6-7, 1990.

Sample:	Influent	Influent	Influent	Inf-Eco	Inf-Brew	Effluent	Effluent	Effluent	Eff-Eco	Eff-Eco	Eff-Brew	Sludge
Date:	3/6/90	3/6/90	3/7/90	3/6-7/90	3/6-7/90	3/6/90	3/6/90	3/7/90	3/6-7/90	3/6-7/90	3/6-7/90	3/6/90
Time:	1000	1615	0955	0955-0925	0945-0915	0945	1540	0945	0945-0915	0945-0915	0945-1600	1630
Parameter Type:	grab	grab	grab	composite	composite	grab	grab	grab	composite	duplicate	composite	grab
Turbidity (NTU)	40	42	45	38	41	5.6	4.7	5.6	4.8		4.4	
Conductivity (umhos/cm)	811	774	839	849	814	752	765	748	748		767	
Alkalinity (mg/L $CaCO_3$)	316	288	311	304	311	171	166	166	166		168	
Hardness (mg/L $CaCO_3$)				206					204			
Cyanide, total (mg/L)				0.006					<0.005			0.043
Solids:												
Total (mg/L)				612	620				535		530	
Tot. NV (mg/L)				367	353				363		355	
TSS (mg/L)	159	152	151	115	121	18	14	19	14	12	12	
Tot. NVSS (mg/L)				15	13				4		4	
BOD_5 (mg/L)				173	170				7	7	8	
COD (mg/L)	337	505	335	356	406	54.5	49.6	47.4	50.5		63.6	
TOC (% dry)									23			8.50
NH_3-N (mg/L)	16.2	16.8	19.7	21.5	23.9	0.400	0.175	0.163	0.45		0.070	
NO_3+NO_2-N (mg/L)	0.808	0.745	1.29	0.650	0.385	4.40	4.22	4.18	4.18		19.8	
Total-P (mg/L)	3.90	3.50	7.28	3.93	5.43	4.65	4.50	5.34	4.73		5	
Fecal Coliform (#/100 mL)								130				
Grease & Oils (mg/L)						6.4	6.1					
% Solids												0.9
Field Analyses:												
pH (std. units)	8.57	8.02	8.23	8.13	7.85	8.05	7.49	7.74	7.76	-	7.88	-
Temperature (°C)	13.8	13.8	13.7	3.5	5.5	11.2	12.0	11.7	3.3	-	6.7	-
Conductivity (umhos/cm)	740	690	720	780	775	730	750	730	724	-	716	-
Chlorine Residual (mg/L):												
Free						<0.1	<0.1	<0.1	<0.1	-	<0.1	-
Total						0.1	0.2	0.2	0.1	-	0.1	-

E - laboratory analyses performed by Ecology's lab
B - laboratory analyses performed by Brewster's lab

Table 4. Comparison of Inspection Results to NPDES Permit Limits and Design Criteria, Brewster Class II Inspection: March 6-7, 1990.

Parameter	Monthly Average	Weekly Average	Inspection Results: Effluent	Influent	85% of Criteria	Design Criteria+
BOD5: mg/L	30	45	7	173	-	-
lbs/day*	96	143	10	259	541	637
% removal	85	-	96	-	-	-
TSS: mg/L	30	45	14	115	-	-
lbs/day*	114	171	21	172	646	760
% removal	85	-	88	-	-	-
Fecal Coliform, #/100 mL	200	400	130	-	-	-
pH	6.0-9.0		8.05,7.49, 7.74	-	-	-
Flow, MGD	0.36	-	-	0.1797	0.3090	0.3635

* - Brewster's influent flowmeter reading of 0.1797 is used in loading calculations.

\+ - from Brewster's O & M manual, year 2000 design values.

Effluent Bioassays

No effluent toxicity was observed in the three bioassays (Table 5). No toxicity (no dose-response relationship) was seen in the Microtox test. Survival of rainbow trout was 100 percent in 100 percent effluent. *Daphnia magna* showed no significant mortality or decreased reproduction due to effluent effects. In fact, reproduction in all dilutions was greater than the laboratory control, probably due to nutrient enhancement.

Effluent Chemistry

Three volatile organics analysis (VOAs), ten base neutral acids (BNAs), and seven priority pollutant metals were detected in Brewster's influent (Table 6). All of these except arsenic were reduced throughout the treatment process. In fact, no BNAs were found in the effluent, and the VOAs were at very low concentrations.

The source of these organics is unknown. Acetone and methylene chloride are used in laboratory glassware cleaning procedures, but were not found in the analytical blanks. Both are used as solvents. Chloroform also has uses in fumigants and pesticides (Sax, *et al.*, 1987). The phthalates are generally associated with plastics, and are somewhat ubiquitous. Diethyl phthalate is used in insecticide sprays, such as mosquito repellent. Benzoic acid is a food preservative and anti-fungal agent. Phenol has uses as a solvent. 4-Methylphenol is usually associated with the breakdown of wood products but is also associated with vehicle exhaust emissions (Verschueren, 1983).

Effluent metals are compared to EPA's water quality criteria in Table 7. Silver exceeded the chronic criterion but was detected in the lab blank at a similar concentration. Mercury and copper were slightly greater than the criteria for chronic protection of receiving waters. A dilution factor of 1.5 and 5 would have been required for copper and mercury, respectively, at the edge of the dilution zone. These metals caused little if any adverse effects to the bioassays, as mentioned in the previous section.

Sludge Chemistry

Chemically, Brewster's sludge was fairly 'clean' with one exception. The sum of DDT, DDE, and DDD exceeded EPA's proposed limits for non-agricultural land disposal- 0.16 ppm versus the proposed limit of 0.11 ppm (Table 8). All other parameters were greater than one order of magnitude <u>less</u> than the proposed limits except for copper and mercury. As shown in Table 9, the six metals listed were all less than the geometric means from previous Class II inspections.

Sampling Procedures

Brewster collects a chlorinated effluent sample at an appropriate location. However, the effluent compositor was collecting too much per subsample: the 3.5 gallon container was full by 4:00 p.m. after only about seven hours. The solution was to reprogram the sampler, which was subsequently done.

Table 5. Effluent Bioassay Results - Brewster Class II Inspection: March 6-7, 1990.

96-hour Rainbow trout (*Oncorhyncus mykiss*) - 100% concentration

	# of live test organisms: Initial	Final	Percent Mortality
Effluent	30	30	0
Control	30	30	0

Microtox

No toxicity was observed.

***Daphnia magna* 11-day* survival & reproduction**

NOEC - 100.0%
LOEC - >100.0%
LC_{50} - N/A

% effluent	% adult survival	avg.# young /adult
0 (control)	100	16.2
1.5	90	19.4
3.0	100	20.7
6.25	100	23.0
12.5	100	24.9
25.0	100	29.9
50.0	100	36.7
100.0	100	32.8

* - test was increased from normal 7 days to 11 days due to delayed onset of reproduction.

LC_{50} - concentration lethal to 50% of the organisms.
EC_{50} - concentration causing the tested effect to 50% of the organisms.
NOEC - No Observed Effect Concentration: the highest concentration of effluent that did not cause an observable adverse effect.
LOEC - Lowest Observed Effect Concentration: the lowest concentration of effluent that caused an observable adverse effect.

Table 6. Summary of Priority Pollutants Detected in Influent and Effluent-Brewster Class II Inspection: March 6-7, 1990. All results in $\mu g/L$.

Sample: Lab Log #: Type: Date:	Inf-Eco 108161 composite 03/6-7/90		Eff-Eco 108163 composite 03/6-7/90	
VOA Compounds*				
Methylene Chloride	1	J	1	J
Acetone	110		4	J
Chloroform	18		2	J
Cyanide, Total	6		5	U
BNA Compounds				
Phenol	6	J	10	U
Benzyl Alcohol	7	J	10	U
4-Methylphenol	39		10	U
Benzoic Acid	76		50	U
Naphthalene	2	J	10	U
Diethyl Phthalate	7	J	10	U
Di-n-Butyl Phthalate	1	J	10	U
Butylbenzylpthalate	2	J	10	U
Bis(2-Ethylhexyl)phthalate	34		4	U
Di-n-Octyl Phthalate	2	J	10	U
Priority Pollutant Metals				
Arsenic	4.9	J	5.9	
Cadmium	0.27	J	0.15	J
Copper	50.5		32.0	
Lead	5.4		1.4	J
Mercury	0.449	J	0.058	J
Silver	15	B	3.5	JB
Zinc	169		88.9	

* - VOA results are from grab samples- see Table 1.
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 - This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

Table 7. Effluent Metals Compared to Water Quality Criteria*-Brewster Class II Inspection: March 6-7, 1990.

Metal	Effluent (μg/L)	FW Acute	FW Chronic
Antimony	1.0 U	9000	1600
Beryllium	1.0 U	130	5.3
Cadmium	0.15 J	8.8	2.0
Chromium	4.0 U	3100	370
Copper	32.0	34.7	21.7
Lead	1.4 J	202	7.9
Mercury	.058 J	2.4	0.012
Nickel	20 U	2600	290
Selenium	1.0 U	260	35
Silver	3.5 JB	14	0.12
Thallium	2.0 U	1400	40
Zinc	88.9	214	194

* - effluent hardness of 204 mg/L used for hardness-dependent criteria.

J - indicates an estimated value when result is less than the specified detection limits.

U - indicates compound was analyzed for but not detected at the given detection limits.

Table 8. Sludge Parameters Compared to EPA's Proposed Sludge Limits for Non-Agricultural Land Application - Brewster Class II Inspection: March 6-7, 1990. All units are mg/Kg dry weight (ppm).

Pollutant	Max. Conc.*	Sludge
Aldrin/dieldrin	0.33	0.013
Arsenic	36	3.5
Benzo(a)pyrene	6.9	<11
Cadmium	380	2.0
Chlordane	24	<0.056
Chromium	3100	19
Copper	3300	380
DDT/DDE/DDD(total)	0.11	0.16
Dimethyl nitrosamine	1.4	NA
Heptachlor	1.5	<0.006
Hexachlorobenzene	2.8	<11
Hexachlorobutadiene	6.8	<11
Lead	1600	72
Lindane	92	<0.006
Mercury	30	5.4
Molybdenum	230	NA
Nickel	990	13
PCBs	0.11	<0.006
Selenium	64	0.98
Toxaphene	0.97	<0.11
Trichloroethylene	180	NA
Zinc	8600	730

* - from Journal WPCF, Volume 61, #7, July 1989.
NA - parameter not analyzed.

Table 9. Sludge Metals Compared to Previous Inspection Averages-Brewster Class II Inspection: March 6-7, 1990.

Metal	Brewster sludge (mg/Kg dry wt**)	Data from previous inspections* Range (mg/Kg dry wt)	Geometric mean (mg/Kg dry wt)	Number of samples
Cadmium	2.0	<0.1-25	7.6	34
Chromium	19	15-300	61.8	34
Copper	380	75-7100	398	34
Lead	72	34-600	207	34
Nickel	13	<0.1-62	25.5	29
Zinc	730	165-3370	1200	33

* - summary of data collected for activated sludge plants during previous Class II inspections (Hallinan, 1988).

** - percent solids = 0.9%

Brewster's influent sampling point may underestimate influent concentration. Their influent sampler collects once per hour from the vertical section of the influent pipe below the invert. The upstream lift station pumps only intermittently. Therefore, many subsamples are undoubtedly collected between cycles, during periods of quiescent conditions in the pipe. Brewster may be able to relocate their influent sampler to an upstream location (e.g., manhole or lift station) where flow is continuous. If this proves to be impractical for a permanent installation, temporary and/or intermittent upstream sampling may provide important information on actual plant loadings. More frequent subsampling from the automatic samplers are recommended as well, such as every 30 minutes rather than every 60 minutes.

Laboratory Evaluation

Several specific suggestions were made to improve laboratory techniques for BOD, TSS, pH, and fecal coliform analyses. These items that needed attention were listed in an earlier memo to Lynn (Reif, 1990) and are listed as Appendix 4. Otis Hampton, an Ecology roving treatment plant operator consultant, assisted Lynn with laboratory procedures after the inspection.

For the split samples, Brewster and Ecology compared well on TSS, fecal coliform, and BOD determinations (Table 10). Brewster's BOD value for Ecology's influent sample did not compare well and is considered an outlier. Also, both labs were within EPA's acceptance limits for the TSS and BOD performance evaluation (PE) samples.

CONCLUSIONS

Brewster's wastewater treatment plant was operating well during the inspection. All NPDES permitted requirements were met. Removal of BOD and TSS were 96 and 88 percent, respectively. Influent loadings were less than 85 percent of design capacity. The highest parameter was BOD, at 59 percent of design.

The level of staffing for the plant seemed to be marginal at best. General maintenance could have been a little better and was very likely linked to understaffing. One specific example was an overground section of RAS piping that represented a potential safety hazard.

Brewster's influent flowmeter compared well with Ecology's portable flowmeter. Brewster's effluent meter seemed to have lost calibration.

Very few priority pollutants were detected in Brewster's effluent. No BNAs were found and the few VOAs detected were at very low concentrations. For metals, mercury and copper slightly exceeded EPA's water quality criteria for chronic protection of receiving waters. However, dilution factors of only 5 and 1.5 times would have been needed at the edge of the dilution zone.

No effluent toxicity was detected for the three bioassays. Rainbow trout had 100 percent survival in 100 percent effluent, NOEC and LC_{50} were greater than 100 percent effluent in the *Daphnia magna* test, and Microtox had no detectable toxicity.

Table 10. Comparison of Laboratory Results-Brewster Class II Inspection: March 6-7, 1990.

Sample	Sampler	Laboratory	BOD_5 (mg/L)	TSS (mg/L)	Fecal Coliform (#/100mL)
Composites					
Influent:	Ecology	Ecology	173	115	-
	Ecology	Brewster	120	110	-
	Brewster	Ecology	170	121	-
	Brewster	Brewster	173	126	-
Effluent:	Ecology	Ecology	7	14	130
Eff dupl	Ecology	Ecology	7	12	-
	Ecology	Brewster	8.0	13.2	-
	Brewster	Ecology	8	12	-
	Brewster	Brewster	8.0	14.8	108
EPA PE:		Ecology	63	36	-
		Brewster	79	41.4	-
		true value:	59.7	41.9	-
		acceptance limits:	42-86	33-47	-

Brewster's sludge was relatively low in metals, organics, and pesticides, with one exception. The sum of DDT, DDE, and DDD, at 0.16 ppm, exceeded EPA's proposed limit of 0.11 ppm for non-agricultural disposal of sludge.

Samples split between Brewster's and Ecology's labs compared well. Both labs 'passed' EPA's performance evaluation samples for BOD and TSS.

Brewster's influent sampler placement is not ideal; the influent settles between pump cycles. This probably leads to an underestimation of influent concentrations.

RECOMMENDATIONS

Brewster's effluent flowmeter needs to be recalibrated. Any appropriate measures to keep this meter from losing calibration should be taken.

RAS piping should be located underground if at all possible. This will eliminate a possible health hazard.

The feasibility of relocating the influent composite sampler to an upstream location with constant flow, such as the sewage lift station, should be investigated. Also, both samplers should be set to sample at least every 30 minutes.

Brewster's local health authority should be notified about the possible exceedance of the proposed EPA limits for DDT+DDE+DDD.

REFERENCES

Hammond, Collier & Wade - Livingstone Associates, Inc. 1983. Town of Brewster Sewage Treatment Plant Operation and Maintenance Manual. HCW-L Project No. 2420-205 RVII-B-205. Hammond, Collier & Wade - Livingstone Associates, Inc. Consulting Engineers. Seattle, Wa. July 1983.

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Appendix 1. Analytical Methods- Brewster Class II Inspection: March 6-7, 1990.

Laboratory Analyses	Method used for Ecology analyses	Laboratory performing analysis
Turbidity	APHA, 1989: 2130B	Ecology; Manchester, WA
Conductivity	APHA, 1989: 2510B	Ecology; Manchester, WA
Alkalinity	APHA, 1989: 2320B	Ecology; Manchester, WA
Hardness	APHA, 1989: 2340C	Ecology; Manchester, WA
Total Solids	APHA, 1989: 2540B	Ecology; Manchester, WA
TNVS	APHA, 1989: 2540E	Ecology; Manchester, WA
TSS	APHA, 1989: 2540D	Ecology; Manchester, WA
TNVSS	APHA, 1989: 2540E	Ecology; Manchester, WA
BOD_5	APHA, 1989: 5210B	Ecology; Manchester, WA
COD	APHA, 1989: 5220D	Ecology; Manchester, WA
NH_3-N	EPA, 1983: 350.1	Amtest Inc.; Redmond, WA
NO_3+NO_2-N	EPA, 1983: 353.2	Amtest Inc.; Redmond, WA
T-Phosphate	EPA, 1983: 365.1	Amtest Inc.; Redmond, WA
Fecal Coliform	APHA, 1989: 9221C	Ecology; Manchester, WA
% Solids	APHA, 1989: 2540G	Amtest Inc.; Redmond, WA
TOC	APHA, 1989: 5310C	Amtest Inc.; Redmond, WA
VOA	EPA, 1984: 624	Laucks Testing Labs; Seattle, WA
BNA (water)	EPA, 1984: 625	Laucks Testing Labs; Seattle, WA
BNA (solids)	EPA, 1986: 8270	Laucks Testing Labs; Seattle, WA
Pest/PCB (water)	EPA, 1984: 608	Laucks Testing Labs; Seattle, WA
Pest/PCB (solids)	EPA, 1986: 8080	Laucks Testing Labs; Seattle, WA
PP Metals	Tetra Tech, 1986	Ecology; Manchester, WA
Cyanide	EPA, 1983: 335.2-1	Laucks Testing Labs Seattle, WA
Trout 96-hour	Ecology, 1981	Biomed, Inc. Bellevue, WA
Microtox	Beckman	Parametrix, Inc. Bellevue, WA
Daphnia magna (chronic)	EPA, 1987	E.V.S. Consultants; Seattle, WA

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Appendix 2. Results of VOA, BNA, Pest/PCB and Metal Priority Pollutant Scans.
Brewster Class II Inspection: March 6-7, 1990.

Sample:	Inf-Eco		Eff-Eco		Sludge
Lab Log #:	108161		108163		108165
Type:	composite		composite		grab
Date:	03/6-7/90		03/6-7/90		03/06/90
VOA Compounds*	μg/L				
Chloromethane	10	U	10	U	
Bromomethane	10	U	10	U	
Vinyl Chloride	10	U	10	U	
Chloroethane	10	U	10	U	
Methylene Chloride	1	J	1	J	
Acetone	110		4	J	
Carbon Disulfide	5	U	5	U	
1,1-Dichloroethene	5	U	5	U	
1,1-Dichloroethane	5	U	5	U	
1,2-Dichloroethene (total)	5	U	5	U	
Chloroform	18		2	J	
1,2-Dichloroethane	5	U	5	U	
2-Butanone	10	U	10	U	
1,1,1-Trichloroethane	5	U	5	U	
Carbon Tetrachloride	5	U	5	U	
Vinyl Acetate	10	U	10	U	
Bromodichloromethane	5	U	5	U	
Trichlorofluoromethane	5	U	5	U	
1,2-Dichloropropane	5	U	5	U	
trans-1,3-Dichloropropene	5	U	5	U	
Trichloroethene	5	U	5	U	
Dibromochloromethane	5	U	5	U	
1,1,2-Trichloroethane	5	U	5	U	
Benzene	5	U	5	U	
cis-1,3-Dichloropropene	5	U	5	U	
2-Chloroethylvinylether	5	U	5	U	
Bromoform	5	U	5	U	
4-Methyl-2-Pentanone	10	U	10	U	
2-Hexanone	10	U	10	U	
Tetrachloroethene	5	U	5	U	
1,1,2,2-Tetrachloroethane	5	U	5	U	
Toluene	5	U	5	U	
Chlorobenzene	5	U	5	U	
Ethylbenzene	5	U	5	U	
Styrene	5	U	5	U	
Total Xylenes	5	U	5	U	
Cyanide, Total	6		5	U	43

Sample:	Inf-Eco	Eff-Eco	Sludge
Lab Log #:	108161	108163	108165
Type:	composite	composite	grab
Date:	03/6-7/90	03/6-7/90	03/06/90

BNA Compounds

Phenol	6 J	10 U	100
Bis(2-Chloroethyl)Ether	10 U	10 U	100 U
2-Chlorophenol	10 U	10 U	100 U
1,3-Dichlorobenzene	10 U	10 U	100 U
1,4-Dichlorobenzene	10 U	10 U	100 U
Benzyl Alcohol	7 J	10 U	100 U
1,2-Dichlorobenzene	10 U	10 U	100 U
2-Methylphenol	10 U	10 U	100 U
Bis(2-chloroisopropyl)ether	10 U	10 U	100 U
4-Methylphenol	39	10 U	2100
N-Nitroso-Di-n-Propylamine	10 U	10 U	100 U
Hexachloroethane	10 U	10 U	100 U
Nitrobenzene	10 U	10 U	100 U
Isophorone	10 U	10 U	100 U
2-Nitrophenol	10 U	10 U	100 U
2,4-Dimethylphenol	10 U	10 U	100 U
Benzoic Acid	76	50 U	81 J
Bis(2-Chloroethoxy)Methane	10 U	10 U	100 U
2,4-Dichlorophenol	10 U	10 U	100 U
1,2,4-Trichlorobenzene	10 U	10 U	100 U
Naphthalene	2 J	10 U	100 U
4-Chloroaniline	10 U	10 U	100 U
Hexachlorobutadiene	10 U	10 U	100 U
4-Chloro-3-Methylphenol	10 U	10 U	100 U
2-Methylnaphthalene	10 U	10 U	100 U
Hexachlorocyclopentadiene	10 U	10 U	100 U
2,4,6-Trichlorophenol	10 U	10 U	100 U
2,4,5-Trichlorophenol	50 U	50 U	500 U
2-Chloronaphthalene	10 U	10 U	100 U
2-Nitroaniline	50 U	50 U	500 U
Dimethyl Phthalate	10 U	10 U	100 U
Acenaphthylene	10 U	10 U	100 U
2,6-Dinitrotoluene	10 U	10 U	100 U
3-Nitroaniline	50 U	50 U	500 U
Acenaphthene	10 U	10 U	100 U
2,4-Dinitrophenol	50 U	50 U	500 U
4-Nitrophenol	50 U	50 U	500 U
Dibenzofuran	10 U	10 U	100 U
2,4-Dinitrotoluene	10 U	10 U	100 U

Sample:	Inf-Eco		Eff-Eco		Sludge	
Lab Log #:	108161		108163		108165	
Type:	composite		composite		grab	
Date:	03/6-7/90		03/6-7/90		03/06/90	
Diethyl Phthalate	7	J	10	U	100	U
4-Chlorophenyl-Phenylether	10	U	10	U	100	U
Fluorene	10	U	10	U	100	U
4-Nitroaniline	50	U	50	U	500	U
4,6-Dinitro-2-Methylphenol	50	U	50	U	500	U
N-Nitrosodiphenylamine	10	U	10	U	100	U
4-Bromophenyl-Phenylether	10	U	10	U	100	U
Hexachlorobenzene	10	U	10	U	100	U
Pentachlorophenol	50	U	50	U	500	U
Phenanthrene	10	U	10	U	100	U
Anthracene	10	U	10	U	100	U
Di-n-Butyl Phthalate	1	J	10	U	100	U
Fluoranthene	10	U	10	U	100	U
Pyrene	10	U	10	U	100	U
Butylbenzylpthalate	2	J	10	U	8	J
3,3'-Dichlorobenzidine	20	U	20	U	200	U
Benzo(a)Anthracene	10	U	10	U	100	U
Chrysene	10	U	10	U	100	U
Bis(2-Ethylhexyl)phthalate	34		4	U	500	
Di-n-Octyl Phthalate	2	J	10	U	12	J
Benzo(b)Fluoranthene	10	U	10	U	100	U
Benzo(k)Fluoranthene	10	U	10	U	100	U
Benzo(a)Pyrene	10	U	10	U	100	U
Indeno(1,2,3-cd)Pyrene	10		10	U	100	U
Dibenzo(a,h)Anthracene	10	U	10	U	100	U
Benzo(g,h,i)Perylene	10	U	10	U	100	U
Pest/PCB Compounds						
alpha-BHC	0.05	U	0.05	U	0.05	U
beta-BHC	0.05	U	0.05	U	0.05	U
delta-BHC	0.05	U	0.05	U	0.05	U
gamma-BHC (Lindane)	0.05	U	0.05	U	0.05	U
Heptachlor	0.05	U	0.05	U	0.05	U
Aldrin	0.05	U	0.05	U	0.05	U
Heptachlor Epoxide	0.05	U	0.05	U	0.05	U
Endosulfan I	0.05	U	0.05	U	0.14	
Dieldrin	0.10	U	0.10	U	0.12	
4,4'-DDE	0.10	U	0.10	U	1.4	
Endrin	0.10	U	0.10	U	0.094	J
Endosulfan II	0.10	U	0.10	U	0.50	

Sample:	Inf-Eco		Eff-Eco		Sludge	
Lab Log #:	108161		108163		108165	
Type:	composite		composite		grab	
Date:	03/6-7/90		03/6-7/90		03/06/90	
4,4'-DDD	0.10	U	0.10	U	0.10	U
Endosulfan Sulfate	0.10	U	0.10	U	0.10	U
4,4'-DDT	0.10	U	0.10	U	0.10	U
Methoxychlor	0.50	U	0.50	U	0.50	U
Endrin Ketone	0.10	U	0.10	U	0.10	U
alpha-Chlordane	0.50	U	0.50	U	0.50	U
gamma-Chlordane	0.50	U	0.50	U	0.50	U
Toxaphene	1.0	U	1.0	U	1.0	U
Aroclor-1016	0.50	U	0.50	U	0.50	U
Aroclor-1221	0.50	U	0.50	U	0.50	U
Aroclor-1232	0.50	U	0.50	U	0.50	U
Aroclor-1242	0.50	U	0.50	U	0.50	U
Aroclor-1248	0.50	U	0.50	U	0.50	U
Aroclor-1254	1.0	U	1.0	U	1.0	U
Aroclor-1260	1.0	U	1.0	U	1.0	U
Priority Pollutant Metals						
Antimony	1.0	U	1.0	U	9.2	
Arsenic	4.9	J	5.9		31.1	
Beryllium	1.0	U	1.0	U	1.0	U
Cadmium	0.27	J	0.15	J	18	J
Chromium	4.0	U	4.0	U	169	
Copper	50.5		32.0		3400	
Lead	5.4		1.4	J	649	
Mercury	0.449		0.058	J	48.2	
Nickel	20	U	20	U	117	
Selenium	1.0	U	1.0	U	8.8	J
Silver	15	B	3.5	JB	41.4	
Thallium	2.0	U	2.0	U	1.0	U
Zinc	169		88.9		6530	

* - VOA results are from grab samples- see Table 1.
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 - This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

Appendix 3. Tentatively Identified BNA Compounds - Brewster Class II Inspection: March 6-7, 1990. All results in $\mu g/L$.

Sample:	Inf-Eco	Eff-Eco	Sludge
Lab Log #:	108161	108163	108165
Type:	composite	composite	grab
Date:	03/6-7/90	03/6-7/90	03/06/90
Dodecanamide, N,N-bis(2-hydroxyethyl)	39 J		
Cyclododecane	26 J		
Tetradecanoic acid	35 J		
Cyclohexadecane	30 J		
5-Eicosene, (E)-	46 J		
Hexadecanoic acid	120 J		2500 J
9-Octadecanoic acid (Z)-	90 J		470 J
Octadecanoic acid	140 J		
Pentatriacontane	46 J		5600 J
Octacosane	560 J		530 J
1H-Benzimidazole, 2-(4-thiazolyl)		12 J	
Eicosane, 7-hexyl-		11 J	
Butanoic acid			110 J
Pentanoic acid, 2-methyl-			170 J
Pentanoic acid			170 J
Hexanoic acid			100 J
Propanedioic acid, phenyl-			220 J
Benzene, 1-isocyano-2-methyl-			270 J
Benzenepropanoic acid			250 J
Pentacosane			250 J
Pentadecanoic acid			220 J
9-Hexadecanoic acid			2600 J
Octadecanoic acid			2700 J
Dodecane, 1-cyclopentyl-4-(3-cyclopentylpropyl)-			410 J
Cholesterol			670 J

J - indicates an estimated value.

Appendix 4.

CHRISTINE O. GREGOIRE
Director

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

7171 Cleanwater Lane, Building 8, LH-14 • Olympia, Washington

March 22, 1990

Lynn Lawson, Brewster Plant Operator
Post Office Box 385
Brewster, WA 98812

SUBJECT: Lab Review Follow-up

Dear Mr. Lawson:

As promised, I would like to go over a few notes about lab procedures from our talk last week. Starting with pH meter calibration, buffers of pH 7 and 10 seem to best bracket your samples usual pH range. For your TSS samples, filters need to be pre-washed, dried, and stored in the desiccator before use. Remember to check whether the desiccant is any good also.

For the BOD test, there were two main suggestions. First, switch to settled raw influent for your seed source instead of final effluent. Second, run the seed BOD procedure with two dilutions initially (you might be able to switch to one as you gain confidence in its typical strength), making sure to get at least 2.0 mg/L D.O. drop in each dilution. Then use the formula on the bottom of your worksheet to calculate the seed correction factor. If you want, only one bottle is necessary per dilution, for both the seed BOD and sample BODs. Pour off excess water after capping the BOD bottles, and use distilled water for the seals.

I hope you will be able to meet with Otis at Okanogan on Wednesday the 28th. When you are ready, run the EPA samples, using your influent seed. Send me the results of the PE samples and the influent and effluent splits when you get them all done. Call me at (206) 753-2006 if you have any questions.

Sincerely,

Don Reif

Don Reif
Compliance Monitoring Section

DR:krc

cc: Norm Glenn
Polly Zehm, CRO
Otis Hampton