Segment No. 01-01-02

Publication No. 79-e28

WA-01-0040

STATE OF WASHINGTON

Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY

7272 Cleanwater Lane, Olympia, Washington 98504

MEMORANDUM
October 15, 1979

To: Bruce Johnson/Roger Stanley

From: Bill Yake

Subject: Georgia Pacific, Bellingham, Class II Inspection

Introduction

A Class II inspection was conducted at the Georgia Pacific pulp and chlor/alkali facilities in Bellingham on August 28 and 29, 1979. The Department of Ecology (DOE) was represented by Bruce Johnson and Roger Stanley (Industrial Section), as well as Mike Morhous, Anne Haines, and Bill Yake (Water and Wastewater Monitoring Section). Warren Maurey and Bob LeCroix represented Georgia Pacific. Dan Tangerone of the U.S. Environmental Protection Agency (EPA) was also present.

Georgia Pacific has recently completed secondary treatment facilities for their pulp mill wastes. Operation began May 1, 1979 with reported compliance achieved on June 15, 1979. Discharge to Whatcom Waterway has been discontinued and pulp mill wastes (including waste streams which receive primary clarification) are pumped across Whatcom Waterway to an aerated stabilization lagoon. Additional wastewaters (low in organics) including cooling waters and chlor/alkali plant wastewaters are pumped to the discharge end of the lagoon. All wastewaters are discharged by way of a diffuser to Bellingham Bay (see Figure 1). Prior to aeration basin construction, wastewaters were discharged into Whatcom Waterway (waterway segment 01-01-03). Treated wastewaters are now discharged to waterway segment 01-01-02. Both segments are Class B waters and are identified in the five-year strategy as segments that do not presently meet water quality goals, but are anticipated to meet these goals between 1983 and 1988. Georgia Pacific and urban runoff are listed as possible causes of water quality violations. Parameters not meeting these goals are fecal coliform, pH, and dissolved oxygen. Although conditions have visibly improved in Whatcom waterway, it is too early to tell if improvements in water quality at ambient stations (see Figure 1) and intensive survey stations in the bay will be sufficient to meet the goals. During the summer of 1979, violations of pH and dissolved oxygen goals have been noted at BLL006. Recent values are similar to historical values.

One and possibly more leaks in the lagoon retaining walls have been noted. The most serious of these involves leakage around the discharge line. Therefore, not all of the effluent is being discharged by way of

the diffuser. During the second day of the inspection, Whatcom Waterway became noticeably discolored (reddish-brown). The source of this discoloration could not be isolated during the inspection.

Composite samples were obtained at five points in the system (see 24-hour composite sample locations). These samples were split with Georgia Pacific personnel for analysis. Two Georgia Pacific composite samples (lagoon influent and effluent) were also split between DOE and Georgia Pacific personnel for analysis by both labs. In addition, field parameters and grab samples were taken at composite sampler sites as well as a number of additional sites (see Class II Field Review and Sample Collection). Special emphasis was placed on mercury sampling at the chlor/alkali plant and calibration checks of pH meters at the chlor/alkali plant and final effluent. Roger Stanley reviewed laboratory procedures with the Georgia Pacific staff. Laboratory review is therefore not included in this memorandum.

Findings and Conclusions

DOE laboratory results are summarized in Table 1; Georgia Pacific laboratory results are noted in Table 2. All analytic results from both sets of composite samples indicate compliance with BOD_5, TSS, and pH permit limitations. Intralaboratory results from DOE and Georgia Pacific composite samples were similar; however, interlaboratory results for TSS and BOD revealed some discrepancies. The Georgia Pacific laboratory reported BOD_5 results which were 16 - 48% above those reported by the DOE laboratory. Similarly, Georgia Pacific TSS results were 27 - 71% above DOE laboratory results. Independent discussions with Steve Robb and Roger Stanley regarding procedures in the two laboratories revealed no apparent reasons for these consistent discrepancies.

Tables 3 and 4 summarize the results of mercury and metals analyses. Where appropriate, some of these data are also tabulated on Tables 1 and 2. Table 3 provides mercury loading data at several points in the Georgia Pacific waste stream. NPDES permit limitations are based on mercury discharges from the chlor/alkali plant (chlor/alkali sewer plus chlor/alkali cooling water). Based on DOE analysis of 2 sets of grab samples, the total loading from these lines was .060 to .068 lbs Hg/day, compared to a daily average limitation of 0.07 lbs Hg/day. A composite sample of the full "cleanwater effluent" yielded a comparable loading of .054 lbs/day. A grab sample of the total plant effluent at the lagoon discharge, however, resulted in a calculated loading of 0.82 lbs Hg/day, or approximately 10 times the NPDES permit limitation. The source of this additional mercury is unknown. However, Bruce Johnson indicated that historically there has been some mercury contamination of the NaOH produced at the chlor/alkali plant. This NaOH is then used at the pulp mill and may be, at least partially, responsible for the additional mercury in the lagoon effluent.

Table 3 summarizes all mercury and metals analyses. Grab samples of the influent to and effluent from the Adam's filters provide an indication of the treatment efficiency of mercury contaminated wastewaters. Backwash from the Adam's filters is intermittently discharged to a holding pond (see Figure 1). The pond also receives other mercury contaminated wastewaters. Water is pumped from the pond and cycled through the sulfate/Adam's filter treatment system with only backwash returned to the pond. Flecks and globules of mercury were apparent on the pond banks and bottom.

A bank-side grab sample was obtained from Whatcom Waterway northeast of the mercury pond (see Figure 1). The pond is separated from the waterway by 30 to 50 feet of earth at this point. The detected concentration of mercury in this sample was 0.68 μg/l. This compares to the EPA water quality criteria of 0.10 μg/l for the protection of marine aquatic life.

Approximately 75 to 100 feet northeast of this sampling point an unidentified discharge was noted during low tide. The pipe was partially submerged and was discharging a red-brown effluent to the waterway. A grab sample was obtained near the pipe. This sample represents the effluent/waterway mixture near the pipe and contained 71 μg Hg/l. This discharge is not referenced in the NPDES permit and Georgia Pacific personnel could not identify its source.

In addition to these mercury results, the moderately high lead concentrations in the Whatcom Waterway and unidentified discharge samples (300 and 200 μg/l, respectively) may be cause for concern.

Table 5 represents the results of accuracy checks on Georgia Pacific effluent monitoring equipment at the chlor/alkali plant.

Table 5. Accuracy Checks: Chlor/Alkali Plant Metering

	pH			Chlor. Res.			Hg (mg/l)			
Location	Monitor Line - DOE Field	Pump Sump - DOE Field	G.P. Monitor/Recorder	Monitor Line - DOE Field	Pump Sump - DOE Field	G.P. Monitor/Recorder	Monitor Line - DOE Lab.	Pump Sump - DOE Lab.	G.P. Monitor/Recorder	G.P. Lab Analysis
Chlor/Alkali 8" Sewer	7.3	7.6	7.3	<.1	<.1	<.1	7.1	7.3	<2	0.9
	7.1	7.7	6.6	<.1	<.1	<.1	5.4	5.8	<2	---
Chlor/Alkali 30" Cooling Water	7.0	---	7.1	<.1	--	<.1	.68	---	<2	N.D.
	7.0	---	7.1	<.1	--	<.1	.68	---	<2	---

pH checks were adequate. Samples could not be obtained directly from the reservoir where the pH probes are located. Because these reservoirs have about a 15-minute nominal retention time, precise correlation is not expected. Because no chlorine residual was detected during the inspection, it is not possible to define the accuracy of this monitoring system. Substantial discrepancies were noted in the mercury monitoring system. These discrepancies carried over into the comparison of lab results for the 8-inch chlor/alkali sewer samples. DOE results were 6 to 8 times those obtained by Georgia Pacific. Because DOE results indicate Georgia Pacific is discharging mercury at levels near or above their permit limitations, it is important that these discrepancies be resolved. The extraction and analytical procedures for mercury determination are rather complex. For this reason, it is suggested that staff people from DOE and Georgia Pacific laboratories meet and resolve analytical discrepancies which may be responsible for the divergent results.

Table 6 represents the results of a check on the continuous effluent pH monitor. Effluent is pumped through a sample line approximately 1/4 mile to the compressor house. Here, pH is sensed and a gage read-out provided. This signal is then conveyed to the boiler house (another 1/4 to 1/2 mile away) where it is recorded on a script chart.

Table 6. Accuracy Check - Lagoon Effluent pH

Location	Time	pH
Lagoon Effluent at Outfall	0905	6.3
Lagoon Effluent from Compressor House Sample Line	0920	6.3
Compressor House pH Gage	0920	6.8
Boiler House pH Script Chart	0920	6.15

This arrangement makes the system difficult to calibrate and, as can be noted, agreement in values at various steps in the system was not good. Although centralization of effluent data (flows, pH's, etc.) in the boiler house is a necessity, a short-lead pH monitor and recorder might be installed at the outfall. Frequent and accurate calibration of this monitor would provide an accurate record of effluent pH for NPDES reporting requirements. This assumes added importance in light of the historical record of pH violations in the receiving water.

Flows are monitored at Georgia Pacific by means of vortex shedding devices at various points in the system. These are in-line devices and were, therefore, not checked for calibration. Georgia Pacific personnel noted that the system had not been yielding accurate flows and that the effluent meter was recording greater flow than influent water use would dictate. A complete system flow calibration program should be undertaken and repeated at intervals sufficient to assure accurate reporting of waste stream flows.

Fecal coliform samples were taken from both lagoon influent (historical effluent) and lagoon effluent. Influent samples contained few coliforms (<1 to 10/100 mls). If this sample is representative of prior to secondary treatment, it may indicate that Georgia Pacific historically was not directly responsible for fecal coliform violations in Bellingham Bay. The lagoon effluent samples were overgrown with spreader colonies, making fecal coliform enumeration impossible. Fecal coliform populations at other secondary pulp wastewater facilities throughout the state have been substantial. Because Bellingham Bay experiences fecal coliform counts in excess of water quality goals, it would seem advisable to re-sample the effluent for fecal coliforms, perhaps during the upcoming post-treatment intensive survey. If spreader colonies recur, they should be identified. Fecal coliform colonies should also be analyzed to determine what percentage of the fecals are Klebsiella. Receiving water samples should be likewise analyzed to clarify the relationship between the current Georgia Pacific discharge and fecal coliform concentrations in Bellingham Bay.

Summary

The following are the major findings of this inspection. Where appropriate, possible remedial measures are noted.

1. At the time of the inspection, Georgia Pacific treatment facilities were in compliance with permit limitations for BOD, suspended solids, and pH.

2. Mercury discharge was in marginal compliance with daily average limitations as presently defined by the NPDES permit. However, total effluent mercury loading was apparently in excess of the limitations specified for the chlor/alkali plant. Further, sampling should define the extent and sources of this additional mercury.

3. Substantial discrepancies in analytical results for mercury were noted. Communication between labs, possibly including additional sample splits and mutual observation of each lab's techniques may resolve these discrepancies. This should facilitate proper calibration of the continuous mercury monitors at the chlor/alkali plant.

4. An unidentified and unpermitted discharge was observed near the mercury pond. Mercury content in this discharge was substantial (>71 μg Hg/l), although total flow at the time of observation was not high. This discharge should be properly accounted for and treated, rerouted, or sealed, as appropriate.

5. Mercury concentration in a single grab sample from Whatcom Waterway was approximately 7 times the EPA criteria level required for the protection of marine life. The post-treatment intensive survey of the receiving water should include mercury analysis to define the extent of this apparent problem and suggest possible sources (contaminated sediments, mercury pond leachate, the unpermitted discharge, lagoon leakage, etc.).

6. During the post-treatment intensive survey, the fecal coliform (and percent Klebsiella) content of the discharge and receiving waters should be determined to define the impact of Georgia Pacific discharge on fecal coliform counts in Bellingham Bay.

7. The accuracy of final effluent pH monitoring is questionable. The installation of a short-lead continuous pH monitor with script chart at the effluent discharge may provide more reliable data. Frequent (at least weekly) calibration of pH monitors is necessary to obtain useful data.

8. Calibration of vortex-shedding flow measuring devices in the wastewater conveyance and treatment system is necessary. Re-calibration on a regular schedule would provide some assurance of the accuracy of reported flows.

BY:cp

Attachments

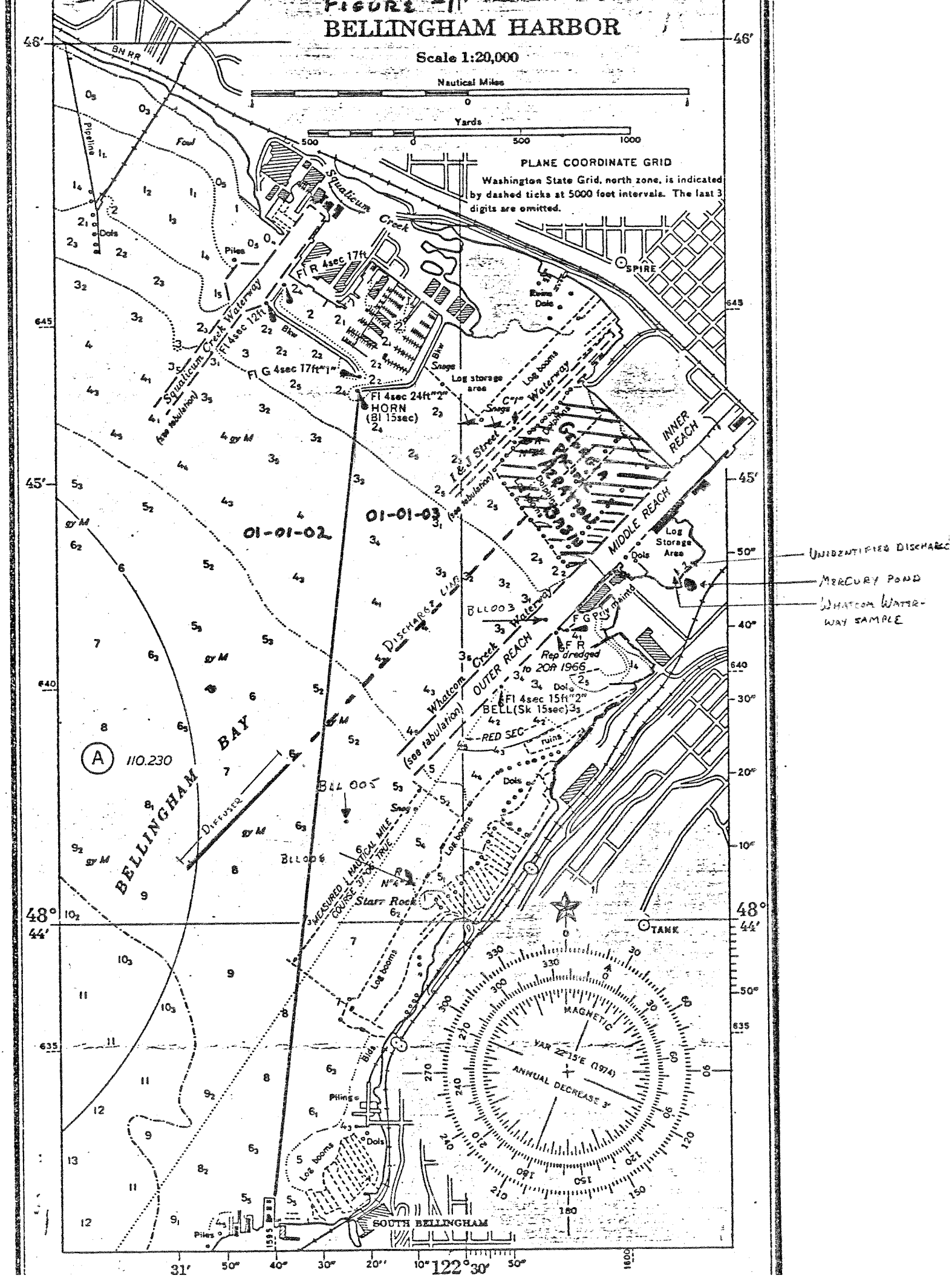
FIGURE -1
BELLINGHAM HARBOR
Scale 1:20,000
Nautical Miles
Yards
PLANE COORDINATE GRID
Washington State Grid, north zone, is indicated by dashed ticks at 5000 foot intervals. The last 3 digits are omitted.
Squalicum Creek
Squalicum Creek Waterway
Fl R 4sec 17ft
Fl 4sec 12ft
Fl G 4sec 17ft"1"
Fl 4sec 24ft"2"
HORN
(Bl 15sec)
Log storage area
Log booms
I & J Street Waterway
GEORGIA PACIFIC AERATION BASIN
INNER REACH
MIDDLE REACH
Log Storage Area
SPIRE
TANK
01-01-02
01-01-03
BELLINGHAM BAY
110.230
DISCHARGE LINE
BLL003
BLL005
BLL006
Whatcom Creek Waterway
OUTER REACH
Rep dredged to 20ft 1966
Fl 4sec 15ft"2"
BELL(Sk 15sec)
RED SEC
Starr Rock
MEASURED 1 NAUTICAL MILE COURSE 37°06' TRUE
DIFFUSER
MAGNETIC
VAR 22°15'E (1974)
ANNUAL DECREASE 3'
SOUTH BELLINGHAM
UNIDENTIFIED DISCHARGE
MERCURY POND
WHATCOM WATERWAY SAMPLE
46'
45'
48° 44'
31'
122° 30'

Class II Field Review and Sample Collection

24-Hour Composite Sampler Installations

Sampler	Date and Time Installed	Location
1. Primary Clarifier Influent Sample Aliquot: 250 ml/30 min.	9/28/79 - 0928	Inside central diffuser ring of clarifier
2. Primary Clarifier Effluent Sample Aliquot: 250 ml/30 min.	9/28/79 - 0935	Through grates at clarifier outfall
3. Cleanwater Effluent Sample Aliquot: 250 ml/30 min.	9/28/79 - 1005	Through grates to cleanwater pump sump
4. Lagoon Influent Sample Aliquot: 250 ml/30 min.	9/28/79 - 1005	Behind bar screen in influent pump sump
5. Lagoon Effluent Sample Aliquot: 250 ml/30 min.	9/28/79 - 0855	Through grates directly before outlet

Grab Samples

Sampler Location	Date and Time	Parameter(s)
Chlor/Alkali 30" cooling water (monitor line)	9/28/79 - 1125,1430	Hg, metals
Chlor/Alkali 8" sewer (pump sump)	9/28/79 - 1124,1430	Hg, metals
Chlor/Alkali 8" sewer (monitor line)	9/28/79 - 1125,1430	Hg, metals
Lagoon Effluent	9/28/79 - 1620	Hg
Lagoon Effluent	9/29/79 - 0905,1055	Fecal coliform
Lagoon Influent	9/29/79 - 1005,1040	Fecal coliform
Adams Filter (in)	9/28/79 - 1445	Hg
Adams Filter (out)	9/28/79 - 1500	Hg
Whatcom Waterway near Mercury Pond	9/28/79 - 1510	Hg, metals
Unidentified discharge pipe near Mercury Pond	9/28/79 - 1515	Hg, metals

Field Data

Sample Location		Date and Time	Parameter(s)
Primary Clarifier Influent	- grab	9/28/79 - 0928	pH, Temp.
	- grab	9/28/79 - 1555	pH
	- grab	9/29/79 - 0935	pH, Temp.
	- composite	9/29/79 - 0935	pH
Baghouse Fly Ash Water	- grab	9/28/79 - 1555	pH
Primary Clarifier Effluent	- grab	9/28/79 - 0935	pH, Temp.
	- grab	9/28/79 - 1555	pH
	- grab	9/29/79 - 0945	pH, Temp.
	- composite	9/29/79 - 0945	pH
Cleanwater Effluent	- grab	9/28/79 - 1005	pH, Temp., Chl. Res.
	- composite	9/29/79 - 1000	pH
Lagoon Influent	- grab	9/28/79 - 1005	pH, Temp.
	- composite	9/29/79 - 1000	pH
Lagoon Effluent	- grab	9/28/79 - 0855	pH, Temp.
	- grab	9/28/79 - 1620	pH
	- grab	9/29/79 - 0905	pH, Temp.
	- composite	9/29/79 - 0905	pH
Lagoon Effluent from Compressor House Line		9/29/79 - 0920	pH
Chlor/Alkali Sewer (Monitor)		9/28/79 - 1130,1430	pH, Chl. Res.
Chlor/Alkali Sewer (Sump)		9/28/79 - 1130,1430	pH, Chl. Res.
Chlor/Alkali Cooling Water (Monitor)		9/28/79 - 1140,1455	pH, Chl. Res.

Table 1 - DOE Laboratory Results

Parameter	DOE Composite Samples					Georgia Pacific Samplers		Daily Average Limitations
	Clarifier Influent	Clarifier Effluent	Cleanwater Effluent	Lagoon Influent	Lagoon Effluent	Lagoon Influent	Lagoon Effluent	
BOD_5 (mg/l)	320	180	<4	360	24	280	31	
(lbs/day)	48,400	27,800	<430	116,000	10,300	89,900	13,300	22,500
TSS (mg/l)	1000	?	1	52	36	52	35	
(lbs/day)	161,000	--	108	16,700	15,500	16,700	15,000	35,300
Flow (MGD)	(18.5)	(18.5)	(13.0)	(38.5)	(51.5)	(38.5)	(51.5)	
Color	317	400	17	1318	1972			
COD (mg/l)	1600	770	36	?	73	?	?	
PBI (mg/l)	3300	3100	?	?	3400			
Lignins† (mg/l)	59	74	0.29	92	68			
Total Solids (mg/l)	2000	1100	700	1950	1700	1900	1700	
TNVS (mg/l)	550	590	520	950	1000	930	1000	
TSS (mg/l)	1000	?	1	52	36	52	35	
TNVSS (mg/l)	76	<1	<1	<1	<1	<1	<1	
NH_3-N (mg/l)	0.30	0.20	0.03	11.0	1.4			
NO_2-N (mg/l)	<0.1	<0.1	0.02	0.10	<0.1			
NO_3-N (mg/l)	<0.1	<0.1	0.03	<0.1	0.1			
O-PO_4-P (mg/l)	0.5	0.3	<0.01	0.7	0.5			
T-PO_4-P (mg/l)	1.1	4.4	0.03	1.2	1.4			
pH (S.U.)	6.5	5.9	7.1	5.4	6.5	5.5	6.5	5.0 - 9.0
	7.65*	6.35*	7.1*	5.2*	6.2*			
	6.4*	5.9*						
	6.2*	5.9*			6.3*			
	6.3**	6.0**	7.1**	5.6**	6.4**			
Specific Conductivity (μmhos/cm)	683	813	1310	1430	1550	1490	1510	
Temp (°C)	29.0*	28.4*	29.2*	31.4*	28.0*			
	28.8*	26.0*			27.2*			
Total - Hg (μg/l)	--	--	0.50	--	1.9*			
Fecal Coliform (#/100 ml)				<1[1]	SPR[3]			
				10[2]	SPR[4]			

[1]Grab Sample - 9/29/79 (1005 hrs.)
[2]Grab Sample - 9/29/79 (1040 hrs.)
[3]Grab Sample - 9/29/79 (0905 hrs.) spreader
[4]Grab Sample - 9/29/79 (1055 hrs.) spreader

*Grab Sample
**Composite Sample - Field Analysis
†Lignins as Tannin
?Apparent Laboratory Error

Table 2A. Georgia Pacific Laboratory Results

Parameter	DOE Composite Samples					Georgia Pacific Samplers		
	Clarifier Influent	Clarifier Effluent	Cleanwater Effluent	Lagoon Influent	Lagoon Effluent	Lagoon Influent	Lagoon Effluent	Daily
BOD_5 (mg/l)	----	----	1	416	34	390	46	
Lbs/day	----	----	108	134,000	14,600	125,000	19,800	22,500
TSS (mg/l)	----	33	----	66	59	82	60	
Lbs/day	----	5090	----	21,200	25,300	26,300	25,800	35,300
Flow (MGD)	18.5	18.5	13.0	38.5	51.5	38.5	51.5	
pH (S.U.)	----	----	6.8	5.0	6.4			5.0-9.0
PBI (mg/l)	----	----	8	7810	4510			
Settlable Solids (ml/l)	----	1.9	----	----	----			

Table 2B. Chlor/Alkali Plant

	Hg (μg/l)
Cooling Water (Monitor) (30" Line)	0.9
Sewer (Monitor) (8" Line)	Undetectable

Table 3. Mercury Loading

Location	Flow (MGD)	Hg (mg/l)	Hg (lbs/day)	Permit Limitations	
				Daily Avg.	Daily Max.
Chlor/Alkali 8" Sewer (Monitor)	0.55	7.1[1] 5.4[2]	.033[1] .025[2]		
Chlor/Alkali 8" Sewer (Sump)	0.55	7.3[1] 5.8[2]	0.34[1] .027[2]		
Chlor/Alkali 30" Sewer (Monitor)	6.0	0.68[1] 0.68[2]	.034[1] .034[2]		
Chlor/Alkali Total Effluent	6.55		.068[1] .060[2]	0.07	0.15
Cleanwater Effluent*	13.0	0.50	.054		
Lagoon Effluent	51.5	1.9	.82[3]		

[1]Based on Grab Sample - 9/28/79 - 1130

[2]Based on Grab Sample - 9/28/79 - 1430

[3]Based on Grab Sample - 9/28/79 - 1620

*Composite Sample