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Mill Characterization:

Tahsis Company Ltd.
Gold River Pulp Division
February 1974

Manuscript Report 74-10
Pacific Region

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MILL CHARACTERIZATION:

TAHSIS COMPANY LIMITED

GOLD RIVER PULP DIVISION

February, 1974

by

William E. McLean

and

Gerald C. Tanner

Environment Canada
Environmental Protection Service
Pollution Abatement Branch
Pacific Region

Manuscript Report - 74-10
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ABSTRACT

This report was prepared from technical data provided by Tahsis Company Limited, Gold River Pulp Division. The report provides supplemental information for establishing a water pollution abatement program to meet the requirements of the Federal Pulp and Paper Effluent Regulations. The report will be used as a guide when determining the progress and changes made by the mill to achieve the requirements of the Federal Pulp and Paper Effluent Regulations.

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1. INTRODUCTION

The following assessment of Tahsis Company Ltd.'s Gold River Mill was carried out in February 1974. This project was initiated with a number of purposes in mind. Firstly, an attempt was made to become familiar with individual mill processes in order to gain insight into sources of particular effluent streams. Also, an up to date inventory of sampling methods, testing techniques and abatement facilities was compiled. During this period a good working relationship was established with the mill personnel involved in water pollution abatement programs.

2. MILL DESCRIPTION

2.1 Location

Gold River Pulp Mill is located near the estuary of the Gold River on Vancouver Island. Effluent is discharged to Muchalat Inlet.

2.2 Organizational Structure

Mill Manager; J.P. Cloutier

Technical Super.; J. Shivis

Within the technical group an environmental engineer, E. Lawson, one water technician and two air technicians are devoted full time to pollution monitoring and abatement programs. A union pollution committee has been established and was functional as of February 1974.

2.3 Operation Information

2.3.1 Production. The average production of kraft pulp over 1973 was 754 ADT/D. Various grades were produced:

Grade	G.E. Brightness
High Brightness	>90
Low Brightness	85-89
Semi Bleached	65

2.3.2 Water Supply. Process water is drawn from the Gold River. All raw water passes through travelling screens to a settling basin before being used in mill processes. After settling, a portion of the water passes through down flow filters. Filter backwash effluent flows to the flyash settling pond. Boiler feed water passes through ion exchange columns. Cleaning and regeneration chemicals (NaOH and H_2SO_4) are sewered. The 1973 average water usage rate was 36.9×10^6 USG/D or 50,000 USG/ADT.

2.3.3 Chip Supply. Approximately 50% of the chips are produced on site. The proportions of species cooked are as follows:

Hembal	75%
Cedar	25%

2.3.4 Mill Processes. The following description attempts to characterize major mill processes. Complete equipment list and flow diagrams are provided in Appendix I.

(a) Wood Mill:

- Average production = 693 cunits/day
- Hydraulic debarkers; one Nicholson
  one Bellingham.
  Each debarker has Tyroc bark dewatering screens (0.034" face openings).
- Effluent clarifier; Dorr Oliver, 80' dia.

(b) Pulping:

- The brown stock produced at the digester over 1973 averaged 830 ADT/D. This resulted in a bleached kraft production of 754 ADT/D.
- Digester; Kamyr continuous; the present design rating is 768 ADT/D of brown stock production. Modifications in the chip feed system have increased production capabilities to 1000 ADT/D (brown stock).

- Knotters; 6 Can. Ingersall-Rand Ltd. 56 inch screen plates, 3/8 inch perforations
- Knot tank; 15 ft dia x 16 ft high (21,200 U.S. gal)
- Brown stock washers; two, 14 ft dia x 22 ft long
- Fiber salvage tank; 21¼ ft dia x 11 ft high (29,300 U.S. gal)
- Unbleached white water tank; 127,000 U.S. gal

(c) Recovery:

- Evaporators; Jacoby, 6 effects. Design feed rate = 765,000 lb/hr at 15% solids
  Output = 220,000 lb/hr at 52% solids
- Weak black liquor storage; 2 tanks, 40 ft dia x 41 ft high. Total storage = 770,000 U.S. gal
- Strong black liquor storage; 1 tank, 40 ft dia x 41 ft high. Total storage = 385,000 U.S. gal
- Black liquor dump tank; 21¼ ft dia x 18 ft high (48,000 U.S. gal)
- Recovery boiler; C.E. 2,750,000 lb BLS/hr
- No weak or strong black liquor oxidation at present.

(d) Recausticizing:

- Raw green liquor storage; 21¼ ft dia x 33.5 ft high (89,000 U.S. gal)
- Recaust spare storage tank; 50 ft dia x 32 ft high (470,000 U.S. gal)
- Kiln; Canadian Allis Chalmers 11.5 ft dia x 275 ft long
- Dregs filter; Dorr Oliver drum vacuum 6 ft dia x 4 ft
- Venturi Scrubber on kiln stack, weak wash used on scrubber

(e) Bleach Plant:

At present, the bleach sequence is as follows:

Co.N.H.E.D.

where Co = Cl_2, ClO_2 mix

N = neutralization or cold caustic extraction stage

H = sodium hypochlorite stage

The original mill design called for the H.C.N.H.D.E.D. sequence.

- Chemical preparation;
  Matheson ClO_2 generation process produces 7.5 tons ClO_2/D
  ClO_2 storage: #1 12,400 U.S. gal
  #2 12,400 U.S. gal
  A sulfur burner is on site for generation of SO_2.

(f) Sheet Formation:

- 1973 production = 754 ADT/D
- Machine blending tank; 35 ft dia x 40 ft high
- Broke storage tank; 35 ft dia x 52 ft high
- Wire; Fourdrinier 236" wide
- Flakt Dryer

2.3.5 Water Reuse.

(a) Bleach washer filtrate is reused in the last four washing stages. This results in two discharges from the bleach plant; an acid effluent from the chlorination stage and a caustic extraction effluent from the neutralization stage.

(b) Digester contaminated condensate (60 gpm) is sewered at the present time. However, facilities exist to reuse this stream.

(c) Clean warm water (4300 gpm) from the digester condenser is reused on the bleach washers.

(d) Evaporator contaminated condensate (1000 gpm) is reused in recaust and on the brown stock washers.

(e) Evaporator foul condensate from the vacuum steam ejector is sewered.

3. SEWER SYSTEM AND EFFLUENT CHARACTERISTICS

3.1 Sewer Layout

A layout of the sewer system is shown in Figure 1. All streams are combined in a common outfall.

3.2 Spill Detection

The locations of continuous recording pH probes and conductivity probes are shown in Figure 1.

3.3 Sewer Sampling

Chain and vacuum sampler locations are shown in Figure 1. Both types are constant samplers (not flow proportional).

3.3.1 Sampling Procedures.

(a) Weekday and 3-day weekend composite fiber loss measurements are carried out at the machine room, main outfall, recaust recovery and pulping group sewers.

(b) Once per week, daily composite samples are taken at the main outfall for BOD_5, V.S.S., S.S., settlable solids and colour analysis.

(c) Weekly grab samples are taken at the wood room clarifier influent and effluent for assessment of S.S. removal efficiency.

(d) Daily sodium losses are measured at the bleach acid, bleach caustic, recaust recovery pulping group and main outfall sewers.

(e) Daily calcium losses are measured at the main outfall, recaust recovery and bleach acid sewers.

(f) The conductivity of the main outfall composite sample is measured daily (weekdays and three-day weekend composites).

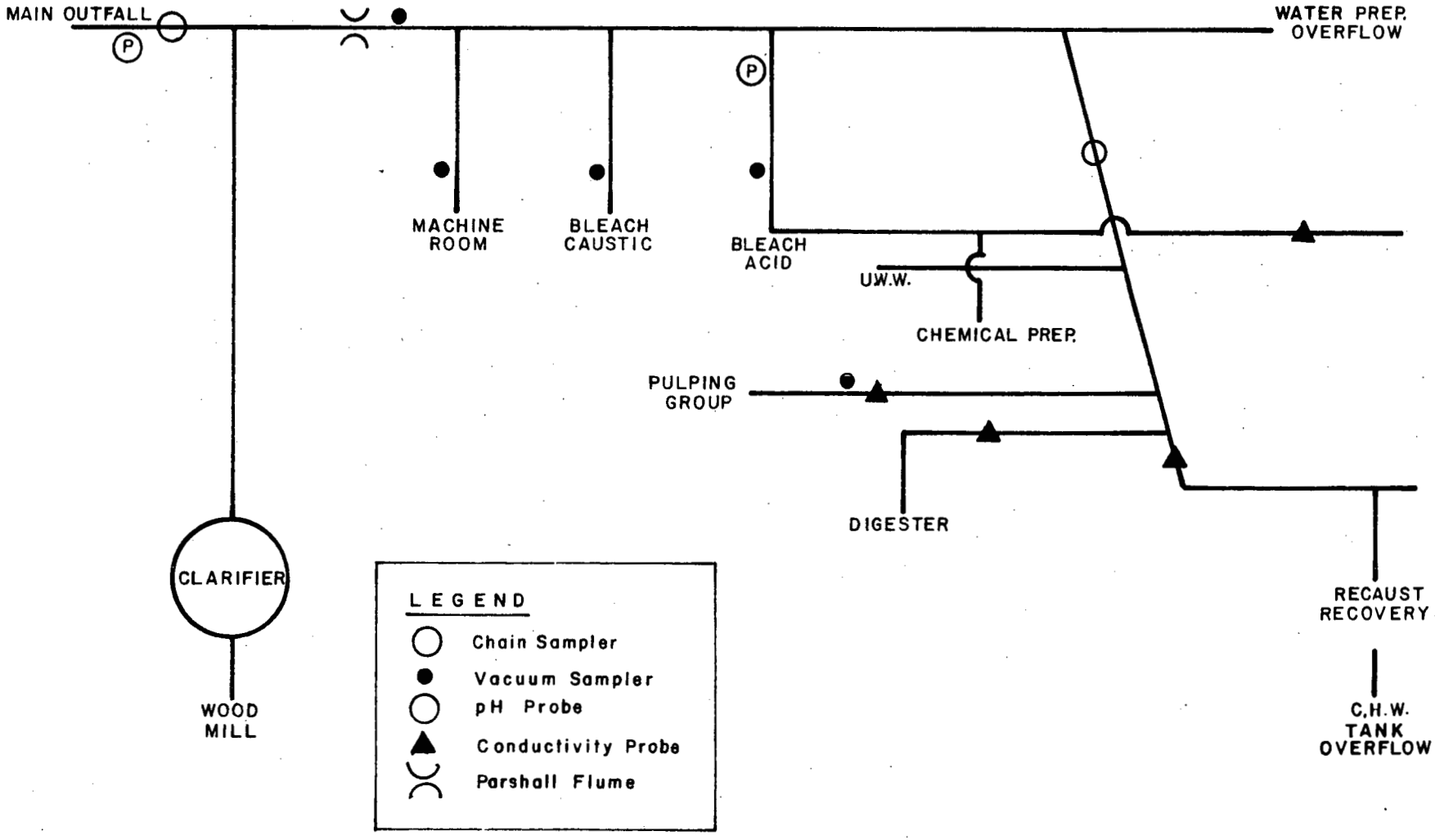

FIGURE 1 SEWER SYSTEM

3.4 Final Effluent Discharge

3.4.1 Provincial and Federal Effluent Quality Requirements. Gold River has applied for a Pollution Control Board effluent discharge permit (Level B). The effluent characteristics stipulated are shown in Table 1.

As an existing mill, the Federal Pulp and Paper Effluent Regulations require that Gold River Pulp Mill meet standards more stringent for S.S. and toxicity. The federal requirements are shown in Table 2.

TABLE 1: PROVINCIAL PULP AND PAPER EFFLUENT OBJECTIVES

(a) Kraft Pulping Effluents with Marine Discharge (Level B)

pH Range	6.5-8.5
Temperature	95^{o}F
Floatable Solids	Negligible
Total S.S.	30 lb/ADT
Settlable Solids	2.5 ml/l
BOD_5	60 lb/ADT
Toxicity (TLm_{96})	12.5%
Mercaptans	< 2.0 mg/l
Sulphides	< 1.0 mg/l
Residual Chlorine	< 0.1 mg/l

(b) Wood Mill, Hydraulic Debarking Effluents with Marine Discharge (Level B)

Total S.S.	4.0 lb/cunit
Settlable Solids	2.5 ml/l
BOD_5	4.0 lb/cunit
Floatable Solids	Negligible
Toxicity (TLm_{96})	12.5%
pH	6.5-8.5

TABLE 2: FEDERAL REQUIREMENTS

Process	Allowable S.S.	Allowable BOD_5
Hydraulic Debarking	5 lb/ODT of wood	
Kraft Pulping	7 lb/ADT	64 lb/ADT
Kraft Bleaching	6 lb/ADT	27 lb/ADT
Kraft Sheet Formation	2 lb/ADT	

Toxicity - 80% survival at 65% V/V concentration over 96 hours.

3.4.2 Current Gold River Final Effluent Discharge.

(a) BOD_5 and S.S.: The average daily S.S. and BOD_5 discharges over 1973 are shown in Table 3.

TABLE 3: 1973 AVERAGE S.S. AND BOD_5 DISCHARGE

	Gold River Discharge	Fed. Allowable	P.C.B. Level B
S.S.	31,400 lb/day	15,680 lb/day	27,085 lb/day
BOD_5	38,700 lb/day	66,980 lb/day	51,373 lb/day

Assume: Pulp production = 736 ADT/D
Wood mill = 693 cunits/D or 884 BDT/D.

The suspended solids at the main outfall are basically composed of:

Sand grit and $CaCO_3$ = 19%
Fiber (recoverable) = 46%
Organic material = 35%

Recoverable fiber is defined as that part of the total suspended solids which will be retained by a 65 mesh sieve. The wood mill contributed only about 1050 lb S.S./day of the total mill discharge of 31,400 lb S.S./day over 1973.

(b) Toxicity: Main outfall toxicity data is limited. 96 hour TLm values are not available. However, a study carried out from November 19, 1970 to January 15, 1971 established MST values for the main outfall effluent (Appendix II). Samples were collected every ½ hour from 0915 November 24 until 0900 November 25. MST values were established for each half hour sample. A 24-hour composited sample at a 66% V/V concentration had a MST value of greater than 3000 minutes.

(c) Miscellaneous Effluent Characteristics: The main sewer discharge of Ca (loss plus use) averaged 22,300 lb of Ca as $CaCO_3$ per day over the month of November. These losses are summarized in Figure 2.

Further effluent characteristics for the month of November are shown below:

Conductivity	1,600 mmhos
Colour	2,450 units
BOD_5	39,400 lb/day

The pH of the effluent averaged 5.1; however, lime neutralization has been terminated, so pH's have dropped to between 3.5 and 3.0.

3.4.3 Process Losses. A flow balance is shown in Figure 2. The daily sodium sewer discharge (loss plus use) for the month of November (considered typical of normal operation) averaged 78,400 lbs of sodium per day. However, about 41,200 lb Na/day originated from the bleach plant caustic sewer. The difference, 78,400 - 41,200, or 37,200 lb Na/day is associated with the actual pulping and recovery operations. Brown stock washer saltcake losses averaged about 30 lb Na_2SO_4/ADT (9.7 lb Na/ADT) or about 7,800 lb Na/day.

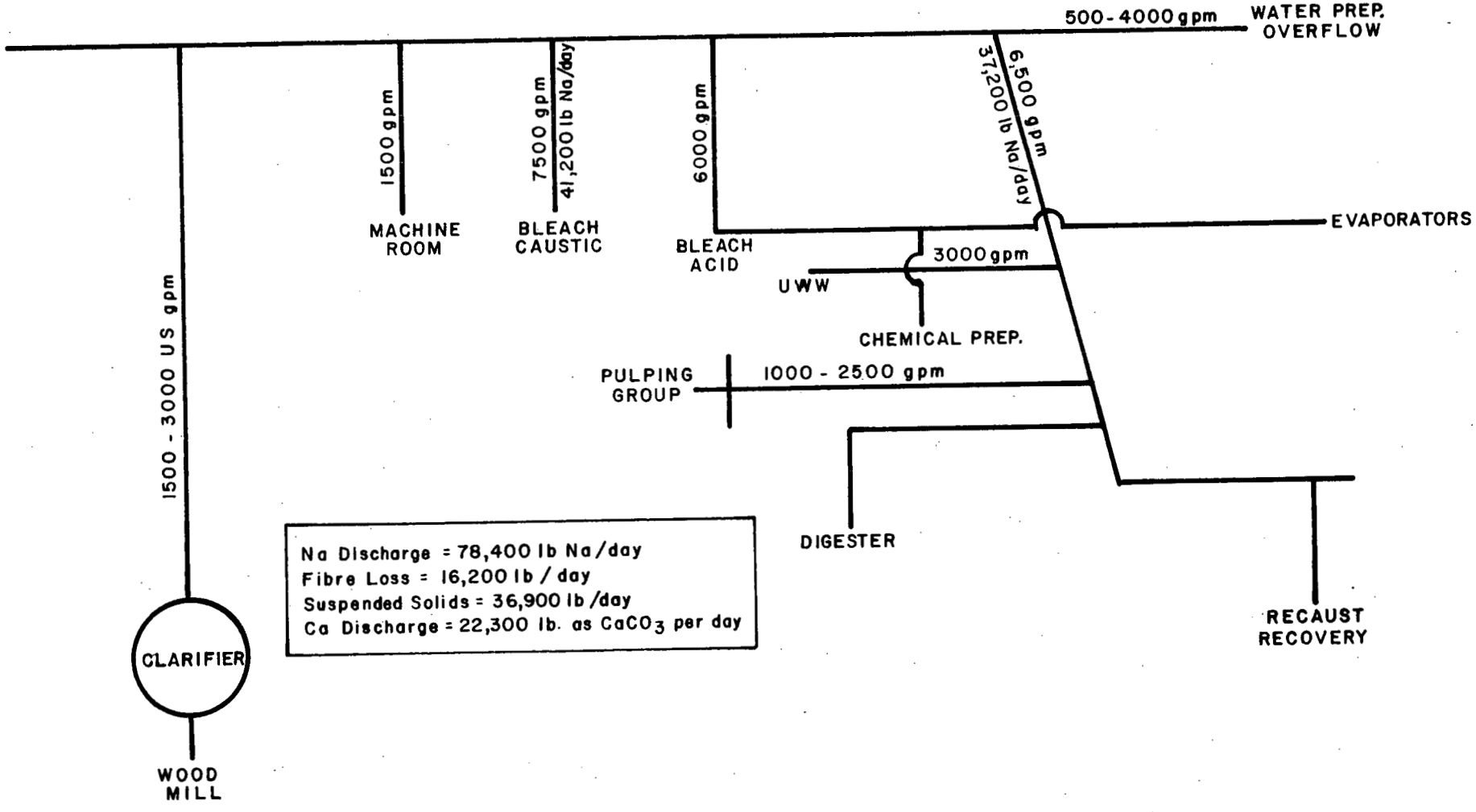

FIGURE 2 FLOW AND SODIUM BALANCE

Fiber losses originate from U.W.W. pulping group and the machine room sewers. For the months of September and November (1973) fiber losses averaged 16,200 lb/D.

3.5 Miscellaneous Discharges. Hog fuel is pressed before burning at the bark press. This effluent is very coloured but is as yet uncharacterized. A line exists to take this effluent to the wood room screens. However, due to plugging, this stream has temporarily been diverted to the ash lagoon.

Leachate from the chip piles flows to the beach area. This effluent is very coloured and is also uncharacterized. The flow is intermittent depending on rainfall.

The flyash settling pond effluent is clear and flows to the beach between the wood mill and log dump.

Contaminated hog fuel, dregs, slaker grits and solid waste generated around the mill is trucked to a dump site. This amounts to about 22,000 yd^3/yr. The site is located near the town site and is separated from the Gold River by the highway. Putrescible wastes are handled by the village of Gold River.

Dredgeate from the log dump and log sorting areas is trucked to a site near the mill. This year approximately 5000 yd^3/yr will be dumped at this site. The mill feels that these dump sites are very good in that water pollution problems associated with leachate are minimized. It was stressed that future sites will be very difficult to locate.

3.6 Effluent Testing Procedures

3.6.1 Suspended Solids. S.S. determinations are carried out once per week on the main outfall sample and once per week on the wood mill clarifier grab samples.

A 500 ml sample is filtered through a 12.5 cm Whatman 44 ashless (0.01% ash) filter disk. Up to 30 minutes is required for a 500 ml filtration. For weekly determinations on the main outfall sewer, two 500 ml samples are filtered separately and the results are averaged. All weighings are carried out on a Sartorius 4 place analytical balance.

3.6.2 Fiber Loss. This test is carried out daily for operating purposes only. It is really an indicator of recoverable fiber. A 65 mesh sieve is used as a filter media. The filtered material is dried for 30 minutes at 220°F. The filtration is carried out at the sample site using a 10 liter volume.

3.6.3 BOD_5. All D.O.'s are measured using the winkler method (sodium azide modification).

The distilled water is prepared from a tin lined electric still. Feed water is prepared by filtering fresh water. The pH of the distilled water is usually in the 5.4 to 6.0 range. A check is run with every batch of BOD_5 tests. The depletion of the distilled water sample is usually in the range of 0.1 mg/l to 0.2 mg/l.

Dilution water is prepared by adding the usual nutrient chemicals plus 1 ml per liter acclimated seed to distilled water. The dilution water has been found to be near saturation without intentional aeration and can therefore be used as is.

All samples are neutralized before testing. The BOD_5 is calculated by subtracting the depletion of the seeded dilution water "B" from the depletion of the diluted sample "A" and dividing by the dilution ratio "D".

$$BOD_5 = \frac{A - B}{D}$$

$$\text{where } D = \frac{\text{Volume of sample}}{\text{300 ml OR Volume of bottle}}$$

With every set of tests a determination is carried out on a glucose standard prepared from D glucose anhydrous (not the glucose glutamic acid mix). A new glucose standard is prepared every week.

Seed is prepared by slowly introducing domestic sewage seed to a neutralized mill effluent. At present neutralized effluent and nutrients are dripped into a bottle containing seed. The system is continuously aerated with mill air. The overflow from this chamber is used as seed. Several comparisons have been made with BOD_5 results obtained at B.C. Research. In all cases results have deviated by no more than ± 10%.

3.6.4 Colour. The sample is adjusted to pH 7.6 using HCl or NaOH. The adjusted sample is filtered through a Whatman 44 paper and the absorbance at 425 mμ on a Spectronic 20 spectrophotometer.

3.6.5 Flow. Flow measurements are carried out by means of parshall flume (Figure 1). The parshall flume on the main sewer, however, is subject to submergence. A grizzly screen downstream from the flume can become plugged, causing backup and parshall flume submergence.

4. POLLUTION ABATEMENT FACILITIES

4.1 Inplant Modifications

4.1.1 Bleach Rejects. Bleach cleaner rejects (approximately 3 T/D) flow to either the unscreened brown stock mix chest or to the rejects chest.

4.1.2 Brown Rejects. Brown stock secondary cleaner rejects (2 T/D) go directly to sewer at present. Plans are being made to dewater these rejects to 20% consistency and truck them to hog fuel storage.

4.1.3 Condensates. A steam stripper has been installed on the digester contaminated condensate but is not in operation. In this system the stripped sulfide and terpene compounds are passed to a weak wash scrubber. The compounds capable of being absorbed go to weak wash and eventually to the liquor system while the remainder of the stripped fraction is vented to atmosphere at the brown stock washer hood exhaust (Figure 3). A condensate stripping trial was carried out and a report was completed in June, 1971 (Appendix III).

Basically, it was concluded that good H_2S and MeSH removal depended on pH adjustment of the condensate (Figure 4). The pH of the condensate has to be lowered from about 9.0 to pH 6 or 7 for a 90 to 95% removal efficiency. Also, BOD_5 and COD removal depended on the percent removal of H_2S and MeSH (Figure 5).

At high sulfide removal efficiencies, about 70% of the condensate BOD_5 and COD was removed. A scrubber has been installed for non-condensibles from the digester condenser (using weak wash). This system is also not operational.

The non-condensible gases from the multiple effect evaporators passes through a weak wash scrubber before going to atmosphere. Scrubber effluent goes directly to the weak wash system for reuse in recaust.

4.1.4 Pulping Group Spill Control. Knotter spills, knot tank overflows and operating floor brown stock washer spills go to a 29,300 U.S. gal fiber salvage tank. These spills can then be fed back into the system at the knotters. Brown stock washer vats can either be drained to the basement or into the fiber salvage tank. At present all spills reaching the basement flow directly to sewer. Operating floor bleach plant washer spills, bleach decker and unbleached decker spills

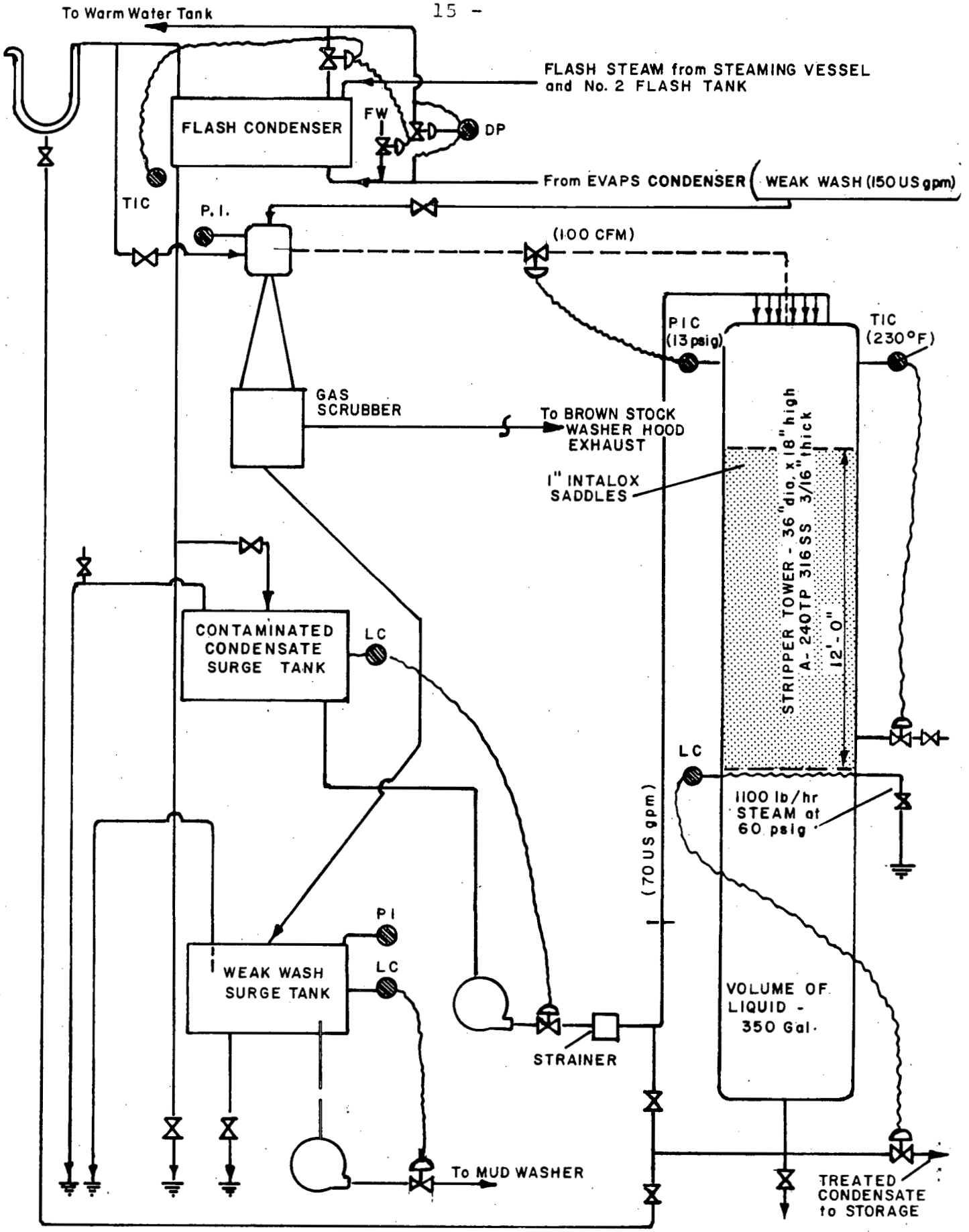

FIGURE 3 GOLD RIVER DIGESTER CONDENSATE TREATMENT UNIT

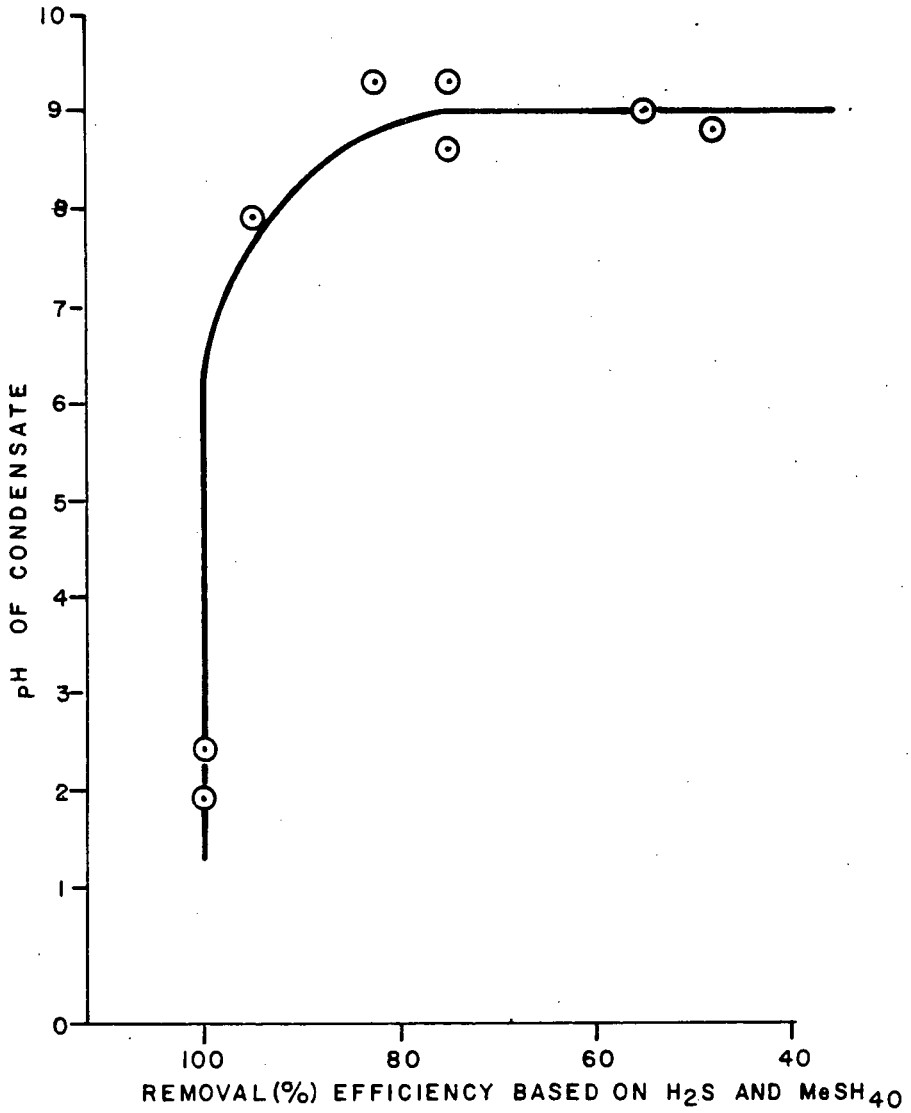

FIGURE 4 REMOVAL EFFICIENCY VERSUS CONDENSATE pH

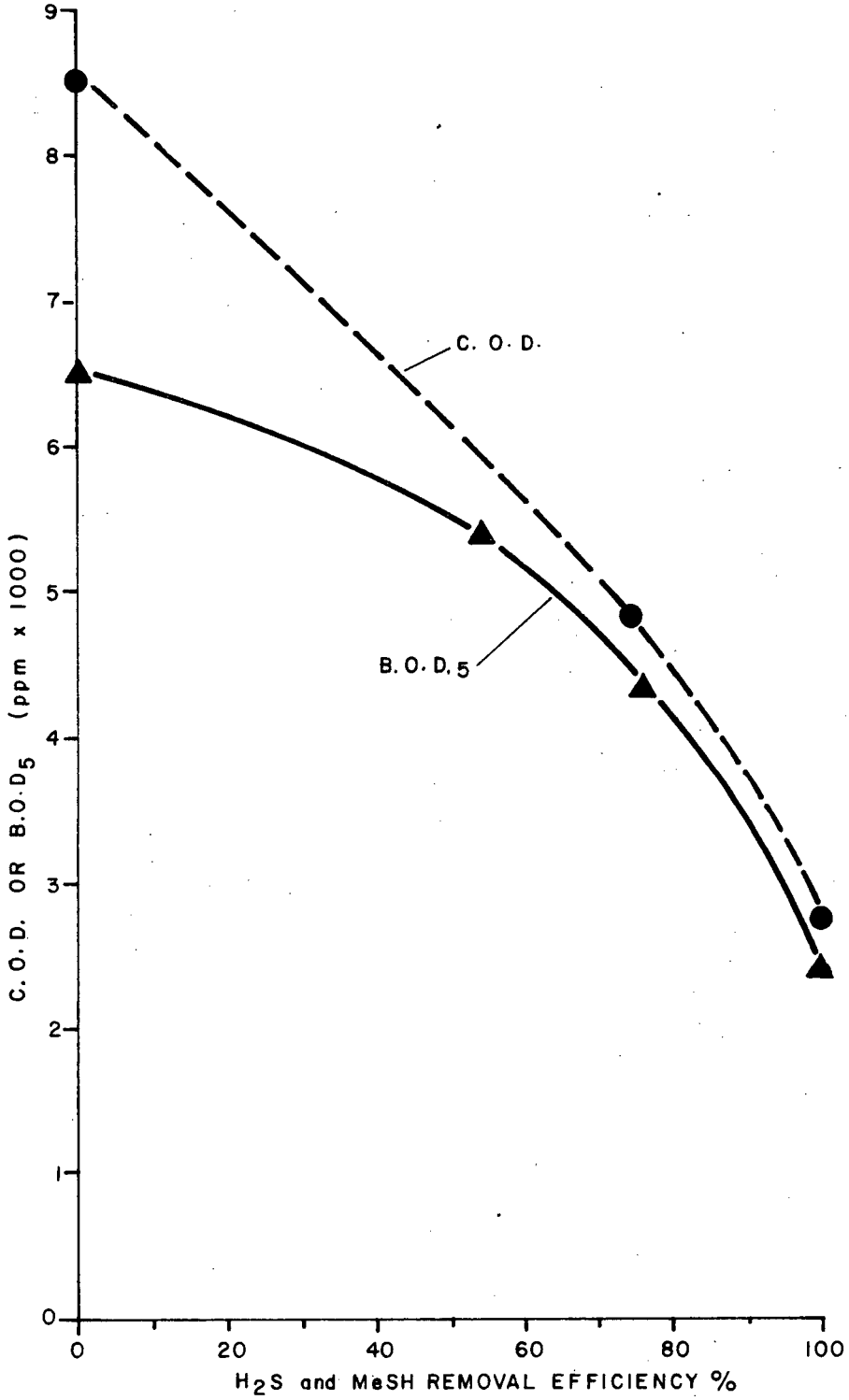

FIGURE 5 EFFECT OF STRIPPING ON COD AND BOD_5

drain to the reject chest. This stock enters the reject system and eventually, after refining, screening and cleaning goes to the brown stock deckers. Bleach washer spills which reach the basement are sewered.

A major extension of this spill control system is presently being planned (Appendix II). Basically, brown stock washer spills which are now going to sewer will be collected in a sump and pumped (2000 gpm) to a 150,000 U.S. gal holding tank. Such spills would then be introduced to the knotters or to the blow tank. Bleach plant spills, which are at present being sewered, would likewise be collected in a sump and pumped (2000 gpm) to a holding tank. Unused bleach tower 40 (218,000 U.S. gal) would be used for this purpose. The collected stock would be passed over a thickener and then to the reject chest.

4.1.5 Recaust Spill Control. A spare storage tank in the recaust area (470,000 U.S. gal) serves as a spill collection tank. Spills from green liquor storage, G.L. clarifier and the W.L. clarifier are collected in this tank and are fed back into the weak wash system.

4.1.6 Recovery Spill Control. A black liquor dump tank (48,000 gal) collects spills from the cascade evaporators, S.B.L. storage and the precipitator mix tank. Collected material is directed to W.B.L. or S.B.L. storage.

4.1.7 Dregs Filter. A Dorr Oliver drum vacuum filter removes dregs from the green liquor clarifier underdrain. Dregs production is about 4 ODT/D at 35% solids. This is trucked to landfill.

4.2 External Treatment Facilities

4.2.1 Wood Mill Clarifier. An 80' dia clarifier treats the screened hydraulic debarker wastes. Each debarker effluent

(1500 gpm) passes through a Tyroc vibrating screen before entering the clarifier. The underdrain from the clarifier is recycled back onto one of the Tyroc screens.

The average discharge for 1973 was as follows:
Flow = 1950 USGPM
S.S. feed to clarifier = 1022 mg/l = 24,000 lb/day
S.S. effluent discharge = 54 mg/l = 1,270 lb/day
Average removal = 94%

These values are based on grab samples taken weekly. When both debarkers are operating simultaneously, and when the clarifier overflow line is partially clogged with slime growth, the clarifier overflows and clarified debarker effluent flows directly to the beach area. The line must then be cleared by pulling a styrofoam "plug" through the pipe. This appears to be a fairly persistent problem.

4.2.2 Flyash Settling Pond. (340 ft x 200 ft x 5.5 ft) Flyash is sluiced to a settling pond (in flow approximately 50 USGPM). The effluent, which contains less than 20 mg/l suspended solids, flows to the dock area. The pond is cleaned as necessary, the flyash being removed to landfill.

4.2.3 Effluent Diffuser. The main outfall effluent travels through a 1700 ft tunnel to an effluent diffuser just west of the pulp mill site. The diffuser discharges horizontally at a depth of 80 ft below low water line. By this means an 1:80 effluent:sea water dilution is achieved at the surface.

4.2.4 pH Neutralization. Previously, the pH of the main outfall effluent was adjusted to neutrality before being discharged. However, several trials showed that with the good effluent dilution coupled with the buffering capacity of the seawater, pH's were near neutrality within a few feet of the

diffuser ports (see Amendment to Permit No. PE 318). Lime addition has not been carried out since December 1973.

4.2.5 Oil Storage. Bunker "C" 2 tanks 120 ft dia x 53 ft high
Heavy oil 2 tanks 26 ft dia x 22 ft high
Light oil 1 tank 11.5 ft dia x 33 ft high

These tanks are surrounded by an earth spill catchment basin. Mill domestic sewage is combined with the total mill effluent.

APPENDIX I

A mill equipment list is included in the Gold River Pulp Mill's file.

APPENDIX II

See the report, "Amendment to Permit No. PE 318" in the Gold River Pulp Mill file.

APPENDIX III

The report, "Steam Stripping of Digester Condensates", by W.E. Forde, can be found on the Gold River file.