WASTE WATER SURVEY

FOR

SPAULDING FIBRE COMPANY, INC.

TONAWANDA, NEW YORK

BY

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PROCESS & WASTE WATER ENGINEERING

HALL LABORATORIES DIVISION

CALGON CORPORATION

PITTSBURGH, PENNSYLVANIA

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SPAULDING FIBRE COMPANY, INC.

TONAWANDA, NEW YORK

INTRODUCTION

This is a summary of the results of the survey conducted by Hall Laboratories, Division of Calgon Corporation of the industrial waste water discharged from the Tonawanda Facilities of Spaulding Fibre Company, Inc. The purpose of this survey was to characterize the nature and amounts of contaminants in the industrial waste waters discharged to the municipal storm sewer system; to establish whether or not treatment of these waste waters would be required prior to discharge; and if treatment is necessary, to provide the basis for design of treatment facilites necessary to obtain the desired degree of contaminant reduction. This report will serve as the basis for negotiations with the State of New York to obtain the necessary approval for construction of these facilities.

CONCLUSIONS

Based on our observations and the analytical data discussed later in this report, we have reached the following conclusions:

1. Those industrial wastes discharged from the plant to the Gibson Street storm sewer system do not meet New York State Standards for continued discharge to a surface stream.
2. Treatment of these industrial wastes will be required to reduce the waste water's organic content as measured by the

biochemical oxygen demand (BOD), phenol, and zinc.

3. Preliminary laboratory tests indicate that the desired contaminant reduction could be achieved through neutralization and clarification of the main plant waste and chemical oxidation of the small phenol containing side stream.
4. Further tests will be conducted to verify preliminary results and to establish the design parameters for the required treatment facilities.
5. A portion of this treated waste water could, with additional treatment such as filtration, be made suitable for re-use in the plant processes in place of the city water presently used. Additional tests would be required to establish the exact degree and type of treatment necessary to achieve this substitution.

NATURE OF THE PROBLEM

This plant manufactures a variety of laminated fiber sheets, phenolic impregnated tubes and sheets. A major portion of the manufacturing process involves the making of paper which serves as the basis for the laminated materials. All the necessary operations such as cooking of the rags used in making this paper, beating and pulping of the rags for preparation of stock, and finally the actual making of the paper are conducted on the premises. These operations provide the bulk of the industrial waste water from the plant.

This paper is then laminated under pressure and impregnated with a zinc chloride solution either continuously or in a batch operation. Rinse waters from these operations provide the other major source of industrial waste water discharged from the plant.

The remainder of the industrial wastes come from the phenolic tube grinding operation and uncontaminated cooling waters. These waters and the previously mentioned industrial waste waters discharge together with any rain water from the roof and yard drains into the Gibson Street storm sewer and from there to the Niagara River.

To augment its own pollution abatement program, Spaulding Fibre retained Hall Laboratories in May 1966 to conduct a survey of the industrial waste discharged from their Tonawanda, New York Plant. This survey was subsequently conducted over the period June 7 - 10 inclusively. Preliminary findings were discussed and a discrepancy was noted in the flow measurements obtained at the Parshall flume receiving wastes from the paper mill. Data developed during the survey did not correlate with previous flow measurements taken by the plant personnel or later by representatives of the State Health Department. Since all three surveys had obtained widely different flows, and since the outlet from this flume appeared to be restricted sufficiently so as to produce false readings under high flow conditions, it was decided to augment the Hall survey data with additional flow measurements obtained by plant personnel using automatic flow recording devices obtained from local authorities and spanning a much longer period of time. Plant personnel cleaned the receiving sewer, removed several obstructions, and made a series of flow measurements. Satisfactory data was developed over the period January 30 through February 3, 1967. These data were reported to Hall Laboratories February 17, 1967 and have been incorporated into this report.

PRESENTATION OF DATA

For the industrial waste water survey, weirs were installed in an open trench in the basement of the paper mill which receives waste water from the two paper making machines and in the manhole outside the fibre plant which receives rinse waters from the continuous fibre mill. In addition, an existing Parshall flume measuring waste water fromhe paper mill stock preparation areas was utilized. The combined waste water flow as measured at these three points represents the great bulk of the industrial waste water discharged from the plant and almost all of the waste water discharged to the storm sewer.

For this survey, Hall Laboratories provided three automatic flow recording devices, Type F water level recorders as manufactured by Leupold and Stevens Instruments, Inc. These instruments recorded the water head at the three measuring points over a 72 hour period. Flow rates for the appropriate sized weirs and the Parshall flume were determined at 15 minute intervals over this period and the average values obtained were used in the calculations included in this report.

Hall also provided two automatic effluent samplers, Model DU-1 manufactured by Brailsford & Company. These samplers operated continouosly over the 72 hour period providing three-24 hour composite samples at each of the two points in the paper mill. These composite samples as well as others collected at different points in the manufacturing process were returned to Pittsburgh to our laboratories for analysis. The results of these analyses are included as exhibits attached to this report.

Those composite samples collected at the weir installed in the basement of the paper mill and receiving waste water from the two paper making machin were analyzed by our Pittsburgh laboratory and the results are tabulated on the attached Exhibit I. Based on these analyses and the average flow as determined during the sampling period, the contaminant loading expressed as pounds of contaminant per eight hours is tabulated on the attached Exhibit I-A. The calculated average loading, pounds per eight hours and the calculated average contaminant concentration, mg/l, are tabulated together with the average flow on the attached Exhibit I-B.

The analyses of those composite samples collected at the Parshall flume in the basement of the paper mill and receiving waste waters from the stock preparation areas are tabulated on the attached Exhibit II. The calculated contaminant loading and average contaminant concentration are tabulated on Exhibit II-A.

Composite samples were collected manually for two-24 hour periods at the manhole outside the fibre plant. Analyses of these samples are tabulated on the attached Exhibit III. The calculated contaminant loading and contaminant concentration are tabulated respectively on Exhibits III-A and III-B.

A relatively small stream flows intermittently from the phenolic tube grinding operation into a small, open settling pond. The effluent from this pond discharges to the storm sewer system. This effluent was sampled as the waste water discharged from the building and again at the point of discharge from the settling pond. Samples were composited on two consecutive days for a one hour period each day. The flow from the building was gauged by means of a bucket and stop watch. The several measurements averaged 50 gallons per minute for approximately three to four minutes per cycle and an average of three cycles per hour. For calculations, we used 50 gallons per minute for ten minutes each hour for a total of 4000 gallons per eight hour shift. The analyses of these samples are tabulated on the attached Exhibit IV. The contaminant loading and concentration are tabulated respectively on the attached Exhibits IV-A and IV-B.

The total industrial waste water discharged from the plant to the Gibson Street storm sewer was sampled at a manhole just opposite the plant entrance at the end of Gibson Street. Two such composites were made each spanning several hours of operation. The samples were collected manually and the analytical results are tabulated on the attached Exhibit V. Due to the very high volume of water discharged at this point, we were unable to gauge the flows. However, since this flow is the total of waste water discharged from the Parshall flume, the paper making machines, and the continuous fibre mill, we can approximate the flow at 3300 gpm. The contaminant loading and average concentration based on this approximate flow are tabulated on the attached Exhibit V-A.

Samples were made of the industrial waste water from Nos. 1 and 2 washers in the stock preparation area and the rag cutter dust collecter. These analytical results are tabulated on the attached Exhibit VI. Flow from the Nos. 1 and 2 washers was determined by means of the bucket and stop watch method to be 75 gpm. The rag cutter dust collector system is completely closed and the flow there could only be estimated at 10 gpm. The contaminant loading for both these sampling points is tabulated on the attached Exhibit Vi-A.

The waste water discharged from the rag cooker in the paper mill stock preparation area was sampled and the analytical results are tabulated on the attached Exhibit VII. This is a batch operation using approximately 5000 gallons of water and 300 to 1000 pounds of 50% caustic per 17,000 pounds of rags in each batch. The operational cycle for each vessel is approximately 24 hours, thus there are approximately eight batches of highly alkaline water discharged each 24 hour period. Based on this volume of 5000 gallons, the contaminant loading and concentration are tabulated on the attached Exhibits VII-A and VII-B.

Waste waters discharged from the batch operated fibre leach tanks was sampled by selecting three representative batch tanks in various stages of treatment and collecting samples from each. The analytical results are tabulated on the attached Exhibit VIII. Based on the maximum tank volume of 2500 gallons, the contaminant loading and the average contaminant concentration are tabulated on the attached Exhibits VIII-A and VIII-B.

Various analyses of the raw river water were supplied by plant engineering. These analyses have been averaged and included along with an analysis of the filtered river water from the paper mill and the Tonawanda City water analysis and have been tabulated on the attached Exhibit IX.

The proposed treatment facilities are shown on the flow sheets attached as Exhibit X. This exhibit also includes the various alternatives to be considered based on further tests.

WATER BALANCE

This plant uses approximately 5.367 million gallons of water per day. 1.367 million gallons of this total is purchased city water. The remainder or four million gallons per day is filtered Niagara River water. This water is discharged from the plant at two points. All the sanitary wastes plus the rinse waters from the fibre sheet and tube departments batch tanks, the rag cooker, and blowdown from the ash pit discharge to the Wheeler Street sanitary sewer. Industrial waste waters from the paper mill, the continuous fibre mill, the tube grinding department, varnish kettle cooling waters and various roof drains discharge to the Gibson Street storm sewer.

Apart from the usual sanitary requirements and plant utilities, city water is used almost exclusively in the fibre mill. In the batch leaching area there are 135 leaching tanks with a volume of 2500 gallons each. These tanks are dumped to waste daily and contribute 337,500 gpd. In addition, there are 152 such tanks which are dumped intermittently over a period of approximately ten days duration. These tanks contribute 380,000 gallons. There are also six larger tanks of perhaps 4000 gallon capacity making a total of 404,000 gallons liquid capacity. If we prorate this volume over the ten day period, this gives an additional 40,400 gpd. Thus the total water discharged from this area to the Wheeler Street sanitary sewer equals 377,900 gpd.

The waste water flow from the continuous fibre plant was measured at the weir installed in the manhole located outside this area. The average flow at that point was 463 gpm or 666,720 gpd. This number compares favorably with the estimate made by plant personnel of 780,000 gpd.

Thus, the total city water discharged from this area equals 1,044,620 gpd. Actual city water consumption during 1966 was 1,367,000 gpd. Thus, an average of some 322,380 gpd is available for sanitary use, utilities, etc.

River water consumpition totals 4,000,000 gpd. This water is used exclusively in the paper mill and the amount discharged to the Gibson Street storm sewer was measured at the weir receiving the waste waters from the two paper making machines and the Parshall flume receiving waste waters from the stock preparation area. These flows were respectively 843 gpm (1,214,000 gpd) and 2000 gpm (2,880,000 gpd) for a total of 2843 gpm (4,094,000 gpd). This total represents fairly close agreement, considering limitations inherent in the type of measurement systems employed, with the total pumpage rate of 4,000,000 gpd.

We were unable to measure the total plant discharge at the Gibson Street storm sewer due to the very large rate of flow. However, this flow rate can be approximated by adding the waste water discharged from the continuous fibre mill (463 gpm) to that previously measured from the paper mill (2,843 gpm) to get a total of 3,306 gpm or 4,752,000 gpd. While there may be some additional small volume flows, such as the tube grinding discharge, the above flow represents the greatest bulk of waste water discharged to this sewer.

Considerable difficulties were experienced in determining the accurate flow at the Parshall flume in the paper mill basement. The values determined during our survey and reported as part of Exhibit II-A were much too high for the volume of river water pumped. The indicated average flow of 2,980 gpm equal some 4,291,000 gpd. This exceeds the total river water pumpage without allowing for the 1,214,000 gpd from the paper making machines. Earlier plant figures were roughly half our values or of the order of magnitude 1400 to 1500 gpm. However, these measurements avoided those periods of high flow caused by filter backwash and other intermittent operations which greatly increased the flow for a short period of time. Subsequently, State authorities made a survey of these facilities. Their flow measurements at the Parshall flume were based on 14 readings over a period of approximately nine days. Their average flow was 1778 gpm. Since all three measurements were widely divergent, we decided to repeat these measurements under somewhat more controlled conditions and after cleaning the sewer to rid it of any obstructions.

This additional flow measurement study was conducted from January 30 through February 3 by plant personnel using borrowed automatic flow measurement devices. Even after the sewer had been cleaned, there were still periods of high flow when the Parshall flume was submerged excessively by backing up of the water at the discharge side due to the inability of the receiving sewer to carry this water away at this flow rate. Nevertheless, sufficient data was obtained to enable us to calculate an average flow rate of approximately 2000 gpm. As mentioned above, this figure is consistent with total pumpage of river water and lies well within the range covered by all three surveys.

DISCUSSION

This survey was primarily concerned with the industrial waste waters discharged to the Niagara River by way of the Gibson Street storm sewer system. However, part of the industrial waste water does discharge to the municipal sanitary sewer system at Wheeler Street. The waste liquor from the rag cooking operation contains a high amount of organic as measured by the BOD content and excessive alkalinity. The organic should be perfectly acceptable in a sanitary sewer system but the presence of the large amount of caustic could, depending upon the flow of other wastes from this plant, produce an unacceptably high pH in the sewer. This, of course, is dependent on the regulation established by the sewage authorities. Additional tests involving continuous monitoring of the plant waste pH would be necessary to establish whether or not this waste could continue to be discharged to the sanitary sewer.

The rinse waters from the fibre mill are objectionable only in that they contain a very high concentration of zinc. The generally accepted level of zinc in waters discharged to a sanitary sewer is 15 mg/l. The three leach tanks sampled, as shown on Exhibit VIII, all exhibited a much higher zinc content. Again, depending on the concentration in the overall waste, these waters could be unacceptable for continued discharge.

In the event that either or both of these industrial waste waters are rejected for discharge to the sanitary sewer system, they would be included as part of the proposed treatment facilities and would present few additional problems, except for hydraulic loading.

The industrial waste waters discharged to the Niagara River by way of the storm sewer system must meet more stringent restrictions by State authorities. These waters as represented by the wastes collected at the Gibson Street storm sewer, are unacceptable for continued discharge to a receiving stream by reason of the high organic content (BOD), suspended solids, zinc, and to a lesser degree, phenol. The high organic content is associated with the suspended solids and comes from the waste materials generated in the processing of rags into finished paper. The zinc comes from the leaching waters from the fibre mill. The phenol is present only in the relatively small discharge from the phenolic tube grinding area.

From our observations of the paper mill waste water, we deduced that the greater portion of BOD could be removed from these waters by clarification of the suspended material. Subsequent to our initial survey, we had additional samples of the waste water from the paper making machines and the stock preparation area collected and sent to our laboratories for analysis. On these samples, the chemical oxygen demand (COD) and biochemical oxygen demand (BOD) were determined on shaken and filtered samples. The filtered samples simulated what we might reasonably expect to achieve with proper clarification. The results of our analyses are tabulated below:

Sample No.	S-4611	S-4612
Identification	Stock Preparation	Paper Machines
pH	6.9	7.0
	mg/1	mg/1
Suspended Solids	170	500
COD, Total	236	554
COD, Filtered	82	26
BOD, Total	75	255
BOD. Filtered	45	10

The above analyses indicate that we could expect to achieve a reduction in BOD of 96% based on the paper machine waste and a reduction of 40% based on the stock preparation waste. Using flows determined during the survey, and indicated in the report, the amount of BOD contributed daily by the two streams as well as the calculated affect of their combination can be tabulated as follows:

Water Source	Total BOD, pounds/24 hours	Filtered BOD, pounds/24 hours
Stock Preparation	1,837	1,102
Paper Machines	2,580	101
Combined Waste	4,417	1,203

The degree of reduction obtained on the combined waste would be 72.7% giving a BOD in the effluent equivalent to 35 mg/1. This is below the generally accepted level of 50 mg/l in discharges to receiving streams. However, if you are held to the 95% reduction figure, we would be required to reduce this BOD loading to 220 pounds per 24 hours which would produce an effluent BOD of 6.4 mg/l.

Based on the above test, plus our observations, we believe that the desired degree of BOD reduction could be achieved through chemical coagulation and clarification of the paper mill waste. This, of course, will have to be established with additional studies on the plant waste but it is certainly a distinct possibility that such treatment would result in the production of an acceptable effluent. Thus, the treatment facilities shown in Exhibit X, Alternative One, are designed to provide for this type of treatment.

In the event that we are not able to achieve the desired degree of treatment through simple coagulation and clarification, this waste should be additionally treated by either of the alternative methods shown in the attached Exhibit X, Alternatives Two and Three. We will now discuss these alternatives in detail:

Alternative One

With this alternative, the uncontaminated cooling water would continue to be discharged directly to the storm sewer along with roof drains.

The zinc bearing water from the continuous fibre mill and if necessary from the batch leaching operation would be collected for treatment in a chemical clarifier. Here the pH would be adjusted to the range 8.5 to 9.0, zinc would be precipitated as the insoluble hydroxide and would be removed from the water along with any suspended material through chemical clarification. The effluent from the clarifier would discharge to the storm sewer. Accumulated sludge would be blown down to a sludge sump for dewatering by means of rotary vacuum filters. The sludge would then be suitable for disposal in a land fill.

Those waste waters from the paper mill, including if necessary the waste liquor from the rag cooking operation, would be collected for treatment in a chemical clarifier. The suspended solids and with them a great deal of the BOD would be removed through coagulation and clarification. The effluent would then be suitable for discharge to the storm sewer. The accumulated sludge would be blown down into a sump for dewatering in rotary vacuum filters. The sludge would then be burned in an incinerator. Approximately 1,000,000 gallons per day of the effluent from this clarifier could be filtered with activated carbon to remove any suspended material and organic material remaining. This water would then be suitable for reuse in the manufacturing process as a substitute for city water in the fibre mill.

Alternative Two

With this alternative, the cooling water and water from the fibre mill would be treated as described under Alternative One.

In the event that we are required to provide additional treatment in order to achieve a further reduction of BOD, the waste waters from the paper mill, again including, if necessary, the rag cooker waste liquor, would be collected in a settling basin to remove the suspended solids and with them a great deal of the organic material. The effluent from this unit would pass into a biochemical treatment unit, either an activated sludge unit or a trickling filter, for further reduction of the BOD. The effluent from this unit would then go to a clarifier or final settling basin and from there the effluent would discharge to the storm sewer. Approximately 1,000,000 gallons per day of this effluent would be chlorinated, activated carbon filtered and returned for reuse in the plant process as a substitute for city water in the fibre mill. Sludge accumulated in the settling basin as well as waste sludge from the final clarifier or settling basin would be dewatered by means of rotary vacuum filters and incinerated. There would be no waste of sludge from the biochemical unit other than that lost through the final clarifier or settling basin.

It is possible that State authorities would require chlorination of the effluent from the biochemical section of this treatment plant prior to discharge to the receiving stream.

Alternative Three

With this alternative, the cooling water and water from the fibre mill would again be treated as described in Alternative One.

In the event further BOD reduction is required, the waters from the paper mill, again including, if necessary, the rag cooker waste liquor, would be collected for treatment in a chemical clarifier. Here the bulk of suspended material and with it the bulk of the BOD would be removed by precipitation. All or a portion of the effluent from the chemical clarifier would be filtered with activated carbon to further reduce the BOD content of the water prior to discharge. Depending on the results of later tests, it might be acceptable to carbon filter only a portion of the water to be discharged to waste so that the blended water would have an acceptably low BOD content. Since no bacterial action is involved here, no chlorination would be required. Again, approximately 1,000,000 gallons per day of the carbon filtered water would be returned to the manufacturing process for use in the fibre mill as a substitute for city water. Sludge accumulated in the clarifier would be dewatered by means of rotary vacuum filters and incinerated.

Common to all three alternatives outlined above, is the use of activated carbon filters to further purify a portion of the plant waste water for reuse in the manufacturing process as a substitute for city water. The minimum size required would be capable of processing 1,000,000 gallons of water per day. If the third alternative method is adopted, this minimum size would be expanded to treat all or part of the paper mill waste water. This expansion could be accomplished merely by adding additional carbon capacity to the plant. This latter method also gives the flexability to allow for changes in the States requirements regarding quality of effluents to State bodies of water or for changes in your manufacturing process which might increase the organic loading on the treatment plant.

In any event, the adsorption of organic material on activated carbon is a reversable process. The organic is de-sorbed by means of thermal regeneration. This involves heating of the exhausted carbon to a temperature of 1600°F in the absence of air. The organic material is burned off and the carbon after quenching is ready for return to service. This thermal regeneration is accomplished in infrequent intervals depending on the adsorption capacity and volume of carbon used in the filters. It is, therefore, not necessary to increase the size of the regeneration furnace with increasing carbon capacity. The furnace is merely utilized more frequently. Thus, the regeneration furnace necessary for a 1,000,000 gallon per day carbon plant could quite easily suffice for a much larger plant.

Recent studies indicate that the furnace required to regenerate activated carbon can be adapted to incinerate the waste sludge. Since some type of incineration is required, a considerable portion of the expense involved in the activated carbon process is thus reduced.

The ultimate selection of the type of treatment facilities required will depend on the results of future studies to determine the degree to which BOD reduction can be achieved through simple clarification, the limitations on the plant effluent quality established by the State, and an economic evaluation of the alternatives offered.

Those waste waters discharged from the phenolic tube grinding area constitute the only source of phenol in the plant waste water. If either biochemical oxidation or carbon adsorption of the organics in the plant waste water becomes necessary, these phenol containing waters can be included with the general plant waste. If, however, Alternative One is adopted, these waters from the tube grinding area should be segregated from the general plant waste for subsequent treatment by chemical oxidation to destroy the phenol content and render this waste water suitable for inclusion with the general plant waste. This could be accomplished on a batch type operation employing two tanks in alternating service and utilizing chlorine as the oxidant. Careful control of the degree of oxidation would guarantee complete distruction of the phenol prior to discharge to the sewer system.

RECOMMENDATIONS

1. Have conducted further laboratory studies designed to determine the effectiveness of clarification on the reduction of BOD in the paper mill waste water.
2. Have conducted parallel studies on the fibre mill waste to verify that we can reduce the zinc content of those waters to the required level.
3. Have conducted carbon adsorption isotherms and column studies to assist in evaluating this process both as to quality of effluent produced and size of equipment required.
4. If chemical oxidation is necessary to eliminate phenol from the plant discharge, provide for segregation of the waste waters discharged from the

tube grinding area for separate, batch wise treatment.

5. Based on these additional studies, have prepared finalized plans for the waste treatment facilities selected. These plans will include together with the design parameters tank capacities, equipment sizes, recommended equipment suppliers, and all other pertinent data necessary to the construction and operation of the treatment facilities required to produce an effluent acceptable by New York State Authorities for discharge to the receiving stream. These finalized plans will be prepared and submitted to the State in compliance with the schedule already approved.

ACKNOWLEDGMENT

We wish at this time to acknowledge the splendid co-operation of Messrs. G. Creighton, H. Parker, W. Billman, and others of the plant engineering staff throughout this survey.

Respectfully submitted

HALL LABORATORIES

L. B. Kline

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Spaulding Fibre
Tonawanda, New York

EXHIBIT I

In-Plant Samples

Paper Mill Waste Water at Weir

Analytical Results

Lab. No.	S-1561	S-1568	S-1576
Date:	6/7-8/66	6/8-9/66	6/9-10/66
pH	7.0	---	6.9
	mg/l	mg/l	mg/l
Alkalinity as $CaCO_3$ - pH 4.6	65	---	58
Chemical Oxygen Demand (COD)	200	142	225
Biochemical Oxygen Demand (BOD)	65	105	30
Suspended Solids	230	180	105
Total Solids	790	---	675
	ml/l	ml/l	ml/l
Settleable Solids:			
15 minutes	> 40	---	> 40
30 minutes	> 40	---	> 40
60 minutes	> 40	---	> 40
90 minutes	> 40	---	> 40

Spaulding Fibre
Tonawanda, New York

EXHIBIT I-A

In-Plant Samples

Paper Mill Waste Water at Weir

Contaminants, Lbs./8 Hrs.

Lab. No. Date:	S-1561 6/7-8/66	S-1568 6/8-9/66	S-1576 6/9-10/66
Alkalinity as $CaCO_3$ - pH 4.6	215.75	---	203.85
Chemical Oxygen Demand (COD)	663.84	465.91	790.79
Biochemical Oxygen Demand (BOD)	215.75	344.51	105.44
Suspended Solids	764.42	590.59	369.03
Total Solids	2622.17	---	2372.36
Ave. Flow, gpm	829.8	820.27	878.65

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EXHIBIT I-B

In-Plant Samples

Paper Mill Waste Water at Weir

	Ave. Loading Lbs./8 Hrs.	Ave. Concentration mg/1
Alkalinity as $CaCO_3$ - pH 4.6	209.80	62.22
Chemical Oxygen Demand (COD)	640.18	189.87
Biochemical Oxygen Demand (BOD)	221.90	65.81
Suspended Solids	574.68	170.45
Total Solids	2497.27	740.67
Ave. Flow, gpm	842.91	

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EXHIBIT II

In-Plant Samples

Paper Mill Waste Water at Parshall Flume

Analytical Results

Lab. No. Date:	S-1560 6/7-8/66	S-1567 6/8-9/66	S-1575 6/9-10/66
pH	7.6	---	7.2
	mg/l	mg/l	mg/l
Alkalinity as $CaCO_3$ - pH 4.6	150	---	120
Chemical Oxygen Demand (COD)	350	285	170
Biochemical Oxygen Demand (BOD)	115	95	65
Suspended Solids	290	260	145
Total Solids	685	---	460
	ml/l	ml/l	ml/l
Settleable Solids:			
15 minutes	3.0	---	7.0
30 minutes	6.0	---	8.0
60 minutes	8.5	---	9.0
90 minutes	9.5	---	10.0
120 minutes	10.5	---	10.0

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EXHIBIT II-A

In-Plant Samples

Paper Mill Waste Water at Parshall Flume

	Ave. Loading Lbs./8 Hrs.	Ave. Concentrat: mg/1
Alkalinity as $CaCO_3$ - pH 4.6	1080	135
Chemical Oxygen Demand (COD)	2144	268
Biochemical Oxygen Demand (BOD)	736	92
Suspended Solids	1856	232
Total Solids	4584	573
Ave. Flow, gpm	2000	

Note: Average flow determined during original survey was 2980 gpm. Above value based on later data.

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Tonawanda, New York

EXHIBIT III

Effluent Samples

Fibre Plant Waste Water at Weir

Analytical Results

Lab. No.	S-1562	S-1569
Date:	6/8/66	6/9/66
pH	7.1	6.9
	mg/1	mg/1
Alkalinity as $CaCO_3$ - pH 4.6	52	59
Chloride (Cl)	71	112
Chemical Oxygen Demand (COD)	18	12
Biochemical Oxygen Demand (BOD)	5	< 5
Zinc (Zn)	30	85
Suspended Solids	30	40
Total Solids	270	430
	ml/1	ml/250 ml
Settleable Solids:		
15 minutes	0.1	< 0.1
30 minutes	0.2	< 0.1
60 minutes	0.2	< 0.1
90 minutes	0.2	< 0.1
120 minutes	0.2	< 0.1

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EXHIBIT III-A

Effluent Samples

Fibre Plant Waste Water at Weir

Contaminants, Lbs./8 Hrs.

Lab. No. Date:	S-1562 6/8/66	S-1569 6/9/66
Alkalinity as $CaCO_3$ - pH 4.6	88.89	117.71
Chloride (Cl)	121.37	223.45
Chemical Oxygen Demand (COD)	30.77	23.94
Biochemical Oxygen Demand (BOD)	8.55	< 9.98
Zinc (Zn)	51.28	169.59
Suspended Solids	51.28	79.8
Total Solids	461.56	857.90
Ave. Flow, gpm	427.37	498.78

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EXHIBIT III-B

Effluent Samples

Fibre Plant Waste Water at Weir

	Ave. Loading Lbs./8 Hrs.	Ave. Concentration mg/1
Alkalinity as $CaCO_3$ - pH 4.6	103.30	55.77
Chloride (Cl)	172.41	93.08
Chemical Oxygen Demand (COD)	27.36	14.77
Biochemical Oxygen Demand (BOD)	< 9.27	5.00
Zinc (Zn)	110.44	59.62
Suspended Solids	65.54	35.38
Total Solids	659.73	356.16
Ave. Flow, gpm	463.08	---

Spaulding Fibre
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EXHIBIT IV

Effluent Samples

Tube Grinder

Analytical Results

Lab. No.	S-1566	S-1570	S-1565	S-1571
Date	6/8/66	6/9/66	6/8/66	6/9/66
Time	1:55 PM-3:20 PM	10:30 AM-11:30 AM	1:55 PM-3:10 PM	10:35 AM-11:35 AM
Description of Sample Point	Building Outlet	Building Outlet	After Settling Pond	After Settling Pond
pH	7.6	7.4	6.9	7.1
Specific Gravity	1.0	---	---	---
	mg/1	mg/1	mg/1	mg/1
Alkalinity as $CaCO_3$ - pH 4.6	78	87	90	97
Phenol	27.5	17	12	25
Suspended Solids	2875	2205	1235	1265
Total Solids	3245	3415	2540	2935
	ml/500 ml	ml/500 ml	ml/1	ml/500 ml
Settleable Solids				
15 minutes	15.0	10.0	14	1.5
30 minutes	16.0	10.0	14	2.0
60 minutes	16.0	10.0	15	4.0
90 minutes	16.0	11.0	15	4.0
120 minutes	16.0	11.0	15	4.0

Spaulding Fibre
Tonawanda, New York

EXHIBIT IV-A

Effluent Samples

Tube Grinder

Contaminants, Lbs./8 Hrs.

Lab. No.	S-1566	S-1570	S-1565	S-1571
Date	6/8/66	6/9/66	6/8/66	6/9/66
Alkalinity as $CaCO_3$ - pH 4.6	2.6	2.9	3	3.2
Phenol	0.9	0.6	0.4	0.8
Suspended Solids	96	74	41	42
Total Solids	108	114	85	98

Ave. Flow 50 gpm intermittantly
for approximately
10 min/hour or
4000 gals/8 hours

Spaulding Fibre
Tonawanda, New York

EXHIBIT IV-B

Effluent Samples

Tube Grinder

	Ave. Loading Lbs./8 Hrs.	Ave. Concentration mg/l
Alkalinity as $CaCO_3$ - pH 4.6	2.9	87
Phenol	0.7	21
Suspended Solids	63	1890
Total Solids	101	3030

Ave. Flow, 4000 gals/8 hours

Spaulding Fibre
Tonawanda, New York

EXHIBIT V

Effluent Samples

Storm Sewer at Gibson Street

Analytical Results

Lab. No. Date	S-1559 6/7/66	S-1764 6/9/66
pH	6.9	6.6
	mg/1	mg/1
Alkalinity as $CaCO_3$ - pH 4.6	90	98
Chloride (Cl)	---	140
Chemical Oxygen Demand (COD)	225	260
Biochemical Oxygen Demand (BOD)	95	110
Phenol	0.065	0.069
Zinc (Zn)	65	50
Suspended Solids	195	120
Total Solids	640	605
	ml/1	ml/1
Settleable Solids		
15 minutes	19.5	14
30 minutes	19.5	18
60 minutes	20.1	13
90 minutes	21	13
120 minutes	21	12

Spaulding Fibre
Tonawanda, New York

EXHIBIT V-A

Effluent Samples

Storm Sewer at Gibson Street

	Ave. Concentration mg/1	Ave. Loading Lbs./8 Hrs.
Lab. No.	S-1559 & S-1764	S-1559 & S-1764
Date	6/7/66 & 6/9/66	6/7/66 & 6/9/66
Alkalinity as $CaCO_3$ - pH 4.6	94	2.59
Chloride (Cl)	140	3.85
Chemical Oxygen Demand (COD)	242	6.66
Biochemical Oxygen Demand (BOD)	102.5	2.82
Phenol	0.067	0.001
Zinc (Zn)	57.5	1.58
Suspended Solids	157.5	4.33
Total Solids	622.5	17.12
Flow, gpm	3000	

Spaulding Fibre
Tonawanda, New York

EXHIBIT VI

In-Plant Samples

Analytical Results

Lab. No.	S-1564	S-1563
Date	6/8/66	6/8/66
Description of Sample Point	Paper Mill Waste Water No. 1 & 2 Washers	Rag Cutter Dust Collector
pH	7.6	6.9
	mg/1	mg/1
Alkalinity as $CaCO_3$ - pH 4.6	314	107
Chemical Oxygen Demand (COD)	1560	2540
Biochemical Oxygen Demand (BOD)	785	640
Suspended Solids	1550	2690
Total Solids	2640	2490
	ml/1	ml/1
Settleable Solids		
15 minutes	> 40	> 40
30 minutes	> 40	> 40
60 minutes	> 40	> 40
90 minutes	> 40	> 40
120 minutes	> 40	> 40

Spaulding Fibre
Tonawanda, New York

EXHIBIT VI-A

In-Plant Samples

Contaminants, Lbs./8 Hrs.

Lab. No.	S-1564	S-1563
Date	6/8/66	6/8/66
Description of Sample Point	Paper Mill Waste Water Nos. 1 and 2 Washers	Rag Cutter Dust Collector
Alkalinity as $CaCO_3$ - pH 4.6	94.2	0.008
Chemical Oxygen Demand (COD)	468	0.211
Biochemical Oxygen Demand (BOD)	235.5	0.053
Suspended Solids	465	0.224
Total Solids	792	0.207
Ave. Flow, gpm	75	10

Spaulding Fibre
Tonawanda, New York

Exhibit VII

In-Plant Samples

Paper Mill Waste Water

Rag Cooker

Analytical Results

Lab. No.	S-1765	S-1577
Date	6/9/66	6/10/66
pH	11.2	11.8
Specific Gravity	1.01	1.04
	mg/1	mg/1
Alkalinity as $CaCO_3$ - pH 8.2	2900	6667
Alkalinity as $CaCO_3$ - pH 4.6	6667	11,834
Chemical Oxygen Demand (COD)	36,200	21,500
Biochemical Oxygen Demand (BOD)	8690	10,740
Suspended Solids	3530	4530
Total Solids	25,255	35,945
	ml/1	ml/1
Settleable Solids		
15 minutes	18	< 0.1
30 minutes	25	0.15
60 minutes	26	0.15
90 minutes	25	0.5
120 minutes	24	0.7

Spaulding Fibre
Tonawanda, New York

Exhibit VII-A

In-Plant Samples

Paper Mill Waste Water

Rag Cooker

Contaminants, Lbs./dump

Lab. No.	S-1765	S-1577
Date	6/9/66	6/10/66
Alkalinity as $CaCO_3$ - pH 8.2	120.83	277.79
Alkalinity as $CaCO_3$ - pH 4.6	277.79	493.08
Chemical Oxygen Demand (COD)	1508.33	895.83
Biochemical Oxygen Demand (BOD)	362.08	447.50
Suspended Solids	147.08	188.75
Total Solids	1052.29	1497.71
Tank Volume, gals.	5000	5000

Spaulding Fibre
Tonawanda, New York

Exhibit VII-B

In-Plant Samples

Paper Mill Waste Water

Rag Cooker

	Ave. Loading Lbs./dump	Ave. Concentration mg/l
Alkalinity as $CaCO_3$ - pH 8.2	199.31	9.97
Alkalinity as $CaCO_3$ - pH 4.6	385.44	19.27
Chemical Oxygen Demand (COD)	1202.08	60.10
Biochemical Oxygen Demand (BOD)	404.79	20.24
Suspended Solids	167.92	8.40
Total Solids	1275	63.75
Tank Volume, gals.	5000	

Spaulding Fibre
Tonawanda, New York

Exhibit VIII

In-Plant Samples

Fibre Leach Tanks

Analytical Results

Lab. No.	S-1578	S-1579	S-1580
Date	6/10/66	6/10/66	6/10/66
Tank	T1*	T2**	T3***
pH	6.5	6.8	6.7
	mg/1	mg/1	mg/1
Alkalinity as $CaCO_3$ - pH 4.6	42	59	45
Chloride (Cl)	850	175	242
Chemical Oxygen Demand (COD)	460	9.4	15.7
Biochemical Oxygen Demand (BOD)	Toxic	---	5
Zinc (Zn)	1000	140	220
Suspended Solids	20	15	40
Total Solids	95	580	925
	ml/1	ml/1	ml/1
Settleable Solids			
15 minutes	< 0.1	< 0.1	1.0
30 minutes	0.1	< 0.1	1.25
60 minutes	0.15	< 0.1	1.25
90 minutes	0.15	0.1	1.25
120 minutes	0.15	0.15	1.25

* T1 (2-3) Treated 6/8

** T2 (3-5) Treated 6/6
Dumped 6/9

*** T3 (2-10) Cold Water 10 days
Heated 6/9 - 1st time

Spaulding Fibre
Tonawanda, New York

Exhibit VIII-A

In-Plant Samples

Fibre Leach Tanks

Contaminants, Lbs./dump

Lab. No.	S-1578	S-1579	S-1580
Date	6/10/66	6/10/66	6/10/66
Tank	T1	T2	T3
Alkalinity as $CaCO_3$ - pH 4.6	0.88	1.23	0.94
Chloride (Cl)	17.71	3.65	5.04
Chemical Oxygen Demand (COD)	9.58	0.20	0.33
Biochemical Oxygen Demand (BOD)	---	---	0.10
Zinc (Zn)	20.83	2.92	4.58
Suspended Solids	0.42	0.31	0.83
Total Solids	1.98	12.08	19.27
Tank Volume, gals.	2500	2500	2500

Spaulding Fibre
Tonawanda, New York

Exhibit VIII-B

In-Plant Samples

Fibre Leach Tanks

	Ave. Loading Lbs./dump	Ave. Concentration mg/1
Alkalinity as $CaCO_3$ - pH 4.6	1.02	0.10
Chloride (Cl)	8.80	0.88
Chemical Oxygen Demand (COD)	3.37	0.34
Biochemical Oxygen Demand (BOD)	0.10	0.10
Zinc (Zn)	9.44	0.94
Suspended Solids	0.52	0.05
Total Solids	11.11	
Tank Volume, gals.	2500	

Spaulding Fibre
Tonawanda, New York

EXHIBIT IX

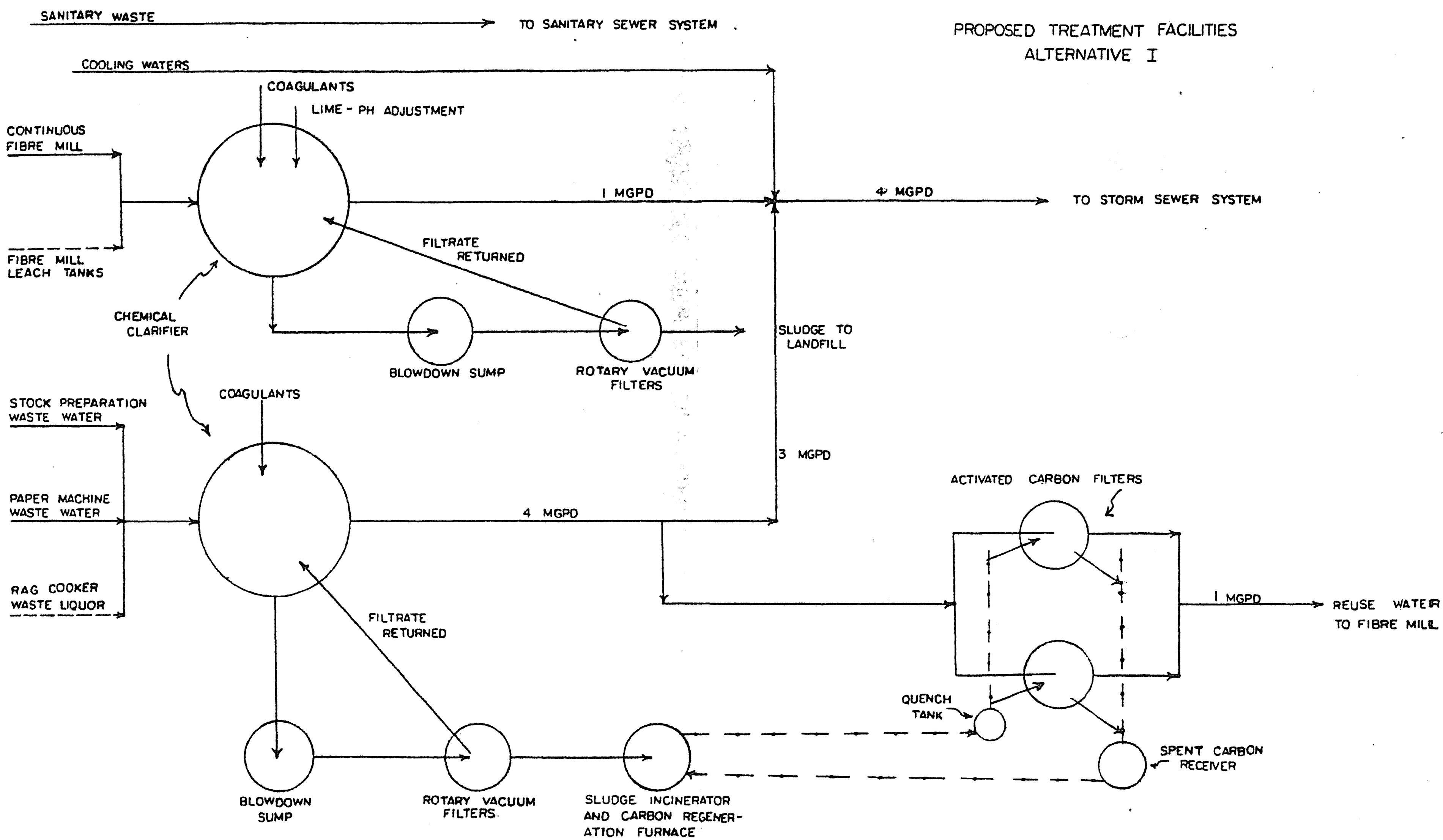
Niagara River Water

Analytical Results

	Raw River Water	Filtered River Water	Tonawanda City Water
pH	7.1-7.8	-----	7.4
	mg/1	mg/1	mg/1
Total Solids	259	310	206
Suspended Solids	21	10	18
Dissolved Solids	238	300	188
Hardness *	131	164	130
Calcium (Ca) *	35	34.4	27
Magnesium (Mg) *	4	---	---
Zinc (Zn) *	0.44	30	0.12
Chlorine (Cl)	36	74	25
Sulfate (SO_4) *	29	26	28.8

* Based on a single analysis

PROPOSED TREATMENT FACILITIES
ALTERNATIVE I



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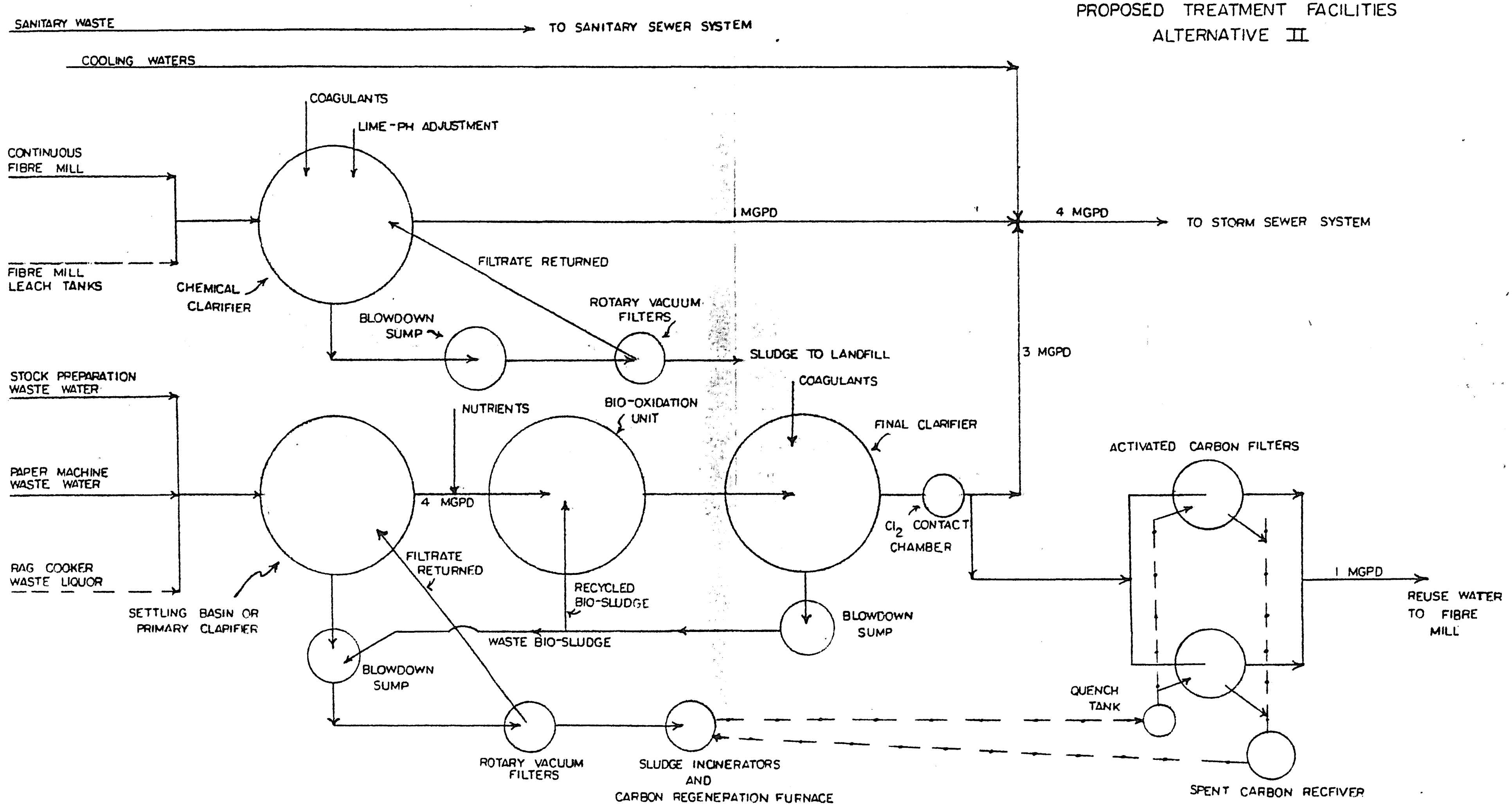
G. & W. LEACH CO. PGH., PA.

PROPOSED TREATMENT FACILITIES
ALTERNATIVE II



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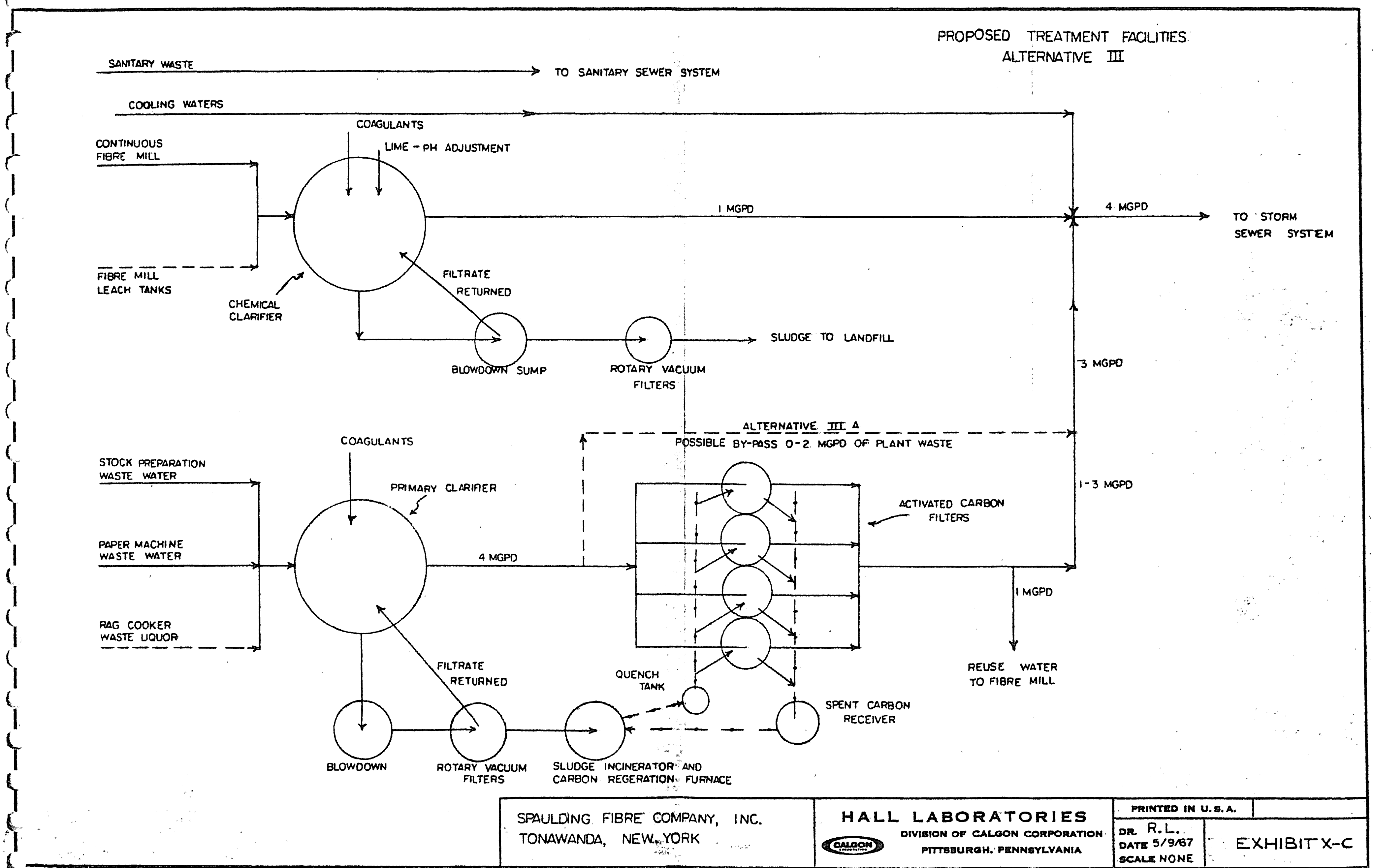
PROPOSED TREATMENT FACILITIES
ALTERNATIVE III
SANITARY WASTE
TO SANITARY SEWER SYSTEM
COOLING WATERS
COAGULANTS
LIME - PH ADJUSTMENT
CONTINUOUS FIBRE MILL
FIBRE MILL LEACH TANKS
CHEMICAL CLARIFIER
1 MGPD
4 MGPD
TO STORM SEWER SYSTEM
FILTRATE RETURNED
BLOWDOWN SUMP
ROTARY VACUUM FILTERS
SLUDGE TO LANDFILL
3 MGPD
ALTERNATIVE III A
POSSIBLE BY-PASS 0-2 MGPD OF PLANT WASTE
COAGULANTS
STOCK PREPARATION WASTE WATER
PRIMARY CLARIFIER
PAPER MACHINE WASTE WATER
4 MGPD
RAG COOKER WASTE LIQUOR
ACTIVATED CARBON FILTERS
1-3 MGPD
1 MGPD
REUSE WATER TO FIBRE MILL
FILTRATE RETURNED
QUENCH TANK
SPENT CARBON RECEIVER
BLOWDOWN
ROTARY VACUUM FILTERS
SLUDGE INCINERATOR AND CARBON REGERATION FURNACE
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TONAWANDA, NEW YORK
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EXHIBIT X-C