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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 <u>Klebsiella</u>) 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. Recalibration on a regular schedule would provide some assurance of the accuracy of reported flows.

BY:cp

Attachments

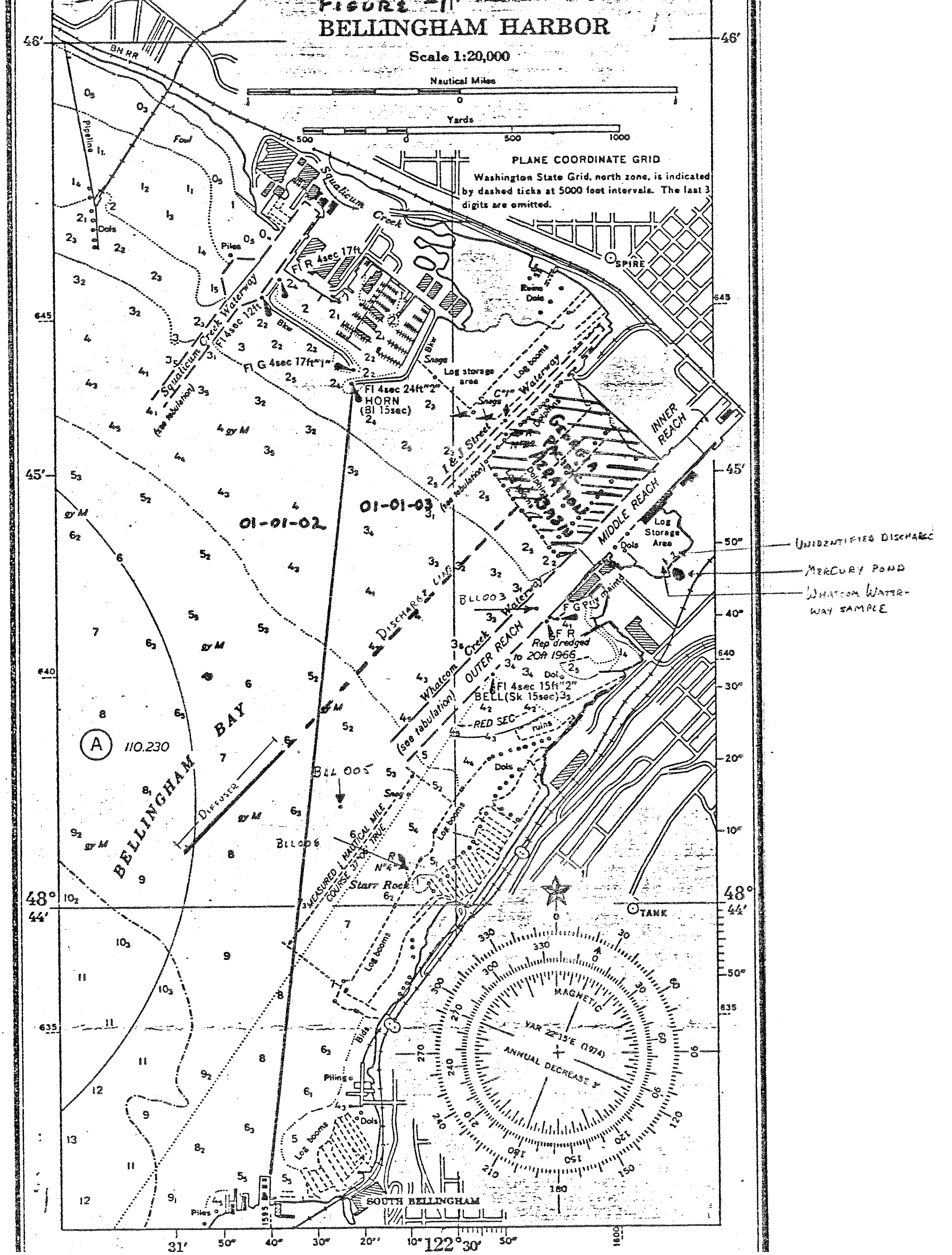
FIGURE 11
BELLINGHAM HARBOR
Scale 1:20,000
Nautical Miles
Yards
PLANE COORDINATE GRID
Washington State Grid, north zone, is indicated by dashed ticks at 5000 foot intervals. The last 3 digits are omitted.
Squalicum Creek
Squalicum Creek Waterway
(see tabulation)
Fl R 4sec 17ft
Fl 4sec 12ft
Fl G 4sec 17ft "1"
Fl 4sec 24ft "2"
HORN
(Bl 15sec)
Log storage area
C "I" Waterway
I & J Street
GEORGIA PACIFIC AERATION BASIN
INNER REACH
MIDDLE REACH
Log Storage Area
UNIDENTIFIED DISCHARGE
MERCURY POND
WHATCOM WATERWAY SAMPLE
01-01-02
01-01-03
DISCHARGE LINE
BLL003
BLL005
BLL006
Whatcom Creek Waterway
OUTER REACH
Rep dredged to 20ft 1966
Fl 4sec 15ft "2"
BELL (Sk 15sec)
RED SEC
ruins
DIFFUSER
A 110.230
BELLINGHAM BAY
MEASURED 1 NAUTICAL MILE COURSE 37° 05' TRUE
Starr Rock
Log booms
SPIRE
TANK
MAGNETIC
VAR 22°15'E (1974)
ANNUAL DECREASE 3'
SOUTH BELLINGHAM
BN RR
Pipeline
Foul
Piles
Dols
Snags
Bkw
Pilings
46'
45'
48° 44'
122° 30'
31'

Class II Field Review and Sample Collection

## 24-Hour Composite Sampler Installations

| Sampler | Date and Time Installed | Location |
|---|---|---|
| 1. Primary Clarifier Influent<br>Sample Aliquot: 250 ml/30 min. | 9/28/79 - 0928 | Inside central diffuser ring of clarifier |
| 2. Primary Clarifier Effluent<br>Sample Aliquot: 250 ml/30 min. | 9/28/79 - 0935 | Through grates at clarifier outfall |
| 3. Cleanwater Effluent<br>Sample Aliquot: 250 ml/30 min. | 9/28/79 - 1005 | Through grates to cleanwater pump sump |
| 4. Lagoon Influent<br>Sample Aliquot: 250 ml/30 min. | 9/28/79 - 1005 | Behind bar screen in influent pump sump |
| 5. Lagoon Effluent<br>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)<br>(lbs/day) | 320<br>48,400 | 180<br>27,800 | <4<br><430 | 360<br>116,000 | 24<br>10,300 | 280<br>89,900 | 31<br>13,300 | <br>22,500* |
| TSS (mg/l)<br>(lbs/day) | 1000<br>161,000 | ?<br>-- | 1<br>108 | 52<br>16,700 | 36<br>15,500 | 52<br>16,700 | 35<br>15,000 | <br>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<br>7.65*<br>6.4*<br>6.2*<br>6.3** | 5.9<br>6.35*<br>5.9*<br>5.9*<br>6.0** | 7.1<br>7.1*<br><br><br>7.1** | 5.4<br>5.2*<br><br><br>5.6** | 6.5<br>6.2*<br><br>6.3*<br>6.4** | 5.5 | 6.5 | 5.0 - 9.0 |
| Specific Conductivity (μmhos/cm) | 683 | 813 | 1310 | 1430 | 1550 | 1490 | 1510 | |
| Temp (°C) | 29.0*<br>28.8* | 28.4*<br>26.0* | 29.2* | 31.4* | 28.0*<br>27.2* | | | |
| Total - Hg (μg/l) | -- | -- | 0.50 | -- | 1.9* | | | |
| Fecal Coliform (#/100 ml) | | | | <1[1]<br>10[2] | SPR[3]<br>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<br>8" Sewer (Monitor) | 0.55 | 7.1[1]<br>5.4[2] | .033[1]<br>.025[2] | | |
| Chlor/Alkali<br>8" Sewer (Sump) | 0.55 | 7.3[1]<br>5.8[2] | 0.34[1]<br>.027[2] | | |
| Chlor/Alkali<br>30" Sewer (Monitor) | 6.0 | 0.68[1]<br>0.68[2] | .034[1]<br>.034[2] | | |
| Chlor/Alkali<br>Total Effluent | 6.55 | | .068[1]<br>.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