PN-ABU-162

METAL FINISHING U.S. STUDY TOUR

Volume 2 of 2

APPENDIX B

Participant Reports

United States
December 6 - 16, 1993

Prepared for:

US - ASIA ENVIRONMENTAL PARTNERSHIP

WEC

WORLD ENVIRONMENT CENTER

INDUSTRIAL WASTE MINIMIZATION ASSESSMENT

STUDY TOUR

INDONESIAN PULP AND PAPER INDUSTRY

Reported by

WARIH SUPRIADI

PT. SURABAYA AGUNG INDUSTRI PULP DAN KERTAS

DRIYOREJO, GRESIK

EAST JAVA, INDONESIA

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LIST OF ACRONYMS

ASB	:	Aerated Stabilization Basin.
BOD	:	Biological Oxygen Demand
DO	:	Dissolved Oxygen
EPA	:	Environment Protection Agency
ISO	:	International Standard Organization
MGD	:	Million Gallon Day
NCASI	:	National Council Of the Paper Industry for Air and Stream Improvement.
OCC	:	Old Corrugated Container
TQC	:	Total Quality Control
TSS	:	Total Suspended Solid
USAID	:	United States Agency for International Development
WEC	:	World Environment Council

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I EXECUTIVE SUMMARY

On October 24th - November 5th, 1993 On the invitation of WEC, I, Warih Supriadi representing PT Surabaya Agung Industri Pulp dan Kertas, Driyorejo,Gresik joined the Industrial waste minimization assessment study Tour with a group of Indonesian Pulp and Paper Industry to visit some Industrial Organization and Association in Pulp and Paper in the United States which is especially involved in the technology of waste water treatment and its management.

The main purpose of this visit is to enable us to learn and absorb the experience of some pulp and paper mill as well as to learn how to handle the problem, to broaden our knowledge that concerns the technology of Pulp and Paper, and waste water treatment.

This program is a follow up of " Lokakarya Minimisasi Limbah Industri pada Industri Pulp dan Kertas " which was held in Hotel Indonesia Jakarta, in July 1993. by WEC and supported by USAID and BAPPEDAL.

The aim of this program included visiting several research organization which support waste water minimization program in the US like NCASI.

The main point is to study the process of waste water treatment and it's handling technology. Secondly before making some regulation the US Government take into consideration the working process and mechanism of the industry.

Some representative from Indonesia pulp and paper industry are :

Mr. Widya Tjahyana L, PT Pakerin ,Mojokerto.
Mr. Darono Wikanaji, PT Kertas Leces (Persero) , Probilinggo
Mr. Warih Supriadi, PT Surabaya Agung Industri Pulp dan Kertas,Gresik.
Mr. Zulkifli Lubis, PT Indah Kiat Pulp and Paper,Bengkalis Riau.

From government institution ;

Mrs. Hendayani T.A Msc, from Institute Research and Development of cellulose under Industrial Ministry, Bandung.
Mr. Ian Suwargana, from The Environmental Impact Management Agency (BAPEDAL), Jakarta.

And Mr. Charles J.H Hong , Deputy Project Manager WEC ,New York.

The place to be visited :

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Monday,October 25th,1993.
NCASI,Gainesville Florida ,meet with Mr. Ashok K. Jain, Regional Manager Shoutern Region.

Wednesday,October 27th, 1993
Willamette Industries, Inc. Marlboro Mill, Bennettsille, South Carolina, meet with Mr. Martin Barfield. Technical Services Manager and Mr.Greg Fullenwider, Technical Specialist. .

Thursday,October 28th, 1993
Scnoco Industries,to see with Mr. Phillip Whichard, Technical Recovery Manager..

Friday,October 29th,1993.
Union Camp Corporation,Fine Paper division Eastover,South Carolina.meet with Mr. Wesley A. Foy Technical Control Manager. Mr. James P. Witkowski, Environmental Engineering Manager and Mr. Dough R. Lazar , Senior Application Engineer.

Tuesday, November 02nd,1993.
Weyerhaeuser , Pulp Division, Oglethrope, Georgia meet with Mr.Russell K. Stevenson, Plant Environmental Manager and Mr. Frank D.Wohhrley , Environmental Project Engineer.

Thursday,November 04th, 1993
NCASI, Madison Avenue, New York .meet with Mr.DR Isaiah Gellman,President..

The program the visit is meant to get several information along with technology,knowledge of pulp and paper especially in waste water. The result of the finding is expected to be applied through out Indonesia.

II INTRODUCTION.

Generally all pulp and paper industry in US have an installation to process waste water from the production. This installation had been completed with primary clarifier and secondary treatment with lagoon.

Delignification process is removing lignin from the fiber,pure oxygen it's one agent which generally used in pulp and paper mill such as Marlboro mill, Union camp and Wayerhaueser.

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For bleaching agent still use chlorine and chlorine dioxide,but there are still some factory trying to use other bleaching agent i.e. ozone, to be used in Wayerhaueser and Union Camp.

Solid waste such as bark from chipping process, solid waste filtered from the waste water are burned with coal in waste boiler to create steam for pulp and paper process.

Black liquor from the bleaching process,to manufacture in the recovery boiler and recovery chemical to take some chemical to be re-used in bleaching process. This process can also be used to reduce odor and air pollution.

They are strictly careful in throwing waste water,solid waste and other pollutant because of its tight strong regulation.

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III. FINDING.

III.1. NCASI, SHOUTERN REGION GAINESVILLE, FLORIDA.

This organization is founded in 1943, by several Industrial Pulp and Paper Industry in U.S. Up to now almost 95 % pulp and paper industry become the member of the organization and supporting budget of 10 million dollar every year.

With 100 employees from different back ground such as Chemist, Chemical engineer, Ecologist, Forestrist, Biologist etc. it has 4 branch offices ;

- New York as a head office.
- Washington,take the responsibilities in impact marine research.
- Boston take the responsibilities in surface water modelling research.
- Gainessville , Florida have a specialization in air pollution research.

In doing so, the organization help the industry which face some difficult in processing waste water or pollution and make some improvement to increase the quality with limited impact to environment. Besides it, they also help industry to make agreements with the government in deciding some new regulations.Indeed the US government has a good relationship with the industry.

Every region in the US have different regulation, but generally to process new regulation in the US is " top - down " that means the federal government arranges public hearing for 90 days, than continue to public discussion, finally the new regulation is made.

Furthermore, the regulation based on risk analysis, it will take lots of time therefore the analysis must be based on technology.

GAINESSVILLE BRANCH OFFICE

Especially for air pollution research it is done in Gainessville branch office. The annual budget spend every year is about 60 % which amount approximately 6 million dollar.

The facility of the lab in this office is complicated completed with work shop, prepare sample room ,analysis room and some analysis equipment as ;

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1. Collecting air equipment, it can be used to take some air sample from every part of the mill.

2. HPLC an equipment for separating and identifing liquid organic compound.

3. GCMS this can be used to separate mix gas in such as SO_2, NO_x, Cl_2, etc.

Periodically this organization send all the result of the research to the industry which are member of the organization and also send it to the government for further consideration when making some new regulation. This organization is almost equal to TAPPI and EPA.

Therefore the existence of this organization is very helpful not only to the industry but to the government as well.

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III.2 MARLBORO PAPER MILL ,WILLAMETTE INDUSTRIES. Inc. SOUTH CAROLINA.

Marlboro paper mill in Bennettesville,South Carolina begin its first production in December,1990. Producing 245.000 ton fine paper or almost 750 ton/day with 291 employee. This production need 12-13 MGD,as a total water consumption from the river. The total area is about 1.800 acre located along Pee Dee river in South Carolina.

A. PAPER MAKING PROCESS.

The main raw material is chips. 60 % the supply of material taken from Willamette Corp saw Mill and 40 % from the operating chips mill.

Chip is separated in two classification - hard wood and soft wood. The composition of the product is interchangeable every 2 - 3 days ie 40 % hard wood and 60 % soft wood , 60 % hard wood and 40 % soft wood.

From chips operating in the mill , the remove bark (solid waste) is to be burned at waste wood boiler to create steam to be used in the paper making process.

The purpose chips cooking in the six digester for 1,5 hour, is to separated lignin or natural glue from this wood fibers.
The pulp exits from the digester,this mixture washes and goes to Oxygen delignification process, Oxygen delignification process is highly efficient using Oxygen to break-down and remove lignin after cooking stage.

Instead of the typical five stage process, the mill used three stage bleaching process, after this process the pulp is washed in the final washing process,then goes to high density storage.

From high density storage water is added to the pulp, to get the consistency .5 % pulp and 95.5 % water. This mixture is delivered to the head box and goes to the paper machine for dewatered by gravity and suction , then going to a series presses. Paper goes thru series of 47 dryer heater with steam. Starch to be applied in the size press and heated in the second series of 18 dryer. The sheet goes through a set of vertical caiendars. The final stage of the process is in reel ready to be cut in different sizes before releasing to the customer.

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B EFFLUENT TREATMENT PROCESS.

B. 1 Primary Treatment

The treatment process begin from the lift station with bar screen, and has a rate of 15 MGD and pumped to the primary clarifier. The primary clarifier has a volume of 2,5 million gallon, a diameter of 195 feet, depth 9 feet with a rise rate 500 gpd/sg tt, and the retention time is 4 hour at 15 MGD. This process is able to settle 90 % or more of the able solid and 10 - 20 % of the BOD is to be removed from water treatment.
Settled sludge with 3 - 5 % concentration being pumped goes to screw press and dewatrered up to 50 % solid content. The screw press handle more than 17 dry ton sludge/day. If screw press fail or broken, the sludge flow will be diverted to another sludge lagoon of about one acre.
If the hydraulic overloaded, the flow more than 15 MGD, it is diverted from lift station to surge basin,with a storage capacity of 14,7 million gallon, from this storage the waste water basin pumped to the surge basin back to primary clarifier system.

SPILL BASIN.

Spill basin is similar to surge basin ,the capacity is 14,7 million gallon covering 3 acre and 15 feet deep, used as collecting spill and also can be used as alternative clarifier during primary clarifier maintenance period.

B.2 Secondary treatment.

AERATED STABILIZATION BASIN I , II.

After leaving primary waste water clarifier, it goes to ASB I, capacity of this basin is 90 million gallon with 2000 feet long, 400 feet wide and 15 feed deep. Covering 20 acre completed with 9 mechanical aerator and each has 75 horse power.

Second basin, ASB II has the same dimension as ASB I completed with 4 mechanical aerator 75 horse power. This operating process need 12 days time,6 days for each basin. The efficiency a removal of approximately 90% BOD removal can be produced from this basin.

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POLISHING POND

Treated waste water exiting from ASB II will enter the first of the two polishing ponds. Each polishing pond cover 30 acre can be filled to a depth of 15 feet and is lined with 12 inch native clay,the combine capacity is 295 million gallon. Each pond is equipped with one with one electronic aerator of 75 horse power located near the outlet. This aerator will be switch on when DO level is below 1 ppm.

During normal operation only one Polishing pond is operating and this pond is usually 4 feet depth or less. Which will enable as to maintain mill operation for about 20 days without discharging waste water to the river.

The ASB produce 10,900 lbs suspended solid per day, 50 % of which is expected to be removed and going to the polishing pond at least only 5,450 lbs (50 %).

DIFFUSION HEADER.

This mill has two diffuser header, one header can discharge up to 15 MGD ; while the other header discharge 15 - 45 MGD.

B. 3 Other Installation.

DOMESTIC LAGOON.

This lagoon is provided for domestic waste water, consisting of two parts with total capacity of 175,000 gallon. The capacity first lagoon is 100 000 gallon and the second, having a capacity of 75,000 gallon.
The first lagoon is equipped with 3 horse power aerator and second lagon equipped with 1 horse power aerator. This lagoon is able to reduce up to 90 % BOD and TSS.

SOLID WASTE

Coarse particle on bar screen will be taken to Marlboro country Land Fill; solid waste from the clarifier dewatered up to 50 % is also removed to Marlboro land fill.

EVAPORATOR AND RECOVERY BOILER.

The wood becomes paper while the lignin processed with cooking liquor,result of which is called black liquor. The black liquor goes to the evaporator to remove

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water, leaving the mass organic material to be burned in the recovery boiler to produce steam while the remaining inorganic chemical is called green liquor. Another function of the recovery boiler is to reduce odor.

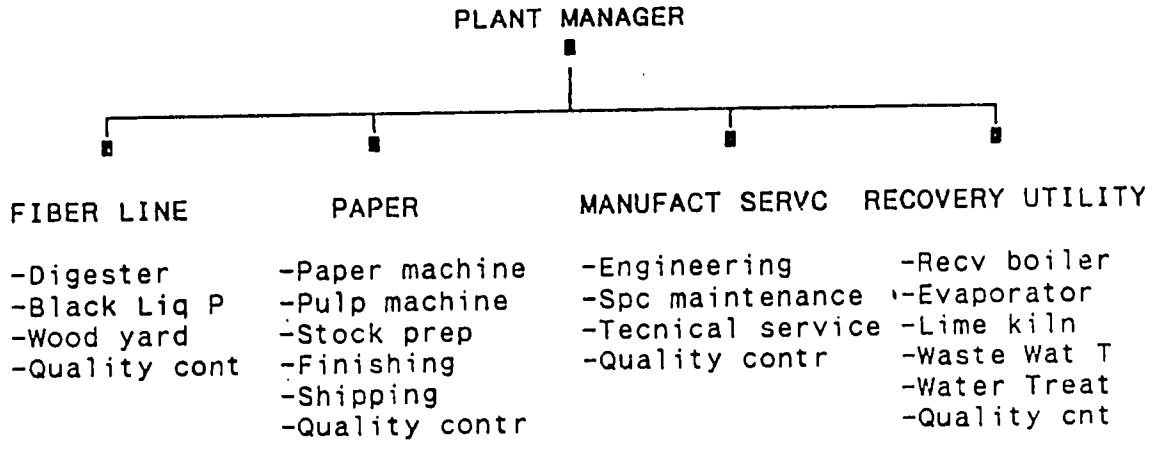
LIME KILN (Ahlstrom)

Lime kiln is to cook green liquor with new lime to make fresh white cooking liquor, for processing chips in the digester.

THE WASTE WOOD BOILER.

The waste wood boiler , has another name called Hogged fuel boiler, it can consume almost anything to produce steam , tree bark solid filtered from waste water , etc.

C ORGANIZATION



TECHNICIAN; (Independent)
- Give tools
- Basic maintenance.

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III. 3. SONOCO PAPER MILL CORP, HARTSVILLE , SOUTH CAROLINA

The mill is founded in 1900, with the main product such as paper roll,paper spiral,OCC,medium liner, bronze sack ,etc This corporation has another branch in Canada and in Mexico.

The mill produce pulp from chips and using recycle fiber from the public, to produce pulp this mill use soda pulping process.

With eight paper machines, one is a fourdriner type and the others are cylindermould , each paper machine has a capacity of almost 500 ton per day, so the total capacity 4000 ton per day.

To produce pulp and paper need 3,5 - 4 MGD water consumption, and 2 - 3 MGD non contact water.

A. PAPER MAKING PROCESS.

Chips as raw material from this mill is being cooking in the continuous digester with a temperature of 305 ^{0} F and pressure is 150 psi. Using Na_2CO_3 as additive in this process and producing black liquor from the digester to be sent to the recovery chemical and Na_2CO_3 can be taken out in the recovery. In order to yield darker OCC , Na_2CO_3 in used at 250 pound every ton product. Total yield of this process 81 %. Besides using virgin pulp this mill use secondary fiber as raw material for producing medium liner.

This is processed with Voith Equipment, which finally is being supplied to the 8 paper machines, capacity of each is 500 ton per day.

B. WASTE WATER TREATMENT

Waste water from each unit such as pulping, washing, cleaning recovery etc, is processed in two types of manufacturing effluent

Anaerobic treatment.

This installation consist of one lagoon with a capacity of 24,3 MGD,design water level 199,0 inch. The lagoon is covered with plastic,and treating water need 5 days time, from this lagon will go to aerobic treatment.

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As the pulping process used Na2CO3 and Na2SO3, therefore the waste water after treatment in an aerobic system produced H_2S gas which is very hazardous and corrosive.

Aerobic process.

Treated water from the anaerobic process going to aerobic process. The lagoon has a total capacity of 40 MGD, equipped with two type aerator 4 aerator with 100 horse power and 16 aerator with 50 horse power , it has a total 1200 horse power. Treated water in this lagoon need 10 days time, this system has an efficiency of 95 % removal. So if the quality of waste water in - let has 800 - 700 BOD, treated water flowing out of this lagoon can be expected with only 40 - 35 ppm BOD.

Settling basin

Finally treated water processed in settling basin, there are two settling basin no I and no II. Treated water before going to the river passes the out let which is equipped with a flow sampling equipment to take some sample for analysis in the lab and monitoring station

Beside producing waste water which need to be processed in waste water treatment installation, the mill also produce no contact water, which can be thrown directly to the creek, with the temperature of 1050 F

RECOVERY CHEMICAL

Black liquor produced from the pulp plant goes thru three stage evaporator to increase its concentration from 8 % to 40 %, and from 40 % to 50 % in two stage evaporator.
Furthermore the black liquor is processed in the KILN (BARTELLOTT - SNOW with 100 feet long and 10 feet diameter) result of which sent to dissolver no 3 and the ash is sent to dissolver no 1. Both of them finally will be in dissolver no 2 then to processed to Carbonate solution holding tank to be washed in washer filter. After passing the Carbonate clarifier, the Sodium Carbonate is kept in the storage tank ready for used in the pulp plant.

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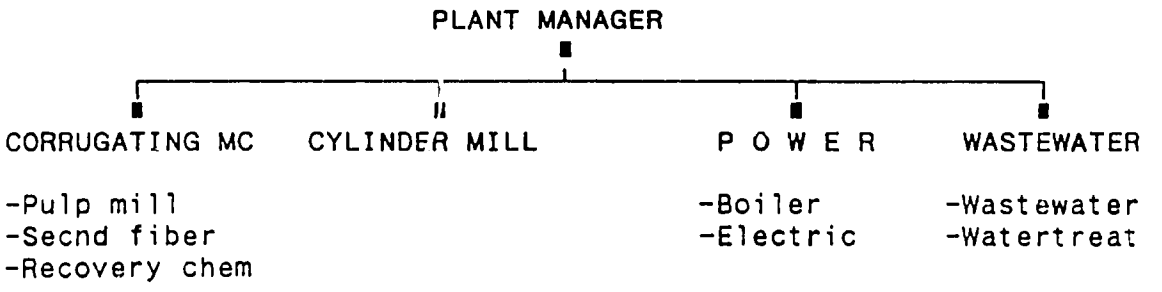
SOLID WASTE

Solid waste in this mill is handled in three types ;
first, burned in the incinerator
second, sent to the waste boiler to be burned for example solid waste from chipping process.
third, sent to the land fill , for example waste from boiler i.e. ash.

C. ORGANIZATION



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III. 4. UNION CAMP, FINE PAPER DIVISION, EASTOVER , SOUTH CAROLINA

Union camp pulp and paper division is located in Eastover, South Carolina with a 4000 acre construction area, and 150 acre for it's mill. With 800 employees which it separated in to four shift.This mill only produce fine white paper. They use river water for the production ,they need 1400 gallons fresh water for one ton product .

A PAPER MAKING PROCESS

This mill has two paper machines and one pulp machine

Paper machine I.

Starting operation in August,1984 all the equipment is from Voith --Duo former, with a capacity of 800 ton per day producing fine paper 46 - 55 gsm.

Paper machine II.

Start up in July, 1991 Producing fine paper 35 - 46 gsm the equipment is from Beloit Bil Baie III capacity this machine 660 ton per day.

Pulp Machine.

This pulp mill uses trees as raw material. The chipping process goes to two continuous digester for delignification process then to bleaching process . This equipment is a combination of Valmet and Ahlstrom

For the process they use Chlorine dioxide, Ozone, and Oxygen for bleaching.

Design capacity is 1850 ton per day, this machine in able to produce two kind of pulp i.e. soft wood and hard wood and starting operation on April, 1991. They produce 330 ton of pulp for the pulp market.
pulp.

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B . EFFLUENT TREATMENT.

Effluent treatment is meant to reduce organic matter as BOD,Solid (TSS) , color , also pH . There are two kind of first treatment system ; sanitary treatment and primary clarifier treatment. The result of both treatment is sent to the mixing box for secondary treatment.

Clarifier. (primary treatment.)

Effluent from wood yard, paper mill , pulp mill, recovery plant, evaporator etc through the pipe filtered in the bar screen going to primary clarifier no I. The sludge is carried to the dewatering process, This system can remove 95 % of solid waste.

Mixing box.

Treated water from clarifier no I and no II are mixed with effluent from bleach plant and sanitary treatment in mix box from the mixing box ,treated water goes to ASB through splitter box.

Aerated Stabilization Basin. (secondary treatment)

Effluent treatment for ASB splitter box separate in 2 series, one goes to ASB I and ASB II. Both of them had the same capacity. Each ASB equipped with 9 electrical aerator of 75 horsepower for mixing and aerating, treated water in ASB need 6 days time.
Treated water from ASB I goes to ASB no 3 and ASB II goes to ASB no 4.

Effluent holding pond

From the secondary treatment, the treated water is stored in the effluent holding pond which finally lead to the river through diffuser. This treated water has 10 ppm BOD, and so is the TSS

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C. AIR POLLUTION CONTROL

In the process of production , this mill also produce gas such as SO_2, NOX Cl_2 which can pollute the air and this gas produce by the recovery furnace, power boiler , bleach plant etc. To control this pollution the mill uses precipitator,incinerator. Therefore low Sulfur fuel preferable for power boiler.

D. SOLID WASTE

The main resource of solid waste is primary clarifier as sludge, power boiler as a fly ash, Pulp Mill produce reject knot. Almost all solid waste are sent to land fill of the mill.

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III. 5 WEYERHAEUSER PAPER Co, OGLETHROPE, GEORGIA.

This mill is founded in 1978 located in Oglethrope, Georgia. Producing 750 ton pulp per day, all the product is for the pulp market. The first time to produce 1 ton pulp this mill consume 17,000 gallon fresh water, but now water consumption is reduced to 10,000 gallon per ton product.

In the delignification process the mill uses 100 % Oxygen, furnished with recovery plant, evaporator, recovery boiler to reduce air pollution.

For the bleaching process using Chlorine and Chlorine dioxide at the comparison of 70 % Chlorine dioxide and 30 % Chlorine.

The use of Chlorine dioxide can be decreased but effecting the brightness of the pulp produced, therefore until now researches are still being conducted to replace it.

A. PAPER MAKING PROCESS

CHIPS YARD

To fulfill the need of chips as the raw material in pulp making, there are two ways can be done ;

- Making chips in the mill with wood as raw material to be cut in slasher, and sent to the debarking drum. Result of which is sent to chipper. Then, the chips are kept in the chips surge basin. Bark i.e. solid waste from debarking drum can serve as fuel for the boiler.
- Chips purchased from other mill are sent to the metal detector.

The two above kind of chips are put together in scalping screen, the oversize (reject) is sent back in the chipper process. After filtering in the scalping screen, the active chips as the result of the process are sent to the next process that is digesting process.

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DIGESTING.

After the previous process the chips the go to the impress - vessel where then it will go to the vapor phase digester, before coming to the digester, it will first go to the diffusion washer tank. There are two KAMYR digester which each of them has a capacity of 270 mt.

Both digester, pulp enter to 2 stage brownstock diffusion and washer, finally to high density storage.

Chips,after passing filter in knotter, enter in to decker and oxygen reactor, then going to blow tank and further 3-stage-oxygen -washer.

It finally going to the pre bleaching tank. There are two tanks each having the same capacity of 250 MT . Chips is ready for bleaching process and finally to become pulp.

BLEACHING PROCESS.

In the bleaching process a good pulp need caustic soda and oxygen to be pumped to the top tower (to get a good mixture) then going to the diffusion washer stage.

Then ClO_2, H_2SO_4, Na_2CO_3 is added to the pulp and pump to the D2 tower (for washing with white water)

Finally the pulp are kept in high density storage. This mill has two high density storage which each of them has the capacity of 210 ADMT.

STOCK PREPARATION AND DRYER.

Pulp from high density storage, enter to machine chest with 15 MT capacity, through Silo and pressure screen to fourdriner.Pulp pressed and dewatered in this machine and heated on the dryer. a series of dryer contain 29 phases, final pulp from jumbo roll scaled and labelled and stored in the warehouse. This warehouse is able to file it up to 10,000 MT, with ready to be sent to the costumer.

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B. WASTE WATER TREATMENT

Primary treatment.

Waste water from the mill flow in to canal with a bar screen going to a primary clarifier,with 1,75 million gallon treated water,it has 3 hour resistant time. In this clarifier there is also pH adjustment. Solid waste produced goes to screw press for dewatering and remove this solid waste to the landfill.
Theclarifier able to remove BOD and TSS up to 90 % .
Ifsomething happen in this waste water installation the mill has prepare on emergency spill basin placed before the bar screen.

Secondary treatment.

Treated water from the primary clarifier goes to firstlagoon, of 25 acre it has 15 million gallon, with 12 aerator. Treated water in the first lagoon has retention time for 5 days.treated water leaving the first lagoon goes to the second one covering 22 acres with 6 aerators, it has resistant time for 9 days.

Stabilization Pond

In order to make treated water to become cleaner, from the second lagoon it goes to the stabilization pond, this pond equipped with 1 aerator covering 25 acres and treated water has 10 daysresistant time
Beside that, the installation has a holding pond with660 million gallon capacity, which function for keepingtreated water from the stabilization pond.

This treated water need 24 days resistant time as long it is treated ; Before treatment in this installation the in-let effluent has 500 ppm BOD. After treatment, the out let is expected to only 35 ppm BOD.

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C. RECOVERY CHEMICAL

black liquor from the pulping process goes to the evaporator, collected in the " process condensate tank ", it is then washed in post oxygen washer and stored in the " cylinder mould filtrate tank ", solid of which is 1 %, this tank has a capacity of 750 million gallon.

From this 1 % solid of black liquor it is concentrated to 40 %solid, this need to be sent to the first stage filtrate tank. The next is to go to the extraction tank and filtered.

Result of above process is collected in flash tank, from then on black liquor increased their concentration up to 67%. to be stored in two tank, each has a capacity of 130 million gallon. The next process is in the recovery boiler, green liquor is produced from the recovery boiler going to the clarifier.

From the clarifier its goes thru to the slacker where caustizer process take place the next process of it produces white liquor. The white liquor is ready for use in the digester and Oxygen reactor.

D. AIR POLLUTION CONTROL

For the weak gas
Using incinerator to reduce pollution. The source of pollution is from power hose , pulping vessel passed to moisture separation finally sent to smell dissolving tank vent and to recovery boiler.

For the strong gas
Gas from the evaporator area and from pulping unit are passed toliquid ring compressor goes to " moisture separator " finally separated to stack, power boiler and to calciner.

F. TRAINING.

Every week employees from the operator level all department spent 2 hours for training especially in environment impact held by Environment Technical Department. For the new employee sent to the some university in Georgia and to institution before they start working in this factory.

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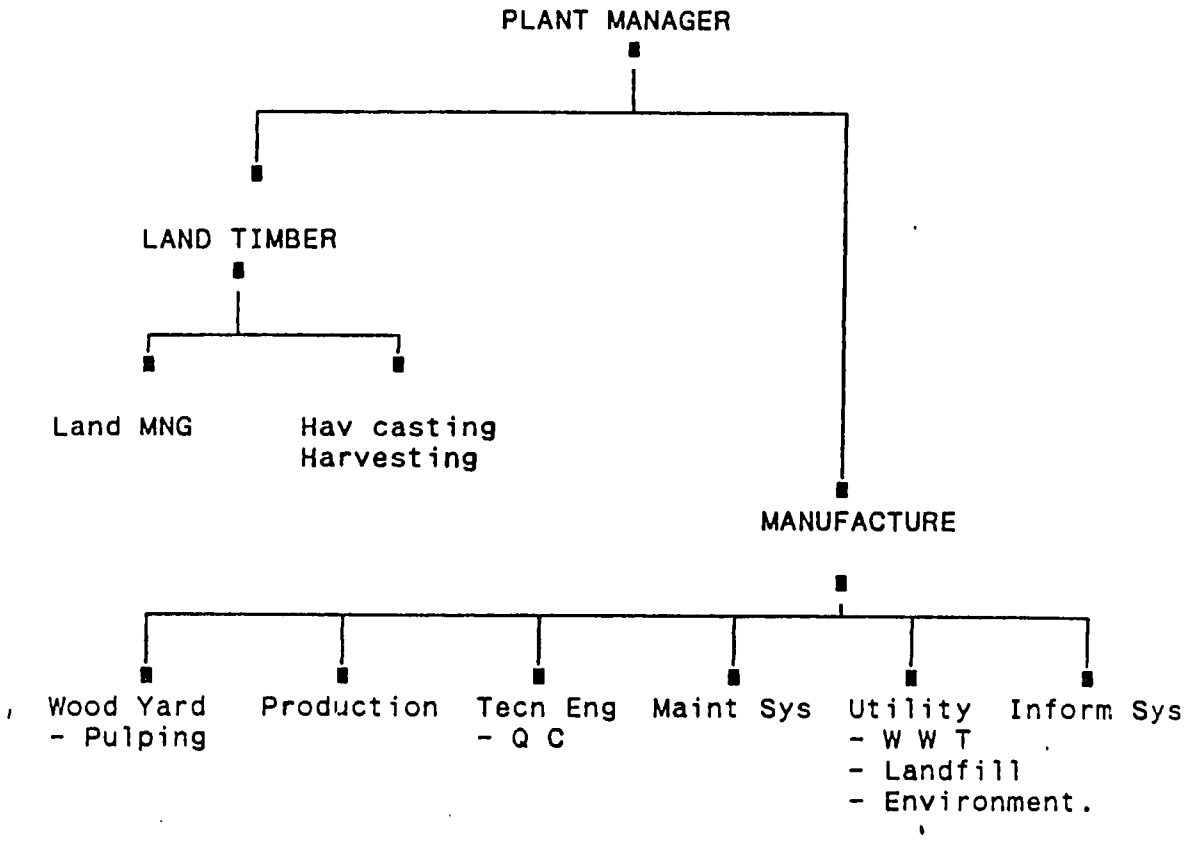
G. ORGANIZATION



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IV CONCLUSIONS AND RECOMMENDATIONS.

Conclusion consists of three groups ;

a. Technology.
b. Management and organization.
c. Relationship between Government and Industry.

A. TECHNOLOGY.

- Oxygen delignification.

The function of this process is to separate lignin and natural glue from the fiber using Oxygen. It's a highly efficient process in which Oxygen are using to break-down and remove lignin. Almost all pulp and paper mill use oxygen for delignification, as in Union Camp, Marlboro Mill and Wayerhouser.

- Bleaching process

For bleaching, although Chlorine and Chlorine dioxide are used,but a part of pulp and paper mill now are trying to use another alternative i.e. Ozone, since it is quite friendly to environment.

- Chemical and Boiler Recovery.

In order to reduce air pollution and odor recovery chemical and recovery Boiler is used since it will produce a chemical which will be used in bleaching process.

- Waste water treatment.

Generally pulp and paper mill in the US have good installations for waste water treatment, including primary and secondary treatment with lagoon. Some mill still apply chemical treatment one of them SONOCO.

That pulp and paper mill in the US is completely furnished, with all equipment needed to preserve clean and healthy surrounding.

We can say as the industry as high responsibility to the environment and the regulation is very, very STRICT.

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B. MANAGEMENT AND ORGANIZATION

Mill organization is quite simple, not to complicated and it is quite advantageous. If trouble and problem arise, the mill can easily handle it . This is the result of the educational background,high responsibility and capability of the employee. Regular and systematic training is still being held among other Weyerhaeuser.

The application of TQC and ISO 9000 in several mill is quite good, by providing Quality control in every department such as in Marlboro Mill

C. RELATIONSHIP BETWEEN GOVERNMENT AND INDUSTRY.

For new decision making in the US the term of " Top - Down "is applied. It mean that before making a new decision,there must be public hearing and public opinion .

In this case, organization such as NCASI is very helpful to the government and industry in making anew decision by giving information and acting as a third person .

This organization is indeed needed in Indonesia to help the Industry and the government.

This program will be more effective if enough time is given to the participant to know more about the detail of pulp and paper technology in order be able to apply it in practice, it will be helpful that the participant is given the chance to take part or get involved in the pulp and paper making process.

To arouse the interest of Industry in waste minimization and waste assessment go low cost and no cost, it will be good to make a pilot plant in Indonesia by inviting several Industrial representative in Indonesia to have a look directly at the pilot project waste minimization and assessment. The place can be chosen in one of the mill in Indonesia

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APPENDIX A

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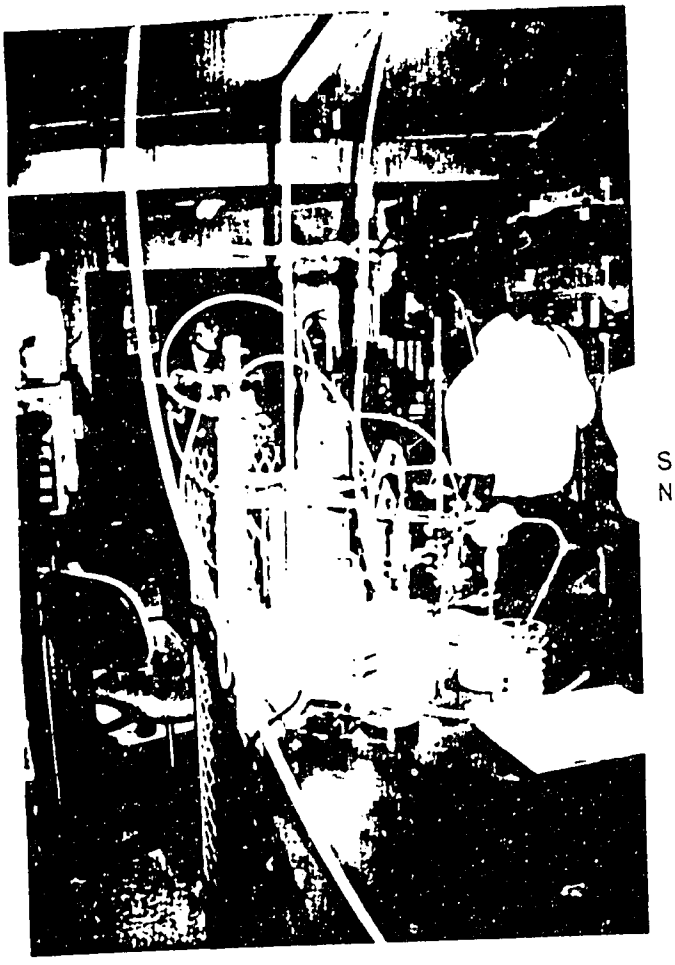
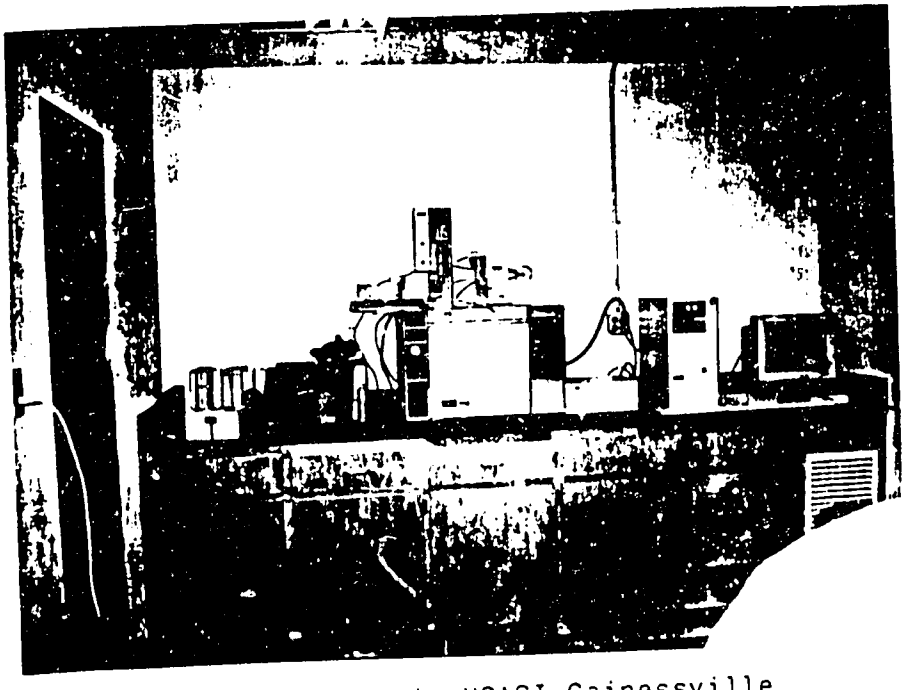


Sampel preparation room
NCASI , Gainessville.



HPLC instrument in NCASI Gainessville

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Separate gas Analyser, in NCASI

Newest HPLC

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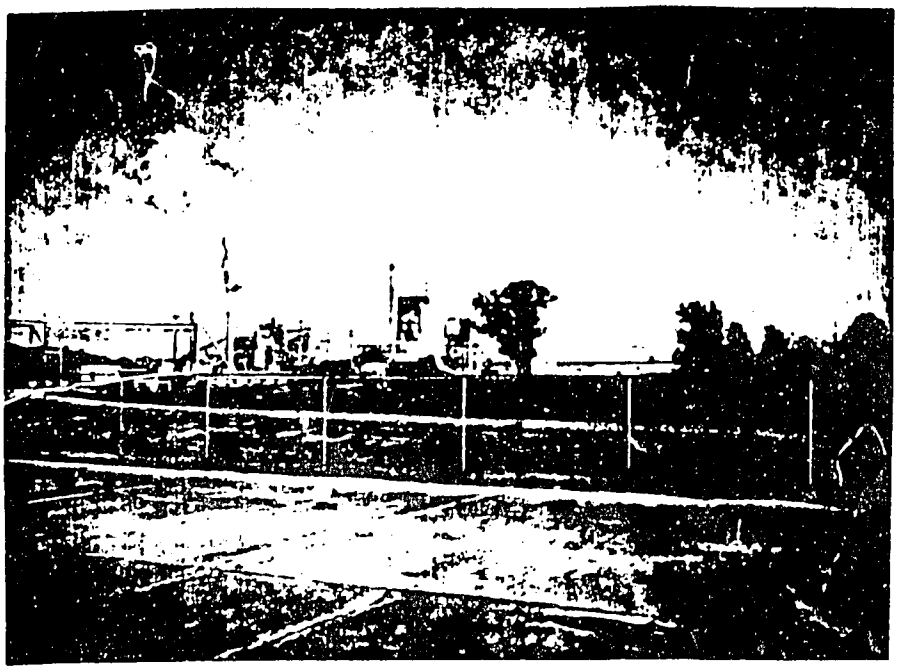

Marlboro Mill

Wood Yard

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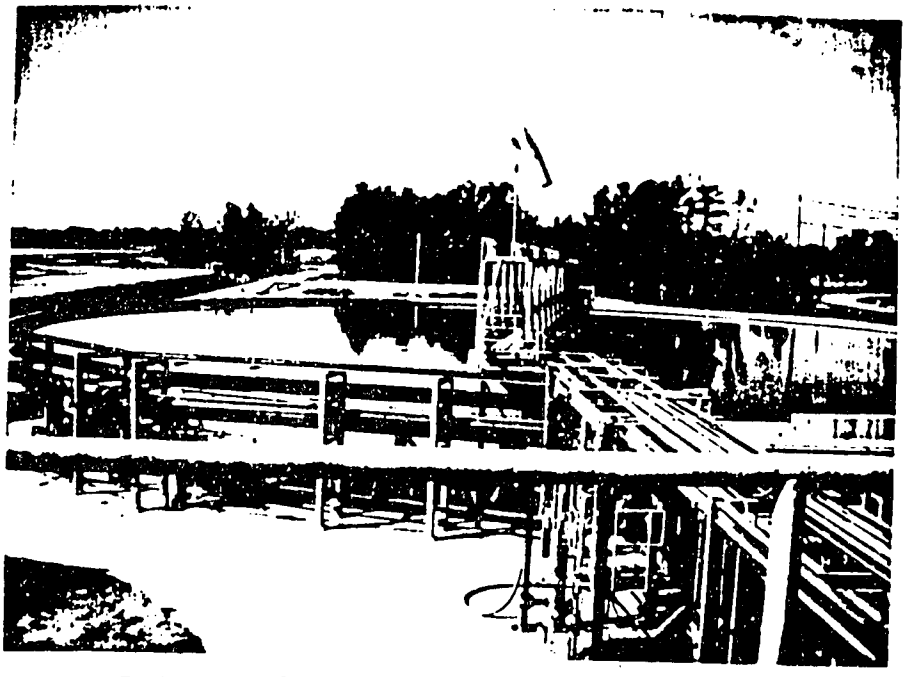
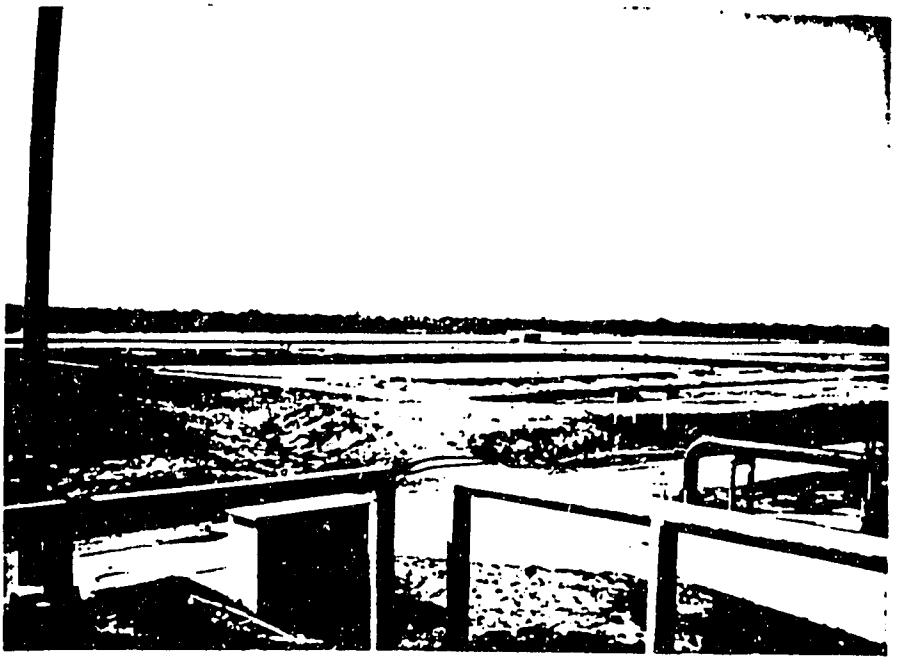


Primary Clarifier Effluent treatmant



Lagoon, in Marlboro Mill

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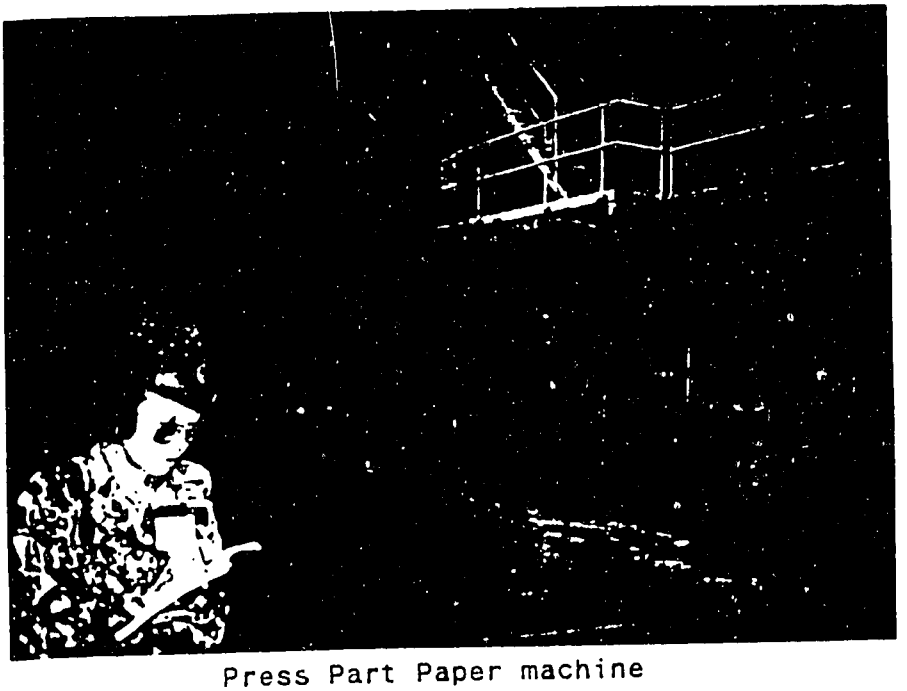
Recovery Boiler and Chemical



Press Part Paper machine

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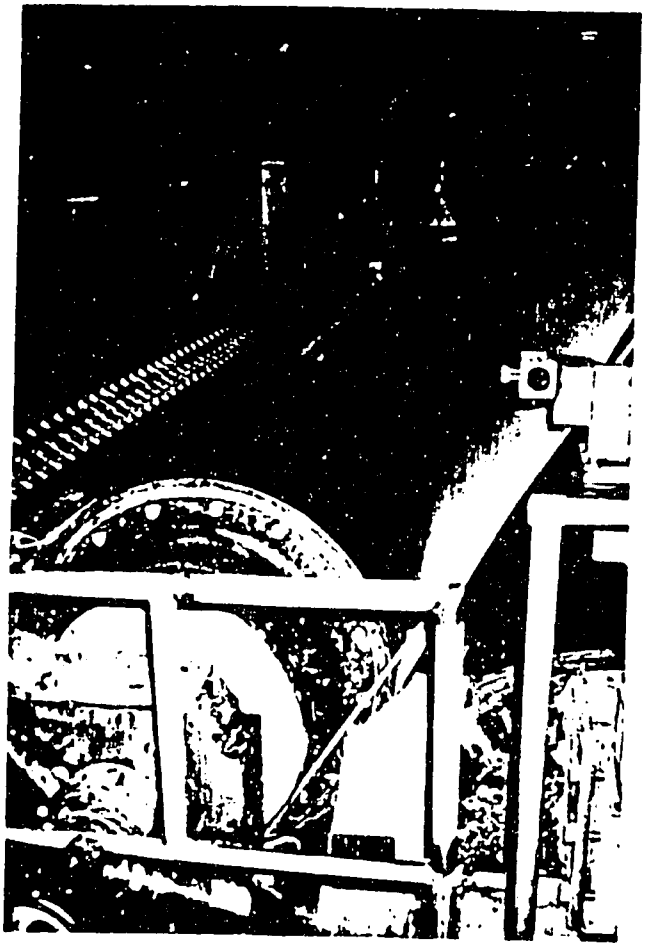
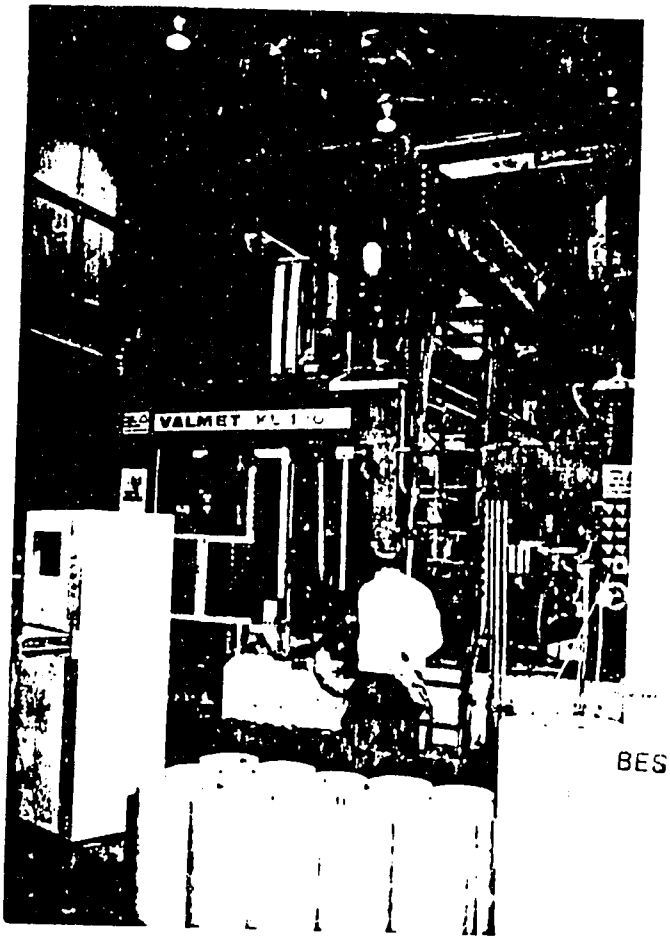


Size press in paper machine



Double cutter

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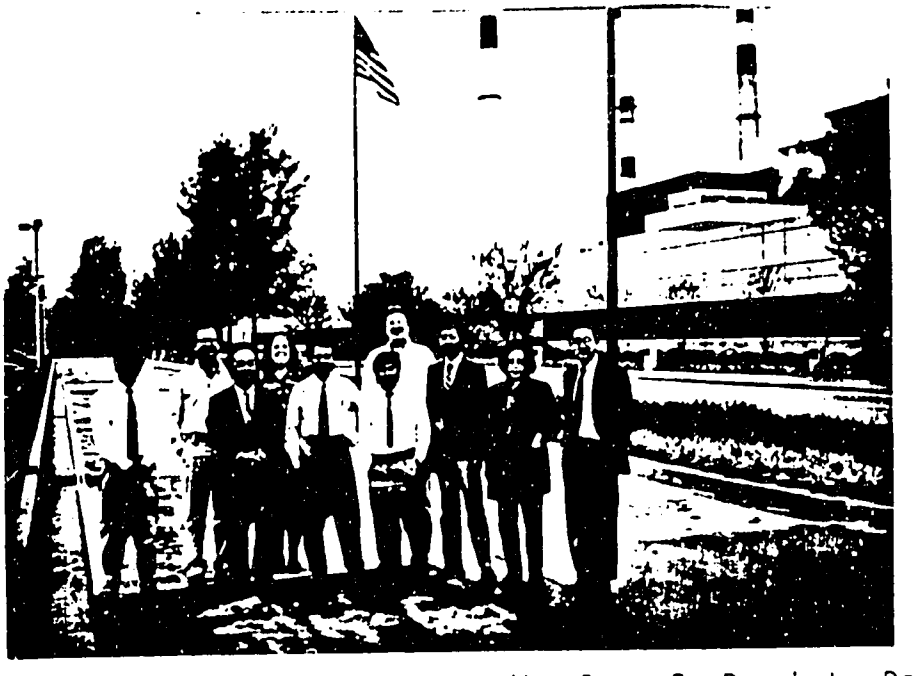
Union Camp,Pulp
and Paper mill



Zulkifli, Foy, Widya, Secretary. Warih, Iyan S, Dough L, Darono, Hendayani, Charles (from left to right) in Union Camp background

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Weyerhaeuser Pulp Mill

Meeting in Weyerhaeuser Pulp Mill

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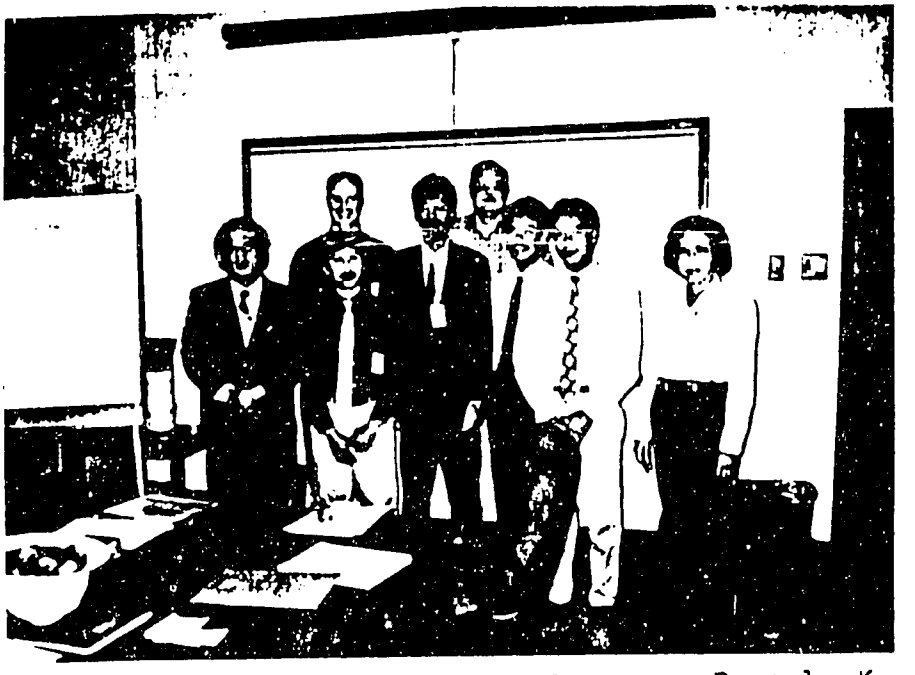

Widya T, Frank D W, Iyan S, Darono, Russel K, Wari Zulkifli,Hendayadi after meeting in Weyerhaeuser.

High Pressure storage Tank Weyerhaeuser.

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Meeting with Vice Precident WEC,in New York office

Meeting with Dr Isaiah Gellman, President NCASI,in head office
260 Madison Avenue,New York.

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APPENDIX B

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World Environment Center 419 Park Avenue South Suite 1800 New York, NY 10016 US.
Tel: (212) 683-4700 Telex: 261290 Envirocent FAX: (212) 683-505

AGENDA FOR U.S. STUDY TOUR
INDONESIAN DELEGATES

Saturday, October 23, 1993

- Gainesville Fl
- CCH arrives
- Fairfield Inn Mariott Hotel
  6901 NW 4th Blvd.
  Gainsville, Fl 32606
  Tel: 904 332 8292
  Fax: 904 332 8292
  (same as tel - wait for them to switch over when faxing)

Sunday, October 24, 1993

- Gainesville, Fl
- Delegates arrive
- Fairfield Inn Mariott Hotel
  (same as above)

Monday, October 25, 1993

- Gainesville, FL
- Meeting at NCASI 9:00am
- Mr. Ashok Jain
  Regional Manager
  3434 SW 24th Avenue
  Gainesville, Fl 32607
  Tel: 904 377 4708 x 224.
  Fax: 904 371 6557
- Fairfield Inn Mariott Hotel

Tuesday, October 26, 1993

- Travel to
- Florence, SC
- Ramada Inn Hotel
  2038 West Lucas Street
  Florence, SC 29501
  Tel: 803 669 4241
  Fax: 803 665 8883

Wednesday, October 27, 1993

- Bennettesville, SC
- Meeting at Willamette Mill 9:00am
  Mr. James Myers
  Plant Manager
  P.O. Box 673
  Bennettsville, SC
  Tel: 803 479 0200 exit 164
  Fax: 803 479 0608
- Ramada Inn Hotel

Thursday, October 28, 1993

- Travel to
- Columbia, SC
- Ramada Town House
  1615 Gervais Street
  Columbia, SC 29201
  Tel: 803 771 8711
  Fax: 803 252 9347

Friday, October 29, 1993

- Eastover, SC
- Meeting at Union Camp 9:00am
  Mr. Wes Foy
  Technical Control Manager
  P.O. Box B
  Eastover, SC 29044
  Tel: 803 353 7700
  Fax: 803 353 7981
- Ramada Town House

Saturday, October 30, 1993

- Travel to
- Atlanta, GA
- Embassy Suites Hotel
  3265 Peachtree Road, NE
  Atlanta, GA 30305
  Tel: 404 261 7733
  Fax: 404 262 0522

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Sunday, October 31, 1993

- Atlanta, GA
- Free day
- Embassy Suites Hotel

Monday, November 1, 1993

- Travel to
- Perry, GA
- Comfort Inn Hotel
  1602 Sam Nunn Blvd
  Perry, GA 31069
  Tel: 912 987 7710
  Fax: 912 987 7710 (same as tel
  - wait for switch over)

Tuesday, November 2, 1993

- Oglethrope, GA
- Meeting at Weyerhauser 9:00am
  Mr. Russell Stevenson
  Plant Environmental Manager
  P.O. Box 238
  Oglethrope, GA 31068
  Tel: 912 472 2527
  Fax: 912 472 5508
- Comfort Inn Hotel

Wednesday, November 3, 1993

- Travel to
- Atlanta, GA/New York
- Roger Smith Hotel
  501 Lexington Avenue
  New York, NY 10017
  Tel: 212 755 1400
  Fax: 212 319 9130

Thursday, November 4, 1993

- New York, NY
- Meeting at NCASI 9:00am
  Dr. Isaiah Gelman
  Vice President
  260 Madison Avenue, Suite 1105
  New York, NY 10016
  Tel: 212 532 9000
  Fax: 212 779 2849

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Friday, November 5, 1993

- Delegation departs from New York, to Indonesia

PULP AND PAPER STUDY TOUR SCHEDULE
OCTOBER 23 - NOVEMBER 3, 1993

Sat. 23	Sun. 24	Mon. 25	Tues. 26	Wed. 27	Thurs. 28	Fri. 29
Gainesville, Fl. CCH Arrives	Gainsville, Fl. Delegates Arrive	Gainsville, Fl. **NCASI** **Ashok Jain,** **Regional Manager**	Depart Gainsville, Fl for Florence, SC	Drive from Florence, SC to Bennettesville, SC **Willamet Mill** **James Myers** **Plant Manager**	Drive from Bennettesville, SC to Columbia, SC	**Columbia, SC to** **Eastover, SC** **Union Camp** **Wes Foy** **Technical** **Control Mgr.**
Hotel: Fairfield Inn Marriott 6901 NW 4th Blvd.	Hotel: Fairfield Inn Mariott 6901 NW 4th Blvd.	Hotel: Fairfield Inn Marriott 6901 NW 4th Blvd.	Hotel: Ramada Inn 2038 West Lucas Street	Hotel: Ramada Inn 2038 West Lucas Street	Hotel: Ramada Town House 1615 Gervais Street	Hotel: Ramada Town House 1615 Gervais Street

Sat. 30	Sun. 31	Mon. 01	Tues. 02	Wed. 03	Thurs. 04	Fri. 05
Drive from Columbia, SC to Atlanta, GA	Atlanta/ Free Day	Drive from Atlanta, GA to Oglethrope, GA	Oglethrope **Weyerhauser** **Russell** **Stevenson** **Plant Env. Mgr.**	Drive to Atlanta Depart for NY	NY, NY **NCASI** **Dr.Isalah Gelman** **Vice President**	Delegates depart from NY to Indonesia
Hotel: Embassy Suites 3265 Peachtree Rd	Hotel: Embassy Suites 3265 Peachtree Rd	Hotel: Comfort Inn Hotel 1602 Sam Nunn Blvd	Hotel: Comfort Inn Hotel 1602 Sam Nunn Blvd	Hotel: Roger Smith Hotel 501 Lexington Avenue	Hotel: Roger Smith 501 Lex. Ave.	

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"OUR ENVIRONMENT...A SHARED COMMITMENT"

INDONESIA PULP AND PAPER INDUSTRY GROUP VISIT

OCTOBER 29, 1993
ROOM 137

AGENDA

9:00 A.M.	WELCOME / INTRODUCTIONS
9:15 A.M.	GROUP'S OBJECTIVES / AGENDA
9:30 A.M.	EASTOVER MILL OVERVIEW
10:00 A.M.	EFFLUENT TREATMENT
10:30 A.M.	AIR POLLUTION CONTROL
11:00 A.M.	ODOR CONTROL
11:30 A.M.	SOLID / HAZARDOUS WASTE
12:00 NOON	LUNCH
1:00 P.M.	UNION CAMP BLEACHING TECHNOLOGY
2:00 P.M.	MILL TOUR
4:30 P.M.	EXIT

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APPENDIX C

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P.T. PAKERIN
PULP, PAPER, & CORRUGATED BOX MFG.

WIDYA TJAHYANA LAUWANGSA

Office :
Jl. Kertopaten 3, Surabaya – Indonesia
Phone : (31) 315173 (8 Lines)
Telex : 31140 IPMOB IA
Fax : 31 – 314245
Cable Add : PAKERIN Surabaya

Factory :
Desa Bangun Pungging -
Mojokerto
Phone : Krian 63

THE ENVIRONMENTAL IMPACT
MANAGEMENT AGENCY
(BAPEDAL)

Iyan Suwargana
Dit. Pengelolaan Limbah B3
Direktorat for Hazardous Waste Management

Arthaloka Building 11th Floor
Jl. Jendral Sudirman No. 2 Jakarta 10220 - Indonesia
Telp. (62-21) 5703419 ext. 209 225
Fax. (62-21) 5703365, 5702547

ZULKIFLI LUBIS
VICE SECTION CHIEF
ENVIRONMENTAL PROTECTION

PT INDAH KIAT PULP & PAPER CORPORATION

HEAD OFFICE : WISMA BANK INTERNASIONAL INDONESIA 6th FLOOR
JALAN M.H. THAMRIN KAV 22, JAKARTA 10350, INDONESIA
FAX NO. (021) 3104582-3 TLX NO. 61507 IKPP IA.
TEL NO. (021) 3104647, 3104452-3, 3104405-7, 3104424-7

BRANCH OFFICE : 85, JALAN TEUKU UMAR, PEKANBARU, INDONESIA
FAX : (0761) 33662 TLX : 56121 IKPP PBR.
TEL (0761) 21527, 32547, 33265.

PAPER MILL : KM 8, JL. RAYA TANGERANG - SERPONG, TANGERANG.
JAWA BARAT, INDONESIA.

PULP & PAPER MILL : KEC. SIAK, KAB. BENGKALIS, RIAU, INDONESIA
FAX : (0761) 33080, TEL (0761) 38988, 33630

P.T. Surabaya Agung Industri Pulp & Paper

Drs. Warih Supriadi
Quality Control Dept.

Head Office :
69 Jalan Bongkaran
Phone : (031) 333457 - 62 (6 lines)
Telex : 31430
Fax : 335043
Surabaya - Indonesia

Factory :
Driyorejo / Sapanjang
Kabupaten Gresik,
Phone : (031) 833363, 335085
707129, 707130
Jawa Timur
Indonesia

BALAI BESAR PENELITIAN DAN
PENGEMBANGAN INDUSTRI SELULOSA

ir. HENDAYANI T. ADISESHA, MS.
KEPALA BALAI PENELITIAN DERIVAT
SELULOSA DAN POLUSI

Kantor :
Jl. Raya Dayeuhkolot 132
Telp. (022) 502980-502871
Fax 502871 Bandung 40258

Rumah : 23
Jl. Hegarmanah
Telp (022) 1325
Bandung 40141

WEC World Environment Center

CHARLES JONG HWA HONG
DEPUTY PROJECT MANAGER

WORLD ENVIRONMENT CENTER
419 PARK AVENUE SOUTH
SUITE 1800
NEW YORK, N.Y. 10016

(212) 683-4700
TLX 421290 ENVIROCENT
FAX (212) 683-5033

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43

ASHOK K. JAIN
REGIONAL MANAGER
SOUTHERN REGION

P.O. BOX 141020
GAINESVILLE, FLORIDA 32614-1020
(904) 377-4708
FAX (904) 371-6557

James P. Witkowski
Environmental Engineering
Manager

FINE PAPER DIVISION
P.O. BOX B, EASTOVER, SC 29044

TEL: 803/353-7916
FAX: 803/353-7026

DR. ISAIAH GELLMAN
PRESIDENT
(212) 532 9000

NATIONAL COUNCIL OF THE PAPER INDUSTRY
FOR AIR AND STREAM IMPROVEMENT, INC.
260 MADISON AVENUE
NEW YORK, N.Y. 10016

Wesley A. Foy
Technical Control Manager

FINE PAPER DIVISION
P.O. BOX B, EASTOVER, SC 29044

TEL. (803) 353-762

W. Martin (Marty) Barfield
Technical Services Manager

Willamette Industries, Inc.
Marlboro Mill
P.O. Box 678
Bennettsville, SC 29512
(803) 479-0200
FAX: (803) 479-6603

CFREE®

Doug R. Lazar
Senior Application Engineer

UNION CAMP TECHNOLOGY, INC.
HWY. 601 S, P.O. BOX B
EASTOVER, SC 29044

TEL: 803/353-7917
FAX: 803/353-7026

Greg Fullenwider
Technical Specialist

Marlboro Mill
Willamette Industries, Inc.

Post Office Box 678
Bennettsville, SC 29512
803/479-0200
FAX: 803/479-0603

Pulp Division

Frank D. Wohrley
Environmental Project Engineer

Flint River Operations
Old Stagecoach Road
P.O. Box 238
Oglethorpe, Georgia 31
Tel (912) 472 5283
Fax (912) 472 5508

Weyerhaeuser

CFREE®

Doug R. Lazar
Senior Application Engineer

UNION CAMP TECHNOLOGY, INC.
HWY. 601 S, P.O. BOX B
EASTOVER, SC 29044

TEL: 803/353-7917
FAX: 803/353-7026

Pulp Division

Russell K. Stevenson
Plant Environmental Manager

Flint River Operations
Old Stagecoach Road
P.O. Box 238
Oglethorpe, Georgia 3
Tel (912) 472 5518
Fax (912) 472 5508

Weyerhaeuser

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APPENDIX D

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APPENDIX D 1

MARLBORO MILL ,Bennetsville,SC

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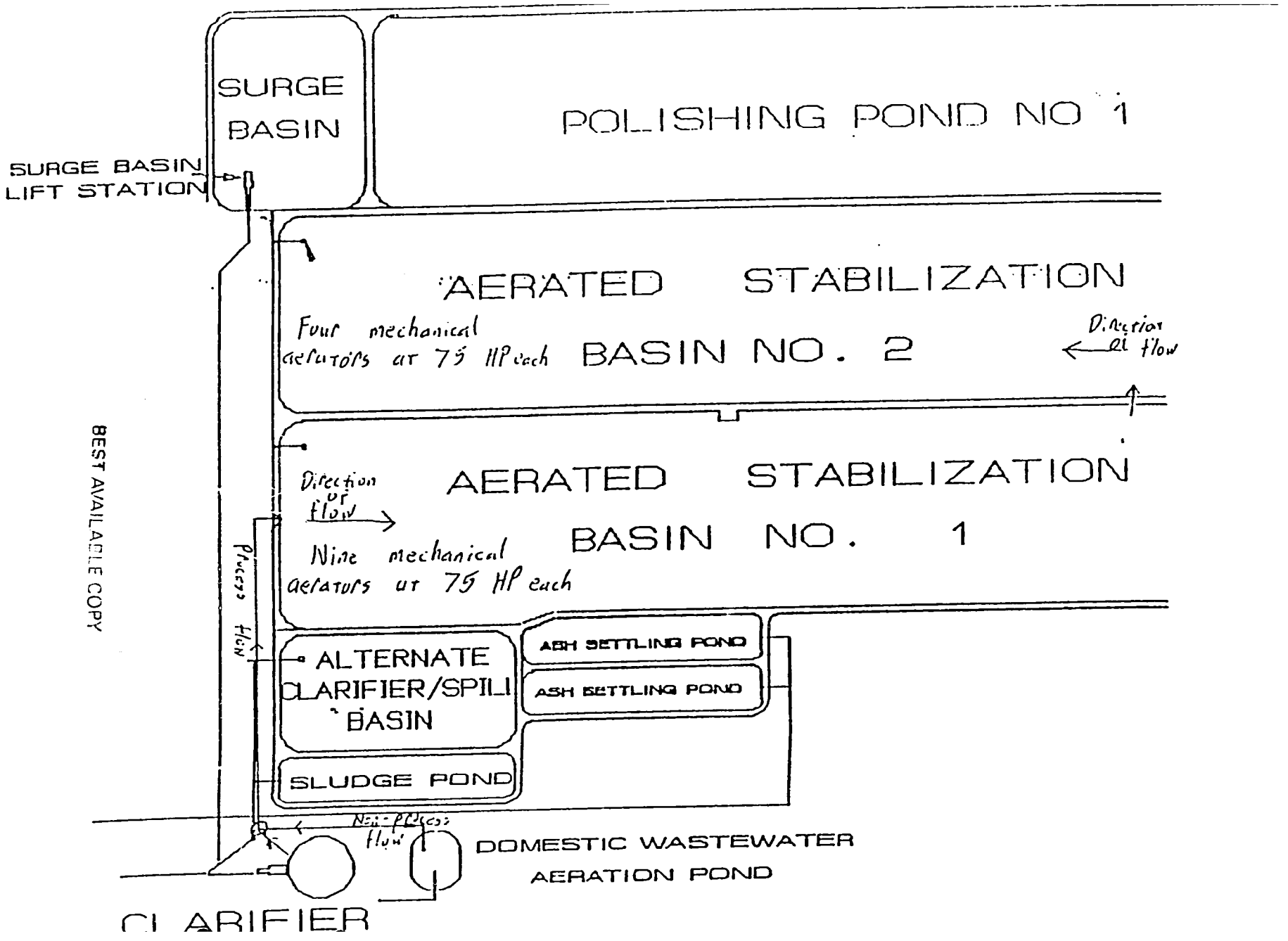

Figure 5. Spill and Surge Basins Layout

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Question 62

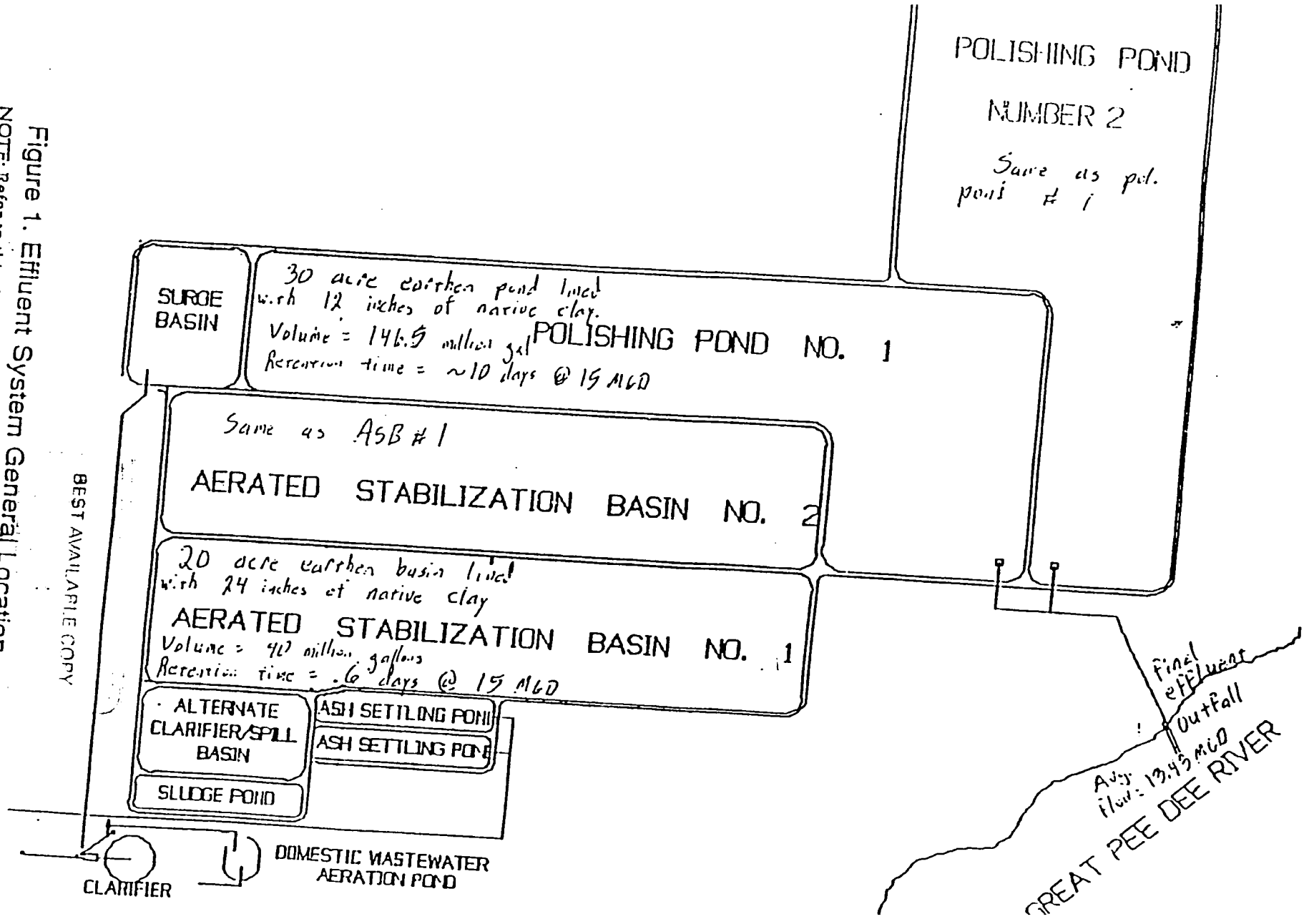

Figure 1. Effluent System General Location

NOTE: Refer to this drawing when you tour the effluent system.

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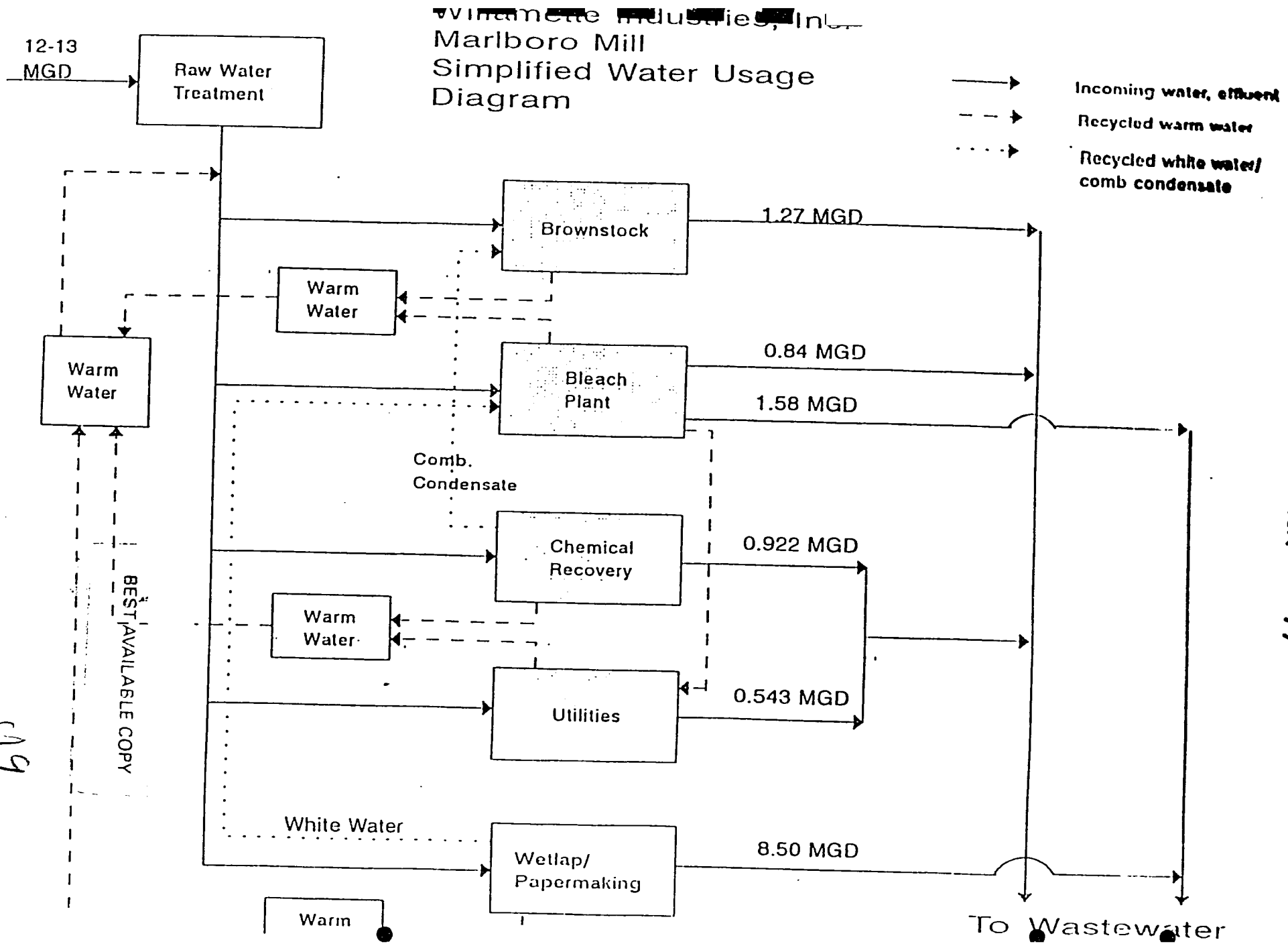

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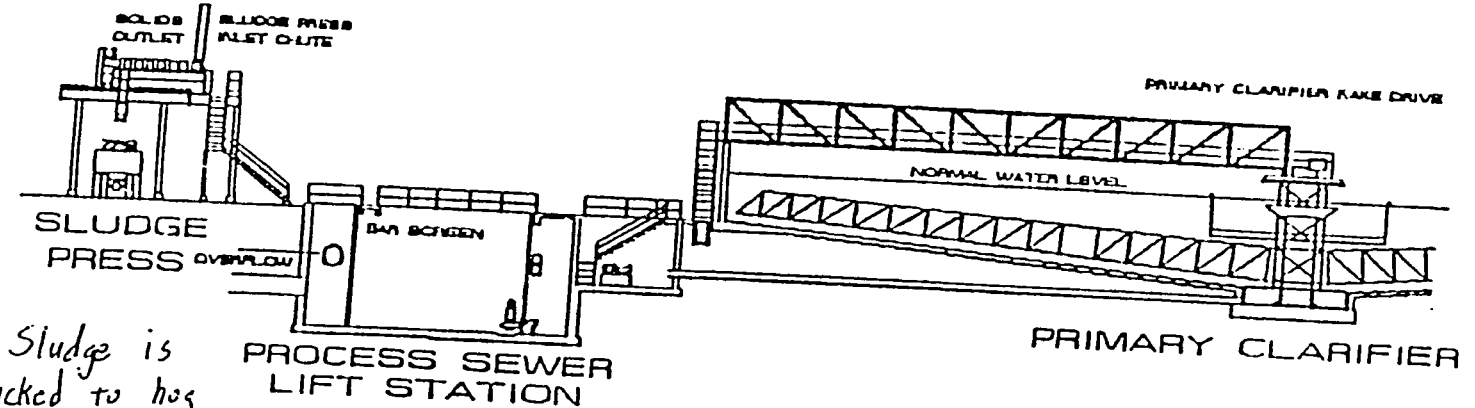
EXHIBIT # 41

Question 62



Sludge is trucked to hog fuel boiler

Figure 4. Lift Station Layout

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Effluent System Level

APPENDIX D 2

SONOC MILL ,Hartsville,SC

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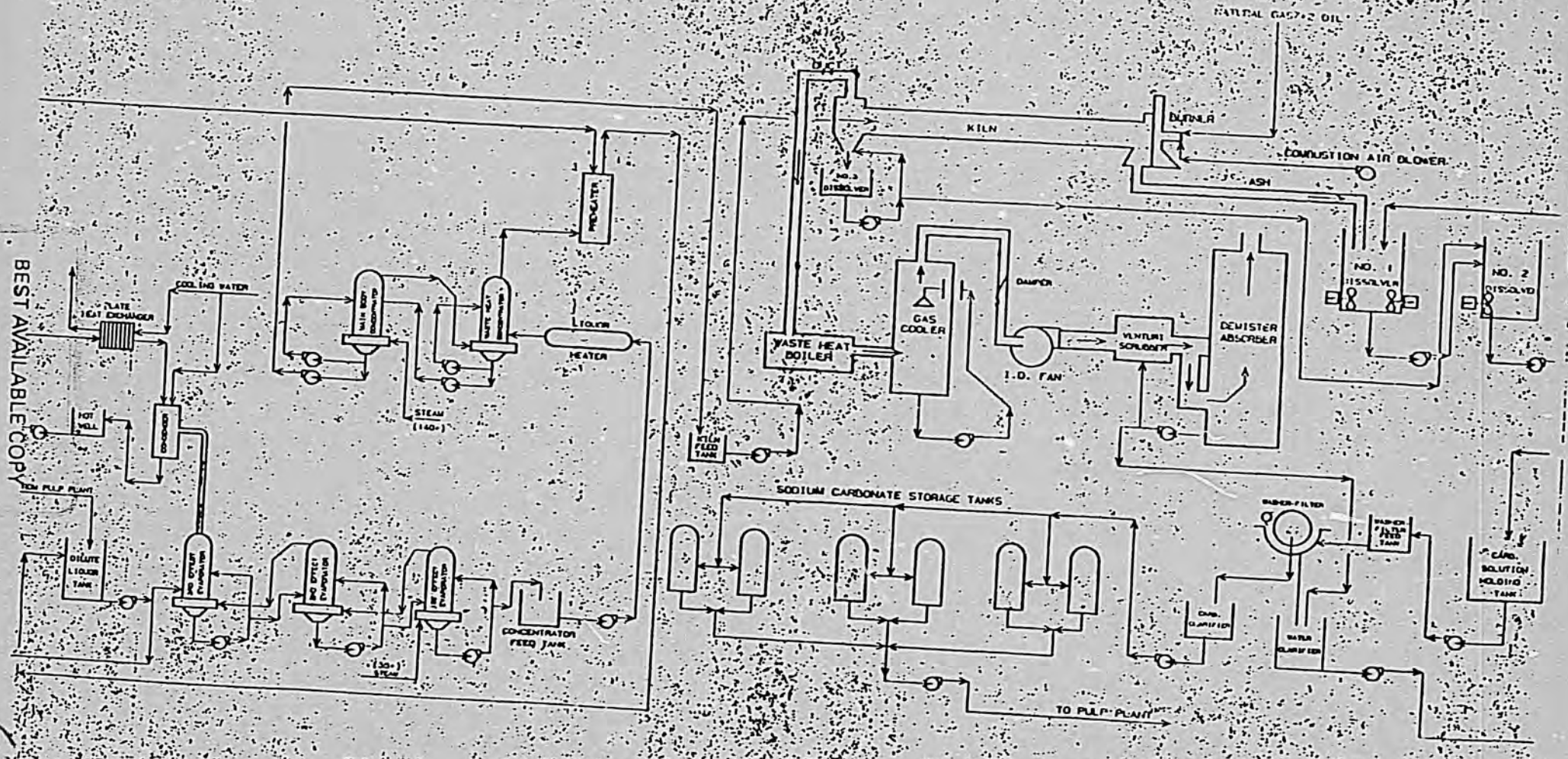
CORRUGATING DIVISION

CHEMICAL RECOVERY PLANT



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APPENDIX D 3

UNION CAMP,Eastover ,SC

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EASTOVER

EASTOVER MILL FACT SHEET

UNION CAMP CORPORATION
FINE PAPER DIVISION
EASTOVER, SOUTH CAROLINA

EO I PAPER MACHINE

- Medium Weight Fine Paper (46-55 Basis Weight)
- Design Rate: 600 TPD
- Phase II Rebuild Design Rate: 800 TPD
- Equipment:

  Voith Duofomer Twin Wire Paper Machine

  372 Inches Wide

  3000 FPM Maximum Speed
- Start-Up: 8/84

EO II PAPER MACHINE

- Light Weight Fine Paper (35-46 Basis Weight)
- Design Rate: 660 TPD
- Equipment:

  Beloit Bel Baie III Paper Machine

  372 Inches Wide

  4400 FPM Maximum Speed
- Start-Up: 7/91

PULP MACHINE

- Bleached Kraft Pulp

  Softwood Pulp - EASTOCELL
  Hardwood Pulp
- Design Rate: 500 TPD
- Equipment:

  Valmet-Ahlstrom Wet End

  192 Inches Wide

  215 FPM Maximum Speed

  Flakt Compact Dryer

  Lamb Cutter Layboy and Bale Line
- Start-Up: 4/91

SVH (7/1/91)

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EASTOVER

EASTOVER MILL STATISTICS

UNION CAMP CORPORATION
FINE PAPER DIVISION
EASTOVER, SOUTH CAROLINA

Business Purpose: Manufacture fine white paper for use in the communications industry, (i.e., copier paper, envelopes, business forms, offset printing, reading materials and writing supplies) and bleached market pulp.

Design Rate: 1800+ Tons Per Day Total Production
1500 Tons Per Day Fine Paper
300 Tons Per Day Bleached Pulp

Location: 30 Miles East of Columbia, South Carolina

Employees: Union Camp Personnel 860

On-Site Service Contractors 153

Total Investment: $1.25 Billion
Phase I $500 Million
Phase II $750 Million

Estimated Yearly Spending*

Annual Payroll	40 Million
Local Wood Purchases	65 Million
Products and Services	35 Million
Payments to Freight Carriers	33 Million
Annual Property Taxes (Phase I)	12 Million

*Amounts spent in South Carolina

Post Office Box B, Eastover, South Carolina 29044, Phone: (803) 353-7653

SVM/lzm EOFACT.593

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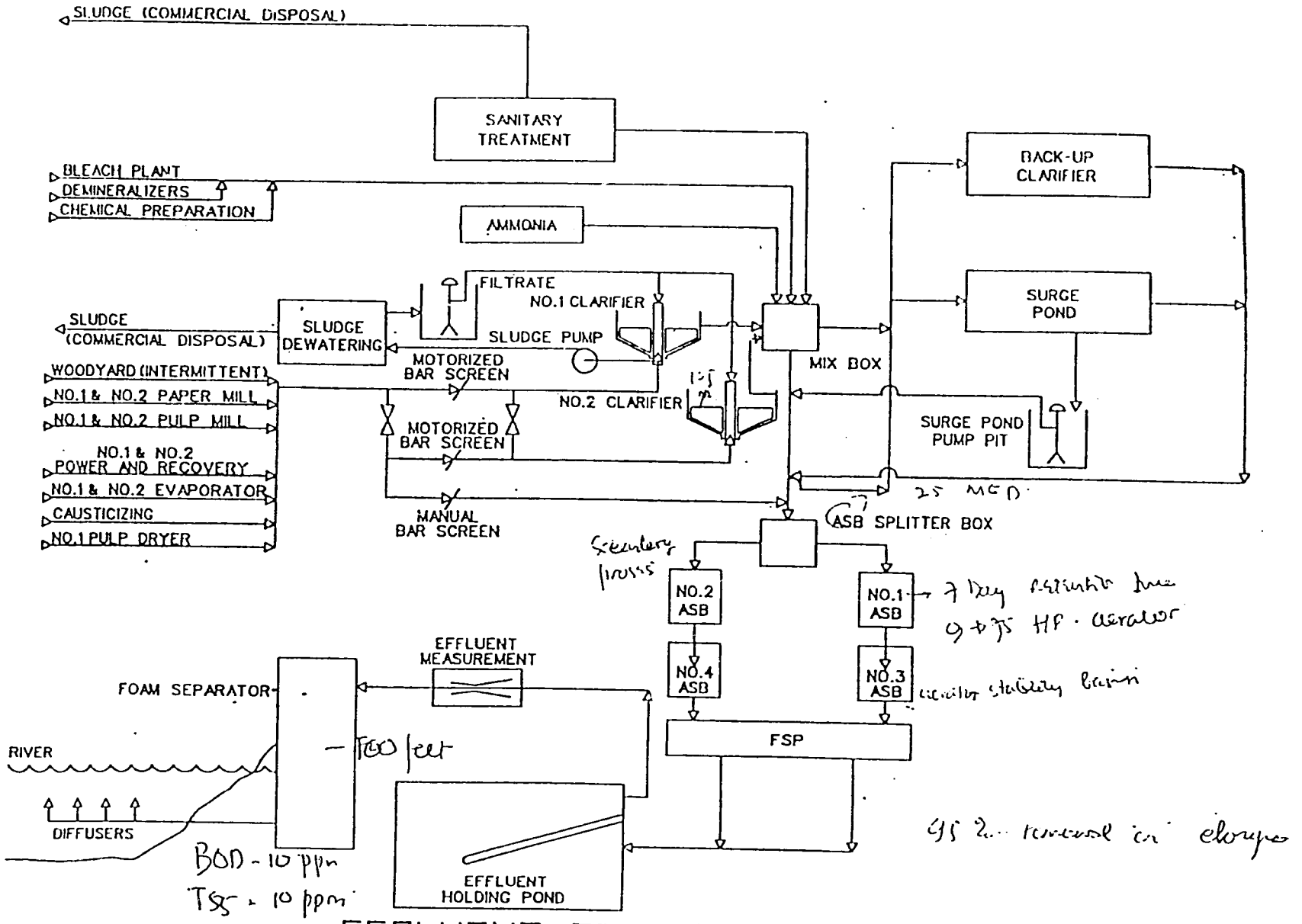

EFFLUENT TREATMENT SYSTEM -

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THE ROAD TO SUCCESS

- Well Prepared Applications
- Productive Dialogue with DHEC
- Valuable Public Input
- Commitment to Permit Limits
- Honor Those Commitments
- Open & Ongoing Communications with Neighbors
- Proven Environmental Record

DEVELOP AND MAINTAIN A

HIGH ENVIRONMENTAL ETHIC

UNION CAMP CORPORATION ENVIRONMENTAL, HEALTH, SAFETY AND FORESTRY PRINCIPLES

- TO MAKE ENVIRONMENTAL, HEALTH, AND SAFETY CONSIDERATIONS PRIORITIES IN OPERATING EXISTING FACILITIES, AS WELL AS IN PLANNING NEW OPERATIONS.

- TO RECOGNIZE ENVIRONMENTAL, HEALTH, AND SAFETY EFFECTS OF PRODUCT MANUFACTURE, DISTRIBUTION, USE, AND DISPOSAL.

- TO MONITOR ENVIRONMENTAL, HEALTH, AND SAFETY PERFORMANCE AND TO REPORT REGULARLY ON THESE MATTERS TO THE BOARD OF DIRECTORS.

- TO TRAIN EMPLOYEES AND TO PROMOTE AWARENESS AND ACCOUNTABILITY ON THESE MATTERS.

- TO IMPROVE PERFORMANCE THROUGH SUPPORT OF RESEARCH AND DEVELOPMENT.

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ENVIRONMENTAL, HEALTH, SAFETY, AND FORESTRY (CONT)

- TO COMMUNICATE WITH EMPLOYEES, CUSTOMERS, SUPPLIERS, THE COMMUNITY, PUBLIC OFFICIALS, AND SHAREHOLDERS.

- TO PARTICIPATE CONSTRUCTIVELY IN THE DEVELOPMENT OF PUBLIC POLICIES.

- TO CONTINUE TO PURSUE ENERGY CONSERVATION.

- TO PRACTICE A LAND STEWARDSHIP ETHIC THAT RECOGNIZES THE IMPORTANCE OF SOIL CONSERVATION, AIR AND WATER QUALITY, WILDLIFE AND FISH HABITAT, AND AESTHETICS.

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APPENDIX D 4

WEYERHAEUSER,Oglethrope,GEORGIA

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"Business success can and must march in step with a safe and pleasing environment."

Jack Creighton
President

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Weyerhaeuser Company
ENVIRONMENTAL POLICY

Respect for the environment runs deep at Weyerhaeuser.

We're proud of our long tradition of concern for — and stewardship of — the world we inhabit: land, water, air, fish, wildlife and, of course, our forests.

Weyerhaeuser pioneered the American Tree Farm system by establishing the feasibility and desirability of replanting forests after harvest. We led the industry in devising ways of treating industrial wastewater to minimize the impact on streams and rivers. And, in 1971, Weyerhaeuser was one of the first forest products companies to enact an environmental policy.

Since then, our policy has been further refined and strengthened as we've learned more about the impact of our activities upon the environment.

Stated briefly, our goal is that Weyerhaeuser and its employees will continuously seek to harmonize our operations with the requirements of a safe and pleasing environment.

Our environmental policy guides us in achieving this goal.

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Weyerhaeuser employees at all levels will:

1. comply with all environmental laws and regulations.

2. identify, understand and respond to public health and environmental impacts of our operations and the use of our products and services.

3. conserve energy and natural resources by ensuring efficient utilization.

4. work diligently to protect the environment on the job, and consider doing so off the job.

In addition, Weyerhaeuser managers will:

5. factor environmental laws and regulations into strategic planning and decision-making processes.

6. evaluate environmental performance through use of tools such as internal audits and exception reporting.

7. promote the development and adoption of scientifically sound and balanced environmental policies, laws and regulations through active support of and participation in governmental legislative and rule-making processes and other forums dedicated to providing public officials with technical information and advice.

8. develop and implement procedures for waste minimization, emissions reduction, by-product recycling and materials handling and disposal.

10. be held accountable for environmental performance and results. Facility and unit managers will:

- monitor and certify compliance
- promptly report non-compliance conditions
- take corrective action, including curtailment of operation, if necessary, to prevent serious harm.

11. recognize superior environmental performance by encouraging and rewarding employee suggestions for improving environmental performance.

12. develop and communicate to appropriate local authorities environmental incident emergency plans for any operations that pose a significant risk of off-site impacts.

13. respond openly and promptly to public inquiries about environmental issues involving the company, and initiate communications with others who might be affected.

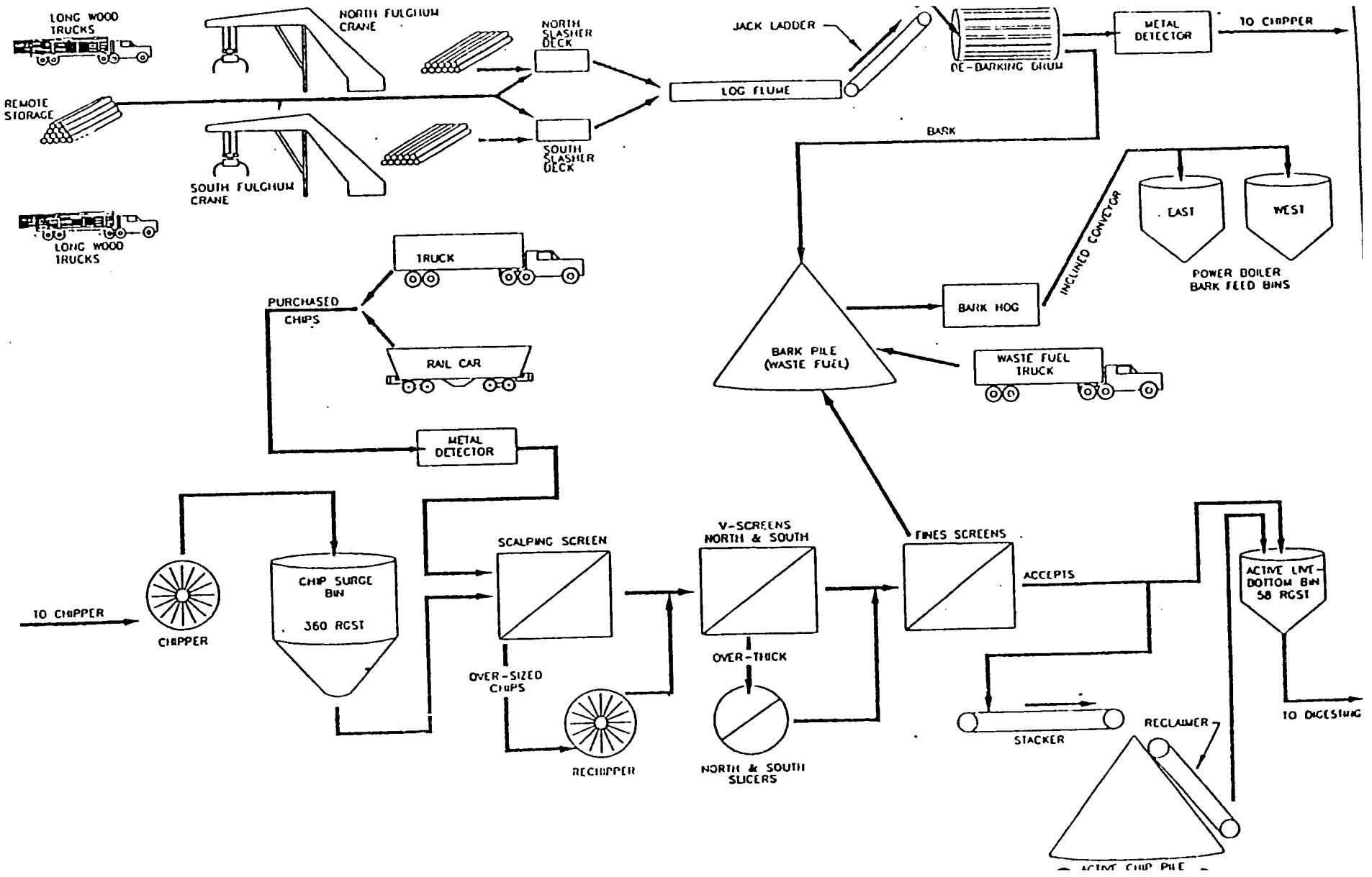
14. work in good faith with non-governmental organizations and individuals to resolve environmental quality problems.

15. adopt internal environmental standards for situations not adequately covered by current law or regulation, or where we believe more stringent measures are necessary to protect the environment.

16. select contractors and vendors who demonstrate proper concern for environmental protection.

In addition, the Office of the Environment will:

17. report annually to the board of directors on the company's overall environ



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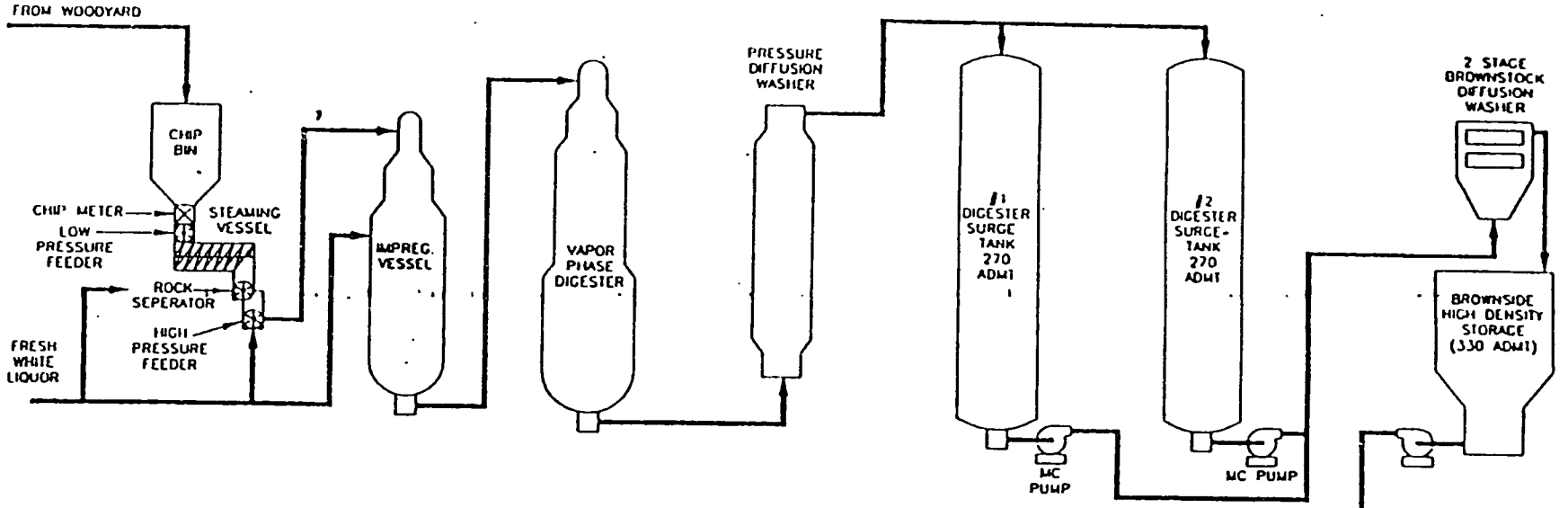
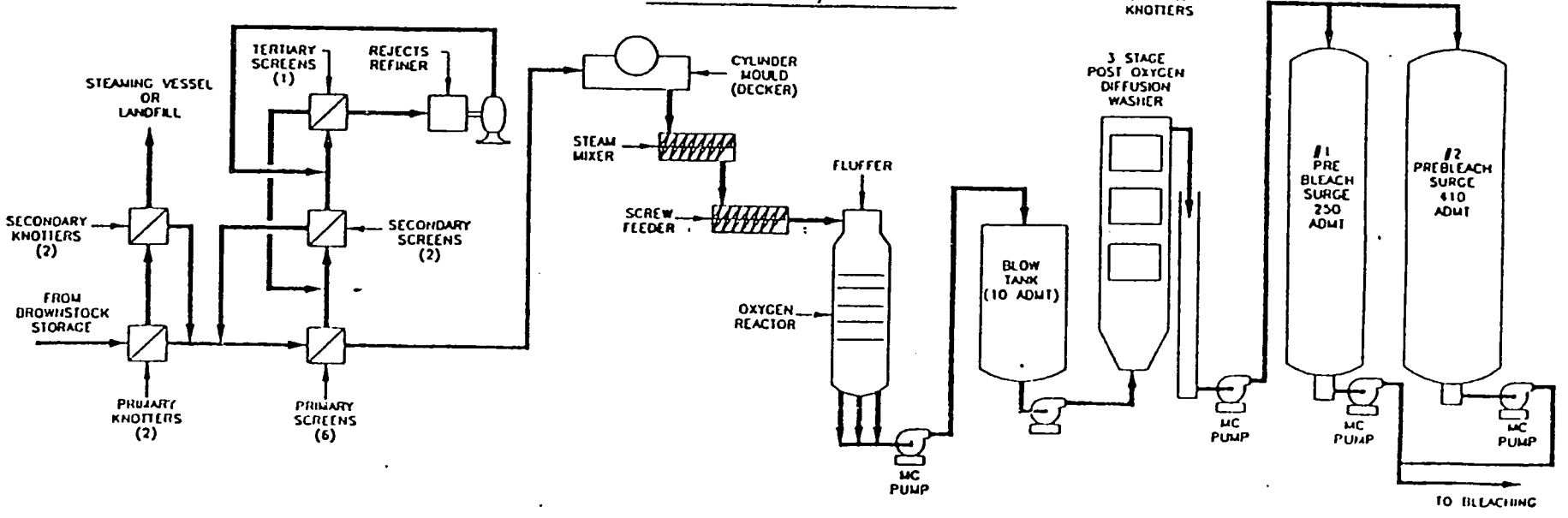
DIGESTING



SCREENING/OXYGEN



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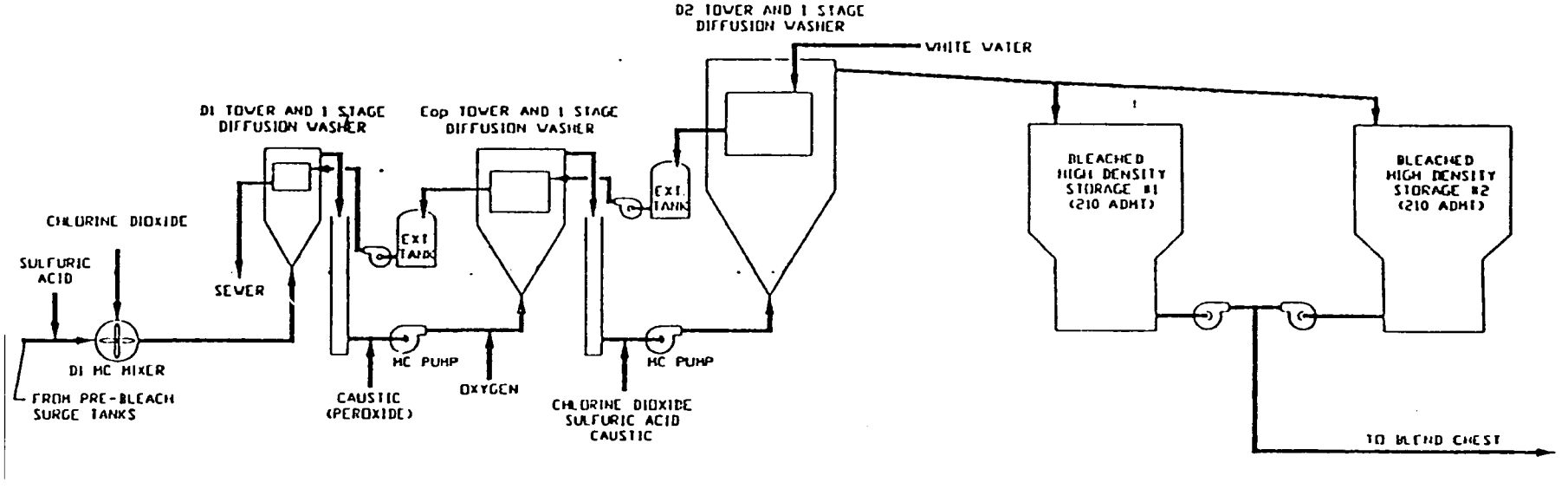
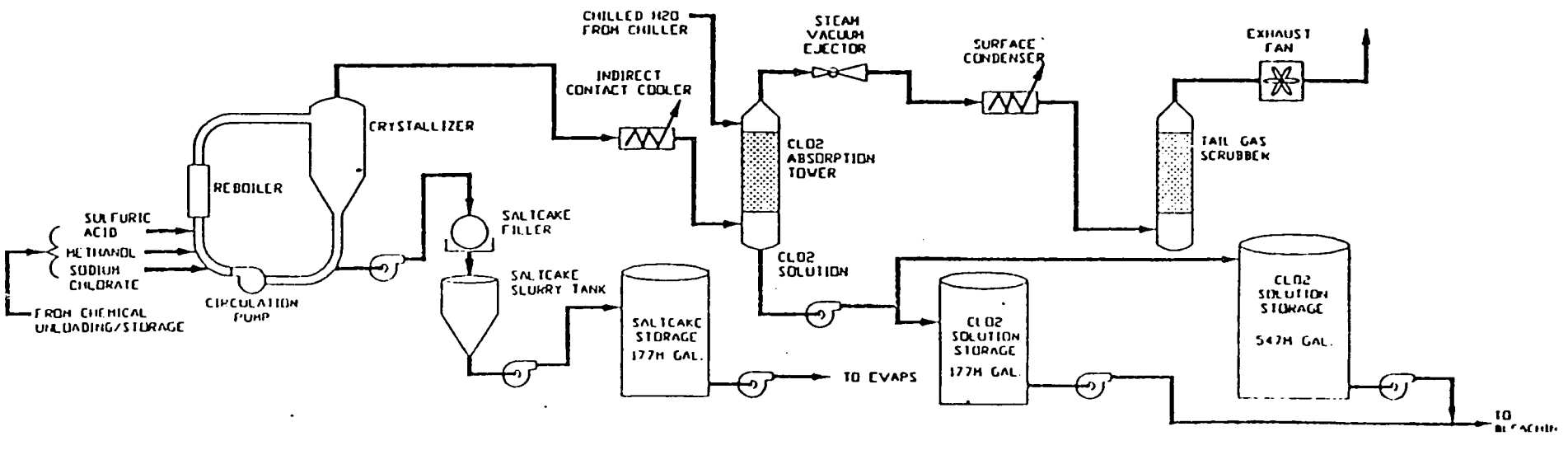
BLEACHING



R-8 CHEMICAL GENERATOR



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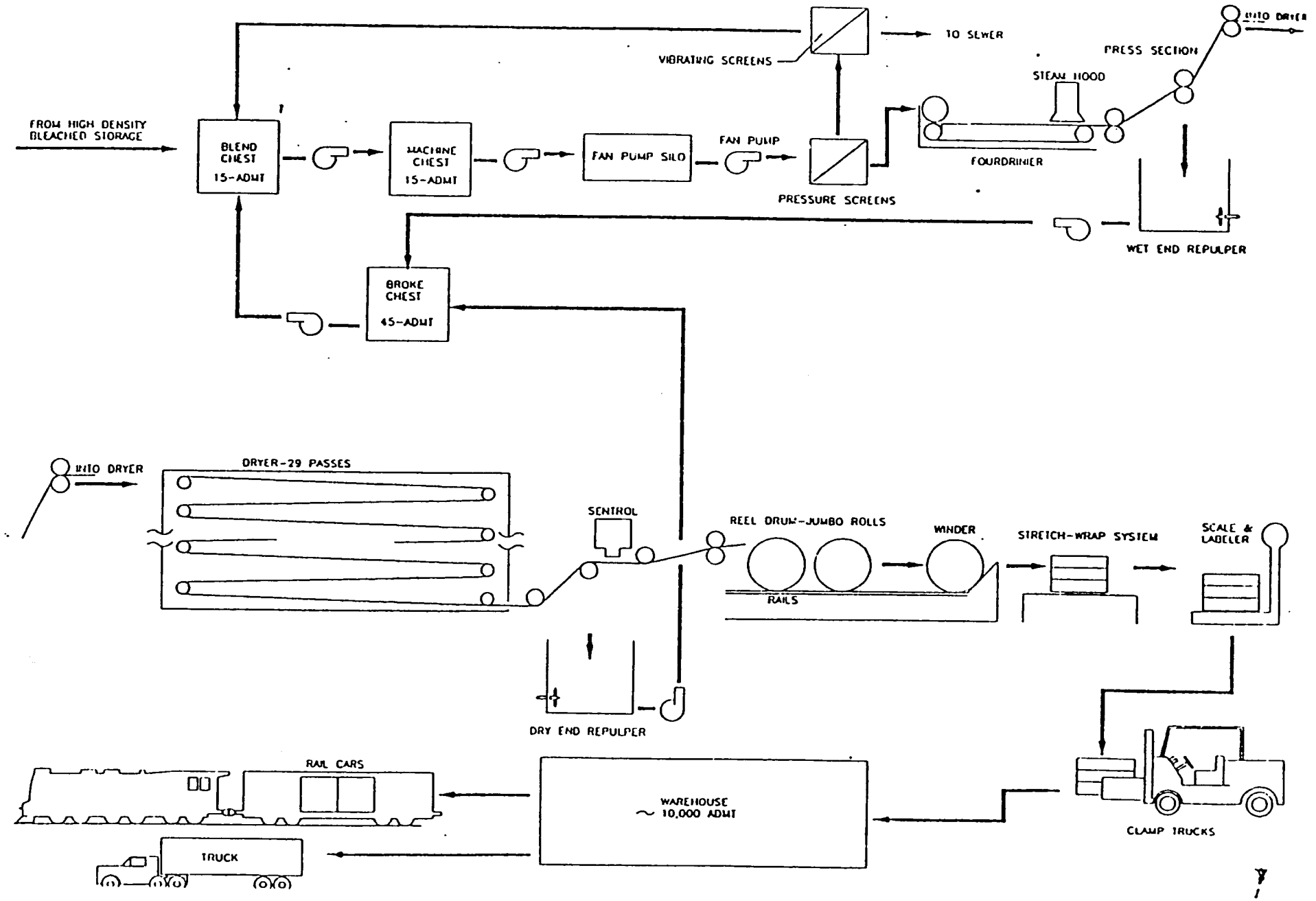
STOCK PREPARATION/DRYER



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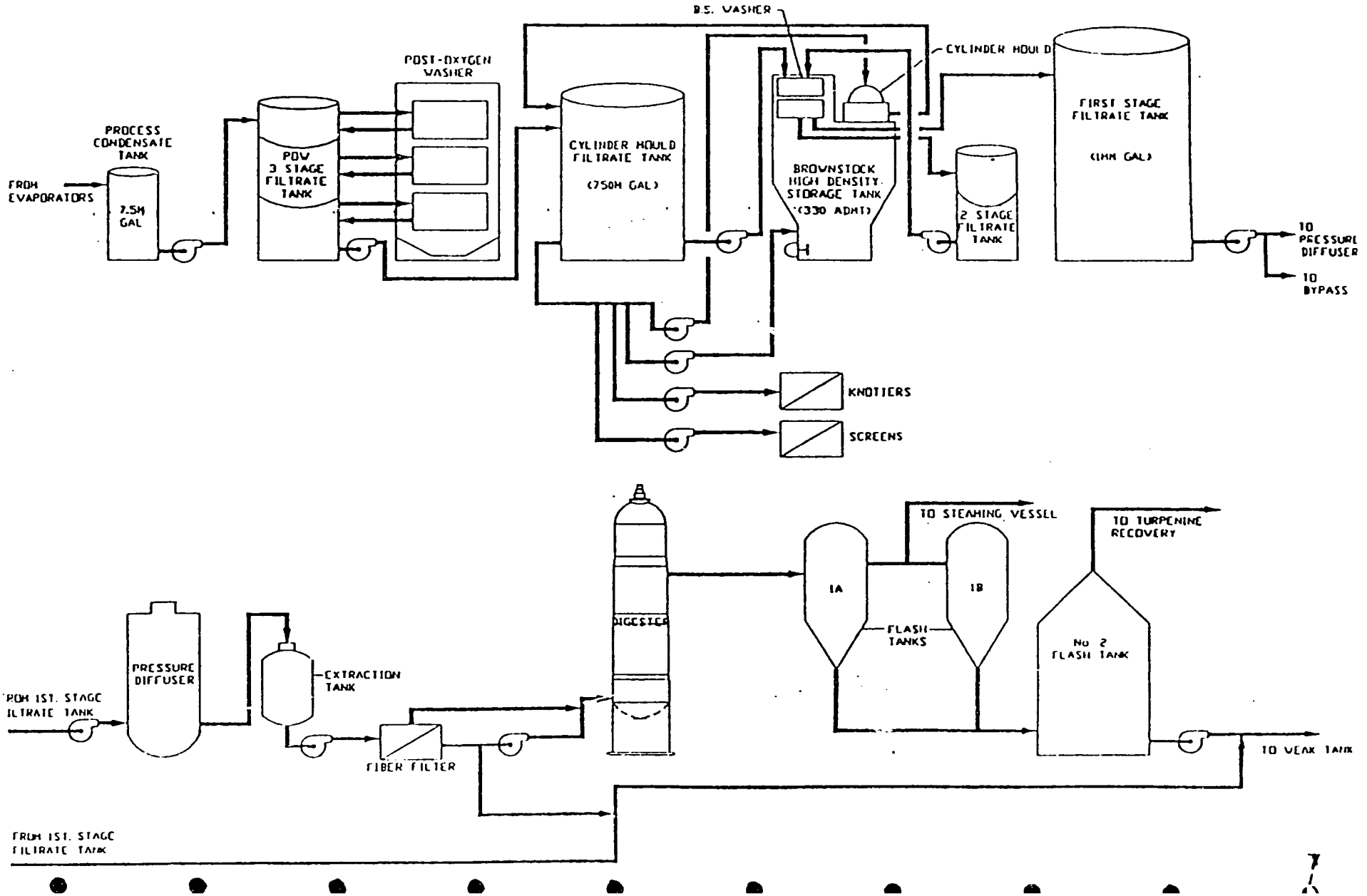
PULPING FILTRATE LOOP



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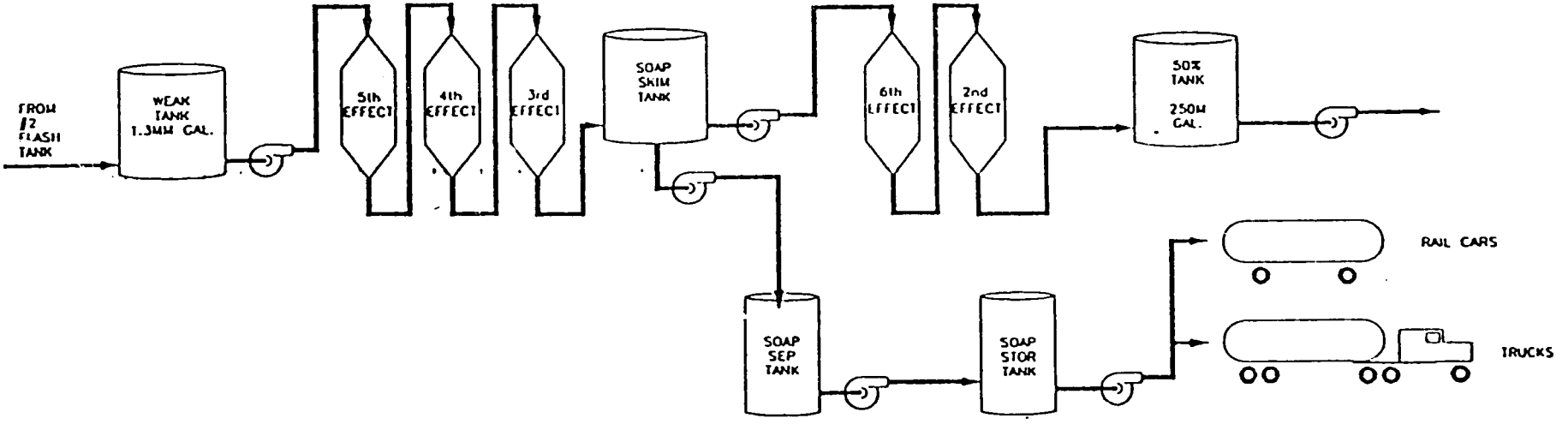
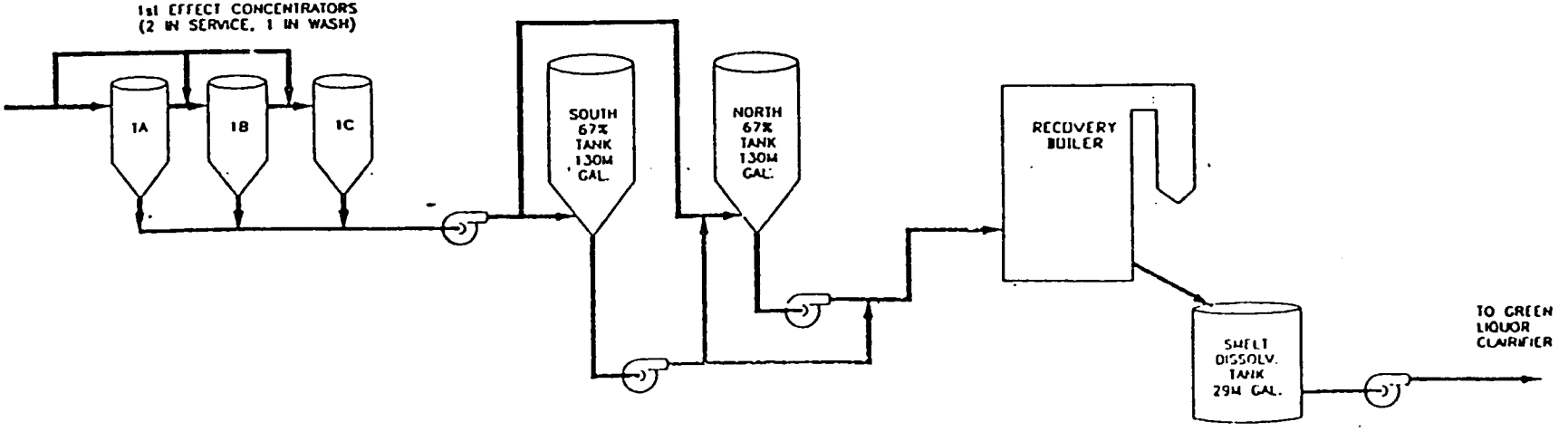
CHEMICAL RECOVERY, BLACK SIDE

EVAPORATION/RECOVERY





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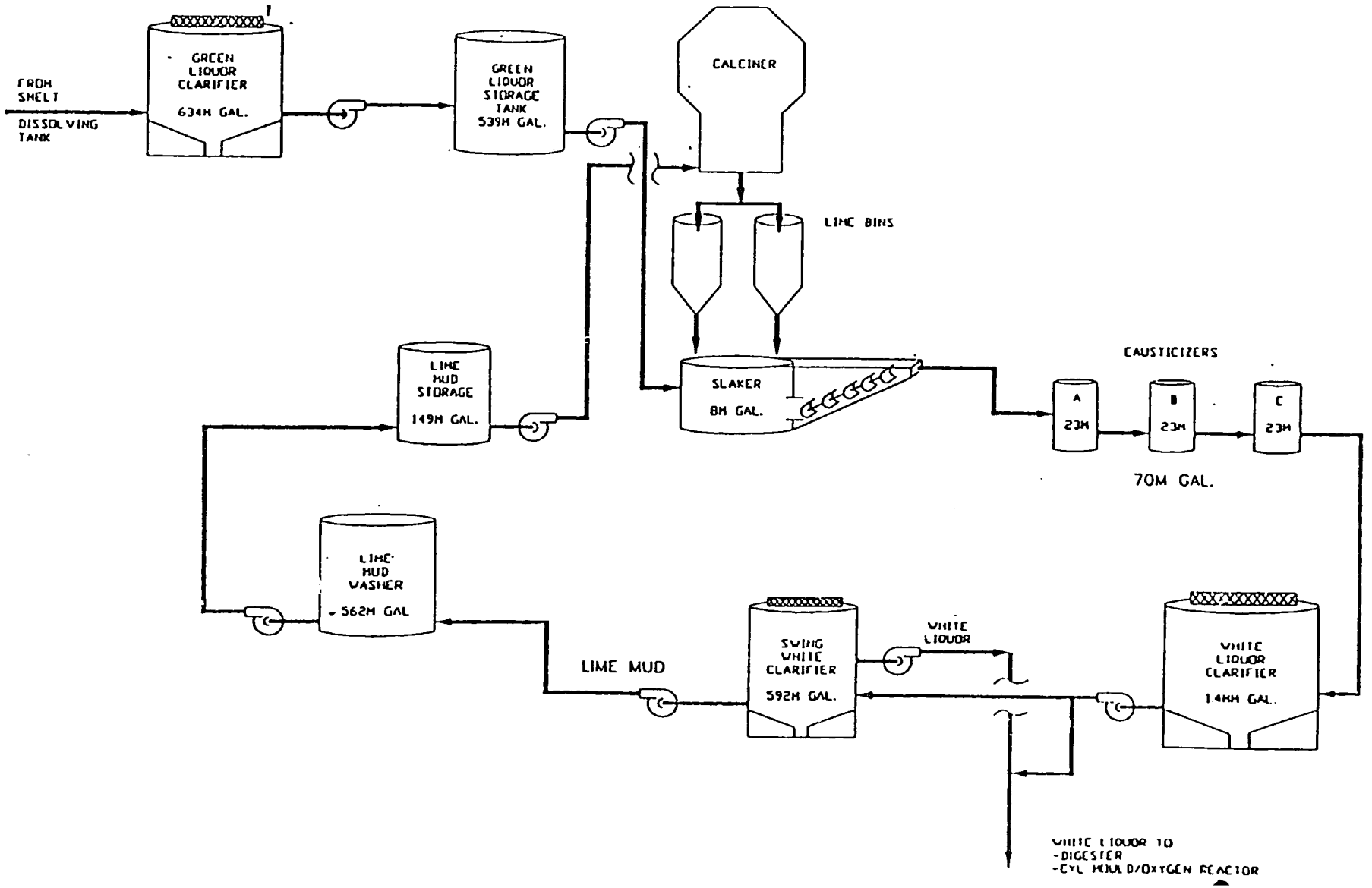
CHEMICAL RECOVERY, GREEN & WHITE SIDE

CAUSTICIZING



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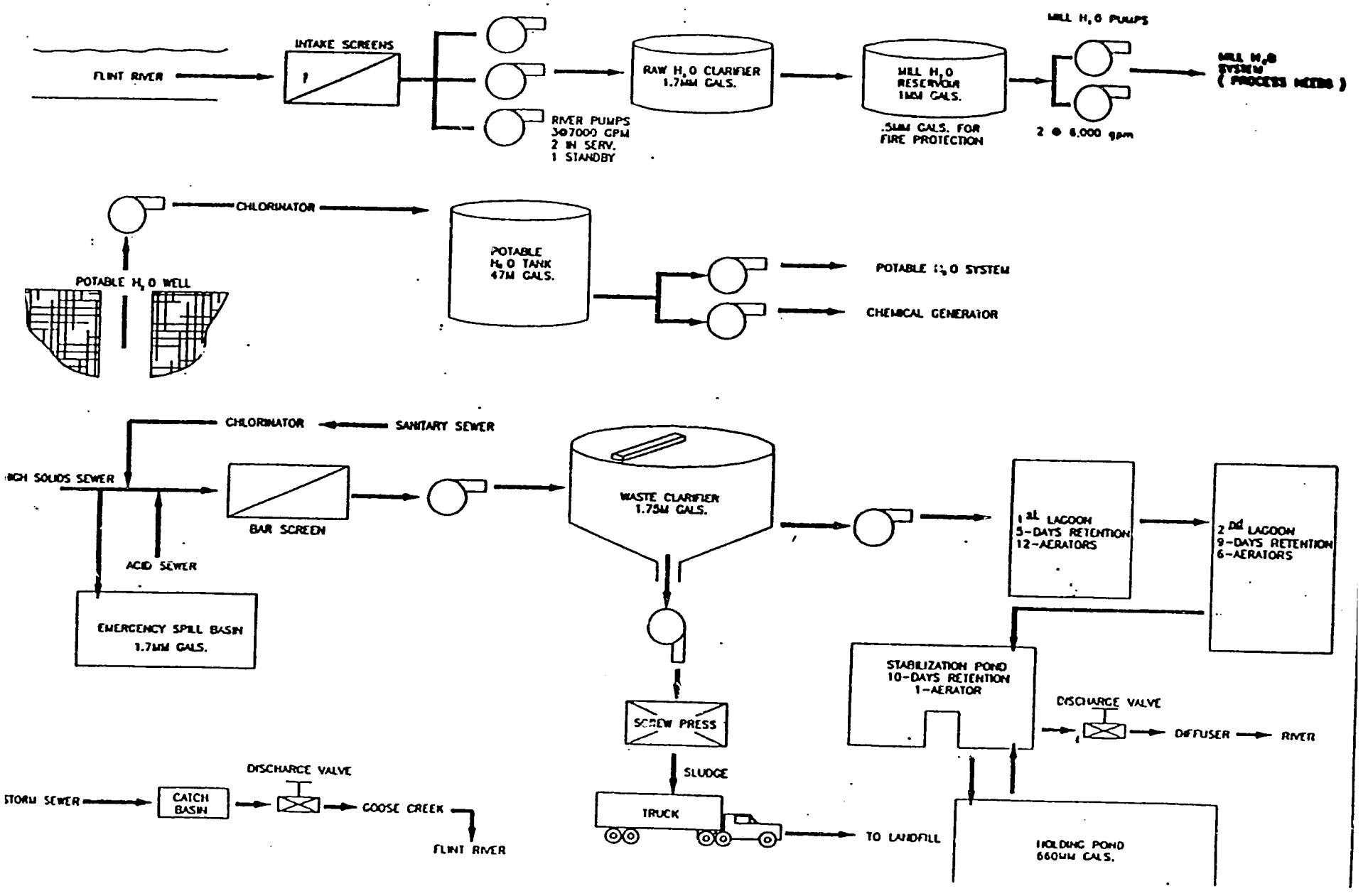
WASTE & WATER TREATMENT



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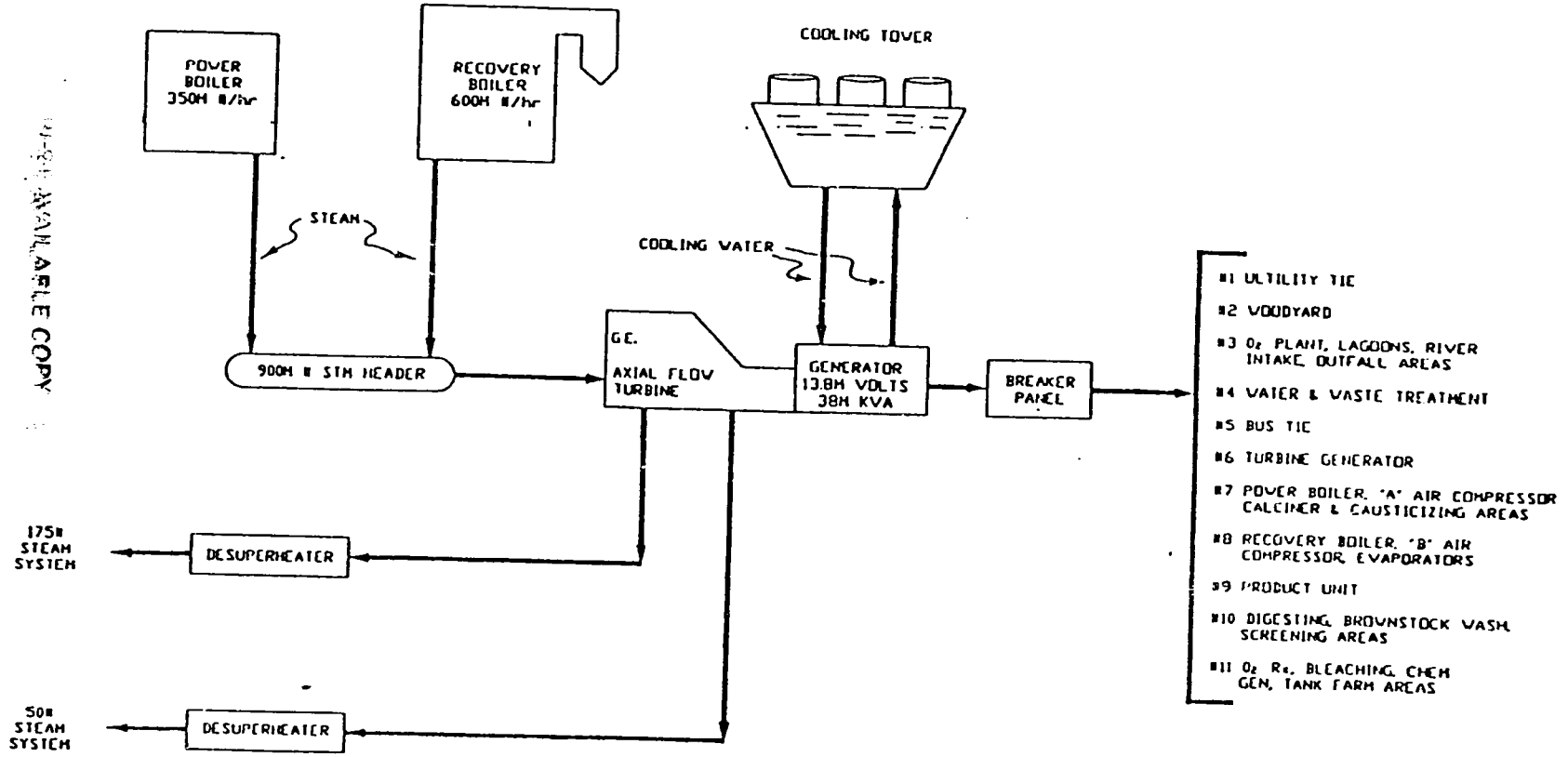
TURBINE GENERATOR STEAM/POWER FLOW

POWER SYSTEM



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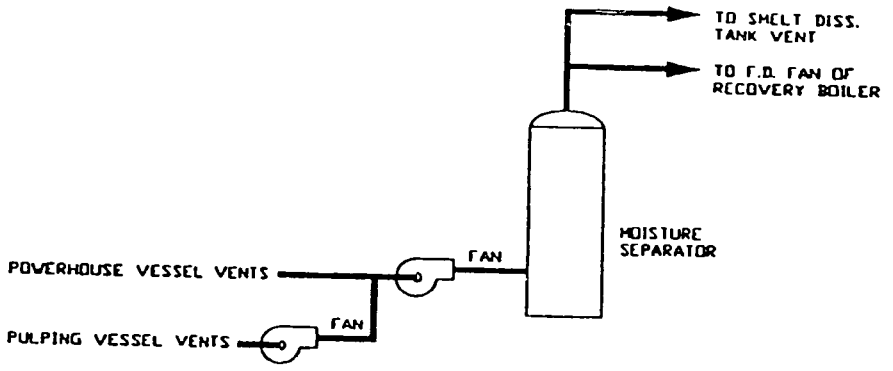
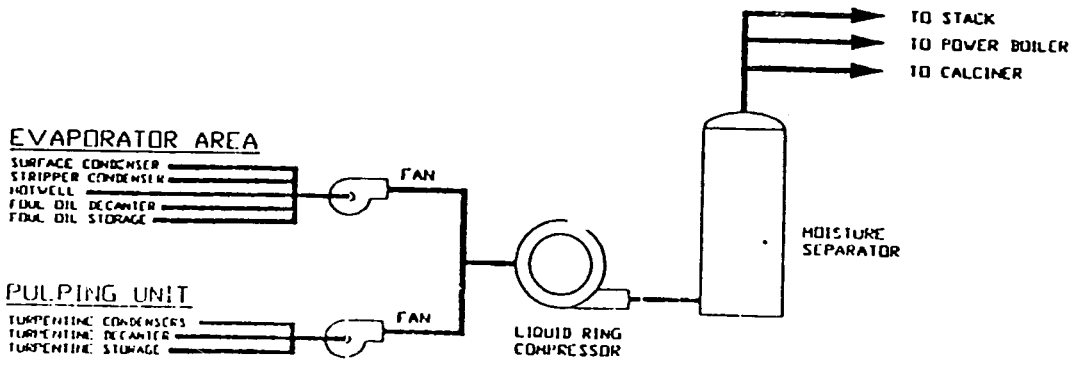
WEAK GAS INCINERATION



STRONG GAS INCINERATION



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APPENDIX D 5

NCASI,Head Office Madison Avenue, NEW YORK.

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MOST-RECENT TECHNICAL BULLETINS

624	2/92	USER'S GUIDE FOR THE CORNELL MIXING ZONE EXPERT SYSTEM (CORMIX)
625	3/92	DEVELOPMENT OF A METHOD FOR DETERMINATION OF EPICHLOROHYDRIN AND EPICHLOROHYDRIN-POLYAMIDE RESIN BY-PRODUCTS IN WORKPLACE AIR
626	3/92	A SCREENING STUDY OF THE TREATABILITY OF DIOXINS AND FURANS IN BLEACH PLANT FILTRATES AND MILL WASTEWATERS
627	3/92	MARINE CHRONIC BIOASSAYS - TECHNICAL EVALUATIONS AND EFFLUENT RESPONSES WITH THE ECHINODERM SPERM/EGG TEST
628	3/92	EFFECTS OF FOREST MANAGEMENT ON SOIL STORAGE
629	3/92	NATURALLY OCCURRING ORGANOHALOGEN COMPOUNDS - A SURVEY
630	3/92	EFFECTS OF CHLORINE DIOXIDE SUBSTITUTION ON BLEACH PLANT EFFLUENT BOD AND COLOR
631	6/92	THE EFFECTIVENESS OF BUFFER STRIPS FOR AMELIORATING OFFSITE TRANSPORT OF SEDIMENT, NUTRIENTS, AND PESTICIDES FROM SILVICULTURAL OPERATIONS
632	5/92	1991 REVIEW OF THE LITERATURE ON PULP AND PAPER INDUSTRY EFFLUENT MANAGEMENT
633	6/92	A COMPUTERIZED NON-LINEAR LEAST SQUARES ALGORITHM FOR ESTIMATING THE PARAMETERS OF THE DUAL FIRST ORDER LONG TERM BOD MODEL (NLS-DFO)
634	6/92	STATUS OF THE NCASI CUMULATIVE WATERSHED EFFECTS PROGRAM AND METHODOLOGY
635	7/92	PHYSICOCHEMICAL TREATMENT OF BLEACH PLANT FILTRATES AND FINAL EFFLUENTS FOR THE REDUCTION OF CHLORINATED ORGANIC COMPOUNDS
636	7/92	AN ANAYSIS OF KRAFT RECOVERY FURNACE NO_x EMISSIONS AND RELATED PARAMETERS
637	7/92	STORM WATER FROM LOG STORAGE SITES: A LITERATURE REVIEW AND CASE STUDY
638	9/92	MARINE CHRONIC BIOASSAYS - TECHNICAL EVALUATIONS AND EFFLUENT RESPONSES WITH THE BIVALVE EMBRYO/LARVAL TEST
639	9/92	CESIUM-137 IN INDUSTRIAL WOOD ASH: CONCENTRATIONS, FATE, AND HUMAN HEALTH RISKS

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640	9/92	SULFUR CAPTURE IN COMBINATION BARK BOILERS
641	9/92	SOLID WASTE MANAGEMENT AND DISPOSAL PRACTICES IN THE U.S. PAPER INDUSTRY
642	10/92	AMBIENT CHLOROFORM CONCENTRATIONS IN THE VICINITIES OF BLEACHED PULP MILL EFFLUENT TREATMENT SYSTEMS
643	9/92	CHEMICAL COMPOSITION OF PULP AND PAPER INDUSTRY LANDFILL LEACHATES
644	1/93	THE SIGNIFICANCE OF PAPER IN MUNICIPAL SOLID WASTE COMPOSTING
645	1/93	PREDICTING BLACK BEAR HABITAT SELECTION FROM FOOD ABUNDANCE UNDER THREE FOREST MANAGEMENT SYSTEMS
646	2/93	EMISSION FACTORS FOR NO_x, SO_2, AND VOLATILE ORGANIC COMPOUNDS FOR BOILERS, KRAFT PULP MILLS, AND BLEACH PLANTS
647	3/93	EVALUATION OF XAD-2 SORBENT TUBES AND DETECTOR TUBES FOR DETERMINATION OF EPICHLOROHYDRIN AND BY-PRODUCTS OF EPICHLOROHYDRIN-POLYMIDE RESINS IN WORKPLACE AIR
648	3/93	GROWTH VARIATIONS IN OLD-GROWTH DOUGLAS-FIR FORESTS OF THE PUGET SOUND AREA
649	5/93	AN INVESTIGATION OF FACTORS THAT INFLUENCE CHLOROFORM GENERATION FROM RECOVERED PAPER FIBER BLEACHING WITH HYPOCHLORITE
650	6/93	COMPILATION OF 'AIR TOXIC' EMISSION DATA FOR BOILERS, PULP MILLS, AND BLEACH PLANTS
651	8/93	FORESTRY, WILDLIFE AND HABITAT IN THE EAST (AN ANNOTATED BIOLIOGRAPHY) 1986-1990
652	8/93	A LABORATORY AND FIELD EVALUATION OF PORTABLE GAS CHROMATOGHRAPHS FOR MEASURING REDUCED SULFUR COMPOUNDS IN KRAFT PULP MILL WORKPLACE ATMOSPHERES
653	9/93	AQUATIC COMMUNITY EFFECTS OF BIOLOGICALLY TREATED BLEACHED KRAFT MILL EFFLUENT BEFORE AND AFTER CONVERSION TO INCREASED CHLORINE DIOXIDE SUBSTITUTION: RESULTS FROM AN EXPERIMENTAL STREAMS STUDY
654	10/93	REGRESSION MODELS TO ESTIMATE ADSORBABLE ORGANIC HALIDE (AOX) LEVELS IN BLEACHED KRAFT MILL WASTEWATERS

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MOST-RECENT SPECIAL REPORTS

92-03	2/92	PROCEEDINGS OF THE 1991 NCASI SOUTHERN REGIONAL MEETING
92-04	3/92	A SUMMARY OF DATABASES AND INFORMATION SYSTEMS PERTINENT TO THE PULP AND PAPER INDUSTRY
92-05	3/92	PROCEEDINGS OF THE 1991 NCASI NORTHEAST REGIONAL MEETING
92-06	4/92	NCASI INFORMATION EXCHANGE SESSION ON MEASUREMENT OF 'AIR TOXICS' EMISSIONS
92-07	5/92	IMPACTS ON PRIVATE FORESTRY FROM CONSERVATION STRATEGIES FOR THREATENED AND ENDANGERED SPECIES
92-08	5/92	INFORMATION ON EPA REGION X MULTI-MEDIA INSPECTIONS
92-09	7/92	COMPARISON OF PERSONAL SAMPLING DEVICES FOR THE ESTIMATION OF WOOD DUST EXPOSURE LEVELS
92-10	9/92	PRELIMINARY REPORT ON MAMMALIAN AND AVIAN SPECIES IN MANAGED AND UNMANAGED POCOSINS
92-11	9/92	A REVIEW OF 1990 SARA SECTION 313 RELEASE REPORTS FILED BY FOREST PRODUCT INDUSTRY MANUFACTURING FACILITIES
92-12	12/92	A COMPILATION OF DATA ON CHEMICAL AND BIOLOGICAL PROPERTIES OF 28 CHLORINATED PHENOLIC COMPOUNDS
92-13	11/92	MATERIAL PRESENTED AT THE WEST COAST REGIONAL MEETING SEPTEMBER 30, OCTOBER 1, 1992 GENERAL SESSION
92-14	1/92	A SURVEY OF PULP AND PAPER INDUSTRY ENVIRONMENTAL PROTECTION EXPENDITURES - 1991
93-01	1/93	PROCEEDINGS OF THE 1992 NCASI CENTRAL-LAKE STATES REGIONAL MEETING
93-02	1/93	PROCEEDINGS OF THE 1992 NCASI NORTHEAST REGIONAL MEETING
93-03	2/93	ESTIMATES OF 1990 SULFUR DIOXIDE AND OXIDES OF NITROGEN EMISSIONS FROM PULP AND PAPER MILLS
93-04	4/93	REVIEW OF NCASI FORESTRY-WILDLIFE RESEARCH ACTIVITIES IN THE PACIFIC NORTHWEST

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93-05	4/93	PROCEEDINGS OF THE 1992 NCASI SOUTHERN REGIONAL MEETING
93-06	4/93	ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL AND CHEMICAL TESTING OF RIVER AND MARINE SEDIMENTS
93-07	5/93	ANNOTATED BIBLIOGRAPHY ON AQUATIC BIOLOGY ASPECTS OF PULP AND PAPER MILL EFFLUENT DISCHARGES TO RECEIVING WATERS
93-08	6/93	SUMMARY OF DATA REFLECTIVE OF PULP AND PAPER INDUSTRY PROGRESS IN REDUCING THE TCDD/TCDF CONTENT OF EFFLUENTS PULPS AND WASTE WATER TREATMENT SLUDGES
93-09	8/93	ESTIMATED ADDITIONAL COSTS TO THE PULP AND PAPER INDUSTRY DUE TO THE GREAT LAKES WATER QUALITY INITIATIVE
93-10	8/93	A SURVEY OF PULP AND PAPER INDUSTRY ENVIRONMENTAL PROTECTION EXPENDITURES - 1992

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APPENDIX E

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WORLD ENVIRONMENT CENTER

(W E C)

Train the trainer Program Report

October 23 - November 5, 1993

A Project by :

World Environment Center

419 Part Aveneu South, Suite 1800

New York, New York 10016

Report by

Zulkifli Lubis

Vice chief of Environmental Protection

Indah Kiat Pulp and Paper Cor.

Riau - Indonesia

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I. Executive summary / Introduction .....

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I. Executive Summary / Introduction.

The word Environmental Center (W E C), Hirough a cooperative agrement with the United State Agency of International Devalopment (U S A I D) in Indonesia and Enviromental Impact Management Agency of Indonesia (BAPEDAL) Organize a U.S. Study tour for six Indonesia Reprentative .

Participating in the assesment were: Ms. Hendrayani (Institut for Research and Development of Collulose Industry), Mr. Iyan Suwargono(Enviromental Impact Management Agency Of Indonesia), Mr.Zulkifli Lubis (Indah Kiat Pulp Paper Cor.), Mr. Darono Wikanaji (P.T. Kertas Leces), Mr. Warih Supriadi (P.T. Surabaya Agung), Widya Tyahyana (P.T. Pakerin).

U.S. Study tour was held on October 23-Novembers-1993 The objectives of the visit to provide Managers and design Enginners With Intensive training in Waste minimization program and practices in the pulp and paper Industry in the US. And after return to Indonesia, the study tour participants will conduct a waste minimization Workshop for Indonesian pulp and paper Industry detailing their experiences in the U.S. and in Indonesia.

U.S study tour including one two days Visit for facility (so that athorouph facility tour may provided), meeting with persons responsible for waste Water management, Waste Management and Waste minimization programs.

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II.Finding

The National Concil of the paper Industry for Air and Stream Infrovement (N C A S I)

The National Council of Pepar Industry for Air and Stream Improvement (N C A S I) is Institut for Research, founded by Pulp & Paper Assosiation . This Institut usually does the Research for Solid waste, Air, Water, and Forest.

Now N C A S I have a head office in new York and for Branch office each in Origon, Boston, Qainsville and Medingham. Wich Hundred Employees and spendi USD 300.000.000 per years.

N C A S I do the research for Finding the problem as in Accordance by Mill, But they not give Sugestions for the repair of improvement The findings of the research is ussually published for the members of the Assosiation only.

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II.2. Willamette Industries Inc

The Marlboro Paper Mill.

Willamette Industries was founded in 1906 as the Willamette Valley. In 1067 Willamette Valley and several related firm merged to form Willamette Industries Inc. Its stock became publicly fraded in 1968.

Today Willamette is a diversified, Integrated forest product company with 75 manufacturing fasilities arround the United States. Willamette owns or controls over 1 million acres of timberland nationwide. Of the total, approximately 100.000acres area in the Carolines.

Willamette employes over 10.000 people and pays over $ 400 Million each year in wapes and benefits, Willamette produces container board, bag paper, find paper, bleached hardwood market pulp, speciality printing paper, corrugated containers, businees forms, cut sheetpaper, paper bag, ink, humber, plywood, particle board, medium density, fiberboard and value-added wood products. These manufacturing facilities are 64% energy self-sufficient.

II.2.a. The Marlboro Mill.

Thre Marlboro Mill, Located on 1.800 acres just South of bennettsvillen south Caroline along the Great Pee Dee River, operastes with the most advanced technology available to the pulp and paper industry.

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Started in Pee 1990,produces 245.000 tons annually of paper with 291 employees Since day one of the Marlboro Mill project, willamette has been dedicated to stoffing the Mill With people from the local Area, Willameterlooked for and found highly motivated people with exceptional learning ability and mechanical aptitude.

As Employees, their training will contineu throughout their careers, enabling then to grow along with the mill. The Resulting work force in comprised of people with the initiative, dedication and knowledge necessary to keep the Mill running Smoothly and efficiently.

The Mill ases a participative management approach where in everyone is a member of a team, this is an all saloried work force concept designed to employ the mind, not just body.

Safety is also an important part of the sistem, Employees are encouraged to suqqest ways to improve the Mill's safety Willamette provedes all the necessary safety trainning and equipment for for every job in the Mill. Everyone is dedicate to providing a drup-free work environment at Morlboro. The employees' motto, Proud to be Drug Free is a constant reminder of this dedication.

Paper Mill employ a cross soction of engeneering skill including chimical.electrical, environmental,automation and Mechanical to keep the Mill running at peak performance. Willamette practicing predutive maintenance, the means using the latest technology to constantly analyze vibra-

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tions, tempratures and hibrication to keep problems from developing.

This Mill doesn't have a central maintenance department like most operations. Instead, each technician receives maintenance trainning for his work area. This way , if there is aproblem the technician has the basic knowledge needed to correct the problem, saving time and money.

II.2.B. The Paper making Process.

The paper making Process starts with trees, or more spoci fically, the fiber in the tree's wood. Fibre to the mill in the form of chips form harvest operations and milling lettovers form Willamerte's Plywood plant in chester, s.c. and other wood productsfirms, also uses whole trees from pulpwood thinnings from willamete's nearby timberlands or from those of other landowners. These trees are cnipped at the mill site and the removed bask goes to the waste wood briller where it is burned to create steam used in papermaking.

The chips are seperated by two tree classifications : hardwood and softwood. The softwood fiber give the paper , it strength while the hardwood fibers enhance smoothness and appearance. Usually use 60 % of hardwood and 40 % of softwood.

The chips qo on different convigors to chip piles where they are stored before heading to the diqesters. Marlboro has six digesters, each of which works like a large pressure looker. Apre-measured amount of hardwood or

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softwood go into the digester, the while cooking ligow is added on the digester is closed. The chips cook for about 1 1/2 hours.

The purpose of this stage is to separate the ligain , or nature's glue, from the wood fibers. Malboro uses an extended cooking process to remove more liguin Prior to the Bleacking Stage. This is important because less liguin means the is less to the bleach. The removed liguin goes to the Recovery Cycle.

Malboro is the only one commercial Kroft pulp mill in the world that pumps the pulp mixture out of the digester instead of blowing it out with steam or air. This helps keep fiber strength high while it also save energy.

Once of the pulp exits the digester, the entire mixture is washed and goes to the oxygen delignification process.

Oxygen delignification is a highly-efficient process which uses oxygen is very gentle on the fibers while it attacks the liguinin. At this point , the pulp contains mostly fiber and very little liguin, allowing Marlboro to use a more environmentally friendly three-stge bleacking process instead of the typical five-stage process.

Bleacking insures the pulp will have a high while brightuess once it is made into paper. Marlborouses Chlorin and chlorin dioxide as the bleacking agents. After a final washing stage, the pulp goes to the high density storage tanks.

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Water is added to the pulp from the high-density tanks bringing the consistenly to 99,5% water and 5% fiber. This mixture is delivered to the paper machine and spread evenly on to a fabric mat that will carry the mixture as it is dewatered by gravityand suction. Another fabric is placed on top of the sheet for farther water water removal and to make the paper more symmetrical.

The , Now able to move without the aid of the fabric, goes through aseres of presses to remove more water. Marlboro then runs the paper though one extra press, giving the paper superior uniformity, The paper passes through a series of 47 drayers heated with steam. Starch is applied to give the paper better printability. After passing through an additional 18 dryes, the sheet goes through a set of vertical calender stacks for further smoothness and to control thickness.

The finished paper is wound on to the real at the end of the paper machine before heading to the winder where to roll is cut into sizes specified by the customer, stretch-wropped to protect it from moisture and shipped by rail or truck.

II.2.C. Protecting the Environment

Marlboro's Environmental commitment can be seen in virtually every focet of the mill's operation. Removed bark, spent pulping lignous, sender dust and rejected chips are burned to create steam instead of going in to a waste stream.

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The removed of liguin is done in an environmentally sensitivemanner. Pure Oxygen is one ajent used to remove lignen Marlboro also uses and extended cooking process to the majority of lignin is removed very early in the paper making process.

Teking more lignin out of the pulp mixture means there is less to bleach and fewer bleacking stages are needed. Becouse the lignin goes into the recovery cycle,there is more to burn in the recovery boiler to make steam.

A special incenerator burms and eliminatis the odorous gases,and water vapor is the only component going up to the stack.

2.D. Waste water treatment

- Primary Treatment

The treatment proces begins at alift station with a bar screen. The lift station is at 15 MGD and pumps the process effluent into the primary charifier. Flow and conductivity are monitored on a continuous basin.

The primary chrifier has a volume of 2,5 Million galons , a diameter of 195 feet, a side wall depth of 9 feet with arise rate of 500 gpd/sg.ft. and an hydrautic rentetion time of 4 hoursat 15 MG.D. Ninety percent or more of the settle able solid and 10% to 20% the BOD should be removed from the waste water. Settled sludge at 3% to 5%

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salids concentration, is pamped to screw press and de-watered to approximetely 50 % soled contentn The screw press is expected to handle about 17 dry tons per day of sludge,but is rated at 35 dry tons per day. Should the sludge press fail, sludge flow will be driverted to a one acre sludge lagoon until repairsare made.

Hydranlic overloods, flows over 15 MGD, are diverted from the lift station a surge basin that is 3 acres by 15 feet with storage capacity of 14,7 Million gallons. Apump is used to meter waste water in the surge basin back into the system at the primary clasifier or aerated Stabilization basin (ASB). Surge basin Content can also over flow by gravity to a polishing pond.

High Strength waste water flows, as measured by the life Station conductivity probe, are diverted to aspill basin. These Spill are then metered by gravity into either the life Station or ASB. This Spill basin can also also used as an alternate clasifier during primary clasifier maintenance periods. The flow wiil then go into ASB # 1. The Capasity of the spill basin is the same as the Surge basin, 14,7 million gallon covering 3 acres and 15 fect deep.

- Secondary Trudment

After the waste water leaves the primary clasifier, it is discharged into ABS # 1. This basin is 2000 feet long, 400 feet. Wide and is filled to a depth of 15 feet. This basin covers 20 acres and capable of containing 90 Million gallons. A second basin, ASB # 2, has the same dimensions

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as ASB # 1. and is operated in series with ASB # 1. Based on aflow of 15 MGB. AND 30,200 lb. BOD/days, These basins provide 12 days rentention time. 6 perbasin at an Organic loading rate of 1,3 lb BOD/day/1000 cubic foot. Thirteen Mechanical aerators, 9 in ASB#1. and 4 in ASB #2. rated at 75 Hourse power each will priode 975 total horse power for mixing and aerating the waste water. Based on the flow data above , this provides for an aerated organic loading rate of 31 lbs. BD/Doy/Housepower. This ASB System Should have an efficiency of approximately 90 % BOD removal.

Each ASB 13 lined with 24 inchis of compacted active clay, as are the Surge and spill basins andkas conerete pad on the basin floor beneath each aerator. Biological folids production in each ASB will be limited by maintaining the dissolved oxygen (DO) level between zero ppm and one ppm. At this DO level, abaut 0.4 lbs of biological Solids should be produced for each lbs of BOD removed with an overall production rate of 10900 lbs of suspende solids per day.

Treated waste water exiting ASB #2 will enter the first of two polishing ponds (PP). Each PP covers 30 acres, can be filled to adapth of 15 feet and is lined with 12 inches of native clay. The combined storage capacity of the polishing ponds is 293 million gallons. Each PP has one 75 house power aerator located near the anlet and that aerator 13 turned on when the do level falls below 1.0 ppm. A concrete pad is provided to reduce eraion.

During normal operating, only one PP will be in service and this Pond will usually be filled to adepth of 4

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fect or less. However, should it become necessary to restrict on prevent effluent dischange into the river, the PPs begin to fill simultaneously once the in service pond reacher four feed. This will provide the capability to maintain mill operations for about twenty days without dischrging waste water into the river.

The PPs should have an effisiency rating of at least 50 % based on 27.200 lbs BOD/day being removed in ABS. The producing 10900 lbs suspended solid/day of the 10.900 lbs of solids entering a PP, at least 5450 lbs are expected to be removed.

After treatment in a PP, the effluent is dischanged in to one of two diffusion header discharge between 15 - 45 MGD. Dischange ontomatically by dischange valves.

The loading rates and retention time given above are based on arate of 840 tons per day (tpd) of pulp. At a production rate of 940 tpd, the ABS ret time decreases to 11 days, while to organic loading increases to 1,5 lbs BOD/day/1000 cubic feet and the aerated loading incresses to 35 lbs BOD/day/horse power. Modification of the effluent system would not be necessary to continue efficient operation at this increased rate. However, when the production rate increases to 1250 tpd the retention time falls to 8 days, the organic loading increases to 1,1 lbs BOD/Day/1000 cubic feet, and the aerated loading increases to 46 lbs BOD/Day/horse`power. At this point, it will be necessary to addtional aerator horse power to maintain the proper level of efficient operation.

- Domestic Lagoon

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- Domestic Lagoon

Separate collection and treatment systems are provided for domestic waste water. The treatment plant consists of a two-cell lagoon capable of holding 175.000 gollons of waste water. A single lagoon is devided into two cells by a curtain with the first celll having a capacity off 100.000 contains a 3 horse power aerator, while the second cell has a 1 HP aerator. A ninety percent reduction rate for BOD ad TSS should be achieved by the domestic lagoon. The lagoon is lined with 12 inches of native day.

The treated domestic waste water leaves the lagoon and is disinfected with chlorine tablets to redue the fecal coliform count to less than 1000 per 100 ml on a mothly average. After disinfection, the effluent flow into ASB #1. BOD loading to thes system is based on an estimated 0,1 lbs BOD/person/day and a design flow of 22.000 gpd. The design flow is based on a plant population of 550 people with each person generating 40 gallons of domestic waste water. Influent BOD strength will be 300 ppm and TSS content will be about 350 ppm. Design effluent discharge rates are 30 ppm BOD and TSS and 1000 fecal coliform/100 ml, monthly average.

- Disposal Methods for Captured Solids

Large objects collected on the bar screen will be taken to the Marlbsoro Country loud fill. Shimmed material

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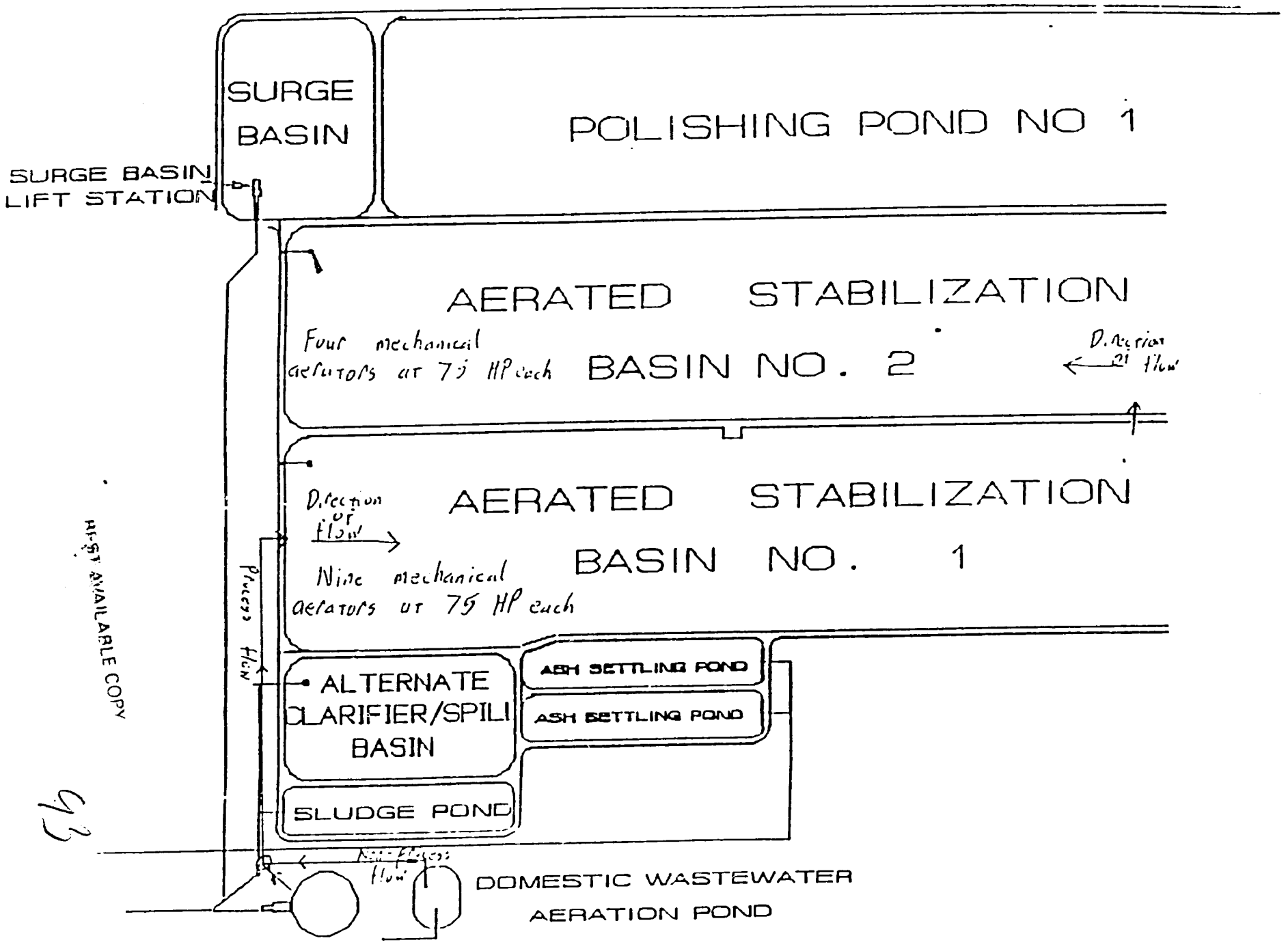
98

Question 62



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Effluent System Level 1

63

Question 6x

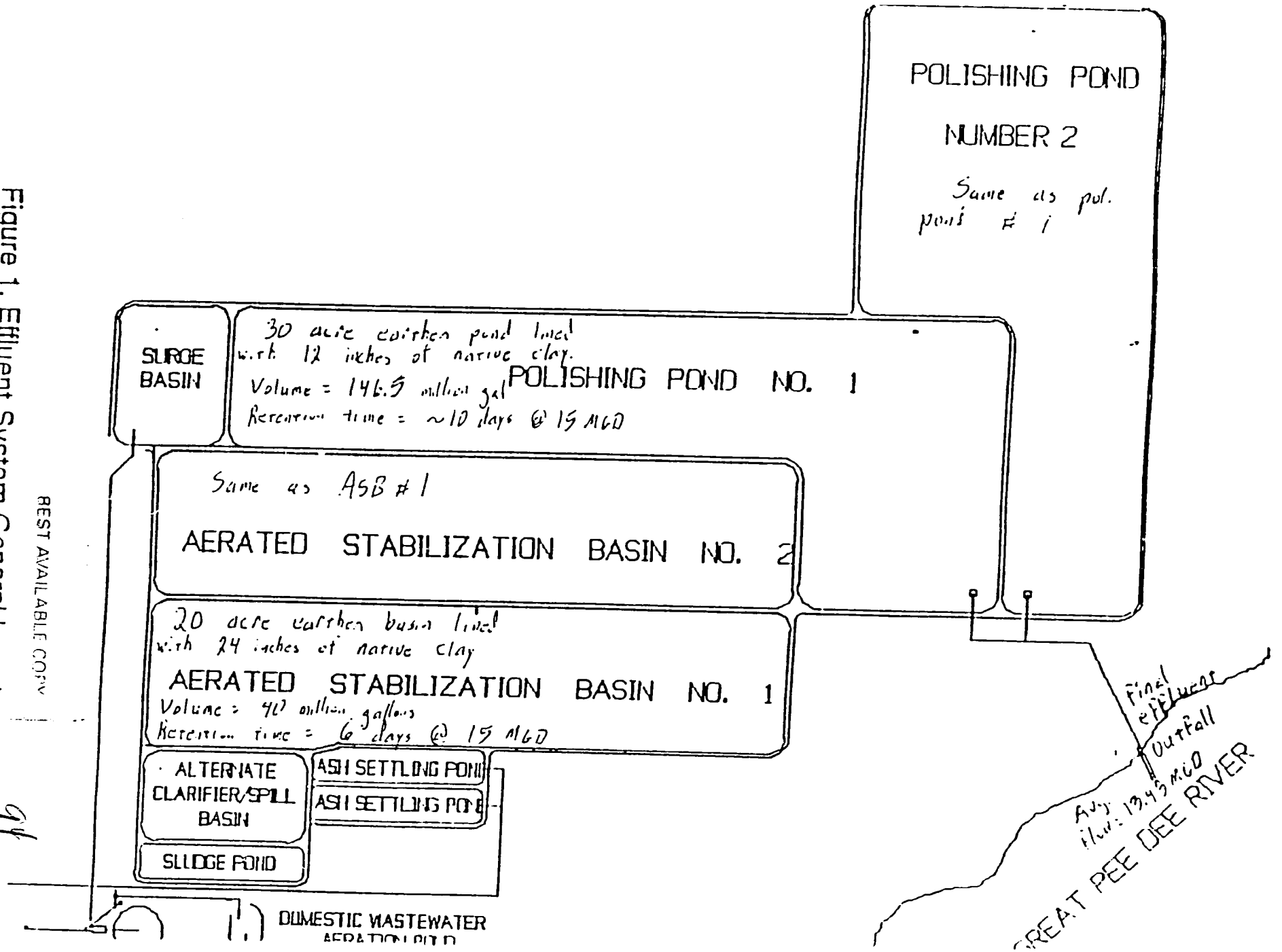

Figure 1. Effluent System General Location

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from the clorifier Surface is deposited in a waste hopper. The water drains into the lift station, while the solids go to the Marlbsoro Country lond fill. Dewatered sludge at 50 % Solids content is burned in the hog fuel boiler. Sludge in the sludge lagoon can be air and removed o the on-site willamette lond fill.

II.3. Union Camp

Union Camp is a multi-National corporation employing more than 20.000 people. In 1992 the company manufacturod more than 3,2 million tons of paper products. Arecord and had ne of $ 3,1 billion. The company operates four paper and paper board mills in the United States, Prattvile, Ala..., Savanah, Ga..., Eastover, S.C, and Franklin, V.A.

II.3.1. Union Camp Corporation
Fine Paper Division
Eastover, South Corolina

Manufacture fine white paper for use in the communications industry, (i.e, copier paper, envelopes, business forms, offset printing, reading materials and writing supplies) and bleached marked pulp. With 1800 tons per day total production as 1500 tons per day fine paper and 300 tons per day bleached pulp. Total investment $ 1,25 billion for phose 1 $ 500 million and fhase II $ 750 million. Have two paper machine with capacity rate 800 TPD, 660 TPD and one pulp machine with capacit 500 TPD.

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Union camp owns 4,400 acresat east over, of which 1000 are still actively farmed strong eviduce of the mill's compatibility with its agricultural surroundings. Best management practices are utilized to prevent topsoil loss and agricultural chemical run-off into the surrounding water ways.

III.3.2 Waste Water Treatment

Waste water form mill seperate to three sewer depend on the source : - sludge
- proces sewer
- bleached plant sewer

Sludge are diverted to the clorifier no. 1, and proces sewer are diverted to the clorifier no. 2 the clorifier no. 1 and no. 2 has the same dimensions and operated in parallel, each clorifier has 185 feet diameter and expected to removal 95 % solid. The sludge from clorifier no. 1 are pressed in the sludge dewatering.

Hydrolic over loads are diverted from the two clorifier to the mix box and conbined with the waste water from bleach plant. The total flow over 25 MGD, with loading rate 40.000 BOD lbs/Day from proses sewer and 40.000 lbs/Day BOD. If the loading is over, a part of waste water is discharged to the back-up clorifier or surge pond, and slowly will be pumped to the mix box again.

After the waste water leaves the mix box. It is discharged into Aerated Stabilization Basin splitter box, and

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the are dischorged to four Aerated Stabilization Basin (ASB) with two lines, every two ASB is operated in series. Each ASB has aunit 7 horse power aerator with 7 Days Retention time and is lined with a feed of native clay.

This ASB system should have an efficiency of approximatelly 95 % BOD removal.

Treated waste water from ASB will enter to the final stabilization pond and then enter to the effluent holding pond, with capable of containing 1000 million gallons. This pond is purposed to hold the waste water before discharge to the river in summer, to control the quality of the river.

Before the waste water discharge to the river, the effluent are discharged to the effluent measurment and foam seperator, the effluent is expected loading 2500 lbs BOD/Day.

III Conclusion and Recomendation

It has been observed that most of the mills in U.S.A have in common, many kind of good fasilities and systems, which we also should adopt for better performance.

1. The general mill lay-out is well designed such that, all the unit manufacturing department are properly located in one straight line. This good lay-out helps them in

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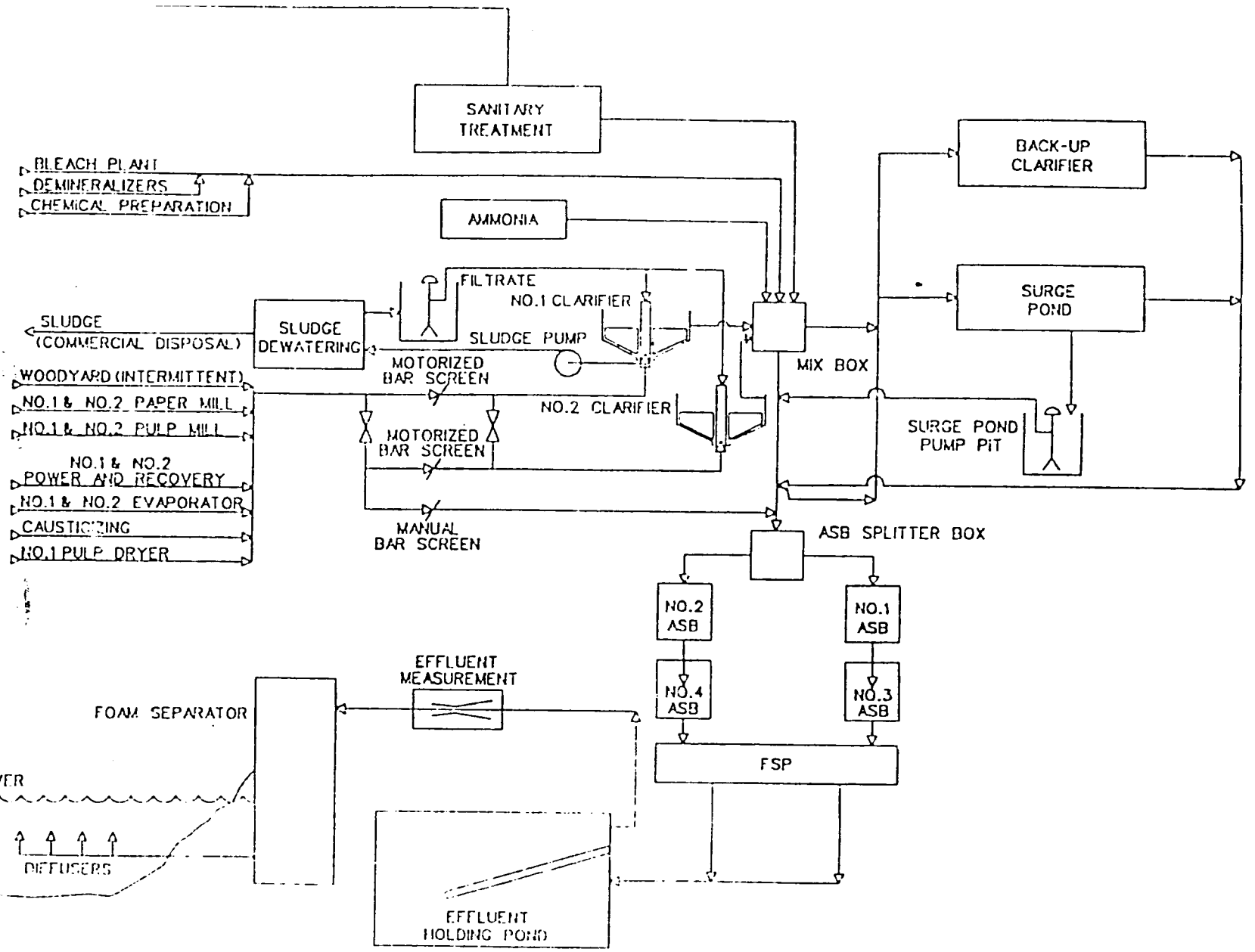

EFFLUENT TREATMENT SYSTEM

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maintaining good access to all departments, cuts production corts, cleaner up keep besides an impressive look to any visitors.

2. The mill in general have large area adjoining the existing plants for ficture wxpansions, without sacrifising the decent mill lay-out plans.

3. The location of all the mills has been quite away from the towns. So that the direct impact of air & noise four odour pollution is not felt by the residents in the town. The mills have also extensively grown trees of fast growing spicies along the out skirts & Boundaries of the mill. This gives an impressive look and commitment towards growing fresh trees.

4. Ut most priority is given on House keeping in all the mills visited, to maintain a hygenic & safer operations in the mills. The good house keeping policy has been inculcated a mong all the employees to increase their good spirits at work, this policy ahs also helped to produce good guality products.

5. Most of the mills have waste water treatment plants based on Aerated Stabilization Basin (ASB), the choise for ASB is due to
   a. easy operation
   b. low treatment cost
   c. lower maintenance and

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d. the process is difficult to be distrubed by sudden spillovers.

The only draw back is that a large area is reqired to trat the waste water by ASB processing. In view of th above facts, it is surprising that why in Indonesia, most of the mill are going for a Complicated Activated sludge process involving huge investment. Rather than going for A.S.B process.

In fact Indonesia and good tropical weather compared to USA.

6. The inplat controls, like spill control is very well organised. The spill are collected and recycled into the processes to save chemicals and reduce the waste loads to the waste water treatment plants.

7. The waste water treatment plants have emergency standard operations facilities to react immediately to any up set conditions due to problems in the pulp & paper mills with the help of emergency operation facilitier, the operation crew of the waste water treatment plant can maintain the treated effluent quality to the local, standards, without any damage.

8. In Indonesia, there are many smaller pulp & paper mills, who do not have recovery briler to process their black liqòr, in view of very hage capital cost, such mills can allternatively go for cheaper devices like roasters/smelters/kilns etc, etc, to save chemicals & reduce pollution.

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9. The research & development department should incessantly strive to develop new systems of pulp & paper manufacture to protect the evironment, without loasing the quality of the product. If may be even necessary to look for alternate raw-material sources, and processes to achieve the results.

10. The Indonesia pulp and paper manufacturis association may setup a national level research & development conte in future, to develop new environment friendly systems, and also help the pulp & paper mills in Indonesia in barious activities to improve the operational performance.

11. It is sugested that in future such study tours may please be arranged to one good modern mill in USA or Europe so that the participants can find more time to study & understand, carefully the new technology, this will help the participants togather more useful information to implement in our mills in Indonesia.

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IV. APPENDICES

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World Environment Center 419 Park Avenue South Suite 1800 New York, NY 10016
Tel: (212) 683-4700 Telex: 261290 Environment FAX: (212) 683

AGENDA FOR U.S. STUDY TOUR
INDONESIAN DELEGATES

Saturday, October 23, 1993

- Gainesville Fl
- CCH arrives
- Fairfield Inn Mariott Hotel
  6901 NW 4th Blvd.
  Gainsville, Fl 32606
  Tel: 904 332 8292
  Fax: 904 332 8292
  (same as tel - wait for them to switch over when faxing)

Sunday, October 24, 1993

- Gainesville, Fl
- Delegates arrive
- Fairfield Inn Mariott Hotel
  (same as above)

Monday, October 25, 1993

- Gainesville, FL
- Meeting at NCASI 9:00am
- Mr. Ashok Jain
  Regional Manager
  3434 SW 24th Avenue
  Gainesville, Fl 32607
  Tel: 904 377 4708 x 224.
  Fax: 904 371 6557
- Fairfield Inn Mariott Hotel

Tuesday, October 26, 1993

- Travel to
- Florence, SC
- Ramada Inn Hotel
  2038 West Lucas Street
  Florence, SC 29501
  Tel: 803 669 4241
  Fax: 803 665 8883

Wednesday; October 27, 1993

- Bennettesville, SC
- Meeting at Willamette Mill 9:00am
  Mr. James Myers
  Plant Manager
  P.O. Box 673
  Bennettsville, SC
  Tel: 803 479 0200
  Fax: 803 479 0608
- Ramada Inn Hotel

Thursday, October 28, 1993

- Travel to
- Columbia, SC
- Ramada Town House
  1615 Gervais Street
  Columbia, SC 29201
  Tel: 803 771 8711
  Fax: 803 252 9347

Friday, October 29, 1993

- Eastover, SC
- Meeting at Union Camp 9:00am
  Mr. Wes Foy
  Technical Control Manager
  P.O. Box B
  Eastover, SC 29044
  Tel: 803 353 7700
  Fax: 803 353 7981
- Ramada Town House

Saturday, October 30, 1993

- Travel to
- Atlanta, GA
- Embassy Suites Hotel
  3265 Peachtree Road, NE
  Atlanta, GA 30305
  Tel: 404 261 7733
  Fax: 404 262 0522

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Sunday, October 31, 1993

- Atlanta, GA
- Free day
- Embassy Suites Hotel

Monday, November 1, 1993

- Travel to
- Perry, GA
- Comfort Inn Hotel
  1602 Sam Nunn Blvd
  Perry, GA 31069
  Tel: 912 987 7710
  Fax: 912 987 7710 (same as tel
  - wait for switch over)

Tuesday, November 2, 1993

- Oglethrope, GA
- Meeting at Weyerhauser 9:00am
  Mr. Russell Stevenson
  Plant Environmental Manager
  P.O. Box 238
  Oglethrope, GA 31068
  Tel: 912 472 2527
  Fax: 912 472 5508
- Comfort Inn Hotel

Wednesday, November 3, 1993

- Travel to
- Atlanta, GA/New York
- Roger Smith Hotel
  501 Lexington Avenue
  New York, NY 10017
  Tel: 212 755 1400
  Fax: 212 319 9130

Thursday, November 4, 1993

- New York, NY
- Meeting at NCASI 9:00am
  Dr. Isaiah Gelman
  Vice President
  260 Madison Avenue, Suite 1105
  New York, NY 10016
  Tel: 212 532 9000
  Fax: 212 779 2849

Friday, November 5, 1993

- Delegation departs from New York, to Indonesia

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APPENDIX B

Bussines Cards

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Greg Fullenwider
Technical Specialist

Marlboro Mill
Willamette Industries, Inc.

Post Office Box 678
Bennettsville, SC 29512
803 / 479-0200
FAX: 803 / 479-0608

W. Martin (Marty) Barfield
Technical Services Manager

Willamette Industries, Inc.
Marlboro Mill
PO Box 678
Bennettsville, SC 29512
(803) 479 0200
FAX. (803) 479 6603

CFREE®

Doug R. Lazar
Senior Application Engineer

UNION CAMP TECHNOLOGY, INC.
HWY. 601 S, P.O. BOX 8
EASTOVER, SC 29044

TEL: 803/353-7917
FAX: 803/353-7026

James P. Witkowski
Environmental Engineering Manager

FINE PAPER DIVISION
P.O. BOX B, EASTOVER, SC 29044

TEL: 803/353-7916
FAX: 803/353-7026

Wesley A. Foy
Technical Control Manager

FINE PAPER DIVISION
P.O. BOX B, EASTOVER, SC 29044

TEL. (803) 353-7627

World Environment Center
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Drs. R.H.M. WIRADIPUTRA
COUNTRY DIRECTOR INDONESIA

Kuningan Plaza South Tower, Lvl 11 Suite 1104
Jl. H.R. Rasuna Said Kav. C 11 - 14 Phone [illegible]
Jakarta 12940 - Indonesia [illegible]

World Environment Center

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DEPUTY PROJECT MANAGER

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Fax (912) 472 5508

Weyerhaeuser

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Weyerhaeuser

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NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT INC

ASHOK K. JAIN
REGIONAL MANAGER
SOUTHERN REGION

P.O. BOX 141020
GAINESVILLE, FLORIDA 32614-1020
(904) 377 4708
FAX (904) 371-6557

ncasi

DR. ISAIAH GELLMAN
PRESIDENT
(212) 532 9000

NATIONAL COUNCIL OF THE PAPER INDUSTRY
FOR AIR AND STREAM IMPROVEMENT INC
260 MADISON AVENUE
NEW YORK, N.Y. 10016

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APPENDIX C

Documents Received

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World Environment Center 419 Park Avenue South Suite 1800 New York, NY 10016
Tel (212) 683-4700 Telex 261290 Envirocent FAX (212) 683-5

MISSION

The World Environment Center contributes to sustainable development worldwide by strengthening industrial and urban environmental, health and safety policy and practices.

To achieve this mission, the Center:

- Maintains an independent and non-advocacy position.
- Seeks to integrate environment, economics, energy and education.
- Establishes and promotes partnerships among industry, government and non-governmental organizations.
- Serves as a bridge for the exchange of information and expertise among industry, government and non-governmental organizations.
- Provides training and technical cooperation programs staffed by volunteer and other experts from industry, government, academia, non-governmental organizations and the general public.
- Encourages corporate environmental leadership and responsibility worldwide by providing international public recognition for outstanding accomplishments.

HISTORY

The World Environment Center is a not-for-profit, non-advocacy environmental organization. Although independent since 1981, WEC was founded in 1974 with seed funding from the United Nations Environment Programme. Today the Center is funded by industry, government, international organizations, corporate or private foundations and private citizens.

Initially, WEC published the bi-weekly World Environment Report and a number of environmental information directories. In 1977, the Center made a conscious decision to draw industry into the environmental policy dialogue with the creation of its International Environment Forum (see IEF).

In 1981, WEC held the first of four major conferences on the links between the environment and development, drawing representatives from industry, government, non-governmental and international organizations, academia and the media from countries around the world.

In 1982, after earlier pilot activities, WEC launched an industry and government supported pro bono environmental technology transfer program, the International Environment and Development Service (see IEDS).

In 1985, the first WEC Gold Medal for International Corporate Environmental Achievement was presented.

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PROGRAMS

International Environment Forum (IEF)

The IEF is a group of 57 major multinational manufacturing corporations based in eight countries and engaged in nine industrial sectors with operations on six continents. The IEF meets quarterly for off-the-record discussions of environmental, health, safety and resource management issues with senior policy-makers from around the world.

WEC offers the IEF proprietary programs, including the Country Profile Program which, through reports produced by and for IEF companies, supplies detailed information on environmental, health and safety requirements in over 20 countries worldwide.

WEC offers workshops that promote the inter-sectoral exchange of information and experience in such subjects as corporate international environmental management, environmental auditing, waste minimization, total product life-cycle analysis and waste remediation practices. Additionally, WEC coordinates the joint development of training programs to provide IEF companies cost-effective, culturally-relevant solutions to the steadily increasing need to transfer skills, technology and information to operations worldwide.

International Environment and Development Service (IEDS)

Using volunteers and other experts, contributed services and materials from industry, government, academia and non-governmental organizations, IEDS provides pro bono assistance worldwide to enhance industrial and urban environmental, health and safety management policy and practices. To accomplish this, IEDS conducts:

- institutional and factory assessments;
- technology cooperation and training workshops; and
- study tours and on-the-job internships for environmentalists and government and industry officials.

Travel and management costs are funded primarily through cooperative agreements with the U.S. Agency for International Development. Other funding comes from industry, the U.S. Environmental Protection Agency, the World Bank and private citizens. More than 250 activities have provided opportunity to work with or training for 700 professionals from 28 countries.

WEC Gold Medal for International Corporate Environmental Achievement

The WEC Gold Medal honors multinational corporations having outstanding, sustained and well-implemented, worldwide environmental policies. It may be awarded annually by an independent international jury of distinguished environmentalists from academia, government, non-governmental organizations and the medal-winning company of the previous year. Past recipients of the WEC Gold Medal are Xerox Corporation (1993), The Procter & Gamble Company (1992), Rohm and Haas Company (1991), IBM Corporation (1990), The Dow Chemical Company (1989), The British Petroleum Co. p.l.c. (1988), E.I. du Pont de Nemours & Co. (1987), Exxon Corporation (1986) and 3M (1985).

10 February 1993

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World Environment Center 420 Park Avenue South Suite 1800 New York
Tel (212) 683-4700 Telex 261270 Environcom

WEC WASTE MINIMIZATION PROJECTS INDONESIA: 1992-PRESENT

1992:

May: Waste minimization assessment of three metal finishing plants, followed by a one-day workshop/seminar on waste minimization. Two WEC-sponsored U.S. experts visited the facilities.

June: Waste minimization assessment at two pulp and paper facilities. This assessment involved observation of the current waste minimization/pollution control activities and facility operation. Two WEC-sponsored U.S. experts visited the facilities.

August: Workshop in Los Angeles, California to develop a comparative city case study on mobile sources of air pollution, in preparation for "Megacities" conference, 1993, Jakarta.

October-November: Second round of waste minimization assessment for the Pulp and Paper industry. One facility was visited by a WEC-sponsored U.S. expert.

December: Waste minimization assessments of 5 textile plants in Bandung, Indonesia followed by a one-day workshop/discussion to review audit results with plant managers. Two WEC-sponsored U.S. experts participated in the waste minimization assessments.

1993

February: WEC sponsored the "Megacities on the Pacific Rim and the Burden of Air Pollution" conference in Jakarta, Indonesia. This conference and working session addressed air quality concerns of eight major urban centers in the Pacific Rim. Topics included: Stationary sources; Mobile sources; Health and economic concerns; Institutional and regulatory frameworks.

April: Third round of waste minimization assessments for the Pulp and Paper industry. Four Indonesian Pulp and Paper facilities were visited by three WEC-sponsored U.S. experts.

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June: Second round of waste minimization assessments at metal finishing facilities. Eight facilities were visited by two WEC-sponsored U.S. experts.

July: Pulp and Paper Workshop:

This workshop was specifically designed to follow the pulp and paper plant waste minimization assessments conducted during the past year, by the three experts who performed those assessments. The workshop addressed industry-wide needs identified during the assessments. These needs included improved sampling and analysis of waste streams, knowledge of raw material used, and knowledge of manufacturing waste minimization principles and assessment practices. Workshop participants will be selected for further intensive training with the agreement that they serve as waste minimization trainers for the Pulp and Paper industry.

October: Metal Finishing Workshop:

This workshop was designed to follow up waste minimization assessments in the Metal Finishing industry sector conducted during the past year. The workshop addressed: Environmental management programs and waste minimization principles and assessment practices in the following areas: Electroplating, wastewater treatment, principles of rinsing, cyanide (chemical) safety and control, recycling and recovery, process modification.

October: Two week Pulp and Paper Study Tour of medium sized pulp and paper facilities in the United States.

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WEC NETWORK NEWS

ED BY WORLD ENVIRONMENT CENTER VOLUME 12, NUMBER 1, WINTER 1993

pollution · *Clear skies over Mexico City's Paseo de la Reforma.*

ope's ecological disaster can be ated, Megacities session told

- The environmental dis- at is Eastern and Central n easily be repeated, the tes ambassador warned a e here on air pollution.

ave all heard about in- ollution in Eastern cities, I can tell you from personal observation, over 25 years of service in that region, that the environmental disaster there is worse than you can imagine," Robert Barry, U.S. Ambassador to Indonesia, told the February session of Megacities of the Pacific Rim and

continued on page 6

Emerging economies face choice, environment or development

Jakarta – Less developed countries are increasingly finding themselves caught on the sharp horns of a dilemma as they work to expand their economies.

Dr. Emil Salim, Indonesia's Minister of the State for Environment and Population, speaking to the closing session of Megacities on the Pacific Rim and the Burden of Air Pollution, said policy makers face deciding between badly needed economic development and ecosystems stretched to their limits.

The minister remarked that the realization that bumping up against the environmental carrying capacity is creating significant constraints, comes at an unfortunate time for less developed countries. Populations have shifted from rural to urban areas and urban populations are growing faster while rural population growth declines.

As an example of environmental demands, Dr. Salim outlined an informal survey he made of his Indonesian cabinet colleagues. The survey asked each minister to estimate future departmental land-use requirements. Responses added up to 256 million hectares.

He said the survey results, even though informal, clearly indicated land-use planning cannot be left to individual sectors and land users must be prepared to compromise on their requirements.

Dr. Salim said he reached his conclusions when he realized total land requirements were 63 million hectares more than Indonesia's 193 million hectare land mass.

As less developed countries progress, the minister urged policy-

continued on page 6

lacement of 'Evil Empire' arduous, daunting task minister says

lled "Evil Empire" may be e but cobbling together a replacement is proving to uous and daunting task.

Kolbasov, the Russian n's Vice Minister of Ecol- Natural Resources, told the ernational Environment EF) meeting in New York er, current confusion over ns is rooted in the dif- es of entities which make deration.

88 members constitute an Federation. Of that ship, 20 areas are republics r own constitutions, legisla- governments. By contrast ately 50 areas, referred to s, have no local ent.

ssor Kolbasov told the IEF nizations influence environ- egislation at the federal e Ministries of Environmen- ion and Natural Resources, Public Health and Atomic Energy deal with environmental issues along with two committees, the State Committees on Emergencies and Rehabilitation.

At the regional level 17 agencies are responsible for environmental regulation in addition to a number of local agencies. "Fortunately, recent reforms have resulted in some reduction in the number of organizations," he said.

With 20 republics holding a substantial degree of autonomy, Prof. Kolbasov commented on the need for careful management of relations between the central government and the republics. Environment and natural resources are currently the subject of treaties between the federal and republican governments. Agreements cover other areas such as transportation, industrial development, and railways.

Consolidating organizations and implementing new policies is a slow process prolonged by vested interests resisting change, according to Professor Nicholas Robinson, Director of the Pace University School of Law's Center for Environmental Legal Studies and Vice Chairman of World Environment Center.

Oleg Kolbasov · *Russian Federation's Vice Minister of Ecology and Natural Resources.*

Participating as a member of a discussion panel with Prof. Kolbasov, Prof. Robinson noted Russian public opinion shows concern about the environment. "Western companies interested in investing in Russia must show, by example, their concern," he added.

A complicating element facing western companies is they are being asked to accept responsibility for clean up of past contamination. James Hildrew, Mobil Corporation's Manager of Environmental Affairs, the second member of the discussion panel, noted companies are prepared to offer technical resources to correct problems but should not be asked to shoulder undefined burdens in pre-existing conditions.

During discussions, Prof. Kolbasov said that while foreign investors will not be held responsible on a blanket basis, each situation will be looked at case by case.

continued on page 8

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Corporate group reorganized
Veras promoted, new director named

The Corporate Programs group of World Environment Center (WEC) has been reorganized. As a result Senior Vice President, James Veras, has been promoted to executive vice president and a new director of corporate programs has been appointed.

Effective February 1, Ramon Alfonso took over responsibilities as director of WEC's corporate programs including the International Environment Forum (IEF) and the WEC Gold Medal for International Corporate Environmental Achievement.

Mr. Alfonso joined WEC after a variety of management positions with Combustion Engineering and United Technologies. He founded and became president of the Alliance for International Environmental Support. The alliance, in partnership with Yale and Universidad Lasalle, was involved in training of industrial environmental managers in Latin America.

While at United Technologies, Mr. Alfonso participated in programs of the Center. He was United Technologies' senior representative to IEF and was a major contributor to and supporter of WEC's Country Profile Program.

WEC's President, Antony Marcil, on announcing Mr. Veras' promotion said it reflects a restructuring of and new challenges for senior management at the Center.

In the last eight years Mr. Veras has been involved in all aspects of the Center's management but mainly responsible for relations with corporate participants in WEC's International Environment Forum and the WEC Gold Medal program. Under Mr. Veras IEF participation grew from 30 companies to 60 firms in 1991.

The new title formally recognizes Mr. Veras' participation in strategic planning and development of the Center's long-term goals and his role in day-to-day management. He will continue to work with companies on activities involving the IEF including development of Forum meetings outside of the United States.

Following his graduation from the Massachusetts Institute of Technology, Mr. Veras spent 33 years with a number of multinational companies before beginning his own consulting practice which eventually led to his role at World Environment Center. ▲

Prague, Jakarta new WEC office sites

World Environment Center (WEC) added emphasis to its worldliness with the addition of two new offices.

Facilities in Prague, in the Czech Republic, were opened in the fall of 1992 operating with three part-time staff members. Ludmila Hofova manages the office as country coordinator. Jim Scherer is serving as advisor to the Czech Federal Committee, and the Ministries for Environment, Industry and Privatization. Radomir Matyas is a WEC Fellow who will coordinate activities.

Former PT Goodyear employee, Harry Wiradiputra, was appointed January 1 to head WEC's new office in Jakarta, Indonesia. Mr. Wiradiputra assumed his position in time to be involved in the February activities conference.

Staff in the Prague office will be responsible for activities in Eastern and Central Europe. The Jakarta office, space for which is being acquired, will oversee a number of WEC activities in Indonesia including the Local Accident Mitigation and Prevention program.

WEC currently operates with headquarters in New York and offices in Washington, DC; Mexico City, Mexico; and Bangkok, Thailand. ▲

Berlin IEF - *Former USEPA Administrator William Reilly makes a point at a news conference while his German counterpart, Klaus Töpfer, listens.*

EPA's carrot & stick work better than command & control

Berlin – Much remains to be done before major environmental goals are accomplished, but steps necessary to reach the objectives have been established, the outgoing Administrator of the United States Environmental Protection Agency (EPA) told a meeting here of the International Environment Forum (IEF).

"We may not yet have fully realized our most important environmental and economic goals, but I think the path we need to take is well marked," William Reilly, who left the EPA in January, 1993 said at the December meeting.

The 1992 environment conference in Rio de Janiero established the political "linkage" between economic growth and environmental protection, Mr. Reilly remarked. "Linkages between the economy and the environment, accepted as philosophical truth in many political and business circles, are still difficult to forge in practice."

Mr. Reilly criticized what he called, "command and control as standard U.S. government operating procedure" admitting it had improved environmental quality in the United States.

"But over time it's become apparent that environmental policy based on prescriptive 'command and control' has many drawbacks. It doesn't work as well, or at all, when the sources of pollution are small and dispersed, when individual – as opposed to corporate – behavior is involved."

In the last four years EPA has imposed more fines, penalties and months of jail time for violators of environmental law than in the agency's previous 18 years combined. "But we are adding a new tool, a carrot that complements the big stick of enforcement."

He said government, by defining the best pollution controls for an industry, "creates a disincentive for technological advancement."

Community right-to-know requirements, law since 1986, have produced an unexpected result. By requiring business to report the quantity of some 200 toxic chemicals released into air, water and land, corporate executives have also been informed of the waste from their own facilities, the result of inefficient use of process chemicals, solvents and energy.

"It gave corporate executives a strong economic incentive to find ways to reduce waste and liability, save money and . . . improve their image and build public confidence," he said.

Subsequently, EPA was able to get reductions in pollution levels by asking. Mr. Reilly added reductions were achieved, "not just because we asked, but because corporations increasingly realize that it's in their economic best interests to cut pollution." Other voluntary efforts have achieved "similar results", he said.

continued on page

Conventional wisdom is wrong - environment must come first

...n - Current conventional wis-...m is wrong - environmental is-...n Eastern Europe and the ...World cannot take second ...o economic development ...t "serious consequences," ...r. Klaus Töpfer, the German

...Töpfer - German Minister for the ...ment, Nature Conservation and ...r Safety.

...l Minister for the Environ-...Nature Conservation and ...r Safety; told the 64th meet-...the International Environ-...Forum (IEF).

...f Töpfer speaking to the ...ber meeting, IEF's first ever ...session in Europe, said ". . . we are often confronted with the theory that, because of their (Eastern European and Third World countries) economic situation, these countries are not in a position to take account of the environment. According to this theory . . . it is only on the basis of a certain level of economic prosperity that environmental protection can be financed."

"I believe this is a fallacy which could have serious consequences for these countries, not only from an ecological, but also from an economic point of view," the minister warned.

Prof. Töpfer told the IEF session the environment must be viewed as any other capital asset and treated by corporations in the same way a company looks after its other capital stock. "By taking . . depreciation into consideration a company sets the basis for maintenance of its activities in the long term. The same is true of our environmental capital."

The minister cited examples from a recent German study which examined the scale of costs of environmental abuse:

- emission-related building damage - 1.8 to 3.2 billion Deutsche Marks per year ($1.13 to $2 billion dollars US);
- cost to provision of safe drinking - 1.7 billion Deutsche Marks ($1 billion dollars US); and
- soil pollution cost - 22 to 60 billion Deutsche Marks ($13.8 billion to $37.8 billion dollars US).

"There can be no doubt preventative environmental protection is cheaper than subsequent clean-up," the minister said adding, "environmental protection must not be put off . . . it must be ensured that this (economic) growth is environmentally compatible and thus can be maintained in the long-term."

In addition to delivering the keynote address to the session, Prof. Töpfer was also its host as a result of his 1991 invitation to the IEF to meet in Germany. The gathering was a series of opportunities. Not only was it an occasion for IEF companies to meet and hear from the German minister, it was also an event for European company officials to be exposed to IEF and to hear from a leading American regulator, William Reilly, the outgoing Administrator of the United States Environmental Protection Agency.

Commenting on environmental policy, the minister noted effective policy requires involvement by both government and the private sector. He was critical of the former Eastern European governments saying, "the socialist command economy" failed to provide even a minimum level of regulation.

However, the free market economy is not "automatically environmentally compatible," he added.

The objective of government e...vironmental policy "must be to ge... the social market economy towards" ecological needs.

Government policies which se... "clear framework" of law and in...

"There can be no doubt preventat... environmental protection is cheaper th... subsequent clean up"

...tegrate environmental and busine... concerns, will trigger "the superiority of market mechanisms" generating corporate "interest" in protecting the environment.

"In order for an ecological market economy to function, cooperation is required between the state and trade and industry." The minister added, "however, it is in the final analysis, the state whic... bears ultimate responsibility for en...vironment policy and thus must en...sure the measures that are necessary are implemented even if they meet with opposition from trade and industry."

The countries of Central and Ea...ern Europe have "dramatic ecologi...cal legacies" which they cannot ove...come on their own. Similarly, countries of the Third World have equal need for assistance from the industrialized countries.

"These (developing) countries. . also have a moral right to aid since it is beyond doubt that many globa... environmental problems have bee... caused by the industrialized countries."

...from page 2

...'s carrot & stick

...Reilly called on multinational ...nies to "embrace the revolu-...volunteerism," saying to do ...help governments address ...g global environmental ...with the least burden on ...y and society.

...u should be committed to go... ...compliance, whatever com-...means in a host country. It ...you to foster technological ...tion, continuous improve-...he told the group of cor-...officials.

...ernment actions on ecologi-...edges will be dictated by politi-...osophy and their state of ...ic development. Regardless ...se actions, "voluntary actions ...national corporations will be ...to . . . overall success," ...ed.

IEF in Berlin sets new records

December's 64th meeting of the International Environment Forum (IEF) in Berlin, Germany set a number of IEF firsts.

World Environment Center's (WEC) Executive Vice President, James Veras, responsible for the IEF, reported the Forum's meeting in Berlin was the first IEF session held outside of North America.

A second milestone for the IEF came from its speakers. For the first time, an IEF audience heard from two senior environment ministers at the same session. Prof. Dr. Klaus Töpfer, the German federal Minister for Environment, Nature Conservation and Nuclear Safety; and his outgoing American counterpart, William Reilly, the then administrator of the U.S. Environmental Protection Agency (EPA), both addressed the meeting.

With two high quality speakers, it was not unusual that the forum should have its largest audience, the third accomplishment for the Berlin meeting.

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derstanding other cultures

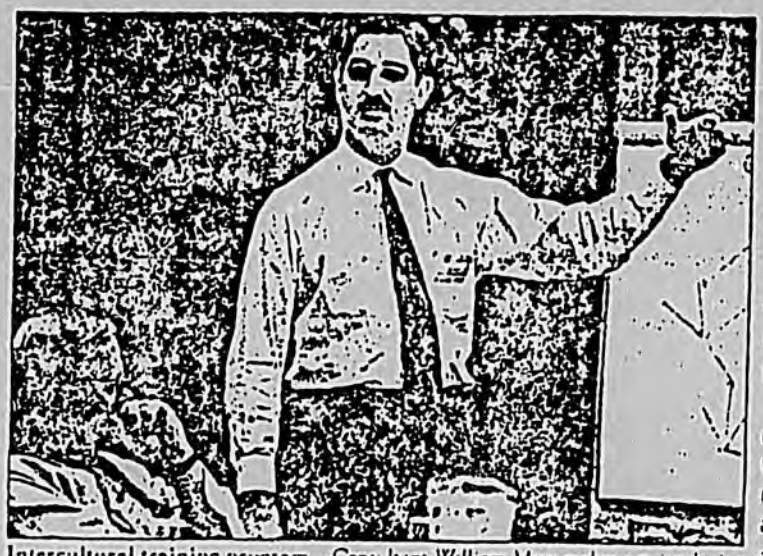
New program offers training to appreciate other cultures

Iraq and the coalition forces Desert Storm go to war be- cultural misunderstanding? at's the conclusion the Saudia Ambassador to the United came to as the air war began Iraq on January 17, 1990. Bandar bin Sultan, who's were reported by Bob Wood- his book *The Commanders* and Schuster 1991), is said been involved in negotia- between Iraq, the United and Saudia Arabia following invasion of Kuwait.

mass destruction of war an extreme example, but it worst possible result when from different cultures fail erstand each other because differences.

sponding to the increasing ation of business, and the g higher potential for mis- standing, World Environment (WEC) is now offering a pro- to expose international busi- to the need for sensitivity in ons between cultures.

program, "Training for Diversity: Understanding the n Factor," was offered during a compressed, one-day session in New York last October.



Intercultural training program - *Consultant William Moss makes a point during the first intercultural training program. WEC's Director of Training, Peter Beckschi, is seated at left.*

William Moss, a consultant with extensive experience in intercultural training, and Peter Beckschi, WEC's Director of Training, lead the session for 20 representatives from companies participating in the International Environment Forum (IEF).

"Lack of cultural, human sensitivity is one of the most potent barriers to the flow of information," Mr. Beckschi said.

To overcome that lack of sensitivity the seminar examines a five dimensional "model." Mr. Moss said this model is used by a number of multinational firms, such as Royal Dutch Shell and British Petroleum, to define cultural differences.

Among the areas covered are the way a culture creates authority structures, the role of personal identity and integration with groups, and tasks and relationships.

The objective of the program, according to Mr. Beckschi, is to give participants a working "mental model" of how different cultures operate. As a result, there should be less anxiety for people who must work across cultures and greater comprehension of information passed between cultures.

"At the urging of a number of companies, WEC began looking at this area in the context of transferring information on and as well as awareness of environmental, health and safety issues to other cultures," Mr. Beckschi remarked.

Following the October seminar WEC was approached by companies to offer the program to employees. One in-house session has been contracted and Mr. Beckschi said another seminar, open to IEF companies, will take place May 13 and 14 in New York City.

Seating at seminars is limited. Additional information is available from Mr. Beckschi at WEC. ▲

Ten IEF companies mark 10 years

992 marked a decade of par- tion for ten companies of the ational Environment Forum

cornerstone of World Environ- Center (WEC), the Forum, cur- a group of some 60 multina- manufacturing companies, several times each year for record discussions on en- mental, health, safety and ice management issues with policy-makers from around world.

an October 14, 1992 dinner hairman and Vice President of Signal, Inc., Edward Callahan, Professor Nicholas Robinson, Chairman of the WEC Board of tors, presented plaques recog- g corporate participation and essing appreciation for con- d support.

Companies recognized were: Minerals, The Dow Chemical Company, Engelhard Corporation, Exxon Corporation, IBM Corporation, Mobil Oil Corporation, Occidental Petroleum Corporation, 3M Corporation, Unocal Corporation, and Westvaco Corporation.

IEF senior representatives - *Company representatives receiving plaques marking ten years of participation are (left to right) Ernie Rosenberg of Occidental Petroleum, Robert Dostal of Dow Chemical, David Benforado of 3M, John Kelly of Exxon International, James Hildrew of Mobil Oil, Rita Ewing of BHP Minerals and IEF Chairman Edward Callahan of Allied-Signal.*

Employees of the ten firms have contributed countless volunteer hours to the Center as a whole and the International Environment and Development Service (IEDS) in particular. IEDS is a technical cooperation program providing professional development and sharing of environmental expertise around the world.

Organizations eligible to participate in the IEF are multinational manufacturing or processing companies with production facilities in more than one country and a desire to contribute to global sustainable development by strengthening industrial and urban environmental, health and safety policies and practices. ▲

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ime away from government refreshes, revitalizes, gives perspective

orual struggle to main- t with customers, it is r an organization, te, to keep employees ew clients' perspectives.

e organizations en- oyees to work outside on for a period then g a new, refreshed in- ch the Intergovernmen- Act the United States enables its employees term positions with ents and non- organizations. For e, it is an opportunity ew skills, learn how dif- zations function and a new perspective.

vironment Center enefitted from this pro- t Hardaker, now a n WEC's Washington to WEC having been iginal employees of ental Protection Agen- an interview with Net- Mr. Hardaker talked vernment career, its nd the satisfaction of EC.

ews: What did you mplish by participating ge?

er: In mid-1991, I ersonal conclusion I end some time outside envent myself. There things I wanted to ac- felt I needed to get environment, working e-ground issues. In wanted to work on inter- vironmental issues and proaches to govern- y cooperation. I also e whether I could have tive and more satisfy- n problems from out- bureaucracy.

oes that relate to your our perspective at EPA.?

er: I like to think I have variety of programs in environmental looking for better ways vernment services, cooperation among all holders and building state and local environmental management capacity.

NN: Do you think that influenced your desire to look outside of government?

Mr. Hardaker: In some ways, yes. If you are familiar with TQM (total quality management) you know a keystone of TQM is identification with your customer. That's important for government too because it is easy for government employees, after a time, to come to believe their client is government. It's not.

NN: Do you know why you felt that need to see the world from the other side of the fence, as it were?

Mr. Hardaker: I've been working in government for 20 years. I realized I needed to get out with my real clients and see the government from their perspective. To me the experience will clearly help me to do my job better.

NN: What arrangements lead to your coming to WEC?

Mr. Hardaker: For all intents and purposes, I'm on loan to WEC from the EPA. Once I decided I wanted to work outside of the EPA I received approval from the deputy administrator for two-years service. An agreement between WEC and the agency provides me with a secure position at the agency and a job at WEC. The agreement between the two also includes a negotiated arrangement on payment of my government salary and benefits.

NN: You have been here at WEC for a little over a year. Have you come to any conclusion about your experience at the Center?

Mr. Hardaker: It has been incredibly satisfying.

If you are really intent on having a perceptible impact, if you really crave it, this (WEC) is the place. Of course, the environmental problems in these countries (where WEC works) are enormous, but pretty much whatever you do has an impact. You can see it in the faces of the people with whom we work. I feel that I'm having a real effect.

Now I may have been in a really advantageous position from the start because it was an extraordinary coincidence that I met (WEC President) Tony Marcil just as the Mexico program was about to begin.

At EPA I did a lot of work shaping programs and initiatives. With the Mexico program I have had the chance to develop the program concept then actually working on its implementation.

NN: What will you take back to EPA, both personally and professionally, from your experience?

"If you really are intent on having a perceptible impact, if you really crave it, WEC is the place."

Mr. Hardaker: Well, first of all, I'll take back a feeling of renewal, revitalization. Second, I'll also take back a sense of the environmental challenges out there, challenges that people and organizations, like WEC, are doing something about.

Third, and perhaps most important, I'll return with a sense of how and what EPA can and should do to work more effectively with industry and nongovernmental organizations, like WEC, to accomplish our shared environmental goals.

NN: As a manager in government, what would you say to a staff member or colleague who asked about the wisdom of and the experience from this kind of activity?

Mr. Hardaker: I would, without question, recommend the experience particularly if it was with an organization like WEC.

NN: You transferred from a large organization into a much smaller one, how does it feel?

Mr. Hardaker: It has been a definite challenge shifting from a large government system to a small nongovernmental organization! I have also moved from doing a lot of talking about problems to doing a lot about them.

Working on the Mexico project has the additional demand of moving from thinking in terms of U.S. culture and problems to thinking about those of Latin America.

NN: Are there other aspects to your service with WEC that give you satisfaction?

Mr. Hardaker: As you know, we work primarily with volunteers, experts in their professional fields. They give us their expertise, on an uncompensated basis, for a period of about two weeks.

So far, it has been a truly wonderful, growing experience that, as we often hear from the volunteers, gives back way more than it takes!

NN: How did you come to be working at WEC?

Mr. Hardaker: Bill Reilly, (then the EPA's administrator, has been very interested in international environmental and trade-related issues and I was working in his office on a range of international environmental problems.

My first boss in Washington and long-time mentor, Bert Printz, is the person largely responsible for my being with WEC today. He connected me with Tony Marcil and we both agreed WEC was the right place.

NN: What career background did you bring to WEC?

Mr. Hardaker: I have over 20 years of experience in the environmental field starting with the Department of the Interior's Federal Water Quality Administration in Chicago. Most of my career has been spent in Washington with a strong emphasis on managing domestic water quality programs.

I have worked on a number of challenging programs including development of the new National Pollutant Discharge Elimination System and development of an innovative operations and maintenance training and technical assistance program for waste water treatment facilities.

Just prior to coming to WEC, I was acting director of the EPA administrator's Office of Cooperative Environmental Management. ▲

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Megacities initiatives to continue

- Eight of the world's ities, home for over 75 mil- ple, have agreed to con- series of joint initiatives to s problems of urban air pollu-

egations representing the greed, at the concluding ses- Megacities on the Pacific d the Burden of Air Pollution, lish a permanent steering ttee of city representatives to n common air quality issues.

r the next two to five years es will attempt to address ex- roblems and transfer and im- t new air pollution tech- and techniques. The role of ering committee will be to t various national initiatives ding facilities for exchange mation between participat- es.

anization of the permanent g committee began immedi- llowing the February ties meeting here.

ong the projects the cities ertake are harmonization of t air quality standards, emis- onitoring and coordination of tion programs within the region and exchange of information on existing technology and techniques.

Each of the eight cities participating in the Megacities meetings will appoint a representative to the steering committee. World Environment Center (WEC), one of the meeting organizers, will provide support services to the steering committee. WEC will also assist the cities by aiding the steering committee in identifying projects, organizing timelines, and project monitoring and evaluation.

Participating in the four days of Megacities meetings and the new committee are representatives of the cities of Bangkok, Jakarta, Kuala Lumpur, Los Angeles, Manila, Mexico City, Singapore, and Taipei. The meeting's examination of the stipulated principal emissions source, mobile source, was aided by the release of a two volume report prepared at California's South Coast Air Quality Management District in the summer of 1992.

Megacities was organized by WEC with assistance from the Mansfield Center for Pacific Affairs. ▲

d from page 1

lem urban growth unstoppable

s to focus on four principal resource management, waste gement, human resource gement and rehabilitation and ment of the prevailing nment.

ce those factors have been ed, the focus can then be to economic progress gh development of those nts.

r days of Megacities meet- n February were attended by ple from the cities of ok, Jakarta, Kuala Lumpur, geles, Manila, Mexico City, pore, and Taipei.

ing to address the problems world's megacities, such as ation, risks damaging the ecol- nd the economic stability of es themselves, Indonesia's as- t minister for population and nment told the Megacities ng session.

the problems facing urban areas in developing countries, yet remaining unaddressed by society, are traffic congestion, backlogs of services and facilities and resource depletion. The assistant minister said those problems are often interrelated and not limited by local, regional or international boundaries.

"To remain unchallenged (these environmental problems) will lead to various population and environmental constraints so that . . . ecologically sound and sustainable development itself will be at risk," Dr. R.E. Soeriaatmadja, Assistant Minister of State for Population and Environment, said.

To date, the world's megacities have failed to adequately address a number of issues, urban air pollution among them, he added.

Laying the statistical groundwork for his minister's remarks, Dr. Soeriaatmadja noted the global urban population has grown from under 300 million people in 1950 to over 1.3 billion people in 1992.

If the urbanization trend continues over the 1990s, the world's urban population will reach two billion people. "No country in the world, especially in the developing countries, . . . is able to restrain, successfully, the urban population growth," Dr. Soeriaatmadja added.

To support themselves, the megacities must improve their productivity and quality of urban environment will be key to accomplishing that goal. The assistant minister remarked that an improved environment will result in "better income generating activities" producing "higher productivity of human resources" in urban areas.

Future development of the megacities will be a fine balancing act. Improved productivity and environmental quality may add to problems confronting the cities by increasing their desirability and generating increased migration from rural areas.

Solutions to the problems of or of the megacities may lie in the experiences of another. In some cases, the assistant minister said, one city's failures may turn out to be another city's solution because of the diversity in conditions between the cities. ▲

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Pollution transnational problem

the Burden of Air Pollution.

"Cities there (Eastern Europe) are an environmental nightmare and I fear the mistakes made in Eastern Europe will be repeated elsewhere," Ambassador Barry warned conference participants including over 60 representatives from eight major cities of the Pacific Rim.

He said the Megacities meeting represents an important landmark, "(it) reflects the realization that none of us can afford to pursue economic growth blindly, relegating environmental protection to secondary importance."

"Pollution is a transnational problem . . . we are all in this together," he added.

Speaking at the opening of the four-day Megacities symposium, the ambassador told city representatives environmental awareness is no longer a "luxury." Traditional economic growth and resource utilization policies have "seriously degraded" the earth's productive capacity. "We must use resources more wisely than in the past."

"Clearly, I do not mean to suggest that we must cease all industrialization or economic development. That is obviously impossible and undesirable. But I do mean that sustainable economic growth policies must become the norm, with social and environmental needs factored into planning."

Commenting on American technical and regulatory initiatives, the ambassador said progress has be made, "but more needs to be done." In particular he cited the need for American companies to transfer, to countries with air poll tion needs, improved environmen protection technology.

"The U.S. is committed to wor ing, as a partner, with Indonesia and with other countries in the region to promote sustainable economic growth," Ambassador Barry said. He told city representatives the United States does not have all the answers. It does have considerable experience with environmental technologies that can be "helpful."

Four days of Megacities meetings were attended by representatives of the cities of Bangkok Jakarta, Kuala Lumpur, Los Angele Manila, Mexico City, Singapore, a Taipei. The meetings, following u sessions held in the summer of 1992, heard a series of technical reports and concluded by organizing information sharing and actio programs to address urban air pollution.

Megacities was organized by World Environment Center (WEC) with assistance from the Mansfield Center for Pacific Affairs. The United States Agency for International Development, the United States/Asia Environmental Partnership and the Environmental Protection Agency provided substantial funding for the event with additional financing from Taiwan and WEC. ▲

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ɜste minimization demonstration

East Europeans show pollution prevention can be profitable investment

ɔu made a one-time investɜnt of $5,000 and earned a ɜn of $90,000 a year following ɜst year and for every year ɜafter, would you consider it a ɔwhile investment?

ɜat is a conservative estimate ɜnomic returns to be earned ɜolish industrial facility parɜing in a waste minimization ɜnstration project run by World ɜnment Center (WEC). The ɜmonths of WEC's program, ɜed by the United States Agency ɜernational Development ɜD), shows the potential for ɜarger financial returns at ɜproject sites.

ɜablishing a value for the posiɜvironmental impact of the ɜam is not as easy as calculatɜe economic benefits but the ɜs are equally profound, accordɜRomuald Michalek, WEC's ɜresident for Central and Eastɜurope's Region I.

ɜprovements at this Polish ɜshould see air emissions of orɜcarbons alone drop by about ɜetric tonnes per year.

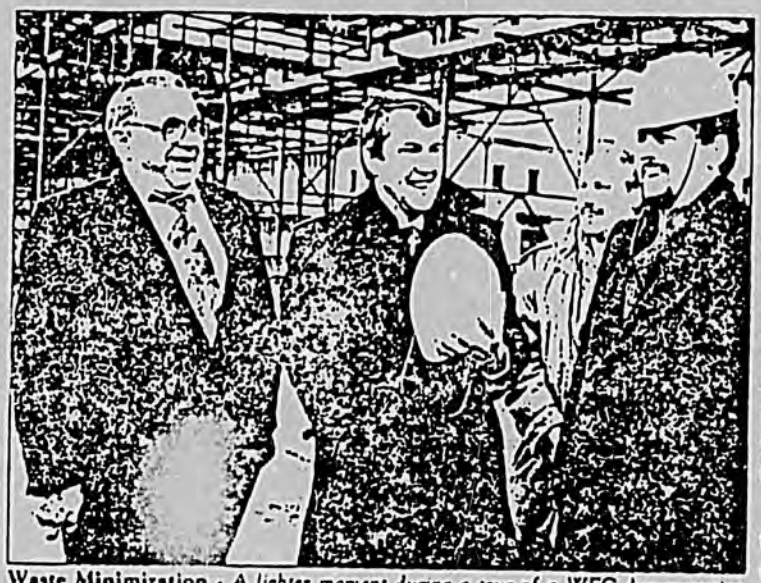
ɜams from WEC's International ɜnment and Development SerɜEDS) are running a series of ɜnstration projects at targeted ɜial plants in Central and Eastɜurope. The main objective is ɜnsfer technology and techni-

> ɜ5,000 invested in ɜste reduction earns ɜturn of $90,000 a year . . ."

ɜ build local pollution reducɜapabilities and show economic ɜs from the use of low-cost ɜcost waste minimization ɜques.

ɜt every plant or company is ɜe to participate in the proɜr. Michalek said. "Facilities ɜneet five criteria."

ɜt, and perhaps most impor-tant, plant management must be interested in and committed to the project. As an indication of commitment company executives must sign a participation agreement. "There is no question about it, top plant management must be committed to the project," remarked Tom McGrath, WEC's Vice President for Central and Eastern Europe's Region II.



Waste Minimization - *A lighter moment during a tour of a WEC demonstration project. U.S. Ambassador to Poland, Thomas Simons, (center) and U.S. Consul General in Poznan, Christian Kennedy (right) were briefed by Jerzey Ossowski, General Director of Organika Zachem, (left) and WEC officials at company facilities in Bydgoszcz, Poland.*

Second, the facility must have serious pollution problems and opportunities for waste minimization.

Third, the company must be in an industrial category important to the host country. With the condition of economies in the region, an early focus on key economic sectors is important to the countries, Mr. Michalek said.

Fourth, the plant must be economically viable. If the enterprise has not been privatized, it should be a candidate for government divestiture.

The fifth, and key criteria, is the site, when feasible, must be within the river basins that feed the Danube River. USAID, The World Bank and other organizations are involved in programs to improve the quality of the Danube.

Enhancing plant efficiency generates economic savings which should improve the financial viability of these enterprises by reducing their consumption of inputs such as energy and raw materials, Mr. McGrath said. Less being consumed means lower quantities of waste. For the plant, the diminished waste stream means reduced environmental liabilities and improved opportunities for relationships with western companies.

The old centrally planned economies of Europe curbed plant reinvestment in favor of directing profits to large, national undertakings. Projects important to local management were given lower priority.

Minimizing waste should occur at source, Mr. Michalek said. To take advantage of economic and environmental benefits, local management needs to be in a position to decide priorities and make choices.

A typical WEC waste minimization team is made up of at least three people: an independent consultant, an expert and a WEC staff member. The team works with management and staff, both at and away from the plant, for about a year.

While process updating is a significant factor in project success, equally important is sensitizing plant operations staff and management to waste and its economic and environmental costs.

"One of the things we are trying to do is work ourselves out of a job," Mr. McGrath said. WEC teams assist with establishment of a plant-wide waste minimization committee structure and provide training programs to educate plant staff and management, local independent consultants as well as representatives of other area plants.

Depending on the project, time may be divided between plant process matters and training of staff and management in waste minimization activities.

"We are working to promote the spread of waste-free technology and techniques throughout the region like the ripples created when you drop a stone in a pool of water," Mr. McGrath commented. To avoid reinventing the wheel, teams also aid in seeking out case studies and other sources of information useful to project participants.

> *"We are working to promote the spread of waste-free technology . . . like the ripples created when you drop a stone in a pool . . ."*

The waste minimization project, a first for WEC, was conceived and designed by WEC staff working closely with both Washington-based and field staff of USAID. By demonstrating the economic benefit of waste reduction at source, the old state owned companies develop their own motivation to achieve the ultimate goal of waste-free industrial processes. ▲

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EC Gold Medal

Call for nominations

World Environment Center (WEC) is now accepting nominations enth WEC Gold Medal for International Corporate Environ- Achievement.

rded annually, the WEC Gold Medal recognizes industry's con- to international environmental management.

e eligible, a corporation must have substantial international s with an outstanding, sustained and well-implemented en- ental policy. Submissions are evaluated by an international jury guished, independent, multi-disciplinary, multinational experts ustry, academia, government and non-governmental organiza- The jury assessment of the submissions seeks a corporate policy ating positive environmental practices, clear examples of that d leadership in the international environmental field.

stry, organizations, governments, associations, institutions and in- s may submit nominations. Self-nominations are also accepted. mission deadline is August 2, 1993 with the jury announcing its in December. The medal presentation takes place at es in Washington, D.C. in the spring of 1994.

e Corporation will receive the 1993 WEC Gold Medal at ion ceremonies on April 30. Previous recipients include The & Gamble Company, Rohm and Haas Company, IBM Corpora- e Dow Chemical Company, The British Petroleum Company, E.I. de Nemours & Co., Exxon Corporation and 3M Corporation.

onal information is available from the Center. ▲

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Russians seek money & clean technology

The vice minister added, "Russia encourages foreign investment but is seeking experienced investment, investment that brings with it high and clean technologies."

Established in 1991, the Ministry of Environment and Natural Resources plays a key role in the regulatory process. The Law of the Russian Federation on Protection of the Natural Environment is the main regulatory statute setting policy for resource development and economic activities ranging from existing industry to agriculture and use of water, forests, and other biological resources.

Prof. Kolbasov noted new federal laws have been passed setting standards for air, soil, drinking water and food. Others are being developed based largely on current European Community standards. ▲

"Russia encourages foreign investmer is seeking experienced invest investment that brings with it high clean technologies."

NETWORK NEWS is published by the World Environment Center (WEC), an dependent, not-for-profit, non-advocacy organization. Founded in 1974, WEC contributes to sustainable development worldwide by strengthening industrial and urban environmental, health and safety policy and practices. Through thre complementary programs, WEC serves as a bridge for the exchange of informa tion and expertise among industry, government, and non-governmental organi tions.

WEC receives funding, in-kind resources from industry, government, national and international agencies, foundations and private citizens. Volunteer expert vices are the hallmark of the Center's programs.

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Since 1977, the IEF has offered industry executives the opportunity to meet senior policy makers from around the world for off-the-record discussions on environmental and resource management issues. Today, 59 multinational corporations, based in eight countries and engaged in ten industrial sectors, participate in the IEF. Through IEF quarterly meetings, an international network of government and industry contacts is maintained. The IEF also offers workshops and country profiles for the benefit of the participating corporations.

WEC Gold Medal for International Corporate Environmental Achievement

The WEC Gold Medal is presented to a multinational company that has an outstanding, sustained and well-implemented worldwide environmental policy. Every year since 1985, an independent international jury of environmentalists from government, academia and industry has selected the recipient of the WEC Gold Medal. Public recognition of corporate environmental initiatives stimulates global environmental leadership and draws attention to the potential benefits of an environmentally sound corporate policy.

Recipients of the WEC Gold Medal are The Procter & Gamble Company (1992), Rohm and Haas Company (1991), IBM Corporation (1990), The Dow Chemical Company (1989), The BP Group (1988), E.I. du Pont de Nemours & Company (1987), Exxon Corporation (1986) and 3M (1985).

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These companies participate in the IEF, a program of the World Environment Center

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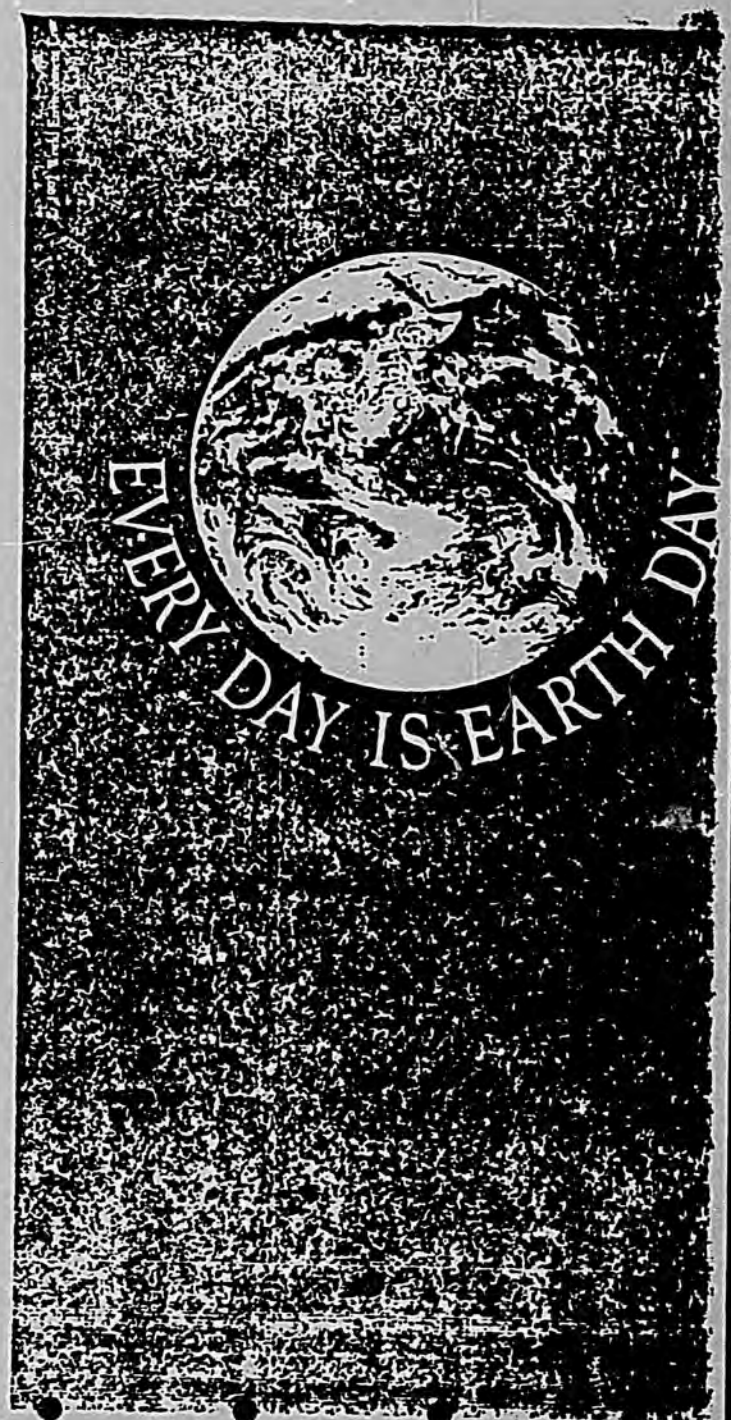
WEC™ World Environment Center



ery day is Earth Day at the World Environment enter (WEC), an independent, non-advocacy ganization contributing to sustainable evelopment by strengthening industrial and urban vironmental, health and safety policy and actices worldwide.

EC makes every day Earth Day as it seeks to egrate the four E's - *Environment, Economics, ergy* and *Education* - in practical solutions to obally recurrent issues.

accomplish this, WEC establishes and promotes rtnerships and acts as a bridge linking industry d government and non governmental ganizations (NGOs) around the world. The thusiastic participation of volunteer experts from dustry, government, academia and NGOs has en the cornerstone of WEC's success.

vo complementary programs - the International nvironment and Development Service and the ternational Environment Forum - respond to the owing demand for environmental expertise by fering opportunities for sharing technical formation between the private and public sectors. e WEC Gold Medal for International Corporate nvironmental Achievement recognizes corporate adership above and beyond regulatory quirements or common practices.

ounded in 1974, WEC's headquarters are located New York City with additional offices in Prague, zechoslovakia; Mexico City, Mexico; Bangkok, hailand; and Washington, DC, U.S.A.

The Earth Summit's goal of forging a new "Earth Ethic" is epitomized by the World Environment Center's global vision. The Center, an outstanding environmental leader, builds partnerships around the world for environmentally sound, sustainable development.

Maurice F. Strong, Secretary-General
United Nations Conference on

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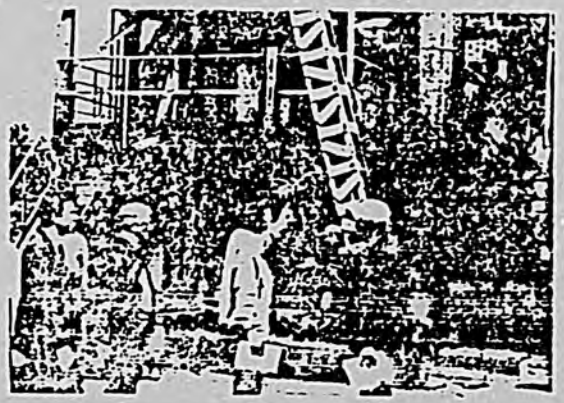
A volunteer expert from Fletcher Challenge Canada Ltd. and a host country engineer at a pulp and paper plant in Akdeniz, Turkey

An Occidental Petroleum Corporation volunteer inspects a fire boss at a petroleum facility in Dhurnal, Pakistan



International Environment and Development Service (IEDS)

Thanks to over 275 environmental, health and safety volunteer experts, IEDS has provided pro bono services in 32 countries.

Since its first project in 1982, IEDS has demonstrated to companies, organizations and governmental agencies that economic benefits are derived from environmentally sound management.

Over 180 projects involving 700 host-country professionals have been completed including activities such as:

- industrial environmental reviews at national, sectoral and individual plant levels;
- support for the strengthening of environmental institutions and the drafting of environmental laws and regulations;
- organization or support of workshops, training programs and conferences; and
- study tours and on-the-job internships for officials from industry and government.

Travel and management costs were initially funded through cooperative agreements with the US Agency for International Development. Additional funding has come from industry, the US Environmental Protection Agency, Environment Canada, the World Bank and private citizens. Close working relationships with NGOs and other organizations augment WEC's multidisciplinary approach.

The World Environment Center's continuing commitment to the worldwide exchange of information on environmental issues plays an important part in ensuring a clean and healthy future for our fragile planet.

Union Camp Corporation

Fine Paper Division

East Over, South Coroline

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"OUR ENVIRONMENT...A SHARED COMMITMENT"

INDONESIA PULP AND PAPER INDUSTRY GROUP VISIT

OCTOBER 29, 1993
ROOM 137

AGENDA

9:00 A.M.	WELCOME / INTRODUCTIONS
9:15 A.M.	GROUP'S OBJECTIVES / AGENDA
9:30 A.M.	EASTOVER MILL OVERVIEW
10:00 A.M.	EFFLUENT TREATMENT
10:30 A.M.	AIR POLLUTION CONTROL
11:00 A.M.	ODOR CONTROL
11:30 A.M.	SOLID / HAZARDOUS WASTE
12:00 NOON	LUNCH
1:00 P.M.	UNION CAMP BLEACHING TECHNOLOGY
2:00 P.M.	MILL TOUR
4:30 P.M.	EXIT

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OUTLINE
C-Free™ TALK FOR INDONESIAN VISITORS
to EASTOVER MILL OCTOBER 29th

I. UNION CAMP BLEACHING DEVELOPMENT
- MOTIVATING FACTORS AND TECHNOLOGY ADVANCEMENT
- BLEACH PLANT CLOSURE
- BLEACHING SEQUENCE DEVELOPED
- BLEACH PLANT CONTRIBUTION TO EFFLUENT

II. FULL SCALE COMMERCIAL OPERATION
- FRANKLIN START-UP EXPERIENCE
- FIBER QUALITY PERFORMANCE
- OPERATING EFFECTIVENESS

III. ENVIRONMENTAL ANALYSIS
- POTENTIAL EFFLUENT LOAD REDUCTIONS
- ACTUAL MILL PERFORMANCE AT FRANKLIN
- PROJECTED PERFORMANCE ON OTHER SPECIES
- ENVIRONMENTAL IMPACT OF C-Free™

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C-Free™ PULP DEVELOPMENT

UNION CAMP - ENVIRONMENTAL AWARENESS

FRANKLIN MILL - SMALL LOW-FLOW RIVER

EASTOVER MILL - GREENFIELD MILL STANDARDS

DEMONSTRATED DEVELOPMENT EFFORTS

MANY YEARS OF INTENSE BLEACHING RESEARCH

AMONG FIRST COUNTER CURRENT BLEACHING IN USA

ONE OF FIRST USING O2 BLEACHING WITH RECYCLE

HIGH CONSISTENCY O2BLEACHING FOR MAXIMUM CLOSURE

$6.5MM+ PILOT PLANT INVESTMENT AND
CONTINUING COMMITMENT ($1.5MM EXPANSION)

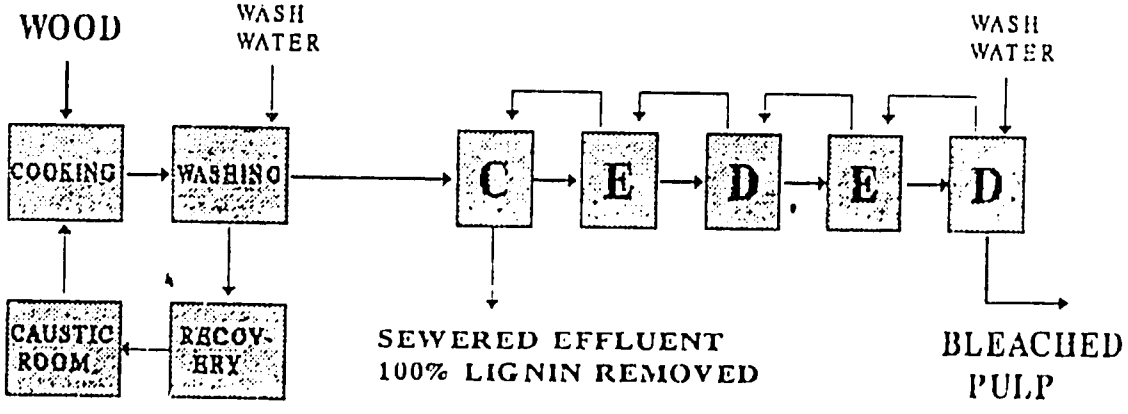
FULL SCALE REACTOR SIMULATION AND PROCESS MODELING

$100MM FULL SCALE 1000 TPD OZONE BLEACH PLANT

ESTABLISHED UNION CAMP TECHNOLOGY

MARKETING ARRANGEMENT WITH SUNDS DEFIBRATOR

Conventional CEDED



PROBLEMS: HIGH WATER USE AND SEWER FLOW

ALL BLEACHED CHEMICALS AND ORGANICS MUST BE SEWERED
HIGH BOD, COD AND COLOR

USE OF CHLORINE PRODUCES CHLORINATED ORGANICS
DIOXIN, TOCL, AOX AND CHLOROFORM

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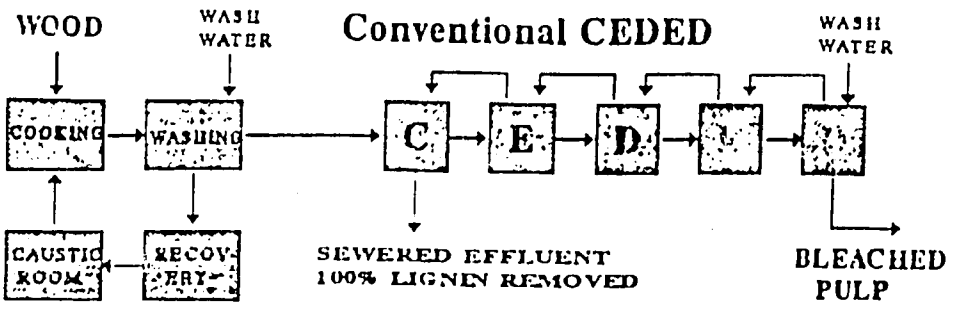
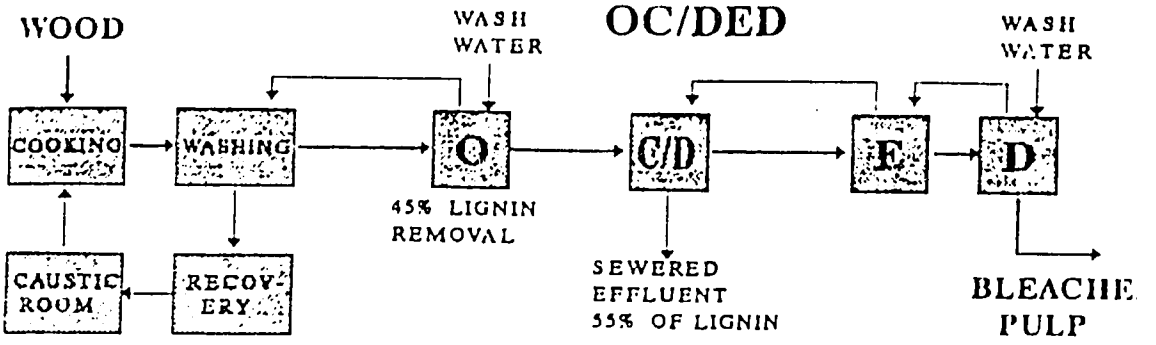
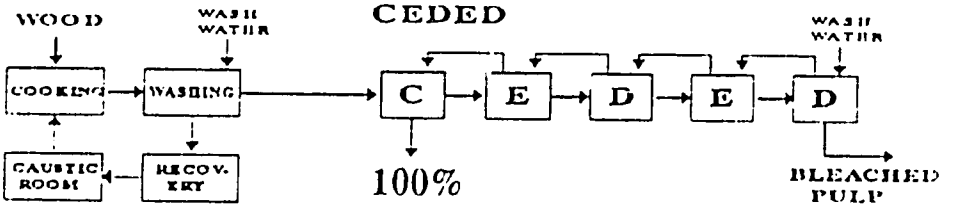
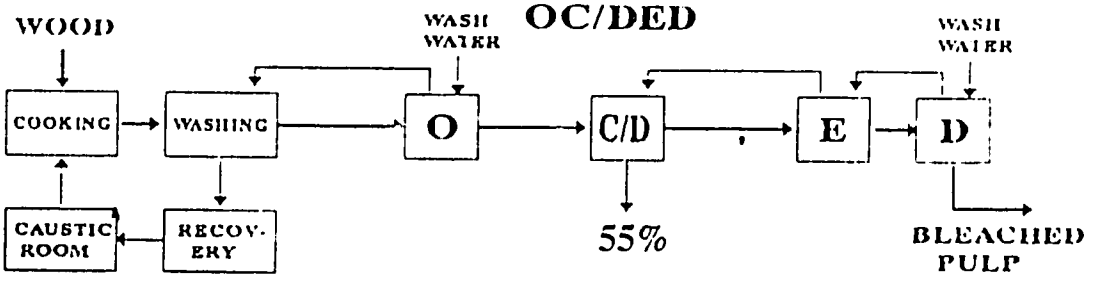


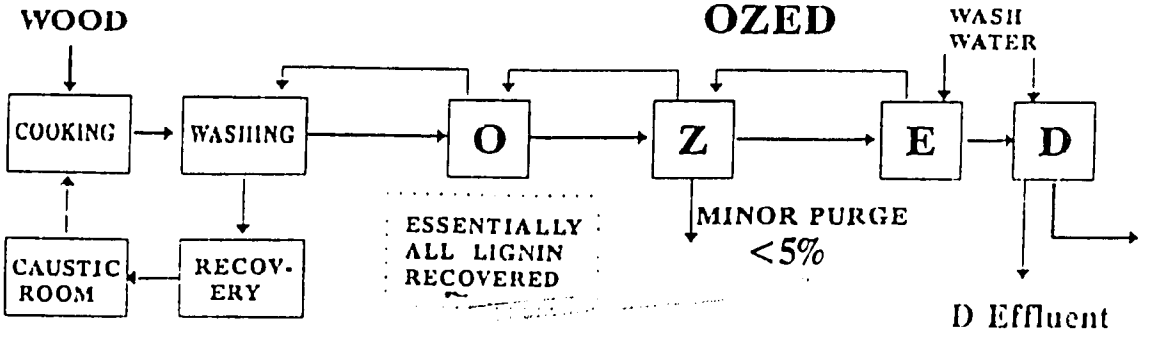


PROBLEMS: STILL A HIGH PERCENTAGE OF ORGANICS AND BLEACHING CHEMICALS SENT TO THE SEWER WITH HIGH BOD, AND COLOR.

CHLORINE STILL USED; SIZABLE AMOUNTS OF CHLORINATED ORGANIC PRODUCED.







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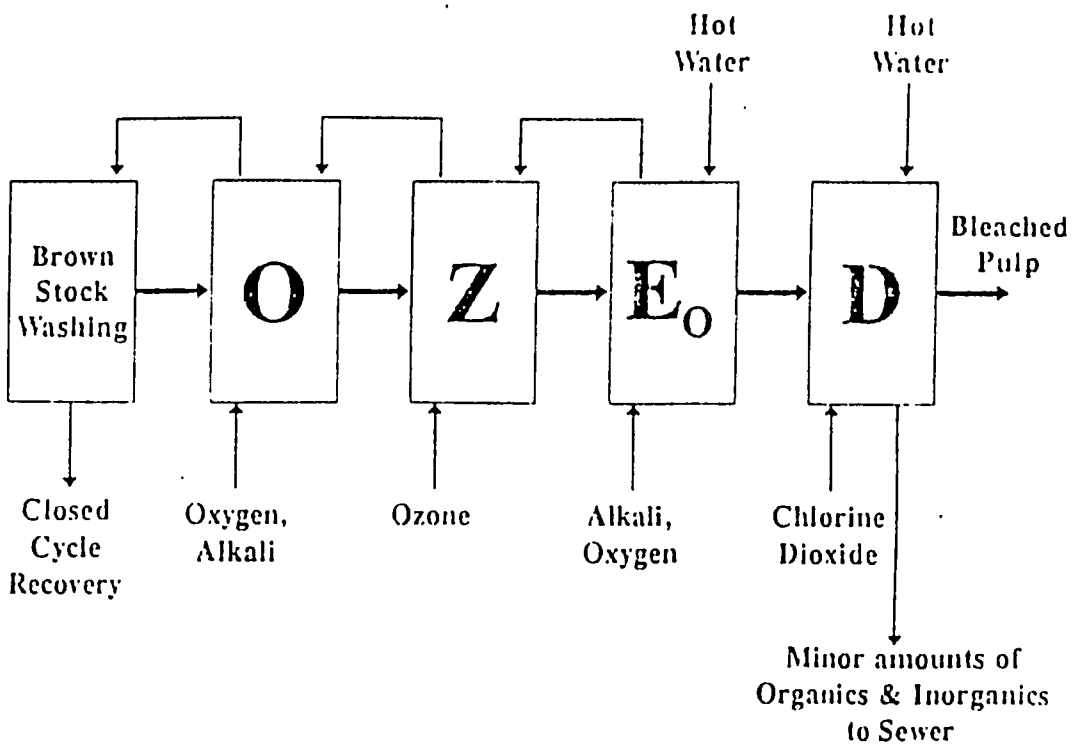
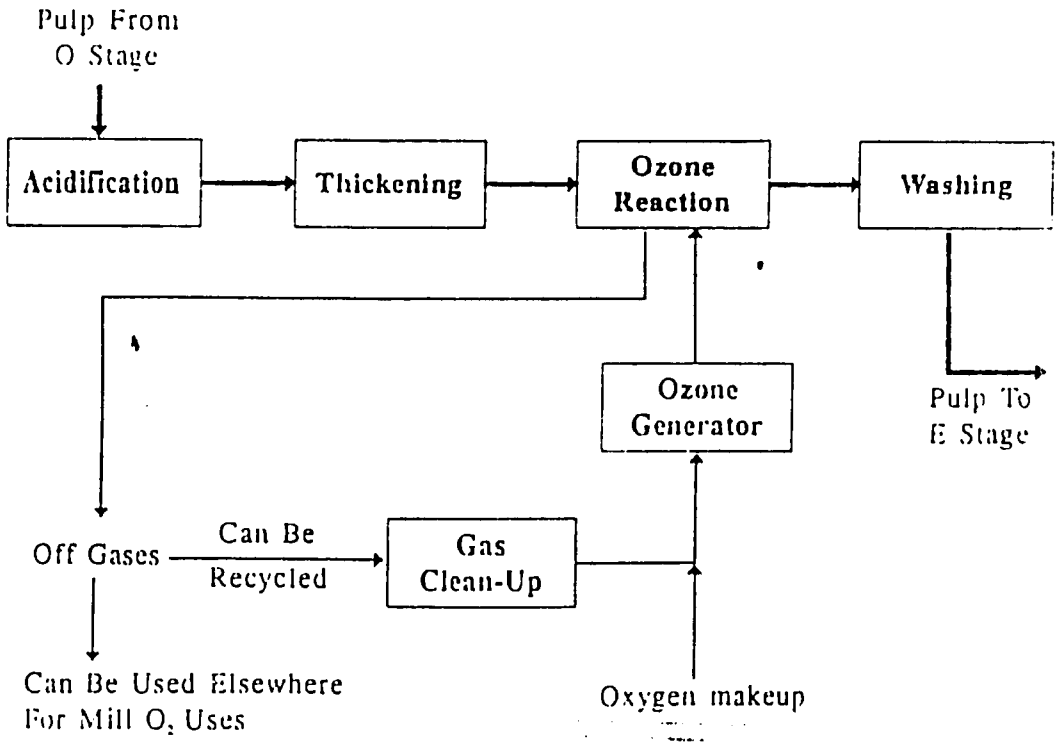
OZ(EO)D Bleaching



OZONE TREATMENT STEP



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BLEACHING COST REDUCTIONS FOR VARIOUS WOODS

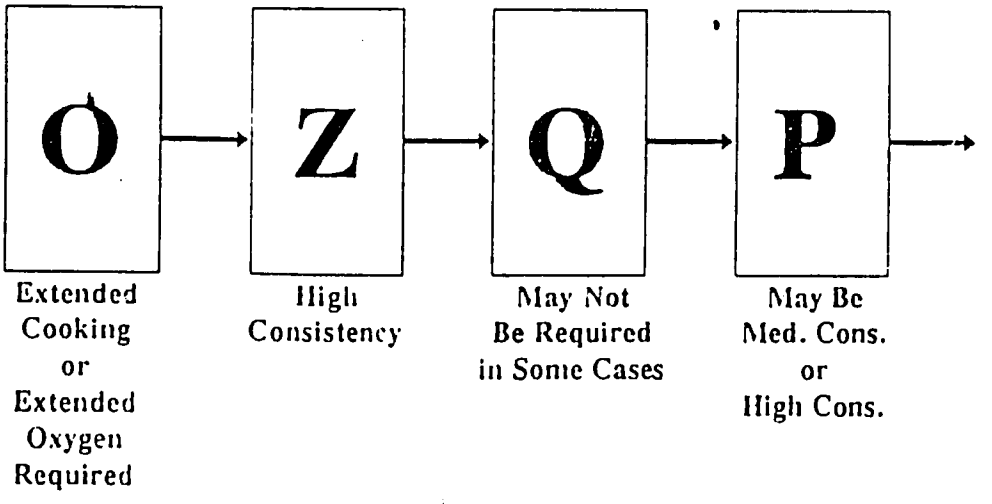
C-Free™ Compared with Conventional Bleaching

90 G.E. BRIGHTNESS PULP

	Percent reduction at Average U.S. Material Costs		
	Normal C/D Substitution	100% D/C Substitution	Comparison Sequence
Birch	42%	47%	OC/DED
Southern HD	20%	52%	CEDED
Eucalyptus	16%	46%	CEDED
Hemlock/Fir Mix	38%	61%	CEDED
Spruce/Pine Mix	35%	52%	OC/DED

OZQP (TCF) Bleaching
Totally Chlorine Compound Free

For Easy to Bleach Pulps - Market Brightness & Strength Possible



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OZONE
START-UP EXPERIENCES

FRANKLIN F-LINE
- STARTED UP ON OZONE — SEPTEMBER 19,1992

Z STAGE PERFORMANCE
- SELECTIVITY & EFFICIENCY — AS EXPECTED
- BLEACHING UNIFORMITY — EXCELLENT
- SYSTEM OPERATION — MINOR PROBLEMS ONLY

GAS SYSTEM PERFORMANCE
- STARTED UP ON OZONE — SEPTEMBER 19, 1992
- SAFETY PERFORMANCE — EXCELLENT
- OZONE PRODUCTION — EXCELLENT
- GAS RECYCLE SYSTEM — MINOR "NEW SYSTEM" ITEMS

EFFLUENT RECOVERY
- SMALL Z STAGE PURGE FOR CALCIUM

OZONE STAGE PERFORMANCE

	Ozone Application		Brightness % ISO		Viscosity dm^3/kg		Selectivity
	Kg/ADT Applied	Percent Consumed	In	Out	In	Out	$\frac{\Delta \text{Brightness}}{\Delta \text{Viscosity}}$
Expected	6.8	90-95	39	53	705	590	0.12
Current Operation	7.6	95+	36	51	706	600	0.14

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OZ(EO)D
BLEACH CHEMICAL SAVINGS

	Reduction vs CEDED
Typical	26%
Optimized	35%

FRANKLIN MILL

1992 OPERATING CONDITIONS

Effect of F-Line OZEoD Pine

FOR ALL SIX PAPER MACHINES	Gross Production Tons/Day	1st Grade Production Tons/Day	Sheet Breaks Number/Day	Machine Downtime min./day
Baseline Jan-July A&B Bleach Lines	2045	1806	13.1	18.3
Oct-Dec F-Line as OZEoD	2057	1822	12.3	15.6

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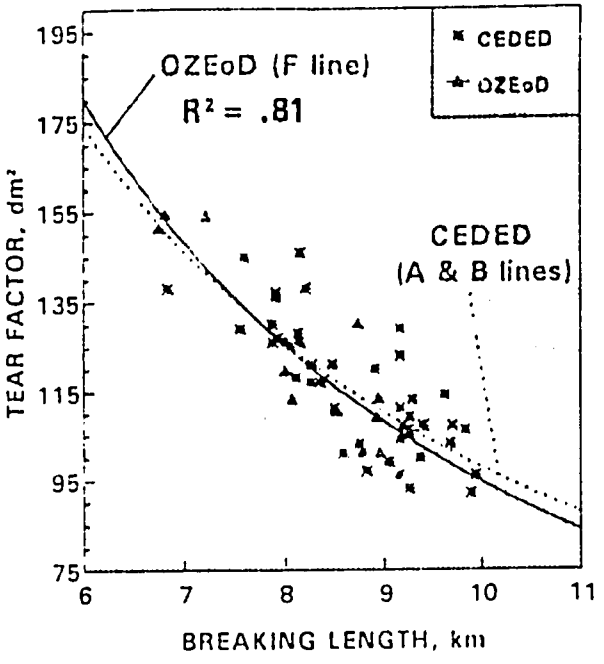
TEAR vs TENSILE

Franklin Southern Pine



PFI BEATING DATA

BLEACH PLANT CONTRIBUTION to MILL EFFLUENT TREATMENT PROBLEMS

As a Percent of Total Mill	Normal Mill	With Rest of Mill as Closed as Possible
EFFLUENT FLOW	50%	65%
EFFLUENT BOD_5	35%	45%
EFFLUENT COLOR	60%	85%
CHLORINATED ORGANICS	85%	85%

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POTENTIAL BENEFITS

BLEACH PLANT ORGANICS

Southern PINE Kraft to 82 ISO

	CEDED	OC/DED	OZED
BOD_5 (kg/ADMT)	16	6.5	2
COD (kg/ADMT)	65.5	22.5	6
COLOR (kg/ADMT)	185	41.5	1.5

RESULTS ON EFFLUENT PRODUCED FROM COMMERCIAL OZ(EO)D PLANT

	CEDED	OC/DED	Predicted OZED	INITIAL MEASURED F-LINE
BOD_5 (kg/ADMT)	16	6.5	2	1.8
COD (kg/ADMT)	65.5	22.5	6	5.6
COLOR (kg/ADMT)	185	41.5	1.5	0.9
TOX (kg/ADMT)	6.5	3.0	0.075	0.14
AOX	--	--	--	N.D.(<1-5ppb)
Chloroform	0.18	0.08	0.003	0.00017

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C-Free ENVIRONMENTAL IMPACTS

- ESSENTIALLY ELIMINATES **DIOXIN**
- ELIMINATES MOST OF THE TOTAL CHLORINATED ORGANIC **CHLOROFORM, TOX and AOX**
- ALMOST ELIMINATES **COLOR** IN BLEACH PLANT EFFLUENT
- OFFERS LARGE **BOD** REDUCTIONS IN EFFLUENT TREATMENT
- USES LESS **WATER** AND PRODUCES LESS **EFFLUENT**

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UNION CAMP CORPORATION ENVIRONMENTAL, HEALTH, SAFETY AND FORESTRY PRINCIPLES

TO MAKE ENVIRONMENTAL, HEALTH, AND SAFETY CONSIDERATIONS PRIORITIES IN OPERATING EXISTING FACILITIES, AS WELL AS IN PLANNING NEW OPERATIONS.

TO RECOGNIZE ENVIRONMENTAL, HEALTH, AND SAFETY EFFECTS OF PRODUCT MANUFACTURE, DISTRIBUTION, USE, AND DISPOSAL.

TO MONITOR ENVIRONMENTAL, HEALTH, AND SAFETY PERFORMANCE AND TO REPORT REGULARLY ON THESE MATTERS TO THE BOARD OF DIRECTORS.

TO TRAIN EMPLOYEES AND TO PROMOTE AWARENESS AND ACCOUNTABILITY ON THESE MATTERS.

TO IMPROVE PERFORMANCE THROUGH SUPPORT OF RESEARCH AND DEVELOPMENT.

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ENVIRONMENTAL, HEALTH, SAFETY, AND FORESTRY (CONT)

- TO COMMUNICATE WITH EMPLOYEES, CUSTOMERS, SUPPLIERS, THE COMMUNITY, PUBLIC OFFICIALS, AND SHAREHOLDERS.

- TO PARTICIPATE CONSTRUCTIVELY IN THE DEVELOPMENT OF PUBLIC POLICIES.

- TO CONTINUE TO PURSUE ENERGY CONSERVATION.

- TO PRACTICE A LAND STEWARDSHIP ETHIC THAT RECOGNIZES THE IMPORTANCE OF SOIL CONSERVATION, AIR AND WATER QUALITY, WILDLIFE AND FISH HABITAT, AND AESTHETICS.

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POTENTIAL WATER & EFFLUENT BENEFITS

Using OZED Bleaching

Estimated Values for a Typical Plant

	CEDED	O(CD)ED	OZED
Bleach plant Water Use	47.5	15.8 *	13.7 *
Bleach Plant Effluent	55.4	14.2	7.5

M^3/A.D.Metric Ton

* Some water is recycle therefore savings may vary

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THE ROAD TO SUCCESS

- Well Prepared Applications
- Productive Dialogue with DHEC
- Valuable Public Input
- Commitment to Permit Limits
- Honor Those Commitments
- Open & Ongoing Communications with Neighbors
- Proven Environmental Record

DEVELOP AND MAINTAIN A

HIGH ENVIRONMENTAL ETHIC

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EFFLUENT TREATMENT

REGULATED POLLUTANTS

- ORGANIC MATTER (BOD)
- SOLIDS (TSS)
- NUTRIENTS
- COLOR

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IN PLANT CONTROLS

SEGREGATED SEWERS

- PROCESS (SOLIDS)
- BLOCK PLANT (ACID)

SPILL CONTROL

- OIL STORAGE DIKING
- PAVING + CURBING
- SPILL RECOVERY

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SYSTEM PERFORMANCE

BODs

PROCESS SEWER → CLARIFIER →
40,000 #/DAY 75 %

BLEACH PLANT SEWER →
40,000 #/DAY

→ ASB'S
95 %

= 2500 #/DAY FINAL EFFLUENT

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SOLID WASTE

MAJOR STREAMS

- PRIMARY CLARIFIER SLUDGE
- POWER BOILER FLY ASH
- RECAUSTICIZING GRITS & DREGS
- PULP MILL KNOTS & REJECTS

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HAZARDOUS WASTE

CLASSIFICATION

LISTED

- PURE
- UNUSED
- FUNCTION
- APPLICATION

CHARACTERISTIC

- CORROSIVITY
- REACTIVITY
- IGNITABILITY
- TOXICITY

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HAZ. WASTE MANAGEMENT

GENERATOR RESPONSIBILITY

- GENERATION
- TRANSPORTATION
- STORAGE
- TREATMENT
- DISPOSAL

MANIFEST SYSTEM

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Weyerhaeuser Paper Corp

Flint River Plant

Oglethorpe, Georgia

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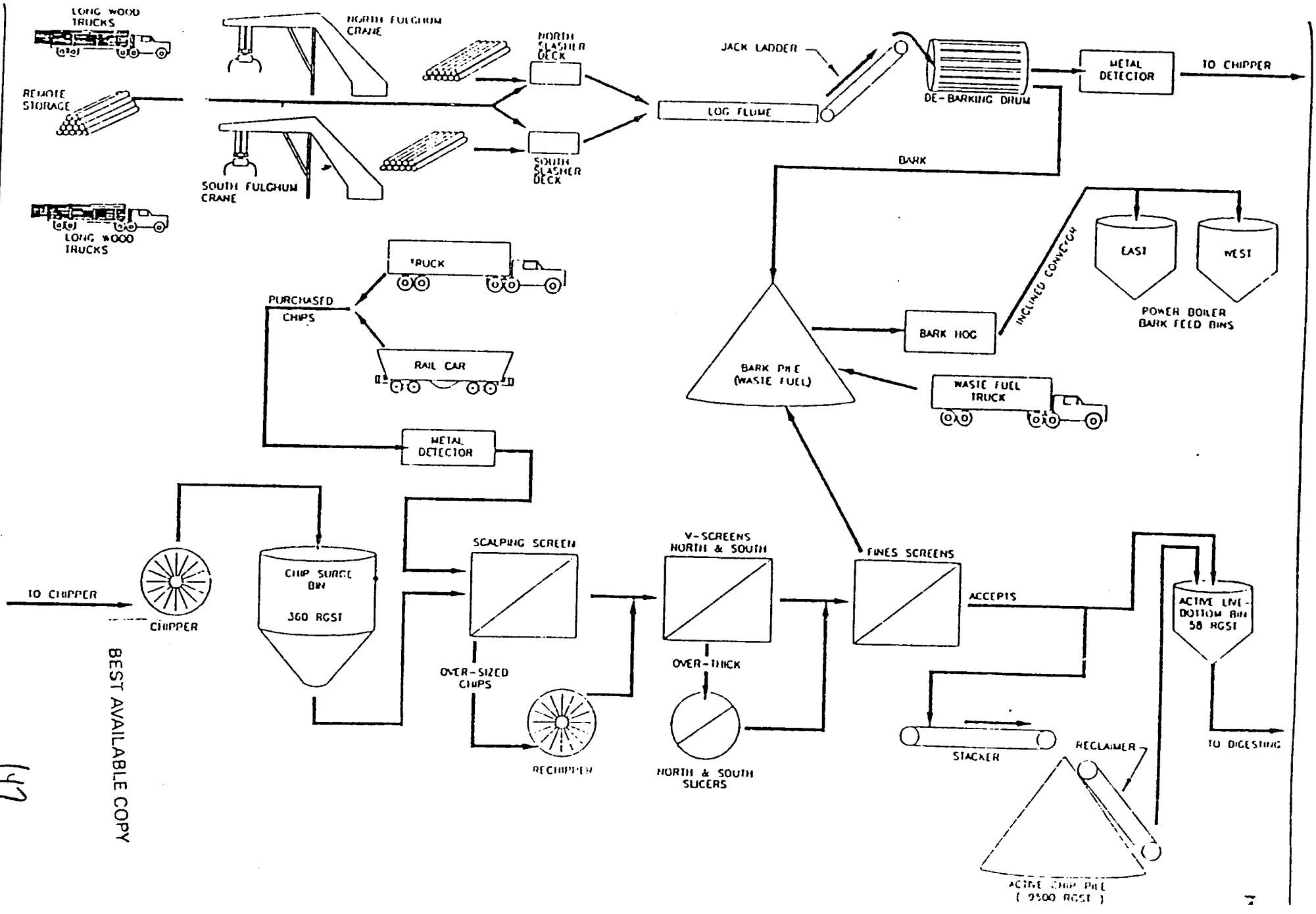

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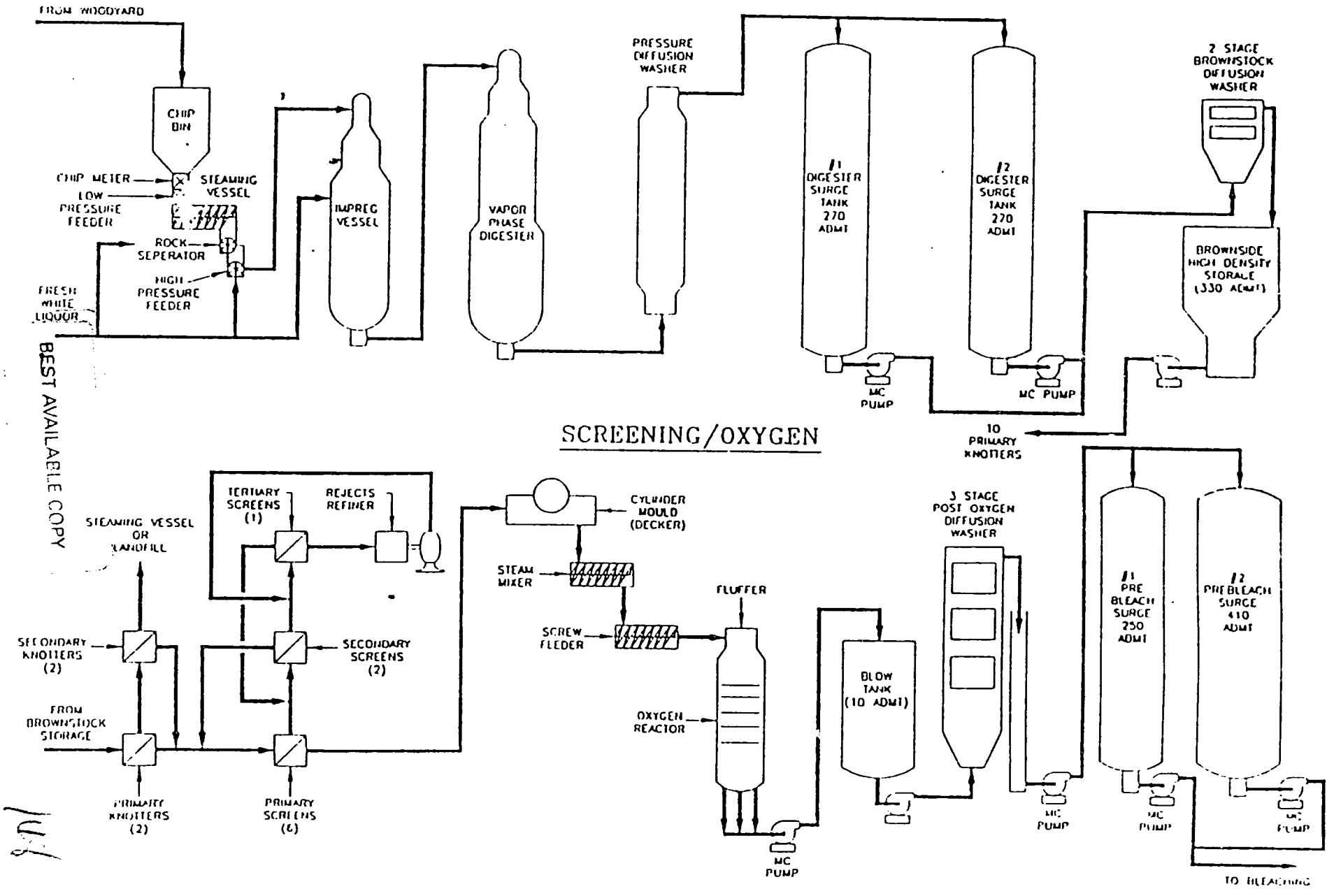

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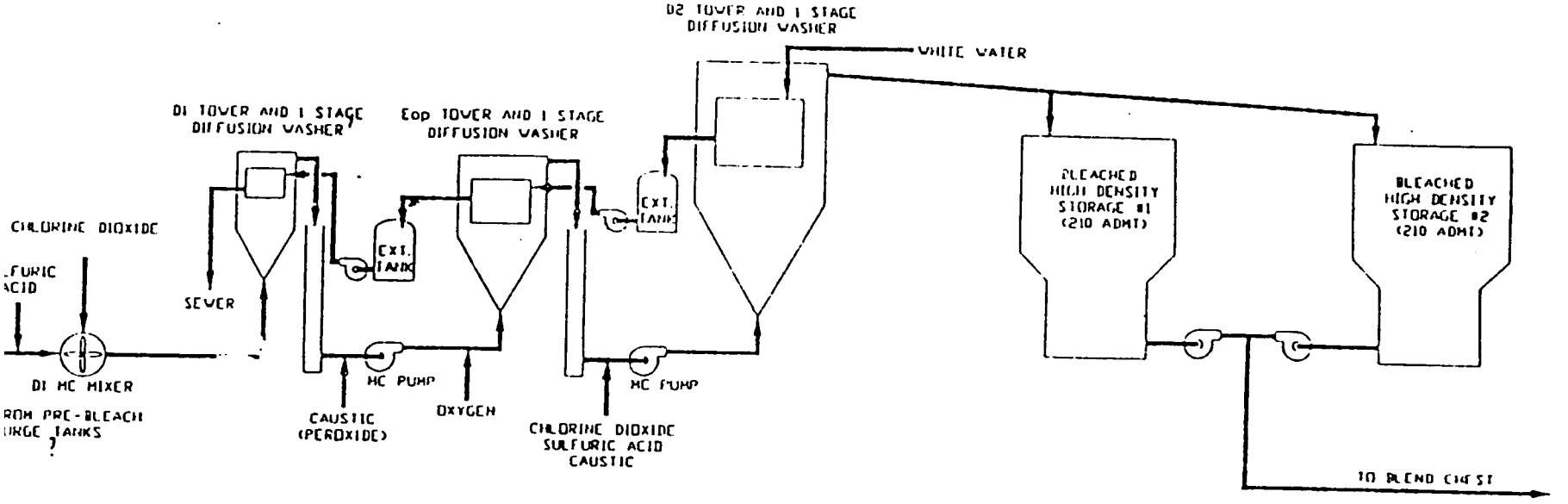
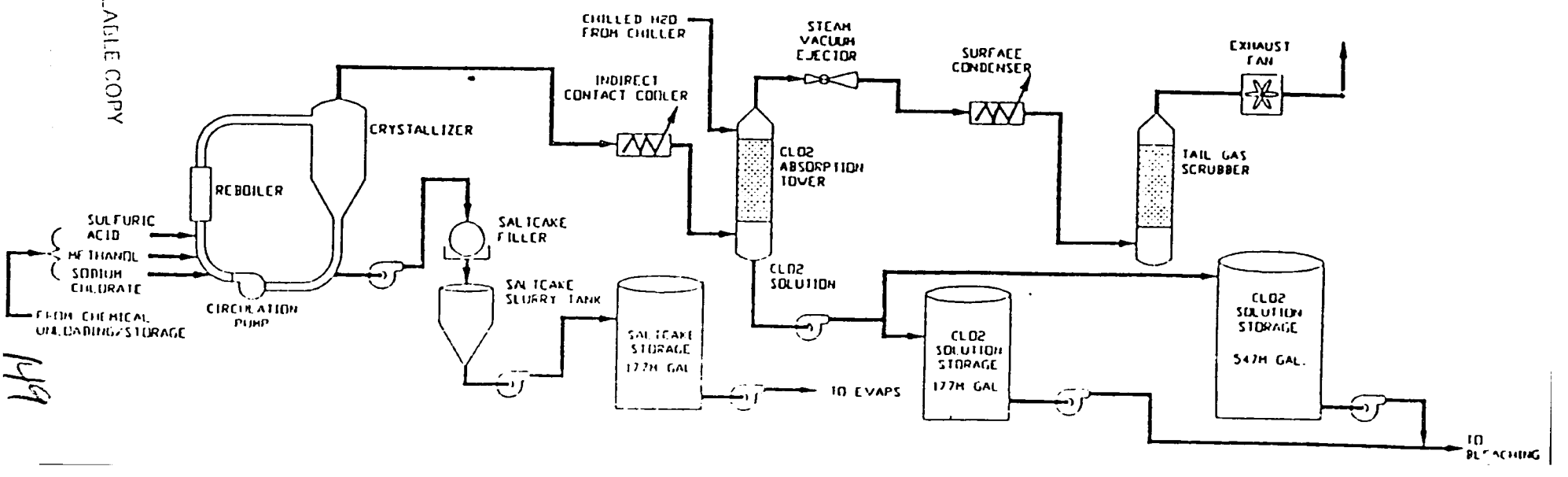


R-8 CHEMICAL GENERATOR



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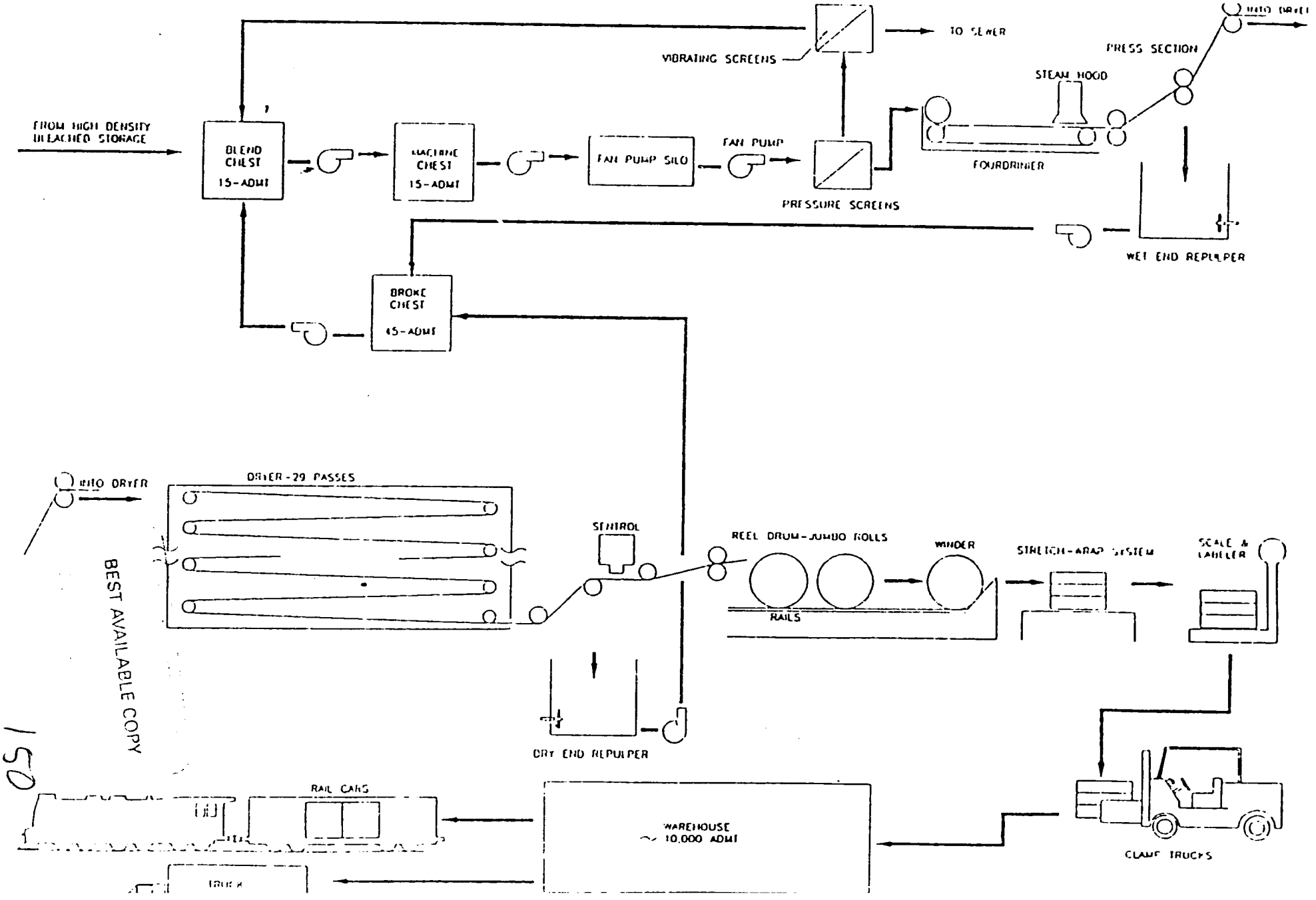

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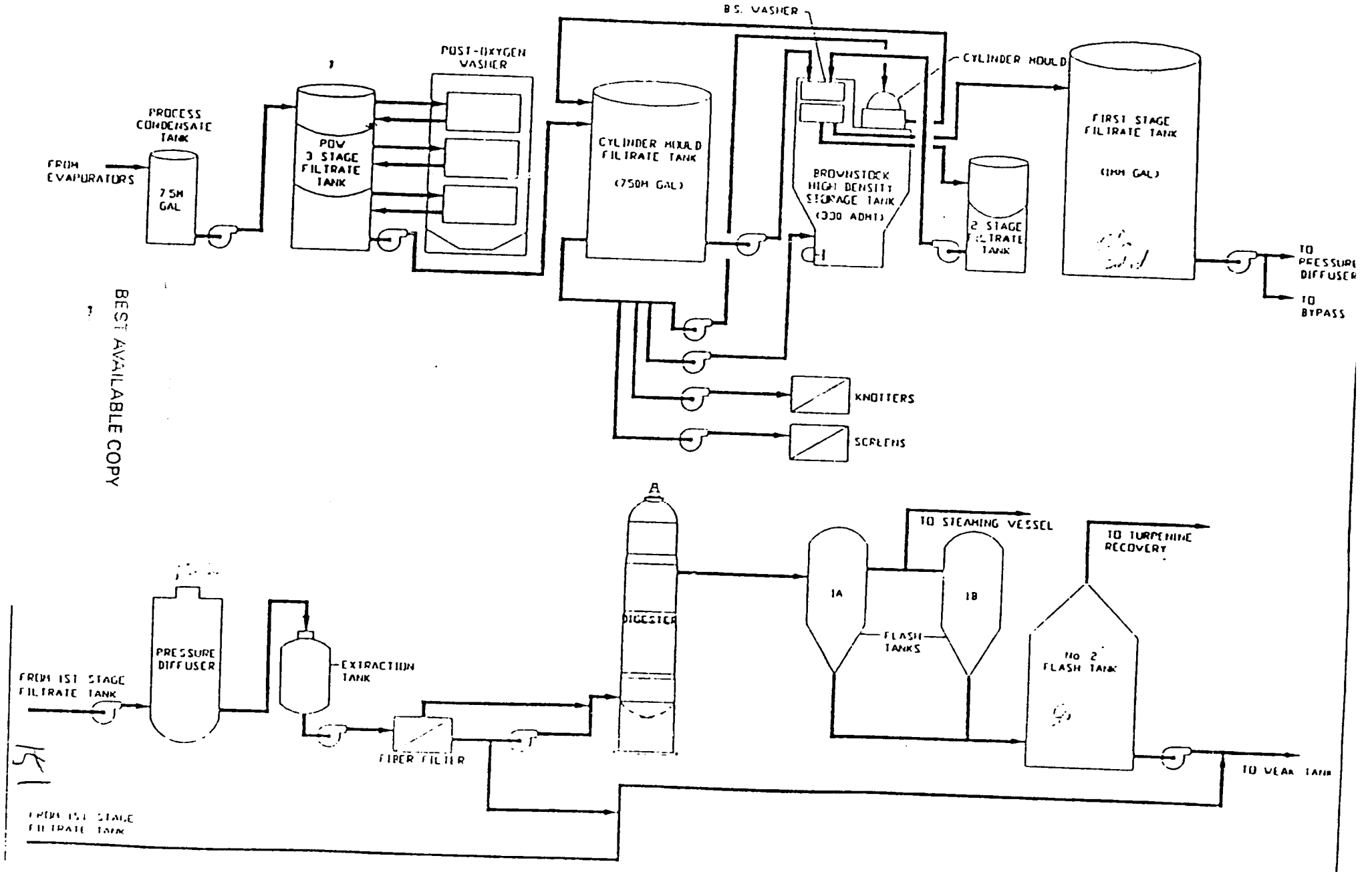

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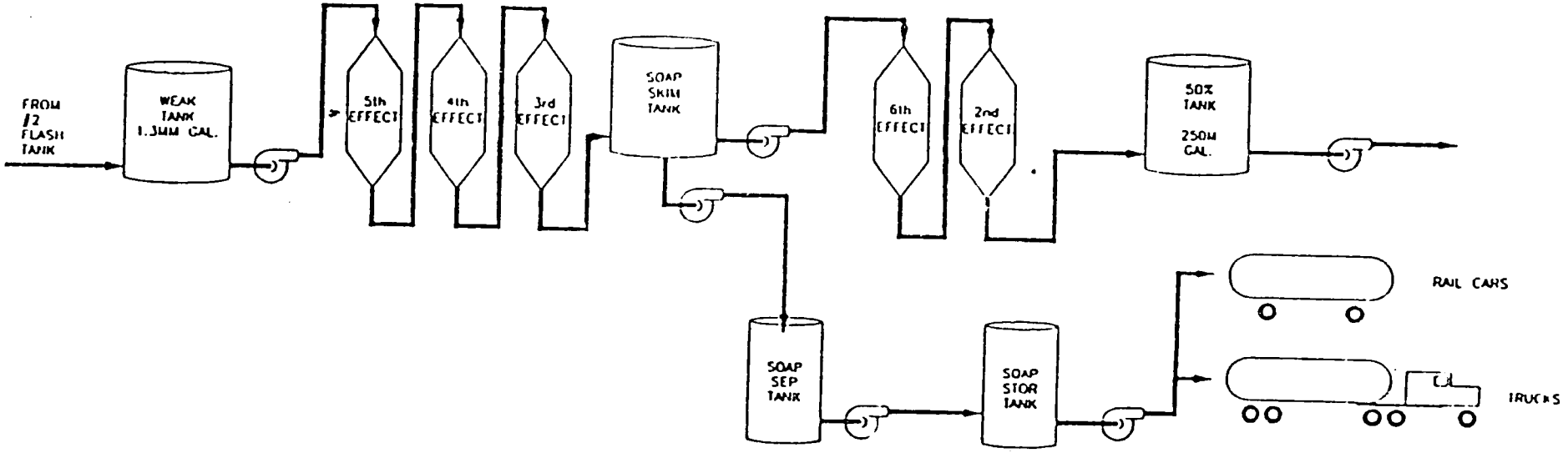
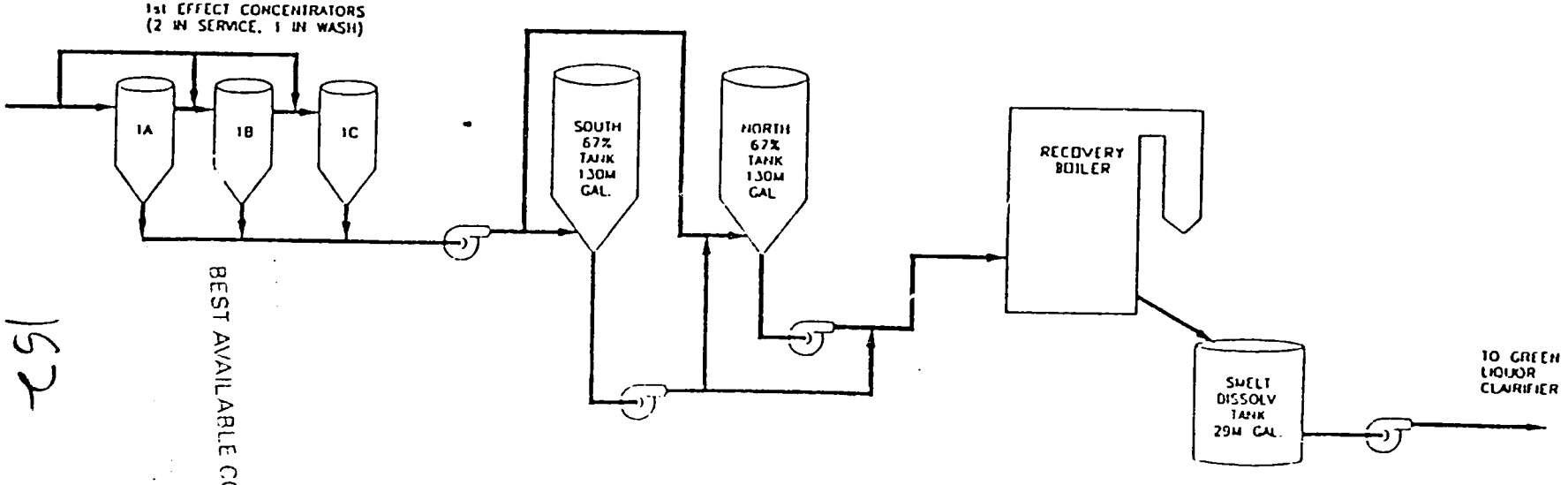
EVAPORATION/RECOVERY





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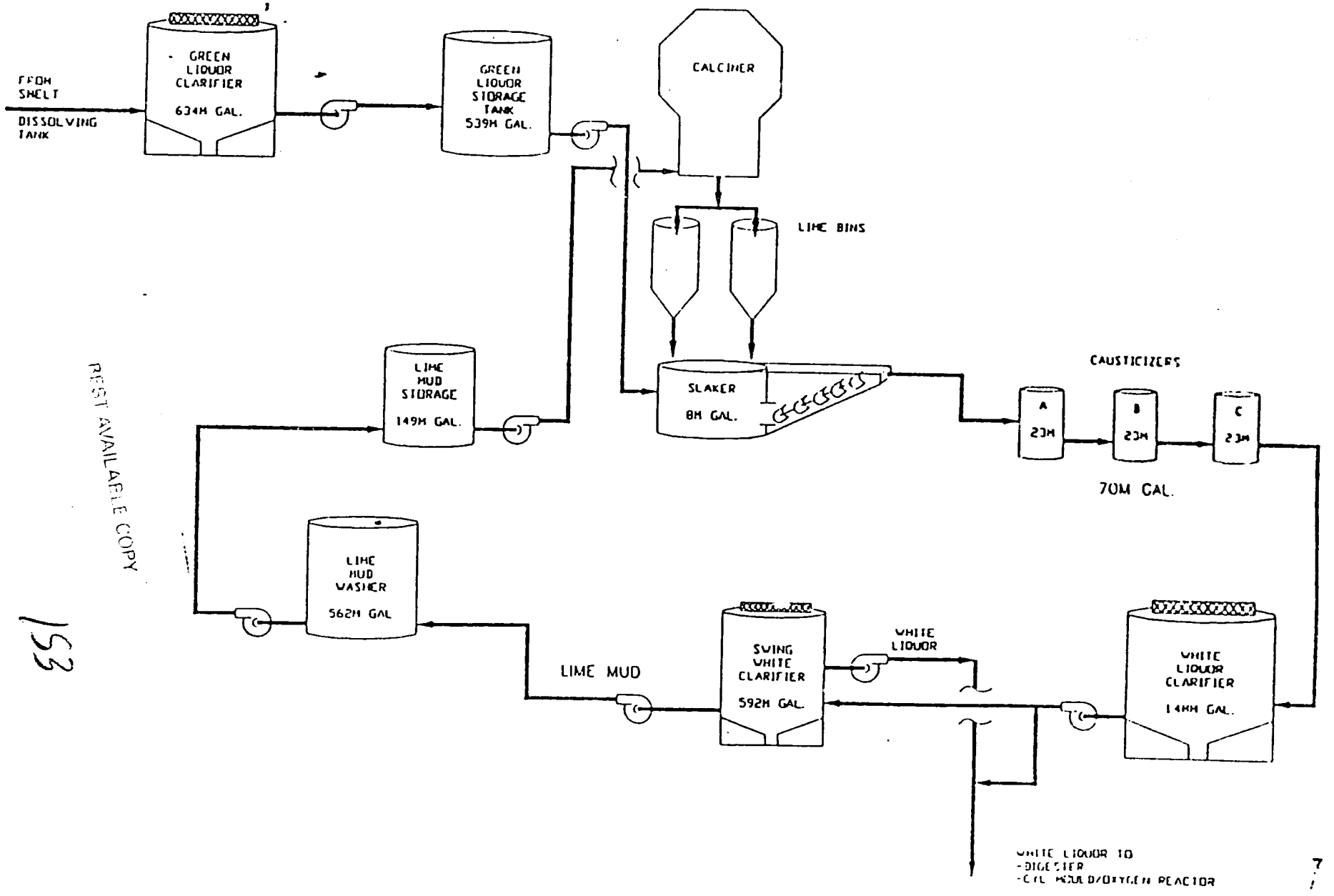
CAUSTICIZING



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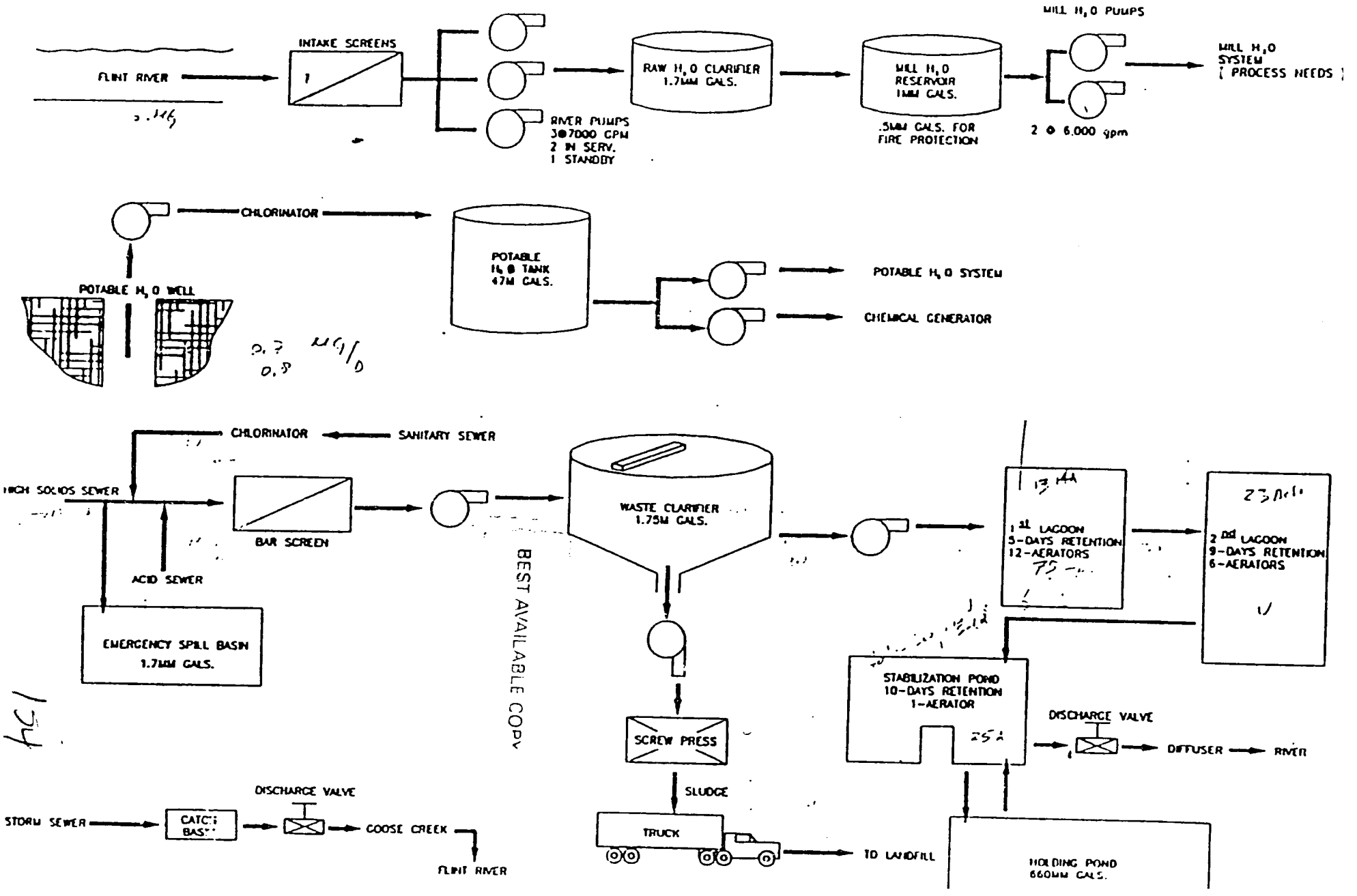

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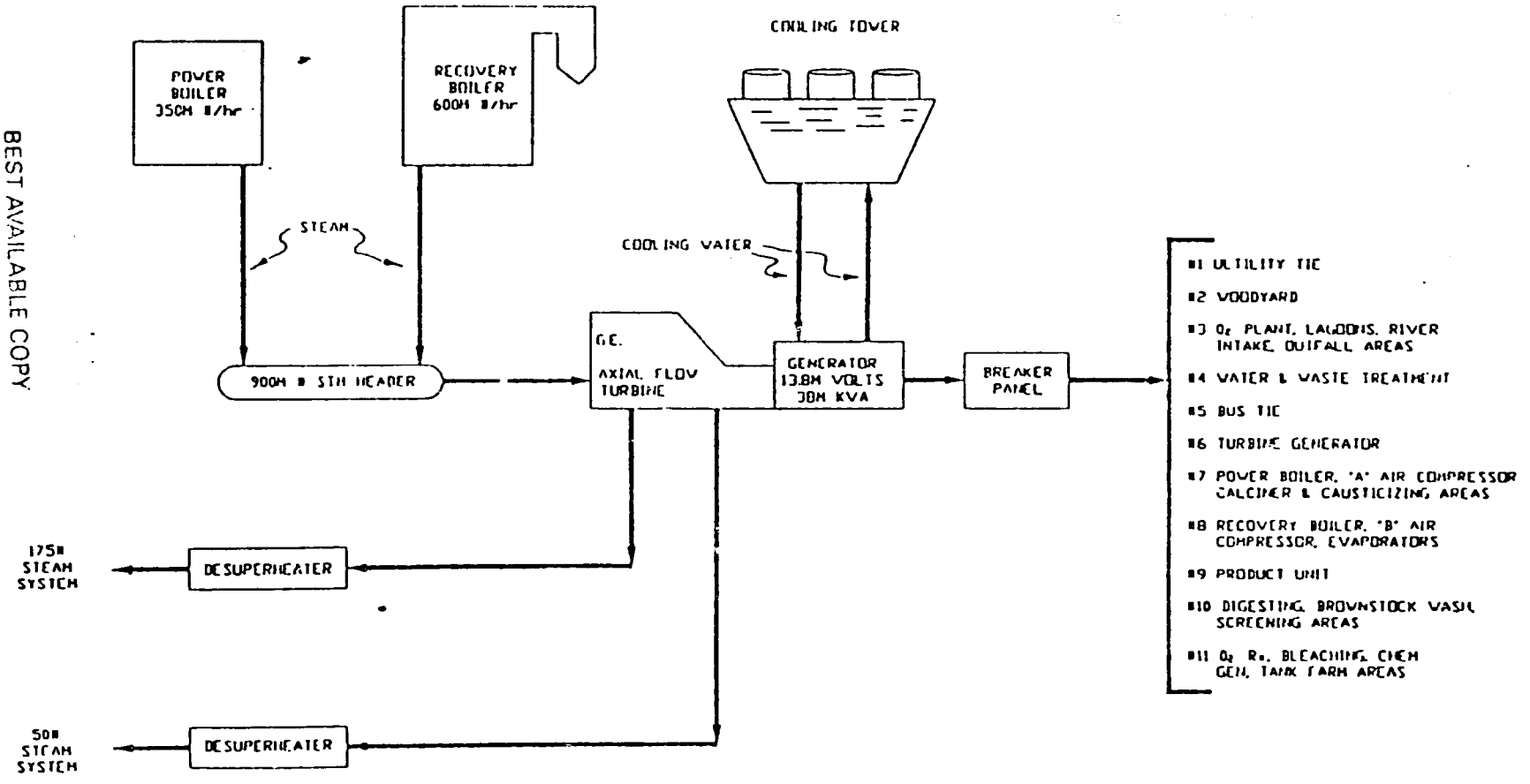
POWER SYSTEM



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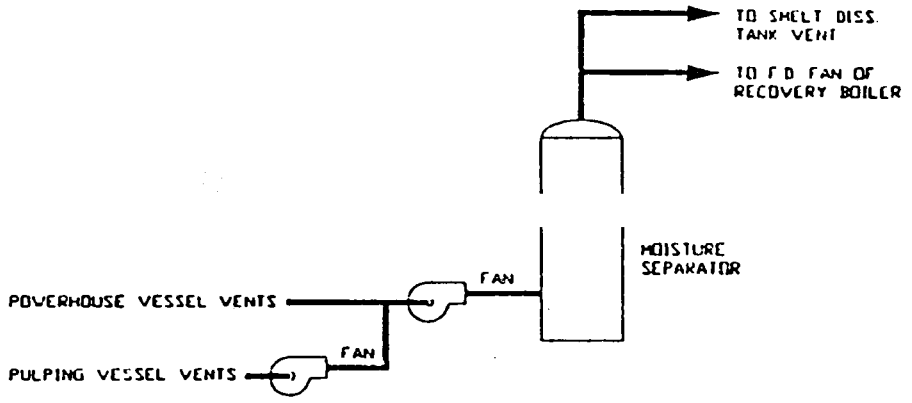
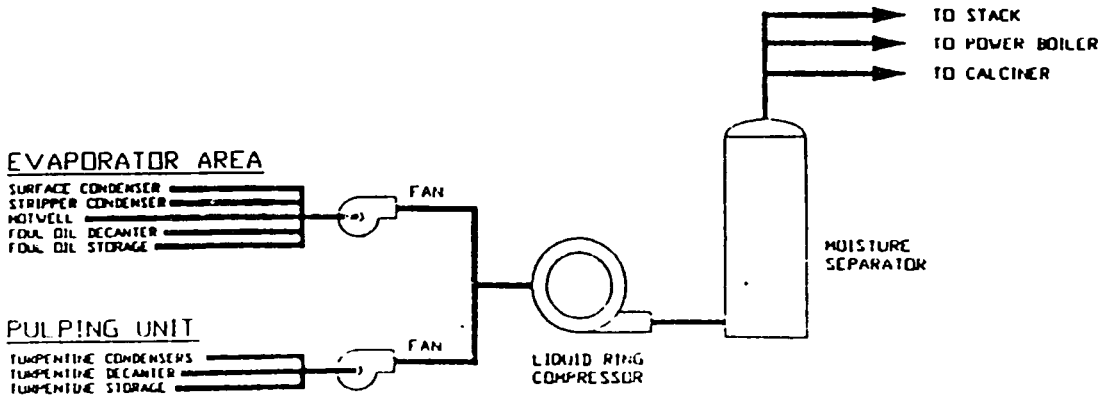
WEAK GAS INCINERATION



STRONG GAS INCINERATION



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TRAIN THE TRAINER PROGRAM OF

INDONESIAN DELEGATION

AT THE PULP AND PAPER MILL

FLORIDA, SOUTH CAROLINA, GEORGIA, USA

October 23 - November 5, 1993

A project by:
WORLD ENVIRONMENT CENTER
419 Park Avenue South, Suite 1800
New York, New York 10016

WITH SPONSORSHIP BY:
THE U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID)/INDONESIA
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TRAIN THE TRAINER PROGRAM OF INDONESIAN DELEGATION AT THE PULP AND PAPER MILL UNITED STATE OF AMERICA

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November 1993

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LIST OF ACRONYMS

ADMT	Air Dry Metric Ton
ASB	Aerated Stabilization Basin
AOX	Absorbable Organic Halide
BAPEDAL	Badan Pengendalian Dampak Lingkungan / Environmental Impact Management Agency of Indonesia
BBS	Balai Besar Penelitian dan Pengembangan Industri Selulosa / The Institute for Reasearch and Development of Cellulose Industry (IRDCLI)
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
mgd	million gallons per day
TSS	Total Suspended Solid
USAID	United State Agency for International Development
WEC	World Environment Center

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I. EXECUTIVE SUMMARY

On October 24 - November 5, 1993, Indonesian delegation for study tour of " Train The Trainer " program visited United State of America. This visit was an follow up of the pulp and paper work shop hold on Jakarta last July 1993, and it was also given as an award to the pulp and paper industry which have conducted mill audit and waste minimization assessment.

Participating in the study tour were: Mrs. Hendayani Teguh Adisesha - BBS Bandung, Mr. Iyan Suwargana - Bapedal, Mr. Darono Wikanaji - PT Kertas Leces (Persero), Mr. Zulkifli Lubis - PT Indah Kiat Pulp and Paper Corporation, Mr. Widya Tjahyana Lauwangsa - PT Pakerin, and Mr. Warih Supriadi - PT Surabaya Agung Industri Pulp and Paper.

The objective of the visit were to provide the study tour participant with intensive training in waste minimization program and practices in pulp and paper industry in the United State of America, to communicate and discuss about waste water assessment that has been conducted in the USA, no cost / low cost waste minimization techniques in the pulp and paper industry that might be applied in Indonesia.

The study tour start with the meeting with NCASI representative at Florida, Gainsville, Mr. Ashok K. Jain - Regional Manager Southern Region. National council of The Paper Industry for Air and Stream Improvement (NCASI) is the foundation that conducted research in the field of air and stream improvement - as a request or not as a request of the industry - and it could be implemented by the industry. The study tour participant then visited Marlboro Mill - Willamette Industries, Inc., Union Camp - fine paper division, as the schedule, and also visited Sonoco Mill (unscheduled visit).

All of these factory have a kraft process in the pulp mill with a hardwood and softwood as a raw material. All of them have had a commitment with the consument to treat the waste water and to recycle the broke paper / waste paper in order to protect the environment before the consument agree to buy their product. Sonoco,if be compared with the other company which have been visited, it has a better technique with relatively no cost/ low cost technology in handling black liquor from the washing part of the pulping processes.

We believe that it is a good prospect for us, and it should could be applied to the pulp and paper industries in the development country, particularly in Indonesia for medium scale of pulp and paper industry.

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paper industry.

II. INTRODUCTION

The study tour in the pulp and paper industries started with visited Willamette Industry, Inc. at Marlboro Paper Mill in the South Carolina (it was wednesday 27 th. october 1993).

The Marlboro paper mill produce mostly copy paper with the average total production 750 ton/day (total pulp production is 850 ton bleach pulp / day, with the water consumption of 9 mgd). In handling the waste water and solid waste it has white water recovery system as an internal treatment, oxygen delignification process in the fibre line, spill prevention system, and waste water treatment facilities as an external treatment, and also waste wood boiler system which could burn almost all off solid wastes/organic wastes.

This mill still uses chlorine and chlorine dioxide (30 % chlorine dioxide and 70 % chlorine white the bleaching stages/sequences of Cd-Co-D). They said that most plant in USA still use chlorine as a bleaching agent compare to the Europe. They should obey more the environment preservation so that they act as a leader in no chlorine agent bleaching processes.

Thursday 28 th oct. 1993 the study tour participant visited Sonoco Mill, Bennettsville, SC., it was an unscheduled visit, we are very glad could visiting this mill. Mr. Ashok K. Jain have requested to the manager of Sonoco mill for his allowance to permit us visiting their mill. This mill produce mainly corrugated medium with a sulfite process.
The most interesting thing that impressed us is the use of rotary kiln for burning black liquor instead of recovery boiler. It is relatively low cost/ no cost technology that should could be applied for handling and treating black liquor in the small and medium scale pulp and paper industries in the development country.

Friday 29 th oct. 1993 we were visiting Union Camp at Eastover South Carolina. The average daily production is 1550 ton/day of uncoated printing and writing paper, 330 ton/day of bleach kraft market pulp. The water consumption is 14,000 gallons / ton product. The bleaching stages : oxygen-chlorine/chlorine dioxide-NaOH-chlorine dioxide. Union Camp at Eastover, SC. only uses oxygen as a bleaching agent, but at Franklin plant (we didn't visit this mill) they said that ,only the oldest of the tree bleaching line still uses chlorine and chlorine compounds as a bleaching agent. The second oldest one uses oxygen bleaching process and the newest one uses ozone as the bleaching agent. It was a big step of Union Camp in answering the market demand for chlorine free paper, that won't result the discharges of dioxin,

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chloroform,and other toxic material that potentially will give the negative impact to the environment.

Tuesday, Nov. 2 ed. 1993, we were visiting Weyerhaeuser Company at Oglethrope, Georgia. It was the last mill that we have had to visited before our departure to New York for the meeting with Dr. Isaiah Gellman, vice president of NCASI.

This mill still uses chlorine and chlorine dioxide as the bleaching agent. The plant designed for 7000 gal/ADMT of water usage but now up to 10,000 gal/ADMT. It was because of the consument request that would like to have 0.1 kg AOX / ton product so they have to use more water in bleaching processes and they have to change the bleaching agent composition of 70 % chlorine dioxide and 30 % chlorine to 100 % chlorine dioxide. (But actually they have just could achieved 0.11 kg AOX / ton product.).

At this mill we have just more discussed and concerned to the waste water treatment and solid disposal. The mill total production is 930 ton / day and the water uses is 11 mgd which consist of 10 mgd of water from the Flint river for the process water, and about 0.7 until 0.8 mgd well water for consumption water. The waste water is going to the waste water facilities with an aerobic process, and the sludge is going to the screw press prior to the landfill. The usage of the screw press for sludge dewatering processes are likely will give us another benefit despite the usage of wire press.

Wednesday, Nov.3 th., 1993, the delegation met to pay courtesy call on Mr. Lisa A. Raudelunas, project manager of WEC at their head office in New York. Then at thursday 4 th. 1993, the delegation also met to pay courtesy call on Dr. Isaiah Gellman, the president of NCASI. He looking for the information of what our desire in connection with what they have to do, and he promise to give their response.

III. FINDINGS

This section will just cover the description of the facilities of the pulp and paper mill that we have just visited.

A. Willamette Industries Inc. (Marlboro Paper Mill)

The Marlboro paper mill located on 1,800 acre just south of Bennettsville, South Carolina. We met with Mr. Greg Fullenwider, technical specialist, and Mr. W. Martin (Marty) Barfield, the Technical Service Manager of Willamette Industries Inc., Marlboro paper mill.
The raw material of this mill are hardwood and softwood which come from Willamette's plywood plant in Chester, SC.,

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Willamette's nearby timberlands or from those of other landowners. The timber are chipped at the mill site and the removed bark goes to the waste wood boiler where it is burned to create steam used in papermaking. The chip are stored by hardwood and softwood classifications.

The fibre line :
The raw material (hardwood and softwood chip) and the cooking liquor go into the digester for cooking processes/ kraft process. The cooking process take about 1.5 hours, then once the pulp exist the digester the pulp mixture pump out of the digester instead of blowing it out with steam and air. It then send to the washing processes and oxygen delignification processes.

Oxygen delignification process is a highly efficient process that uses oxygen to further breakdown and remove lignin from fibre after cooking stages, so that the pulp just contain mostly fibre and very little lignin. The kind of the process, make them to use a more environmentally tree stages bleaching process, but this mill still uses chlorine and chlorine dioxide as the bleaching agents.

After bleaching processes the pulp to be stored in the high density storage tank. For making paper,the pulp from the high density storage tank are pumped out of the HD tower and mixes with water so that the consistency is 99.5 % water and 0.5 fibre. This slurries is pumped to the head box, go to the wet formation part,press part, drying part, and then to a set of calander. The finish product then cut into sizes specified by the customer, then stretch wrapped by machine to protect it from moisture, it ready to shipped.

Environment protection :
In order to protect the environment and to recovered the chemical, Marlboro paper mill send the mixture of lignin and spent cooking liquor from washing stages to the recovery system. The black liquor goes through a set of evaporator to remove the water from the black liquor,leaving a thick mass of organic material. This material is then burned in the recovery boiler to generate steam, and the result of this process dissolved in the water to produce green liquor. The green liquor add with lime to produce white cooking liquor. They also have lime kiln to produce new lime that mixes with green liquor to make fresh white cooking liquor.

The waste wood boiler, organic waste material such as tree bark, sludge from waste water treatment, are burner in the waste wood boiler. Its could eliminate the solid wastes to be discharged to the environment.

The waste water treatment facilities, the waste water from Marlboro paper mill goes to the waste water treatment facilities / effluent treatment plant in purpose to eliminate the waste water impact on the environment. This unit consist mainly of

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primary treatment and secondary treatment.

In the primary treatment, the waste water goes to the primary clarifier. The primary clarifier has a volume of 2.5 million gallons, a diameter of 195 feet,aside wall depth of 9 feet with a rise rate of 500 gpd/sq.ft., and the retention time of 4 hours at 15 mgd. At this unit more than 90 % of settleable solid and about 10 % - 20 % of the BOD should be remove from the waste water. The sludge from the primary clarifier, at 3 % - 5 % concentration, is pumped to a screw press and dewatered to about 50 % solid content. If there is a trouble of the screw press, the sludge flow will be diverted to a one acre sludge lagoon until repairs is made.

The unit has a basin for hydraulic overload and spill / high strength waste water spill. In the case of emergency, the waste water flows over 15 mgd the waste water are diverted to surge basin that have storage capacity of 14.7 million gallons. Once there are high strength waste water flows, they are diverted to a spill basin / spill collection system that has a capacity of 14.7 million gallons.

In the secondary treatment, all of the waste water that has been processed in the primary treatment goes to the secondary treatment. At this unit the waste water goes first to a series of aerated stabilization basin (ASB-1 and ASB-2) which both have a capacity of 90 million gallons with a depth of 15 feet. The total retention time is 12 days, 6 days per basin. It is based on 15 mgd flow and 30,200 lb BOD /day and the organic loading rate is 1.3 lb BOD/day/ 1000 cubic foot. It has 9 mechanical aerator in ASB-1 and 4 mechanical aerator ASB-2, rated at 75 hp each. This ASB system should have an efficiency of approximately 90 % BOD removal. Each of the ASB is lined with 24 inches of compacted native clay, as are the surge and spill basin, and has concrete pads on the basin floor beneath each aerator. The dissolved oxygen (DO) of this system be maintained between zero and one ppm, so that about 0.4 lb of biological solid (biosludge) should be produced per each lb of BOD removed. The overall biosludge production rate is about 10,900 lbs./day.

Treated waste water then enter the first of two polishing ponds that also lined with 12 inches of native clay, each of it has one 75 hp aerator near the outlet of this ponds to maintain the DO level above 1.0 ppm. The combined polishing pond has a capacity of 293 million gallons with the retention time each of it is 10 days. During normal operation, this pond just will be filled to a depth of 4 feet and only one of them in service. In emergency cases these ponds has a capability to maintain mill operation for about twenty days without discharging the waste water into the river.

Solid disposal, solid object collected from bar screen, skimmed material from clarifier, and sludge that has been dewatered until 50 % solid content burned in the hog fuel boiler / waste wood

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boiler. Sludge from tne sludge lagoon can be air-dried and remov to the on-site Willamete landfill. Solid wastes fro recaustisation and lime kiln unit are also dumped to tr landfill. Beside that treatment Willamette industries also ha separate collection and treatment system for domestic wastewate with a capacity of 175,000 gallons of wastewater that also line with 12 inches of native clay.

B. Sonoco Mill

Outline of the process :

The Sonoco mill located on Bennettsville, SC. We met wit Phillips Wichard, the chemical recovery and wastewater treatmen manager of the Sonoco Mill. Sonoco mill has 8 paper machine: vourdriner machine and 7 cylinder paper machine, with th capacity of each machine is 500 ton /day, so that total capacit of Sonoco mill is 1,000 ton/ day.

The kind of product of the Sonoco mill are corrugated medium medium liner, paper board, spiral and gross rezak. The proces used are kraft process with hardwood,softwood, and old corrugate container/OCC as the raw material. In pulping process they use sodium carbonate from the chemical recovery processes 90 %, an 10 % make up. The water consumption is 3.5 - 4.0 mgd for th whole plant, part of it's : 2,000 gal/ton product, are the wate consumption for OCC processes. They uses sodium carbonate 25 lb/ton pulp with its concentration is 17 lb/cuft, and in order t avoid a dark pulp they must add OCC. Sonoco has a problem o water resources because of it's plant site are on the downstrea of the nuclear power plant. So they have a lack of wate resources and the temperature of the water raises of normal particularly in the dry season. But actually usually the wate temperature are still at the range of 82 F - 85 F, and the limi temperature is 105 F.

Environment protection :

In order to protecting the environment from the negative impac of the waste water from washing processes (black liquor) in th pulping line, Sonoco has relatively no cost / low cos technologies which should could be applied in our country. We ar very surprise with the technology used in Sonoco. It just use rotary kiln instead of recovery boiler that need a lot o investment in handling black liquor. The dimension of the rotar kiln is 10 ft in diameter by 100 ft long. It has variable spee motor. There is no fuel for the rotary kiln except for th ignitation.
Black liquor from the pulping processes (washing stages) sen directly to the evaporator after passing the fixed screen. At th first three evaporator the solid concentration of black liquo could raise from 8 % until 40 % ,then at the last two effec evaporator the solid concentration of black liquor could reach 5

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%, and then burned in the rotary kiln. The operating temperature of the rotary kiln is about 1200 F so they have a flue gas with temperature of 1200 F. Using this process they could recovered a lot of sodium carbonate, so that they just need 10 % sodium carbonate as a make.

In handling white water they said that they could recovered more than 90 % of white water.

In handling wastewater they use a process combination of anaerobic and aerobic biotreatment. The retention time of anaerobic processes are 5 days and the retention time of aerobic processes are 10 days.
It uses 4 aerator of 100 hp and 14 - 16 aerator of 50 hp. These process could eliminate 93 - 95 % of BOD inlet of 700 - 800 ppm. The only problem we have to give more attention in the anaerobic process are hydrogen sulfide and methane product. We have to flare/ burn them which might cause another problem in air pollution.

C. Union Camp

The Union Camp fine paper division located on Eastover, South Carolina. The mill construction begin in 1982 with total mill area are 4000 acre, and the actual mill area are 150 acre. The total production of this mill is 1,800 ton/day with the water consumption is about 14,000 gallons / ton product. The mill was design for even more extension potential, ultimately one day they hope have the 3 ed. paper machine but not at immediate future.

Today they have two paper machine, 2 pulping machine, and boiler complex with 2 power boiler and 2 recovery furnaces. They uses kraft processes with sodium and sulfur operation with a big chemical recovery loop that include recaustizaition and lime kiln operation.

We met with Mr. Wesley A.Fay, Technical control manager of the union camp paper mill, Mr. Doug R. Lazar, Senior Application Engineer, and Mr. James P. Witkowski, the Environmental Engineering Manager of Union Camp paper mill.

The fibre line :

In wood yard operation, they mixes southern pine and southern hardwood which is served from about 100 mill radius from the mill, with a proportionality 1 part of pine and 2 part of hardwood. The pine has a longer fibre and the characteristic of strength and hardwood ha s a short fibre length and provide the uniformity characteristic. The raw material mostly log of pine and hardwood and their chip. The log goes into the debarking operation and then to chipper. It is stored in pile. To make sure the uniformity of chip sizes it must go to the chip screening so that we should more sure that we will have a better uniformity of

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pulp quality.

In the pulping operation, they have two line of pulping operation. The first line dedicated to pine processing and the second line dedicated to hardwood processing. Again it will help them control with the pulp quality, because they don't have to swing between the pine and the hardwood with these dedicated operation. They uses a continues digester for both of them. The yield is about 35 % because they uses any of the debarking operation, lignin separation processes from fibre, and kraft pulping processes.

Environment protection :

The Union Camp corporation stands out as a company that has voluntarily taken for more recycled fibre and less use of chlorine in paper making. It made them as a work leader in bleaching technology and they uses a counter current washing processes. It use a lot of water and of course it is not a low cost / no cost processes but they would strongly applicate counter current washing.

The second big match in Union Camp is the use of oxygen bleaching technology. They said that they has been actively looking for substitutes for chlorine since 1980. So it is not only just help from the pulp quality stand point but also have great environment benefit both in the wastewater and water used reduction, because they can use wash water elsewhere in the process and with the quality of the effluent. With a number of thing like BOD, color, chlorinated organic are great be reduced. The bleaching sequences are: oxygen - chlorine / chlorine dioxide - sodium hydroxide - chlorine dioxide, are both on pine and hardwood line. By these technology, they said that between 35 - 40 pulp and paper mill with kraft processes, they have the best effluent quality of their class.

The most important thing we have just met in the Union Camp is the bleaching technology they were going to develop. As a big step in a worldwide bleaching technology used by Union Camp is the perfectional ozone bleaching. They have taken it from the pilot scale to commercial production at their mill in Franklin, and it has been under operation for 4 years. With this new technology it has some environmental advantages. With the chlorine bleaching process, the used water must be discharged because it is to corrosive to metals to be reused in other parts of the paper making process.
One advantage of ozone bleaching is that the residues from the process are not corrosive, so the water can be recycle and chemical that are pulled out of the pulp can be recovered. It is actually not totally chlorine free, since chlorine dioxide is used to brighten the pulp, but the majority of the substance has been removed.

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In the USA the main regulation of pollution they have concerne about in the pulp and paper industries are: organic matter (BO), solids (TSS), nutrients, color. It is difference with th regulated pollutants concerned in Indonesia, which is mainl consist of organic matter (COD and BOD), solids (dissolve solid and filtered solid), nutrients, color, pH, temperature and AOX (Adsorbable Organic Halide), and now dioxin als included. It is not just based on concentration but also based o mass / ton product especially for COD, BOD, suspended solid, an AOX.

In Plant Control :

The focus here is segregated sewer, it has been a common practic in the state to separate the sewer that did have significan solid from those it did. In the case the process sewer have significant solid that potentially have solid, therefore the goes to the primary clarification. They also segregate the sewe of the bleach plant which typically acidic, and have a by pass t clarifier.

Oil spill prevention measure, is one of the other thing that the are dial with to all of their oil storage tank, includin turpentine storage tank which have 4 dike, and essentially th capacity of the largest tank is 10 % for storm water, and it' separate the dike system for all of their storage tank. They als to eliminate the tank overflow, liquor tank overflow, and proces tank overflow which caused concrete paving and curving. The othe thing we might more concerned is the uses of conductivit transmitter system instead of a common spill tank system, so i the conductivity were high the pump system would automaticall pump back the stream to the chemical recovery system. It is fairly low cost spill recovery system. But in practice a hig maintenance could keep the system reliable working, and it is very effective way to reduce the sewer losses

Odor gas control, they uses odor gas collection fo noncondensable gases, TRS gases. The compound they concerned ar hydrogen sulfide, merchaptance, dimethyl sulfide, dimethy disulfide. In design of many odor control system, the two majo combustible component we have to be carefully considered ar turpentine and methanol. The more importance commitment is t minimize the outside odor that was concerned by the neighbor. I normal operation sulfur should not be detectable on out side. Th Union Camp uses the NCG collection system to reduce the overal sulfur dioxide emission from their facilities and then go to th scrubber system.

Wastewater Treatment Facilities:

All of wastewater goes through the segregated sanitary system t the primary clarifier for about 4 hour retention time. The sludg settle on the bottom of the clarifier are pumping to th dewatering processes. The clarified water goes to the AS

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splitter box. If there is a overloading in the primary clarifier part of this wastewater go to the surge pond or back up clarifier for sludge overloading protection. On the ASB splitter box the wasterwater split to the parallel of 2 series of ASB, with the retention time on each ASB are about 7 days and equipped with 9 aerator of 75 Hp. The treated water are then send to the final settling pond before going to the effluent holding pond that could hold the treated water for 1 month. Then the treated water could discharged to the river trough some kind of diffuser, so the probability of foam generation caused by turbulence could be eliminated.

It is very difference with the Indonesian regulation for the industries in discharging their wastewater to the river. That is because of we should gush out our wastes in discharging to the river, in order for more easy for them to monitor the discharges and to eliminate the probabilities of the cheat action of the industries in discharging their wastes.

D. Weyerhaeuser Company

The Weyerhaeuser Pulp Mill division located on Oglethrope, Georgia. We met with Mr. Russell Stevenson - The Plant Environmental Manager, and Mr. Frank D. Wohrley - Environmental Project Engineer of the Weyerhaeuser Co. This mill uses kraft processes with continuous digester : 1 two-vessel vapor phase, with oxygen delignification stage. In the pulp processing unit they have: hot stock refiner, 2 washer that consist of 2-stage diffusion brownstock and 3-stage post-oxygen diffusion washer tower. They also have chemical recovery plant that consist of 1 five-effect evaporator, 1 recovery boiler, 1 lime kiln, and 1 recaustization plant. The pulp drying machine are: Fourdriniers 240 " trim, with 1 drier and 1 reels.

At this company our discussion were more concerned to the waste minimization program that they have been able to reduce the waste water. The plant are originally designed for 7,000 gallons/ ADMT of water usage (= 28,000 litter water / ton product). They are now up to about 10,000 gallons / ADMT. The big increase is that when they are starting up the mill, in the bleach plant they were 70 % chlorine dioxide and 30 % chlorine, They have since move to 100 % chlorine dioxide. They also have customer who would like to have 0.1 kg AOX / ton product, so they have to use more water in the bleaching plant.

Environment protection :

This mill uses 3 stages bleach plant, chlorine dioxide stage, extraction with caustic + oxygen, and another chlorine dioxide stages. They have to manage the total chlorine dioxide used in that process,they know the relationship between their bleaching chemistry and their 0.1 kg AOX / ton of pulp product, and the capability of their effluent. They have just reach 0.11 kg AOX /

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ton of pulp product, so they are still to minimize the amount of chlorine dioxide used in the bleaching sequence.

Wastewater treatment facilities, there is at least 3 sewer going to the waste water facilities, sanitary sewer just about 50 - 60 gallons /minute, acid sewer about 2 - 4 mgd, and high solid sewer about 7 mgd. They have emergency spill basin with a capacity of 1.7 millon gallons. It's function is if there were a high pH stream this basin would held the stream for several time as a buffer basin. Then the wastewater go through the bar screen prior to the waste clarifier that have 1.75 millon gallons and 3 hour retention time.

The function of the waste clarifier is not only as a clarification unit but also as a retention tank for allowing pH adjustment. The sludge 19 % of solid are pumped to the screw press for dewatering processes. They produces 15 - 20 ton / day sludge with a dry content of about 50 %, and send to the landfill. The clarified water from the waste clarifier are pumped to the 1 st lagoon (13 acre) that has 5 days retention time and equipped with 12 aerator of 75 Hp. Then to the 23 acre of 2 nd lagoon, 9 days retention time, 6 aerator. After that to stabilization pond that has 10 days retention time and equipped with just 1 aerator. The treated water ready to be diffuse on the river, but in some cases the treated water could be hold in the 660 million gallons of holding pond that covered 29 acre of land.

IV. RECOMMENDATIONS AND CONCLUSIONS

Our recommendation are based on what we have found during our visit. Actually what we have had during following this study tour are still insufficient for us to become the trainer in the field of waste minimization assessment program that will be held on Indonesia by next month. We have a lack of information and we need more. May be one month visit for each mill are enough for us to take a lot of information. So we could take their philosophy as a benefit for us, what they have done and what we have to do, what kind of technology that could be applied in our country. In order to be more valuable of this program to our company, I think it is important to held some kind of one-day workshop for our boss / plant manager / the owner of the company, just to show what kind of benefit could be taken from this waste minimization assessment.

Each company that we have visited has a specific process and specific way in handling their wastes, to minimize the wastes and it's impact to the environment that in some cases will give them more benefit.

A. Willamette Industry

The usage of oxygen delignification process, a very efficient

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process that uses oxygen to further breakdown and remove lignin remaining after the cooking stage, is a very importance step because less lignin means there is less to bleach. They also have a waste wood boiler, by this unit it's could eliminate solid wastes that might be dumped to the landfill. It is very appropriate if this boiler can be installed to our factory in Indonesia, because we have some problem in handling our solid wastes, we now just still have a very limited area for landfill.

B. Sonoco Mill

The very attractive way in handling black liquor which we have never seen before are conducted in Sonoco Mill. They uses rotary kiln instead of recovery boiler to recover cooking liquor from black liquor. It is a low cost technology that should could be applied to a medium scale pulp and paper mill especially in the development countries such as Indonesia. As we have known, pulp mill is a very polluted industries. It is our responsibilities to protect our environment. The more concerned about this cases, the more great benefit might be achieved. We have had a flowsheet of this process but we still need a lot of information about this.

C. Union Camp

What has been done by Union Camp as a volunteer in producing more recycle fibre/paper and less use of chlorine - chlorine dioxide as a bleaching agent should become a good pattern for us. By replacing chlorine bleaching processes with ozone bleaching process that means we will deal with more friendly environmentally bleaching process. Even though Union Camp is not totally use chlorine-free processes for bleaching, but it has been reduced significantly. So when then the consumer really argue the recycle paper and chlorine free paper, the Union Camp product were really satisfied. It is a good process, may be the best, right now in the world in the bleaching processes and it has been patented.

D. Weyerhaeuser Co.

A good sewer system help them to overcome any overloading of wastewater flows, so they could split any overflows of effluent to the emergency spill basin. The Weyerhaeuser still uses chlorine - chlorine dioxide in bleaching processes, but they almost surpass the standard of AOX loading request by the consumer. They still have to do better in handling their bleaching processes, even though they have done better than us in overcoming this cases.
The usage of " screw press " for dewatering processes for their sludge have many advantages at least reducing any problem caused by the usage of " wire press ". They used to uses wire press but now they uses screw press.The usage of hot steam to protect screw

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press from sludge blanked are the other benefit that might be applied to solid handling with screw press system. But unfortunetly it is still not clear for us how the flow pattern of fluid inside the screw press, so how it could separate the solid from the liquid.

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V. APPENDICES

A. Photographs

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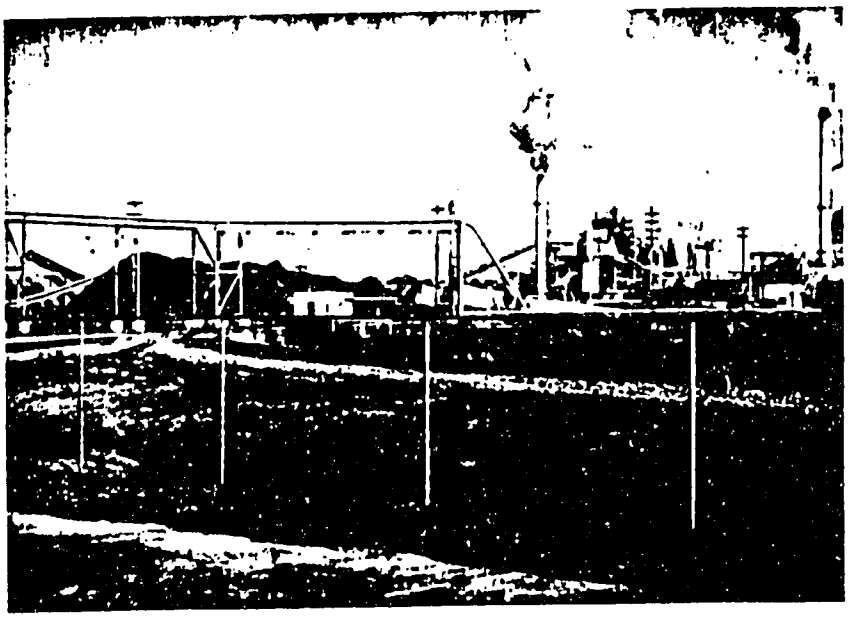
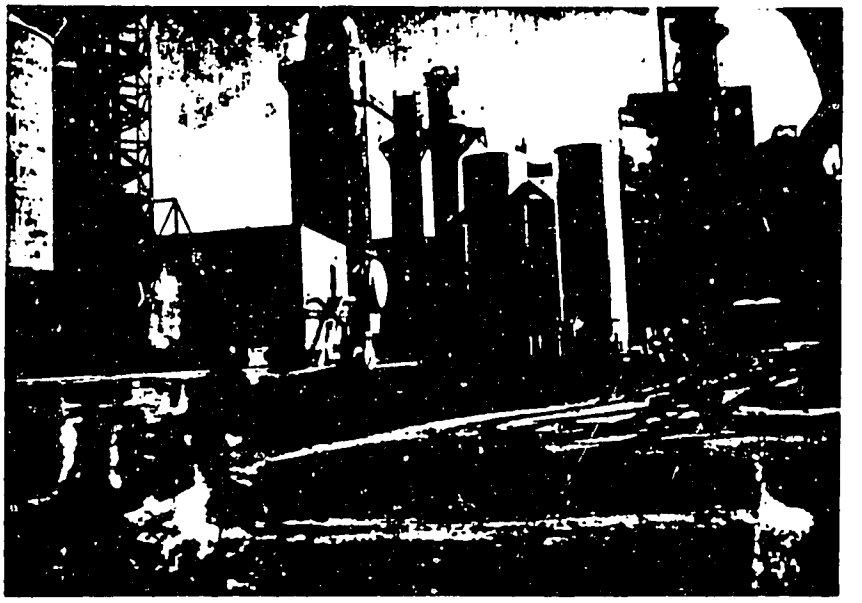


Willamette



Willamette

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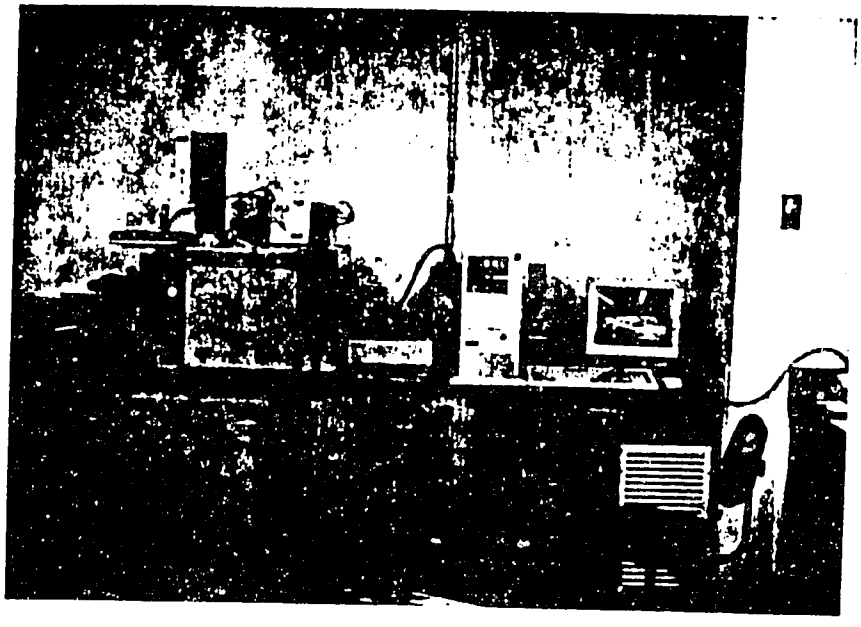
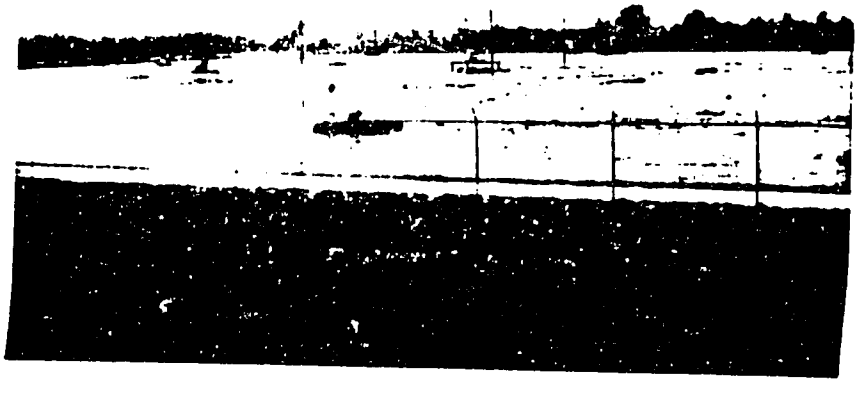


NCAR



SCNOCC, Alvarado Lagoon.

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Sonoa. Anaerobic

Sonoa an aerobic lagoon covered with plastic

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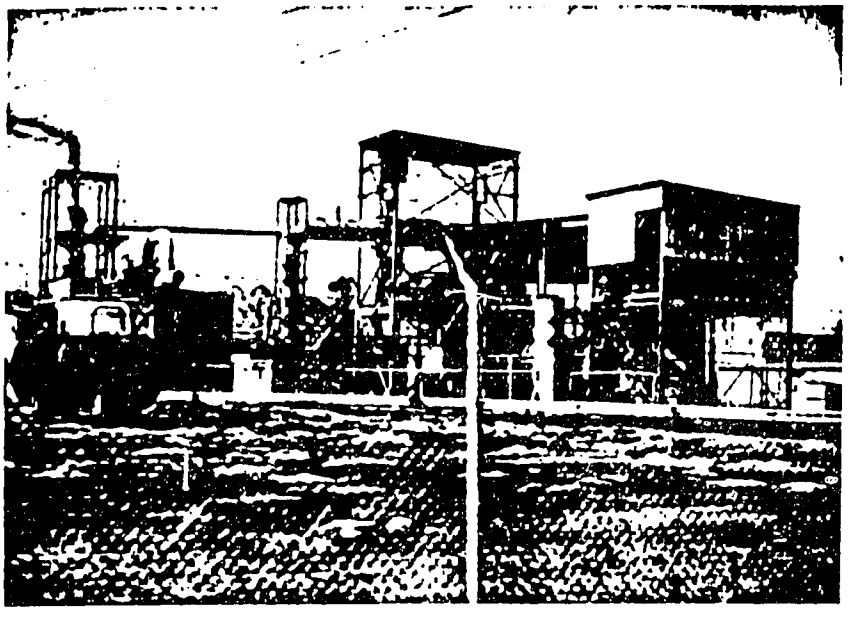

Sonoco, Rotary kiln for black liquor process

Union Camp Power Boiler

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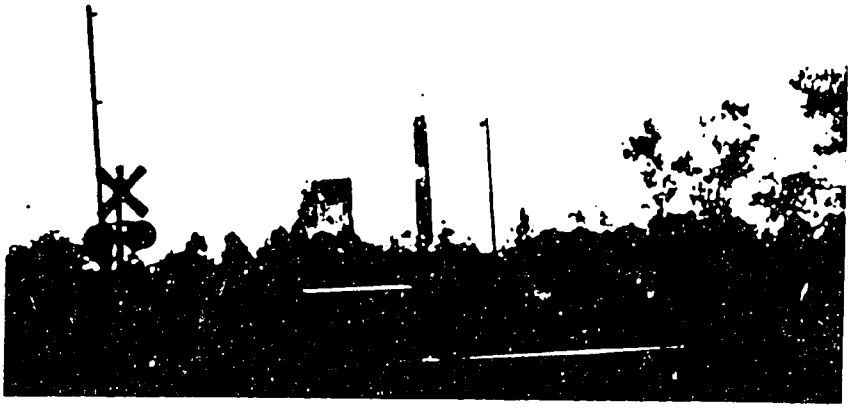

View of Marion Camp Weyerhaeuser

Presentation of Weyerhaeuser staff.

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B. Itinerary

Saturday, October 23, 1993

* The delegation depart for USA.

Monday, October 25,1993

* Meeting at NCASI 9:00 am
* Mr. Ashok K. Jain, Regional Manager of NCASI
* 3434 SW 24 th Avenue, Gainesville, Florida 32607
* Tel. 904 377 4708 x 224
* Fax. 904 371 6557

Wednesday, October 27, 1993

* Meeting at Willamette Mill 9:00 am
* Mr. W. Martin (Marty) Barfield, Technical Services Manager
* Mr. Greg Fullenwider, Technical Specialist
* P.O. Box 678
  Bennettsville, South Carolina 29512
* Tel. (803) 479-0200
* Fax. (803) 479-6603

Thursday, October 28,1993

* Meeting at Sonoco Mill 10:00 am
* Mr. Phillips Wichard, Chemical Recovery and Wastewater Treatment Manager of Sonoco Mill
* Sonoco Mill, Bennettesville, South Carolina
  (There is no business card, unscheduled visit under corporation with Mr. Ashok K. Jain, NCASI).

Friday, October 29,199

* Meeting at Union Camp 10:00 am
* Mr. Wesley A. Fay, Technical Control Manager
* Mr. James P. Witkowski, Environmental Engineering Manager
* Mr. Doug R. Lazar, Senior Application Engineer
* P.O. Box. B, Eastover, SC., 29004
* Tel. (803) 353 7627, (803) 353 7916, 7917
* Fax. (803) 353 7026

Tuesday, November 2, 1993

* Meeting at Weyerhaeuser 10:00 am
* Mr. Russell K. Stevenson,PlantEnvironmental Manager
* Mr. Frank D. Wohrley, Environmental Project Engineer
* P.O. Box. 239, Oglethorpe, Georgia, 31068
* Tel. (912) 472 5518, 5283
* Fax. (912) 472 5508

Wednesday, November 3, 1993

* Meeting at WEC HQ 5:00 pm
* Mr. Lisa A. Raundelunas, Project Manager
* WEC, 419 Park Avenue South, Suite 1800, New York, New York 10016
* Tel. (212) 683 4700 Ext. 239
* Tlx. 261290 Envirocent
* Fax. (212) 683 5053

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Pulp Division

Frank D. Wohrley
Environmental Project Engineer

Flint River Operations
Old Stagecoach Road
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Oglethorpe, Georgia 31068
Tel (912) 472 5283
Fax (912) 472 5508

Weyerhaeuser

W. Martin (Marty) Barfield
Technical Services Manager

Willamette Industries, Inc.
Marlboro Mill
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(803) 479-0200
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Pulp Division

Russell K. Stevenson
Plant Environmental Manager

Flint River Operations
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Fax (912) 472 5508

Weyerhaeuser

Greg Fullenwider
Technical Specialist

Marlboro Mill
Willamette Industries, Inc.

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803 / 479-0200
FAX: 803 / 479-0603

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REGIONAL MANAGER
SOUTHERN REGION

P.O. BOX 141020
GAINESVILLE, FLORIDA 32614-1020
(904) 377-4708
FAX (904) 371-6557

DR. ISAIAH GELLMAN
PRESIDENT
(212) 532 9000

NATIONAL COUNCIL OF THE PAPER INDUSTRY
FOR AIR AND STREAM IMPROVEMENT INC
260 MADISON AVENUE
NEW YORK, N Y 10016

Wesley A. Foy
Technical Control Manager

FINE PAPER DIVISION
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TEL. (803) 353-7627

CFREE*

Doug R. Lazar
Senior Application Engineer

UNION CAMP TECHNOLOGY, INC.
HWY. 601 S, P.O. BOX B
EASTOVER, SC 29044
TEL 803/353-7917
FAX 803/353-7026

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World Environment Center
Indonesia Office

DR. R.H.M. WIRADIPUTRA
COUNTRY DIRECTOR INDONESIA

Kuningan Plaza South Tower, 3rd Fl Suite 304 A
Jl. H.R. Rasuna Said Kav. C 11 - 14 Phone [illegible]
Jakarta 12940 - Indonesia [illegible]

World Environment Center

CHARLES JONG, HWA HONG
DEPUTY PROJECT MANAGER

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World Environment Center

LISA A. RAUDELUNAS
PROJECT MANAGER

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Union Camp

James P. Witkowski
Environmental Engineering
Manager

FINE PAPER DIVISION
P.O. BOX B, EASTOVER, SC 29044

TEL: 803/353-7916
FAX: 803/353-7026

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C.Participants

* Mr. Darono Wikanaji	* PT Kertas Leces (Peresero) Leces - Probolinngo, 67202 East Java, Indonesia. - Wastewater Treatment Facilities - Chlor Alkali Plant - Tel. (0335) 21993, 21994, 21996 Ext. 257, 311
* Mrs. Hendayani T. A.	* Institute of Research and Development of Cellulose Industry - Raya Dayeuhkolot 132 Bandung 40258, Indonesia - Tel. (022) 502980, 502871 - Fax. (022) 502871 - Head of Sellulose Derivatives and Pollution Division
* Mr. Iyan Suwargana	* The Environmental Impact Management Agency (BAPEDAL) Dit. Pengolahan Limbah B-3 - Arthaloka Building 11 th. Floor - . Jendral Sudirman No: 2 Jakarta 10220, Indonesia - Tel. (62-21) 5703419 Ext. 209 - Fax. (62-21) 5703365, 5702547
* Mr. Warih Supriadi	* PT Surabaya Agung Industri Pulp & Paper Quality Control Department - Jl. Bongkaran 68 Surabaya, Indonesia - Tel. (031) 339457 - 62 (6 lines) - Fax. 335043
* Mr. Widya Tjahyana L.	* PT Pakerin - Jl. Kertopaten 3 Surabaya, Indonesia - Tel. (031) 316173 (8 lines) - Fax. 31 - 314345
* Mr. Zulkifli Lubis	* PT Indah Kiat Pulp & Paper Co. Environmental Protection Section Quality Control Department - Wisma Bank International Indonesia 6 th. Floor. - Jl. M.H. Thamrin Kav. 22 Jakarta 10350, Indonesia - Tel. (021) 3104647, 3104452, - 3 - Fax. (021) 3104582, - 3

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Thursday, November 4, 1993

* Meeting at NCASI Head Office 9:00 am
* Dr. Isaiah Gellman, President of NCASI
* NCASI, 260 Madison Avenue, New York, N.Y. 10016
* Tel. (212) 532 9000

Another contact person of WEC :

* Mr. Charles Jong Hwa Hong, Deputy Project Manager
* WEC Head Office, 419 Park Avenue South, Suite 1800 New York, N. Y. 10016
* Tel. (212) 683 4700
* Tlx. 261290 Envirocent
* Fax. (212) 683 5053

** Drs. R.H.M. Wiradiputra, Country Director Indonesia
* Kuningan Plaza, South Tower 3 rd.Fl., Suite 304 A Jl. H.R. Rasuna Said Kav. C 11 - 14, Jakarta 12940 Indonesia.
* Tel. 5251120 - Fax. 5251195

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D. Documents Received

- Flow sheet of Chemical Recovery System of Sonoco Mill

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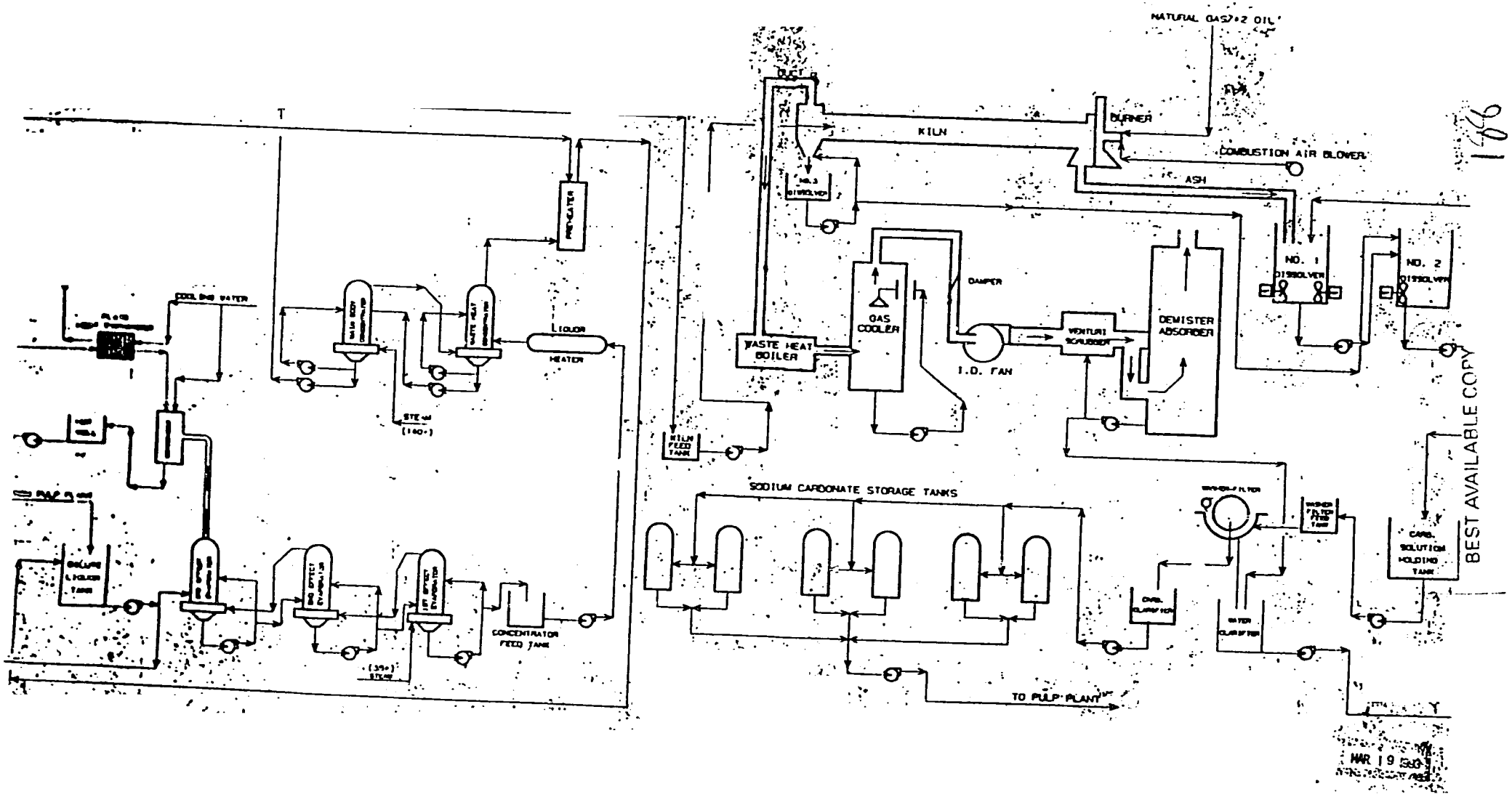
CORRUGATING DIVISION
CHEMICAL RECOVERY PLANT



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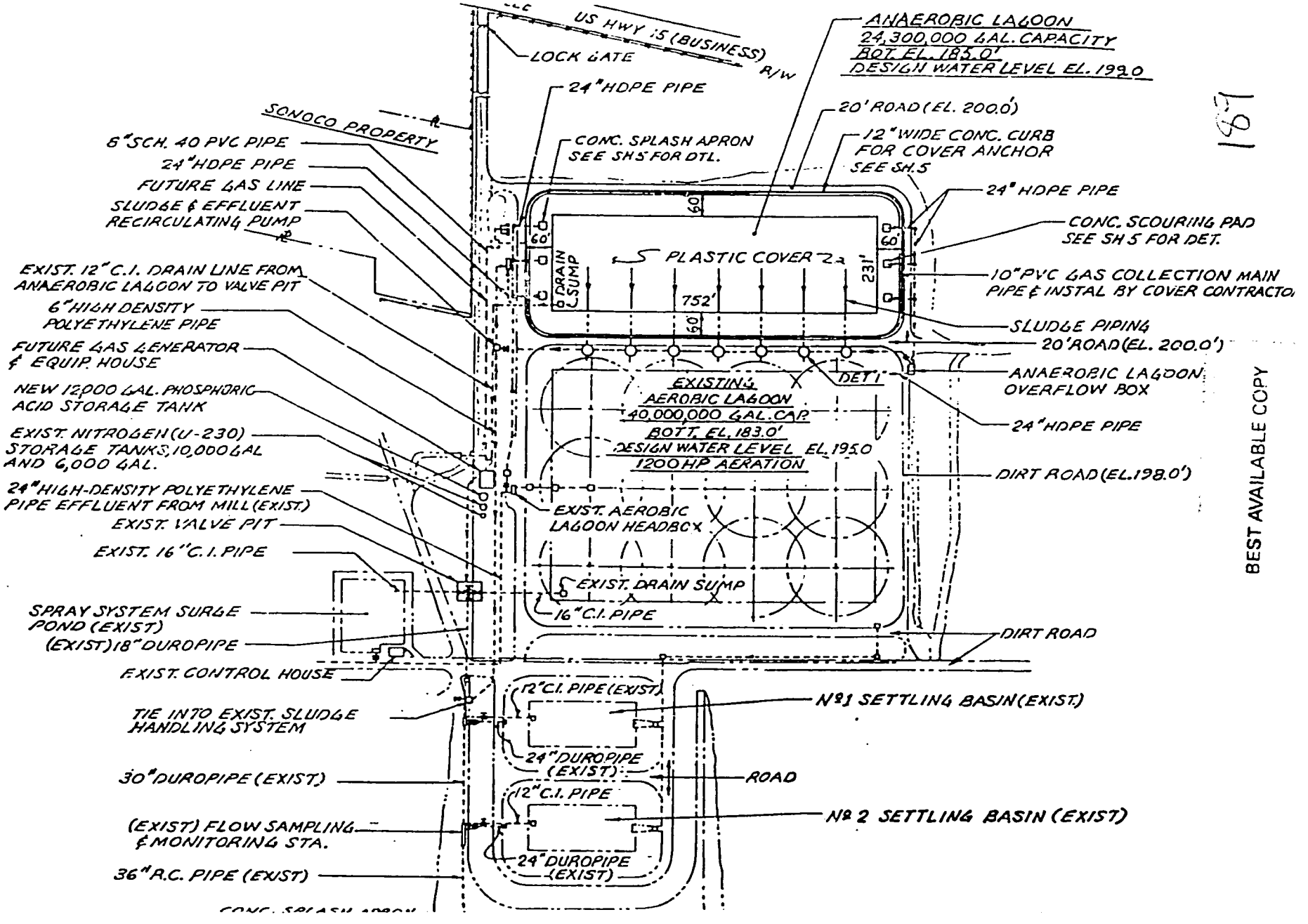

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POTENTIAL WATER & EFFLUENT BENEFITS

Using OZED Bleaching

Estimated Values for a Typical Plant

	CEDED	O(CD)ED	OZED
Bleach plant Water Use	**47.5**	**15.8 ***	**13.7 ***
Bleach Plant Effluent	**55.4**	**14.2**	**7.5**

M^3/A.D.Metric Ton

* Some water is recycle therefore savings may vary

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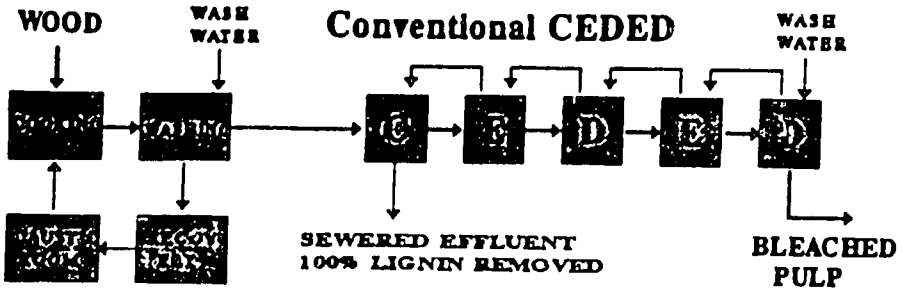
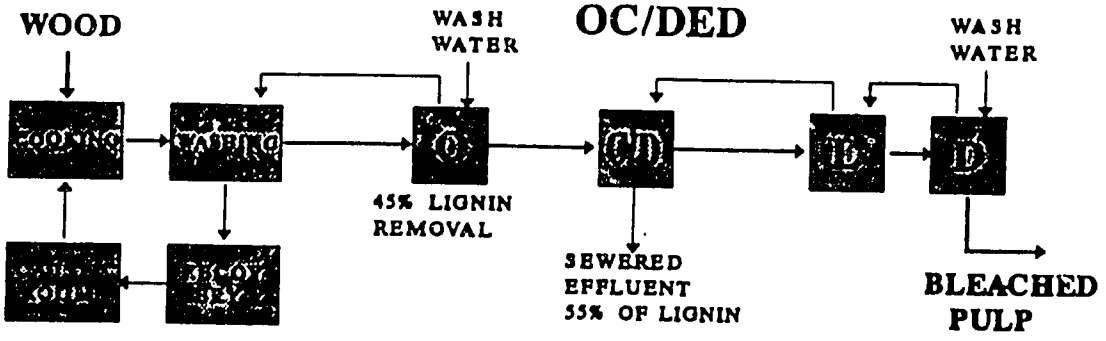
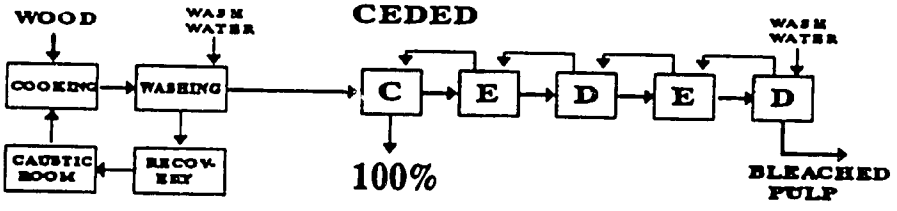
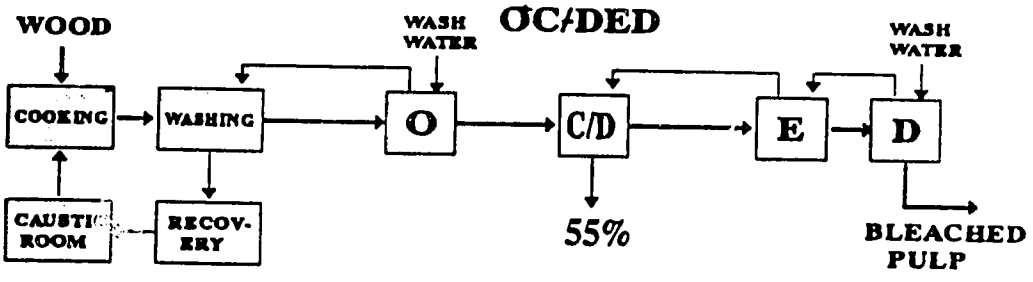


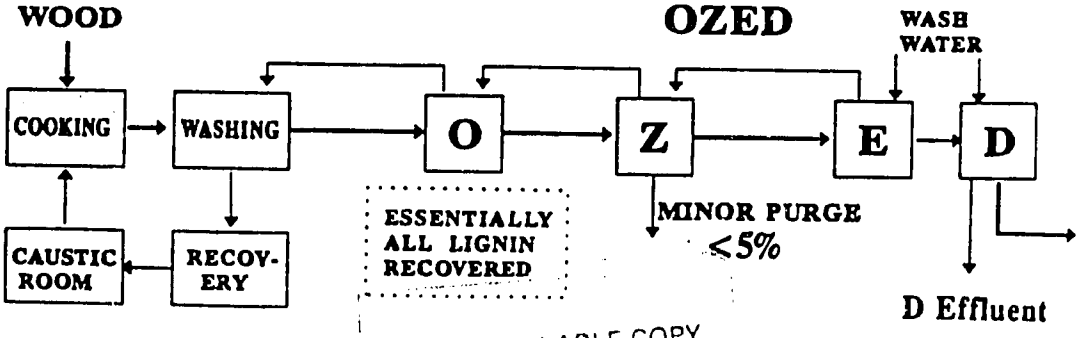


PROBLEMS: STILL A HIGH PERCENTAGE OF ORGANICS AND BLEACHING CHEMICALS SENT TO THE SEWER WITH HIGH BOD, AND COLOR.

CHLORINE STILL USED; SIZABLE AMOUNTS OF CHLORINATED ORGANICS PRODUCED.







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BLEACHING COST REDUCTIONS FOR VARIOUS WOODS

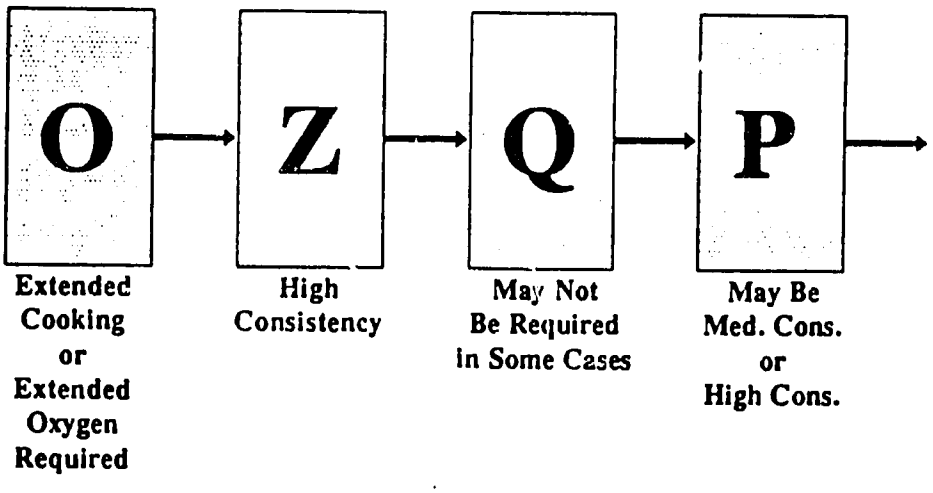
C-Free™ Compared with Conventional Bleaching

90 G.E. BRIGHTNESS PULP

	Percent reduction at Average U.S. Material Costs		
	Normal C/D Substitution	100% D/C Substitution	Comparison Sequence
Birch	42%	47%	OC/DED
Southern HD	20%	52%	CEDED
Eucalyptus	16%	46%	CEDED
Hemlock/Fir Mix	38%	61%	CEDED
Spruce/Pine Mix	35%	52%	OC/DED

OZQP (TCF) Bleaching
Totally Chlorine Compound Free

For Easy to Bleach Pulps - Market Brightness & Strength Possible



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POTENTIAL BENEFITS

BLEACH PLANT ORGANICS

Southern PINE Kraft to 82 ISO

	CEDED	OC/DED	OZED
BOD_5 (kg/ADMT)	16	6.5	2
COD (kg/ADMT)	65.5	22.5	6
COLOR (kg/ADMT)	185	41.5	1.5

RESULTS ON EFFLUENT PRODUCED FROM COMMERCIAL OZ(EO)D PLANT

	CEDED	OC/DED	Predicted OZED	INITIAL MEASURED F-LINE
BOD_5 (kg/ADMT)	16	6.5	2	1.8
COD (kg/ADMT)	65.5	22.5	6	5.6
COLOR (kg/ADMT)	185	41.5	1.5	0.9
TOX (kg/ADMT)	6.5	3.0	0.075	0.14
AOX	--	--	--	N.D.(<1-5ppb)
Chloroform	0.18	0.08	0.003	0.00017

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PERCENT REDUCTION IN EFFLUENT
Using OZED Bleaching
90 G.E. BRIGHTNESS PULP

	Compared to Reference Sequence	COLOR	BOD	TOX	COD
Birch	ODEDED	88%	76%	71%	58%
Southern HD	CEDED	99%	88%	98%	91%
Southern HD	O(D$_{ll}$C)ED	96%	78%	97%	90%
Eucalyptus	CEDED	98%	87%	97%	88%
Spruce/Pine	O(D$_{ll}$C)EDED	98%	---	97%	85%
Hemlock/D. Fir	CEDED	96%	91%	84%	92%
Southern Pine	CEDED	99%	88%	99%	91%
Southern Pine	O(D$_{ll}$C)ED	96%	69%	98%	73%

POTENTIAL BENEFITS
CHLORINATED ORGANICS
Southern PINE Kraft to 82 ISO

	CEDED	OC/DED	OZED
on PULP TOX (kg/ADMT)	0.28	0.13	0.04
in BLEACH PLANT EFFLUENT TOX (kg/ADMT)	6.5	3.0	0.08 [a]
CHLOROFORM GENERATION total (kg/ADMT)	0.18	0.08	0.002

a. Level depends on the amount of chlorine in the chlorine dioxide used

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E. Curriculum Vitae

Personal data :

Name : Darono Wikanaji
Place & day of birth :

Education :

Gadjah Mada University Yogyakarta
Faculty of Chemical Engineering, graduated 1989

IKIP Malang, Intermediate Level English Course, 1992

Indonesian American Friendship Association Surabaya
Intermediate Level English Course, 1993

NIEM Training Package, Industrial Management Preservation, BBS Bandung, 1992.

Experience (all with PT Kertas Leces - Persero)

Oct. 1993 - present	Supervisor of Chlor Alkali Plant
1990 - 1993	Supervisor of Wastewater Treatment Facilities

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REPORT OF STUDY TOUR

TO U.S. PULP & PAPER MILL

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I. EXECUTIVE SUMMARY.

Purpose of this study tour are to give the participant the actual fact about the progress of effluent treatment / pollution control that has been done in U.S. pulp and paper mills. During the trip we found a lot of input data , effluent treatment system, elemental chlorine free bleaching, waste minimization, spill control, mill management system and colaboration between pulp and paper mill to handle any isue in enviroment problem.
During the trip we visited agencies and pulp and paper mills as follows:

1. NCASI Southern Region, Gainsville, Florida.
2. Marlboro Mill, Willamette Industries Inc.,Bennettesville, South Carolina.
3. Sonoco Paper Product, Hartsville, South Carolina.
4. Union Camp Fine Paper Division, Eatover, South Carolina.
5. Weyerhaeuser, Flint River Operations, Oglethorpe, Georgia.
6. World Enviroment Center, New York.
7. NCASI (National Council of The Paper Industry For Air And Stream Improvement Inc.).

All the mills we visited applied Kraft Process for the pulping except Sonoco with Soda Process for his pulping system.
The three modern mills completed with elemental chlorine free bleaching system, Chemical recovery system, Gas Incineration ,Effluent treatment system with primary and secondary treatment.
Especially in Sonoco we found that this company using incineration system for his black liquor and the recover Na_2CO_3 used directly in the digester without doing any recausticising.The investment cost of this system is lower than the conventional recovery system commonly used in Kraft Process. Thanks to Mr Ashok Jain and Mr Charles Hong who arrange the visit to Sonoco mill.

We find that Oxygen and Ozone Bleaching can give significant contribution to waste minimization program.
The three modern mills from the planning stage already takecare of enviroment assesment.
It is quiet different with our existing pulp and paper mill.
For us it will take time to do waste minimization program, install new equipment, do retrofitting, train the operator and carry out spill control program.

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II. INTRODUCTION.

Participant of this Study Tour are 4 participants from Pulp and Paper Mills and two Participants from Indonesian Agencies. They are as follows:

1. Mr. Ir. Darono Wikanaji From P.T. Kertas Leces.
2. Mr. Drs. Warih Supriadi from P.T. Surya Agung Kertas.
3. Mr. Zulkifli Lubis from Indah Kiat Pul and Paper.
4. Mr. Widya T. Lauwangsa from P.T. Pakerin Pulp & Paper.
5. Miss. Ir. Hendayani T. Adisesha, MS. from BBS (Cellulose Institute, Bandung).
6. Mr. Iyan Suwargana from Bapedal .

Selection of the participants carried out by W.E.C./USAID base on the curiculum vitae submitted to them.
Complete name and address of each participant can be seen on Appendix 1

Agencies and Pulp & Paper mills visited are as follows:

25th October 1993	visited NCASI (National Council of the Paper Industry for Air and Stream Improvment Inc.) Southern Region, Gainsville, Florida.
27th October 1993	visited Marlboro Mill, Willamette Industry Inc. Bennettsville, South Carolina.
28th October 1993	visited Sonoco Paper Product, Hartsville,South Carolina.
29th October 1993	visited Union Camp Fine Paper Mill, Eastover, South Carolina.
1st November 1993	visited Weyerhaeuser, Flint River Operation, Oglethorpe, Georgia.
3rd November 1993	visited World Enviroment Center, Park Avenue, New York.
4th November 1993	visited NCASI Head Quarter, Madison Avenue, New York.

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III. FINDING.

At NCASI Research Center, Southern Region. Meeting attended by 5 participants from Indonesia, Mr. Charles Hong from WEC, Mr. Ashok Jain, Regional Manager of NCASI and Mr. Burgess former Regional Manager of NCASI.
The discussed topics are : NCASI Organization, background, programs, relationship between NCASI and EPA of U.S.
Introduction of pulp and paper mill which we planned to see.
At this facilities we are allowed to see the equipment available, result of research (mainly air pollution), and discussed with chief of laboratory.
Mr. Burgess explained about Primary and Biological Secondary Treatment of Effluent Treatment Plant.
Sludge bulking in Activated Sludge Process and how to solved this problem.
Programs carried out by NCASI prepared as a result of meeting of pulp and paper industry. Unscheduled program (crash program, in case to cater the recent isue from organization like Greenpeace) done by contractors under the supervision of NCASI. This crash program should be done by contractor as NCASI must completed the scheduled programs.
Annual budget for the scheduled programs is US $ 10,000,000,- and for crash program is US $ 6,000,000,-. All the funds collected from member of the pulp and paper industry and U.S. Goverment.

Willamette Industries Inc., Marlboro Mills.; Union Camp, Fine Paper Division.; Weyerhaeuser, Flint River Operation.
The three mills applied Kraft Process for the pulping line.
The bleaching system with elemental chlorine free , with recovery boiler, recausticising, gas incinerators, and the effluent treatment system using Primary treatment with Clarifier, Secondary Treatment with Aerated Stabiliation Basin with retention time from 5 to 7 days followed with stilling pond with retention time of 7 to 30 days, at the outlet of theeffluent treatment plant they install one aerator to prevent odour from the waste water.
All the mills using Earth Basins as ASB and Stilling pond. The earth basins covered with compacted clay (thickness : 1 ft) to prevent penetration of waste to surrounding area.
Sludge from Primary Clarifier dehydrated by Screw Press or Belt Press and than dumped to land fill. Leachy from rain water in the land fill is pumped back to waste water treatment plant.

For the Kraft Process the malodourous gas is burnt in the incinerator, methanol sell to other factory as stated by the regulation that any metahnol produce by industry can not be used by producer.

For Soda Process Pulping no Regulation for Odour control.
Please see Appendix : 2, 3, 5 and 6.

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Sonoco Paper Product. Mr. Phillip Richard as Technical Service Manager.
This mill using SCP hardwood and OCC as stock furnish for chip-board and corrugating medium. Pulping Process using Na_2CO_3 alone. The Black Liquor thickened in 5 stage multiple evaporator and than incinerate in kiln. The recovered Na_2CO_3 pumping back to digester. Heat from the kiln recovered in Exhaust Gas Boiler. Steam from Exhaust Gas Boiler used in Evaporator. Balanced steam required in the evaporators supply from Power Boiler.
Effluent Treatment Plant consist of Primary Treatment and Secondary Anaerobic and Aerobic treatment. Biogas from anaerobic lagoon suct by blower and than burnt. The anaerobic lagoon covered with HDPE sheet. Please see Appendix 4.

WORLD ENVIROMENT CENTER, New York.
Mr Frank .....
Mr Frank explained programs of WEC, Gold Medal awards for the enviroment friendly industry. WEC can arrange an intensive training program if the fund available from other sources. As the WEC a non profit and non advocacy organization so they has excess institutes, agencies or industry to support the programs.
Please see Appendix 7.

NCASI Head Quarter, New York.
Dr. Isaiah Gellman, President.
Dr. Gellman explained programs and reports that can be used by participants via Miss Hendayani from BBS, Bandung.
NCASI distributed 1500 copies of report of research to pulp and paper industries, instituter, equipment maker and agencies around the world.
The current report can be seen in Appendixe No....
Please see Appendix 8.

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IV. CONCLUSIONS AND RECOMMENDATIONS.

Study Tour to U.S. Pulp and Paper mill give the participants a lot of input and many new technologies can be applied by Indonesian Pulp and Paper mill.
We hope in the future WEC can arrange a more intensive training in class and on site.
Three modern mills we visited are a well planned industry. It is quiet different with an old/existing mill with has limitation in land area and small capacities of product.
It will take time for the existing industry to do modification of the process system, install new equipment, do retrofitting and train the operators.

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APPENDIX 1

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P.T. PAKERIN
(PULP, PAPER, PAPER PRODUCTS & CHEMICAL INDUSTRIES)

Widya Tjahyana Lauwangsa

Office
Jl. Kertopaten 3, Surabaya – Indonesia
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Telex : 31140 (PM SB IA
Fax : 31 – 314345
Cable Add. PAKERIN Surabaya

Factory :
Desa Bangun, Pungging - Mojokerto
Phone : (0319) 71363

BALAI BESAR PENELITIAN DAN PENGEMBANGAN INDUSTRI SELULOSA

Ir. HENDAYANI T. ADISESHA, MS.
KEPALA BALAI PENELITIAN DERIVAT SELULOSA DAN POLUSI

Kantor :
Jl. Raya Dayeuhkolot 132
Telp (022) 502980-502871
Fax 502671 Bandung 40258

Rumah :
Jl. Hegarmanah
Telp (022) 832
Bandung 40141

ZULKIFLI LUBIS
VICE SECTION CHIEF
ENVIRONMENTAL PROTECTION

PT INDAH KIAT PULP & PAPER CORPORATION

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PAPER MILL : KM 8 JL. RAYA TANGERANG - SERPONG, TANGERANG JAWA BARAT, INDONESIA
PULP & PAPER MILL : KEC. SIAK, KAB. BENGKALIS, RIAU, INDONESIA FAX (0761) 33080 TEL (0761) 38988, 33630

P.T. Surabaya Agung Industri Pulp & Paper

Drs. Warih Supriadi
Quality Control Dept.

Head Office :
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Phone : (031) 339457 - 62 (8 lines)
Telex : 31430
Fax : 335043
Surabaya - Indonesia

Factory :
Driyorejo / Sepanjang
Kabupaten Gresik,
Phone : (031) 833363, 335025, 707129, 707130
Jawa Timur
Indonesia

[illegible] WIKARSA
[illegible] INDUSTRIES
CHEMICAL [illegible]

J. [illegible] 26
[illegible] 50112

THE ENVIRONMENTAL IMPACT MANAGEMENT AGENCY (BAPEDAL)

Iyan Suwargana
Dit. Pengelolaan Limbah B3
Direktorat Hazardous waste Management

Arthaloka Building 11th Floor
Jl. Jendral Sudirman No. 2 Jakarta 10220 - Indonesia
Telp. (62-21) 5703419 ext. 209
Fax. (62-21) 5703365, 5702547

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SOUTHERN REGION

P.O. BOX 141020
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Greg Fullenwider
Technical Specialist

Marlboro Mill
Willamette Industries, Inc.

Post Office Box 678
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W. Martin (Marty) Barfield
Technical Services Manager

Willamette Industries, Inc.
Marlboro Mill
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Wesley A. Foy
Technical Control Manager

FINE PAPER DIVISION
P.O. BOX B, EASTOVER, SC 29044

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Manager

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TEL: 803/353-7916
FAX: 803/353-7026

CFREE®

Doug R. Lazar
Senior Application Engineer

UNION CAMP TECHNOLOGY, INC.
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EASTOVER, SC 29044

TEL: 803/353-7917
FAX: 803/353-7026

Pulp Division

Frank D. Wolfley
Environmental Project Engineer

Flint River Operations
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Fax (912) 472 5508

Weyerhaeuser

Pulp Division

Russell K. Stevenson
Plant Environmental Manager

Flint River Operations
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Weyerhaeuser

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DR. ISAIAH GELLMAN
PRESIDENT
(212) 532 9000

NATIONAL COUNCIL OF THE PAPER INDUSTRY
FOR AIR AND STREAM IMPROVEMENT INC
260 MADISON AVENUE
NEW YORK, N.Y. 10016

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CHARLES JONG HWA HONG
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TLX 261290 ENVIRO UT
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APPENDIX 2

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BENNETTSVILLE

Willamette Industries Inc.	P.O. Box 678 29512, Tel: 803-479-0200 Fax: 803-479-0608
Pulp Mill	Hwys: State Rte #912, James C Myers, Plant Manger, Kraft. Average Daily Production: Bleached Softwood and Hardwood: 700 tons Chemical Recovery Plant. Black Liquor Oxidation System: 1 Ahlstrom, 3MM lbs solid/da 460,000lbs steam/hr. Bleach Plant Sequence: Cd-Eo-D.
Paper Mill	Paper Machines. 1 Valmet twin-wire, 354" width, 710 tpd cap.
Products	Uncoated alkaline printing and writing papers, 650 tons daily

EASTOVER

Union Camp Corp.	Fine Paper Div. PO Box B 29044, Tel: 803-353-7700 Fax: 803-353-7981
	A.D. Fary, Mill Manager, W.A. Foy, Manager Technical Control
Pulp Mill	Kraft. Average Daily Production: Bleached Softwood and Hardwood: 1850 tons of which 330 tons is Market Pulp. Continuous Digesters: 2 Kamyr.
	Chemical Recovery Plant. Bleach Plant. Sequence: (not spec.) chlorine dioxide, ozone, and oxygen bleaching.
	Pulp Drying: Fourdriniers: 1 valmet, 192" wide. — [illegible]
	Dryers: 1 Flakt. Cutter-Layboys: 1 Lamb-grays Harbor .
Paper Mill	Paper Machines. 1 twin-wire Voith Duoformer
	F, 372" Width 3280 fpm.
	1 Beloit Bel Baie III twin-wire, 372" wide, 3400 fpm.
Products	Uncoated printing and writing papers, 1550 tons daily. Bleached kraft market pulp. 330 tons daily

OGLETHORPE

Weyerhaeuser Paper Co.	Flint River Plant State Coach Rd (PO Box 238) 31068
	Tel: 912-472-2527 Fax: 912-472-5508, Hwys: US Rte #49.
	J.B. Crowe, Plant Manager
Paper Mill	Kraft. Average Daily Production: 750 tons of which 750 tons is Market Pulp. Continuous Digesters: 1 two-vessel vapor phase, with oxygen delignification stage. Chemical Recovery Plant. Evaporators: 1 five-effect. Recovery Boilers: 1 Lime Kilns: 1 calciner. Bleach Plant. Sequence: 1 line
	Pulp Processing: Hot Stock Refiners: 2 Washers: 2-stage diffusion brown stock; three-stage post-oxygen diffusion washer tower. Pulp Drying: Fourdriniers: 1 240" trim. Dryers: 1 Reels: 1 .
Steam/Power.	Power boilers: Fuel: Waste Wood. Electricty: Generated:
Water Treatment.	Source: River.
Effluent Treatment.	Primary Treatment: Clarifiers. Secondary Treatment: aeration laggons.
Products.	Bleached softwood kraft paper grade and dissolving market

Sonoco products Company
Hartsville, South Carolina.

Richard

1100 T/day (.500 T/hr) Single wire Fourdrinier type

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APPENDIX 3

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PRODUCTS AND FACILITIES

Paper Group

Corrugated Containers
31 plants in 18 states.
1992 production: 16.1 billion sq. ft.

Pulp and Paper
8 mills in 5 states. 1992 production: 1.96 million tons of linerboard, corrugating medium, bag paper, forms bond, printing papers and bleached hardwood market pulp.

Business Forms
7 plants in 7 states, with distribution centers in major cities of each region. 1992 production: 295,000 tons.

Cut Sheets and Other Converting
3 plants in the East and South. 1992 production: 136,000 tons of cut sheets for photocopiers and computer printers.

Bags
5 plants in 5 states. 1992 production: 130,000 tons of bags.

Inks
2 plants serving the East and West. 1992 production: 5,000 tons.

Preprint
2 plants, serving the East and West, preprinting 480 million sqare feet of linerboard in 1992.

Building Materials Group

Plywood
11 plants in the south, southeast and Oregon. 1992 production: 2 billion square feet (3/8" basis).

Lumber
7 mills, located in the south and in Oregon. 1992 production: 478 million board feet.

Particleboard
5 plants located in Louisiana and Oregon. 1992 production: 562 million sq. ft. (3/4" basis).

Engineered Wood Products
Structural Wood Products, 2 plants producing StrucJoist ® wooden I-beams and laminated veneer lumber, and 3 laminated beam plants.

Medium Density Fiberboard (MDF)
2 plants, located in Arkansas and South Carolina. 1992 production: 189 million sq. ft. (3/4" basis).

Other Facilities
Custom Products -
drawer sides & molding
Custom Services -
lumber drying & planing
Lebanon Machine -
equipment fabrication

WILLAMETTE FACTS

1993

Willamette Industries, Inc.
1300 S.W. Fifth Avenue
Portland, Oregon 97201
(503) 227-5581

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MANUFACTURING PLANTS

91 plants in 21 states: Alabama, Arkansas, California, Colorado, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas and Washington.

EMPLOYMENT

12,000 employees
$ 507,469,000 paid in wages & benefits

TIMBERLANDS

Arkansas, Louisiana & Texas	
Southern pine region	564,000
Oregon	
Douglas fir region	328,000
Tennessee	
Central hardwood region	188,000
North & South Carolina	
Southern pine & hardwood	116,000
Total acres	1,196,000

FINANCIAL HIGHLIGHTS (1992)

Net Sales	$2,372,396,000
Net Earnings	$81,552,000
per share	$1.52
Dividends per share	$ .84
Total Assets	$2,527,416,000
Stockholders' Equity	$1,164,828,000

Price range of common stock (bid):
High: 42¼ Low: 29⅝

Sales by line of business:

Fabricated paper products	46%
Plywood	17%
Pulp and Paper	16%
Particleboard & MDF	8%
Lumber	6%
Other wood products	7%

OTHER FINANCIAL DATA

Capital expenditures:	$367.2 million
Operating cash flow:	$260.6 million
Return on beginning equity:	8.2%
Average return, past five years:	15.8%
Debt to capital ratio:	42%
Working capital:	$157.8 million

RECYCLING

Containerboard has an average 47% post-consumer recycled content.

ENERGY

Facilities are 65% energy self-sufficient.

HISTORY

Established in 1906 in Dallas, Oregon as the Willamette Valley Lumber Co.

Paper Group was organized in 1955.

Willamette Industries formed in its present corporate structure in 1967.

Pronounciation: Will-AM'-it

Stock traded: Over-the-Counter

Stock symbol: WMTT
Quoted on the NASDAQ National Market System

***Fortune 500* rank:** 208

NATIONWIDE

FINANCIAL HIGHLIGHTS (1992)

Net Sales	$2,372,396,000
Net Earnings	$81,552,000
Earnings per share	$1.52
Dividends per share	$.84
Total Assets	$2,527,416,000
Stockholders' Equity	$1,164,828,000

EMPLOYMENT (1992)

12,000 employees.

$507,469,000 paid in wages and benefits.

PRODUCTS

Containerboard, bag paper, fine paper, bleached hardwood & market pulp, specialty printing papers, corrugated containers, business forms, cut sheet paper, paper bags, inks, lumber, plywood, particleboard, medium density fiberboard, laminated beams and value-added wood products.

MANUFACTURING PLANTS

91 plants in 21 states: Alabama, Arkansas, California, Colorado, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Texas and Washington.

TIMBERLANDS

1,196,000 acres in Arkansas, Louisiana, North Carolina, Oregon, South Carolina, Tennessee and Texas.

CORPORATE HISTORY

Established in 1906 in Dallas, Oregon as the Willamette Valley Lumber Co. Paper Group organized in 1955.

Willamette Industries formed in its present corporate structure in 1967.

First acquisition in the Carolinas in 1982.

Pronunciation: Will-AM´-it

Stock Symbol: WMTT

Stock Traded: Over-the-Counter Quoted on the NASDAQ National Market System

FORTUNE 500 ranking: 195

Willamette Industries, Inc.
1300. S. W. Fifth Ave.
Portland, OR 97201
(503) 227-5581

WILLAMETTE INDUSTRIES IN THE CAROLINAS

1993

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Corrugated Container Plants

Lumberton Corrugated Plant
P. O. Box 1247, Lumberton, NC 28359
(919) 738-6214
M. H. Crum, general manager
Dan Krewson, sales manager

Purchased in June, 1992. 107 employees. Produces corrugated containers.

Matthews Corrugated Plant
P. O. Box 1353, Matthews, NC 28106
(704) 333-0115
Keith Sorensen, general manager
David Easom, sales manager

Purchased in Nov. 1982. 110 employees. Produces 480,000,000 sq. ft. of corrugated shipping containers and value-added packaging.

Newton Corrugated Plant
P. O. Box 408, Newton, NC 28658
(704) 464-3841
Jerry Thomas, general manager

Purchased in June, 1992. 107 employees. Produces corrugated containers.

Business Forms Plant

300 Northpark Drive, Rock Hill, SC 29730
(803) 328-3800

Dan Showers, general manager
Jim Hudson, area sales manager

Started in Oct. 1988. 70 employees. Produces 42,000 tons annually of continuous stock computer forms.

Cut Sheet Plant

P. O. Box 219, Tatum, SC 29594
(803) 523-5058
Donnie Culbertson, plant manager

Started in July 1990. 29 employees. Produces 84,000 tons of cut sheet paper annually.

Fine Paper Mill

P. O. Box 678, Bennettsville, SC 29512
(803) 479-0200
Marvin Cooper, vice president
Jim Myers, plant manager

Started in Dec. 1990. 291 employees. Produces 245,000 tons annually of fine paper.

East Coast Development Laboratory

9401 Southern Pine Blvd., Suite D
Charlotte, NC 28273
(704) 523-0010
Bobby Dickey, development manager, kraft paper
Ernest Sackett, development manager, fine paper

Product development, quality improvement, technical service and customer service.

Timberlands

Ken Hill, forestry & logging manager, located at the Chester Plywood Plant

120,000 acres in North and South Carolina.

Medium Density Fiberboard (MDF)

Highway 912, Bennettsville, SC 29512
(803) 479-3002
Bill Black, plant manager
Doug Kohlmeier, sales manager

120 employees. Produces 105 million sq. ft. annually.

Plywood Plants

Chester Plywood
P. O. Box 110
Chester, SC 29706
(803) 581-7164
Allan Carter, regional manager
Bo Weaver, plant manager

Purchased in Dec. 1987. 300 employees. Produces 262 million sq. ft. of plywood.

Moncure Plywood
P. O. Box 230, Moncure, NC 27559
(919) 542-2311
Jim Mullins, plant manager

Purchased in Dec. 1987. 170 employees. Produces 110 million sq. ft. of plywood.

Sales for building materials:

452 Lakeshore Pkwy, #120
Rock Hill, SC 29730
(803) 328-3838
Bill Burkholder, general sales manager
Le Ann Fenton, sales manager
Tom Rinehart, administrative manager

EFFLUENT TREATMENT PROCESS DESCRIPTION

Primary Treatment

The treatment process begins at a lift station with a bar screen. This lift station is rated at 15 MGD and pumps the process effluent into the primary clarifier. Flow and conductivity are monitored on a continuous basis.

The primary clarifier has a volume of 2.5 million gallons, a diameter of 195 feet, a side wall depth of 9 feet with a rise rate of 500 gpd/sq.ft. and an hydraulic retention time of 4 hours at 15 MGD. Ninety percent or more of the settleable solids and 10% to 20% of the BOD should be removed from the wastewater. Settled sludge, at 3% to 5% solids concentration, is pumped to a screw press and dewatered to approximately 50% solids content. The screw press is expected to handle about 17 dry tons per day of sludge, but is rated at 35 dry tons per day. Should the sludge press fail, sludge flow will be diverted to a one acre sludge lagoon until repairs are made.

Hydraulic overloads, flows over 15 MGD, are diverted from the lift station to a surge basin that is 3 acres by 15 feet with a storage capacity of 14.7 million gallons. A pump is used to meter wastewater in the surge basin back into the system at the primary clarifier or aerated stabilization basin (ASB). The surge basin contents can also overflow by gravity to a polishing pond.

High strength wastewater flows, as measured by the lift station conductivity probe, are diverted to a spill basin. These spills are then metered by grayity into either the lift station or ASB. This spill basin can also be used as an alternate clarifier during primary clarifier maintenance periods. The flow will then go into ASB #1. The capacity of the spill basin is the same as the surge basin, 14.7 million gallons covering 3 acres and 15 feet deep.

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Secondary Treatment

After the wastewater leaves the primary clarifier, it is discharged into ASB #1. This basin is 2000 feet long, 400 feet wide and is filled to a depth of 15 feet. The basin covers 20 acres and is capable of containing 90 million gallons. A second basin, ASB #2, has the same dimensions as ASB #1 and is operated in series with ASB #1. Based on a flow of 15 MGD and 30,200 lb BOD/day, these basins provide 12 days retention time, 6 per basin, at an organic loading rate of 1.3 lb BOD/day/1000 cubic foot. Thirteen mechanical aerators, 9 in ASB #1 and 4 in ASB #2, rated at 75 horsepower each will provide 975 total horsepower for mixing and aerating the wastewater. Based on the flow data above, this provides for an aerated organic loading rate of 31 lb

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BOD/day/horsepower. This ASB system should have an efficiency of approximately 90% BOD removal.

Each ASB is lined with 24 inches of compacted native clay, as are the surge and spill basins, and has concrete pads on the basin floor beneath each aerator. Biological solids production in each ASB will be limited by maintaining the dissolved oxygen (DO) level between zero ppm and one ppm. At this DO level, about 0.4 lbs. of biological solids should be produced for each lb. of BOD removed with an overall production rate of 10,900 lbs. of suspended solids per day.

Treated wastewater exiting ASB #2 will enter the first of two polishing ponds (PPs). Each PP covers 30 acres, can be filled to a depth of 15 feet and is lined with 12 inches of native clay. The combined storage capacity of the polishing ponds is 293 million gallons. Each PP has one 75 horsepower aerator located near the outlet and that aerator is turned on when the DO level falls below 1.0 ppm. A concrete pad is provided to reduce erosion.

During normal operation, only one PP will be in service and this pond will usually be filled to a depth of 4 feet or less. However, should it become necessary to restrict or prevent effluent discharge into the river, the PPs begin to fill simultaneously once the in-service pond reaches four feet. This will provide the capability to maintain mill operations for about twenty days without discharging wastewater into the river.

The PPs should have an efficiency rating of at least 50% based on 27,200 lbs BOD/day being removed in the ASBs, thus producing 10,900 lbs suspended solids/day. Of the 10,900 lbs of solids entering a PP, at least 5450 lbs are expected to be removed.

After treatment in a PP, the effluent is discharged into one of two diffusion headers. One header can discharge up to 15 MGD, while the second header discharges between 15-45 MGD. Discharge rates are based on monitored river flow and are controlled automatically by discharge valves.

The loading rates and retention times given above are based on a rate of 840 tons per day (tpd) of pulp. At a production rate of 940 tpd, the ASB retention time decreases to 11 days, while to organic loading increases to 1.5 lb BOD/day/1000 cubic feet and the aerated loading increases to 35 lb BOD/day/horsepower. Modification of the effluent system should not be necessary to continue efficient operation at this increased rate. However, when the production rate increases to 1250 tpd the retention time falls to 8 days, the organic loading increases to 1.9 lb BOD/day/1000 cubic feet, and the aerated loading increases to 46 lb BOD/day/horsepower At this point, it will be necessary to add additional aerator horsepower to maintain the proper level of efficient operation.

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Domestic Lagoon

Separate collection and treatment systems are provided for domestic wastewater. The treatment plant consists of a two-cell lagoon capable of holding 175,000 gallons of wastewater. A single lagoon is divided into two cells by a curtain with the first cell having a capacity of 100,000 gallons and the second cell 75,000 gallons. The first cell contains a 3 HP aerator, while the second cell has a 1 HP aerator. A ninety percent reduction rate for BOD and TSS should be achieved by the domestic lagoon. This lagoon is lined with 12 inches of native clay.

The treated domestic wastewater leaves the lagoon and is disinfected with chlorine tablets to reduce the fecal coliform count to less than 1000 per 100 ml on a monthly average. After disinfection, the effluent flows into ASB #1.

BOD loading to this system is based on an estimated 0.1 lb BOD/person/day and a design flow of 22,000 gpd. The design flow is based on a plant population of 550 people with each person generating 40 gallons of domestic wastewater. Influent BOD strength will be 300 ppm and TSS content will be about 350 ppm. Design effluent discharge rates are 30 ppm BOD and TSS and 1000 fecal coliform/ 100 ml, monthly average.

Disposal Methods for Captured Solids

Large objects collected on the bar screen will be taken to the Marlboro County Landfill. Skimmed material from the clarifier surface is deposited in a waste hopper. The water drains into the lift station, while the solids go to the Marlboro County Landfill. Dewatered sludge at 50% solids content is burned in the hog fuel boiler. Sludge in the sludge lagoon can be air-dried and removed to the on-site Willamette Landfill.

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Question 62

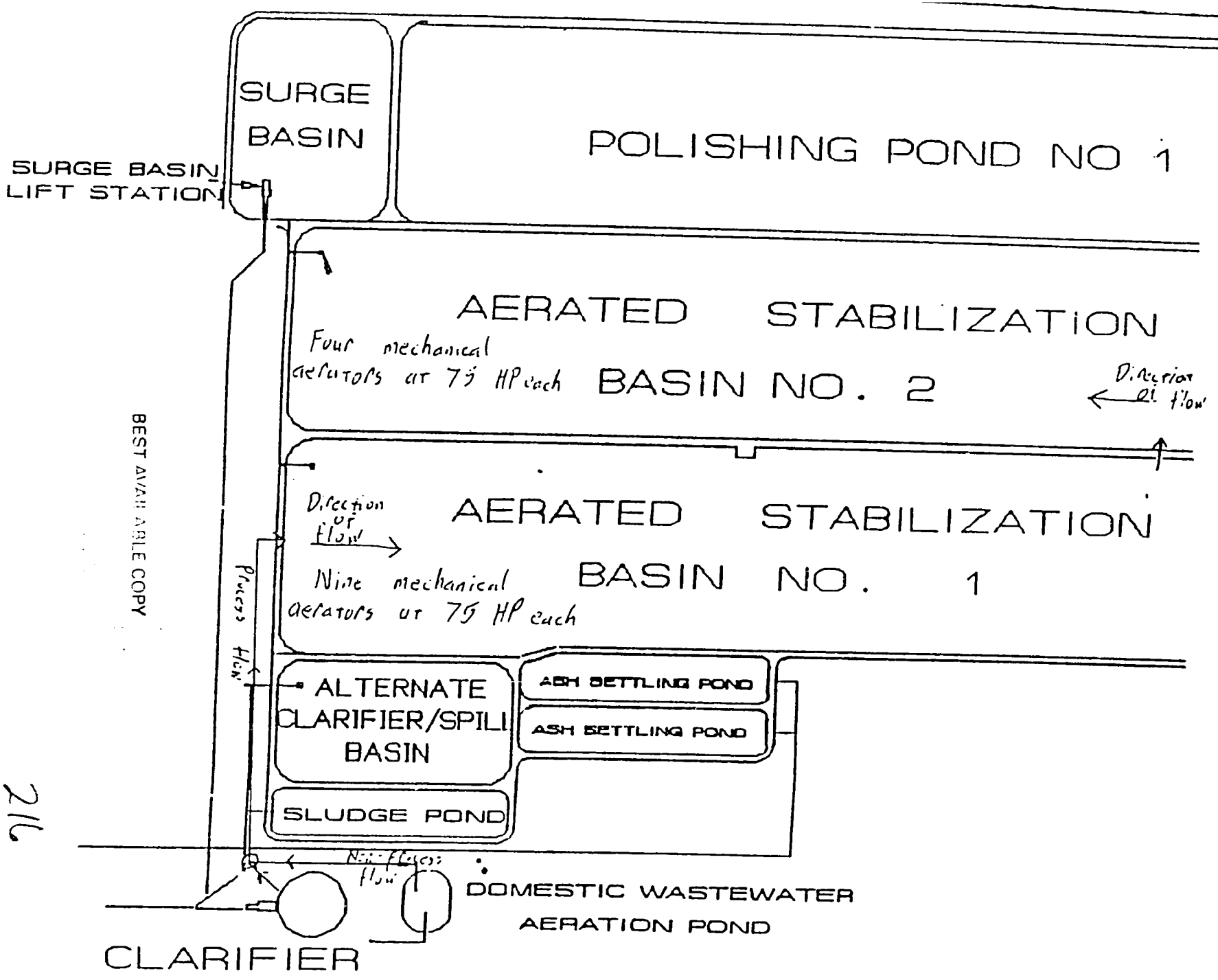

Figure 5. Spill and Surge Basins Layout

Effluent System Level

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Question 62

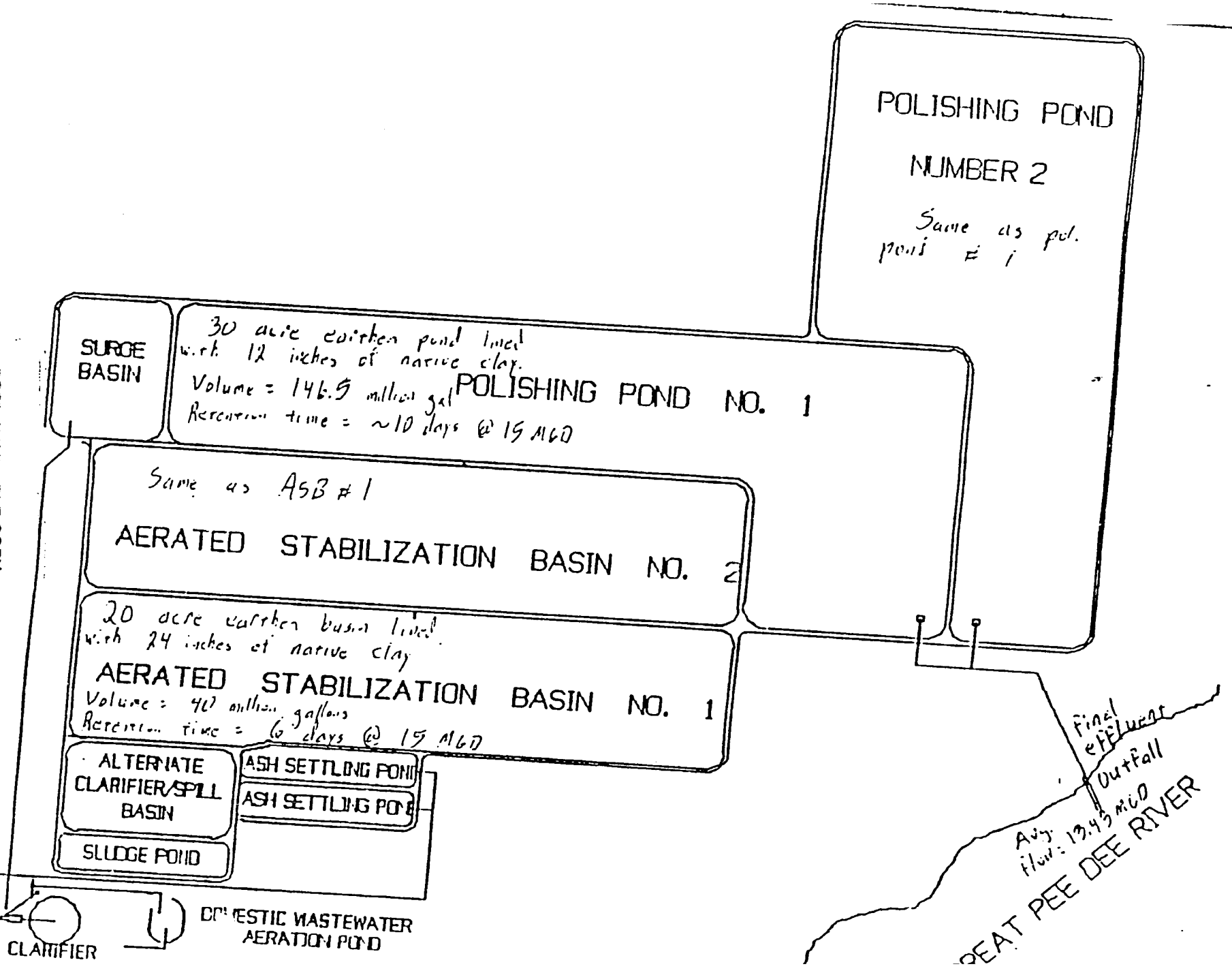

Figure 1. Effluent System General Location

NOTE: Refer to this drawing when you [illegible]

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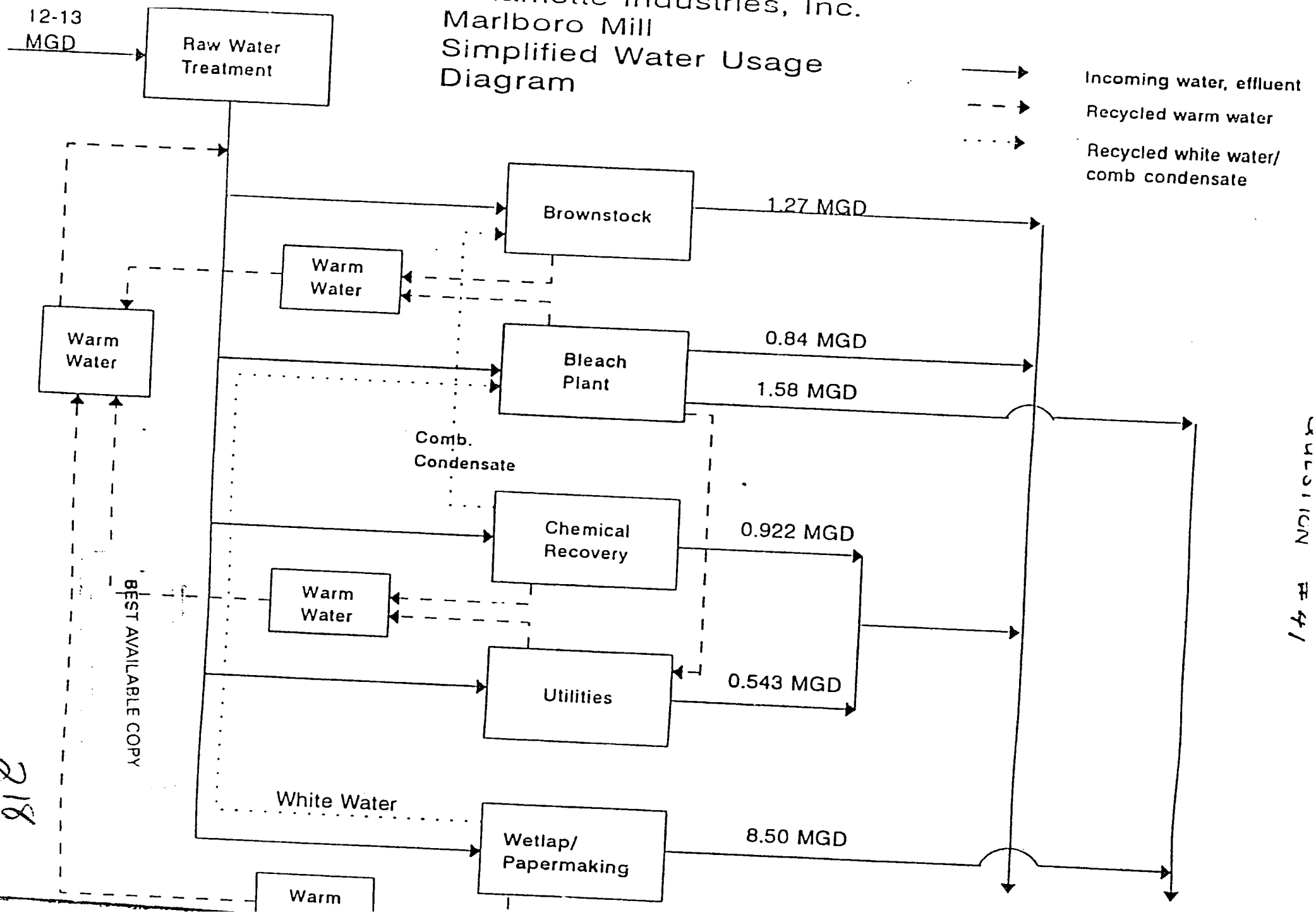
Willamette Industries, Inc.
Marlboro Mill
Simplified Water Usage Diagram



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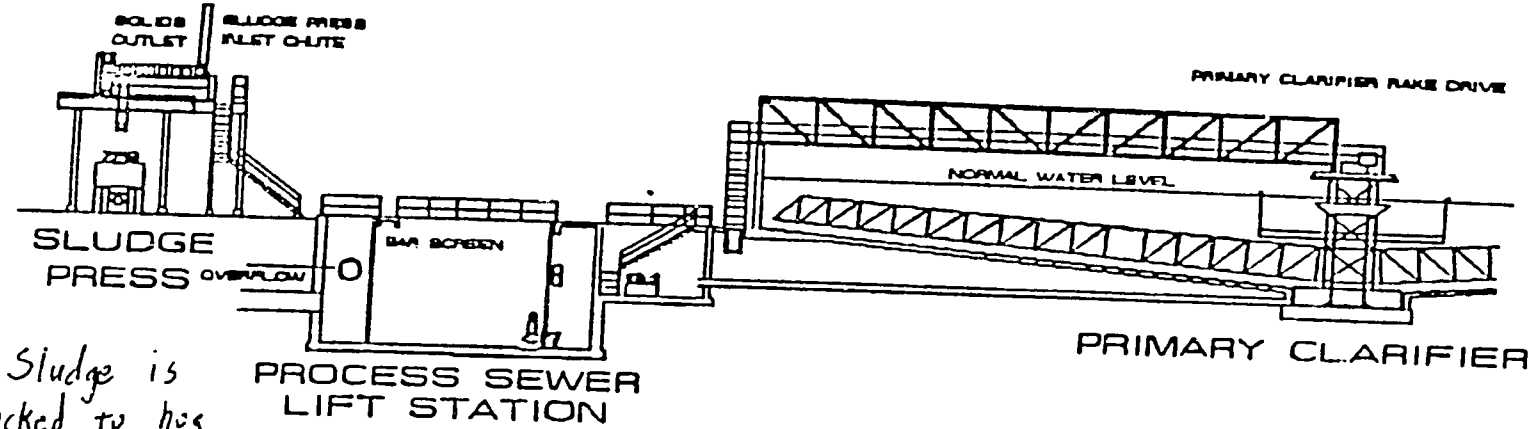
QUESTION #41

Question 62



Sludge is trucked to hog fuel boiler

Figure 4. Lift Station Layout

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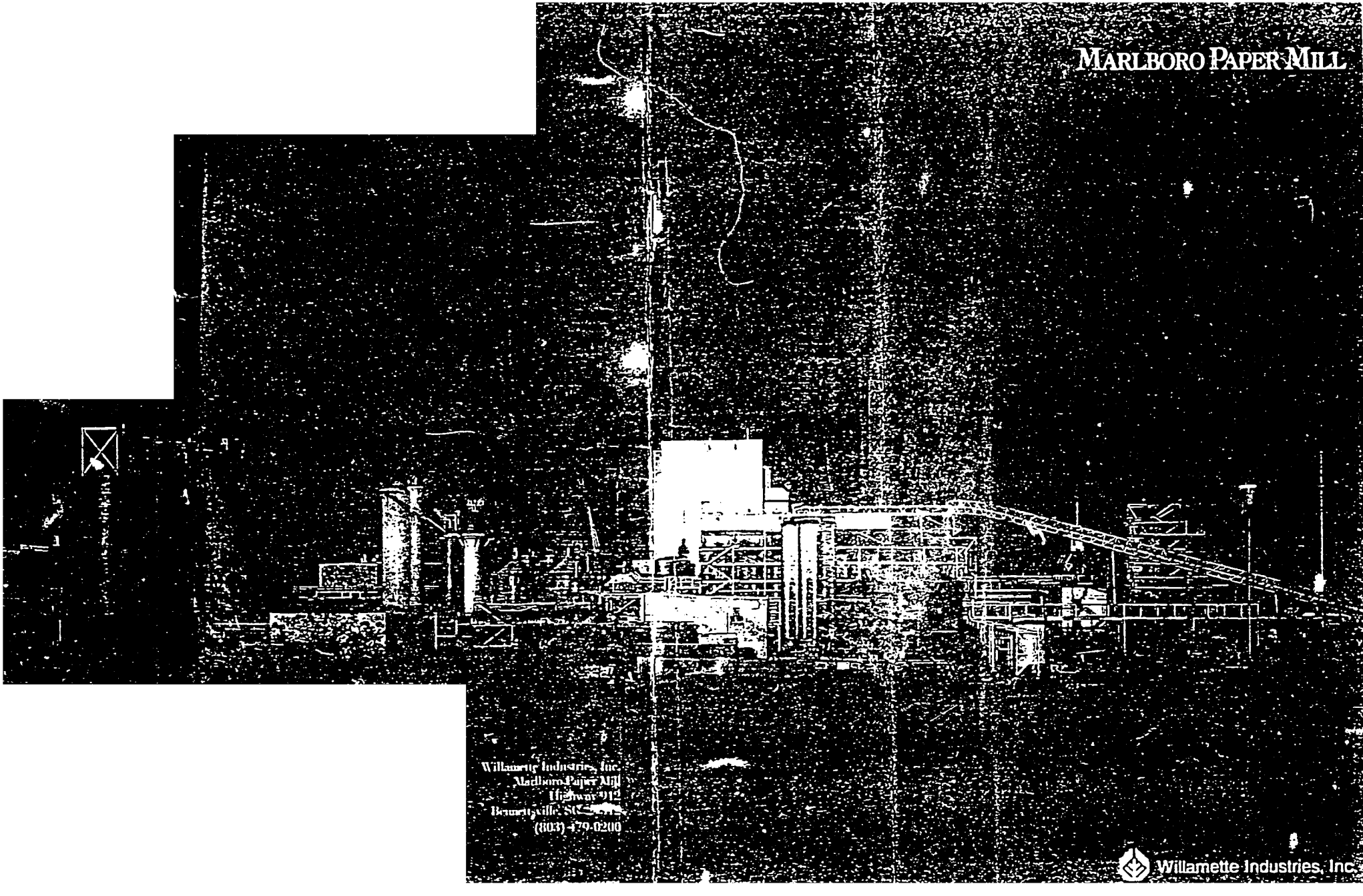
MARLBORO PAPER MILL



Willamette Industries, Inc.
Marlboro Paper Mill
Highway 912
Bennettsville, SC
(803) 479-0200

Willamette Industries, Inc.

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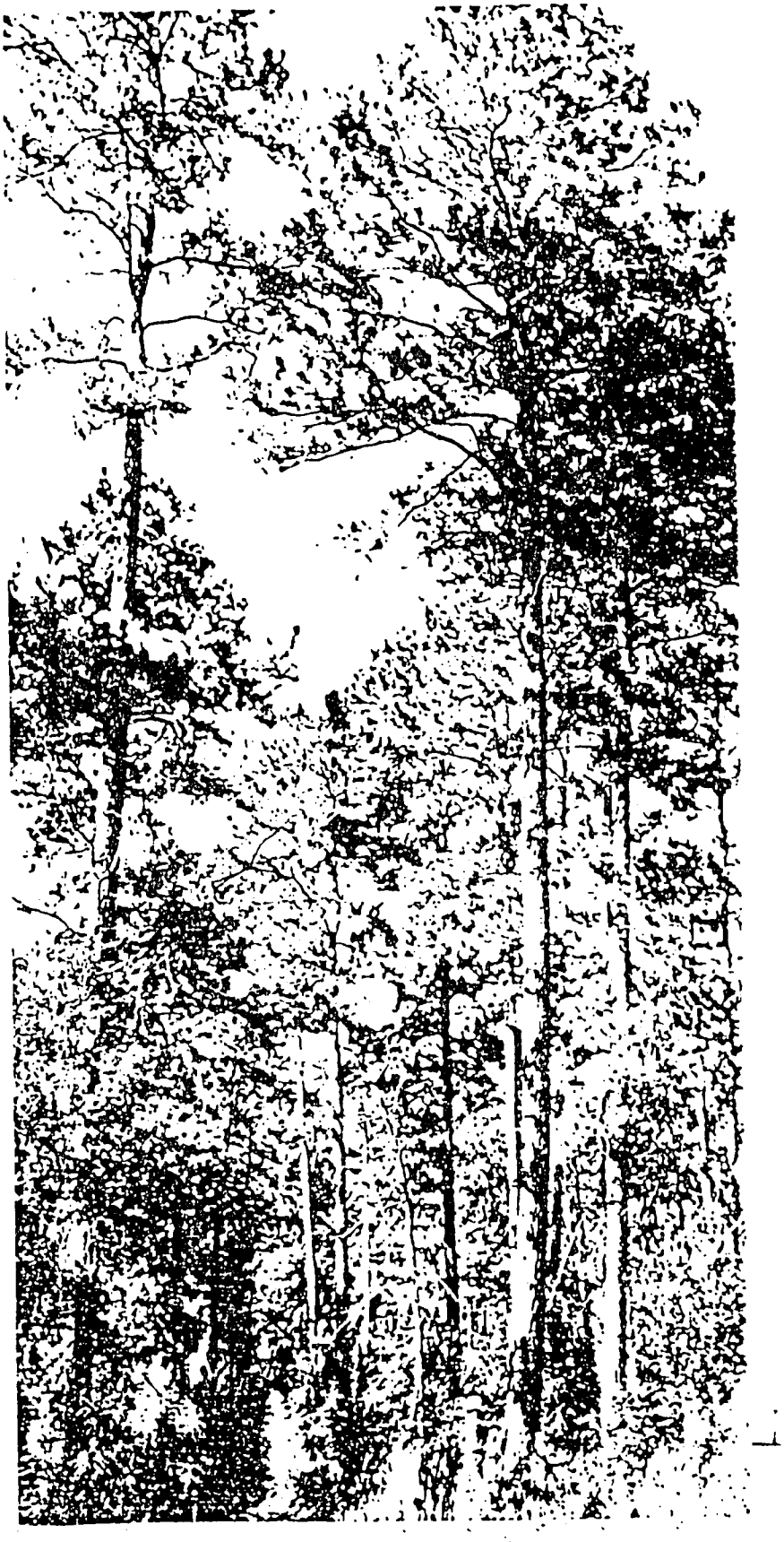
Willamette Industries (Nasdaq: WM-it) was founded in 1906 as the Willamette Valley Lumber Co. in Dallas, Oregon. In 1967, Willamette Valley and several related firms merged to form Willamette Industries, Inc. Its stock became publicly traded in 1968.

Today, Willamette is a diversified, integrated forest products company with 75 manufacturing facilities around the United States. Willamette owns or controls over 1 million acres of timberland nationwide. Of that total, approximately 100,000 acres are in the Carolinas.

Willamette employs over 10,000 people and pays over $430 million each year in wages and benefits.

Willamette produces containerboard, bag paper, fine paper, bleached hardwood market pulp, specialty printing papers, corrugated containers, business forms, cut sheet paper, paper bags, inks, lumber, plywood, particleboard, medium density fiberboard and value-added wood products. These manufacturing facilities are 64% energy self-sufficient.



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THE MARLBORO PAPER MILL:

A New Concept in Making Paper

The Marlboro Mill, located on 1,300 acres just south of Bennettsville, South Carolina along the Great Pee Dee River, operates with the most advanced technology available to the pulp and paper industry. Every process is tightly controlled; every aspect of quality is constantly monitored.

Ground breaking ceremonies, held June 24, 1988. From left, the late South Carolina Senator Jack Lindsey, Governor Carroll Campbell; Willamette's C.E.O. Bill Swindells, Hubert Meggs, Marlboro County Development Council.

Rigid environmental controls were planned for the mill before one ounce of dirt was moved for construction.

The mill is unique in many other ways too. This booklet will help you better understand the inner-workings of the Marlboro Mill.

A Greenfield Project

The Marlboro Mill was a greenfield project, meaning it was built from the ground up. Marlboro was designed entirely on computer, a first for Willamette, by our own engineers. Construction was completed in just 34 months.

Our People Make the Difference

Since day one of the Marlboro project, Willamette has been dedicated to staffing the mill with people from the local area. Because there weren't many other paper mills around, applicants had little to no experience in papermaking. So Willamette looked for and found highly motivated people with exceptional learning ability and mechanical aptitude. These people underwent a battery of tests, structured board interviews and intensive training at our on-site training center, all prior to being hired.

These dedicated and enthusiastic employees are what makes the mill successful, giving Marlboro a competitive edge.

As employees, their training will continue throughout their careers, enabling them to grow along with the mill.

The resulting work force is comprised of people with the initiative, dedication and knowledge necessary to keep the mill running smoothly and efficiently.

The mill uses a participative management approach wherein everyone is a member of a team. This is an all-salaried work force concept designed to employ the mind, not just the body.

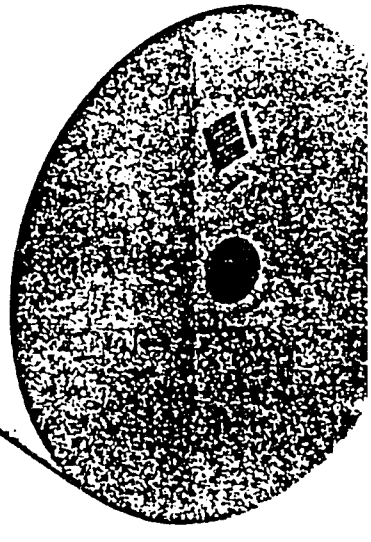
Each employee is a technician an the more tasks a person becomes qualified to perform, the more th person is paid. The technicians a directly involved in the day-to-da decision-making on issues affecti their team. A unique open-door policy allows any technician to speak freely to any manager.

Safety is also an important pa of the system. Employees are encouraged to suggest ways to improve the mill's safety. Willamette provides all the necessary safety training and equipment for every job in the mi

Everyone is dedicated to providing a drug-free work environment at Marlboro. The employees' motto, "Proud to Be Drug Free," is a constant reminde of this dedication.

Keeping It Running

Paper mills employ a cross section of engineering skills including chemical, electrical, environmenta automation and mechanical to kee the mill running at peak performance. Willamette takes th one step further by practicing



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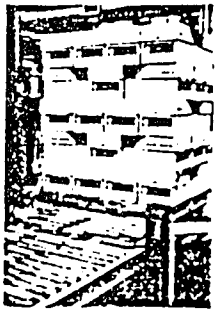
predictive maintenance. This means using the latest technology to constantly analyze vibrations, temperatures and lubrication to keep problems from developing.

The mill doesn't have a central maintenance department like most operations. Instead, each technician receives maintenance training for his work area. This way, if there is a problem, the technician has the basic knowledge needed to correct the problem, saving time and money.

THE PAPER

All of these unique qualities, from the computer-aided design to the philosophies for employment and engineering, add up to one thing: superior paper.

The quality of Marlboro's paper is unrivaled. Every reel of paper goes through quality control tests for grade, brightness, opaqueness and strength. An extra press adds superior uniformity to both sides of the sheet. The paper is at archival quality, meaning it will not fade or turn yellow with time.



The Tatum S.C. plant uses Marlboro paper to make copy paper.

Randolph Griggs performs one of the quality tests run on every roll of finished paper.

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THE PAPERMAKING PROCESS

The papermaking process starts with trees, or more specifically, the fiber in the tree's wood. Fiber comes to the mill in the form of chips from harvest operations and milling leftovers from Willamette's plywood plant in Chester, S.C. and other wood products firms.

Marlboro also uses whole trees from pulpwood thinnings from Willamette's nearby timberlands or from those of other landowners. These trees are chipped at the mill site and the removed bark goes to the waste wood boiler where it is burned to create steam used in papermaking.

The chips are separated by two tree classifications: hardwood and softwood. The softwood fibers give the paper its strength while the hardwood fibers enhance smoothness and appearance.

The chips go on different conveyors to chip piles where they are stored before heading to the digesters.

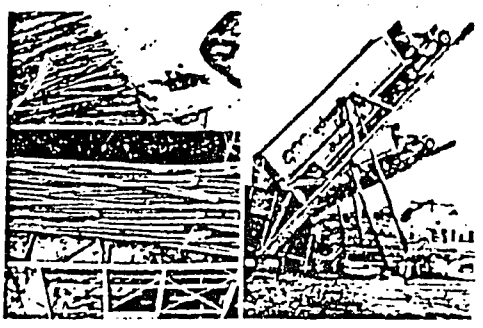
THE FIBERLINE: WHERE THE PROCESS BEGINS

Marlboro has six digesters, each of which works like a large pressure cooker. A pre-measured amount of hardwood or softwood chips go into the digester, the white cooking liquor is added and the digester is closed. The chips cook for about 1½ hours.

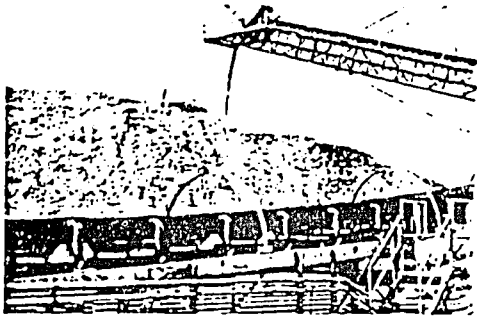
The purpose of this stage is to separate the lignin, or nature's glue, from the wood fibers. Marlboro uses an extended cooking process to remove more lignin prior to the bleaching stage. This is important because less lignin means there is less to bleach. The removed lignin goes to the recovery cycle.

Marlboro is the only commercial kraft pulp mill in the world that pumps the pulp mixture out of the digester instead of blowing it out with steam or air. This helps keep fiber strength high (as much as 15% higher than other mills' fiber) while it also saves energy.

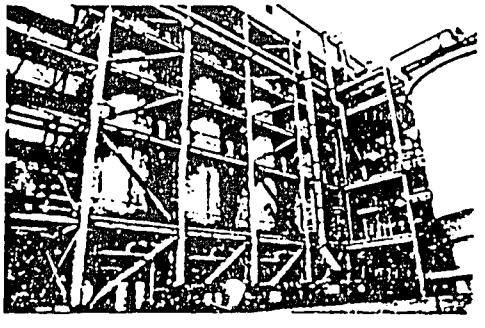
Once the pulp exits the digester, the entire mixture is washed and goes to the oxygen delignification process.



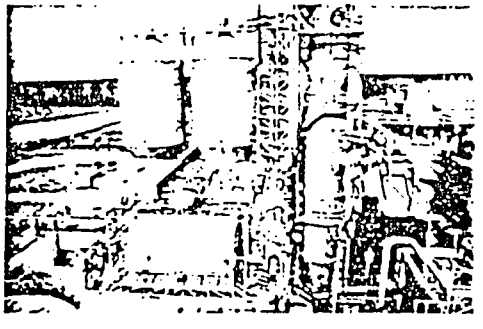
Marlboro receives about 370 loads of pulpwood and 461 truck loads of chips weekly.



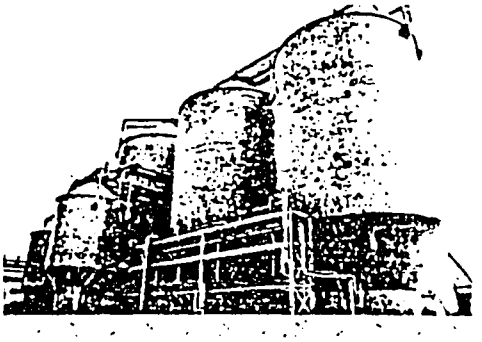
Hardwood and softwood chips are conveyed to separate chip piles for storage.



Each of the six digesters can hold 88 tons of chips.



The oxygen delignification tower (front right) stands directly in front of the bleaching plant and to the right of the washers (front left).



The high density storage tanks each have an 800 ton capacity.

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Oxygen delignification is a highly-efficient process which uses oxygen to further break down and remove lignin remaining after the cooking stage. Oxygen is very gentle on the fibers while it attacks the lignin.

At this point, the pulp contains mostly fiber and very little lignin, allowing Marlboro to use a more environmentally friendly three-stage bleaching process instead of the typical five-stage process.

Bleaching insures the pulp will have a high white brightness once it is made into paper. Marlboro uses chlorine and chlorine dioxide as the bleaching agents.[1] After a final washing stage, the pulp goes to the high-density storage tanks.

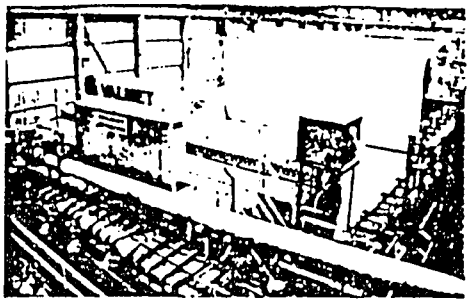
Water is added to the pulp from the high-density tanks bringing the consistency to 99.5% water and .5% fiber. This mixture is delivered to the paper machine and spread evenly onto a fabric mat that will carry the mixture as it is dewatered by gravity and suction. Another fabric is placed on top of the sheet for further water removal and to make the paper more symmetrical.

The paper, now able to move without the aid of the fabric, goes through a series of presses to remove more water. Marlboro then runs the paper through one extra press, giving the paper superior uniformity.

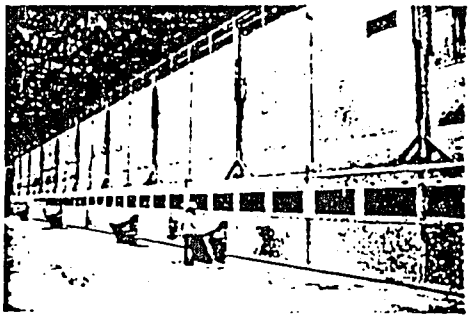
Next, the paper passes through a series of 47 dryers heated with steam. Starch is applied to give the paper better printability. After passing through an additional 18 dryers, the sheet goes through a set of vertical calender stacks for further smoothness and to control thickness.

The final stage is the reel. The finished paper is wound onto the reel at the end of the paper machine before heading to the winder where the roll is cut into sizes specified by the customer, stretch-wrapped to protect it from moisture and shipped by rail or truck.

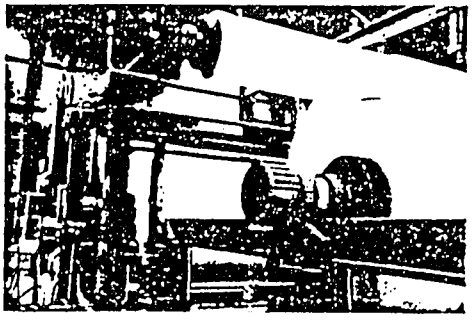
The paper is shipped to many East Coast customers, as well as Willamette's operations including the Tatum, S.C. Willcopy plant and business forms plants in Rock Hill, S.C.; Langhorne, Pa.; Chicago, Ill.; Dallas, Tex.; and Indianapolis, Ind.



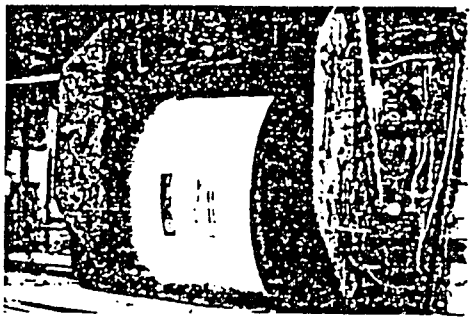
The headbox (lower left) delivers the 99.5% water and .5% pulp mixture onto the fabric.



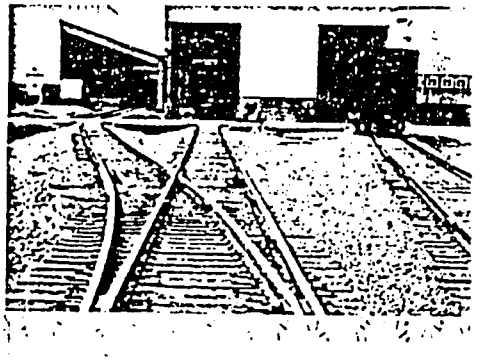
The paper passes through 47 dryers on the way to the starch machine.



The reel (right) contains the paper fresh off the paper machine. This paper goes to the winder (left) to be cut into finished rolls.



Every roll is stretch-wrapped for moisture protection.



On average, 80% of the mill's finished paper is shipped by rail, 20% by truck.

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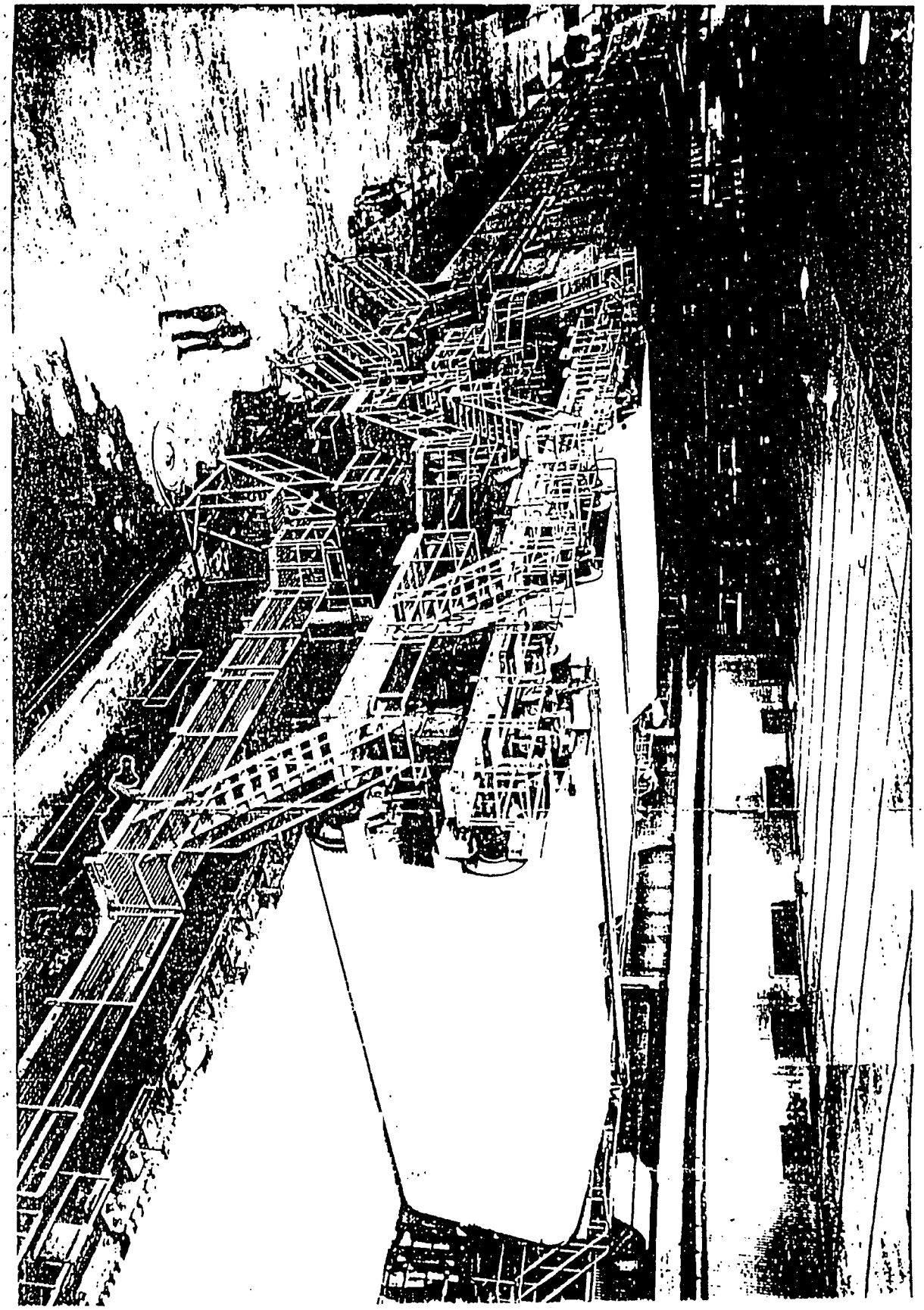

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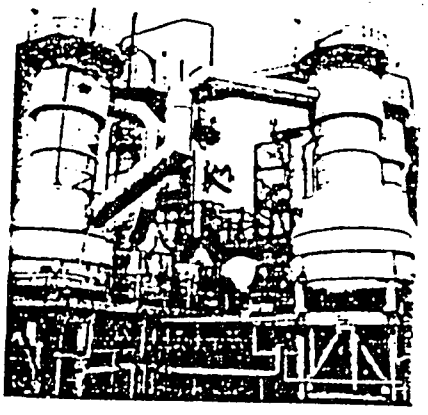
PUTTING ENERGY INTO THE EQUATION



The evaporators remove water from the black liquor, the remainder is burned in the recovery boiler to create steam.

THE RECOVERY BOILER

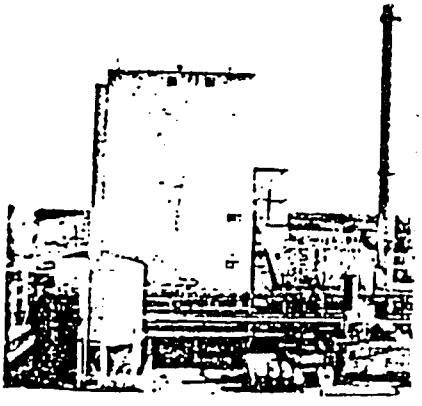
Making paper requires a lot of steam for cooking pulp and drying paper. Marlboro has three steam sources that provide 100% of the mill's needs.

The largest source is the low-odor recovery boiler.

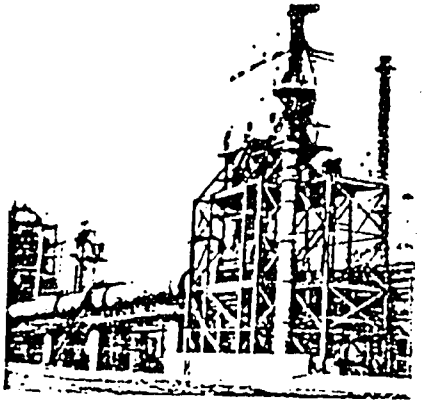
The fiberline, as previously mentioned, uses cooking liquors to separate the wood fibers from the lignin. The fibers go to the paper while the lignin and spent cooking liquor, called black liquor, go into the recovery cycle. The black liquor goes through a set of evaporator to remove the water, leaving a thick mass of organic material. This material is burned in the recovery boiler to generate steam while the remaining inorganics (green liquor) go to another recycling stream.

This stream takes the green liquor, adds lime and produces new white cooking liquor. The white liquor is used to cook the chips in the digesters. Lime mud, a resulting by-product, is sent to the lime kiln to produce more fresh lime. This completes the recovery cycle for the black, green and white liquors.

A separate recovery cycle traps the carbon dioxide released from the lime kiln. A small on-site company, GK Carbonate, bubbles the carbon dioxide through lime and makes calcium carbonate. This calcium carbonate is put into the paper, giving the paper its archival quality.



The low-odor recovery boiler also helps recycle pulping liquors.



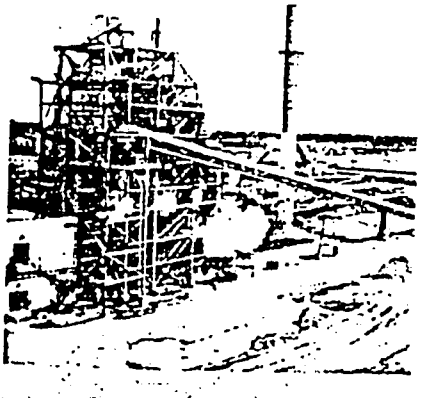
The lime kiln produces new lime that is mixed with green liquor to make fresh white cooking liquor.

THE WASTE WOOD BOILER

The waste wood boiler, or hogged fuel boiler, is so-named because it can consume almost anything. To produce steam, tree bark and solids filtered out from the waste water are burned. The boiler also burns sander dust from Willamette's nearby medium density fiberboard plant.

THE PACKAGE BOILER

The third steam source, a package boiler, is designed as a cold weather back-up to the recovery boiler and waste wood boiler. This boiler uses natural gas as fuel.



The waste wood boiler burns bark, sander dust and bark filtered from the waste water to produce steam.

WATER: A VITAL RESOURCE IN MAKING PAPER

Water is one of the basic raw materials in papermaking. It helps cook the chips, carries the fiber to the paper machine, washes the pulp and even helps in bleaching.

Because of its wide array of uses, the river water must be clean. Filters help remove any sediment and minerals that can damage the mill's machinery.

After the water is reused several times in the mill, it heads to the effluent system where it is cleaned, aerated and returned to the river. In addition to continuous monitoring, numerous water samples are tested each day by a lab technician to ensure the returning water is clean.

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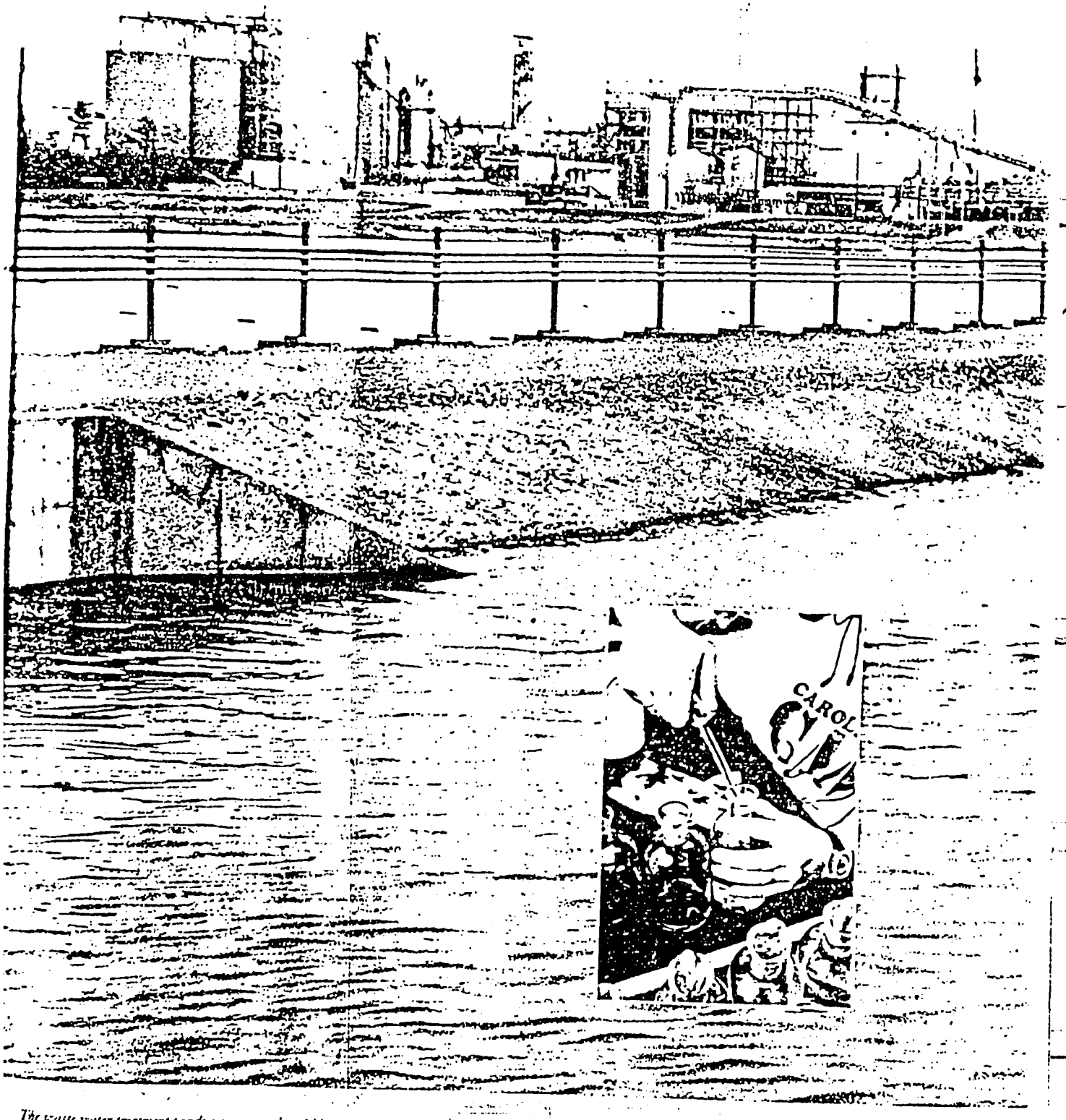

The waste water treatment ponds cover more than 100 acres behind the mill.

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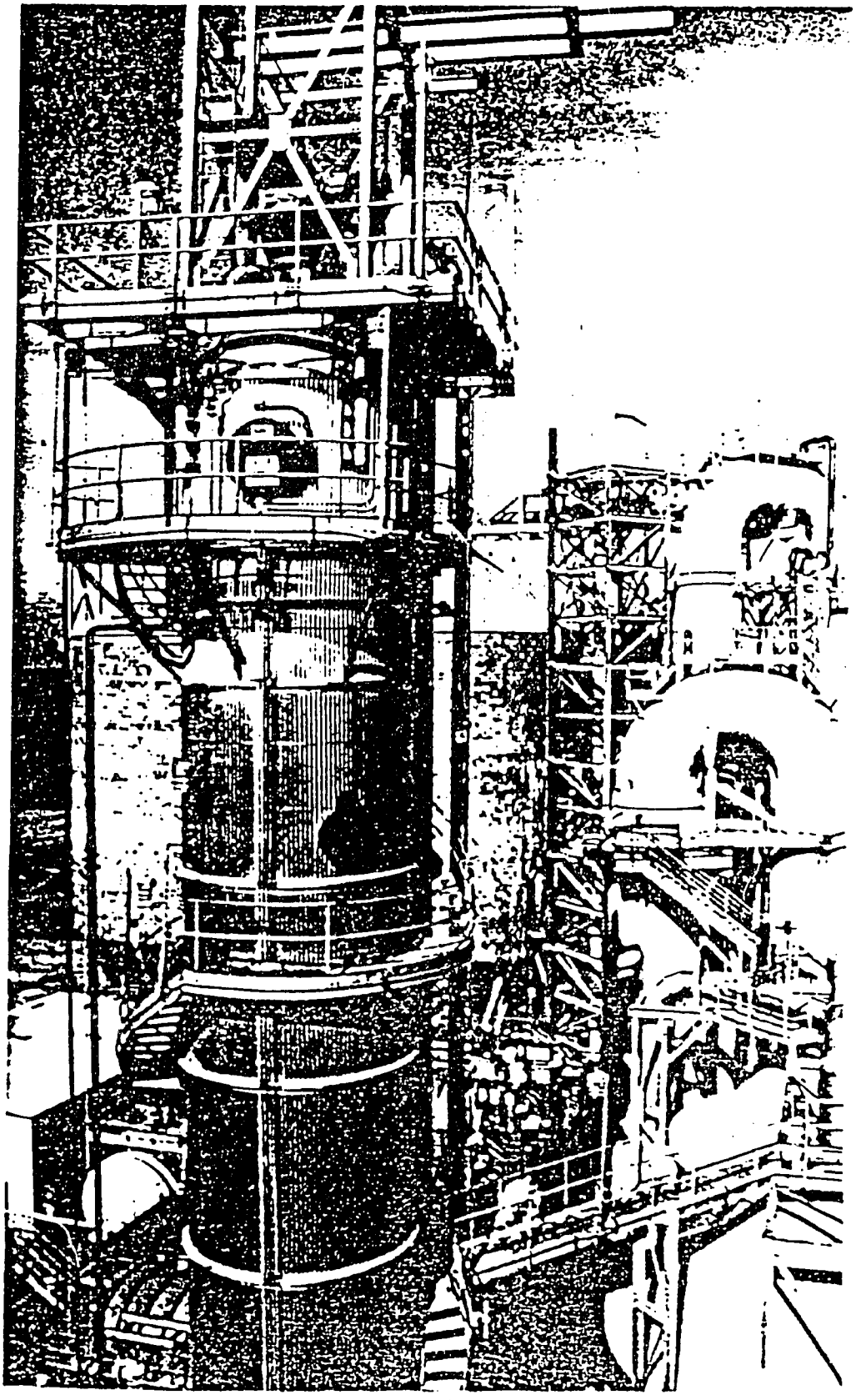

Environmentally sensitive processes, like oxygen delignification (tower, in foreground), were planned for Marlboro before Willamette bought our acre of land.

PROTECTING THE ENVIRONMEN

Willamette Industries has a so reputation as a leader in environmental protection. Willamette built this reputatio by utilizing the most stringent environmental controls availal at every manufacturing operat

Marlboro's environmental commitment can be seen in virtually every facet of the mill operation. Removed bark, spe pulping liquors, sander dust a rejected chips are burned to create steam instead of going into a waste stream.

The removal of lignin is don in an environmentally sensitive manner. Pure oxygen is one agent used to remove lignin. Marlboro also uses an extende cooking process so the majority of lignin is removed very early the papermaking process.

Taking more lignin out of th pulp mixture means there is les to bleach and fewer bleaching stages are needed. Because the lignin goes into the recovery cycle, there is more to burn in t recovery boiler to make steam.

A special incinerator burns and eliminates the odorous gas and water vapor is the only component going up the stack.

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ONE COMPUTER RUNS IT ALL

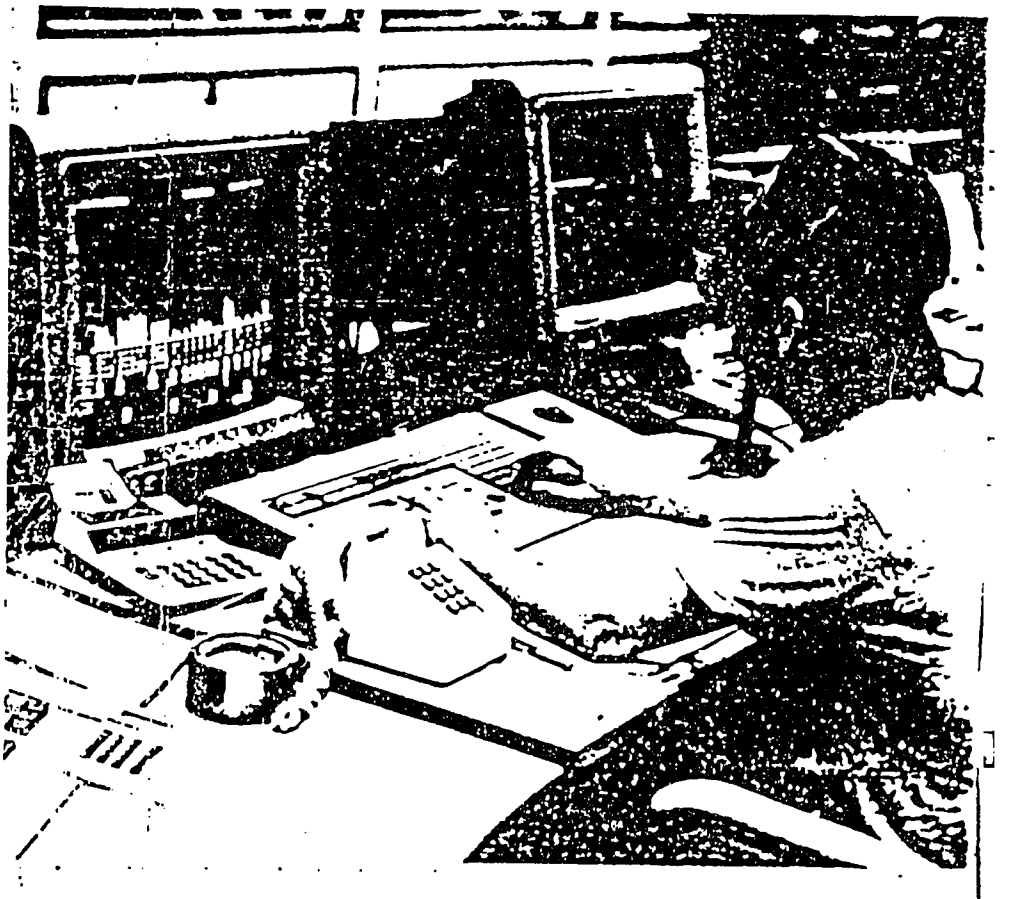
All the machinery needed to make paper from transmitters, sensors, automatic valves and motor starters is wired into a Distributed Control System (DCS) computer. The DCS system runs and monitors the entire mill. The computer is also watchdog. If the DCS sees something go out of its normal range, like an overheating motor, the system alerts the operator and a correction is made before any downtime occurs.

The DCS's three control rooms, located in the fiber line area, recovery/utilities and by the paper machine, are all connected by a data highway. This enables a technician to control a process on one screen and with the touch of a button, to see any other process in the mill.

The computer screens display realistic graphics showing tanks, pipes, motors and valves. If the operator wants to increase the water flow to a tank, the valve on the screen actually appears to open and the water level in the tank appears to rise.

This ability to watch the process as it happens helped the green start-up crews get the mill running in record time.

One other advantage to the DCS is Superview. Superview, a program located off of the mainframe DCS computer, uses current mill data to calculate how any changes will affect the actual operation of the mill.



Gene Lauritsen monitors the paper machine on one of the mill's Distributed Control System computer stations.

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SUPPORTING THE COMMUNITY

Willamette Industries has a long tradition of investing in our plant communities. Marlboro County is no exception.

Since beginning construction in June of 1988, Willamette has donated over $100,000 to projects like the Marlboro Civic Center, a writing-to-read program for Bennettsville primary schools and the purchase of a new rescue squad vehicle.

Many of the Marlboro employees live in Marlboro County. These employees participate in the Arts and serve on various committees, boards and civic organizations.

All of this participation adds up to a better community for our employees and a better business climate for the company.

Willamette believes in investing in our plant communities.

BUILDING FOR THE FUTURE

The very first computer drawing of the mill was done with the vision of creating a mill that could be expanded with the least possible capital investment.

We have adequate water, a good fiber supply, excellent transportation links, a good labor pool and a state government that works with business.

Willamette has spent over $500 million on projects in the Carolinas, including a medium density fiberboard plant, a cut-sheet copy paper plant, a business forms plant, two plywood plants, a chip mill, a paper development lab and the purchase of over 100,000 acres of timberland.

As a part of this entire package, the Marlboro Mill has an excellent, expandable future.

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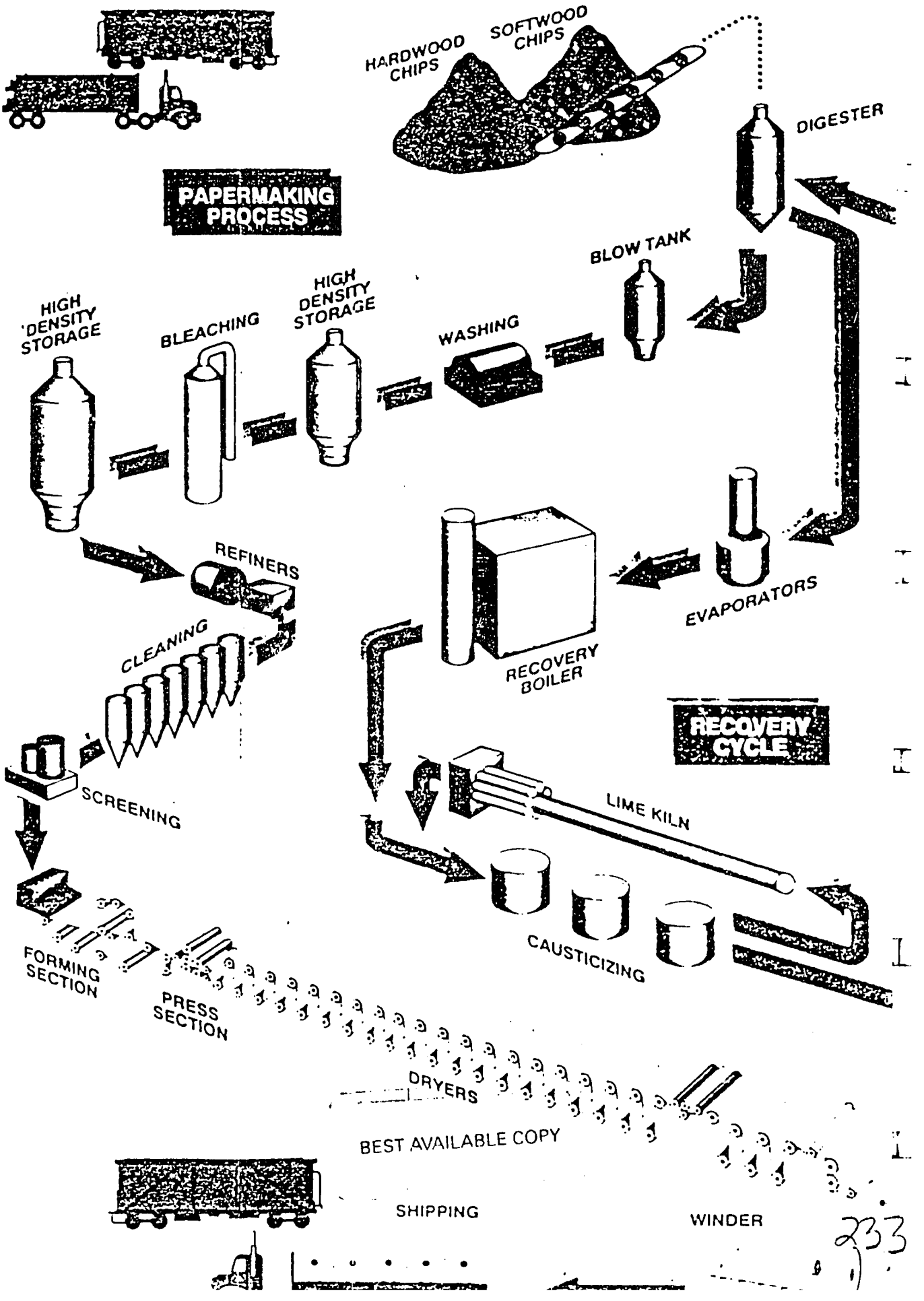

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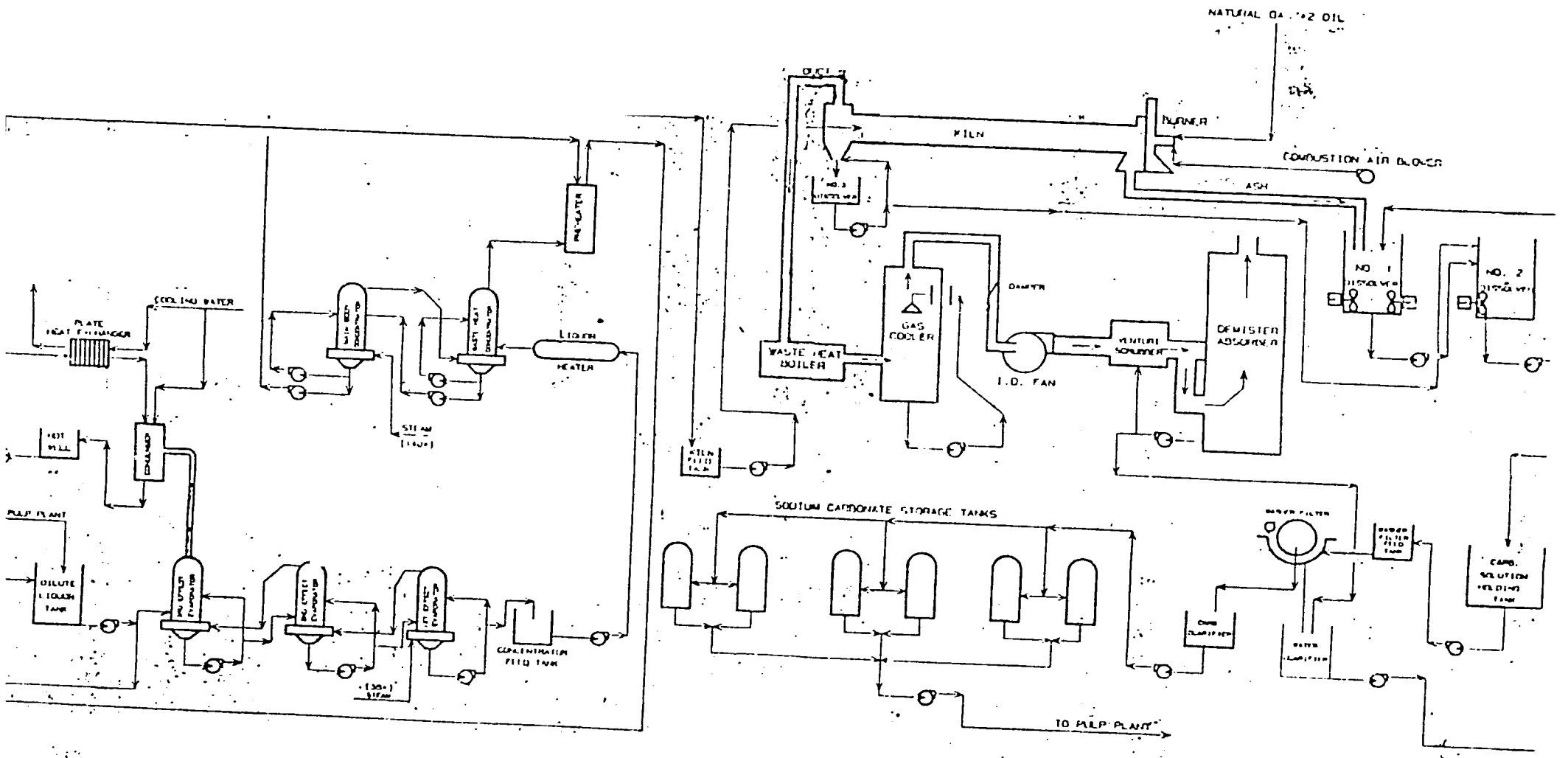
APPENDIX 4

CORRUGATING DIVISION

CHEMICAL RECOVERY PLANT



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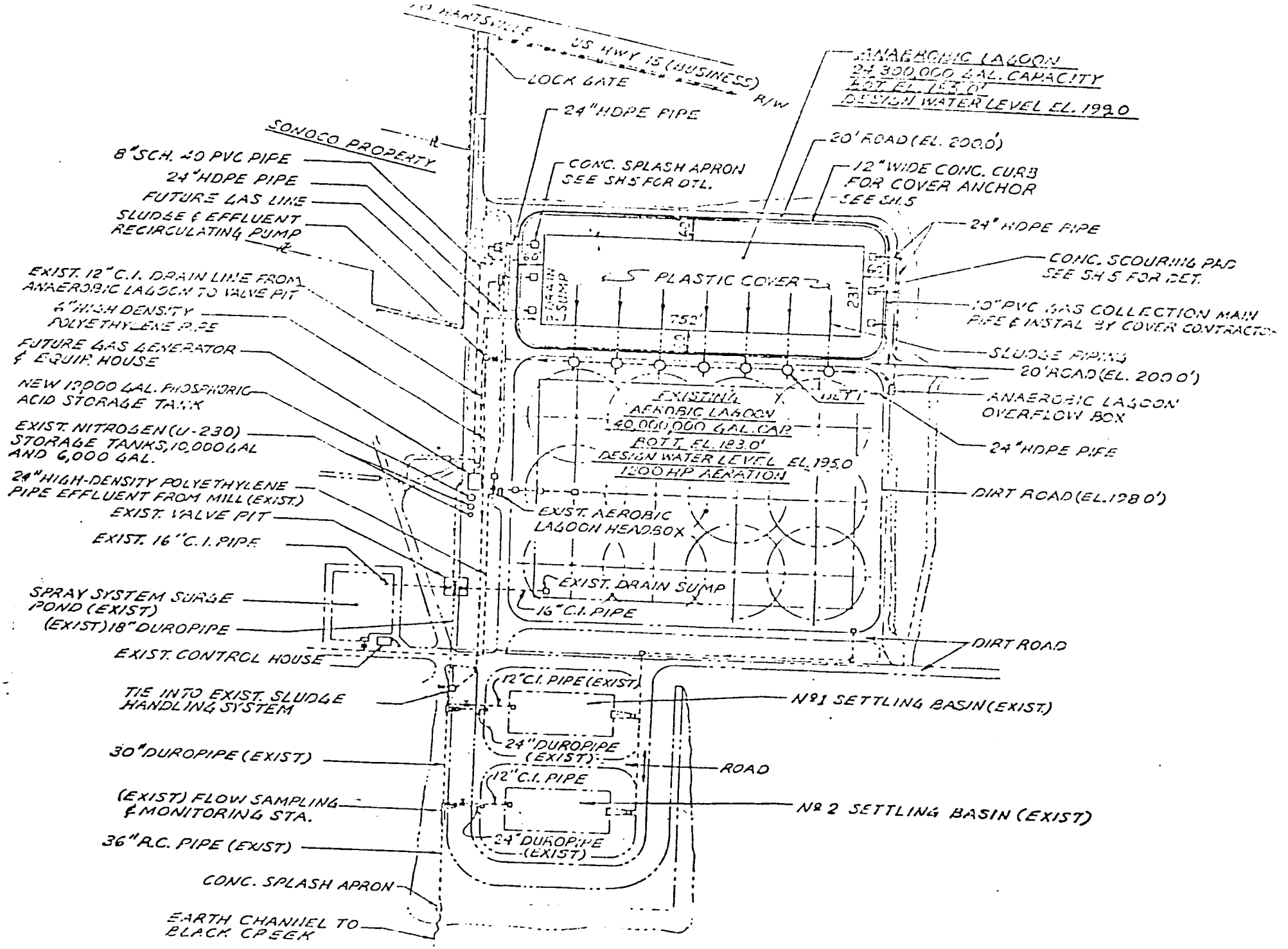

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APPENDIX 5

EASTOVER

EASTOVER MILL STATISTICS

UNION CAMP CORPORATION
FINE PAPER DIVISION
EASTOVER, SOUTH CAROLINA

Business Purpose: Manufacture fine white paper for use in the communications industry, (i.e., copier paper, envelopes, business forms, offset printing, reading materials and writing supplies) and bleached market pulp.

Design Rate: 1800+ Tons Per Day Total Production
1500 Tons Per Day Fine Paper
300 Tons Per Day Bleached Pulp

Location: 30 Miles East of Columbia, South Carolina

Employees: Union Camp Personnel 860

On-Site Service Contractors 153

Total Investment: $1.25 Billion
Phase I $500 Million
Phase II $750 Million

Estimated Yearly Spending*

Annual Payroll	40 Million
Local Wood Purchases	65 Million
Products and Services	35 Million
Payments to Freight Carriers	33 Million
Annual Property Taxes (Phase I)	12 Million

*Amounts spent in South Carolina

— — — —

Post Office Box B, Eastover, South Carolina 29044, Phone: (803) 353-7653

BVM/lgm EOFACT.593

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Union EASTOVER

EASTOVER MILL FACT SHEET

UNION CAMP CORPORATION
FINE PAPER DIVISION
EASTOVER, SOUTH CAROLINA

EO I PAPER MACHINE

- Medium Weight Fine Paper (46-55 Basis Weight)
- Design Rate: 600 TPD
- Phase II Rebuild Design Rate: 800 TPD
- Equipment:

  Voith Duofomer Twin Wire Paper Machine

  372 Inches Wide

  3000 FPM Maximum Speed
- Start-Up: 8/84

EO II PAPER MACHINE

- Light Weight Fine Paper (35-46 Basis Weight)
- Design Rate: 660 TPD
- Equipment:

  Beloit Bel Baie III Paper Machine

  372 Inches Wide

  4400 FPM Maximum Speed
- Start-Up: 7/91

PULP MACHINE

- Bleached Kraft Pulp

  Softwood Pulp - EASTOCELL
  Hardwood Pulp
- Design Rate: 500 TPD
- Equipment:

  Valmet-Ahlstrom Wet End

  192 Inches Wide

  215 FPM Maximum Speed

  Flakt Compact Dryer

  Lamb Cutter Layboy and Bale Line
- Start-Up: 4/91

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SVH (7/1/91)

"OUR ENVIRONMENT...A SHARED COMMITMENT"

INDONESIA PULP AND PAPER INDUSTRY GROUP VISIT

OCTOBER 29, 1993
ROOM 137

AGENDA

9:00 A.M.	WELCOME / INTRODUCTIONS
9:15 A.M.	GROUP'S OBJECTIVES / AGENDA
9:30 A.M.	EASTOVER MILL OVERVIEW
10:00 A.M.	EFFLUENT TREATMENT
10:30 A.M.	AIR POLLUTION CONTROL
11:00 A.M.	ODOR CONTROL
11:30 A.M.	SOLID / HAZARDOUS WASTE
12:00 NOON	LUNCH
1:00 P.M.	UNION CAMP BLEACHING TECHNOLOGY
2:00 P.M.	MILL TOUR
4:30 P.M.	EXIT

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POTENTIAL WATER & EFFLUENT BENEFITS

Using OZED Bleaching

Estimated Values for a Typical Plant

	CEDED	O(CD)ED	OZED
Bleach plant Water Use	47.5	15.8 *	13.7 *
Bleach Plant Effluent	55.4	14.2	7.5

M^3/A.D.Metric Ton

Some water is recycle therefore savings may vary

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THE ROAD TO SUCCESS

- Well Prepared Applications
- Productive Dialogue with DHEC
- Valuable Public Input
- Commitment to Permit Limits
- Honor Those Commitments
- Open & Ongoing Communications with Neighbors
- Proven Environmental Record

DEVELOP AND MAINTAIN A

HIGH ENVIRONMENTAL ETHIC

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UNION CAMP CORPORATION ENVIRONMENTAL, HEALTH, SAFETY AND FORESTRY PRINCIPLES

- TO MAKE ENVIRONMENTAL, HEALTH, AND SAFETY CONSIDERATIONS PRIORITIES IN OPERATING EXISTING FACILITIES, AS WELL AS IN PLANNING NEW OPERATIONS.

- TO RECOGNIZE ENVIRONMENTAL, HEALTH, AND SAFETY EFFECTS OF PRODUCT MANUFACTURE, DISTRIBUTION, USE, AND DISPOSAL.

- TO MONITOR ENVIRONMENTAL, HEALTH, AND SAFETY PERFORMANCE AND TO REPORT REGULARLY ON THESE MATTERS TO THE BOARD OF DIRECTORS.

- TO TRAIN EMPLOYEES AND TO PROMOTE AWARENESS AND ACCOUNTABILITY ON THESE MATTERS.

- TO IMPROVE PERFORMANCE THROUGH SUPPORT OF RESEARCH AND DEVELOPMENT.

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ENVIRONMENTAL, HEALTH, SAFETY, AND FORESTRY (CONT)

- TO COMMUNICATE WITH EMPLOYEES, CUSTOMERS, SUPPLIERS, THE COMMUNITY, PUBLIC OFFICIALS, AND SHAREHOLDERS.

- TO PARTICIPATE CONSTRUCTIVELY IN THE DEVELOPMENT OF PUBLIC POLICIES.

- TO CONTINUE TO PURSUE ENERGY CONSERVATION.

- TO PRACTICE A LAND STEWARDSHIP ETHIC THAT RECOGNIZES THE IMPORTANCE OF SOIL CONSERVATION, AIR AND WATER QUALITY, WILDLIFE AND FISH HABITAT, AND AESTHETICS.

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OUTLINE
C-Free™ TALK FOR INDONESIAN VISITORS
to EASTOVER MILL OCTOBER 29th

I. UNION CAMP BLEACHING DEVELOPMENT
- MOTIVATING FACTORS AND TECHNOLOGY ADVANCEMENT
- BLEACH PLANT CLOSURE
- BLEACHING SEQUENCE DEVELOPED
- BLEACH PLANT CONTRIBUTION TO EFFLUENT

II. FULL SCALE COMMERCIAL OPERATION
- FRANKLIN START-UP EXPERIENCE
- FIBER QUALITY PERFORMANCE
- OPERATING EFFECTIVENESS

III. ENVIRONMENTAL ANALYSIS
- POTENTIAL EFFLUENT LOAD REDUCTIONS
- ACTUAL MILL PERFORMANCE AT FRANKLIN
- PROJECTED PERFORMANCE ON OTHER SPECIES
- ENVIRONMENTAL IMPACT OF C-Free™

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C-Free™ PULP DEVELOPMENT

UNION CAMP - ENVIRONMENTAL AWARENESS

FRANKLIN MILL - SMALL LOW-FLOW RIVER

EASTOVER MILL - GREENFIELD MILL STANDARDS

DEMONSTRATED DEVELOPMENT EFFORTS

MANY YEARS OF INTENSE BLEACHING RESEARCH

AMONG FIRST COUNTER CURRENT BLEACHING IN USA

ONE OF FIRST USING O2 BLEACHING WITH RECYCLE

HIGH CONSISTENCY O2BLEACHING FOR MAXIMUM CLOSURE

$6.5MM+ PILOT PLANT INVESTMENT AND
CONTINUING COMMITMENT ($1.5MM EXPANSION)

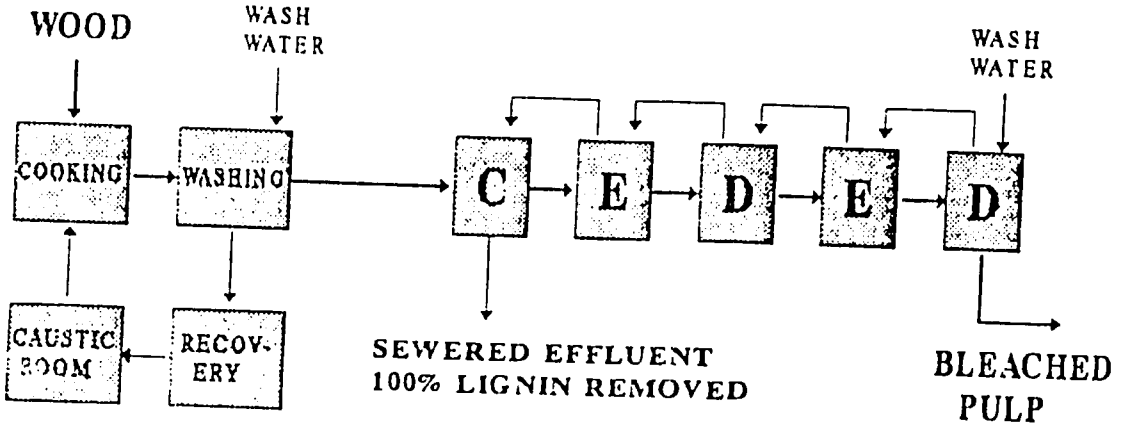
FULL SCALE REACTOR SIMULATION AND PROCESS MODELING

$100MM FULL SCALE 1000 TPD OZONE BLEACH PLANT

ESTABLISHED UNION CAMP TECHNOLOGY

MARKETING ARRANGEMENT WITH SUNDS DEFIBRATOR

Conventional CEDED



PROBLEMS: HIGH WATER USE AND SEWER FLOW

ALL BLEACHED CHEMICALS AND ORGANICS MUST BE SEWERED
HIGH BOD, COD AND COLOR

USE OF CHLORINE PRODUCES CHLORINATED ORGANICS
DIOXIN, TOCL, AOX AND CHLOROFORM

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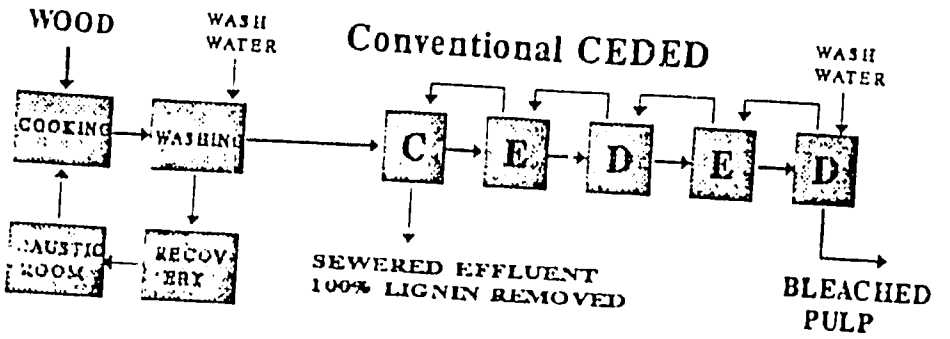
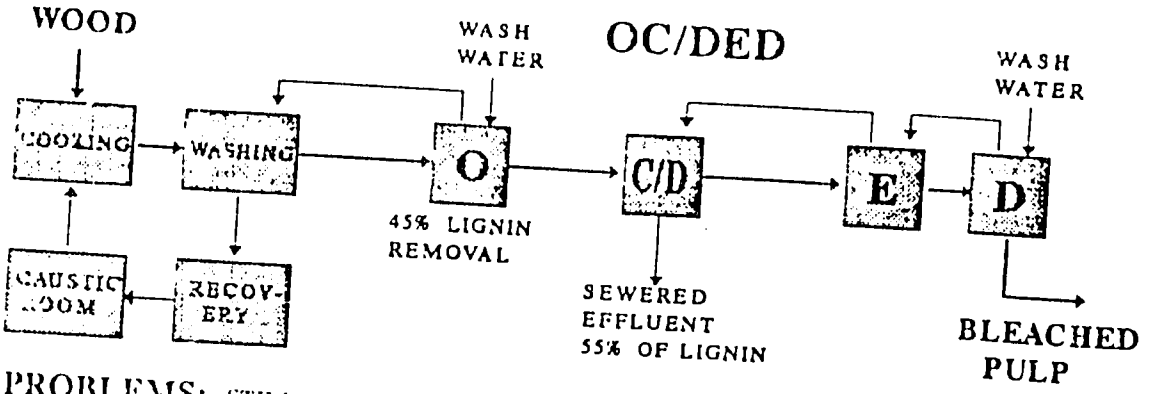
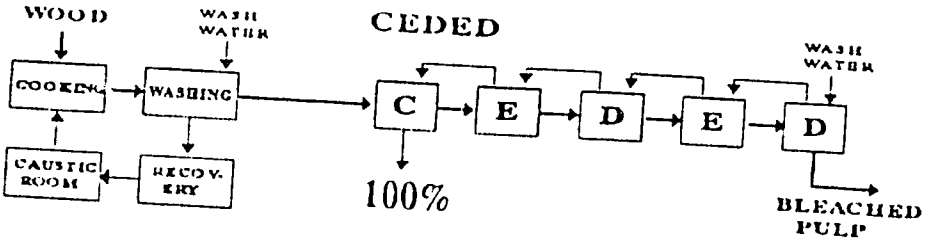
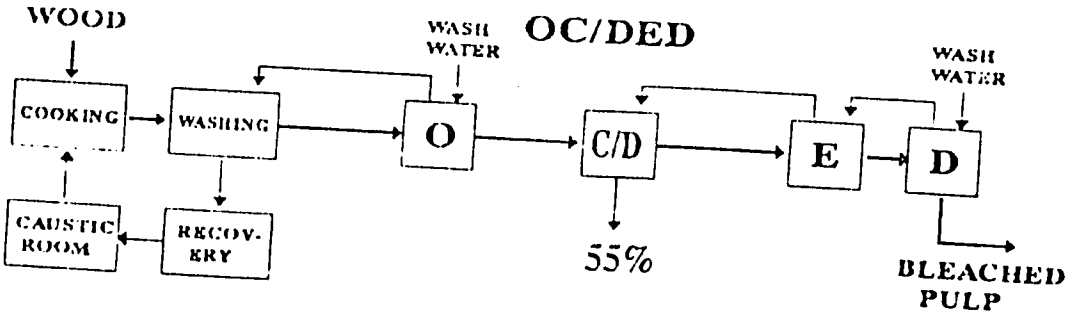


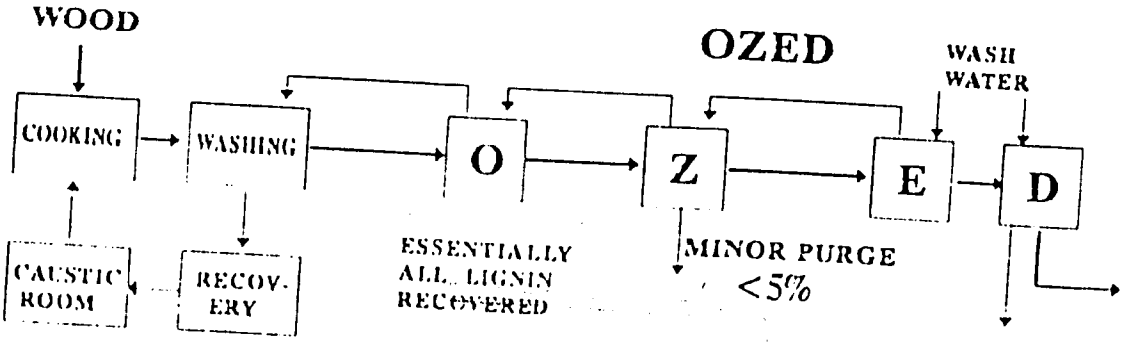


PROBLEMS: STILL A HIGH PERCENTAGE OF ORGANICS AND BLEACHING CHEMICALS SENT TO THE SEWER WITH HIGH BOD, AND COLOR.

CHLORINE STILL USED; SIZABLE AMOUNTS OF CHLORINATED ORGANICS PRODUCED.







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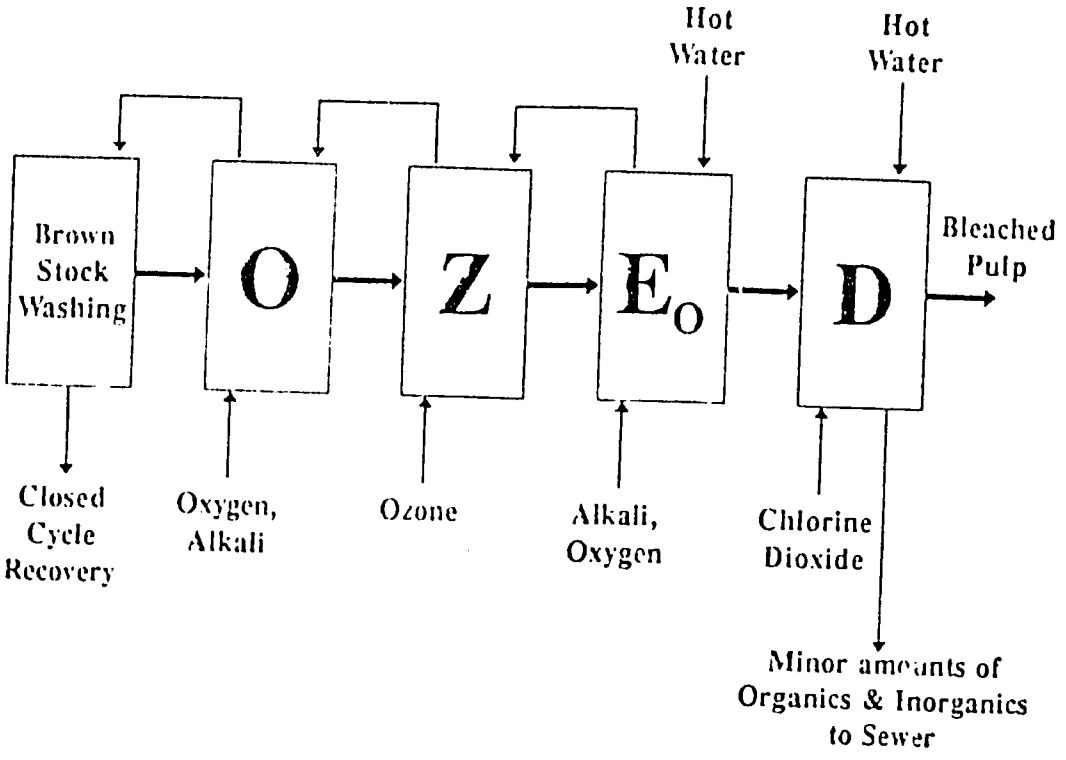
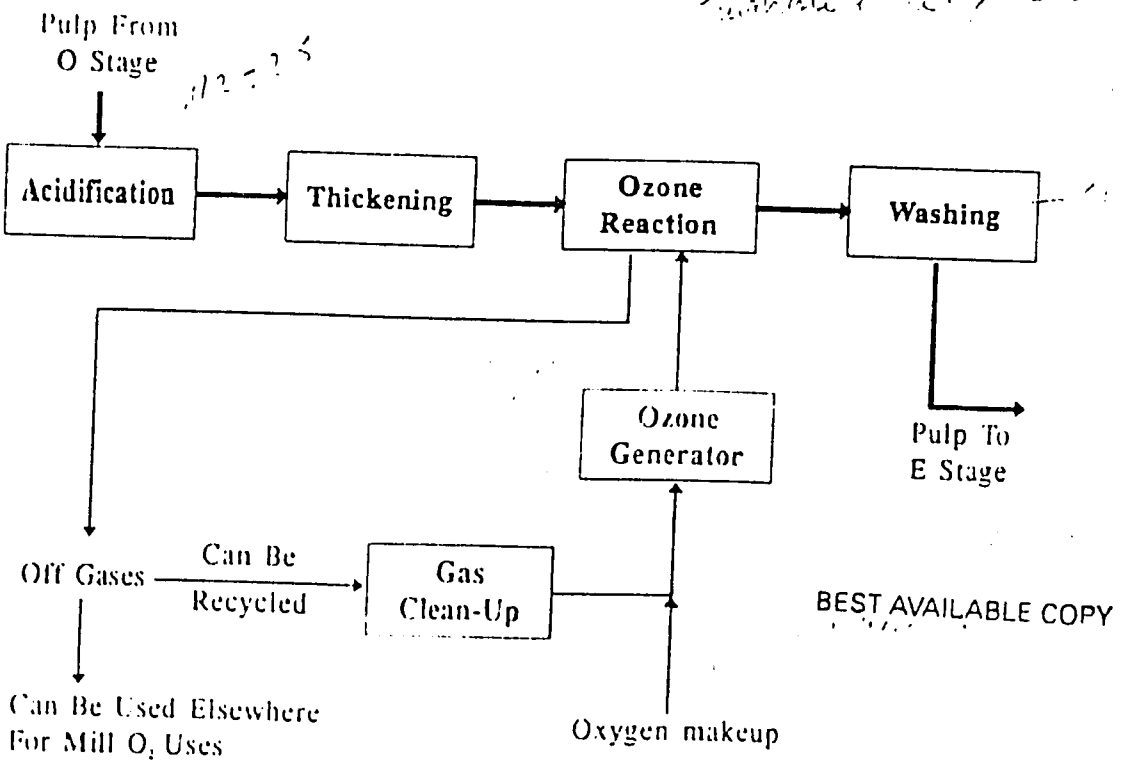
OZ(EO)D Bleaching



OZONE TREATMENT STEP



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BLEACHING COST REDUCTIONS FOR VARIOUS WOODS

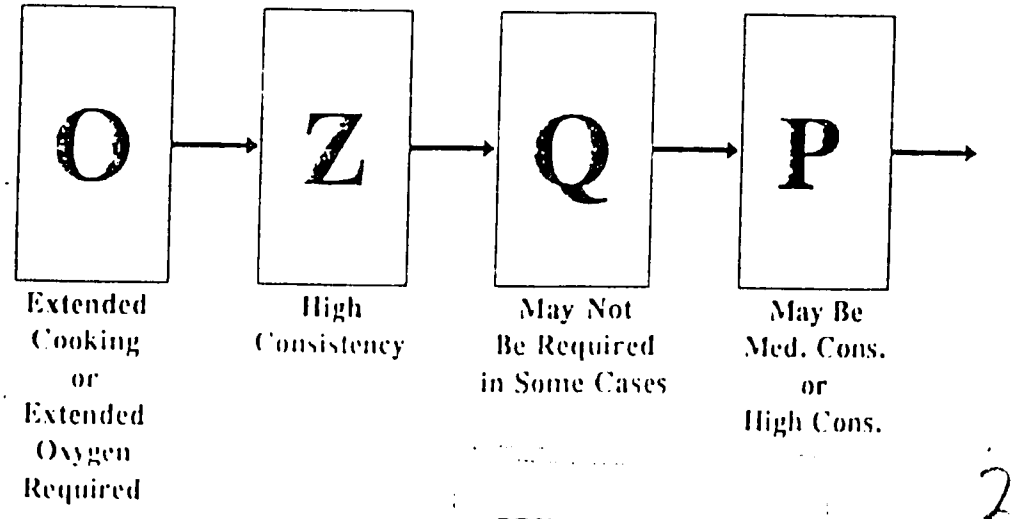
C-Free™ Compared with Conventional Bleaching

90 G.E. BRIGHTNESS PULP

	Percent reduction at Average U.S. Material Costs		
	Normal C/D Substitution	100% D/C Substitution	Comparison Sequence
Birch	42%	47%	OC/DED
Southern HD	20%	52%	CEDED
Eucalyptus	16%	46%	CEDED
Hemlock/Fir Mix	38%	61%	CEDED
Spruce/Pine Mix	35%	52%	OC/DED

OZQP (TCF) Bleaching
Totally Chlorine Compound Free

For Easy to Bleach Pulps - Market Brightness & Strength Possible



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OZONE
START-UP EXPERIENCES

FRANKLIN F-LINE

- STARTED UP ON OZONE — SEPTEMBER 19, 1992

Z STAGE PERFORMANCE

- SELECTIVITY & EFFICIENCY — AS EXPECTED
- BLEACHING UNIFORMITY — EXCELLENT
- SYSTEM OPERATION — MINOR PROBLEMS ONLY

GAS SYSTEM PERFORMANCE

- STARTED UP ON OZONE — SEPTEMBER 19, 1992
- SAFETY PERFORMANCE — EXCELLENT
- OZONE PRODUCTION — EXCELLENT
- GAS RECYCLE SYSTEM — MINOR "NEW SYSTEM" ITEMS

EFFLUENT RECOVERY

- SMALL Z STAGE PURGE FOR CALCIUM

OZONE STAGE PERFORMANCE

	Ozone Application		Brightness % ISO		Viscosity dm^3/kg		Selectivity
	Kg/ADT Applied	Percent Consumed	In	Out	In	Out	$\frac{\Delta \text{ Brightness}}{\Delta \text{ Viscosity}}$
Expected	6.8	90-95	39	53	705	590	0.12
Current Operation	7.6	95+	36	51	706	600	0.14

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OZ(EO)D
BLEACH CHEMICAL SAVINGS (Fsc Pine)

	Reduction vs CEDED
Typical	26%
Optimized	35%

FRANKLIN MILL

1992 OPERATING CONDITIONS

Effect of F-Line OZEoD Pine

FOR ALL SIX PAPER MACHINES	Gross Production Tons/Day	1st Grade Production Tons/Day	Sheet Breaks Number/Day	Machine Downtime min./day
Baseline Jan-July A&B Bleach Lines	2045	1806	13.1	18.3
Oct-Dec F-Line as OZEoD	2057	1822	12.3	15.6

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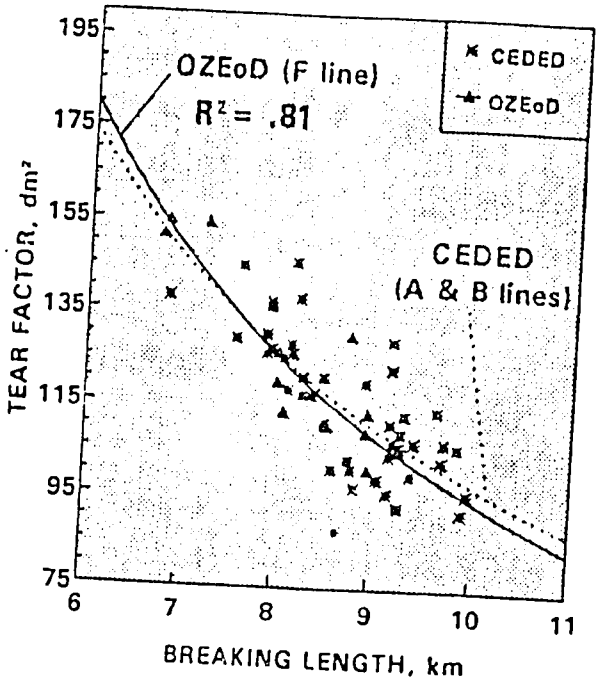
TEAR vs TENSILE

Franklin Southern Pine



PFI BEATING DATA

BLEACH PLANT CONTRIBUTION to MILL EFFLUENT TREATMENT PROBLEMS

As a Percent of Total Mill	Normal Mill	With Rest of Mill as Closed as Possible
EFFLUENT FLOW	50%	65%
EFFLUENT BOD_5	35%	45%
EFFLUENT COLOR	60%	85%
CHLORINATED ORGANICS	85%	85%

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PERCENT REDUCTION IN EFFLUENT
Using OZED Bleaching
90 G.E. BRIGHTNESS PULP

	Compared to Reference Sequence	COLOR	BOD	TOX	COD
Birch	ODEDED	88%	76%	71%	58%
Southern HD	CEDED	99%	88%	98%	91%
Southern HD	$O(D_{10}C)ED$	96%	78%	97%	90%
Eucalyptus	CEDED	98%	87%	97%	88%
Spruce/Pine	$O(D_{10}C)EDED$	98%	---	97%	85%
Hemlock/D. Fir	CEDED	96%	91%	84%	92%
Southern Pine	CEDED	99%	88%	99%	91%
Southern Pine	$O(D_{10}C)ED$	96%	69%	98%	73%

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POTENTIAL BENEFITS
CHLORINATED ORGANICS
Southern PINE Kraft to 82 ISO

	CEDED	OC/DED	OZED
on PULP			
TOX (kg/ADMT)	0.28	0.13	0.04
in BLEACH PLANT EFFLUENT			
TOX (kg/ADMT)	6.5	3.0	0.08 [a]
CHLOROFORM GENERATION			
total (kg/ADMT)	0.18	0.08	0.002

a. Level depends on the amount of chlorine in the chlorine dioxide used

POTENTIAL BENEFITS

BLEACH PLANT ORGANICS

Southern PINE Kraft to 82 ISO

	CEDED	OC/DED	OZED
BOD_5 (kg/ADMT)	16	6.5	2
COD (kg/ADMT)	65.5	22.5	6
COLOR (kg/ADMT)	185	41.5	1.5

EASTOVER.

RESULTS ON EFFLUENT PRODUCED FROM COMMERCIAL OZ(EO)D PLANT

	CEDED	OC/DED	Predicted OZED	INITIAL MEASURED F-LINE
BOD_5 (kg/ADMT)	16	6.5	2	1.8
COD (kg/ADMT)	65.5	22.5	6	5.6
COLOR (kg/ADMT)	185	41.5	1.5	0.9
TOX (kg/ADMT)	6.5	3.0	0.075	0.14
AOX	--	--	--	N.D.(<1-5ppb)
Chloroform	0.18	0.08	0.003	0.00017

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C-Free ENVIRONMENTAL IMPACTS

- ESSENTIALLY ELIMINATES **DIOXIN**
- ELIMINATES MOST OF THE TOTAL CHLORINATED ORGANIC **CHLOROFORM, TOX and AOX**
- ALMOST ELIMINATES **COLOR** IN BLEACH PLANT EFFLUENT
- OFFERS LARGE **BOD** REDUCTIONS IN EFFLUENT TREATMENT
- USES LESS **WATER** AND PRODUCES LESS **EFFLUENT**

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SOLID WASTE

MAJOR STREAMS

- PRIMARY CLARIFIER SLUDGE
- POWER BOILER FLY ASH
- RECAUSTICIZING GRITS & DREGS
- PULP MILL KNOTS & REJECTS

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HAZARDOUS WASTE

CLASSIFICATION

LISTED

- PURE — P
- UNUSED — U
- FUNCTION — F
- APPLICATION — K

CHARACTERISTIC

- * CORROSIVITY
- * REACTIVITY
- IGNITABILITY
- TOXICITY

Flash Point < 140°F

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HAZ. WASTE MANAGEMENT

GENERATOR RESPONSIBILITY

- GENERATION
- TRANSPORTATION
- STORAGE
- TREATMENT
- DISPOSAL

MANIFEST SYSTEM

Recordkeeping

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ODOROUS GAS
NON-CONDENSIBLE (NCG) GAS
TOTAL REDUCED SULFUR (TRS) GAS

- Hydrogen Sulfide H_2S
- Methyl Mercaptan CH_3SH
- Dimethyl Sulfide $(CH_3)_2S$
- Dimethyl Disulfide $(CH_3)_2S_2$

Major Combustible Components

- Turpentine
- Methanol

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EASTOVER MILL ODOR CONTROL SYSTEM

DESIGN CRITERIA

- Safety
- Comply with All Regulations
- Minimize Off-Site Odor
- SO_2 Emission Reduction
- Sulfur Recovery
- Anticipate Future Requirements

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SOURCES

Chip Bins

Steaming Vessels

Flash Tanks

Blow Tanks

Brown Stock Washers

Filtrate Tanks

Knotters

Knot Conveyors

Evaporator Condensers

Black Liquor Tanks

Foul Condensate Tanks

Salt Cake Mix Tanks

Foam Tanks

Soap Tanks

Acid Wash Tanks

Lime Mud Pressure Filters

White Liquor Pressure Filters

Rejects System

Turpentine Tanks

Stripper Off Gas

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CHARACTERISTICS OF SOURCES

1. Above or Below Explosive Limits?

2. High or Low Volume?

- Below LEL ---> Dilute System
- Above UEL ---> Concentrated System
- Treat / Redesign Other Sources

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INCINERATION DEVICES

- Stand Alone Incinerators
- Power Boilers
- Lime Kilns / Calciners
- Recovery Furnaces* — also of [illegible] because of safety
- Flares

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PRIME MOVERS

- Steam Eductors
- Centrifugal Fans
- Liquid Ring Compressors

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DILUTE NCG SYSTEM

Design Basis:
System < 25% LEL, No Individual Source Can Be > 50% LEL

Sources	Prime Mover	Incineration Device
Chip Bin *	Fan With Spare	No. 1 Power Boiler
Blow Tank *		or
Brown Stock Washers		No. 2 Power Boiler
Black Liquor Foam Tanks		
Knotters / Conveyors		
Foul Condensate Tanks		
Pressure Filters		
Miscellaneous Sources		
Total 20,000 ACFM		

265

CONCENTRATED NCG SYSTEM

Design Basis:
All Sources Must be > UEL, Maintain High Velocities

Sources	Prime Mover	Incineration Device
Steaming Vessel *	Steam Eductor	Stand-Alone Incinerator With SO_2 Scrubber
Flash Tanks *		or
Evaporator Condensers		No. 2 Power Boiler (Back-Up)
Stripper Feed Tank		
Turpentine Tanks		
Total 800 ACFM		

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STRIPPER OFF GAS

Design Basis:
BOD and TRS Removal, Provide Commercial Grade Liquid Fuel

Sources	Prime Mover	Disposition
Stripping Columns	System Pressure	Rectification Column or Stand-Alone Incinerator (Back-Up)

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"SWEAT THE DETAILS"

- Materials of Construction
- Condensate Removal
- Flame Arresters
- Rupture Discs
- Vent Locations
- Electrical Grounding
- LEL Meter
- Explosion Suppression System
- Ambient Monitors
- Control System Interlocks

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EFFLUENT TREATMENT

REGULATED POLLUTANTS

- ORGANIC MATTER (BOD)
- SOLIDS (TSS)
- NUTRIENTS
- COLOR

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IN PLANT CONTROLS

SEGREGATED SEWERS

- PROCESS (SOLIDS)
- BLEACH PLANT (ACID)

SPILL CONTROL

- OIL STORAGE DIKING
- PAVING + CURBING
- SPILL RECOVERY - - CONDUCTIVITY CONTROL -
  - training for inventory
  - minimal chemical
  - [illegible] - [illegible] equipment.

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SYSTEM PERFORMANCE

BODs

PROCESS SEWER → CLARIFIER → ASB'S

49,000 #/DAY — 75 % — 95 %

BLEACH PLANT SEWER → ASB'S

= 2500 #/DAY FINAL EFFLUENT

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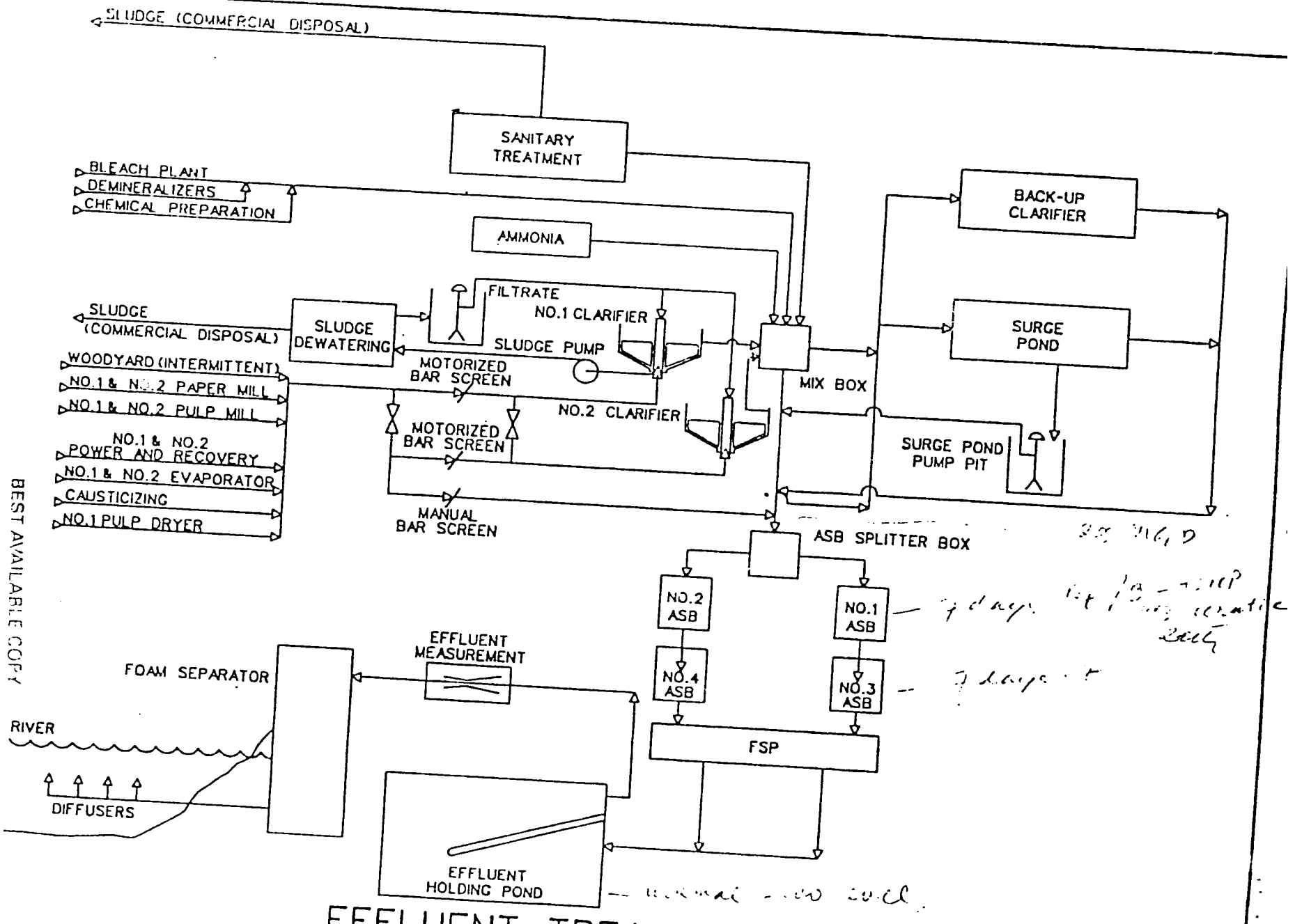

EFFLUENT TREATMENT SYSTEM

FIGURE VI - 1

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EASTOVER

EASTOVER MILL STATISTICS

UNION CAMP CORPORATION
FINE PAPER DIVISION
EASTOVER, SOUTH CAROLINA

Business Purpose: Manufacture fine white paper for use in the communications industry, (i.e., copier paper, envelopes, business forms, offset printing, reading materials and writing supplies) and bleached market pulp.

Design Rate: 1800+ Tons Per Day Total Production
1500 Tons Per Day Fine Paper
300 Tons Per Day Bleached Pulp

Location: 30 Miles East of Columbia, South Carolina

Employees: Union Camp Personnel 860

On-Site Service Contractors 153

Total Investment: $1.25 Billion
Phase I $500 Million
Phase II $750 Million

Estimated Yearly Spending*

Annual Payroll	40 Million
Local Wood Purchases	65 Million
Products and Services	35 Million
Payments to Freight Carriers	33 Million
Annual Property Taxes (Phase I)	12 Million

*Amounts spent in South Carolina

— — — —

Post Office Box B, Eastover, South Carolina 29044, Phone: (803) 353-7653

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SVM/lam EOFACT.593

AIR POLLUTION CONTROL

REGULATED POLLUTANTS

- PARTICULATE
- SULFUR DIOXIDE
- NITROGEN OXIDES
- TOTAL REDUCED SULFUR
- "AIR TOXICS"
  - Methanol
  - Formaldehyde
  - [illegible]
  - [illegible]

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POLLUTANT	SOURCE	CONTROL
PARTICULATE	• RECOVERY FURNACE	• PRECIPITATOR
	• POWER BOILER	"
	• LIME KILN	"
SO_2	• POWER BOILER	• LOW SULFUR FUEL
	• NCG INCINERATOR	• SCRUBBER (column packed)
NO_x	• POWER BOILER	• BURNER DESIGN
TRS	• PULP MILL	• INCINERATION
CHLORINE	• BLEACH PLANT	• SCRUBBER

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PRECIPITATOR DESIGN

EXAMPLE: No. 1 POWER BOILER

COMB. FUEL: COAL (PULVERIZED), OIL, BARK

500 x 10^6 BTU / HR

200,000 ACFM @ 350°F

Multiple cyclone dust collector.

DESIGN

- DUAL CHAMBER
- 4 MECHANICAL, 4 ELECTRICAL FIELDS / SIDE
- 120,000 SQ. FT. COLLECTION AREA

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PRECIPITATOR DESIGN

EXAMPLE: No. 1 RECOVERY FURNACE

2.4 × 10⁶ #/DAY BLS

300,000 ACFM @ 390 °F

DESIGN

- DUAL CHAMBER
- 4 MECHANICAL, 8 ELECTRICAL FIELDS / SIDE
- 150,000 SQ. FT COLLECTION AREA

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SCRUBBER APPLICATIONS

SOURCE	POLLUTANT	TYPE
• BLEACH PLANT	CHLORINE	PACKED COLUMN
• NCG INCINERATOR	SO_2	"
• LIME KILN	PARTICULATE	VENTURI
• SMELT DISSOLVING TANK	PARTICULATE & TRS	DYNAMIC FAN (WITH [illegible])

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APPENDIX 6

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Respect for the environment runs deep at Weyerhaeuser.

We're proud of our long tradition of concern for — and stewardship of — the world we inhabit: land, water, air, fish, wildlife and, of course, our forests.

Weyerhaeuser pioneered the American Tree Farm system by establishing the feasibility and desirability of replanting forests after harvest. We led the industry in devising ways of treating industrial wastewater to minimize the impact on streams and rivers. And, in 1971, Weyerhaeuser was one of the first forest products companies to enact an environmental policy.

Since then, our policy has been further refined and strengthened as we've learned more about the impact of our activities upon the environment.

Stated briefly, our goal is that Weyerhaeuser and its employees will continuously seek to harmonize our operations with the requirements of a safe and pleasing environment.

Our environmental policy guides us in achieving this goal.

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Weyerhaeuser employees at all levels will:

1. comply with all environmental laws and regulations.

2. identify, understand and respond to public health and environmental impacts of our operations and the use of our products and services.

3. conserve energy and natural resources by ensuring efficient utilization.

4. work diligently to protect the environment on the job, and consider doing so off the job.

In addition, Weyerhaeuser managers will:

5. factor environmental laws and regulations into strategic planning and decision-making processes.

6. evaluate environmental performance through use of tools such as internal audits and exception reporting.

7. promote the development and adoption of scientifically sound and balanced environmental policies, laws and regulations through active support of and participation in governmental legislative and rule-making processes and other forums dedicated to providing public officials with technical information and advice.

8. develop and implement procedures for waste minimization, emissions reduction, by-product recycling and materials handling and disposal.

9. factor aesthetics into forest management practices.

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10. be held accountable for environment performance and results. Facility and unit managers will:

- monitor and certify compliance
- promptly report non-compliance conditions
- take corrective action, including curtailment of operation, if necessary, to prevent serious harm.

11. recognize superior environmental performance by encouraging and rewarding employee suggestions for improving environmental performance.

12. develop and communicate to appropriate local authorities environmental incident emergency plans for any operations that pose a significant risk of off-site impacts.

13. respond openly and promptly to public inquiries about environmental issues involving the company and initiate communications with others who might be affected.

14. work in good faith with non-governmental organizations and individuals to resolve environmental quality problems.

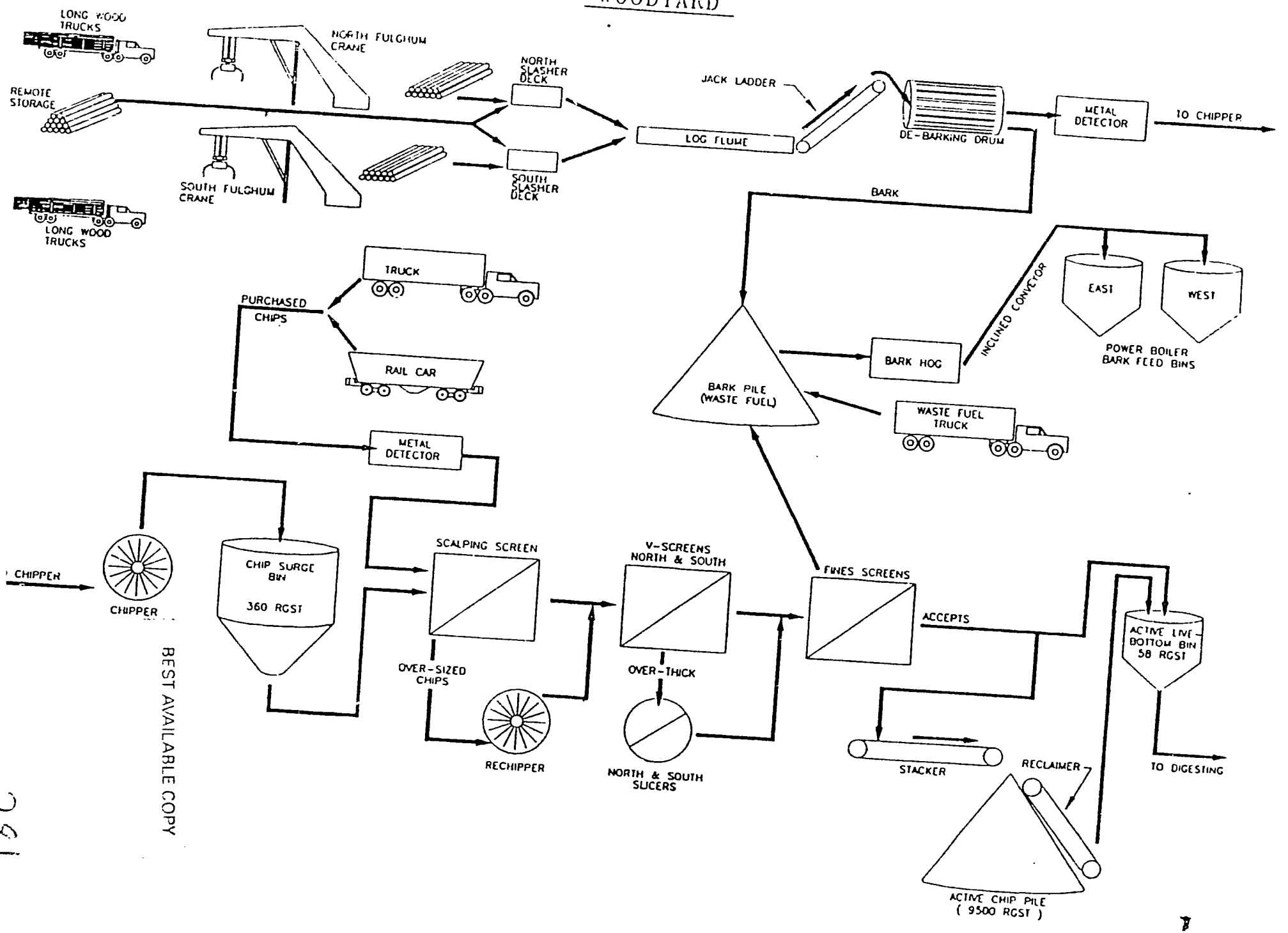
15. adopt internal environmental standards for situations not adequately covered by current law or regulation, or where we believe more stringent measures are necessary to protect the environment.

16. select contractors and vendors who demonstrate proper concern for environmental protection.

In addition, the Office of the Environment will:

17. report annually to the Board of directors on the company's overall environmental performance.

WOODYARD



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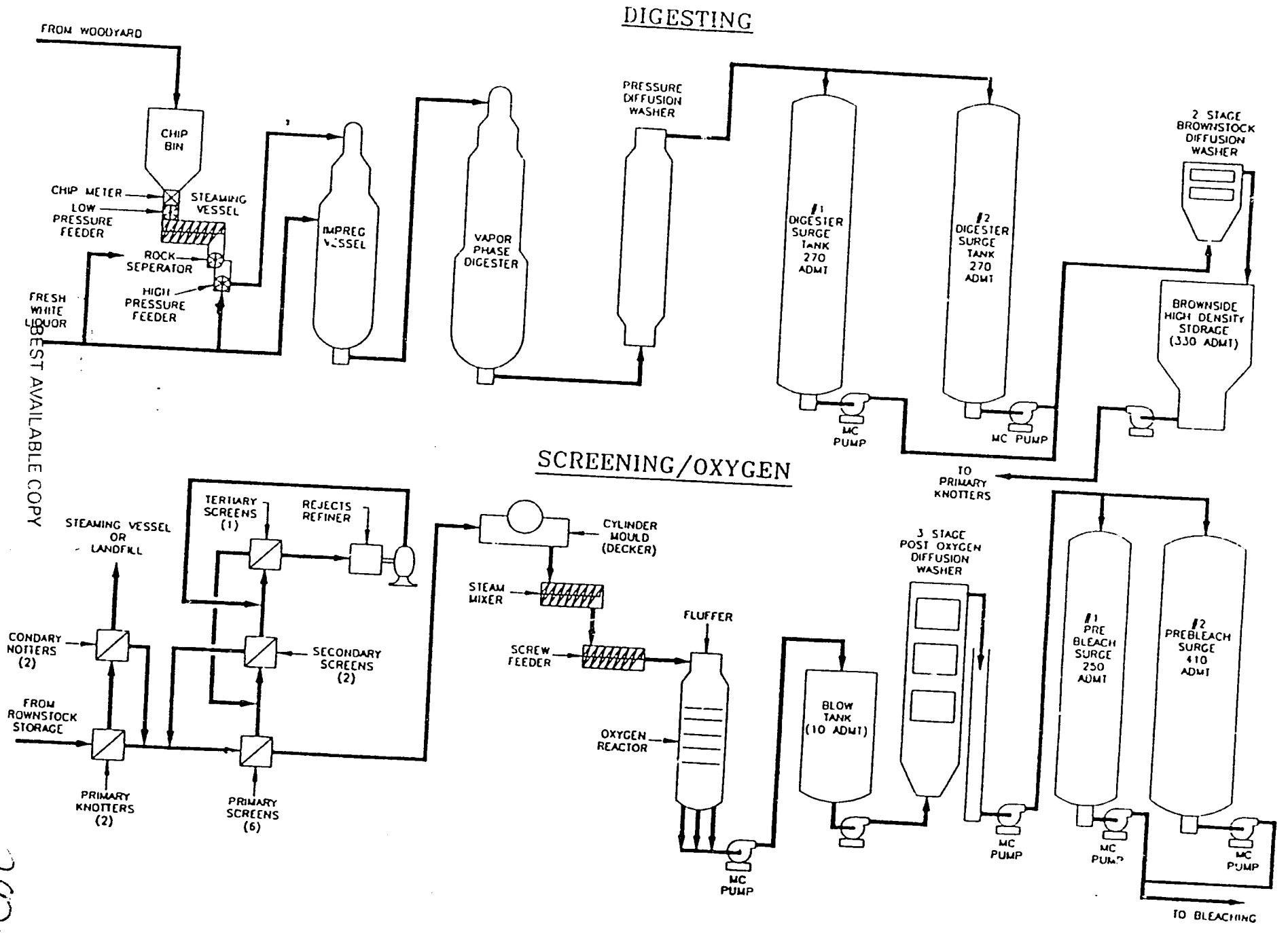

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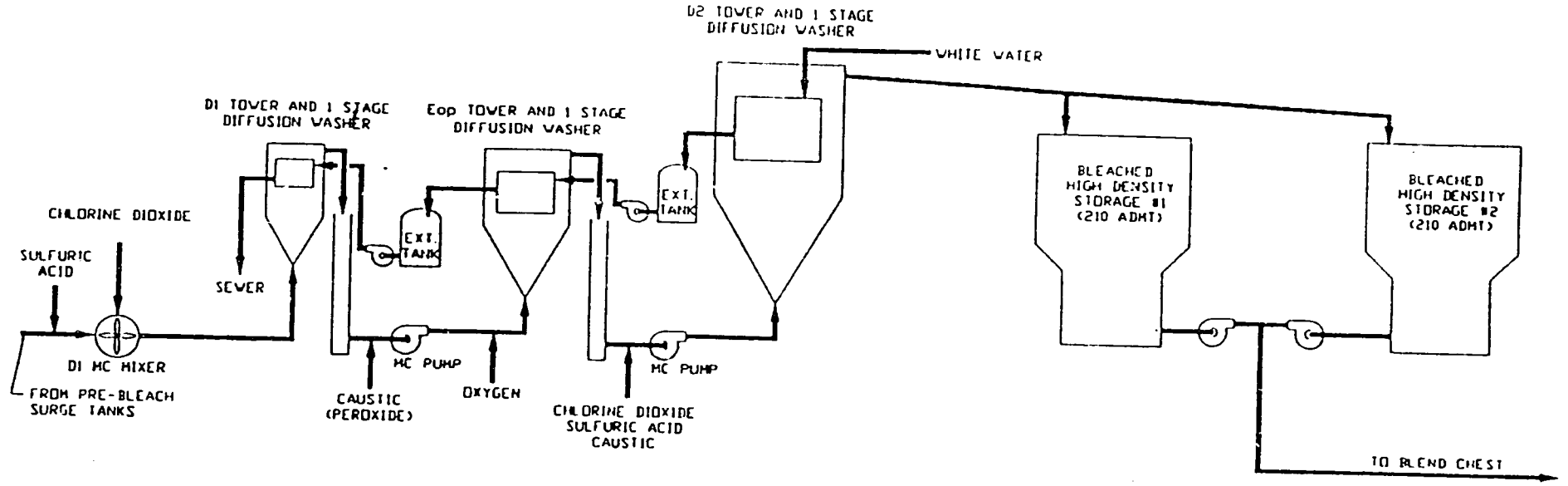
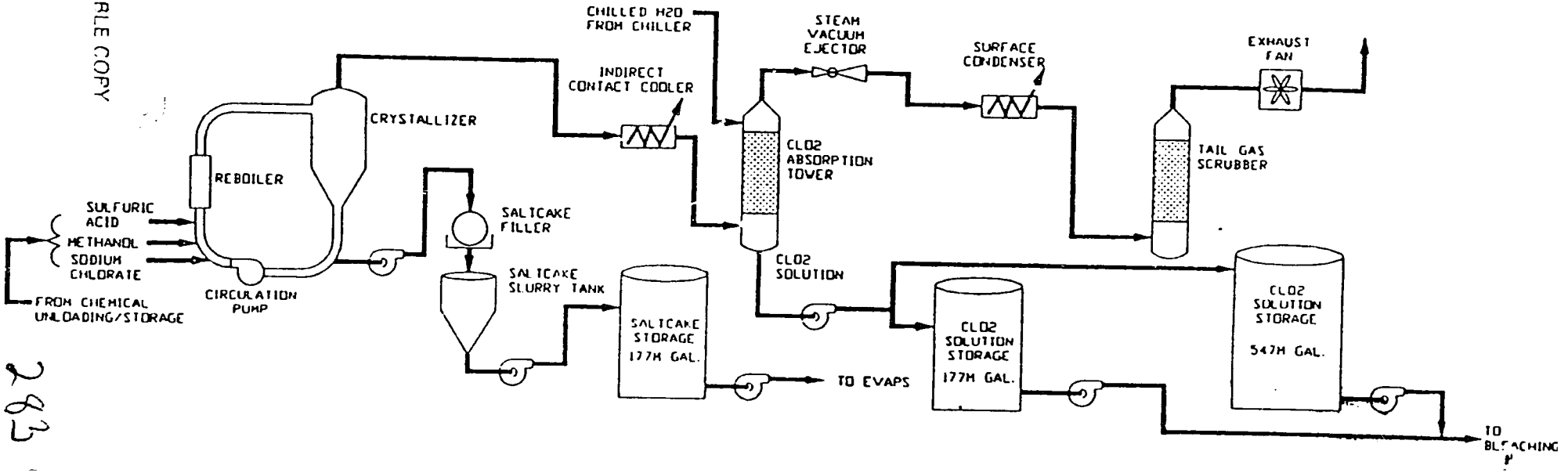
BLEACHING



R-8 CHEMICAL GENERATOR



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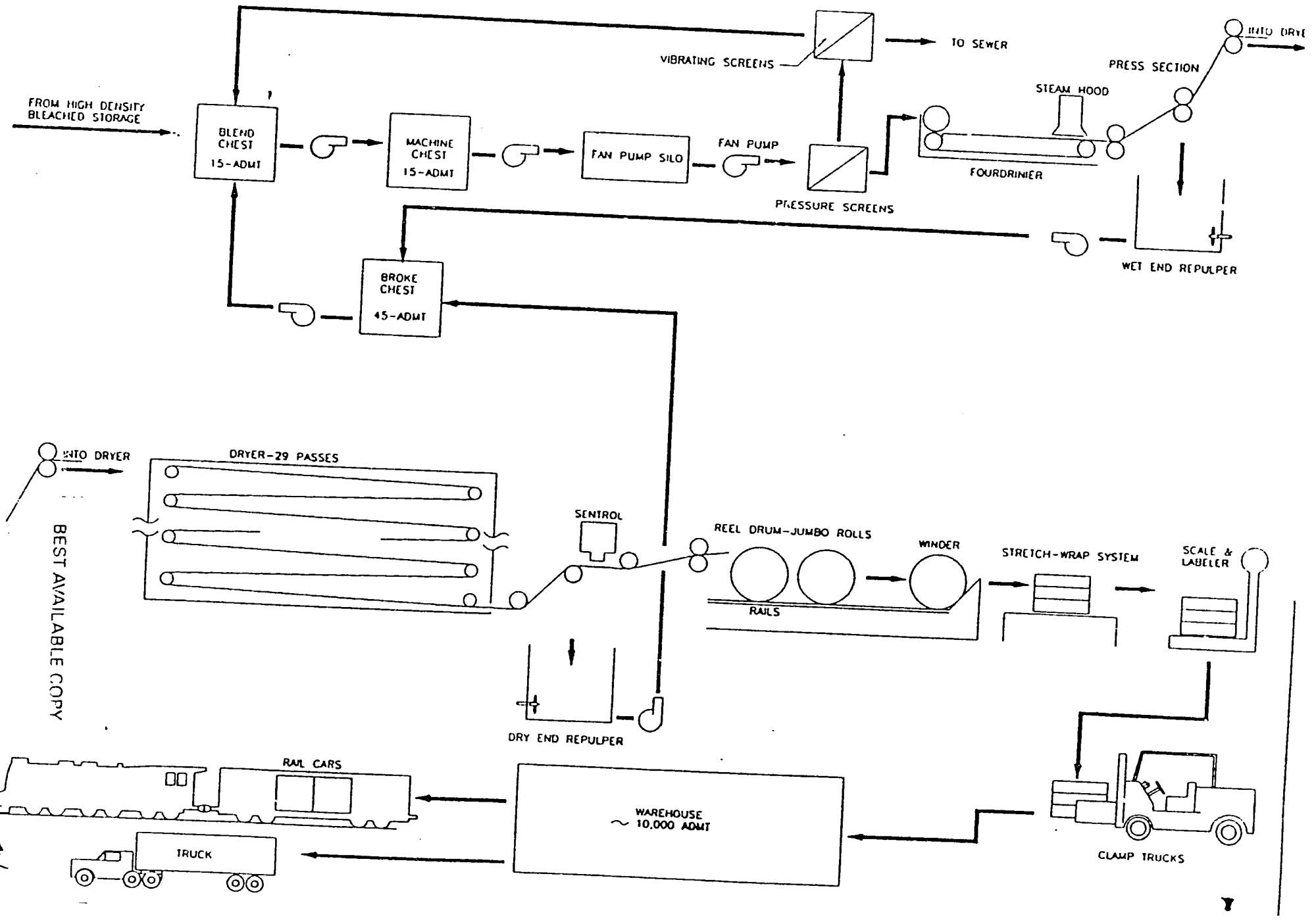

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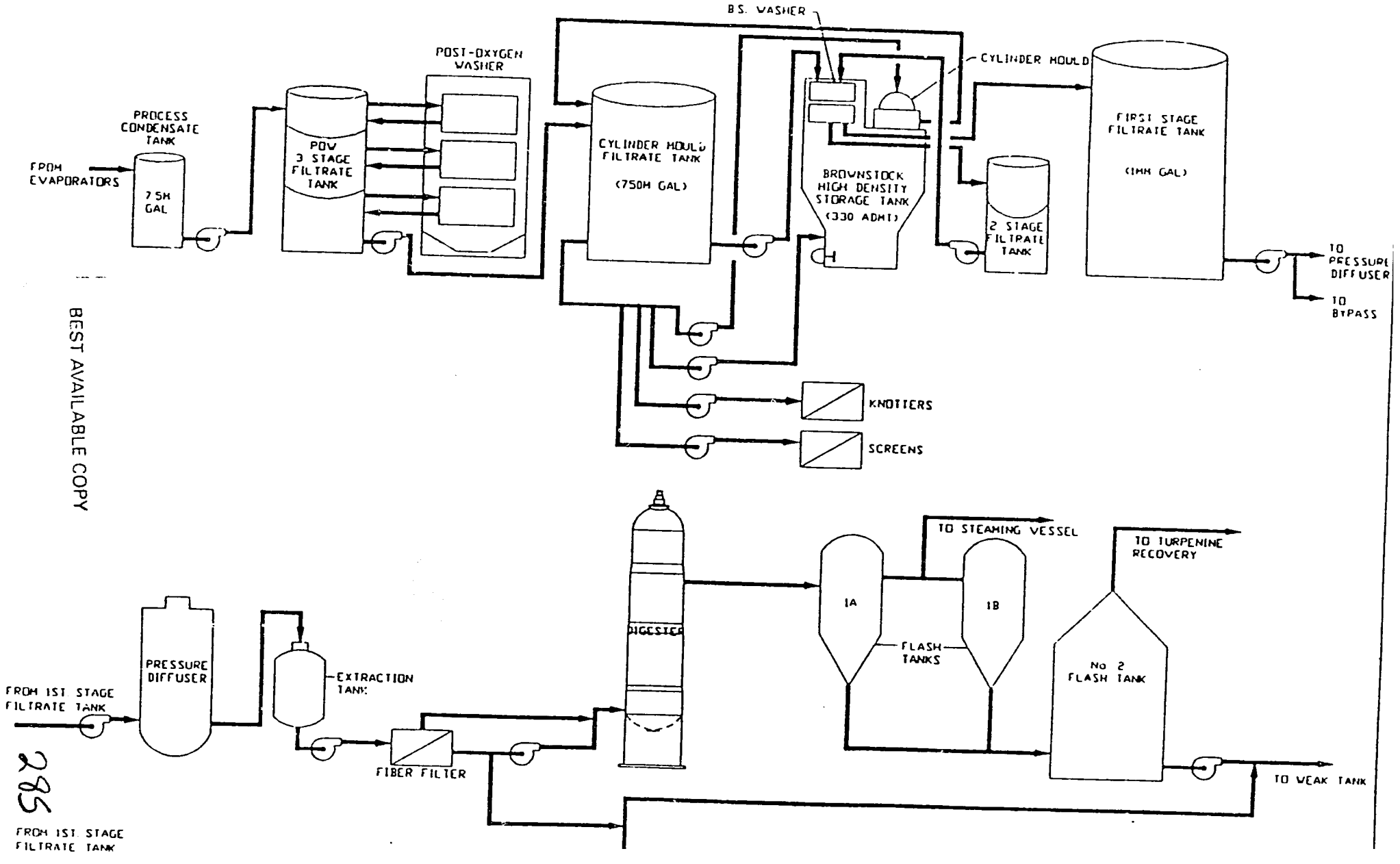
PULPING FILTRATE LOOP



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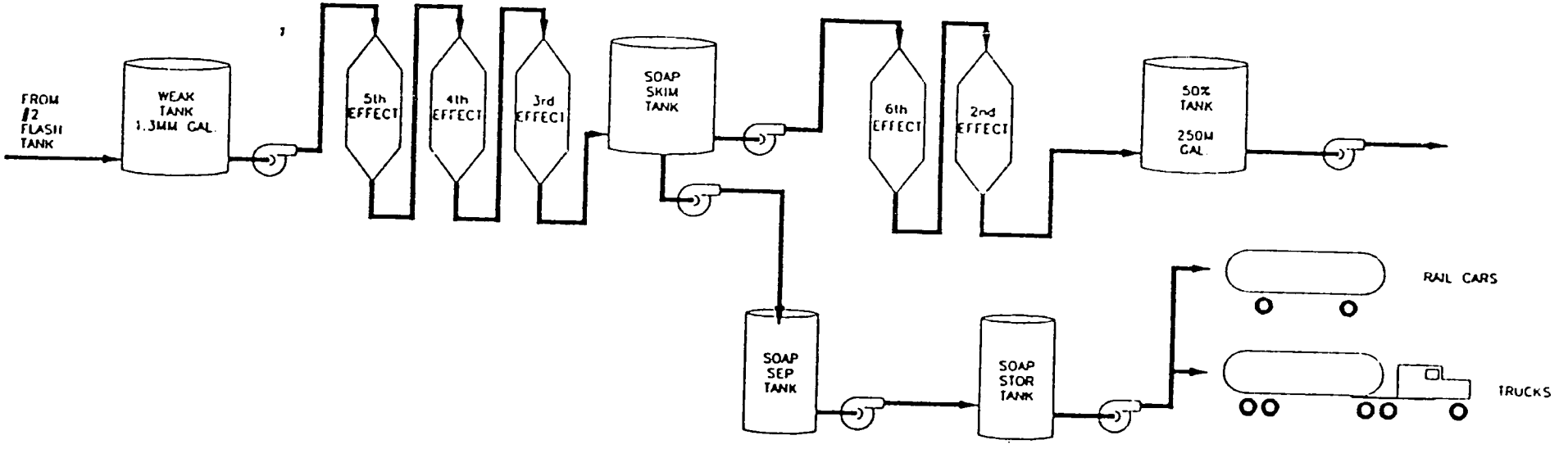
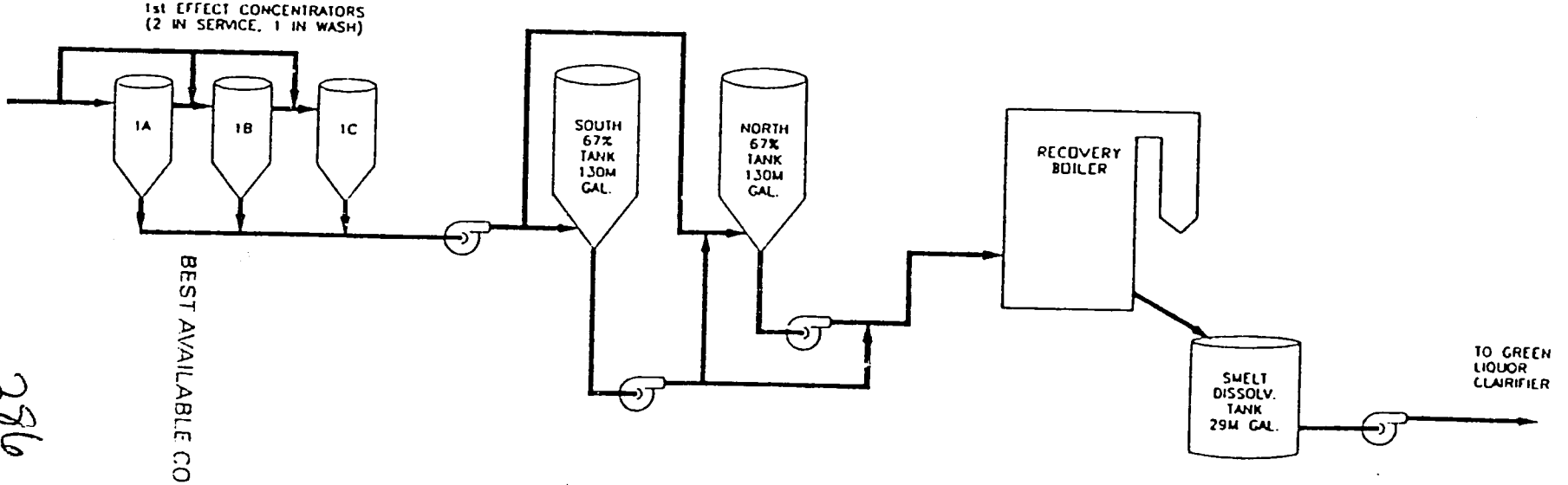
CHEMICAL RECOVERY, BLACK SIDE

EVAPORATION/RECOVERY





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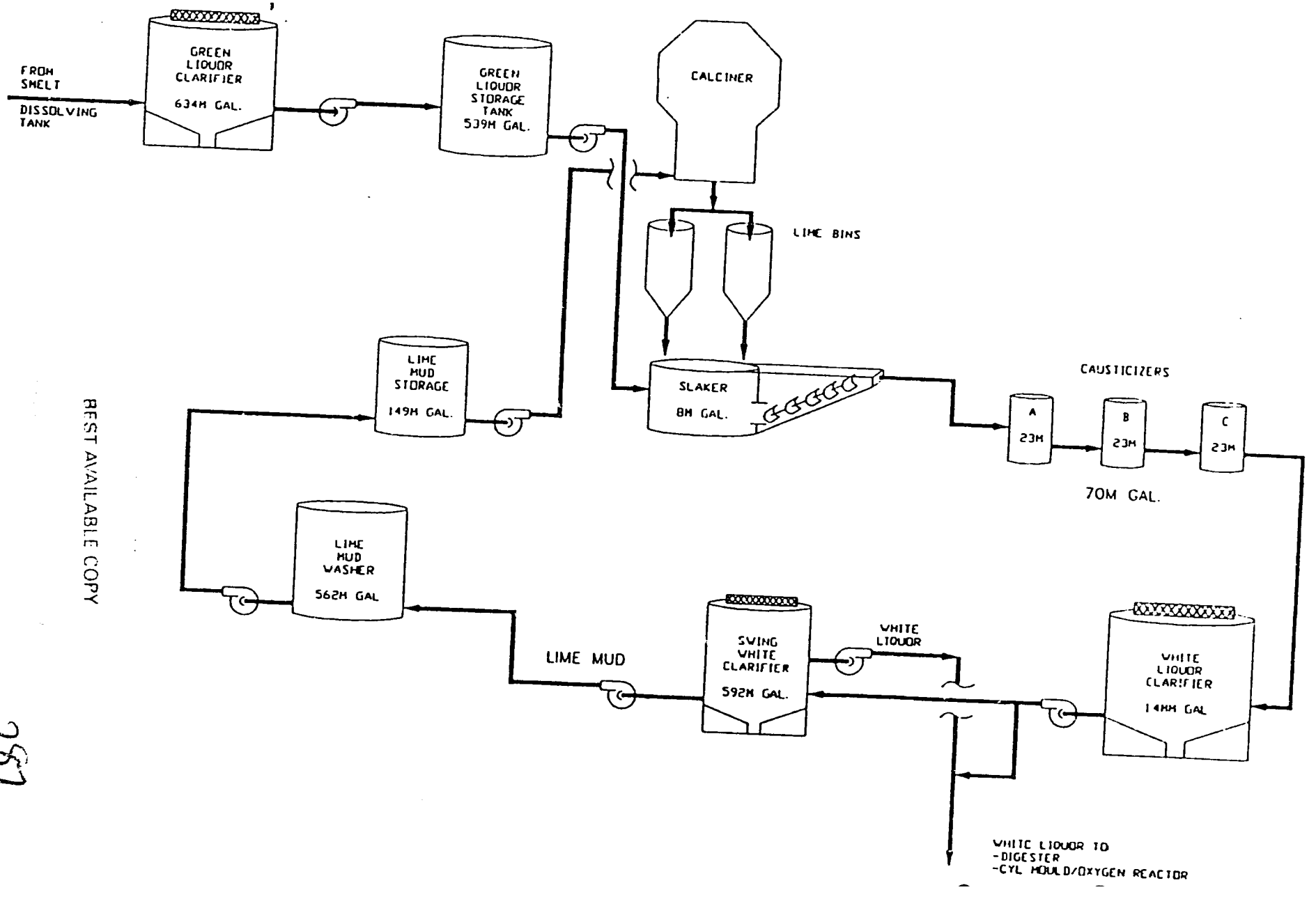
CHEMICAL RECOVERY, GREEN & WHITE SIDE

CAUSTICIZING



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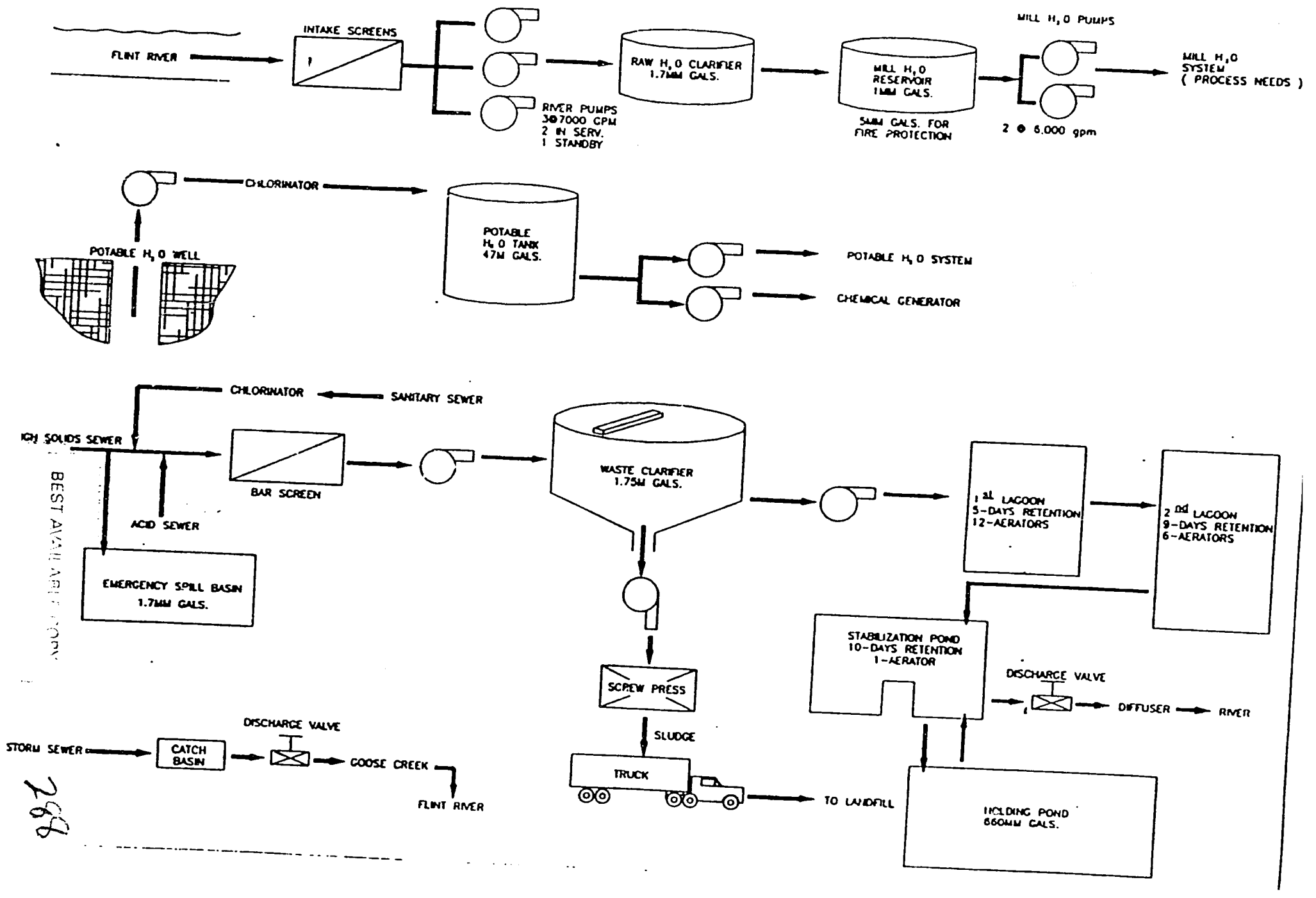
WASTE & WATER TREATMENT



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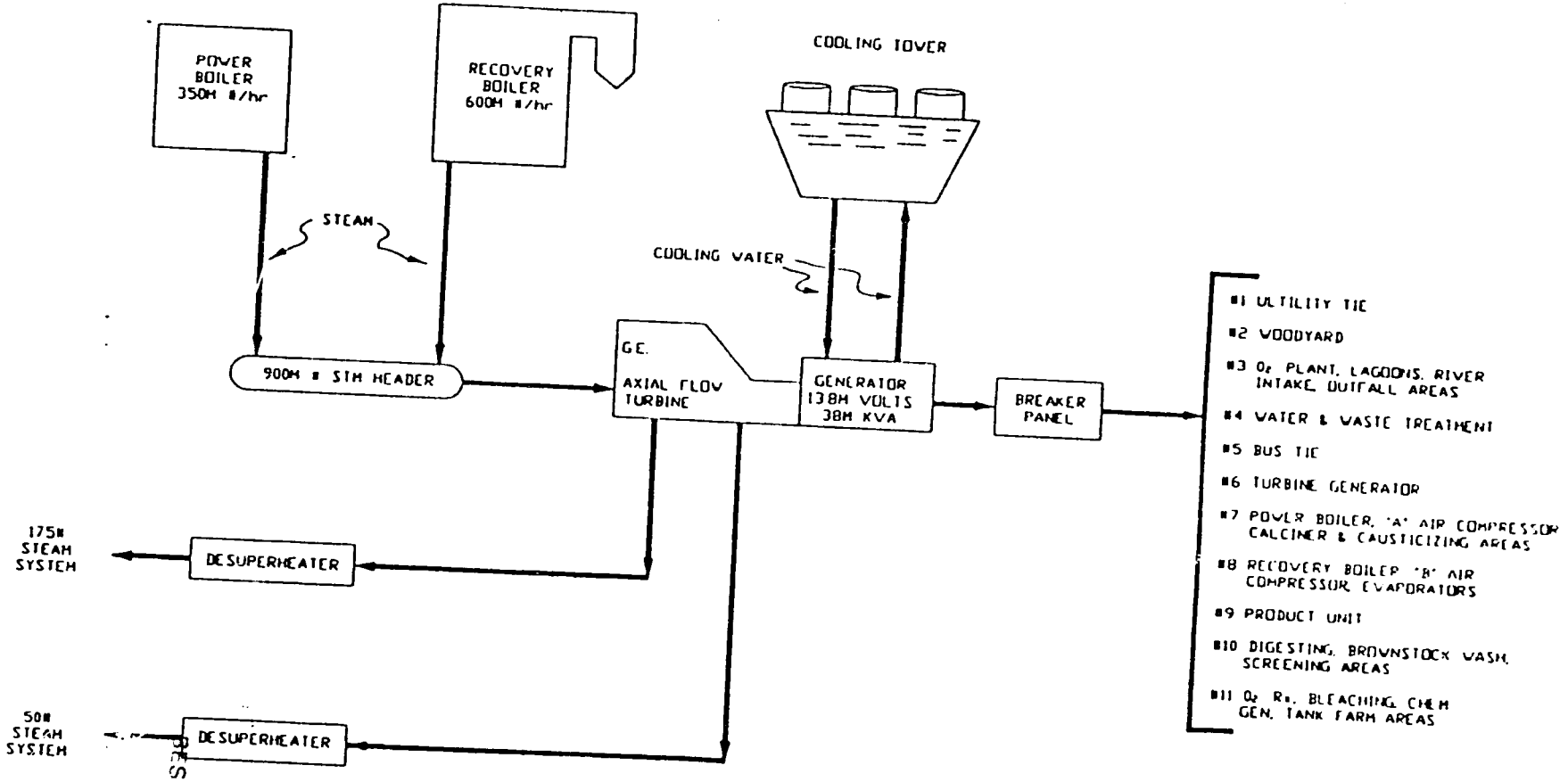
TURBINE GENERATOR STEAM/POWER FLOW

POWER SYSTEM



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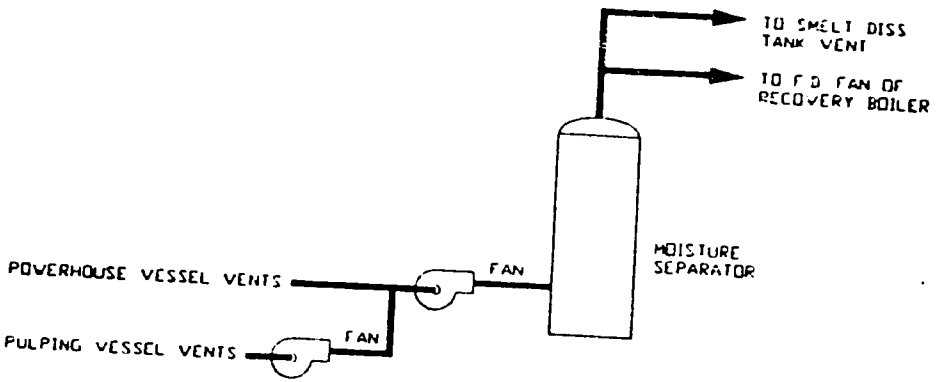
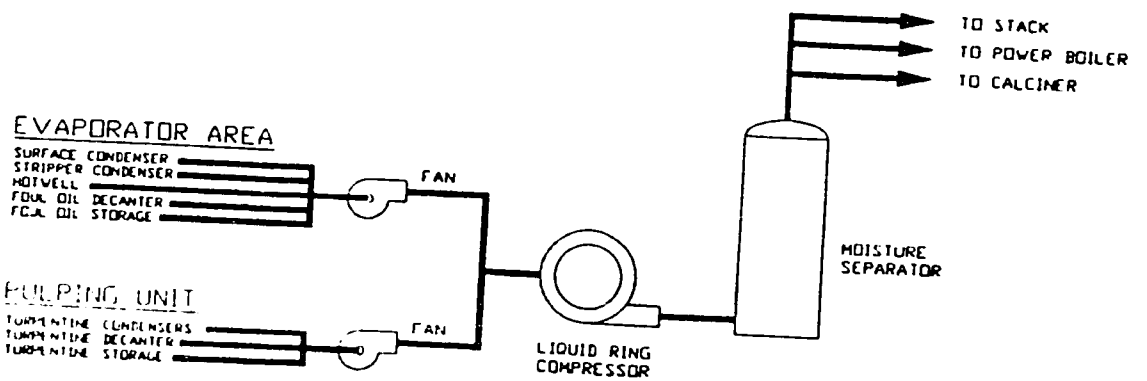
WEAK GAS INCINERATION



STRONG GAS INCINERATION



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APPENDIX 7

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WEC™

World Environment Center

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WORLD ENVIRONMENT CENTER (WEC)

NOT-FOR-PROFIT, NONADVOCACY, INDEPENDENT ENVIRONMENTAL ORGANIZATION

FOUNDED IN 1974 - SEED MONEY FROM UNEP

INDEPENDENT SINCE 1981 - FUNDED BY:

- INDUSTRY
- GOVERNMENT
- INTERNATIONAL ORGANIZATIONS
- CORPORATE & PRIVATE FOUNDATIONS
- PRIVATE CITIZENS

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MISSION

WEC CONTRIBUTES TO SUSTAINABLE DEVELOPMENT WORLDWIDE BY STRENGTHENING INDUSTRIAL AND URBAN ENVIRONMENTAL, HEALTH AND SAFETY (EH&S) POLICY AND PRACTICES.

- MAINTAINS AN INDEPENDENT & NONADVOCACY POSITION
- SEEKS TO INTEGRATE ENVIRONMENT, ECONOMICS, ENERGY & EDUCATION
- ESTABLISHES PARTNERSHIPS AMONG INDUSTRY, GOVERNMENT & NGOs
- SERVES AS A BRIDGE FOR THE EXCHANGE OF INFORMATION AND EXPERTISE AMONG INDUSTRY, GOVERNMENT AND NON-GOVERNMENTAL ORGANIZATIONS
- PROVIDES TRAINING & TECHNICAL COOPERATION PROGRAMS STAFFED BY VOLUNTEERS AND OTHER EXPERTS FROM INDUSTRY, GOVERNMENT, ACADEMIA, NGOs & THE PUBLIC
- ENCOURAGES CORPORATE ENVIRONMENTAL LEADERSHIP & RESPONSIBILITY WORLDWIDE BY PROVIDING PUBLIC RECOGNITION FOR OUTSTANDING ACCOMPLISHMENTS

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ORGANIZATION

HEADQUARTERS: NEW YORK CITY

ADDITIONAL OFFICES:

BANGKOK
JAKARTA
MEXICO CITY
PRAGUE
WASHINGTON, DC

FULL TIME EMPLOYEES - 65

PART TIME EMPLOYEES - 5

IN-COUNTRY COORDINATORS - 8

SENIOR FELLOWS - 2

LONG TERM ADVISORS - 2

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INTERNATIONAL ENVIRONMENT FORUM (IEF)

- 60 MAJOR MULTINATIONAL COMPANIES
- NINE INDUSTRIAL SECTORS
- NINE COUNTRIES
- MEETS 4-6 TIMES/YEAR FOR DISCUSSIONS OF EH&S ISSUES WITH ENVIRONMENTAL MINISTERS

PROPRIETARY PROGRAMS INCLUDING:

- COUNTRY PROFILE PROGRAM - EH&S REQUIREMENTS OF 27 COUNTRIES
- WORKSHOPS -
  - ENVIRONMENTAL MANAGEMENT
  - ENVIRONMENTAL AUDITS
  - WASTE MINIMIZATION
  - PRODUCT LIFE-CYCLE ANALYSIS
  - EMERGENCY PLANNING & MANAGEMENT
  - WASTE REMEDIATION
- TRAINING -
  - TRAINING FOR GLOBAL DIVERSITY: UNDERSTANDING THE HUMAN FACTOR
  - PLANT MANAGER ENVIRONMENTAL HEALTH & SAFETY

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INTERNATIONAL ENVIRONMENT AND DEVELOPMENT SERVICE (IEDS)

PROVIDES PRO BONO ASSISTANCE TO ENHANCE INDUSTRIAL & URBAN EH&S MANAGEMENT PRACTICES

CONDUCTS

- INSTITUTIONAL & FACTORY ASSESSMENTS
- TECHNOLOGY COOPERATION & TRAINING WORKSHOPS
- STUDY TOURS & OJT FOR EH&S FROM GOVERNMENT & INDUSTRY
- IN-COUNTRY ADVISORS TO MINISTERS OF ENVIRONMENT
- STRATEGIC PLANNING FOR PRESENTATION OF COUNTRY ENVIRONMENTAL ACTION PROGRAM
- ENVIRONMENTAL AND ECONOMIC POLICY ANALYSIS
- ENVIRONMENTAL LAW DRAFTING ASSISTANCE

FUNDING

- USAID COOPERATIVE AGREEMENTS
- U.S.EPA
- WORLD BANK
- ENVIRONMENT CANADA

ACTIVITIES

- 300+ THROUGH JUNE 1993
- 700 HOST-COUNTRY PROFESSIONALS
- 37 COUNTRIES

VOLUNTEERS

- 300+ FROM INDUSTRY, GOVERNMENT, NGOs, ACADEMIA & PRIVATE CITIZENS

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MH 8/27/93

WEC GOLD MEDAL FOR INTERNATIONAL CORPORATE ENVIRONMENTAL ACHIEVEMENT

- HONORS MULTINATIONAL CORPORATIONS HAVING OUTSTANDING SUSTAINED WORLDWIDE ENVIRONMENTAL POLICIES & PRACTICES

- SELECTED BY AN INDEPENDENT INTERNATIONAL JURY OF ENVIRONMENTAL EXPERTS

- PAST RECIPIENTS:

XEROX CORPORATION	1993
PROCTER & GAMBLE	1992
ROHM & HAAS	1991
IBM	1990
DOW	1989
BP	1988
DUPONT	1987
EXXON	1986
3M	1985

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MH 2/18/93

PARTICIPATING INTERNATIONAL ENVIRONMENT FORUM MULTINATIONALS

Air Products and Chemicals, Inc.
Allied-Signal, Inc.
American Cyanamid
American Home Products Corp.
AMP Incorporated
Asea Brown Boveri Inc.
Ashland Oil
AT&T
BASF Corporation
The BF Goodrich Company
BHP Minerals
The Black & Decker Corporation
Borden, Inc.
Bristol-Myers Squibb Company
The British Petroleum Co. p.l.c.
Colgate-Palmolive Company
Compaq Computer Corporation
Digital Equipment Corp.
The Dow Chemical Company
Duracell Inc.
Eastman Kodak Company
E. I. Du Pont de Nemours & Co.
Société Nationale Elf Aquitaine
Engelhard Corporation
Exxon Corporation
Ford Motor Company
General Electric Co.
Hercules Incorporated
Hoechst Celanese Corp.
IBM Corp.
ICI Americas Inc.
ITT Corporation
Johnson & Johnson
Merck & Company, Inc.
Mobil Oil Corporation
Motorola Inc.
Noranda Inc.
Northern Telecom Ltd.
Occidental Petro Corp.
Pfizer Inc.
PPG Industries, Inc.
Procter & Gamble Co.
Rohm and Haas Co.
Sandoz Technology Ltd.
S.C. Johnson & Son, Inc.
SB Smithkline Beecham
Schering-Plough Corp.
STATOIL
Texaco Inc.
3M
TRW Inc.
Union Carbide Corp.
United Technologies
W.R. Grace & Co.
Warner-Lambert Co.
Westinghouse Electric
Westvaco Corporation
Whirlpool Corporation

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MISSION: The World Environment Center contributes to sustainable development worldwide by strengthening industrial and urban environmental, health and safety policy and practices.

World Environment Center Activities in Egypt and the Near East

Regional: Over the past two years, WEC has worked with USAID under the Project in International Development and Environment (PRIDE) to address industrial and environmental problems in the Near East.

Using experts, usually with 20 to 40 years of industry experience, WEC has conducted plant environmental, health and safety assessments and, using the considerable experience of the experts, identified very specific in-process opportunities to prevent and reduce pollution.

In addition to assessments, WEC has conducted pollution prevention workshops, sponsored participants at workshops and responded to requests from USAID missions in the region.

Egypt: During the last two years, WEC has conducted five plant assessments and a workshop and participated in an APELL workshop. Assessments have been conducted in the following industries:

- **cement**
- **food processing**
- **printing and packaging**
- **pulp and paper**

Two assessments in the cement industry led WEC to conduct a workshop in March, 1993 in conjunction with Suez Cement Company. This program trained some 50 people in operation and maintenance of air pollution control equipment. Follow-up is planned with Suez Cement.

WEC plans to introduce its waste minimization demonstration projects to the region. These year-long projects, one of which will be staged in Egypt, identify major pollution problems, develop prevention measures and work with plant personnel to implement those proposals to achieve measurable results. The plant is expected to aid WEC in information dissemination and training which would contribute to industry-wide reductions in pollution.

Jordan & Tunisia: WEC has conducted 19 plant assessments, and sponsored participants to three workshops in the U.S. The industries addressed in these countries were:

- **cement**
- **chemical**
- **edible oils and detergents**
- **lead acid batteries**
- **paint**
- **recycled paper and cardboard**
- **tanning**
- **yeast**

WEC looks forward to continued work with USAID and PRIDE on pollution prevention projects in the region.

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Frank T. Wood
Senior Vice President, Technical Programs

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MISSION

The World Environment Center contributes to sustainable development worldwide by strengthening industrial and urban environmental, health and safety policy and practices.

To achieve this mission, the Center:

- Maintains an independent and non-advocacy position.
- Seeks to integrate environment, economics, energy and education.
- Establishes and promotes partnerships among industry, government and non-governmental organizations.
- Serves as a bridge for the exchange of information and expertise among industry, government and non-governmental organizations.
- Provides training and technical cooperation programs staffed by volunteer and other experts from industry, government, academia, non-governmental organizations and the general public.
- Encourages corporate environmental leadership and responsibility worldwide by providing international public recognition for outstanding accomplishments.

HISTORY

The World Environment Center is a not-for-profit, non-advocacy environmental organization. Although independent since 1981, WEC was founded in 1974 with seed funding from the United Nations Environment Programme. Today the Center is funded by industry, government, international organizations, corporate or private foundations and private citizens.

Initially, WEC published the bi-weekly World Environment Report and a number of environmental information directories. In 1977, the Center made a conscious decision to draw industry into the environmental policy dialogue with the creation of its International Environment Forum (see IEF).

In 1981, WEC held the first of four major conferences on the links between the environment and development, drawing representatives from industry, government, non-governmental and international organizations, academia and the media from countries around the world.

In 1982, after earlier pilot activities, WEC launched an industry and government supported pro bono environmental technology transfer program, the International Environment and Development Service (see IEDS).

In 1985, the first WEC Gold Medal for International Corporate Environmental Achievement was presented.

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PROGRAMS

International Environment Forum (IEF)

The IEF is a group of 57 major multinational manufacturing corporations based in eight countries and engaged in nine industrial sectors with operations on six continents. The IEF meets quarterly for off-the-record discussions of environmental, health, safety and resource management issues with senior policy-makers from around the world.

WEC offers the IEF proprietary programs, including the Country Profile Program which, through reports produced by and for IEF companies, supplies detailed information on environmental, health and safety requirements in over 20 countries worldwide.

WEC offers workshops that promote the inter-sectoral exchange of information and experience in such subjects as corporate international environmental management, environmental auditing, waste minimization, total product life-cycle analysis and waste remediation practices. Additionally, WEC coordinates the joint development of training programs to provide IEF companies cost-effective, culturally-relevant solutions to the steadily increasing need to transfer skills, technology and information to operations worldwide.

International Environment and Development Service (IEDS)

Using volunteers and other experts, contributed services and materials from industry, government, academia and non-governmental organizations, IEDS provides pro bono assistance worldwide to enhance industrial and urban environmental, health and safety management policy and practices. To accomplish this, IEDS conducts:

* institutional and factory assessments;
* technology cooperation and training workshops; and
* study tours and on-the-job internships for environmentalists and government and industry officials.

Travel and management costs are funded primarily through cooperative agreements with the U.S. Agency for International Development. Other funding comes from industry, the U.S. Environmental Protection Agency, the World Bank and private citizens. More than 250 activities have provided opportunity to work with or training for 700 professionals from 28 countries.

WEC Gold Medal for International Corporate Environmental Achievement

The WEC Gold Medal honors multinational corporations having outstanding, sustained and well-implemented, worldwide environmental policies. It may be awarded annually by an independent international jury of distinguished environmentalists from academia, government, non-governmental organizations and the medal-winning company of the previous year. Past recipients of the WEC Gold Medal are Xerox Corporation (1993), The Procter & Gamble Company (1992), Rohm and Haas Company (1991), IBM Corporation (1990), The Dow Chemical Company (1989), The British Petroleum Co. p.l.c. (1988), E.I. du Pont de Nemours & Co. (1987), Exxon Corporation (1986) and 3M (1985).

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World Environment Center
Industrial Waste Minimization Assessment Program
Indonesian Pulp and Paper Industry

U.S. Study Tour - October 1993

The World Environment Center (WEC), through a cooperative agreement with the United States Agency for International Development (USAID) in Indonesia, is supporting sustainable development by strengthening industrial and urban health, safety and environmental management policy and practices in industry and government in Indonesia. WEC is demonstrating, through the cooperation of pro bono U.S. technical experts, the environmental and economic benefits resulting from low cost/no cost waste minimization techniques in the pulp and paper industry.

Waste minimization assessments have been conducted at four Indonesian pulp and paper facilities over the past fourteen months. The waste minimization assessments focussed on the identification of low cost/no cost practices and techniques that can reduce the discharge of pollutants and provide economic incentives. Upon completion of these assessments, a technical waste minimization workshop for the pulp and paper industry was held in Jakarta for 40 industry, government and non-government managers and design engineers. The workshop summarized assessment observations, presented Indonesian waste minimization success stories, and provided the sharing of waste minimization experience from Indonesian industries to other Indonesian industries.

WEC is currently coordinating a U.S. study tour for six Indonesian representatives (two from government and four from industry). The objective of the U.S. study tour is to provide managers and design engineers with intensive training in waste minimization programs and practices in the pulp and paper industry in the U.S. The anticipated date is October 1993 for the U.S. study tour.

WEC requests a host facility to participate in the U.S. study tour. A one to two day visit per facility is desired so that a thorough facility tour may be provided, and meetings with persons responsible for wastewater management, waste management and waste minimization programs may be held. Upon return to Indonesia, the study tour participants will conduct a waste minimization workshop for the Indonesian pulp and paper industry detailing their experiences in the U.S. and in Indonesia.

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Business Day

WEDNESDAY, OCTOB

The New York Times

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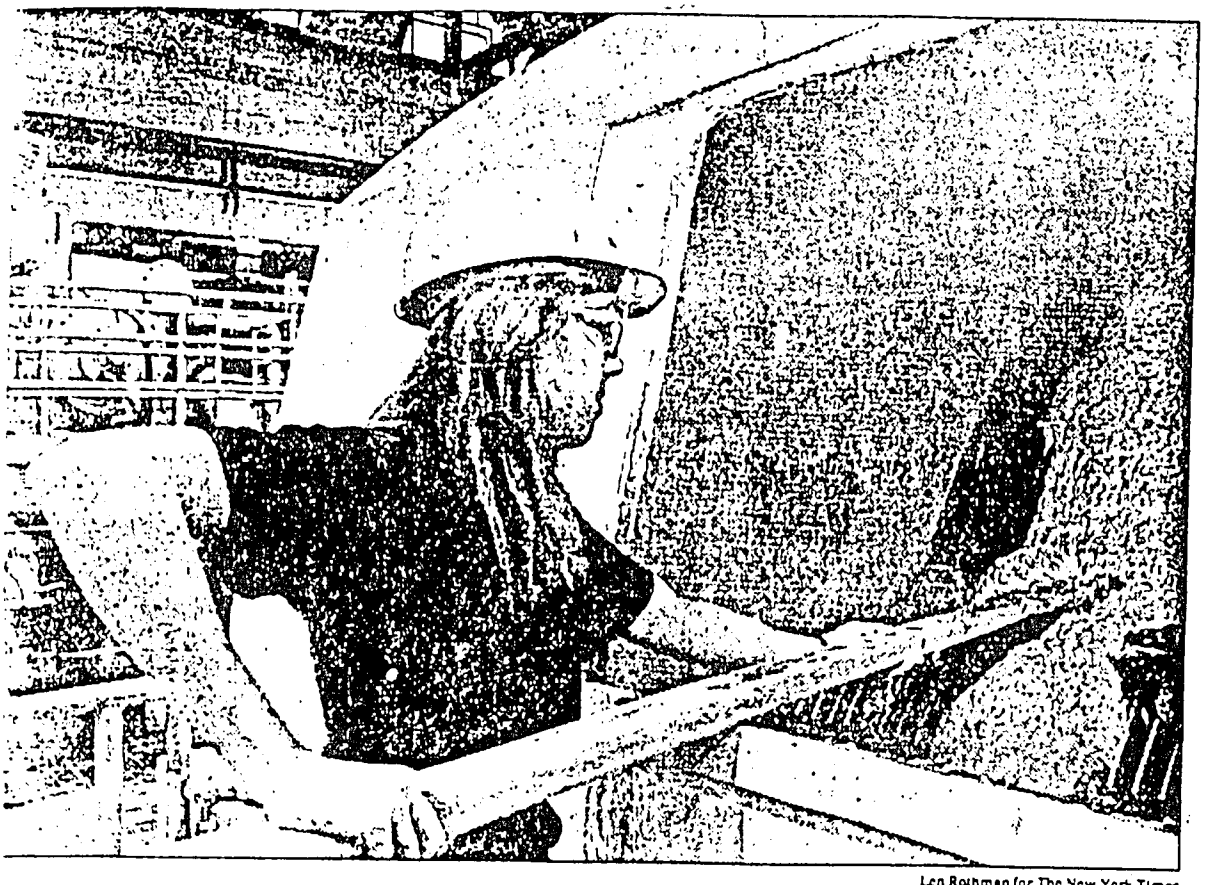

Len Rothman for The New York Times.

The Union Camp Corporation plans to have its Franklin, Va., plant producing paper with 30 percent recycled content by 1995. Rhenda Tindall checks pulp that has been bleached with ozone, rather than chlorine.

Paper Maker Turns a Cleaner Page

By JOHN HOLUSHA

Special to The New York Times

FRANKLIN, Va. — At a time when many in the paper industry are resisting environmentalists' calls for more recycled fiber and less use of chlorine in paper making, the Union Camp Corporation stands out as a company that has voluntarily taken these steps.

At the sprawling paper plant here on the bank of the sleepy Blackwater River, a few miles from the North Carolina border, a confluence of history, geography and economics has led to the "greening" of Union Camp.

To ease the burden on the shallow river, the company last year started a bleaching line that uses ozone, a form of oxygen, instead of chlorine, a toxic water pollutant. And the company is now installing equipment that will remove ink from paper that is retrieved from trash bins, so the recycled fibers can go into new paper.

A manufacturer pursues a greener market.

That means fewer trees will have to be cut — no small consideration at a factory that is one of the world's largest producers of fine-finish writing and printing paper, rolling out 2,000 tons of the products each day.

Such actions by a big paper company delight environmentalists, who say the moves refute industry arguments that eliminating chlorine and adding a substantial amount of recycled paper are either technically impossible or not economic.

"It is important to recognize that this is one of the largest and most profitable fine-paper mills in the world," said Lauren Blum, a staff scientist at the Environmental Defense Fund. "It shows that this environmental stuff makes economic sense."

Indeed, Charles H. Greiner Jr., a Union Camp vice president and manager of its fine-paper division, described the investment of $108 million in the recycling equipment as "a market-driven decision."

"Customers want recycled products," he said. "There is a growing awareness that waste is a form of pollution, and that will keep demand for recycled paper high."

The paper industry and environmental groups are often at odds, if

Continued on Page D5

7,000 Dr Jobs to E Elimina

Most Cuts Wi In New York

By MILT FREUDEN

Amid growing pressure health care costs, thre makers announced pla to cut 7,000 employees o three years, adding to t sands of pharmaceuti jobs eliminated in recent

Many of those jobs wi New York and New Jer large multinational drug maintain headquarters, r oratories or factories. B companies, Pfizer, Ameri mid and Upjohn, declined the cuts would be distrib their worldwide operation tell the workers affected.

Pfizer said yesterday eliminating 3,000 jobs to changes, which, it said, formed drug making in fragile industry." The cor it had already eliminated previously unannounced after it sold or spun off 14

Pfizer is one of the lar facturers still based in City, which has lost at manufacturing jobs since company has 3,400 emplo city and nearly 13,000 in state region, and yesterda would not leave New Yorl

Spreading the Pain

"There will just be here," said Henry A. M Pfizer executive vice pres

He added that the new be spread over 40,000 wo nations and would includ tirements and dismissals. ing will get extra pay and

American Cyanamid, Wayne, N.J., said it wo jobs — about 9 percent of — over three years. Most c be in medical divisions, wh Lederle Laboratories unit and in Pearl River, N.Y.

Upjohn, based in Mich., said it would elim jobs through early retir December 1994 and close the size of 14 of 31 factor

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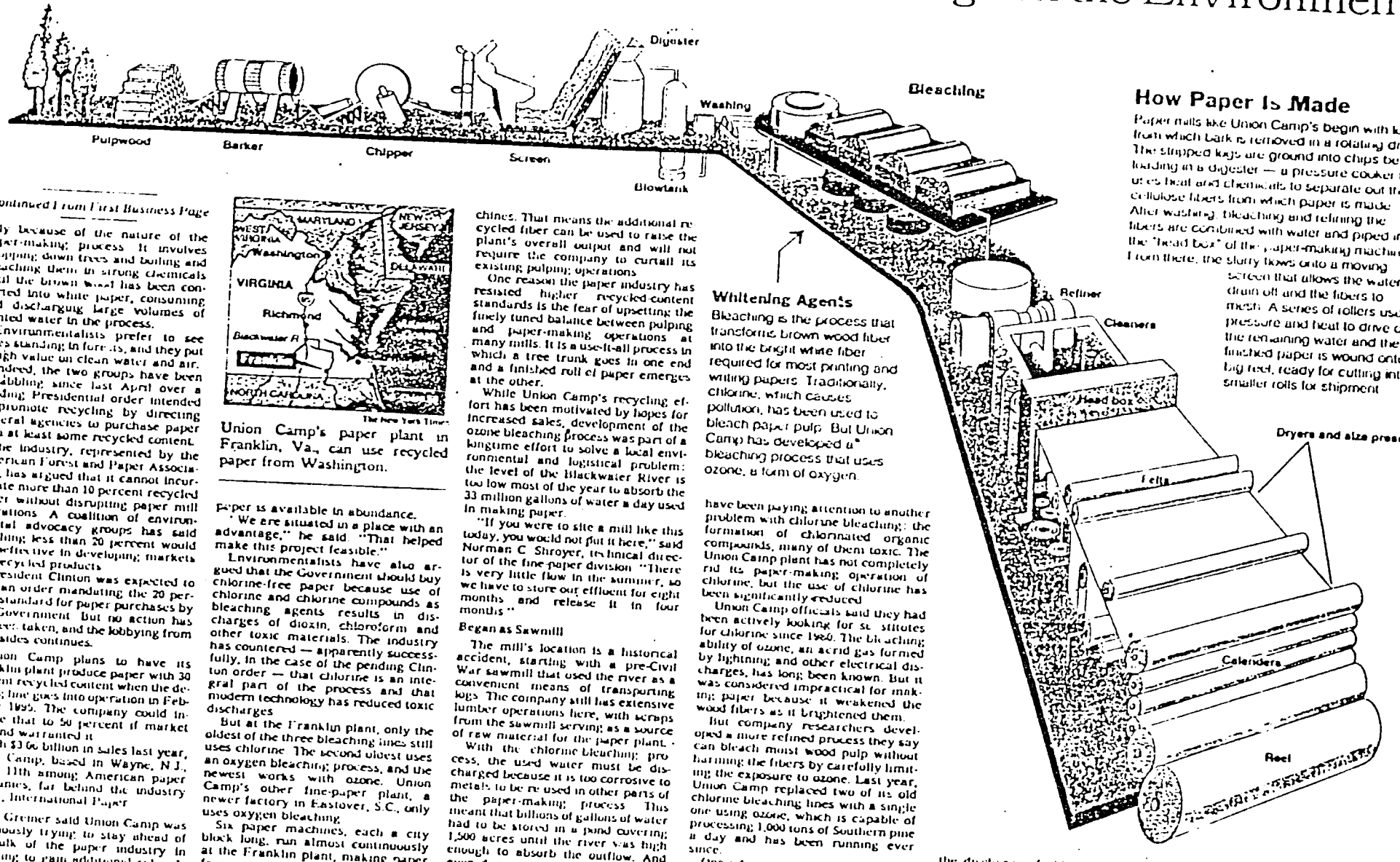
A Union Camp Paper Plant Turns a Cleaner Page on the Environment



How Paper Is Made

Paper mills like Union Camp's begin with logs, from which bark is removed in a rotating drum. The stripped logs are ground into chips before loading in a digester — a pressure cooker that uses heat and chemicals to separate out the cellulose fibers from which paper is made. After washing, bleaching and refining the fibers are combined with water and piped into the "head box" of the paper-making machine. From there, the slurry flows onto a moving screen that allows the water to drain off and the fibers to mesh. A series of rollers use pressure and heat to drive off the remaining water and the finished paper is wound onto a big reel, ready for cutting into smaller rolls for shipment.

Whitening Agents

Bleaching is the process that transforms brown wood fiber into the bright white fiber required for most printing and writing papers. Traditionally, chlorine, which causes pollution, has been used to bleach paper pulp. But Union Camp has developed a bleaching process that uses ozone, a form of oxygen.

Continued From First Business Page

only because of the nature of the paper-making process. It involves chopping down trees and boiling and bleaching them in strong chemicals until the brown wood has been converted into white paper, consuming and discharging large volumes of tainted water in the process.

Environmentalists prefer to see trees standing in forests, and they put a high value on clean water and air.

Indeed, the two groups have been squabbling since last April over a pending Presidential order intended to promote recycling by directing Federal agencies to purchase paper with at least some recycled content.

The industry, represented by the American Forest and Paper Association, has argued that it cannot incorporate more than 10 percent recycled paper without disrupting paper mill operations. A coalition of environmental advocacy groups has said anything less than 20 percent would be ineffective in developing markets for recycled products.

President Clinton was expected to sign an order mandating the 20 percent standard for paper purchases by the Government. But no action has yet been taken, and the lobbying from both sides continues.

Union Camp plans to have its Franklin plant produce paper with 30 percent recycled content when the deinking line goes into operation in February 1995. The company could increase that to 50 percent if market demand warranted it.

With $3.66 billion in sales last year, Union Camp, based in Wayne, N.J., ranks 11th among American paper companies, far behind the industry leader, International Paper.

Mr. Greiner said Union Camp was consciously trying to stay ahead of the bulk of the paper industry in recycling to gain additional sales. It also wants to take advantage of the mill's relative proximity to the urban "forests" of Washington, Philadelphia and New York, where used office paper is available in abundance.

"We are situated in a place with an advantage," he said. "That helped make this project feasible."

Environmentalists have also argued that the Government should buy chlorine-free paper because use of chlorine and chlorine compounds as bleaching agents results in discharges of dioxin, chloroform and other toxic materials. The industry has countered — apparently successfully, in the case of the pending Clinton order — that chlorine is an integral part of the process and that modern technology has reduced toxic discharges.

But at the Franklin plant, only the oldest of the three bleaching lines still uses chlorine. The second oldest uses an oxygen bleaching process, and the newest works with ozone. Union Camp's other fine-paper plant, a newer factory in Eastover, S.C., only uses oxygen bleaching.

Six paper machines, each a city block long, run almost continuously at the Franklin plant, making paper from a mixture of Southern pine and hardwoods.

As part of its recycling program, Union Camp is increasing the capacity of some of its paper-making machines. That means the additional recycled fiber can be used to raise the plant's overall output and will not require the company to curtail its existing pulping operations.

One reason the paper industry has resisted higher recycled-content standards is the fear of upsetting the finely tuned balance between pulping and paper-making operations at many mills. It is a use-it-all process in which a tree trunk goes in one end and a finished roll of paper emerges at the other.

While Union Camp's recycling effort has been motivated by hopes for increased sales, development of the ozone bleaching process was part of a longtime effort to solve a local environmental and logistical problem: the level of the Blackwater River is too low most of the year to absorb the 33 million gallons of water a day used in making paper.

"If you were to site a mill like this today, you would not put it here," said Norman C. Shroyer, technical director of the fine-paper division. "There is very little flow in the summer, so we have to store our effluent for eight months and release it in four months."

The New York Times

Union Camp's paper plant in Franklin, Va., can use recycled paper from Washington.

Began as Sawmill

The mill's location is a historical accident, starting with a pre-Civil War sawmill that used the river as a convenient means of transporting logs. The company still has extensive lumber operations here, with scraps from the sawmill serving as a source of raw material for the paper plant.

With the chlorine bleaching process, the used water must be discharged because it is too corrosive to metals to be re-used in other parts of the paper-making process. This meant that billions of gallons of water had to be stored in a pond covering 1,500 acres until the river was high enough to absorb the outflow. And even during the river's highest seasons, the dark colored water from the bleaching process was running afoul of regulations on water clarity.

Lately, environmentalists and pollution control officials in many states have been paying attention to another problem with chlorine bleaching: the formation of chlorinated organic compounds, many of them toxic. The Union Camp plant has not completely rid its paper-making operation of chlorine, but the use of chlorine has been significantly reduced.

Union Camp officials said they had been actively looking for substitutes for chlorine since 1980. The bleaching ability of ozone, an acrid gas formed by lightning and other electrical discharges, has long been known. But it was considered impractical for making paper because it weakened the wood fibers as it brightened them.

But company researchers developed a more refined process they say can bleach moist wood pulp without harming the fibers by carefully limiting the exposure to ozone. Last year, Union Camp replaced two of its old chlorine bleaching lines with a single one using ozone, which is capable of processing 1,000 tons of Southern pine a day and has been running ever since.

One advantage of ozone bleaching is that the residues from the process are not corrosive, so the water can be recycled and chemicals that are pulled out of the pulp can be recovered. That, and the virtual certainty of Federal rules [illegible] the discharge of chlorotoxins drove the company to develop the process, officials say. It is not totally chlorine free, since chlorine dioxide is used to brighten the pulp, but the majority of the substance has been removed.

Mr. Greiner said the [illegible] ny a competitive advantage when regulation tightens because the system was added as the old lines were becoming obsolete anyway.

"We may not eliminate chlorine [illegible]

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WEC WASTE MINIMIZATION PROJECTS INDONESIA: 1992-PRESENT

1992:

May: Waste minimization assessment of three metal finishing plants, followed by a one-day workshop/seminar on waste minimization. Two WEC-sponsored U.S. experts visited the facilities.

June: Waste minimization assessment at two pulp and paper facilities. This assessment involved observation of the current waste minimization/pollution control activities and facility operation. Two WEC-sponsored U.S. experts visited the facilities.

August: Workshop in Los Angeles, California to develop a comparative city case study on mobile sources of air pollution, in preparation for "Megacities" conference, 1993, Jakarta.

October-November: Second round of waste minimization assessment for the Pulp and Paper industry. One facility was visited by a WEC-sponsored U.S. expert.

December: Waste minimization assessments of 5 textile plants in Bandung, Indonesia followed by a one-day workshop/discussion to review audit results with plant managers. Two WEC-sponsored U.S. experts participated in the waste minimization assessments.

1993

February: WEC sponsored the "Megacities on the Pacific Rim and the Burden of Air Pollution" conference in Jakarta, Indonesia. This conference and working session addressed air quality concerns of eight major urban centers in the Pacific Rim. Topics included: Stationary sources; Mobile sources; Health and economic concerns; Institutional and regulatory frameworks.

April: Third round of waste minimization assessments for the Pulp and Paper industry. Four Indonesian Pulp and Paper facilities were visited by three WEC-sponsored U.S. experts.

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June: Second round of waste minimization assessments at metal finishing facilities. Eight facilities were visited by two WEC-sponsored U.S. experts.

July: Pulp and Paper Workshop:

This workshop was specifically designed to follow the pulp and paper plant waste minimization assessments conducted during the past year, by the three experts who performed those assessments. The workshop addressed industry-wide needs identified during the assessments. These needs included improved sampling and analysis of waste streams, knowledge of raw material used, and knowledge of manufacturing/waste minimization principles and assessment practices. Workshop participants will be selected for further intensive training with the agreement that they serve as waste minimization trainers for the Pulp and Paper industry.

October: Metal Finishing Workshop:

This workshop was designed to follow up waste minimization assessments in the Metal Finishing industry sector conducted during the past year. The workshop addressed: Environmental management programs and waste minimization principles and assessment practices in the following areas: Electroplating, wastewater treatment, principles of rinsing, cyanide (chemical) safety and control, recycling and recovery, process modification.

October: Two week Pulp and Paper Study Tour of medium sized pulp and paper facilities in the United States.

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APPENDIX 8

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ncasi

technical review

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC. 260 MADISON AVENUE, NEW YORK, N.Y. 10016

Bulletin No. 53

January 31, 1992

CURRENT LISTING AND INDEX OF NCASI TECHNICAL BULLETINS AND SPECIAL REPORTS

This issue of the Technical Review is a listing and index of NCASI Technical Bulletins issued since July 1, 1981 and Special Reports issued since January 1, 1986. The past practice of providing a complete listing was discontinued to achieve economy, yet provide the readership with a current guide to these materials. Bulletins no longer listed are available on request by member companies. The subject index continues to cover the complete Technical Bulletin series. The Technical Bulletins and Special Reports are listed in reverse order to that distributed as a reader use accommodation. The distribution of Special Reports, other than to member companies, is by separate request only. Any questions or comments on this listing and index should be directed to Dr. Isaiah Gellman at the address above or at 212-532-9000.

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I LISTING OF TECHNICAL BULLETINS - 600 THROUGH 348 (JANUARY 1991 - JULY 1981)

Number	Title	Date Issued
623	PROCEEDINGS OF A FORUM ON ECOLOGICAL CHARACTERISTICS OF FLATWOODS SPODOSOL FOREST	1/92
622	A STUDY OF FORMALDEHYDE EMISSIONS FROM WOOD RESIDUE-FIRED BOILERS	1/92
621	ESTIMATING THE MEAN OF DATA SETS THAT INCLUDE MEASUREMENTS BELOW THE LIMIT OF DETECTION	12/91
620	AN ASSESSMENT OF EXPOSURE TO DIOXIN FROM CONSUMPTION OF FISH CAUGHT IN FRESHWATERS OF THE UNITED STATES IMPACTED BY BLEACHED CHEMICAL PULP MILLS	12/91
619	DELIGNIFICATION AND BLEACHING OF CHEMICAL PULPS WITH OZONE: A LITERATURE AND PATENT REVIEW	12/91
618	SUPPLEMENTAL USER'S GUIDE FOR APPLYING THE WASP4 MODEL PROGRAM	9/91
617	REVIEW OF FLOW AND TRANSPORT PROCESSES AFFECTING ORGANIC CHEMICALS IN THE VADOSE ZONE	9/91
616	BLEACH PLANT CHLORINE AND CHLORINE DIOXIDE EMISSIONS AND THEIR CONTROL	9/91
615	CURRENT STATUS OF NONRECYCLABLE PAPER BURNING IN THE FOREST PRODUCTS INDUSTRY	9/91

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614	DEVELOPMENT OF A GAS CHROMATAGRAPHIC PROTOCOL FOR THE MEASUREMENT OF KRYPTON GAS IN WATER AND DEMONSTRATION OF ITS USE IN STREAM REAERATION MEASUREMENTS	9/91
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628	3/92	EFFECTS OF FOREST MANAGEMENT ON SOIL STORAGE
629	3/92	NATURALLY OCCURRING ORGANOHALOGEN COMPOUNDS - A SURVEY
630	3/92	EFFECTS OF CHLORINE DIOXIDE SUBSTITUTION ON BLEACH PLANT EFFLUENT BOD AND COLOR
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641	9/92	SOLID WASTE MANAGEMENT AND DISPOSAL PRACTICES IN THE U.S. PAPER INDUSTRY
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APPENDIX 9

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1. At Laboratory of NCASI, Southern Region Gainsville, South Carolina.

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2. At Laboratory of NCASI, Southern Region Gainsville, South Carolina.

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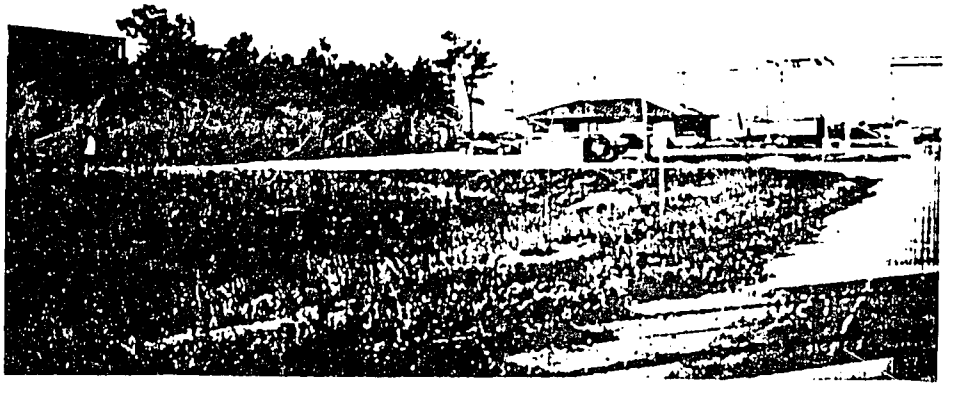
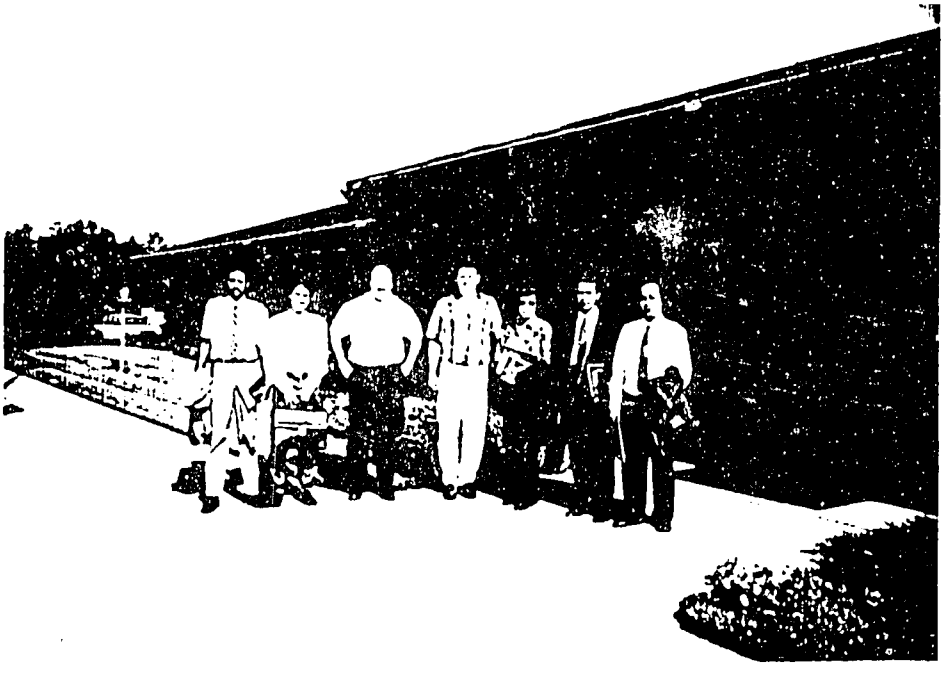
II. WILLAMATTE



1. Willamatte Industries, Inc. Marlboro Mill, Bennettsville, South Carolina.



2. Willamatte Industries, Inc. Marlboro Mill, Bennettsville, South Carolina.

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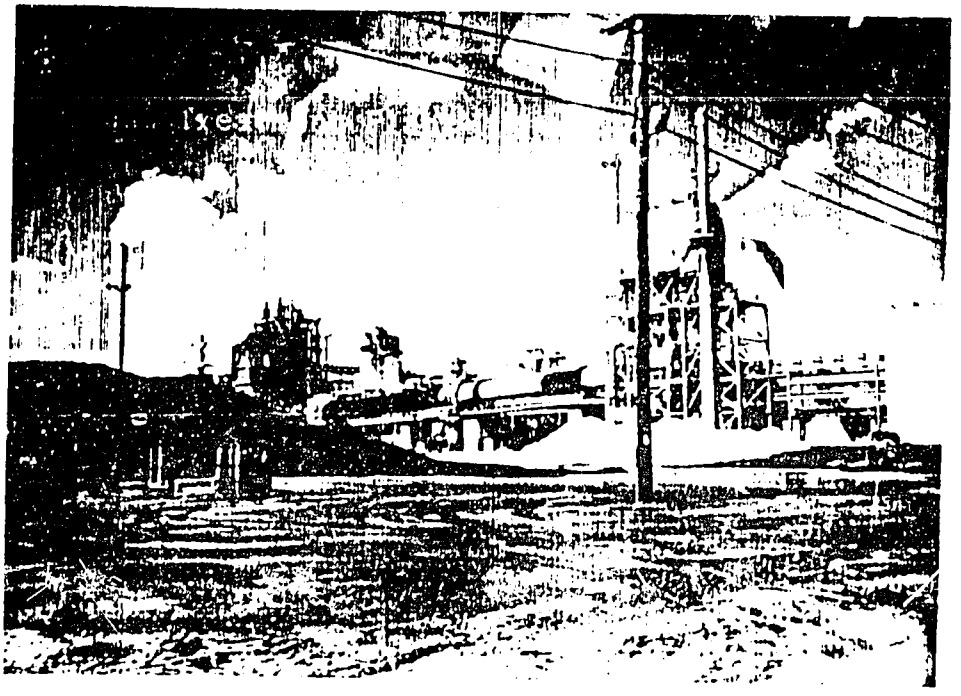
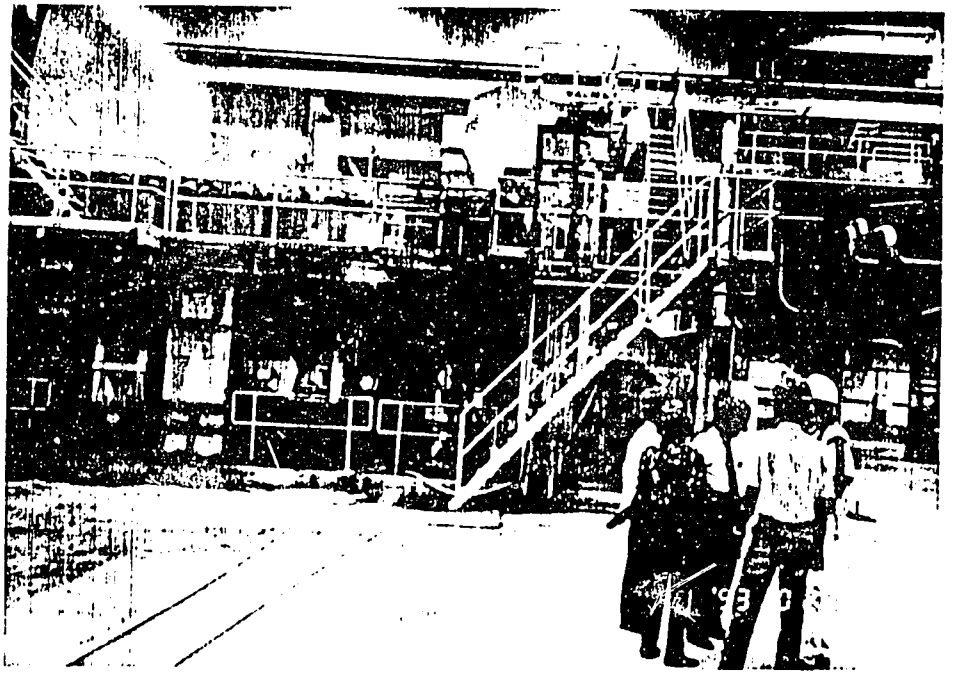


3. Lime Kiln, Recovery Boiler Area



4. Paper Machine

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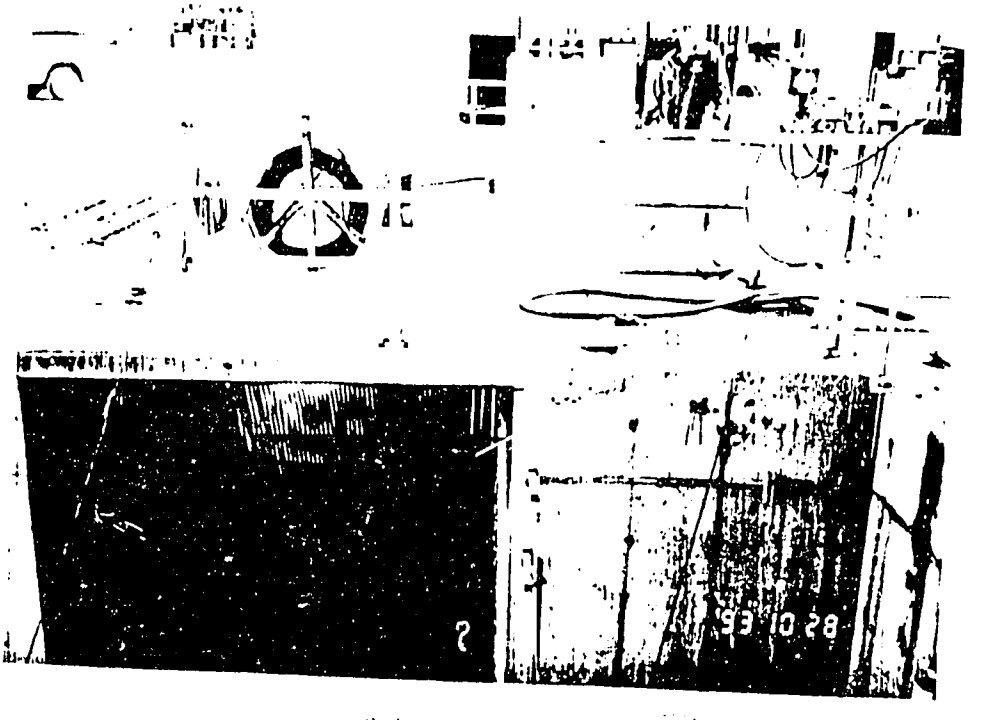
5. Effluent Treatment Plant



6. Bar Screen

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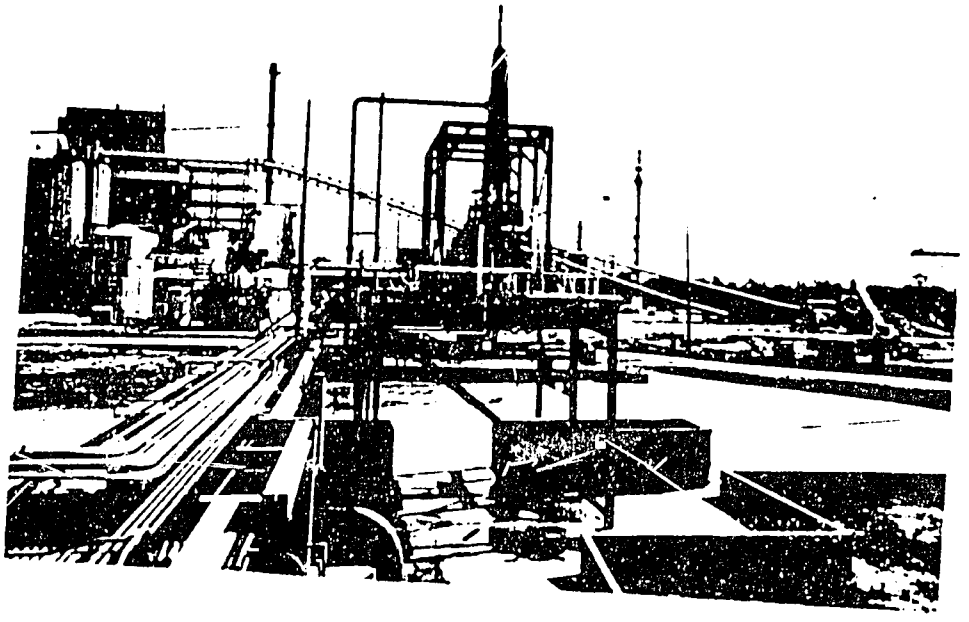

8. Outlet Control Valve of Effluent Treatent Plant

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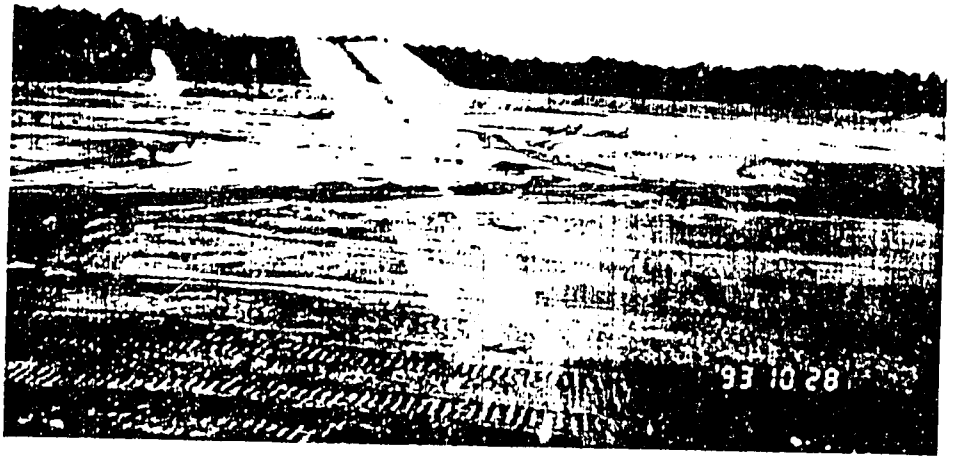
9. Precipitated Calcium Carbonate Using Exhaust Gas from Lime Kiln as Source of CO_2 & Heat



10. Land Fill for Solid Waste Dumping

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III. SONOCO

1. Anaerobic Horizontal Treatment Reactor

2. Anerobic & Aerobic Treatment Plant

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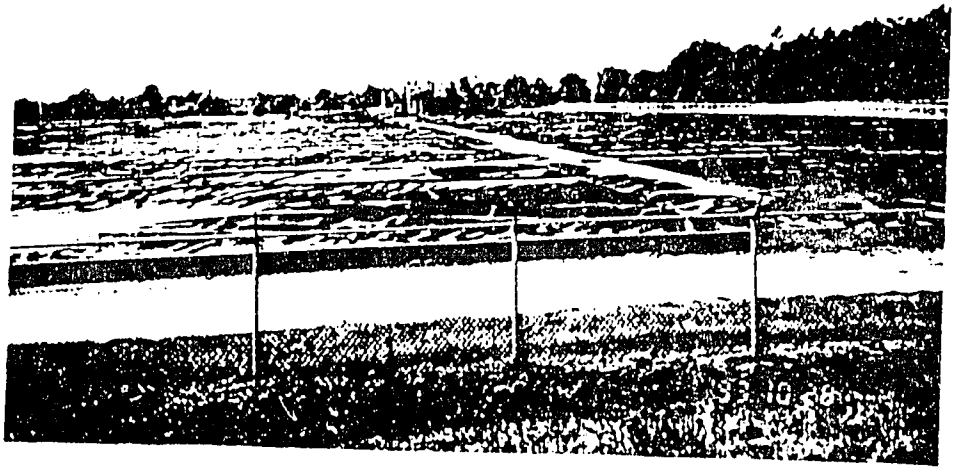
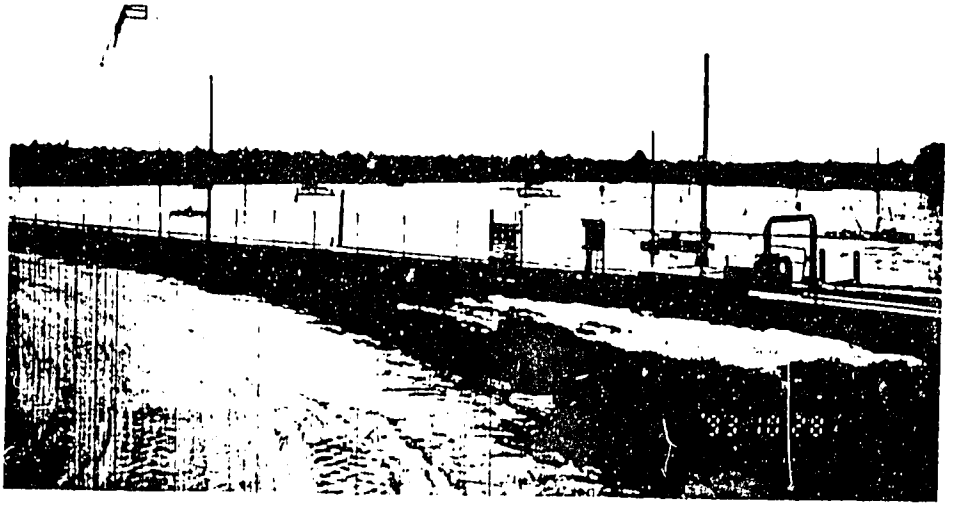


3. Cover of HDPE for Anaerobic Treatment



4. Float & Submerge type Aerator

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5. Kiln for Incinerating of Black Liquor & Na_2CO_3 Recovery

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IV. UNION CAMP, FINE PAPER

1. Division

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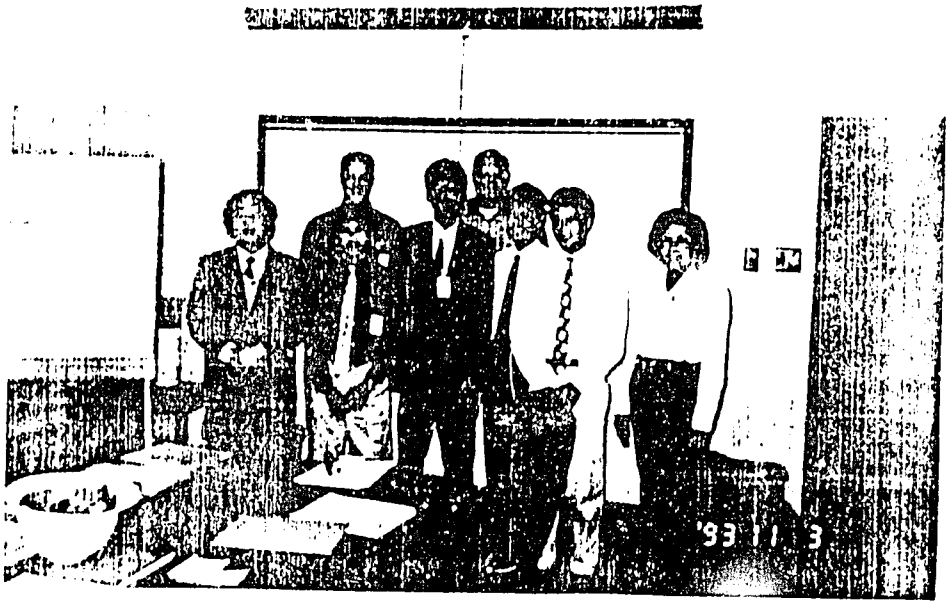
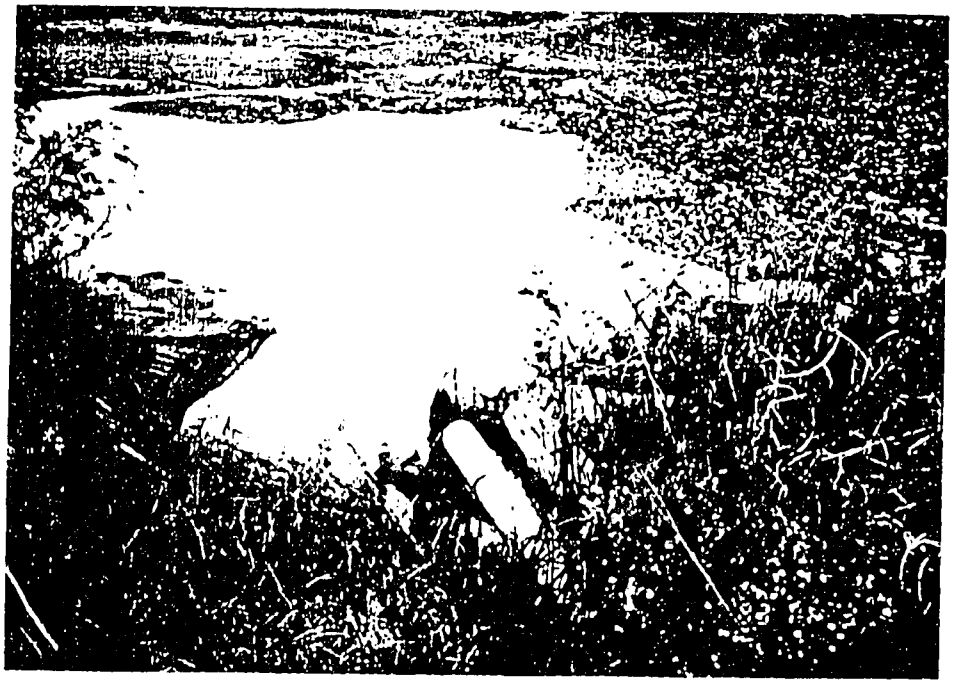
V. WEYERHAEUSER



1. At Weyerhaeuser, Flint River Operations



2. Intake Lean Black Liquor to ASB

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3. Aerated Stabilization Basin

4. Aerated Stabilization Basin

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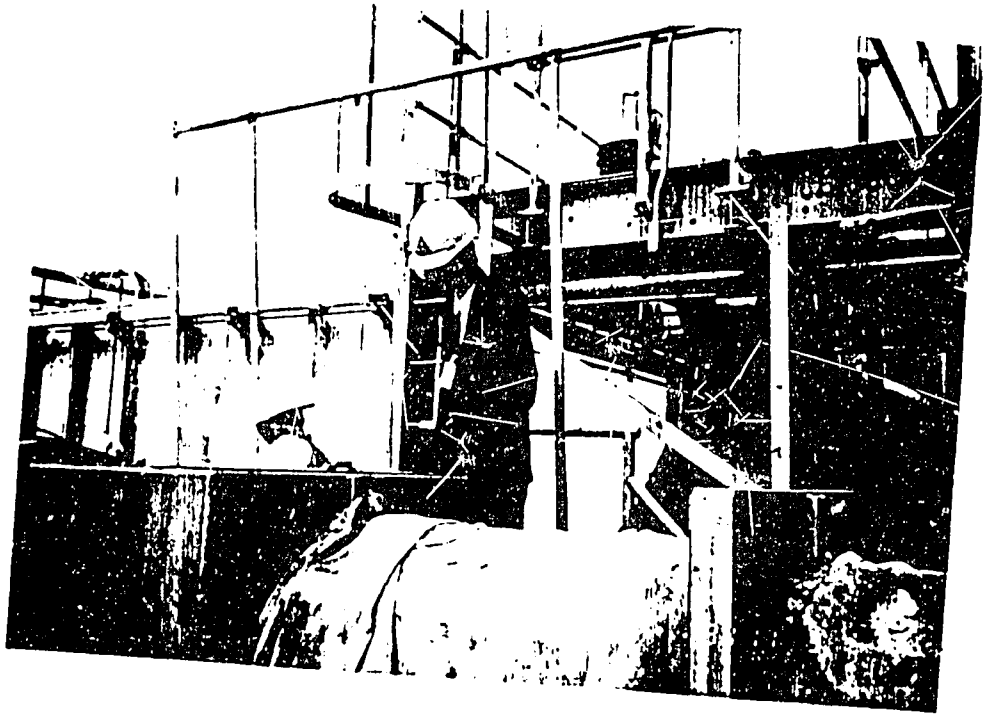

5. Screw Press, with Steam Heating

6. Outlet of Waste Water to River

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7. Land Fill for Solid Waste

8. Collecting Nozzle for Leachy to Collect Rain Water at Land Fill

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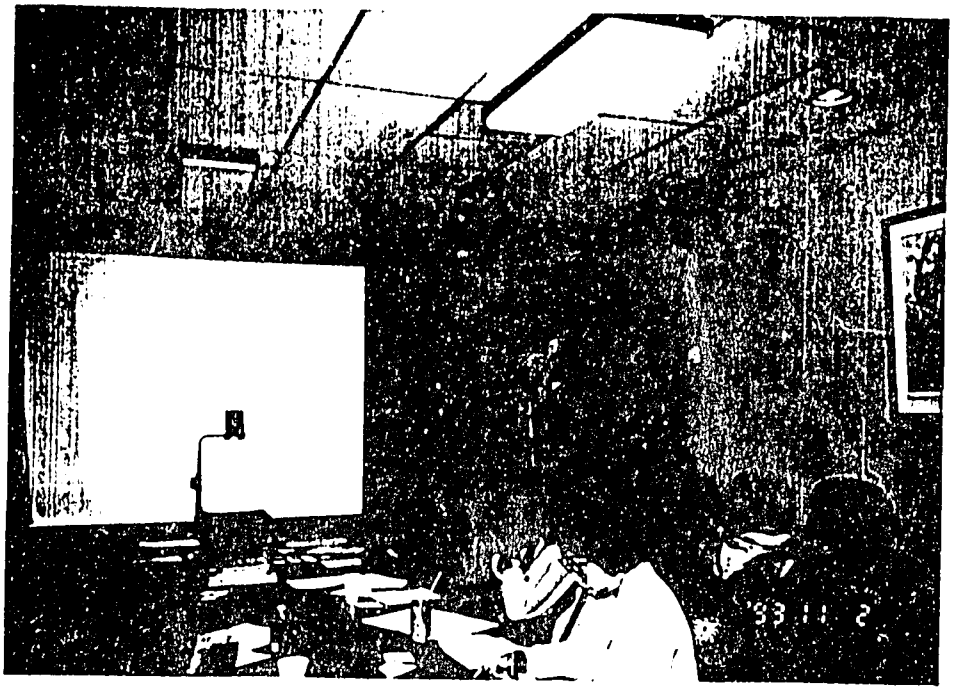
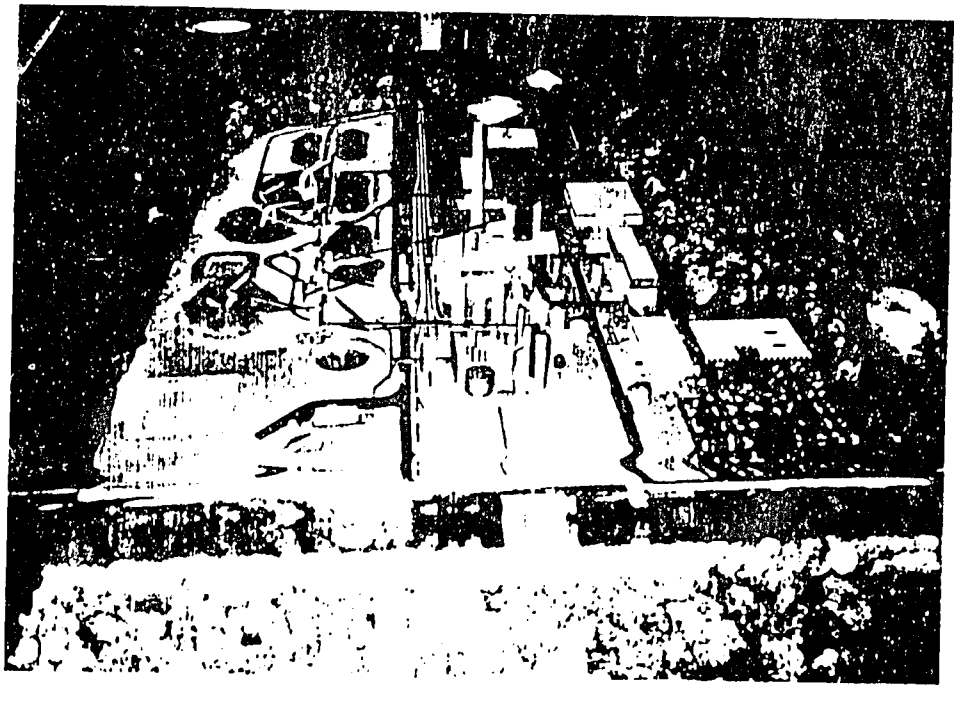


9. Mr Frank D. Wohrley
   at Meeting Room of Weyerhaeuser



10. Miniature of Weyerhaueser, Flint River Operation

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VI. At WEC, New York

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VII. Meeting with Dr Gellman at NCASI New York

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METAL FINISHING U.S. STUDY TOUR

Volume 1 of 2

(Summary Report)

United States
December 6 - 16, 1993

Prepared for:

US - ASIA ENVIRONMENTAL PARTNERSHIP

WEC

WORLD ENVIRONMENT CENTER

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APPENDICES

A. CONTACT LIST

B. PARTICIPANT REPORTS

I. EXECUTIVE SUMMARY

During December 6-December 16, 1993, delegates representing the Indonesian Metal Finishing Industry participated in an intensive study tour of environmental management practices and technologies implemented in U.S. metal finishing facilities. The delegation, representing three Indonesian metal finishing facilities, one privately funded industry development agency, and two governmental agencies, met with senior managers of U.S. facilities to discuss methods of waste minimization and environmental system/technology management. Particular focus was given to assessing the transferability of technologies and management practices applied to wastewater treatment, water use reduction, metals recovery and health and safety.

Funding for this project was provided through a Cooperative Agreement between the World Environment Center (WEC) and the United States-Asia Environmental Partnership (US-AEP) and the United States Agency for International Development/Jakarta (USAID/Jakarta).

This report summarizes technical reports submitted to WEC by the study tour participants. The individual study tour participant reports are included in Appendix B.

II. INTRODUCTION

In response to the developing and strengthening of environmental regulations in Indonesia, numerous organizations of Indonesia's private and public sectors have initiated efforts to enhance the ability of the metal finishing industry to effectively meet both existing and emerging environmental standards/regulations. Close cooperation between the World Environment Center (WEC), the U.S. Government, the Indonesian Ministry of Industry (MOI), the Environmental Impact Management Agency (BAPEDAL) and private industry has allowed for the development of a comprehensive and integrated WEC Indonesian Waste Minimization Program. The program, which focuses on transferrable no/low cost technology and environmental, safety and health management practices, has effectively demonstrated that coordination and communication between regulatory agencies and industry can result in the development of cost effective initiatives for minimizing waste, enhancing production and efficiency, and improving worker safety and health.

Waste minimization assessments have been conducted at eight Indonesian metal finishing facilities over the past two years. The waste minimization assessments focused on the identification of no and low cost practices and techniques that can reduce the discharge of pollutants and improve worker health and safety. Upon completion of the assessments, a technical waste minimization was held for approximately 40 industry, government and non-government managers and design engineers. The workshop summarized assessment observations, presented case studies of successful Indonesian waste minimization projects, and identified technologies and management practices that would enable the industry to meet the newly emerging environmental regulations.

Following up on the waste minimization assessments and technical workshop, a group of six Indonesian delegates visited the United States to exchange information regarding current technologies and best management practices in 10 metal finishing facilities. The facilities visited include: Metal Surfaces, Inc., Electrolyzing Inc., Wastewater Treatment Systems, Inc., Read Rite Inc., Acteron Corporation, Schlage Lock Co., Santa Clara Plating Co., United Airlines, San Francisco, New United Motors Manufacturing, San Jose Water Pollution Control Plant. Presentations were given to the delegates by Lawrence Livermore Laboratories and Chemical Solutions, Inc.

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III. FACILITY AND MEETING SUMMARIES

DECEMBER 6, 1993

METAL SURFACES, INC., BELL GARDENS, CALIFORNIA

Metal Surfaces, Inc., with a staff size of 140 employees, is located in Los Angeles, California and was established in 1954. Mr. Sam Bell, President, and Mr. Bruce Nielsen, Plant Engineer, met with the delegates and provided them with a facility tour and a question/answer session. The facility specializes in precision plating for aircraft parts, electronic components, and aerospace parts. Specific plating operations include: precision plating on titanium, aluminum, beryllium, tungsten, and continuous plating of gold, nickel, tin and solderplate.

The Metal Surfaces, Inc. facility implements a rack plating process and has an in-house laboratory for testing product quality and developing plating solution. Gold plating is done in a separate area due to cyanide containment concerns. The Study Tour participants viewed the production line lay-out as well as equipment used for material/chemical storage and containment, worker safety equipment, and the wastewater treatment facility. Specific equipment of interest to the delegation was: the atomic absorption analyzer, microderm thickness checker, and the betascope thickness checker.

Processes implemented by the facility to minimize waste include: intensive house keeping management, efficient rack/line orientation, drip shields at all plating tanks, extended drip time over the plating tanks, spray rinsing.

The delegation was particularly interested in efforts made by the facility in chemical handling and storage. Metal Surfaces separates all of their chemicals and wastes into the following categories: hazardous/non-hazardous, recyclable material, flammable material, reactive, corrosive and toxic substances. All separated chemical and wastes are clearly marked and stored in an appropriate manner, e.g., all toxic substances are marked and placed in a contained, spill-proof area.

The wastewater treatment facility was constructed on-site in 1987 at a cost of approximately U.S. $1.5 million. The total capacity of the system is 40,000 gallons/day and sludge produced is approximately 200 tons per day. Sludge produced by the wastewater treatment process is then sold (for approximately U.S. $158.00/ton) to a mining company for recycling of heavy metals, e.g., copper, gold, nickel. Most of the wastewater is treated by chemical precipitation settling in clarification tanks.

DECEMBER 7, 1993

ELECTROLIZING INC., LOS ANGELES, CALIFORNIA

Jack Morgan, Plant Manager, met the delegation and provided them with a facility tour and description of Electrolizing's plating process. Electrolizing, which has a staff size of 40 employees, specializes in a coating process that uniformly deposits a dense, hard, high chromium, non-magnetic alloy on the surface of the base metal. The coating has a Rockwell C Hardness value of 67-72 and is deposited with a deposit thickness ranging from .000025" to 0006", with tolerances held from approximately 00001' to .0001". Electrolizing Inc. services the aerospace industry and is exploring applications in the data processing and computer industry.

The delegation was impressed by the ability of the electrolizing processes to coat most geometric shapes, including holes ad intricate configurations. Electrolyzed parts last approximately 2 to 10 times longer than non-electrolyzed parts and also reduces friction, seizure and corrosion.

The delegates noted the need for future application of the electrolizing process in the Indonesian computer and aviation industries.

The facility's wastewater treatment system, which occupies a space of only 40 m^2, has a capacity of approximately 3000 gallons/day and the total amount of sludge produced daily is approximately 20 tons. The delegates were interested in the low operating cost of wastewater treatment, which averages approximately 7% to 10% of the total production cost. Low water treatment cost was achieved through effective chemical precipitation and water recycling.

DECEMBER 9, 1993

LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL)

Mr. Jack Dini, Section Leader, Materials Fabrication Division and Mr. Chris Steffani, Engineer, met with the delegates in the San Francisco Bay area to discuss electroplating practices implemented at LLNL. Please see the attached summary of the LLNL presentation.

DECEMBER 10, 1993

WASTEWATER TREATMENT SYSTEMS INC. (WTS), SUNNYVALE, CALIFORNIA

Mr. John B. Strandberg, P.E., Senior Chemical Engineer, met the delegates and provided them with technical information regarding the various WTS systems and gave a brief tour of the production facility. WTS manufactures packaged industrial waste water treatment systems and provides technical and management support to industries implementing WTS treatment systems.

The delegates received a briefing regarding two specific WTS treatment systems: the HMR Packaged Chemical Precipitation and Clarification System, and the Batch Master Factory Assembled Batch Treatment System.

The HMR is a skid mounted wastewater treatment unit which incorporates separate chambers that perform the following processes:

- Chemical Pretreatment/Precipitation
- Pre-clarification pH adjustment
- Precipitate Flocculation
- Precipitate Clarification
- Sludge Thickening
- Effluent Clear Well

The system is usually supplied with the appropriate sludge processing equipment, effluent filtration equipment, reagent holding tanks, and lift stations. This system has been successfully utilized in the metal finishing industry in both the United States and abroad.

The delegates were impressed by the system's efficiency, as most of the HMR's processes are automatically regulated, e.g., pre-clarification pH adjustment, and they also adjustment that automation of pH monitoring and chemical precipitation could greatly enhance the Indonesian wastewater treatment, as many emissions violations are due to human error and insufficient monitoring.

The Batch Master treatment system was designed to process wastewater from industries with low volumes of process water, hence a continuous flow facility would not be appropriate for this system. The system is also automated and is designed to treat effluents containing the following effluents:

- Hydrofluoric Acid
- Heavy Metals
- Cyanide
- Acids
- Caustics
- Arsenic
- Iron
- Suspended Solids

Components of the Batch Master viewed by the delegates include: process treatment chambers, chemical feed equipment, and the programmable process controller. Again, the delegates found this system to be highly attractive for small, specialized metal finishing industries in Indonesia.

DECEMBER 13, 1993

READ RITE INC., SUNNYSIDE, CALIFORNIA

Read Rite Inc., produces computer components such as floppy disks, hard disks, and disk drive components. The metal finishing services entail mostly precision nickel plating. Due to the sensitive and competitive nature of the computer industry, the delegates were not allowed to enter into the plating/production facility, however, a detailed tour of the waste treatment system was allowed.

Mr. Mark Rothweiler, Manager of Read Rite Operations, briefly met with the delegates, providing them with an overview of the plating process used. Mr. Jim Elliott, Marketing Manager of Process Scientific Inc., (PSI) provided the tour of the waste treatment facility. PSI has been sub-contracted by Read Rite to provide wastewater treatment for the facility.

The PSI system was installed during September, 1993 at a cost of approximately U.S. $800,000, and treats 300 gallons of wastewater per minute. The system utilizes state-of-the-art liquid and solid separation, known as membrane technology.

The delegates were given a detailed review of the PSI membrane filter (trade name EXXFLOW) which separates waste from water through microfiltration. The EXXFLOW technology is based on highly specialized woven textile tubes, which can remove suspended particulates down to approximately 0.1 microns.

Despite the rather high start-up cost of this particular membrane technology, the delegates were highly interested in the system's ability to:

- treat liquids without the addition of chemicals
- recover up to 97% of process wastewater for recycling
- coagulate, settle, clarify, and filter wastes in one process
- treat wastewater in a small, confined area
- self clean the textile tubes

The delegates discussed their interest in following up with additional technical information regarding the PSI system. As this was their first direct exposure to membrane technology, interest in the system was very high. It was discussed that

membrane technology could have may applications in Indonesia, particularly in the metal finishing industry.

Land and water resources are two main issues governing Indonesia's wastewater treatment facilities, as well as industrial activities. Because land and water are increasingly difficult to obtain in industrialized zones, a waste treatment system that allows for high water recovery and little space consumption is highly desirable.

DECEMBER 13, 1993

ACTERON CORPORATION, REDWOOD CITY, CALIFORNIA

Mr. Patrick Burt, President, met with the delegates at the Acteron plating facility and provided a detailed tour of the plating operations and management techniques implemented to minimize waste. Mr. Burt also serves as the Chairman of the National Association of Metal Finishers (NAMF) Waste Minimization Committee.

Acteron specializes in highly reflective plating for infrared optical components used in the industrial and medical fields, electroless nickel on high-reliability electronic components, precious metals plating for electrical components and microwave application, and hard anodizing. The company is approximately 13 years old and serves numerous electronic companies, both foreign and domestic, and also provides plating services for defense contractors.

The delegates were greatly impressed with Acteron's high level of quality control and research and development operations. However, more impressive to the delegates was the amount of savings the company has achieved through efficient management and aggressive waste minimization activities. Seven years ago, the Acteron grew from a staff of 4 to a staff of approximately 40. Despite the rapid growth in staff size and production, Acteron, which consumed 10,000 gallons of water/day, now consumes approximately 1,500 gallons/day and has 90% less heavy metals in the wastewater effluent. This savings was achieved through the implementation of the following initiatives:

- installation of double and triple counterflow rinses
- use of spray rinses over select process rinse tanks
- adoption of conductivity sensors to regulate water condition and flow
- segregation of rinsewater
- implementing acid copper to replace cyanide copper
- periodic reverse current leaning to replace cyanide cleaning
- elimination of vapor degreasing by using a system of dual soak cleaners with ultrasonic enhancement

- use of more dilute formulations in the acid pickling process
- extensive staff training, e.g., extended drip time over rinse tanks

Acteron's wastewater treatment system (HMR) was purchased from Wastewater Treatment Systems, Inc., (WTS) and implements heavy metal precipitation. The total cost of the waste- water treatment system, which occupies a space of 40 m^2, is approximately U.S. $45,000. Facilities similar in size and production to Acteron many times need much larger wastewater treatment systems due to less efficient waste minimization practices.

The delegates made a commitment that they will recommend waste management systems similar to Acteron's for their own companies in Indonesia.

DECEMBER 14, 1994

SCHLAGE LOCK COMPANY, SAN FRANCISCO, CALIFORNIA

Mr. Jim Collins, Manager, Plating Department, met with the delegates and provided a brief tour of the plating facility of Schlage Lock Co.

Schlage Lock plates steel door fixtures using zinc and brass coatings. The plating process implemented is automatic barrel plating.

The delegates were interested in cyanide replacement in the chemical plating process, which was implemented at Schlage to reduce health risks as well as reduce costs relating to cyanide treatment.

SANTA CLARA PLATING CO., INC., SANTA CLARA, CALIFORNIA

Mr. Thomas Coss, President, provided an overview of the plating operations implemented in the Santa Clara Plating Co. facility, with a particular focus on chemical storage and health/safety equipment and management.

The facility primarily serves the computer industry, plating computer casings and some components. Plating is done by a rack plating system, and delegates noted extended drip time over the rinse tanks as well as countercurrent rinsing. Wastewater generated by the facility contains nickel, cyanide and copper.

The wastewater treatment facility implements chemical precipitation and occupies a space of 50 m^2. Again, the delegates noted that the wastewater treatment system was much smaller than expected, given the size and production level of the facility, due to effective reduction of water consumption in the plating process.

The proper application of safety equipment was reviewed, e.g., safety glasses, boots, goggles, face shields, eyewash stations, showers, fire extinguishers, hard hats, safety shoes/boots. The delegates noted that most of the safety equipment found in U.S. facilities are either not available in their facility or are not implemented when available. Of particular interest to the delegates was the availability of adequate ventilation systems over volatile chemical areas in the plating operations.

DECEMBER 15, 1993

UNITED AIRLINES MAINTENANCE OPERATIONS CENTER, SAN FRANCISCO AIRPORT, CALIFORNIA

Mr. Steven Sulgit, Facilities and Engineering Department, provided an overview of the metal finishing sector and wastewater treatment facility. The Maintenance Operations Center (MOC) is one of the largest facilities of its kind and provides maintenance to most of United Airlines world-wide operations The facility repairs, overhauls, and modifies United Airlines aircraft and has facilities for "tooling" various engine and structural components.

Focus of the tour was on providing the delegates with an overview of a large sized private industrial wastewater treatment facility.

The wastewater treatment system implements reactive rinse tanks to remove heavy metals prior to entry into the main waste treatment facility. Here, chemical precipitation removes heavy metals and then the water is pumped into chrome kill tanks or cyanide kill tanks, depending on the waste stream. The pH is then neutralized and heavy metals are further coagulated with polymers, thus dropping to the bottom of the tanks. Overflow from the tanks is reconditioned and recycled.

Final discharge from the facility then goes to a municipal wastewater treatment plant.

NEW UNITED MOTORS MANUFACTURING INC., FREMMONT, CALIFORNIA

New United Motors Manufacturing Inc. is a joint venture between General Motors Corporation and Toyota Motor Corporation. The purpose of this visit was to provide the participants with an overview of a management system that implements both U.S. and Asian management practices.

This exercise gave the delegation a rough idea of how an efficient partnership between the U.S. and Asia may operate. The main principle observed at the facility was Kaizen. Kaizen is the continuous pursuit of improvement in every facet of the

company. Under this management structure, all employees are allowed to comment on the progress of production and teams are developed to develop solutions to production difficulties.

The delegates noted that the facility greatly benefits form the kaizen principle, particularly due to emphasis on team work and open discussion between staff and management. All of the employees are treated equally, from the president to maintenance personnel.

DECEMBER 16, 1993

SAN JOSE WATER POLLUTION CONTROL PLANT, SAN JOSE, CALIFORNIA.

The San Jose Water Control plant is a local government controlled facility that treats municipal wastewater in the San Jose area. Mr. Alex Ekster P.E. Ph. D., provided a brief description of the waste treatment system. The purpose of this visit was to provide the delegates with an overview of a typical U.S. municipal waste treatment system which provides both primary and secondary treatment.

Primary treatment removes floating material, oils and greases, sand and silt and organic solids heavy enough to settle from the wastewater. Secondary treatment biologically removes most of the suspended and dissolved organic impurities.

Treatment steps include: pre-chlorination (for odor control), screening (to remove large objects), grit removal, primary sedimentation, secondary treatment using high purity oxygen-activated sludge, final clarification, sludge digestion, dewatering and sludge removal.

CHEMICAL SOLUTIONS INC.

Mr. Jim Miille, President, concluded the Study Tour with a technical review of the facilities visited. Mr. Miille has participated in numerous projects involving the Indonesia metal finishing sector and attended all of the facility visits during the U.S. Study Tour.

Chemical Solutions, Inc. is a private consulting firm that specializes in environmental issues, with a particular focus on the metal finishing industry.

IV. STUDY TOUR SUMMARY AND CONCLUSIONS

The delegates all expressed interest in developing additional programs of technical cooperation between the United States and Indonesia, based on the overall success of the U.S. Metal Finishing Study Tour.

Many of the facilities visited implemented state-of-the-art technology and management practices in both the plating process and waste treatment process. The technologies, if adapted in Indonesia, could greatly enhance the production of the Indonesian metal finishing industry, as well as reduce the industry's burden on natural resources by reducing water consumption and the amount of wastes discharged into the environment.

All of the delegates noted that they will bring back to their respective companies and organizations new ideas regarding waste minimization management practices and technology and health and safety practices.

Follow up activities identified by the delegates include:

- Additional technology transfer of membrane technology, e.g., EXXFLOW system developed by Process Scientific Inc.

- Training on the use of industrial safety equipment and chemical storage and handling.

- Training for senior metal finishing facility managers in the area of waste minimization, e.g.,:

    - counterflow rinsing techniques
    - drag-in-drag-out rinse techniques
    - reactive rinses
    - spray rinse application
    - extended drip time over plating tanks

- Develop a database of available technologies that enhance waste minimization.

APPENDICES

APPENDIX A

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