

Note: This is a reference cited in AP 42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP42 Section:	11.16
Reference:	13
Title:	Written communication from Wyoming Air Quality Division, Cheyenne, WY, to M. Palazzolo, Radian Corporation, Durham, NC, 1980.

GYPSUM
MANUFACTURING //

AP-42 Section 5.14

Reference Number

13

Response to EPA request for
information from:

Wyoming Air Quality Division

1980

M E M O R A N D U M

TO: GEORGIA-PACIFIC GYPSUM PLANT (COMPLIANCE FILE)

THROUGH: RANDY WOOD, AIR QUALITY ADMINISTRATOR
CHUCK COLLINS, AIR QUALITY SUPERVISOR

FROM: LEE GRIBB, AIR QUALITY DISTRICT ENGINEER

SUBJECT: ANNUAL INSPECTION REPORT - 1978

DATE: JANUARY 15, 1979.

On December 13, 1978, I performed the annual inspection of this company's gypsum milling and wallboard manufacturing plant, located at Himes, Wyoming. I was accompanied on this inspection by Mr. Paul Larson, the plant manager, and Mr. Bruce Wacker, the senior plant engineer.

PROCESS DESCRIPTION

This facility mines gypsum (hydrated calcium sulfate) from seams in the surrounding hillsides and stockpiles the ore at the crusher site above the mill proper. The operation mines 180,000 tons per year of this ore. A front-end loader is used to transfer the material from the stockpile to a grizzley, screen, and feed hopper. The fines from this separation are impure minerals and are discarded. The oversize is conveyed to an eccentric crusher and a hammermill where a minus 2" material is produced. The crushed rock is then conveyed via a covered belt conveyor to a 300T. storage bin that serves as a feed hopper for further grinding.

This phase of the operation produces almost all of the fugitive dust that is emitted from the plant. At times the volume of dust can be very significant, but there are currently no controls on this source.

The ore from the crushed ore storage bin is fed to a single 60" Raymond Mill for fine grinding. A 3½ million BTU/HR, oil-fired flash drier heats and dries the ore, and provides the air to pneumatically carry and size the material. The sizing is accomplished by a 10 ft. diameter cyclone separator (-100 mesh), after which the product is stored in one of two 75T. kettle feed bins. Each bin feeds a separate calcining kettle.

Number 1 calcining kettle processes approximately 15.4 tons per hour of gypsum and number 2 kettle, about 9.6 tons per hour. Each kettle is an upright bin which is heated by a 12 million BTU/HR, oil-fired burner. The gypsum is fed to the top of the bin and pulled off the bottom into hot pits. The water of hydration has been driven off in the kettles and the product, now called stucco or plaster of paris, is conveyed to one of two, 250T outside storage bins, (and then to one of two, 85T. inside storage bins to await transfer to the board plant.

There is some fugitive dust generated by the mill grinding, calcining, and material handling in this portion of the plant, however very little of it escapes the building to the ambient atmosphere. A good portion of the dust in the area, including the Raymond Mill bleed, bin vents, and the kettles exhaust, is captured and ducted to a Research-Cottrell, 30,000 cfm, two-section electrostatic precipitator.

TO: GEORGIA-PACIFIC GYPSUM PLANT (COMPLIANCE FILE)
THROUGH RANDY WOOD AND CHUCK COLLINS
FROM: LEE GRIBB
SUBJECT: ANNUAL INSPECTION REPORT - 1978
DATE: JANUARY 15, 1979.

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The stucco from the inside storage bins is conveyed to a mixing bin where water and additives are mixed with the powder to form a fluid paste. The dust from the mixing bin is controlled by a cyclone collector, however this source has occasionally emitted high-opacity plumes.

The rest of the operation emits very little contaminants. The paste is extruded in a continuous stream between two sheets of paper board, where the stucco sets up hard. An automated saw cuts the continuous sheet into the desired lengths and roller conveyors propel the wallboard through three progressively hotter sections of a drying oven. The three natural gas fired oven burners are 10, 25, and 25 million BTU/HR rated, respectively.

The dried wallboard is then trimmed, taped, and stored for shipment by rail in the plant warehouse. In 1978 apprx. 183 million sq. ft. of wallboard was produced.

COMPLIANCE STATUS

I took one opacity reading during my inspection, this on the precipitator stack. The reading was 5%, well within the allowable of 40%. Another reading was taken by Bernie Dailey on June 21 of this year, resulting in 10% attenuation. I took a third reading on August 15, resulting in a 100% opacity. This high reading was the result of failure of an electrical component in precipitator controls and is detailed in a survey report dated August 23, 1978. This control device experienced a variety of problems during the latter part of this summer, but has been operating acceptably since that time.

During my inspection I noted a high fugitive dust emission from the crusher area of the plant. My inspection of August 15, 1978 also revealed significant emission of fugitive dust from this source. Monitoring will be initiated at this plant, as detailed later in this report, and if ambient standards are being violated, then controls may be required on this source.

Although not noticeable on this inspection, the cyclone vent from the mixing bin has shown high opacity in the past. This stack is another source which may require controls in the future, therefore it will be watched closely.

Georgia Pacific has submitted an application to modify this mill. The proposed modifications include installing a second 60" Raymond Mill, rock bin, and cyclone sizing system in milling section of the plant, and converting from natural gas to fuel oil as a fuel source for the burners on the board drying oven. As of this writing, the Division has completed the analysis of the proposal and is in the process of publishing a tentative approval for public comment. As part of the Division's requirements for approving this application, Georgia-Pacific will have to test the major stacks involved in the modification and will have to initiate an ambient monitoring system for particulate to determine if fugitive and point sources are contributing to violations of ambient standards.

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SUBJECT: ANNUAL INSPECTION REPORT - 1978
DATE: JANUARY 15, 1979.

- 3 -

Georgia-Pacific also applied for a modification permit in July, 1977. The purpose of this application was to convert the firing of the Raymond Mill flash drier and the two kettle burners to a combination of gas and oil. Permit MD-18 was issued on September 26, 1977. The Division now understands that this modification is completed and operational. No notice was received of this completion, therefore I called Bruce Wacker on January 15, 1979 and requested that he send a letter confirming and dating the completion. The Division will review Georgia-Pacific testing requirements due to this modification, (if any) when Mr. Wacker's notification is received.

TABLE I - GEORGIA-PACIFIC POINT SOURCE EMISSIONS

Source	SIZE (scfm)	Control Equipment (Date (Installed))	Pollutant	Avg. Process Rate	Allowable Emissions (lb/hr)	Applicable W.A.Q.S.&R. Section	Actual Emissions (lb/hr)	Latest Date Tested	Estimated Emission (lb/hr)
Raymond Mill, Kettles, and Misc. Bin Vents and Materials Handling Points	18,000	Research-Cottrell, Particulate two section, electrostatic precipitator (1971)	Particulate	20T/HR	30.51	14.g. (existing)	none	n/a	10
Stucco Mixing Bin	unkn.	Cyclone Collector	Particulate	20T/HR	30.51	14.g. (existing)	none	n/a	unkn.
Zone 1 & 2 Oven Burners	unkn.	none	Nitrogen Oxides	25MM BTU/HR	5.75	10.b. (2)	none	n/a	5.75
Zone 3 Oven Burner	unkn	none	Nitrogen Oxides	10MM BTU/HR	2.30	10.b. (2) (existing)	none	n/a	2.30

Emission Estimate For Precipitator From 1978 Permit Application
Emission Estimate For Oven Burners From AP-42

PLUME OBSERVATION FORM

Plant Name: GEORGIA-PACIFICStack Identification: ELECTROSTATIC PPTR.Address LOUVELL

Sec.	0	15	30	45
Min.				
0	5	5	5	5
1	5	5	5	5
2	5	5	5	5
3	5	5	5	5
4	5	5	5	5
5	5	5	5	5
6				
7				
8				
9				

Observer LEE GAIORDate 12/13/78Time 11:26

Type of Background

BLUESKY; SCATTERED CLOUDColor of Emissions LIGHT BROWN

Location of Observer

SE

Distance to Stack

200 YDSWind Direction W
(Approx.)Wind Speed 5 mph
(Approx.)Temperature 10°FSum of numbers recorded 120Total number of readings 24Opacity: Sum of nos. recorded = 5%
Total nos. of readings

Comments:

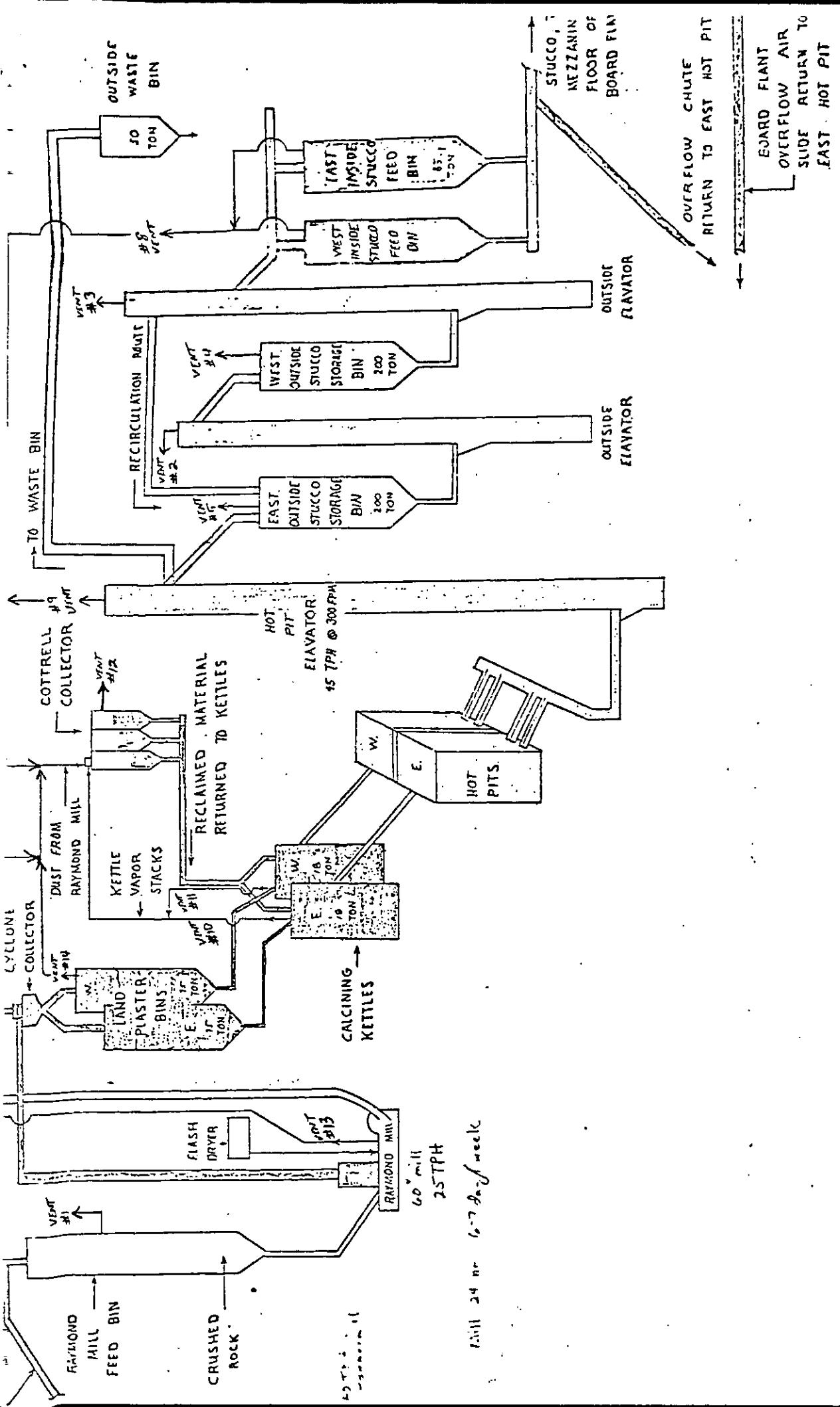
200 ft attached steam plume
cloud background - difficult reading

Sketch of Location:

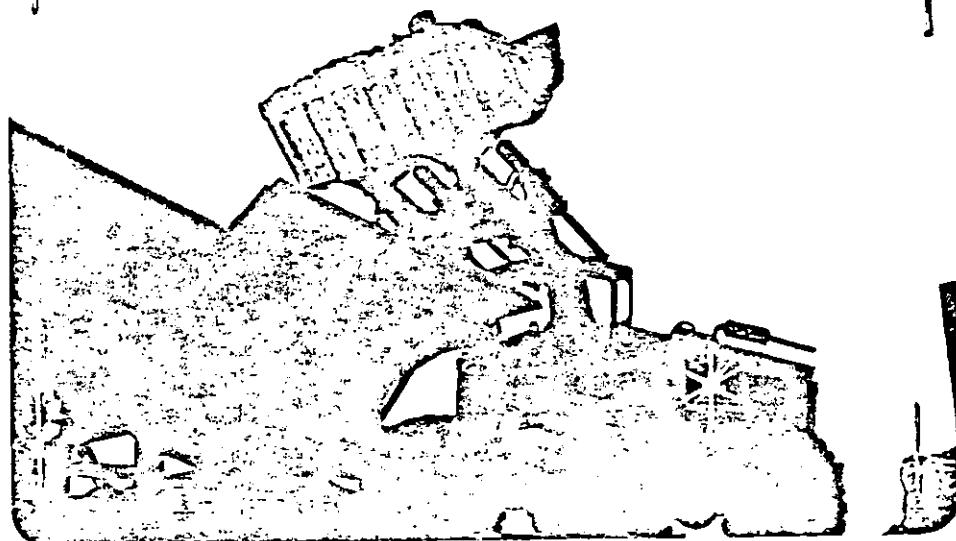
NORTHWIND \rightarrow 0Company Official: Bruce Wacker

Signature

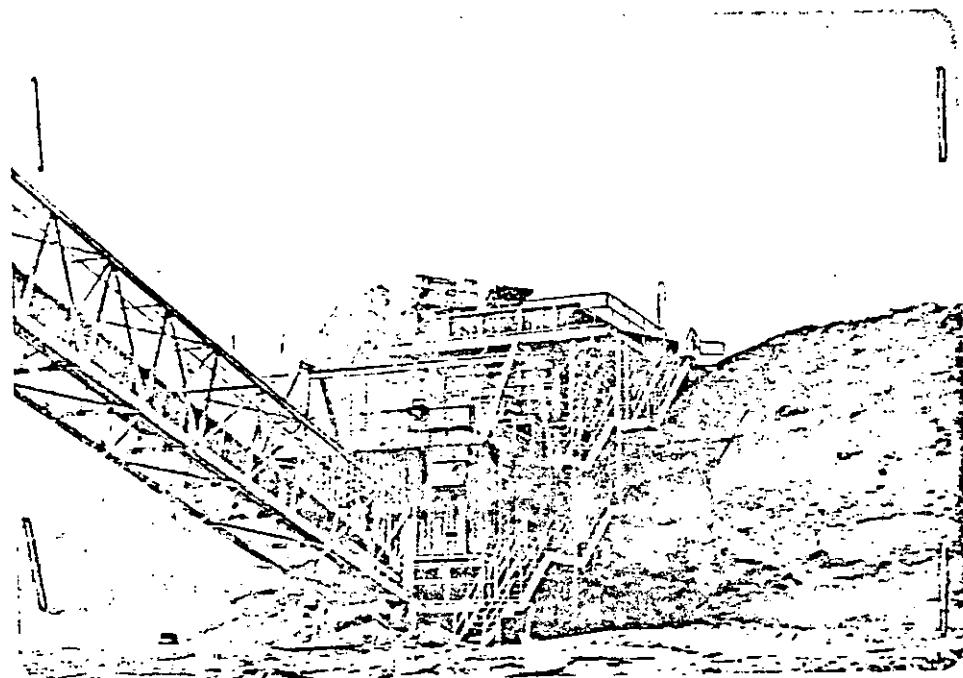
Date 12/13/78Title or Position Maint Supt.Time 11:40Company Name Georgia-PacificDr
observerOSUN



GEORGIA-PACIFIC - December 13, 1978

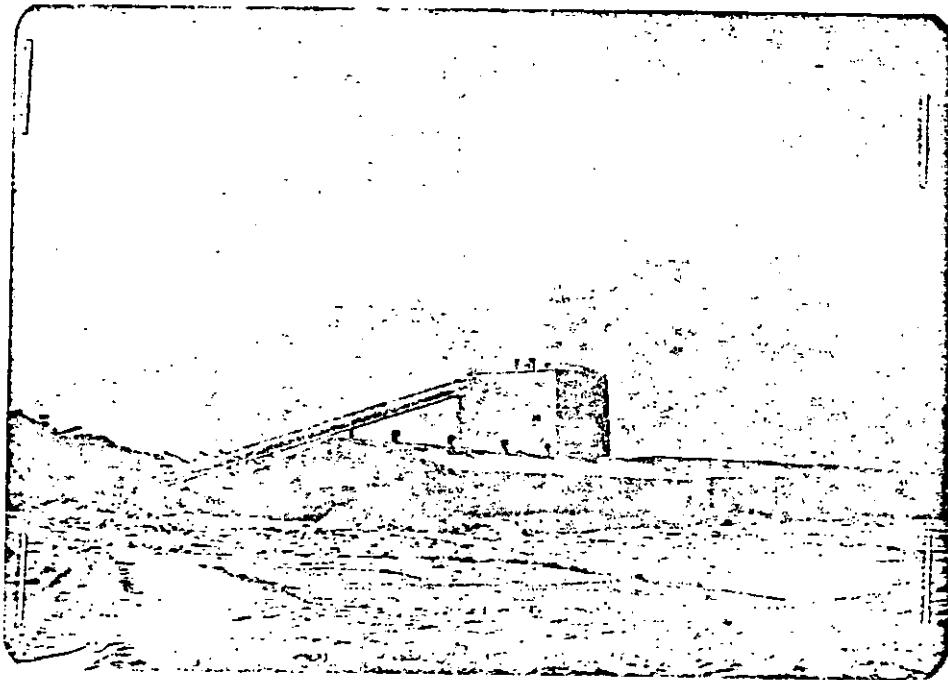


front end loader filling hopper



heavy fugitive dust from crusher facility

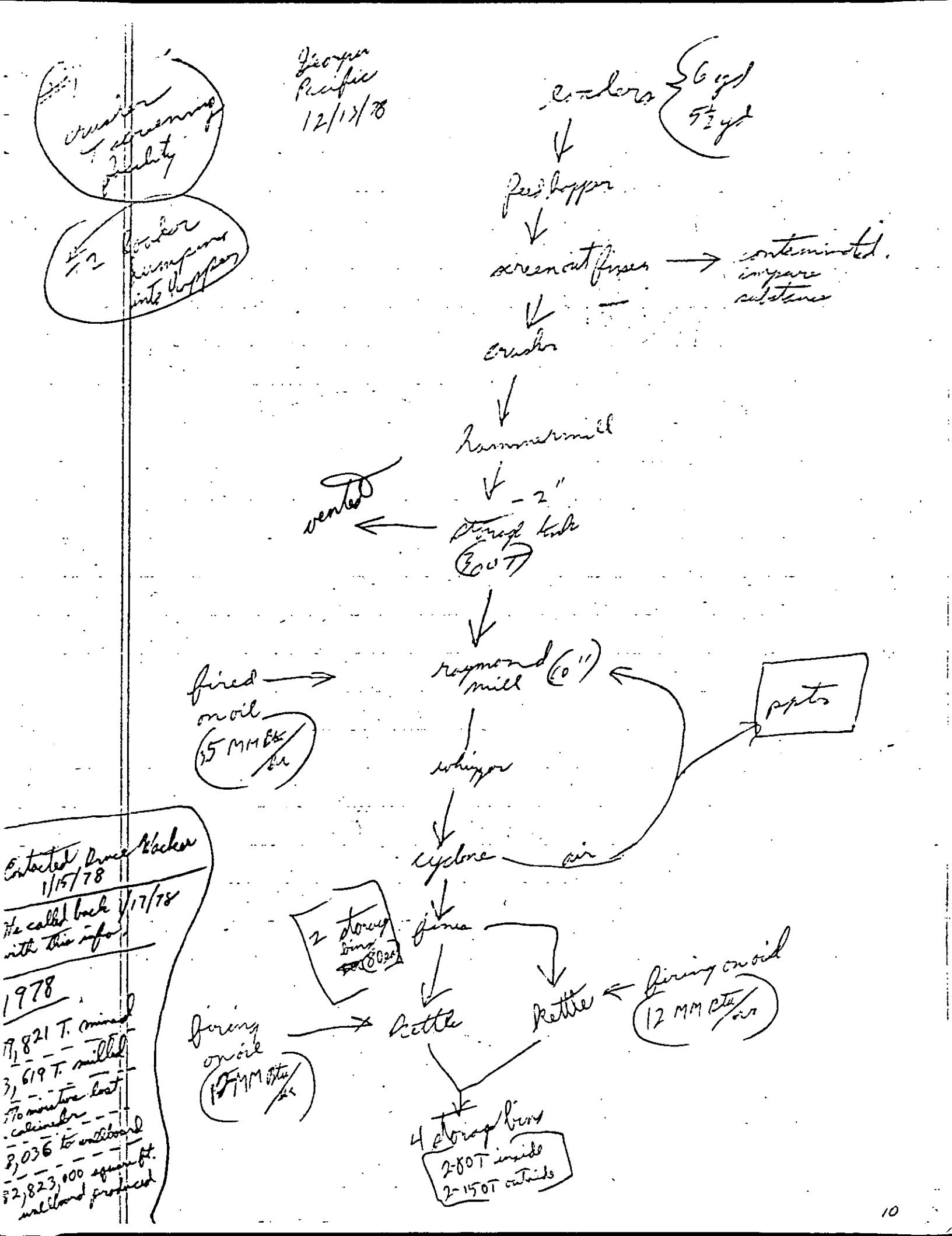
GEORGIA-PACIFIC - December 13, 1978

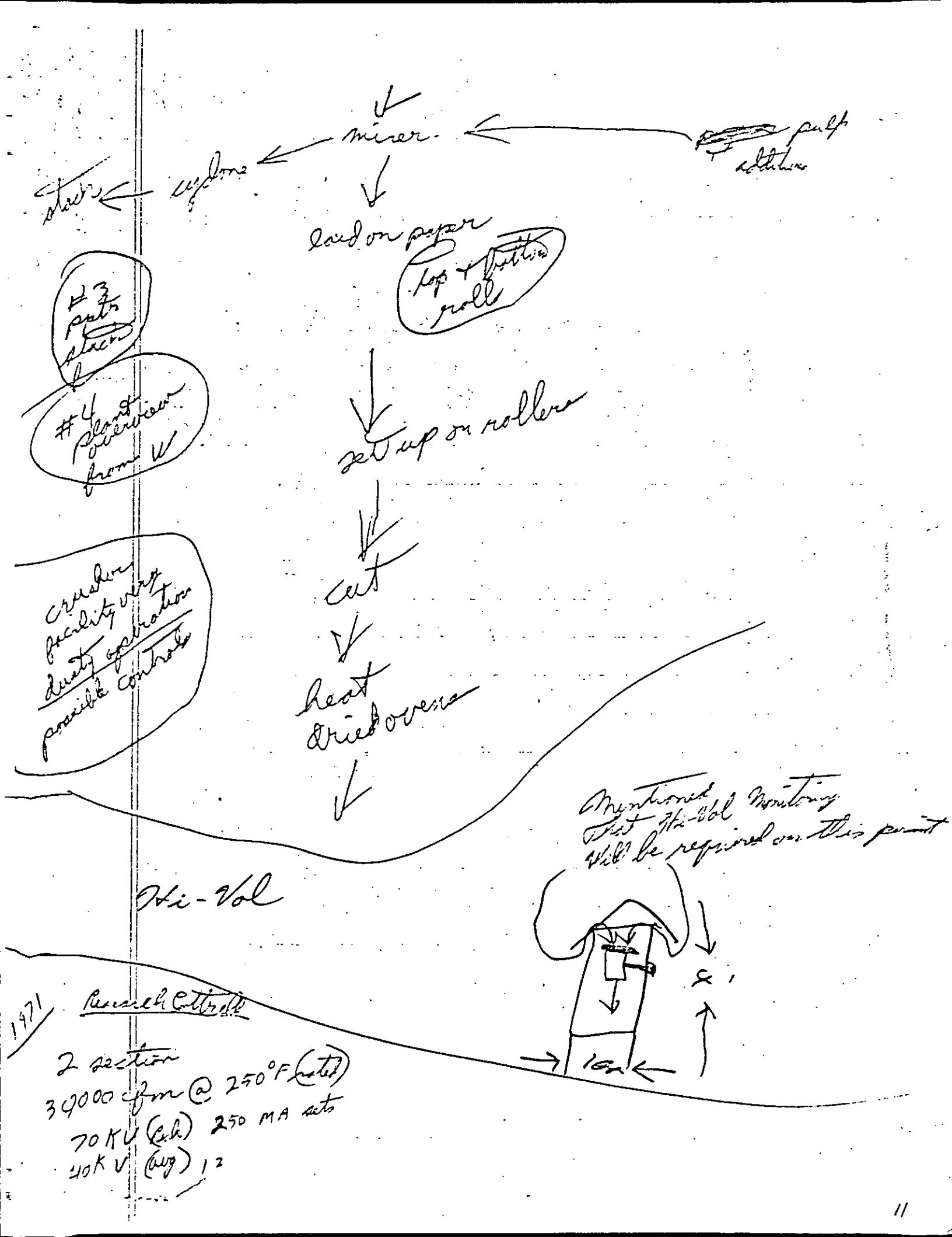


ELECTROSTATIC PRECIPITATOR STACK - MOSTLY STEAM PLUME



PLANT OVERVIEW - LOOKING EAST





M E M O R A N D U M

TO: CELOTEX BIG HORN GYPSUM, CODY (COMPLIANCE FILE)

THROUGH: RANDY WOOD, AIR QUALITY ADMINISTRATOR
CHUCK COLLINS, AIR QUALITY SUPERVISOR.

FROM: *Lee* LEE GRIBB, DISTRICT AIR QUALITY ENGINEER

SUBJECT: ANNUAL INSPECTION REPORT, 1979.

DATE: MAY 3, 1979.

On April 17, 1979, I performed the annual inspection of Celotex Corporation's wallboard manufacturing plant located at Cody, Wyoming just north of town on the north bank of the Shoshone River. I was given the plant operating characteristics and the production data during discussion with Mr. Ed Tuten, the plant manager. Mr. Merle Byers, the production and safety superintendent, guided me on my inspection tour of the facility.

PROCESS DESCRIPTION:-

This facility mines gypsum (calcium sulfate) rock from seams located about 6 miles south of the plant. The rock is hauled by 20 T. trucks through the town, to the mill site. Approximately 33 loads are hauled per day amounting to approximately 660 T. of gypsum rock.

The hauled rock is dumped directly into the crusher feed bin at the mill site. This truck dump is roofed and enclosed on three sides, however, no vacuum control device is used.

The rock in the feed bin is fed directly to the crusher by a steel conveyor located in the bottom of the bin. The crusher is a "Bulldog" brand hammermill with a rated capacity of 150 T/HR. It produces a minus 1 $\frac{1}{2}$ " sized product.

The crushed rock is belt conveyed, via enclosed conveyor and bucket elevator to one of two, 225 T capacity rock storage bins. The gypsum rock at this point has 1-3% free moisture, and 20.9% chemically bound moisture.

The rock bins feed two, 15 T/HR capacity, 50" Raymond Mills, which grind the rock to a fine powder. The powder from the Raymond Mills, now called landplaster, is pneumatically conveyed and deposited by cyclone separation, into two, 120T. capacity landplaster storage bins. Heated air, to remove the free moisture content in the gypsum and to provide the conveyor and separation medium, is supplied to each of the mills by a separate 2.5 MM Btu/HR., natural gas-fired heater. While the cyclone underflow loads the landplaster bins with product, the fines in the mill airstream are ducted to a "Precipitaire" brand, 1 chamber, 3 field, C-type electrostatic precipitator before being released to the atmosphere.

Each landplaster bin feeds a 12.5 MM Btu/HR., natural gas-fired calcining kettle. These kettles are batch-type operations in which approximately 15 T. of landplaster is loaded into each kettle at about 175 F. The landplaster is then heated, over a period of approximately 90 minutes, to drive off all but 6% of the initial chemically bound moisture in the rock.

MEMORANDUM:

TO: CELOTEX BIG HORN GYPSUM, CODY (COMPLIANCE FILE)
THROUGH: RANDY WOOD AND CHUCK COLLINS
FROM: LEE GRIBB
SUBJ: ANNUAL INSPECTION REPORT, 1979.
MAY 3, 1979.

- 2 -

The dump point occurs when the landplaster reaches 315° F.

When each kettle completes its cycle it is dumped, via an air operated gate, to each unit's respective hot pit. The calcined landplaster, now called stucco, is conveyed out of the hot pits and into one of two, 330 T. capacity storage bins, by screw conveyors and a bucket elevator. The emissions from both the hot pits and the stucco storage bin vents are ducted to the electrostatic precipitator, along with the mill dust.

From the stucco bins, the stucco is mixed with a small quantity of dry ingredients (starch and orzan) in a mixing screw. At the end of the screw a water and newsprint paper-pulp slurry is added with an accelerator (small amount of landplaster), and the entire mixture is blended in a pin mixer to a thick mud consistency. This stucco mud is then extruded between two sheets of heavy paper on a long continuous roller conveyor.

This "liquid" wallboard sets up in the 7-8 minutes it takes to reach a rotary knife. The plant makes both 1/2" and 5/8" thick board. The 1/2" board travels at 120 fpm on the rollers and the 5/8" board travels at 96 fpm. The knife cuts the board into approximately 8' sections. The board is then conveyed by an automated system, through a four zone board drying oven.

Each zone of the drier is heated by a separate 25 MM Btu/HR, natural gas-fired burner. Zones 1 and 2 average about 500° F, Zone 3 about 415° F, and Zone 4 about 220° F.

From the drier the wallboard is sent to a set of saws where the ends are trimmed and taped. The dust from the trimmer saws is controlled by a ventilation system connected to a Buffalo Forge brand, Aeroturn, Type "B", air-ring type baghouse dust collector. This collector handles very little dust, has no visible emissions, and although it has not been tested, I estimate it has negligible emissions.

This boardplant operated 8148 hours in 1978 and produced 206 million square feet of wallboard (on a 1/2" basis). The gypsum mill worked 318, 24-hour days in 1978 for a total of 7632 hours. The mill produced 128,183 tons of stucco during the year. All fuel used in the Raymond Mill driers, the kettles, and the board drier amounted to 592,469 MCF of natural gas in 1978.

COMPLIANCE STATUS:

The crusher facility normally only runs a partial day to supply the mills, and it had just completed all operations for the day when I make my inspection, consequently no fugitive emissions were noted this day.

MEMORANDUM:

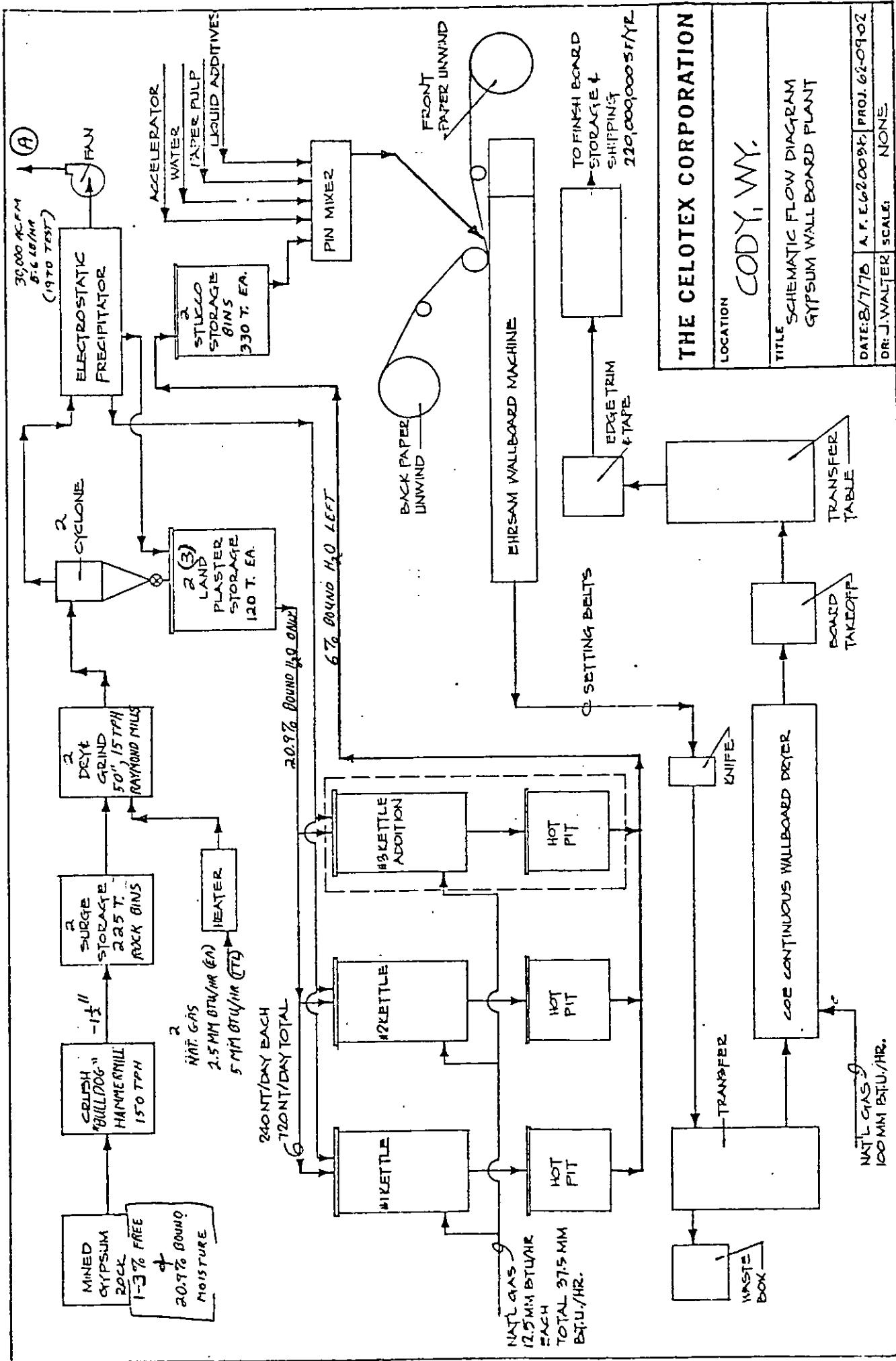
TO: CELOTEX BIG HORN GYPSUM, CODY (COMPLIANCE FILE)
THROUGH: RANDY WOOD AND CHUCK COLLINS
FROM: LEE GRIBB
SUBJ: ANNUAL INSPECTION REPORT, 1979.
MAY 3, 1979.

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The rest of the plant was running, including the kettles. I read the precipitator stack at 11% during this inspection. It was read at 21% on June 22, 1978. This unit has problems with puffing during rapping cycles, although the duration of the puffing is very short, \pm 5 seconds. This precipitator was tested after its installation in 1970 and resulted in an emission rate of 5.6 LB/HR. No production data was given, but assuming a minimum of one kettle running (10 TPH), the allowable for this unit would have been 19.2 LB/HR. The 1970 test report, prepared by Precipitaire is included for reference in this report.

A violation of the Wyoming Air Quality Standards and Regulations was discovered during this inspection. It was found that Celotex did not construct a new landplaster bin, kettle, and hot pit, without obtaining the necessary air quality construction permit. The details of this violation are explained in my April 24, 1979, Survey Report. Celotex has now submitted an application for this permit, however, several items are missing to complete the application. Celotex has been notified of the deficiencies in my letter of April 30, 1979. It is expected that the necessary information will be forthcoming shortly. A Notice of Violation is now being prepared and will be issued to Celotex.

LG/jky



PLUME OBSERVATION FORM

Plant Name: CELOTEXStack Identification: PPTR STACKAddress COOT

Sec.	0	15	30	45	
Min.					
0	5	10	10	5	30
1	5	15	10	5	35
2	5	5	5	40	55
3	10	5	10	5	30
4	100	5	5	10	120
5	5	5	5	5	20
6	5	5	5	5	20
7					
8					
9					

Observer LEE GRIBBDate 4/17/79Time 4:25 pm.Type of Background BLACK WALL SHADOWColor of Emissions OFF-WHITELocation of Observer WDistance to Stack 100 ftWind Direction none (Approx.)Wind Speed none (Approx.)Temperature 65°FSum of numbers recorded 310Total number of readings 28Opacity: Sum of nos. recorded / Total nos. of readings = 11%

Comments:

After puffing occasionally during inspection
 1. cruet mill down allowable 40%
 1. kettle running

Sketch of Location:



NORTH

STACK

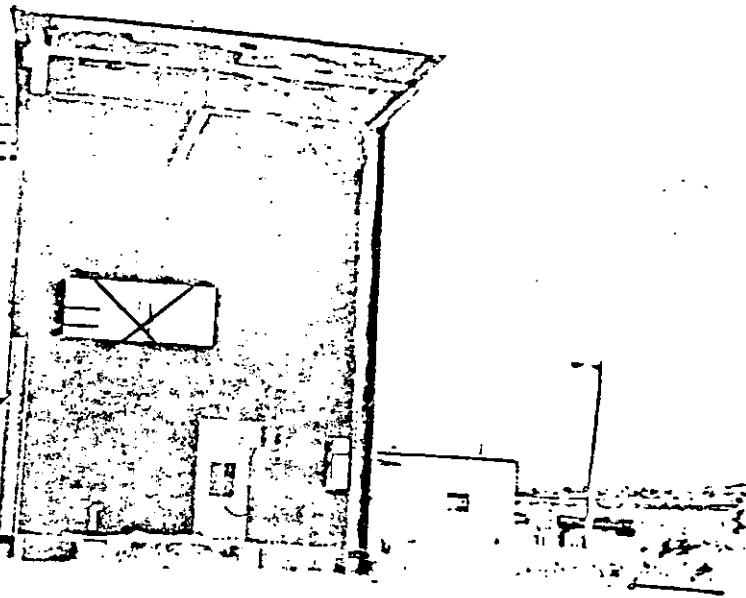
Company Official: P. E. Martin

Signature

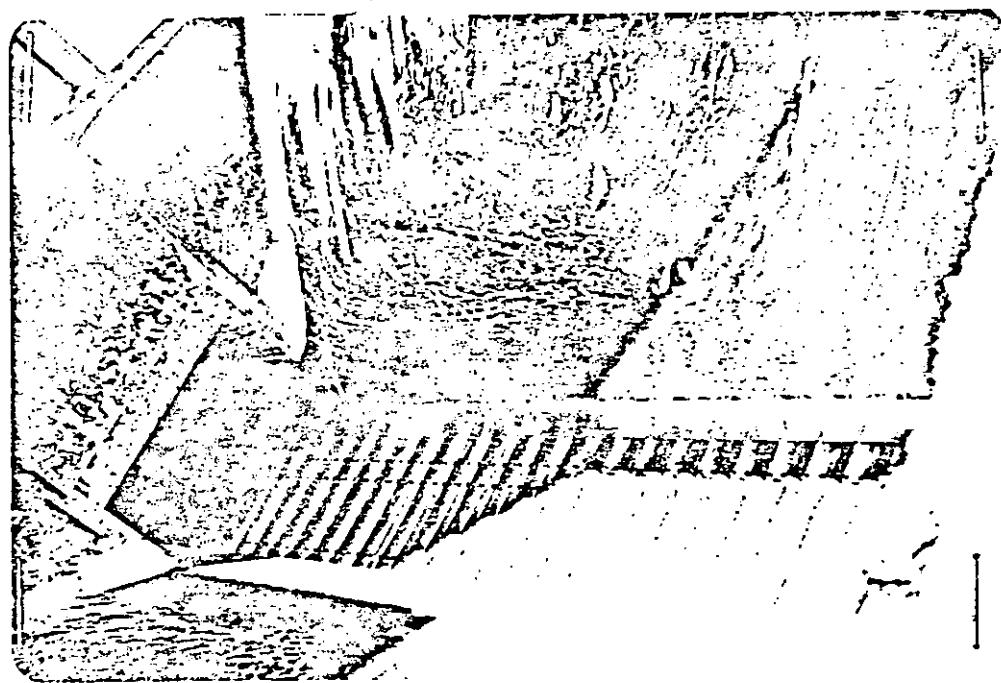
OBSERVER

Date 4-17-79Title or Position Plant ManagerTime 4:35 PMCompany Name THE CELOTEX CORP.

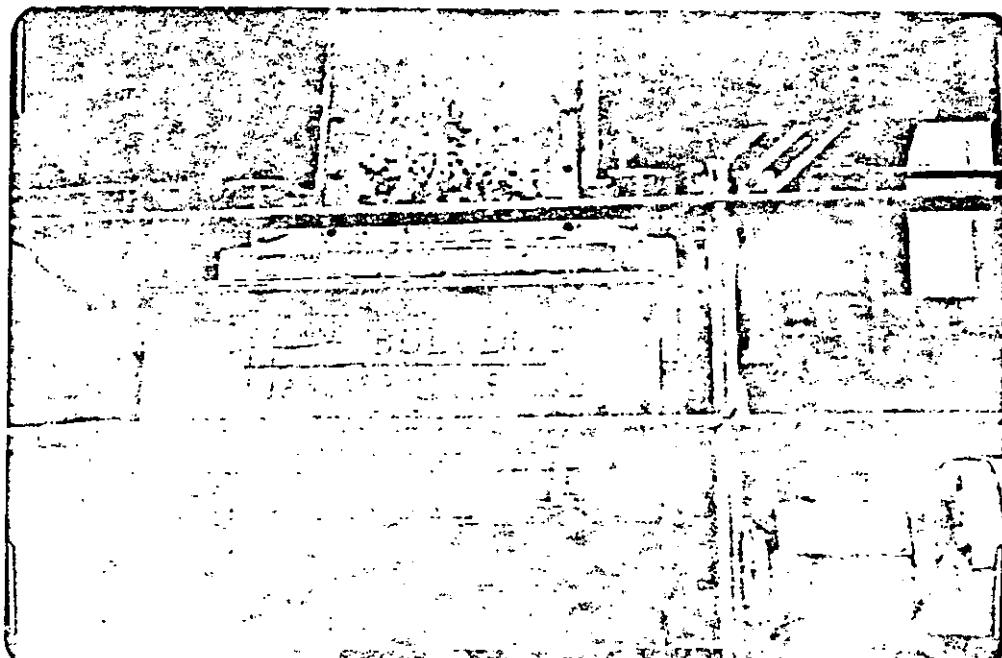
CELOTEX GYPSUM CO., CODY
April 17, 1979



Enclosed Truck Dump



Looking Down Into Feed Bin
At Steel Crusher Feed Conveyor

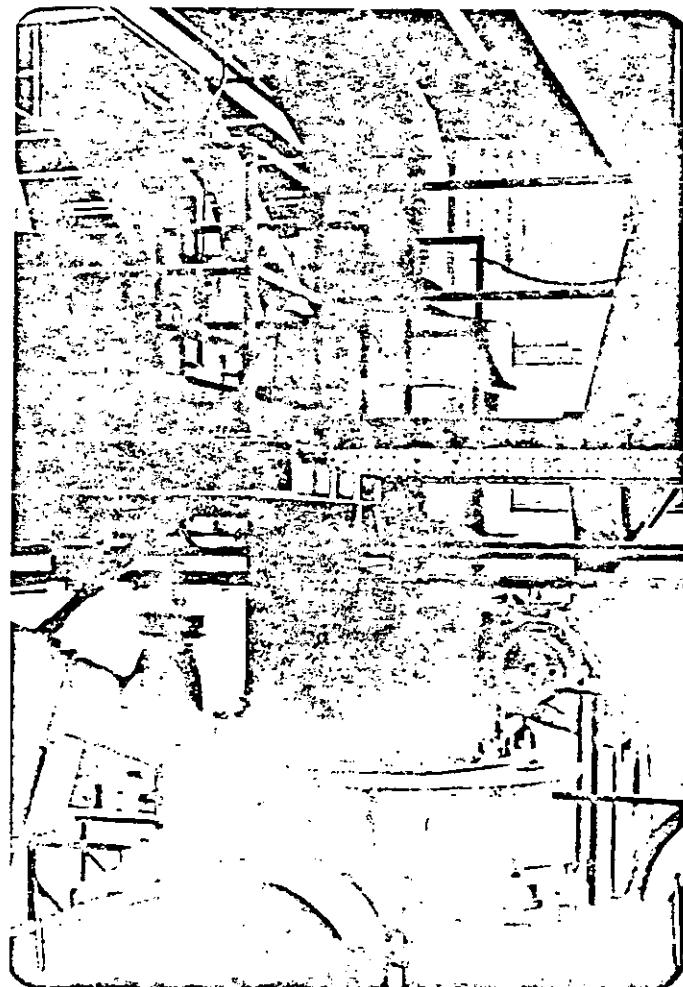


"Bulldog" Hammermill
Crusher

CELOTEX GYPSUM CO., CODY
April 17, 1979

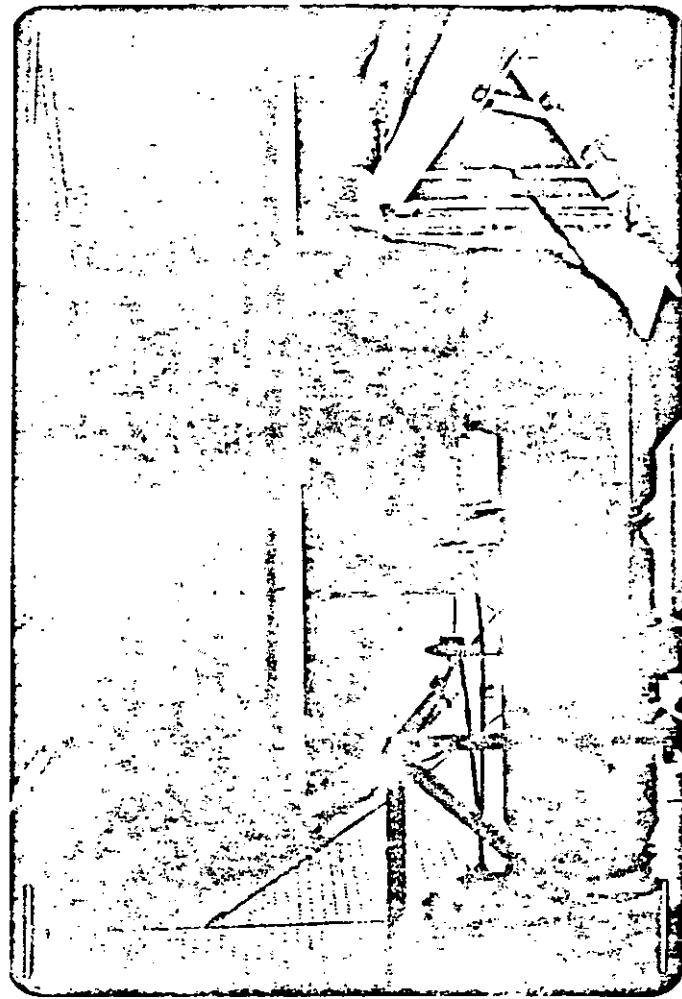


2.5 MM BTU/HR Mill Heater

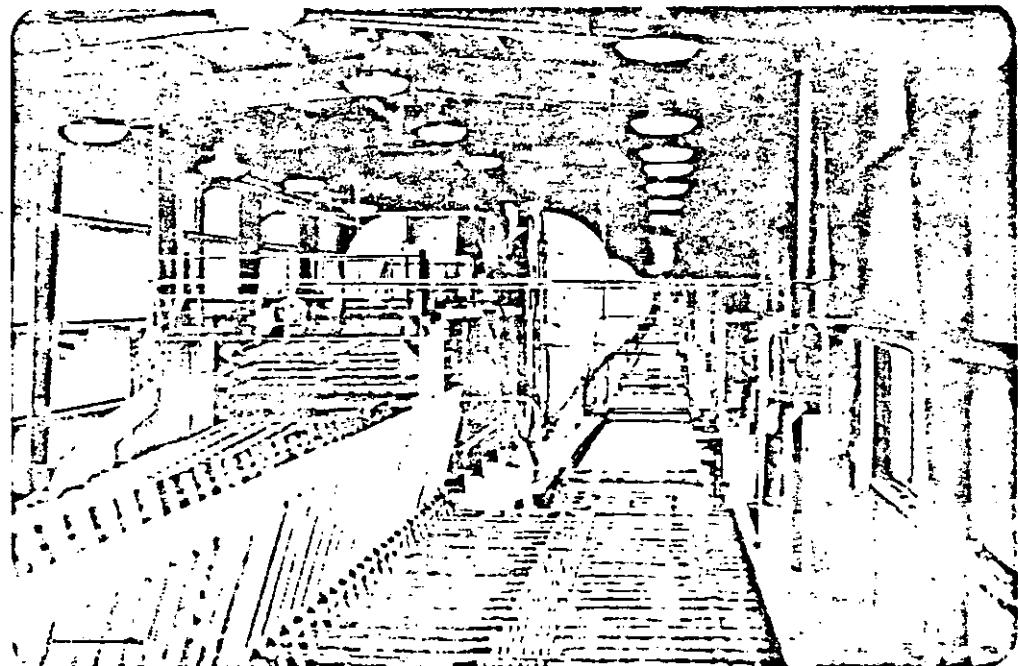


50", 15 T/HR Raymond Mill

CELOTEX GYPSUM CO., CODY
April 17, 1979



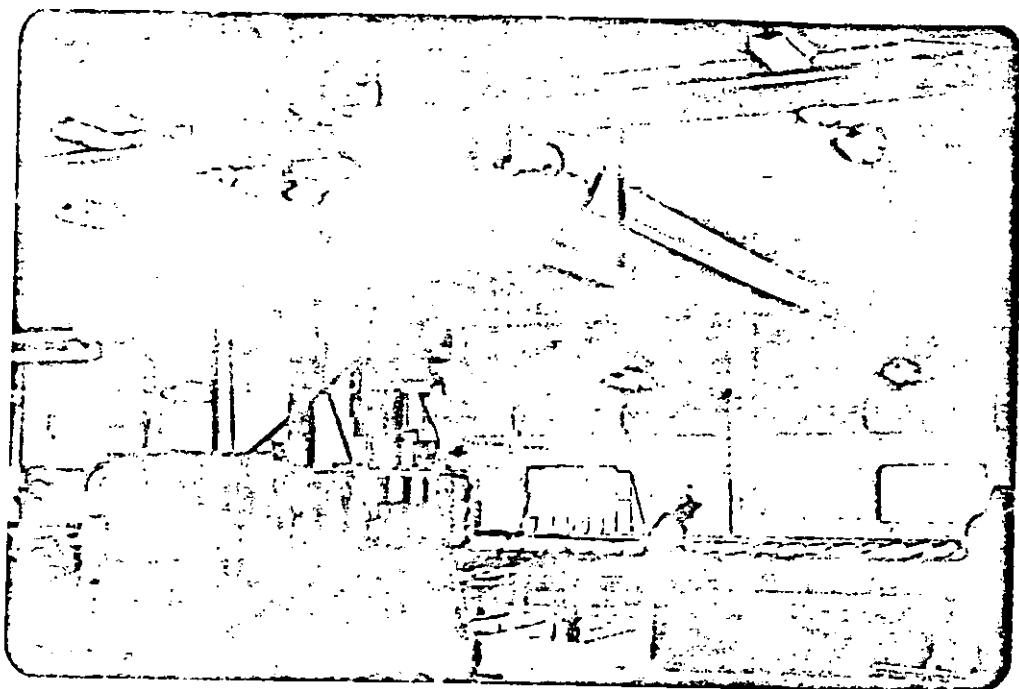
Raymond Mill Cyclone



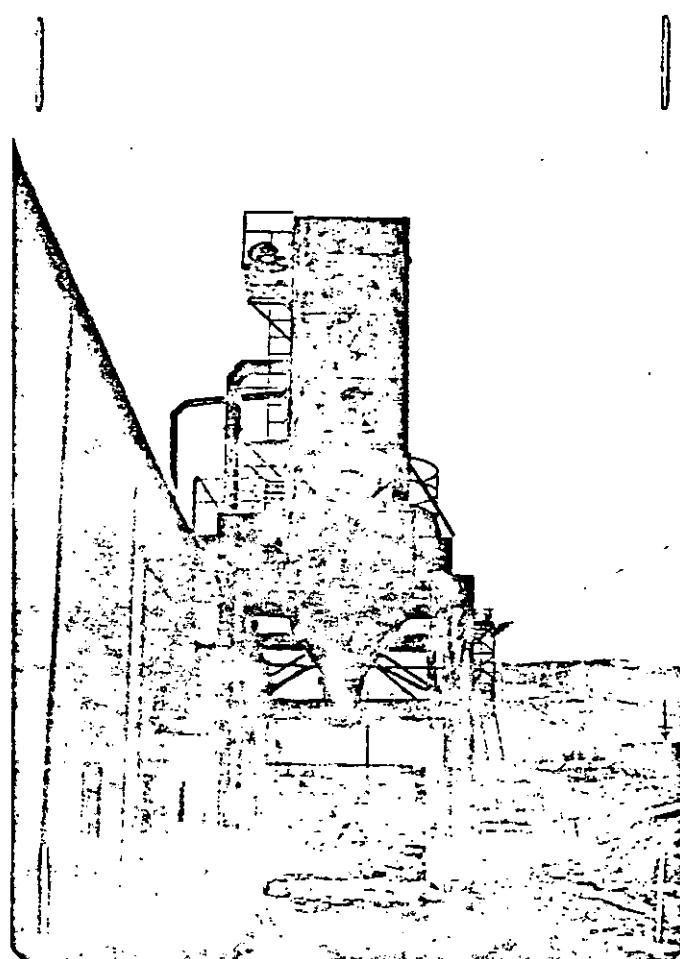
Board Plant Conveyor Line

left-- Board Drier Oven Entrance
right-- Rotary Knife.

CELOTEX GYPSUM CO., CODY
April 17, 1979

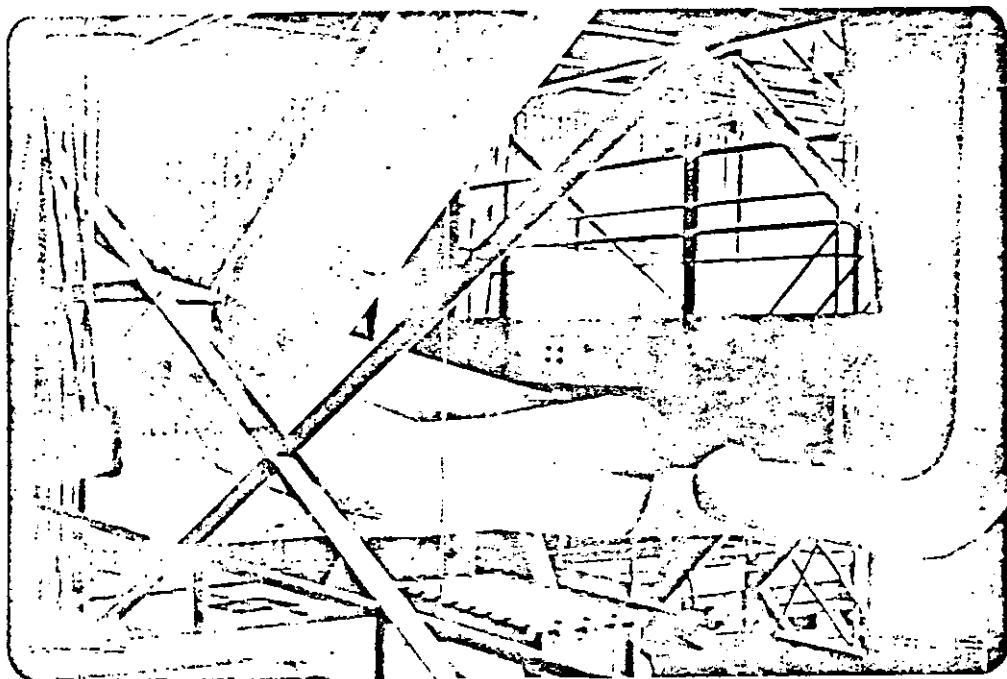


Trim Saws, Ventilation Fan & Duct Work

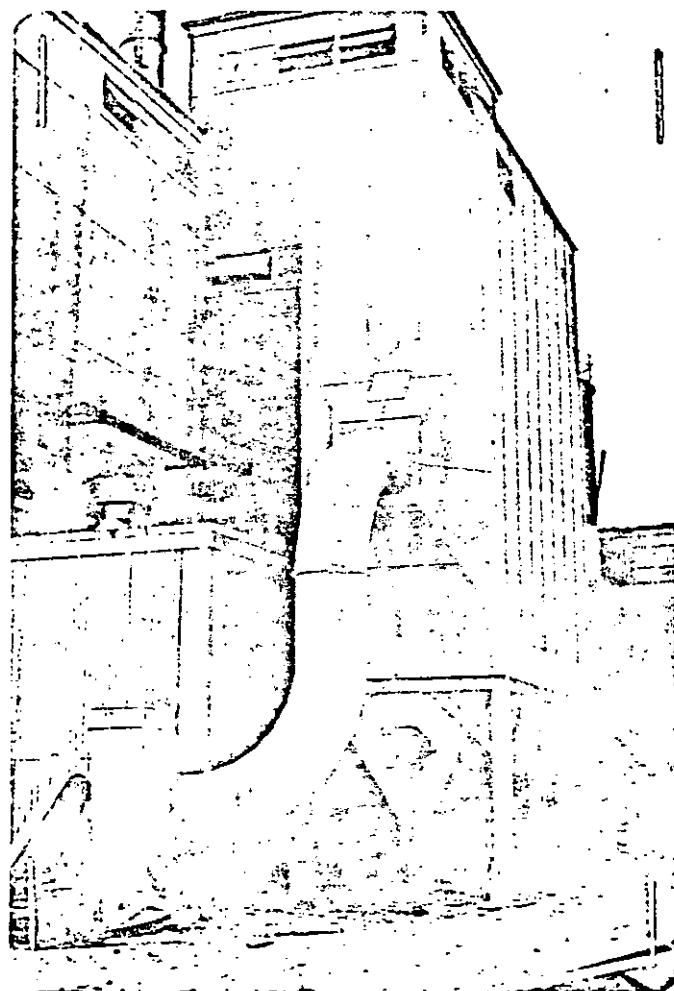


Buffalo Forge Aeroturn Baghouse
(operating)

CELOTEX GYPSUM CO., CODY
April 17, 1979

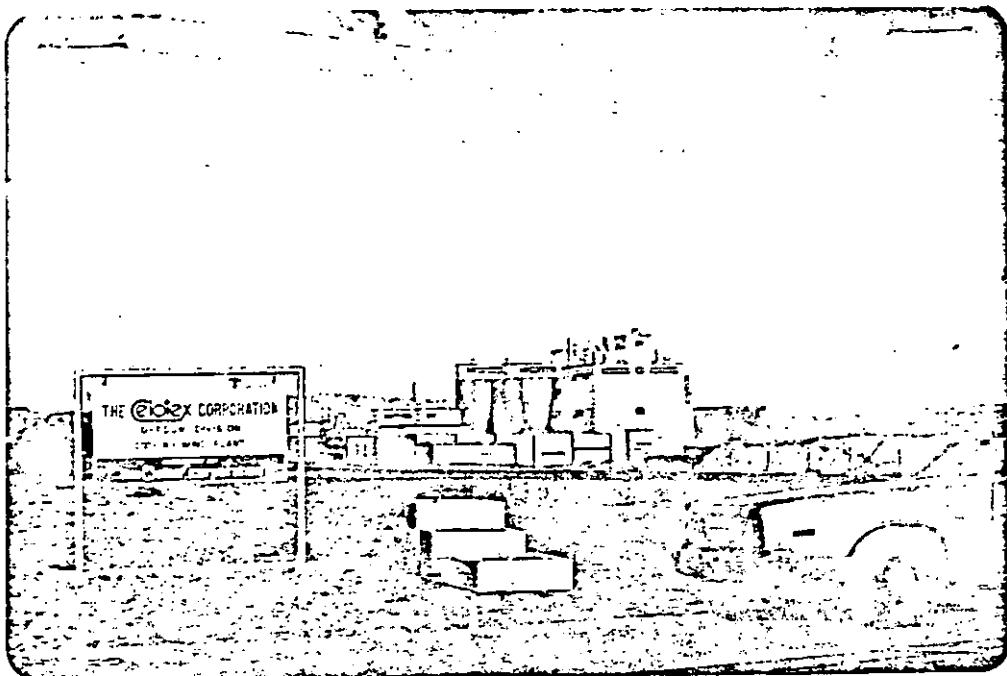


Precipitator Ductwork
(from Raymond Mill Cyclones, Kettle Hot Pits, & Tank Vents)

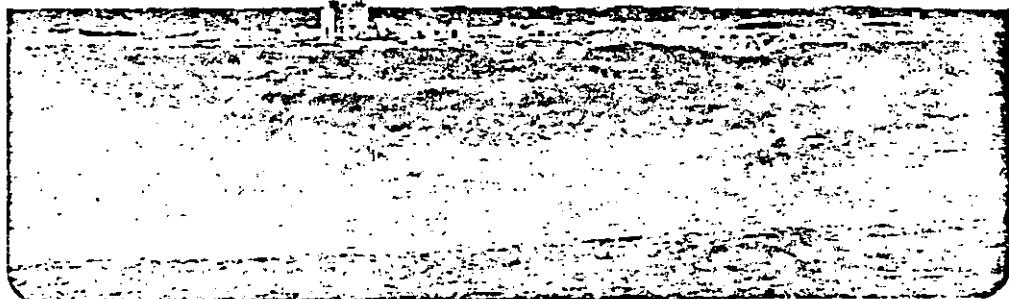


"Precipitaire" Electrostatic Precipitator
(operating)

CELOTEX GYPSUM CO., CODY
April 17, 1979



Mill Overview (looking southeast)
(two large silos are stucco bins)



Plant Overview (looking north)
(note waste wallboard pile (right) - potential dust source on windy days)

AIR POLLUTION REMEDIATION DIVISION

PRECIPITAIR POLLUTION CONTROL, INC.

REPORT

OF

P E R F O R M A N C E T E S T S

CONDUCTED

ON THE

"PRECIPITAIR"

INSTALLED

AT THE

BIG HORN GYPSUM CO.

CODY, WYOMING

SPECIALISTS IN POLLUTION ANALYSIS AND CONTROL

IGCI

CENTRAL JERSEY INDUSTRIAL PARK, BOUND BROOK, NEW JERSEY 08805 (201) 356-5857

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Precipitair Outlet	

AIR MEASUREMENT AND TEST REPORT

PRECIPITAIR POLLUTION CONTROL, INC.

1. Introduction

This report covers the results of tests made to determine the performance of the PRECIPITAIR installed by Precipitair Pollution Control, Inc. for Big Horn Gypsum Company, located in Cody, Wyoming.

The equipment, as furnished and erected, is described in Proposal #0904801 dated September 4, 1968 and Purchase Order #2657 dated December 26, 1968.

2. Purpose of the Installation

The purpose of this installation is to remove gypsum dust from the outlet gases from two (2) Kettle Exhausts, two (2) Raymond Grinding Mills, and the silo vents.

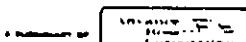
3. Description of the Installation

The installation consists essentially of the following:

- A. A modular electrostatic precipitator with hoppers and automatic controls, high voltage power supplies with silicon rectifiers and interconnecting cables and wiring. The PRECIPITAIR is furnished with galvanized collecting plates, stainless steel corona ribbon (patent pending), electric vibrators with variable automatic controls.
- B. Inlet and outlet hoods with perforated distribution plates.

4. Rating

The normal rated gas capacity for this installation is 30,000 cfm at an inlet gas temperature of 180°F to 260°F.



SPECIALISTS IN POLLUTION ANALYSIS AND CONTROL

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5. Guarantee

Precipitair Pollution Control, Inc., guaranteed that when this installation is adjusted and operating within its rated capacity, the Precipitair shall have a collection efficiency of 97%.

6. Operating Data

This installation was placed in operation in January, 1970, and Performance Tests were run on February 26, 1970. The test procedures followed are in general agreement with the A. S. M. E. Power Test Codes and the Air Measurement Division of Precipitair test procedures.

7. Discussion of Test Results

Inlet and outlet tests were made to prove performance of the installation.

The inlet test volume was 29,300 acfm @195°F, with a dust loading of 708 pounds per hour to the Precipitair. The outlet test volume was 31,400 @170°F with a dust loading of 5.6 pounds per hour to atmosphere giving an efficiency of 99.4%.

All test results and other pertinent operating data are shown on the attached summary sheets.

8. Conclusion

On the basis of the test results, it is concluded that this installation is meeting its guarantee.

Raymond J. Viladesau
Manager, AIR MEASUREMENTS DIVISION
Precipitair Pollution Control, Inc.

bsm
3/5/70

9. Summary of Test Results - February 26, 1970

Gas Volume

Precipitair Inlet..... 29,300 acfm

Precipitair Outlet..... 31,400 acfm

Gas Temperature

Precipitair Inlet..... 195°F

Precipitair Outlet..... 170°F

Dust Loading

Precipitair Inlet..... 2.82 grs/cu.ft.

Precipitair Inlet..... 708 lbs./hour

Precipitair Outlet..... .0188 gr./cu.ft.

Precipitair Outlet..... 5.6 lbs/hour

Moisture Content

Precipitair Inlet..... 12.5%

Precipitair Outlet..... 12.4%

Efficiency..... 99.4%

10. Electrical Readings

During Test

Section #1:

Kilovolts.....37.5

Amps.....5

Section #2 & #3:

Kilovolts.....40.0

Amps.....12

ELECTRICAL READING LEFT AT:

Section #1:

Kilovolts.....40.5

Amps.....10

Section #2 & #3:

Kilovolts.....42

Amps.....20

ANNUAL MEETING OF THE MUSEUM OF THE AMERICAN INDIAN

PRECIPITAIR POLLUTION CONTROL, INC.

GAS VOLUME DATA

Page 5

JOB: Big Horn Gypsum Co. Cody Wyoming

PITOT TUBE TRAVERSE

GAS ANALYSIS					
TEST NO.					
LOCATION					
CO ₂					
O ₂					
CO					
SO ₂					
H ₂ O					
N ₂					

GAS VELOCITY DATA		
TEST NUMBER		
PITOT TUBE CORRECTION FACTOR - F_B		877
DENSITY OF GAS REL. TO AIR - ρ_D		
FLUE OR STACK PRESSURE ("HG) - PA		

CALCULATIONS

TEST NUMBER: _____

$$V_s = 2.9 (F_s) \sqrt{\frac{29.92}{P_a} \times \frac{1.00}{G_d} (T_s)} \sqrt{H}$$

$$V_s = 2.9 (\quad) \sqrt{\frac{29.92}{\quad} \times \frac{1.00}{\quad} (\quad)} \sqrt{H}$$

$$V_s = (\quad) \sqrt{H}$$

$$TEST\ NUMBER: \underline{\hspace{2cm}}$$

$$V_s = 2.9 (\quad) \sqrt{\frac{29.92}{\underline{\hspace{2cm}}} \times \frac{1.00}{\underline{\hspace{2cm}}}} (\quad) \sqrt{H}$$

$$V_s = (\quad) \sqrt{H}$$

PLANT CONDITIONS
FUEL TYPE
FUEL CONSUMPTION RATE
MATERIAL PRODUCTION RATE

SEE PAGE _____ FOR FLUE OR STACK
TRAVERSE LAYOUT

AIR MEASUREMENT DIVISION

PRECIPITAIR POLLUTION CONTROL, INC.

GAS VOLUME DATA

Page 6

Big Horn Gypsum Co., Cody, Wyoming

PITOT TUBE TRAVERSE

GAS ANALYSIS

TEST NO.				
LOCATION				
CO ₂				
O ₂				
CO				
SO ₂				
H ₂ O				
N ₂				

GAS VELOCITY DATA

TEST NUMBER	
PITOT TUBE CORRECTION FACTOR - F_p	855
DENSITY OF GAS REF. TO AIR - ρ_d	
FLUE OR STACK PRESSURE ("HG) - P_a	

CALCULATIONS

$$V_s = 2.9 (F_s) \sqrt{\frac{29.92}{P_a} \times \frac{1.00}{G_d} (T_s)} \sqrt{H}$$

TEST NUMBER: ..

$$V_s = 2.9 \left(\quad \right) \sqrt{\frac{29.92}{H}} \times \frac{1.00}{\left(\quad \right)} \sqrt{H}$$

PLANT CONDITIONS

FUEL TYPE

FUEL CONSUMPTION RATE

MATERIAL PRODUCTION RATE

SEE PAGE _____ FOR FLUE OR STACK
TRAVERSE LAYOUT.

7/17 Ed Tuten — Merle Rogers

Production & Safety

(new letter)

1500 N. Dale Mabry
Tampa, Florida 33607

P.O. Box 22602
Tampa 33622

Engineering

Steve Moore ext 4172
(813) 871-4172

about 33 20T trucks hauling 6 mi. south

(660 T/D. gyp. rock) - crusher

Crusher rated 150 T/H

#4 truck dump

looking W

looking at crusher
feed grate

#6 looking at
crusher

Hammermill
21 hammers

out - $1\frac{1}{2}$ "

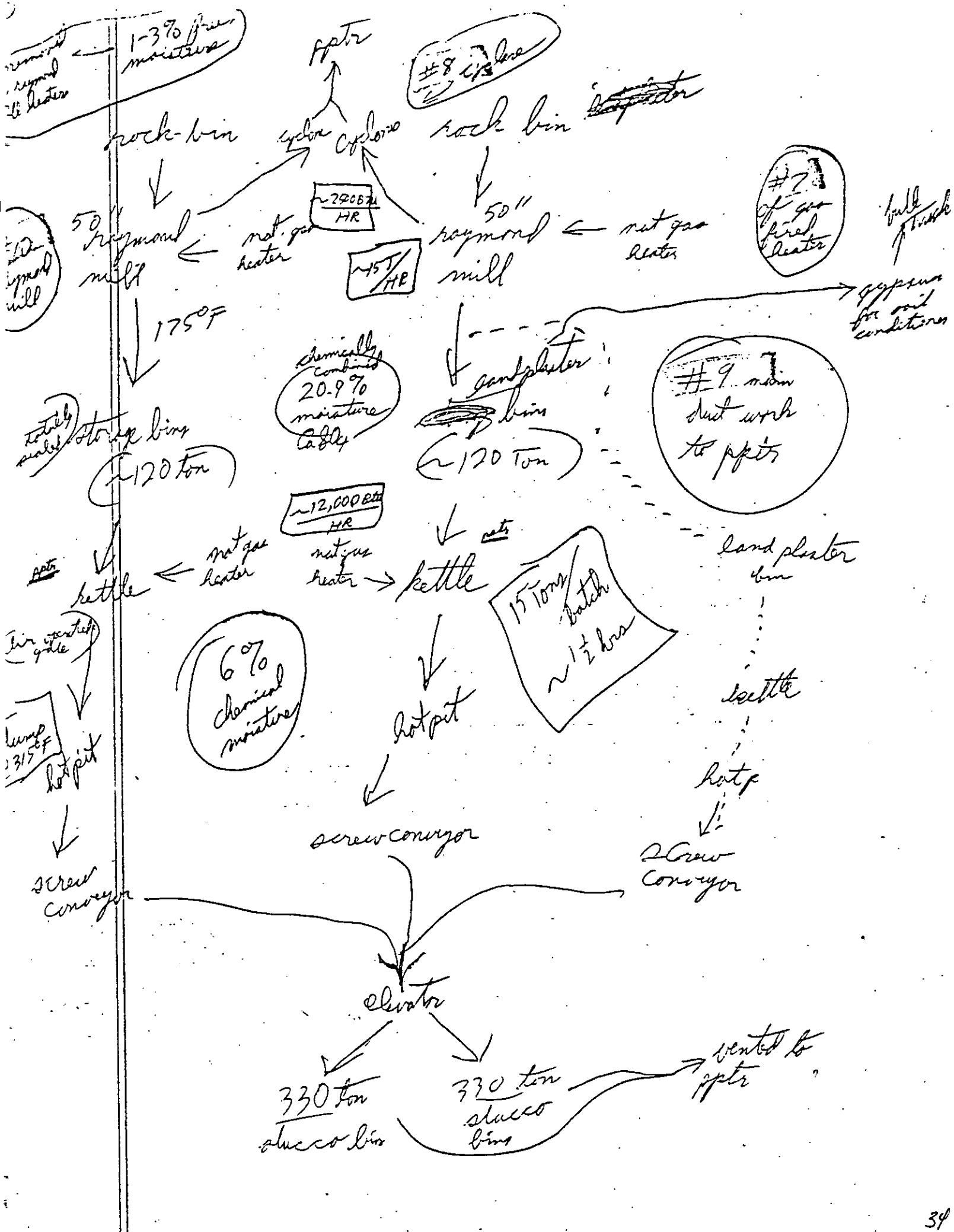
enclosed conveyor

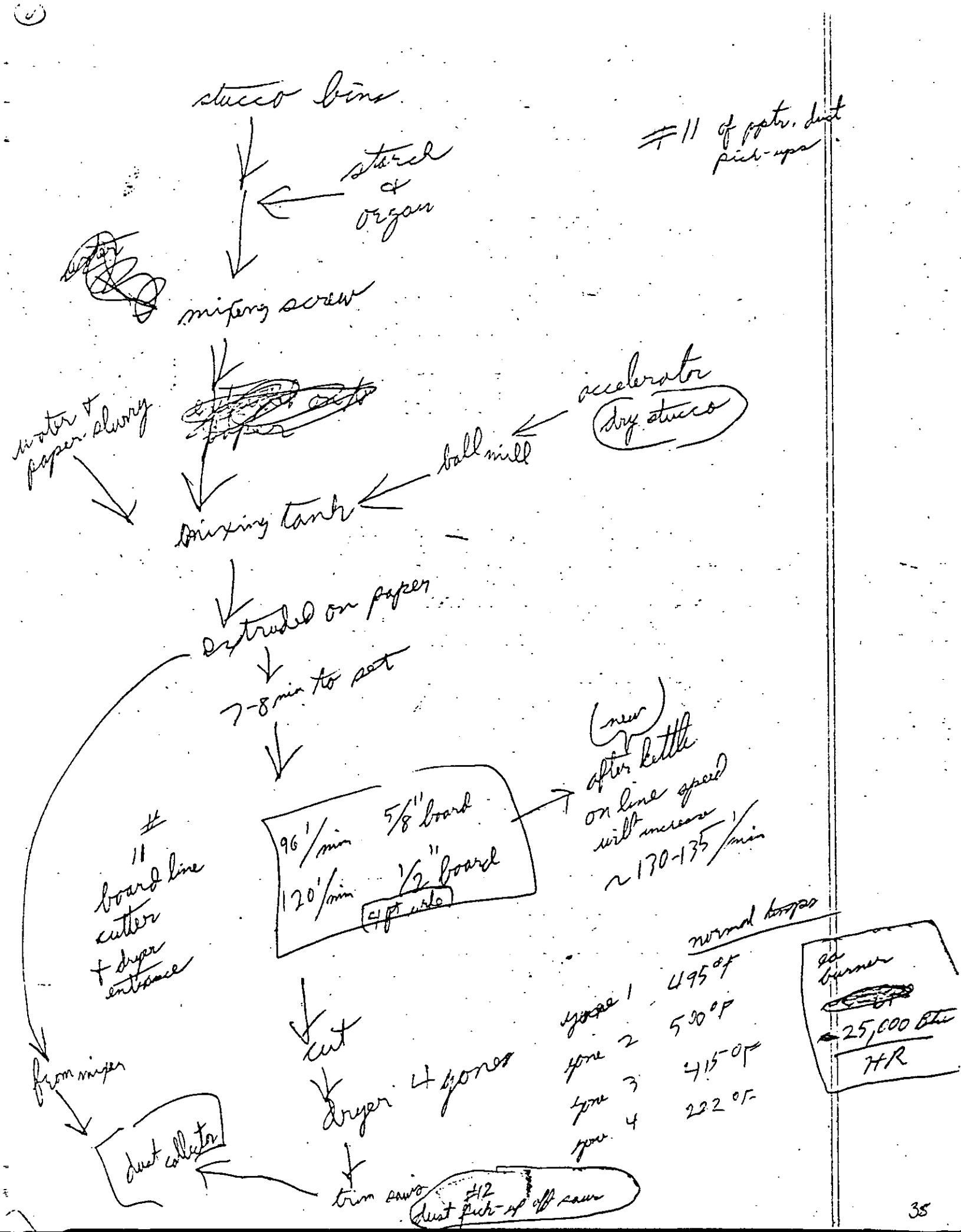
enclosed transfer room

bucket elevator

rock bin
(275 T.ca)

rock bin





(b) 13. soil baffle

Buffalo forge - aeroturn
airing type

Precipitator - 1 chamber - 3 field - C type

1975

Tons silica produced = 128,183 \rightarrow wallboard 206×10^6
ft² on $\frac{1}{2}$ " base

1300 gyp soil conditioners

1978 fuel w

592,469 MCF

1978 total operating hours

8,148 entire plant (good plant)

~ 318 days, 24-hr days on mill

#14
ptr

#15
Plant
overview looking
WSW

#16
Plant overview
looking NW across the Gluhone
River. w/ scrap board job

MEMORANDUM

TO: GEORGIA PACIFIC COMPLIANCE FILE

THROUGH: RANDY WOOD, AIR QUALITY ADMINISTRATOR
CHUCK COLLINS, AIR QUALITY SUPERVISOR

FROM: *LG* LEE GRIBB, DISTRICT AIR QUALITY ENGINEER

SUBJECT: COMPLIANCE TESTING FOR CT-217/CRUSHER DUST

DATE: FEBRUARY 4, 1980

The Division received notice on November 23, 1979 that the new Raymond Mill permitted under CT-217 had been initially started on September 25, 1979. Georgia Pacific had some troubles initially getting the mill to run properly and waited until December 5, 1979 to schedule performance tests on the Cottrell electrostatic precipitator at the plant which controls the Raymond Mill.

On December 5 I was present at the Georgia Pacific plant to observe the testing. Preliminary data had been gathered the previous afternoon by Ecology Audits, the stack testing consultant who was hired to perform this testing. Ecology Audits personnel at the plant were Brad Penn and Brant Gimmeson. My Georgia Pacific contact during the testing was Bob McNeill, the Plant Engineer. I also spoke with Paul Larson, the Plant Manager, and Bruce Wacker, the Senior Plant Engineer.

Testing commenced at 8:00 a.m. after I verified the port dimensions, point locations, operating condition of the precipitator, and the operating level of the mill. The mill ran at a combined rate of 39 TPH of landplaster from both Raymond Mills. The electrostatic precipitator operating parameters are given in Appendix F of Ecology Audits' report (attached).

Testing concluded at 3:45 p.m. after four runs. A broken piece of impinger glassware was discovered during the leak check of run #2 causing it to be invalidated. Cleanup, sample recovery, and observed lab procedures were acceptable.

I read four opacities during the day, one during each of the four test runs. All four readings resulted in 0% observed opacity. The tests showed average emissions of 5.06 lbs./hr. of particulate matter. The allowable for this stack was set as a CT-217 permit condition at 20 lbs./hr. I therefore recommend that these tests be accepted as proof of compliance for this stack.

During the day while I observed these stack tests, I also noted other sources of emission from the operation of this gypsum plant. The main source of these emissions was the plant crusher. I have noted heavy fugitive dust from this source before; and in fact, this emission was what prompted my recommendation that monitoring be undertaken at this plant to determine the impact of these emissions. The accompanying pictures show the heavy emissions from the crusher this day. The crusher was operated essentially all day with perhaps one hour of downtime interspersed throughout the day.

MEMORANDUM

GEORGIA PACIFIC COMPLIANCE FILE
TESTING CT-217/CRUSHER DUST
FEBRUARY 4, 1980
PAGE TWO

Also noted as sources of fugitive emission were the conveyor transfer points and the mill cleanup holes. The belt conveyor carrying the ore from the crusher to the mill has no dust control on the transfer points, consequently it was causing a continuous stream of dust as it ran. The mill cleanup dust is currently pushed out holes cut through the mill wall on each mill floor. This has resulted in a heavy buildup of very light, fine dust as deep as a foot around the mill. This dust is very susceptible to entrainment in the wind while falling to the ground from these cleanup holes and also while lying loose on the ground or being agitated by any activity in the area.

Another source of fugitive dust was noted on October 10, 1979 when I observed a mine blast at the company's pit located about one mile northwest of the plant. A picture of this source is also attached to this memo.

I spoke with Paul Larson about these fugitive sources after the testing was completed. I told him that the cleanup methods at the mill and the crusher appeared to be major sources of fugitive dust. I told him that these sources were of concern to the Division and suggested that some alternatives should be planned for by Georgia Pacific. I told Mr. Larson that if ambient data gained from the company's monitoring site showed high values that these sources would be the first place the Division would look for controls.

Mr. Larson then told me that Georgia Pacific was already looking at some corrective measures. He told me that the company is investigating an in-plant vacuum system for mill cleanup, implementation of which should eliminate that source as a concern to the Division. He also told me that Georgia Pacific was planning modifications to the crusher. I told Mr. Larson that Georgia Pacific should inform the Division of the details of such a modification for a determination of permit requirements. I told him that dust control provisions should be included in any proposal.

PLUME OBSERVATION FORM

Plant Name: GEORGIA-PACIFIC — DURING STACK TEST ##
 Stack Identification: PPTR STACK

Address 1117 E 5

Sec.	0	15	30	45
Min.				
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6				
7				
8				
9				

Observer LEE GRIGG

Date 12/5/79

Time 8:30 a.m.

Type of Background gray sky

Color of Emissions colorless

Location of Observer SE

Distance to Stack 400 ft.

Wind Direction NNW
(Approx.)

Wind Speed 3-5 mph
(Approx.)

Temperature 40°F

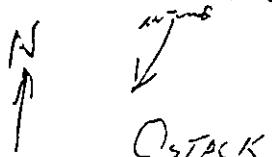
Sum of numbers recorded 0

Total number of readings 24

Opacity: Sum of nos. recorded / Total nos. of readings = 0%

Comments: Stacked them plume
Both Report Full or with the greater

Sketch of Location:



Company Official: J. K. COOPER
Signature

x COOPER

Date 12/5/79 Title or Position PLANT ENGINEER

Time 8:45 Company Name GEORGIA-PACIFIC

PLUME OBSERVATION FORM

DURKIN STACK TEST
#7Plant Name: GENERAL PACIFIC CYCLOMStack Identification: COTTONWOOD MR STACKAddress 1411 MILES

Sec.	0	15	30	45
Min.				
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6				
7				
8				
9				

Observer LEE GRIFFDate 12/15/79Time 10:30 a.m.

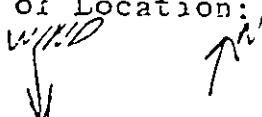
Type of Background

CLOUDYColor of Emissions CREAM

Location of Observer

EAST SOUTH EASTDistance to Stack 40 ftWind Direction N
(Approx.)Wind Speed 7-10 mph (gusting high)
(Approx.)Temperature 45°FSum of numbers recorded 0Total number of readings 24Opacity: Sum of nos. recorded = 0%
Total nos. of readingsComments: SMALL SMOKE PLUMEboth ground smoke + both plume bands

Sketch of Location:

Company Official: John M. Miller
Signature

STAFF

OBSERVER

Date 12/15/79Title or Position Plant ManagerTime 10:30 a.m.Company Name GENERAL PACIFIC CYCLOM

20

40

PLUME OBSERVATION FORM

Plant Name: GEORGIA PACIFIC During Test 4-3
 Stack Identification: GEORGIA PACIFIC PCTR
 Address 4111ES

Sec.	0	15	30	45
Min.				
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6				
7				
8				
9				

Observer LEE GRIBBDate 12/5/79Time 1:20 pmType of Background CloudyColor of Emissions COLORELESSLocation of Observer WESTDistance to Stack 300 ftWind Direction NORTH
(Approx.)Wind Speed 20 mph
(Approx.)Temperature 50° FSum of numbers recorded 0Total number of readings 27Opacity: $\frac{\text{Sum of nos. recorded}}{\text{Total nos. of readings}} = \frac{0}{27} = 0\%$

Comments:

Georgia-Pacific Mill
 & Georgia-Pacific Company

Company Official: R. K. McMillen OBSERVER +
 Signature

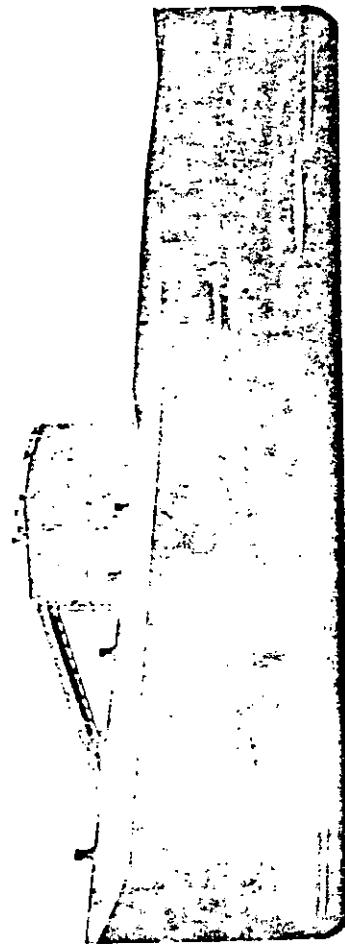
Date 12/15/79 PLANT ENTER.

Title or Position

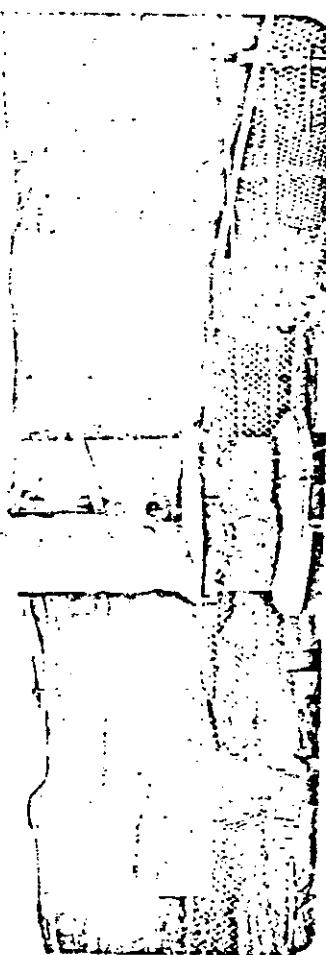
Time 2:50 Company Name GEORGIA-PACIFIC

SUN

41



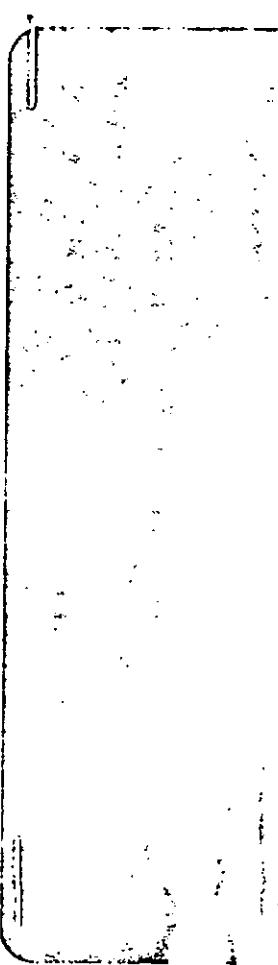
Test I



Test II

From Opacity Vantage Points - Opacities = 0%

Test III



Test IV



PLUME OBSERVATION FORM

Plant Name: GEORGIA-PACIFIC Paper Mill Test 4Stack Identification: COTTRELL ELECTROSTATIC PRECIPITATOR

Address _____

TIMES

Observer LEE GRISBDate 12/5/79Time 2:50 p.m.

Type of Background _____

DARK MOUNTAINSIDEColor of Emissions COLORLESS

Location of Observer _____

West

Distance to Stack _____

400 ftWind Direction North
(Approx.)Wind Speed 10 mph
(Approx.)Temperature 50°FSum of numbers recorded 0Total number of readings 24Capacity: Sum of nos. recorded = 0% Total nos. of readingsComments: detected steam plumeboth burner null
& with kettle running

Sketch of Location:

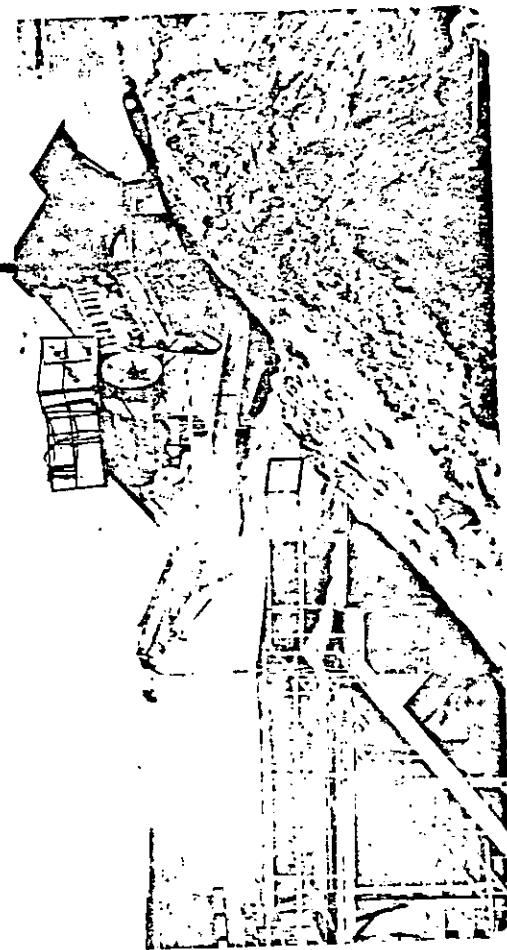
Company Official: Bruce Wacker
SignatureDate 12/5/79 Title or Position Main ListTime _____ Company Name Georgia-Pacific

Georgia Pacific - December 5, 1979

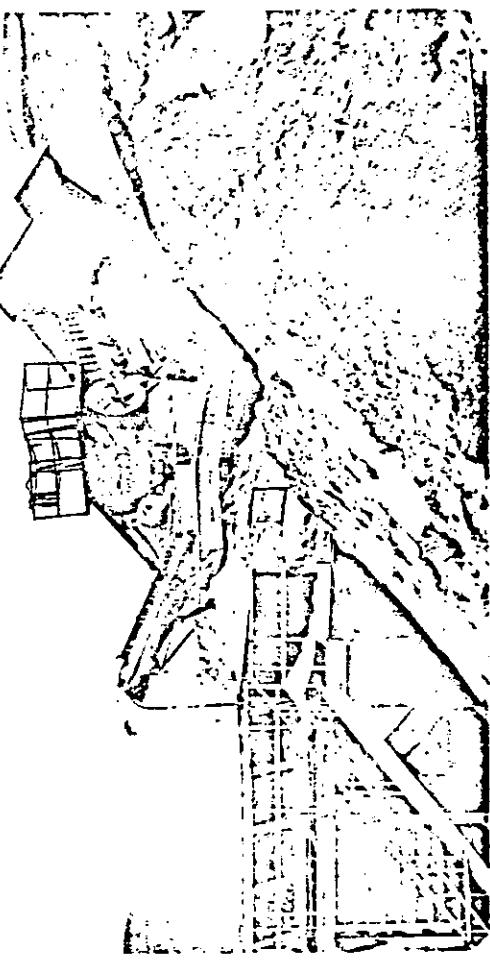


Crusher Dust at 8:40 a.m.





Views of Crusher in Operation at 1:00 p.m.



Crusher Drop Point, 1:00 p.m.

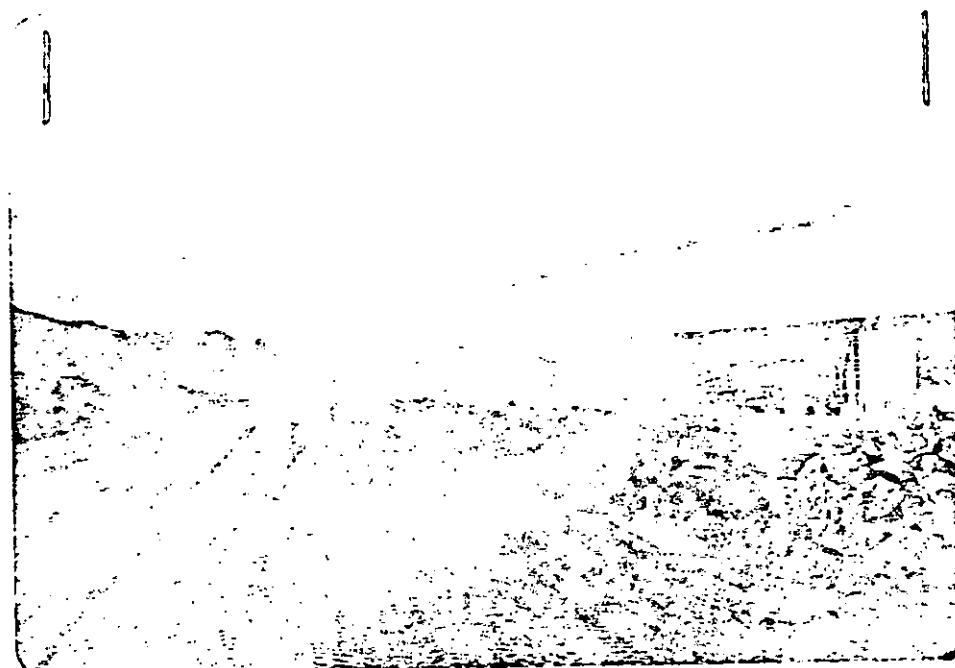
Looking Downwind Through Crusher Plume



Georgia Pacific - December 5, 1979

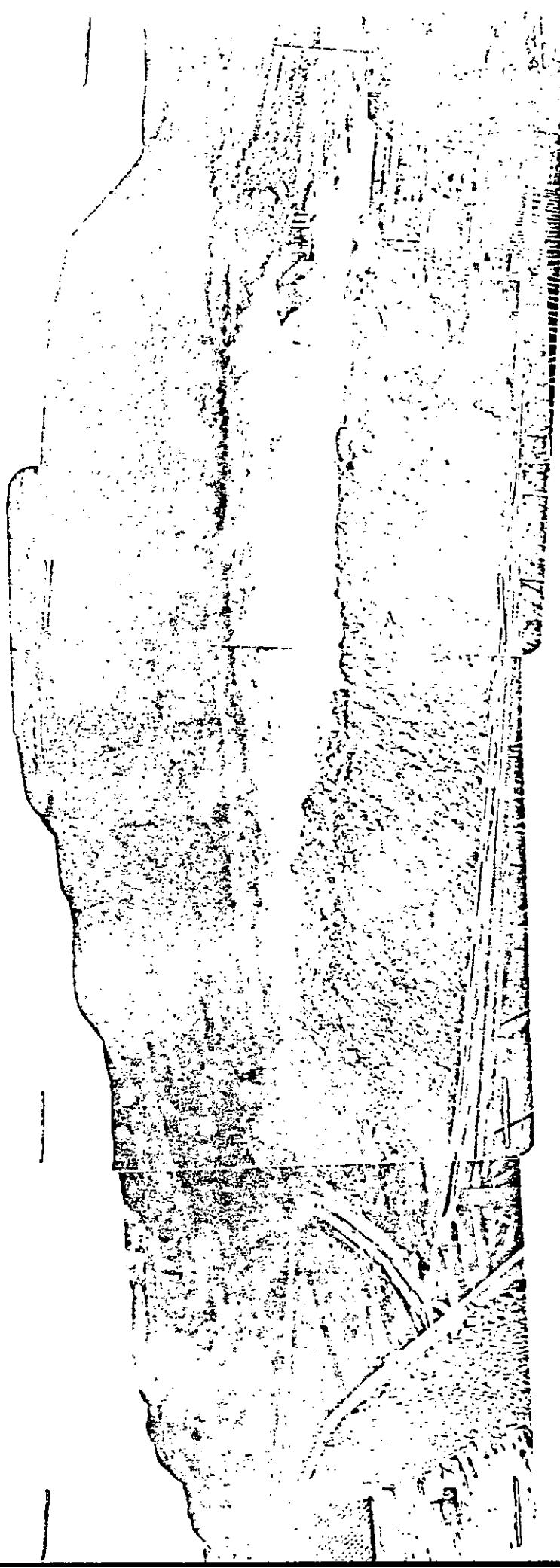


Looking Downwind at Crusher Dust at 1:20 p.m.



Looking Upwind at Crusher Dust from Approximate Hi-Vol Location

Georgia Pacific - December 5, 1979

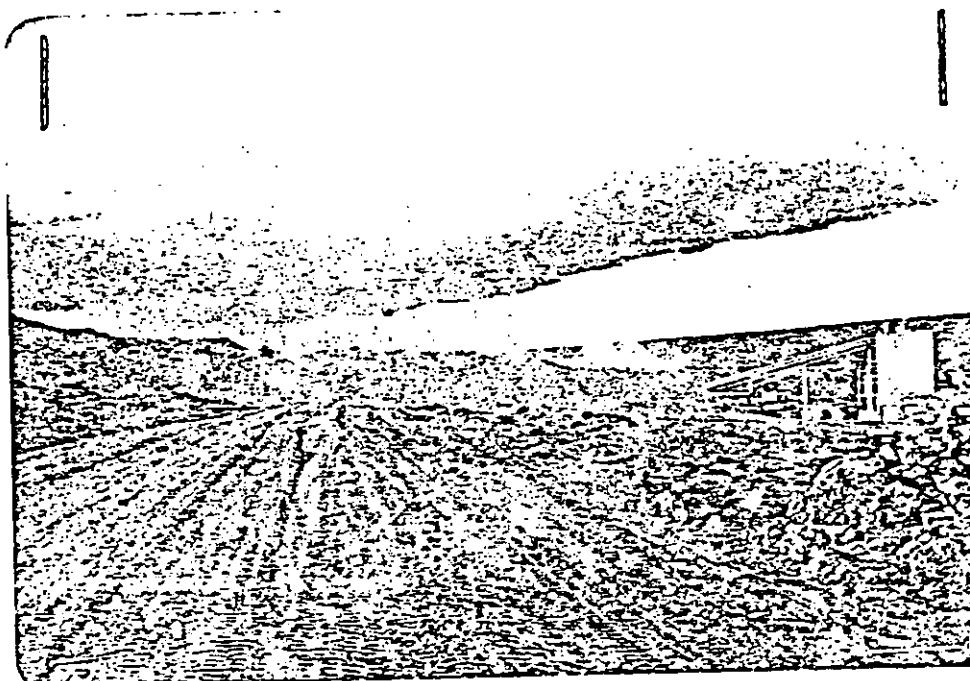


Panorama of Dust Emitted from Crusher - Taken from Mill Roof at 2:00 p.m.

Georgia Pacific - December 5, 1979

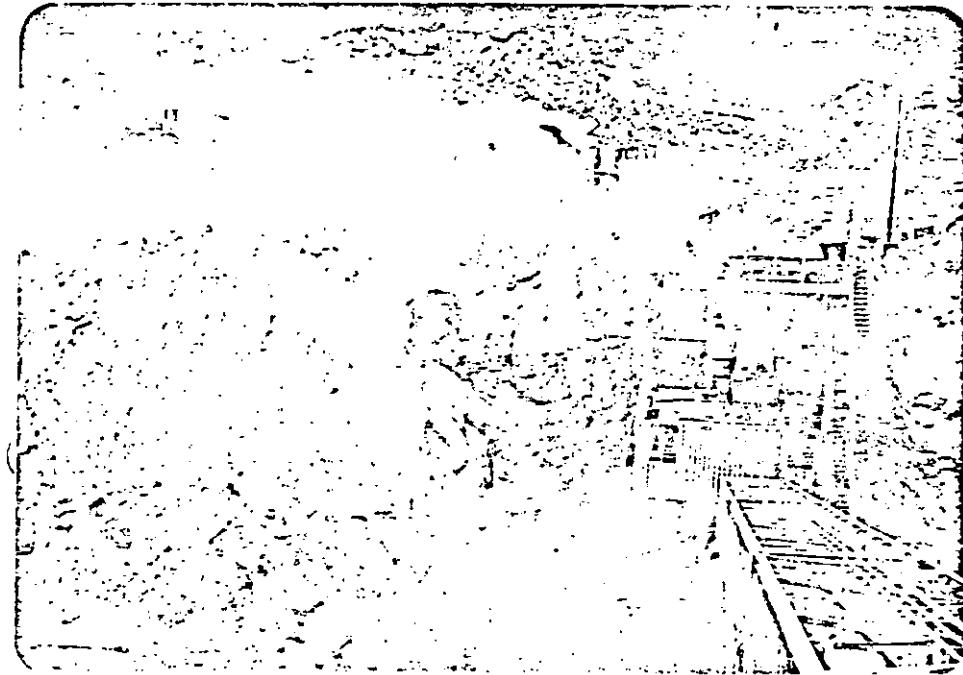


Looking Downwind at Crusher Dust at 1:20 p.m.

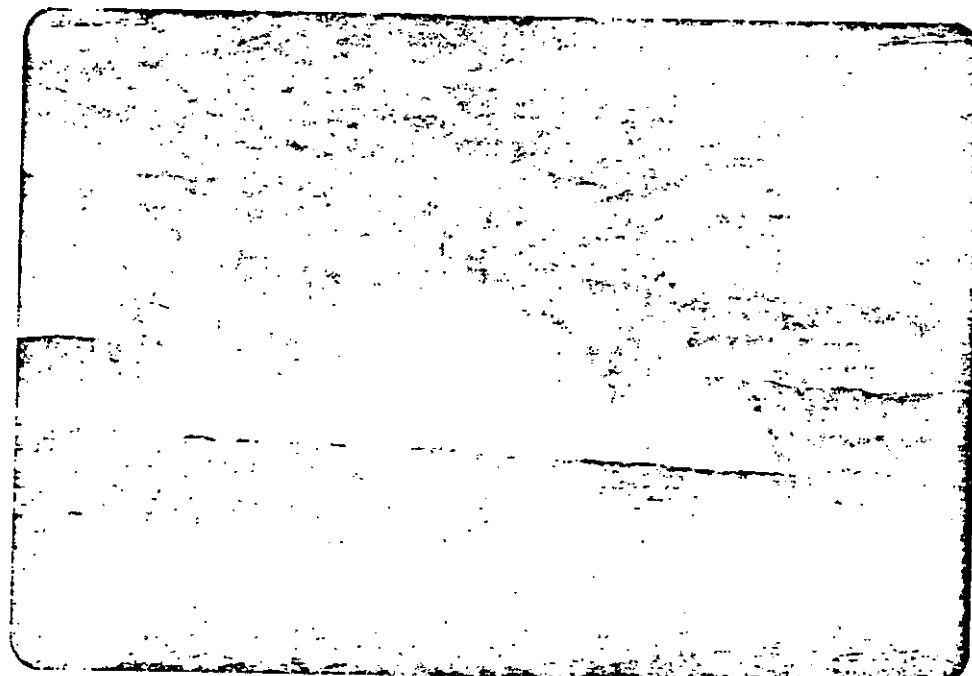


Looking Upwind at Crusher Dust from Approximate Hi-Vol Location

Georgia Pacific



Crusher Dust - Taken from Precipitator Roof at 2:30 p.m.
December 5, 1979



Dust from Pit Blast at Georgia Pacific
October 10, 1979

12/5/79

Georgia Pacific - Start Test F - ~~efficiency~~(0.302 inch
magnet)

7:30 a.m.

inlet 12 spkts/min 405 voltage 40 m³ min. 31 A current transformer

outlet

52,000 volts 300000 ppms 45 A current transformer 700 m³ ppms

start test

6:30-8:44 - 8:00 a.m.

51" d.d. Stock 3.2% 158" 50" "barrier
10.5% 5 3/8" 143
19.4% 9 3/8" - 147
32.3% 15 1/2" 7 131
67.7% 34 1/2" 7 62
80.6% 41 1/8 7 26
89.5% 45 5/8
96.8% 49 3/8 704(104" magnet)
2.0 m³ ppms8:15 Raymond Mill #7 (new) 170°F
Raymond Mill #1 150°F8:30 a.m. Picture #4 opacity = 0%(8:40 a.m.) Picture #5 + 6 cracker

9:10 a.m. cold test 667.991 - leak test stopped lead

inlet 9:20 28 spkts/min 750 fines% 28 m³ 25 amps
ppms transformeroutlet 300 m³ transformer 52,000 volts 56 A transformer 290 Ma
ppms ppms

3/1
3/1
Pacific Pacific 12/5/79
Start IV

2:40 p.m. Start IV - 744.755

2:50 opacity = 0%

3:00 picture #20

3:45 p.m. end - 781.092

- ~~Lock Check~~
~~Topper dead~~

wash up procedure acceptable — mill fairly dirty where
probe was washed

Crusher running all day — excessive dust

Company Union Pacific
Testing Firm Ecology Audit
Date Tested 12/5/79
Test Observed By Lee Grubb
Test Evaluated By Lee Grubb

Location Hines
Tests Conducted By Person
Garrison

Stack Data

Stack ht (ft) 90ft

Stack dia 54 51 inches

Process venting through stack Caliner Kellis & Raymond Mill Cabinet

Traverse Points

Nozzle diameter: Test 1 0.302" Test 2 0.302" Test 3 0.302"

Location of sampling ports 501" downstream (9.98 dia); 104" upstream (204 dia)

Number of traverse points per test: Test 1 16 Test 2 16 Test 3 16

Do sampling points follow EPA guidelines? Yes X No

Comments: actually minimum could have been tested (i.e. 12 points)

Emissions

		<u>Test 1</u>	<u>Test 2</u>	<u>Test 3</u>
Process wt rate	(ton/hr)	<u>39</u>	<u>39</u>	<u>39</u>
Allowable emission	(lb/hr)	<u>20</u>	<u>20</u>	<u>20</u>
Measured emission	(lb/hr)	<u>8.83</u>	<u>3.68</u>	<u>2.66</u>
% Isokinetic		<u>(w/0.6)</u> <u>110%</u>	<u>110%</u>	<u>106%</u>

break-point
condition of (pp)
CT-217 (pp)

Comments and recommendations:

Estimated values may just a factor over the allowed limit on Test #1 & #2, but since the measured emissions are low in comparison to the O.A.C.T. allowable, it would not be required to re-ventilate. all sampling & testing methods are followed and may now be stated in the unattached lab procedures. Therefore I recommend that these tests be accepted as proof of compliance for permit CT-217 valid until 26, 1979.

12/4/80

Data Sheet

$$P_{std} = 29.92 \text{ in Hg}$$

$$T_{std} = 530^{\circ} \text{ R}$$

	<u>Test 1</u>	<u>Test 2</u>	<u>Test 3</u>
P_{bar} = barometric pressure at site (in Hg)	<u>25.81</u>	<u>25.90</u>	<u>25.90</u>
P_s = absolute stack gas pressure (in Hg)	<u>25.82</u>	<u>25.91</u>	<u>25.91</u>
T_s = absolute average stack gas temp. (°R)	<u>640</u>	<u>642</u>	<u>647</u>
T_m = absolute average dry gas meter temp. (°R)	<u>505</u>	<u>512</u>	<u>516</u>
V_{ic} = total volume of water collected (ml)	<u>113.8</u>	<u>122.7</u>	<u>111.9</u>
V_m = volume of gas through dry gas meter (ft ³)	<u>38.001</u>	<u>37.834</u>	<u>37.127</u>
ΔH = average pressure drop across orifice (in H ₂ O)	<u>0.93</u>	<u>0.95</u>	<u>0.93</u>
C_p = pitot tube coefficient	<u>0.842</u>	—	→
$(\bar{p})_{ave}$ = average velocity head of stack gas (in H ₂ O)	<u>0.393</u>	<u>0.390</u>	<u>0.391</u>
A_s = cross-sectional area of stack (ft ²)	<u>14.186</u>	—	→
M_p = total amount of particulate collected (g)	<u>0.1643</u>	<u>0.0687</u>	<u>0.0480</u>
Q = total sampling time (min.)	<u>64</u>	—	→
A_n = cross-sectional area of nozzle (ft ²)	<u>4.97×10^{-4}</u>	—	→

Gas Analysis

	<u>Test 1</u>	<u>Test 2</u>	<u>Test 3</u>
% CO ₂	<u>6</u>	<u>5</u>	<u>5</u>
% O ₂	<u>18</u>	<u>18</u>	<u>18</u>
% CO	<u>2</u> <u>3</u> ⁷⁶	<u>2</u> <u>3</u> ⁷⁷	<u>2</u> <u>3</u> ⁷⁷
% N ₂	<u>74</u>	<u>75</u>	<u>75</u>

Calculations

1. $V_{w \text{ std}}$ = volume of water vapor in gas @ STP (ft³)

$$V_{w \text{ std}} = 0.0474 \text{ ft}^3/\text{ml} \cdot V_{ic}$$

$$V_{w \text{ std}} = 5.39, 5.82, 5.30 \text{ ft}^3$$

2. $V_{m \text{ std}}$ = volume of gas sample through dry gas meter @ STP (ft³)

$$V_{m \text{ std}} = \left(17.71 \frac{\text{or}}{\text{in Hg}} \right) V_m \left(\frac{P_{\text{bar}} + \frac{\Delta H}{13.6}}{T_m} \right)$$

$$V_{m \text{ std}} = 2.49, 33.99, 33.09 \text{ ft}^3$$

3. B_{w0} = proportion by volume of water vapor in gas stream (dimensionless)

$$B_{w0} = \frac{V_{w \text{ std}}}{V_{w \text{ std}} + V_{m \text{ std}}}$$

$$B_{w0} = 0.14, 0.15, 0.14$$

4. Molecular weight (lb/lb mole)

$$M_d = 0.44 (\% \text{ CO}_2) + .32 (\% \text{ O}_2) + .28 (\% \text{ N}_2 + \% \text{ CO})$$

$$M_d = 29.68, 29.52, 29.58 \text{ lb/lb mole}$$

$$M_s = M_d (1 - B_{w0}) + 18 B_{w0}$$

$$M_s = 28.10, 27.84, 27.84 \text{ lb/lb mole}$$

5. V_s = stack gas velocity (ft/sec)

$$V_s = 85.48 C_p (\sqrt{\Delta P})_{\text{ave}} \sqrt{\frac{T_s}{P_s M_s}}$$

$$V_s = 26.57, 26.48, 26.65 \text{ ft/sec}$$

6. Q_s = volumetric flow rate, dry basis, @ STP (ft³/min)

$$Q_s = 60 (1 - B_{w0}) V_s \cdot A_s \left(\frac{550}{T_s} \right) \left(\frac{P_s}{29.92} \right)$$

$$Q_s = 13,474, 13,760, 13,870 \text{ ft}^3/\text{min}$$

7. C_s = concentration (lb/ft³)

$$C_s = 2.205 \times 10^{-3} \frac{M_s}{V_{m \text{ std}}}$$

$$C_s = 0.053 \times 10^{-5}, 0.046 \times 10^{-5}, 0.032 \times 10^{-5} \text{ lb/ft}^3$$

Calculations (continued)

8. E = emission rate lb/hr

$$E = C_s \cdot Q_s \cdot 60$$

$$E = 883, 368, 266 \text{ lb/hr}$$

9. % Isokinetic

$$I = 1.667 T_s \left(0.00267 V_{ic} + \frac{V_m}{T_m} (P_{bar} + \frac{\Delta H}{13.6}) \right)$$

$$\Theta V_s P_s A_n$$

$$I = 110.08, 110.16, 110.41 \%$$



STACK EMISSIONS SURVEY
OF
GEORGIA - PACIFIC COMPANY
LOVELL, WYOMING
DECEMBER, 1979

FILE NUMBER EA 7920-76

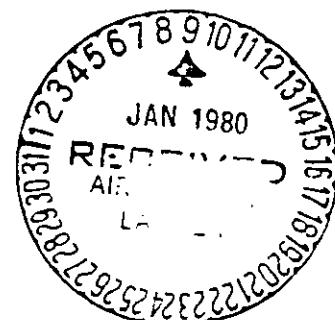




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DESCRIPTION OF SAMPLING LOCATIONS	5
SAMPLING AND ANALYTICAL PROCEDURES	6
DESCRIPTION OF TESTS	8
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B. Source Emissions Calculations	
C. Calibration of Equipment	
D. Field Testing Data	
E. Analytical Data	
F. Precipitator Data	

STACK EMISSIONS SURVEY
GEORGIA PACIFIC COMPANY
LOVELL, WYOMING
FILE NUMBER EA 7920-76

INTRODUCTION

Ecology Audits, Inc., Casper, Wyoming, conducted a stack emissions survey at Georgia - Pacific Company located in Lovell, Wyoming, on December 4, 1979, and December 5, 1979. The purpose of this survey was to determine emissions of particulates from the Cottrell Precipitator Stack.

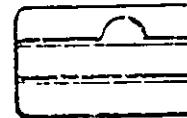
The sampling followed the procedures set forth in the "Wyoming Air Quality Standards and Regulations, Wyoming Department of Environmental Quality, 1979", and the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.



SUMMARY OF RESULTS

Cottrell Precipitator Stack

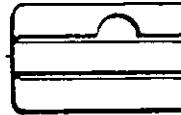
1. The emissions of particulate matter from the Cottrell Precipitator Stack were 5.08 pounds per hour based on averaging the three tests using the "front-half" collections of the EPA-type sampling train.
2. The average allowable particulate emission rate is 20 pounds per hour based on the "Wyoming Air Quality Standards and Regulations, Best Available Control Technology, Permit Conditions." The particulate emissions were 25.4 percent of this standard based on averaging the "front-half" collections of the three tests.



SUMMARY OF RESULTS

Run Number	1	3	4
Stack Flow Rate - ACFM	22714	22629	22714
Stack Flow Rate - DSCFM*	14036	13768	13835
% Water Vapor - % Vol.	13.5	14.6	13.8
% CO ₂ - % Vol.	6	5	5
% O ₂ - % Vol.	18	18	18
% Excess Air @ Sampling Point	651	591	591
Particulates			
<u>Probe, Cyclone & Filter Catch</u> grains/dscf*	.0738	.0762	.0511
grains/cf @ Stack Conditions	.0434	.0190	.0136
lbs/hr	8.88	3.70	2.67
Total Catch			
grains/dscf*	.0745	.0333	.0239
grains/cf @ Stack Conditions	.0459	.0203	.0146
lbs/hr	8.97	3.93	2.84
Production Rate Ore processed tons/hr	39	39	39

* 29.92 "Hg, 68°F



DISCUSSION OF RESULTS

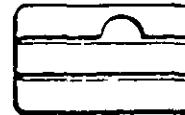
The tests for particulates appeared to be valid representations of the actual emissions. The indicative parameters calculated from the field data were in close agreement. The moisture percentages for the stack were within 4.3 percent of the mean value. The measured flow rates (Q_s) were within 1.1 percent of the mean value. The rates of sampling for the three tests were within the specified limits of the isokinetic rate, the greatest deviation being 9.5 percent.

The total calculated emissions (pounds per hour) were within 3.7 pounds of the mean value.



DESCRIPTION OF SAMPLING LOCATIONS

The sampling ports of the Cottrell Precipitator Stack are located approximately 90 feet above the ground. The sampling was performed from two ports on the circular stack located approximately 42 feet 5 inches (9.98 stack diameters) downstream from the stack inlet and approximately 8 feet 8 inches (2.04 stack diameters) upstream from the stack outlet.



SAMPLING AND ANALYTICAL PROCEDURES

The sampling and analytical procedures used followed the procedures outlined in the "Wyoming Air Quality Standards and Regulations, Wyoming Department of Environmental Quality, 1979" and the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60.

A preliminary velocity traverse was made at the stack in order to determine the uniformity of flow. Particulate samples of four minute duration at each of the traverse points were taken from each port of the Cottrell Precipitator Stack using an EPA-type, heated, glass-lined probe.

Before each test, the sampling train was leak-checked at 15 inches of mercury. After each test, the train was again leak-checked at the highest recorded vacuum reading during the test. Final leak-checking was performed in order to determine the possibility of a diluted sample.



Before and after each test period, the pitot tube lines were checked for leaks under both a vacuum and pressure using the method described in the Federal Register, Volume 42, Number 160, Method 2, Section 3.1. The lines were also checked for clearance and the zero manometer reading verified before and after each test.

The emissions were calculated from gravimetric analysis using the "front-half" collections of the EPA-type sampling train.



DESCRIPTION OF TESTS

Personnel from Ecology Audits, Inc., Casper, Wyoming, arrived at the Georgia - Pacific Company, Lovell, Wyoming, at 1130 hours on Tuesday, December 4, 1979. The equipment was set up on the Cottrell Precipitator Stack and preliminary data were taken by 1500 hours. The equipment was secured for the night awaiting the arrival of the DEQ observer.

On Wednesday, December 5, 1979, work began at 1700 hours, consisting of setting up the sampling train and preliminary leak-checking. Testing began at 0804 hours and continued without difficulty until the test was completed at 0910 hours. A period varying between one half and one and one half hours elapsed between tests to empty product bins.

The second test of the day was run, but, failed final leak-check procedure because of broken internal glassware. This test was discarded. The third test began at 1257 hours and continued without difficulty until its completion at 1403 hours. The fourth test began at 1448 hours and continued without difficulty until its completion at 1546 hours.

The equipment was moved off the Cottrell Precipitator Stack and loaded into the mobile laboratory. The samples were recovered and taken to Ecology Audits' laboratory in Casper, Wyoming, for analyses and evaluation.



Operations at Georgia - Pacific Company, Lovell, Wyoming, were completed at 1630 hours on Wednesday, December 5, 1979.

Gregory Q'Dee Smith
Gregory Q'Dee Smith
Division Manager

Bradley G. Penn
Bradley G. Penn
Supervisor
Field Testing Services



APPENDICES

- A. Locations of Sampling Points
- B. Source Emissions Calculations
- C. Calibration of Equipment
- D. Field Testing Data
- E. Analytical Data



APPENDIX A

Locations of Sampling Points Cottrell Precipitator

The sampling ports are located approximately 42 feet 5 inches (9.98 stack diameters) downstream from the inlet to the stack and approximately 8 feet 8 inches (2.04 stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follow:

Inside Stack Diameter = 51 inches

Port and Wall Thickness = 3/8 inches

<u>Point No.</u>	<u>Percent of Diameter from Wall</u>	<u>Distance from Wall</u>
1	3.2	1 5/8"
2	10.5	5 3/8"
3	19.4	9 7/8"
4	32.3	16 1/2"
5	67.7	34 1/2"
6	80.6	41 1/8"
7	89.5	45 5/8"
8	96.8	49 3/8"



APPENDIX B

Nomenclature and Equations for Calculation of Source Emissions

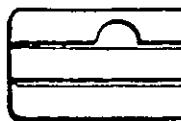
EA 7920-76

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Nomenclature for Particulate Calculations

<u>Symbol</u>	<u>English Units</u>	<u>Metric Units</u>	<u>Description</u>
A_s	in. ²	m ²	Stack Area
C_{an}	gr/dscf	g/dscm	Particulate - probe, cyclone and filter
C_{ao}	gr/dscf	g/dscm	Particulate - total
C_{at}	gr/CF @ stack conditions	g/m ³	Particulate - probe, cyclone and filter
C_{au}	gr/CF @ stack conditions	g/m ³	Particulate - total
C_{aw}	lbs/hr	kg/hr	Particulate - probe, cyclone and filter
C_{ax}	lbs/hr	kg/hr	Particulate - total
C_p			Pitot Tube Calibration Factor
D_n	in.	m	Sampling Nozzle Diameter
%EA			Percent Excess Air at sampling point
g	32.2 ft/sec ²		Acceleration of gravity
%I			Percent isokinetic
%M			Percent moisture in the stack gas by volume
M_d			Mole fraction of dry gas
M_f	mg	mg	Particulate - probe, cyclone and filter
M_{H_2O}	18 lb/lb-mole		Molecular Weight of Water

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)



<u>Symbol</u>	<u>English Units</u>	<u>Metric Units</u>	<u>Description</u>
m_t	mg	mg	Particulate - total
MW	lb/lb-mole	g/g-mole	Molecular Weight of stack gas
MW_{air}	28.95 lb/ lb-mole		Molecular Weight of air
MW_d	lb/lb-mole	g/g-mole	Molecular Weight of dry stack gas
P_b	"Hg Absolute	mm Hg	Barometric pressure
P_m	"H ₂ O	mm H ₂ O	Orifice Pressure drop
P_s	"Hg Absolute	mm Hg	Stack Pressure
ΔP_s	"H ₂ O	mm H ₂ O	Velocity Head of stack gas
P_{std}	29.92 "Hg	760 mm Hg	Standard Barometric Pressure
Q_a	ACFM	m ³ /hr	Stack Gas Volume at Actual Stack Conditions
Q_s	DSCFM	dscm/hr	Stack Gas Volume at 29.92 "Hg, 528°R, dry
R	21.83 "Hg- ft ³ /lb-mole-°R		Universal Gas Constant
T_m	°F	°C	Average Gas Meter Temperature
T_t	min	min	Net time of test
T_s	°F	°C	Stack Temperature
T_{std}	528°R	293°K	Standard Temperature
V_m	ft ³	m ³	Volume of dry gas sampled @ meter conditions
$V_{m_{std}}$	dscf	dscm	Volume of dry gas sampled @ standard conditions
V_s	fpm	m/sec	Stack velocity @ stack conditions
V_w	ml	ml	Total Water Collected in Impingers and Silica Gel
• 528°R, 29.92 "Hg (20°C, 760 mm Hg)			



<u>Symbol</u>	<u>English Units</u>	<u>Metric Units</u>	<u>Description</u>
$V_{w\text{gas}}$	scf	scm	Volume of Water Vapor Collected @ standard conditions
ρ_{air}	0.0748 lbs/ft ³		Density of Air
$\rho_{\text{H}_2\text{O}}$	1 g/ml		Density of Water
ρ_{man}	51.63 lbs/ft ³		Density of Manometer Oil

Standard Conditions: 68°F, 29.92 "Hg (20°C, 760 mm Hg)

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)



Example Particulate Calculations

1. Volume of dry gas sampled at standard conditions.*

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m + 460} \right) \left[\frac{P_b + \frac{P_m}{13.6}}{P_{std}} \right]$$

$$V_{m_{std}} = 17.65 V_m \left(\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right) = \text{dscf}$$

$$V_{m_{std}} = \text{dscf} \times 0.028317 = \text{dscm}$$

2. Volume of water vapor collected at standard conditions.*

$$V_{w_{gas}} = \frac{(V_w - \text{gms SO}_2 - \text{gms H}_2\text{S}) \rho_{H_2O} R T_{std}}{P_{std} M_{H_2O} 453.6}$$

$$V_{w_{gas}} = 0.0472 (V_w - \text{gms SO}_2 - \text{gms H}_2\text{S}) = \text{scf}$$

$$V_{w_{gas}} = \text{scf} \times 0.028317 = \text{scm}$$

3. Percent moisture in stack gas

$$\%M = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \%$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)



4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100}$$

5. Average molecular weight of dry stack gas.

$$MW_d = \left(\%CO_2 \times \frac{44}{100} \right) + \left(\%O_2 \times \frac{32}{100} \right) + \left(\%N_2 \times \frac{28}{100} \right) + \left(\%CO \times \frac{28}{100} \right) = 1b/1b\text{-mole}$$
$$= g/g\text{-mole}$$

6. Molecular weight of stack gas.

$$MW = MW_d \times M_d + 18 (1-M_d) = \frac{1b}{1b\text{-mole}} = g/g\text{-mole}$$

7. Percent excess air at sampling point.

$$\%EA = \frac{100 (\%O_2 - 0.5\% CO)}{0.265 (\%N_2) - (\%O_2) + 0.5 (\%CO)}$$

8. Stack Pressure

$$P_s = P_b + \frac{\text{stack pressure } "H_2O}{13.6} = "Hg Absolute$$

$$P_s = "Hg Abs. \times 25.4 = \text{mm Hg}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)



9. Stack velocity at stack conditions.

$$V_s = C_p \cdot 60 \left[\frac{2g \times \rho_{\text{man}} \times P_{\text{std}} \times \text{MW}_{\text{air}} \times (T_s + 460) \times \Delta P_s}{12 \times \rho_{\text{air}} \times P_s \times \text{MW} \times T_{\text{std}}} \right]^{1/2}$$

$$V_s = 5123.8 C_p \left[\frac{(T_s + 460) \times \Delta P_s}{P_s \times \text{MW}} \right]^{1/2} = \text{fpm}$$

$$V_s = \text{fpm} \times 0.00508 = \text{m/sec}$$

10. Dry stack gas volume at standard conditions.

$$Q_s = \frac{1}{144} V_s \times A_s \times M_d \times \frac{T_{\text{std}}}{T_s + 460} \times \frac{P_s}{P_{\text{std}}}$$

$$Q_s = \frac{0.123 V_s \times A_s \times M_d \times P_s}{T_s + 460} = \text{DSCFM}$$

$$Q_s = \text{DSCFM} \times 1.6990 = \text{dscm/hr}$$

11. Actual stack gas volume at stack conditions.

$$Q_a = \frac{V_s \times A_s}{144} = \text{ACFM}$$

$$Q_a = \text{ACFM} \times 1.6990 = \text{m}^3/\text{hr}$$

• 528°R, 29.92 "Hg (20°C, 760 mm Hg)



12. Percent isokinetic

$$\%I = \frac{V_{m_{std}} \times (T_s + 460) \times P_{std} \times 100 \times 144}{M_d \times T_{std} \times P_s \times T_t \times V_s \times \frac{\pi D_n^2}{4}}$$

$$\%I = \frac{1039 V_{m_{std}} \times (T_s + 460)}{M_d \times P_s \times T_t \times V_s \times D_n^2}$$

13. Particulate - probe, cyclone and filter.

$$C_{an} = \frac{m_f}{V_{m_{std}}} \times \frac{1 \text{ gr}}{64.8 \text{ mg}}$$

$$C_{an} = 0.0154 \frac{m_f}{V_{m_{std}}} = \text{ gr/dscf}$$

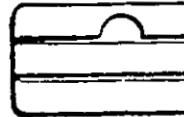
$$C_{an} = \text{ gr/dscf} \times 2.290 = \text{ g/dscm}$$

14. Particulate total.

$$C_{ao} = 0.0154 \times \frac{m_t}{V_{m_{std}}} = \text{ gr/dscf}$$

$$C_{ao} = \text{ gr/dscf} \times 2.290 = \text{ g/dscm}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)



15. Particulate - probe, cyclone and filter at stack conditions.

$$C_{at} = C_{an} \times \frac{P_s}{P_{std}} \times \frac{(T_{std})}{(T_s + 460)} \times M_d$$

$$C_{at} = \frac{17.65 \times C_{an} \times P_s \times M_d}{T_s + 460} = \text{gr/CF}$$

$$C_{at} = \text{gr/CF} \times 2.290 = \text{g/m}^3$$

16. Particulate - total, at stack conditions.

$$C_{au} = \frac{17.65 \times C_{ao} \times P_s \times M_d}{T_s + 460} = \text{gr/CF}$$

$$C_{au} = \text{gr/CF} \times 2.290 = \text{g/m}^3$$

17. Particulate - probe, cyclone and filter.

$$C_{aw} = C_{an} \times Q_s \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ lb}}{7000 \text{ gr}}$$

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = \text{lbs/hr}$$

$$C_{aw} = \text{lbs/hr} \times 0.4536 = \text{kg/hr}$$

18. Particulate - total.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = \text{lbs/hr}$$

$$C_{ax} = \text{lbs/hr} \times 0.4536 = \text{kg/hr}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

STACK EMISSIONS SURVEY
 GEORGIA - PACIFIC COMPANY
 LOVELL, WYOMING
 FILE NUMBER EA 7920-76



SOURCE EMISSIONS CALCULATIONS

Cottrell Precipitator Stack

<u>Symbol</u>	<u>Description</u>	<u>Units</u>	1	3	4
Run No.					
Date			12/5/79	12/5/79	12/5/79
Begin			0804	1257	.448
End			0914	1403	.546
P _b	barometric pressure	"Hg Abs. (mm Hg)	25.81 (655)	25.90 (657)	25.90 (657)
P _m	orifice pressure drop	"H ₂ O (mm H ₂ O)	0.928 (23.60)	.954 (24.26)	.926 (23.55)
V _m	volume dry gas sampled @ meter conditions	ft. ³ (m ³)	38.001 (1.076)	37.834 (1.071)	37.127 (1.051)
T _m	avg. gas meter temp.	°F (°C)	45 (7)	52 (11)	56 (13)
V _m std	volume dry gas sampled @ standard conditions*	dscf (dscm)	34.351 (0.972)	33.832 (0.957)	32.934 (0.932)
V _w	total H ₂ O collected, impingers & silica gel	ml	113.8	122.7	111.9
V _w gas	volume water vapor collected @ standard conditions*	scf (scm)	5.371 (0.152)	5.791 (0.164)	5.282 (0.150)
%M	moisture in stack gas by volume	%	13.5	14.6	13.8

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)



Source Emissions Calculations

Georgia - Pacific Company

Lovell, Wyoming

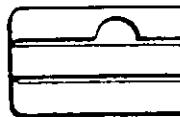
File Number EA 7920-76

<u>Symbol</u>	<u>Description</u>	<u>Units</u>			
M _d	mol fraction of dry gas	---	.8648	.8540	.8620
CO ₂		%	6	5	5
O ₂		%	18	18	18
N ₂		%	74	75	75
%EA	excess air @ sampling point	%	651	591	591
MW _d	molecular weight of dry stack gas	lb/lb-mole (g/g-mole)	29.68 (29.68)	29.52 (29.52)	29.52 (29.52)
MW	molecular weight of stack gas	lb/lb-mole (g/g-mole)	28.10 (28.10)	27.84 (27.84)	27.93 (27.93)
ΔP _s	velocity head of stack gas	"H ₂ O (mm H ₂ O)	0.16 (4.1)	0.15 (3.8)	0.15 (3.8)
T _s	stack temperature	°F (°C)	180 (82)	182 (83)	187 (86)
P _s	stack pressure	"Hg Abs. (mm Hg)	25.82 (656)	25.91 (658)	25.91 (658)
V _s	stack velocity @ stack conditions	fpm (m/sec)	1601 (8.13)	1595 (8.10)	1601 (8.13)
A _s	stack area	in. ² (m ²)	2043 (1.32)	2043 (1.32)	2043 (1.32)
Q _s	dry stack gas volume @ standard conditions*	DSCFM (dscm/hr)	14036 (23847.90)	13768 (23391.09)	13835 (2306.40)
Q _a	actual stack gas volume @ stack conditions	ACFM (m ³ /hr)	22714 (38591.09)	22629 (38446.78)	22714 (38591.09)

* 68°F, 29.92 "Hg (20°C, 760 mm Hg)

Source Emissions Calculations
 Georgia - Pacific Company
 Lovell, Wyoming
 File Number EA 7920-76

<u>Symbol</u>	<u>Description</u>	<u>Units</u>			
T_t	net time of test	min.	64	64	64
D_n	sampling nozzle diam.	in. (m)	0.302 (.007)	0.302 (.007)	0.302 (.007)
%I	percent isokinetic	%	109.5	109.5	106.1
m_f	particulate - probe, cyclone and filter	mg	164.7	68.7	48.0
m_t	particulate - total	mg	168.4	73.1	51.1
C_{an}	particulate - probe, cyclone and filter	gr/dscf* (g/dscm)	0.0738 (0.1691)	0.0313 (0.0716)	0.0224 (0.0514)
C_{ao}	particulate - total	gr/dscf* (g/dscm)	0.0745 (0.1729)	0.0333 (0.0762)	0.0239 (0.0547)
C_{at}	particulate - probe, cyclone and filter @ stack conditions	gr/cf (g/m ³)	0.0454 (0.1041)	0.0190 (0.0436)	0.0136 (0.0313)
C_{au}	particulate total @ stack conditions	gr/cf (g/m ³)	0.0459 (0.1046)	0.0203 (0.0464)	0.0146 (0.0333)
C_{aw}	particulate - probe, cyclone and filter	lbs/hr (kg/hr)	8.88 (4.03)	3.70 (1.68)	2.67 (1.21)
C_{ax}	particulate - total	lbs/hr (kg/hr)	8.97 (4.07)	3.93 (1.78)	2.84 (1.29)

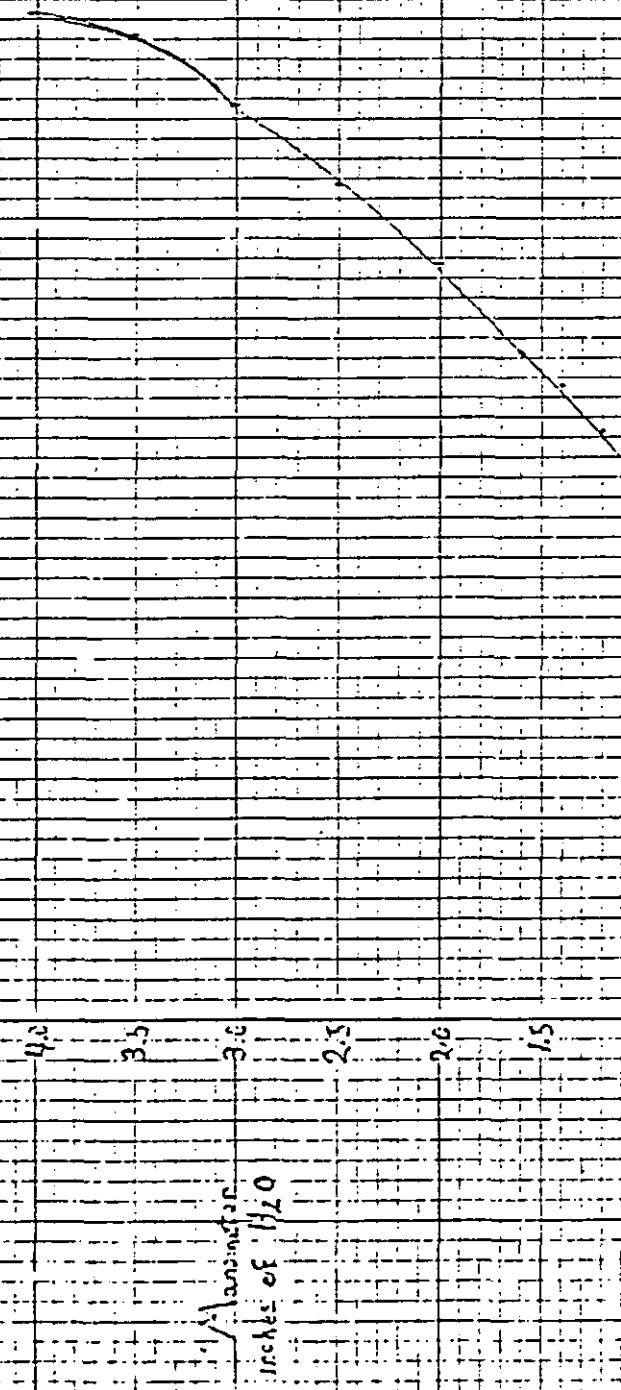


APPENDIX C

Calibration of Equipment

<u>Equipment</u>	<u>Calibration Factor</u>	<u>Calibration Date</u>
Pitot Tube #11	0.842	11/1/79
Probe Tip #4	0.302	6/26/79
Dry Gas Meter #9	1.023	11/30/79
Stack Unit Orifice #9		11/30/79

CFI 1.023



Office Calibration

Unit 2

11-30-79

BC

Standard Cubic Feet per minute

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1

DATE: 11-1-71

PITOT NO: 1 three ft.

COMPANY: EHL
CASPER
HEAD OFFICE

fps mark	CAL. FOR STAND SST ECON ✓	STANDARD AVERAGE	HIGH	✓ HIGH	CAL. FACTOR		CAL. FACTOR
					LOW	✓ LOW	
1.0	2.10	2.65	.09	.3	.873	.13	.868
1.1	2.21		0.13		.868	.30	.828
1.2	2.32		0.26		.890	.47	.817
1.3	2.40		0.40		.857	.58	.822
1.4	2.48		0.55		.844	.72	.808
1.5	2.60		0.77		.821	.89	.813
1.55	2.70		0.83		.835	1.05	.808
1.6	2.80		1.05		.820	1.20	.808
1.7	2.90		1.15		.821	1.40	.793
1.8	2.20		1.30		.824	1.95	.777
1.9	2.60		1.55		.845	2.50	.792
2.0	2.82		1.70		.849	2.80	.778
2.1			2.11		.812		
2.2			2.40		.828		

Summary of Results:

High side calibration factor variation

$$\begin{array}{r}
 842 \\
 2.3 \\
 \hline
 811 \\
 2.3
 \end{array}$$

Low side calibration factor variation

$$C_p = \sqrt{\frac{(0.99)^2 \times \Delta P_{std.}}{\Delta P}}$$

20-97 F.P.S.



APPENDIX D

Field Testing Data

EA 7920-76

Run No. 4 Date 12-5-79 Location Cottrell Stack Operator Person in charge

Ambient Temp. ${}^{\circ}\text{F}$ 32

Assumed Moisture \pm 13

Read and record at the start of each test point.

Sample Box No. TII Meter Box No. 9

Q Factor 0.26.25 to reference

Initial Leak @ 15.0 "Hg = 0.000cfm
Final Leak @ 5.0 "Hg = 0.000cfm

Point	Clock Time	Dry Gas Meter, CF	Pltot in. H ₂ O	Orifice All in. H ₂ O	Pump Vacuum In. Hg Gauge	Stack Temp. ${}^{\circ}\text{F}$	Probe Temp. ${}^{\circ}\text{F}$	Oven Temp. ${}^{\circ}\text{F}$	Effluent Temp. ${}^{\circ}\text{F}$	Dry Gas Temp ${}^{\circ}\text{F}$	Stack press. In. H ₂ O
				Desired	Actual						
1	8 D804	630	844	0.09	0.06	174	184	244	34	34	10
2	5304	631	575	0.13	0.10	178	184	213	34	34	10
3	12	632	375	0.15	0.13	180	177	257	35	42	10
4	10	635	315	0.17	1.05	180	218	254	35	35	10
5	10	637	865	0.19	1.20	172	180	250	35	35	10
6	24	640	602	0.17	1.05	180	180	256	35	35	10
7	1.8	643	310	0.17	1.05	180	184	261	35	35	10
8	32	646	285	0.15	0.94	170	181	266	44	44	10
9	0836	648	723	0.11	0.69	178	190	267	47	47	10
10	0338	649	723	0.11	0.69	174	174	271	47	47	10
11	42	650	925	0.13	0.50	171	182	267	46	49	10
12	46	653	107	0.14	0.55	150	183	265	46	49	10
13	57	655	345	0.13	1.05	150	183	267	50	50	10
14	57	657	910	0.18	1.10	110	110	184	51	51	10
15	58	660	365	0.20	1.25	14	182	271	52	52	10
16	0902	661	210	0.18	1.00	13	152	184	53	53	10
17	0915	665	630	0.16	1.00	13	130	184	53	53	10
18	0910	665	630	0.16	1.00	13	130	184	53	53	10
19	64	667	991	0.16	1.00	13	130	184	53	53	10
20	76	670	210	0.16	1.00	13	130	184	53	53	10
21	76	670	210	0.16	1.00	13	130	184	53	53	10
22	76	670	210	0.16	1.00	13	130	184	53	53	10
23	76	670	210	0.16	1.00	13	130	184	53	53	10
24	76	670	210	0.16	1.00	13	130	184	53	53	10
25	76	670	210	0.16	1.00	13	130	184	53	53	10
26	76	670	210	0.16	1.00	13	130	184	53	53	10
27	76	670	210	0.16	1.00	13	130	184	53	53	10
28	76	670	210	0.16	1.00	13	130	184	53	53	10
29	76	670	210	0.16	1.00	13	130	184	53	53	10
30	76	670	210	0.16	1.00	13	130	184	53	53	10
31	76	670	210	0.16	1.00	13	130	184	53	53	10
32	76	670	210	0.16	1.00	13	130	184	53	53	10
33	76	670	210	0.16	1.00	13	130	184	53	53	10
34	76	670	210	0.16	1.00	13	130	184	53	53	10
35	76	670	210	0.16	1.00	13	130	184	53	53	10
36	76	670	210	0.16	1.00	13	130	184	53	53	10
37	76	670	210	0.16	1.00	13	130	184	53	53	10
38	76	670	210	0.16	1.00	13	130	184	53	53	10
39	76	670	210	0.16	1.00	13	130	184	53	53	10
40	76	670	210	0.16	1.00	13	130	184	53	53	10
41	76	670	210	0.16	1.00	13	130	184	53	53	10
42	76	670	210	0.16	1.00	13	130	184	53	53	10
43	76	670	210	0.16	1.00	13	130	184	53	53	10
44	76	670	210	0.16	1.00	13	130	184	53	53	10
45	76	670	210	0.16	1.00	13	130	184	53	53	10
46	76	670	210	0.16	1.00	13	130	184	53	53	10
47	76	670	210	0.16	1.00	13	130	184	53	53	10
48	76	670	210	0.16	1.00	13	130	184	53	53	10
49	76	670	210	0.16	1.00	13	130	184	53	53	10
50	76	670	210	0.16	1.00	13	130	184	53	53	10
51	76	670	210	0.16	1.00	13	130	184	53	53	10
52	76	670	210	0.16	1.00	13	130	184	53	53	10
53	76	670	210	0.16	1.00	13	130	184	53	53	10
54	76	670	210	0.16	1.00	13	130	184	53	53	10
55	76	670	210	0.16	1.00	13	130	184	53	53	10
56	76	670	210	0.16	1.00	13	130	184	53	53	10
57	76	670	210	0.16	1.00	13	130	184	53	53	10
58	76	670	210	0.16	1.00	13	130	184	53	53	10
59	76	670	210	0.16	1.00	13	130	184	53	53	10
60	76	670	210	0.16	1.00	13	130	184	53	53	10
61	76	670	210	0.16	1.00	13	130	184	53	53	10
62	76	670	210	0.16	1.00	13	130	184	53	53	10
63	76	670	210	0.16	1.00	13	130	184	53	53	10
64	76	670	210	0.16	1.00	13	130	184	53	53	10
65	76	670	210	0.16	1.00	13	130	184	53	53	10
66	76	670	210	0.16	1.00	13	130	184	53	53	10
67	76	670	210	0.16	1.00	13	130	184	53	53	10
68	76	670	210	0.16	1.00	13	130	184	53	53	10
69	76	670	210	0.16	1.00	13	130	184	53	53	10
70	76	670	210	0.16	1.00	13	130	184	53	53	10
71	76	670	210	0.16	1.00	13	130	184	53	53	10
72	76	670	210	0.16	1.00	13	130	184	53	53	10
73	76	670	210	0.16	1.00	13	130	184	53	53	10
74	76	670	210	0.16	1.00	13	130	184	53	53	10
75	76	670	210	0.16	1.00	13	130	184	53	53	10
76	76	670	210	0.16	1.00	13	130	184	53	53	10
77	76	670	210	0.16	1.00	13	130	184	53	53	10
78	76	670	210	0.16	1.00	13	130	184	53	53	10
79	76	670	210	0.16	1.00	13	130	184	53	53	10
80	76	670	210	0.16	1.00	13	130	184	53	53	10
81	76	670	210	0.16	1.00	13	130	184	53	53	10
82	76	670	210	0.16	1.00	13	130	184	53	53	10
83	76	670	210	0.16	1.00	13	130	184	53	53	10
84	76	670	210	0.16	1.00	13	130	184	53	53	10
85	76	670	210	0.16	1.00	13	130	184	53	53	10
86	76	670	210	0.16	1.00	13	130	184	53	53	10
87	76	670	210	0.16	1.00	13	130	184	53	53	10
88	76	670	210	0.16	1.00	13	130	184	53	53	10
89	76	670	210	0.16	1.00	13	130	184	53	53	10
90	76	670	210	0.16	1.00	13	130	184	53	53	10
91	76	670	210	0.16	1.00	13	130	184	53	53	10
92	76	670	210	0.16	1.00	13	130	184	53	53	10
93	76	670	210	0.16	1.00	13	130	184	53	53	10
94	76	670	210	0.16	1.00	13	130	184	53	53	10
95	76	670	210	0.16	1.00	13	130	184	53	53	10
96	76	670	210	0.16	1.00	13	130	184	53	53	10
97	76	670	210	0.16	1.00	13	130	184	53	53	10
98	76	670	210	0.16	1.00	13	130	184	53	53	10
99	76	670	210	0.16	1.00	13	130	184	53	53	10
100	76	670	210	0.16	1.00	13	130	184	53	53	10
101	76	670	210	0.16	1.00	13	130	184	53	53	10
102	76	670	210	0.16	1.00	13	130	184	53	53	10
103	76	670	210	0.16	1.00	13	130	184	53	53	10
104	76	670	210	0.16	1.00	13	130	184	53	53	10
105	76	670	210	0.16	1.00	13	130	184	53	53	10
106	76	670	210	0.16	1.00	13	130				

Run No. H. A. 273

Ambient Temp °F 45

Location Cathell Shells
Vessel #30
Date 12/15/73

Read and record at the
start of each test point.

Assumed Moisture % 11

Operator Perry Gummerson

Sample Box No. T Meter Box No. 9

Q Factor 0.25 to reference
Initial Leak @ 15.0 "lg = 0.000 cfm
Final Leak @ 4.0 "lg = 0.000 cfm
 T_m ps

Int	Clock Time	Dry Gas Meter, CF in. H ₂ O	Pitot Gas Orifice NI in. H ₂ O	Probe Temp °F	Oven Temp °F	Dry Gas Temp °F	Stack Press. In. H ₂ O
Int	Clock Time	Dry Gas Meter, CF in. H ₂ O	Pitot Gas Orifice NI in. H ₂ O	Probe Temp °F	Oven Temp °F	Dry Gas Temp °F	Stack Press. In. H ₂ O
1	12:57	70.7	0.47	0.44	180	264	4.8
2	1:01	70.7	0.14	0.37	163	269	4.8
3	1:05	71.1	0.16	0.99	163	269	4.8
4	1:09	71.3	0.70	1.24	164	260	4.8
5	1:13	71.6	0.18	1.12	164	259	4.8
6	1:17	71.9	0.10	1.12	162	255	4.8
7	1:21	71.2	0.16	0.79	162	261	4.9
8	1:25	72.3	0.14	0.87	179	263	4.9
9	1:29	72.6	0.30	2	178	255	4.9
10	1:31	72.6	0.13	0.81	2	267	31
11	1:35	72.8	0.15	0.73	2	255	4.9
12	1:39	73.0	0.16	0.79	153	258	5.7
13	1:43	73.3	0.00	0.18	153	262	5.7
14	1:47	73.5	0.25	0.16	1.12	241	50
15	1:51	73.4	0.14	0.99	0.97	250	5.8
16	1:55	73.7	0.17	1.05	2	273	5.9
17	1:59	74.2	0.14	0.87	2	256	50
18	2:03	74.4	0.65	2	243	40	5.1
19	2:07	74.6	0.21	2	257	39	5.1
20	2:11	74.8	0.97	2	257	41	5.1
21	2:15	75.0	0.21	2	257	41	5.1
22	2:19	75.2	0.21	2	257	41	5.1
23	2:23	75.4	0.21	2	257	41	5.1
24	2:27	75.6	0.21	2	257	41	5.1
25	2:31	75.8	0.21	2	257	41	5.1
26	2:35	76.0	0.21	2	257	41	5.1
27	2:39	76.2	0.21	2	257	41	5.1
28	2:43	76.4	0.21	2	257	41	5.1
29	2:47	76.6	0.21	2	257	41	5.1
30	2:51	76.8	0.21	2	257	41	5.1
31	2:55	77.0	0.21	2	257	41	5.1
32	2:59	77.2	0.21	2	257	41	5.1
33	3:03	77.4	0.21	2	257	41	5.1
34	3:07	77.6	0.21	2	257	41	5.1
35	3:11	77.8	0.21	2	257	41	5.1
36	3:15	78.0	0.21	2	257	41	5.1
37	3:19	78.2	0.21	2	257	41	5.1
38	3:23	78.4	0.21	2	257	41	5.1
39	3:27	78.6	0.21	2	257	41	5.1
40	3:31	78.8	0.21	2	257	41	5.1
41	3:35	79.0	0.21	2	257	41	5.1
42	3:39	79.2	0.21	2	257	41	5.1
43	3:43	79.4	0.21	2	257	41	5.1
44	3:47	79.6	0.21	2	257	41	5.1
45	3:51	79.8	0.21	2	257	41	5.1
46	3:55	80.0	0.21	2	257	41	5.1
47	3:59	80.2	0.21	2	257	41	5.1
48	4:03	80.4	0.21	2	257	41	5.1
49	4:07	80.6	0.21	2	257	41	5.1
50	4:11	80.8	0.21	2	257	41	5.1
51	4:15	81.0	0.21	2	257	41	5.1
52	4:19	81.2	0.21	2	257	41	5.1
53	4:23	81.4	0.21	2	257	41	5.1
54	4:27	81.6	0.21	2	257	41	5.1
55	4:31	81.8	0.21	2	257	41	5.1
56	4:35	82.0	0.21	2	257	41	5.1
57	4:39	82.2	0.21	2	257	41	5.1
58	4:43	82.4	0.21	2	257	41	5.1
59	4:47	82.6	0.21	2	257	41	5.1
60	4:51	82.8	0.21	2	257	41	5.1
61	4:55	83.0	0.21	2	257	41	5.1
62	4:59	83.2	0.21	2	257	41	5.1
63	5:03	83.4	0.21	2	257	41	5.1
64	5:07	83.6	0.21	2	257	41	5.1
65	5:11	83.8	0.21	2	257	41	5.1
66	5:15	84.0	0.21	2	257	41	5.1
67	5:19	84.2	0.21	2	257	41	5.1
68	5:23	84.4	0.21	2	257	41	5.1
69	5:27	84.6	0.21	2	257	41	5.1
70	5:31	84.8	0.21	2	257	41	5.1
71	5:35	85.0	0.21	2	257	41	5.1
72	5:39	85.2	0.21	2	257	41	5.1
73	5:43	85.4	0.21	2	257	41	5.1
74	5:47	85.6	0.21	2	257	41	5.1
75	5:51	85.8	0.21	2	257	41	5.1
76	5:55	86.0	0.21	2	257	41	5.1
77	5:59	86.2	0.21	2	257	41	5.1
78	6:03	86.4	0.21	2	257	41	5.1
79	6:07	86.6	0.21	2	257	41	5.1
80	6:11	86.8	0.21	2	257	41	5.1
81	6:15	87.0	0.21	2	257	41	5.1
82	6:19	87.2	0.21	2	257	41	5.1
83	6:23	87.4	0.21	2	257	41	5.1
84	6:27	87.6	0.21	2	257	41	5.1
85	6:31	87.8	0.21	2	257	41	5.1
86	6:35	88.0	0.21	2	257	41	5.1
87	6:39	88.2	0.21	2	257	41	5.1
88	6:43	88.4	0.21	2	257	41	5.1
89	6:47	88.6	0.21	2	257	41	5.1
90	6:51	88.8	0.21	2	257	41	5.1
91	6:55	89.0	0.21	2	257	41	5.1
92	6:59	89.2	0.21	2	257	41	5.1
93	7:03	89.4	0.21	2	257	41	5.1
94	7:07	89.6	0.21	2	257	41	5.1
95	7:11	89.8	0.21	2	257	41	5.1
96	7:15	90.0	0.21	2	257	41	5.1
97	7:19	90.2	0.21	2	257	41	5.1
98	7:23	90.4	0.21	2	257	41	5.1
99	7:27	90.6	0.21	2	257	41	5.1
100	7:31	90.8	0.21	2	257	41	5.1
101	7:35	91.0	0.21	2	257	41	5.1
102	7:39	91.2	0.21	2	257	41	5.1
103	7:43	91.4	0.21	2	257	41	5.1
104	7:47	91.6	0.21	2	257	41	5.1
105	7:51	91.8	0.21	2	257	41	5.1
106	7:55	92.0	0.21	2	257	41	5.1
107	7:59	92.2	0.21	2	257	41	5.1
108	8:03	92.4	0.21	2	257	41	5.1
109	8:07	92.6	0.21	2	257	41	5.1
110	8:11	92.8	0.21	2	257	41	5.1
111	8:15	93.0	0.21	2	257	41	5.1
112	8:19	93.2	0.21	2	257	41	5.1
113	8:23	93.4	0.21	2	257	41	5.1
114	8:27	93.6	0.21	2	257	41	5.1
115	8:31	93.8	0.21	2	257	41	5.1
116	8:35	94.0	0.21	2	257	41	5.1
117	8:39	94.2	0.21	2	257	41	5.1
118	8:43	94.4	0.21	2	257	41	5.1
119	8:47	94.6	0.21	2	257	41	5.1
120	8:51	94.8	0.21	2	257	41	5.1
121	8:55	95.0	0.21	2	257	41	5.1
122	8:59	95.2	0.21	2	257	41	5.1
123	9:03	95.4	0.21	2	257	41	5.1
124	9:07	95.6	0.21	2	257	41	5.1
125	9:11	95.8	0.21	2	257	41	5.1
126	9:15	96.0	0.21	2	257	41	5.1
127	9:19	96.2	0.21	2	257	41	5.1
128	9:23	96.4	0.21	2	257	41	5.1
129	9:27	96.6	0.21	2	257	41	5.1
130	9:31	96.8	0.21	2	257	41	5.1
131	9:35	97.0	0.21	2	257	41	5.1
132	9:39	97.2	0.21	2	257	41	5.1
133	9:43	97.4	0.21	2	257	41	5.1
134	9:47	97.6	0.21	2	257	41	5.1
135	9:51	97.8	0.21	2	257	41	5.1
136	9:55	98.0	0.21	2	257	41	5.1
137	9:59	98.2	0.21	2	257	41	5.1
138	10:03	98.4	0.21	2	257	41	5.1
139	10:07	98.6	0.21	2	257	41	5.1
140	10:11	98.8	0.21	2	257	41	5.1
141	10:15	99.0	0.21	2	257	41	5.1
142	10:19	99.2	0.21	2	257	41	5.1
143	10:23	99.4	0.21	2	257	41	5.1
144	10:27	99.6	0.21	2	257	41	5.1
145	10:31	99.8	0.21	2	257	41	5.1
146	10:35	100.0	0.21	2	257	41	5.1
147	10:39	100.2	0.21	2	257	41	5.1
148	10:43	100.4	0.21	2	257	41	5.1
149	10:47	100.6	0.21	2	257	41	5.1
150	10:51	100.8	0.21	2	257	41	5.1
151	10:55	101.0	0.21	2	257	41	5.1
152	10:59	101.2	0.21	2	257	41	5.1
153	11:03	101.4	0.21	2	257	41	5.1
154	11:07	101.6	0.21	2	257	41	5.1



APPENDIX E

Analytical Data

Particulate Analysis

Date 12-6-79Job No. 7920-76Name Georgia PacificLocation Cottrell StackRun No. 1Filter # T-33Front Wash 670 ml

Impinger 1

Impinger 2

Final 0.7256

97.2947

98.8309

Initial 0.6871

97.1658

98.8272

-0.3779.1289.0037

MF

164.7

mg

MT 168.4 mgRun No. 2Filter # T-34Front Wash 550 ml

Impinger 1

Impinger 2

Final 0.7058

98.3923

100.7433

Initial 0.6920

98.3358

100.7369

-0.0138.0565.0044

MF

68.7

mg

MT 73.1 mgRun No. 3Filter # T-35Front Wash 470 ml

Impinger 1

Impinger 2

Final 0.6956

100.2844

Initial 0.6839

100.2813

-0.0117.0377.0031

MF

48.0

mg

MT 51.1 mg

Acetone Blank:

Volume 300 mlFinal 101.4654.9
300X 0.001%X 0.742560.5024 weightInitial 101.4645.0009

Total Weight

-2-

Blank: .003 mg/l



APPENDIX F

Precipitator Data



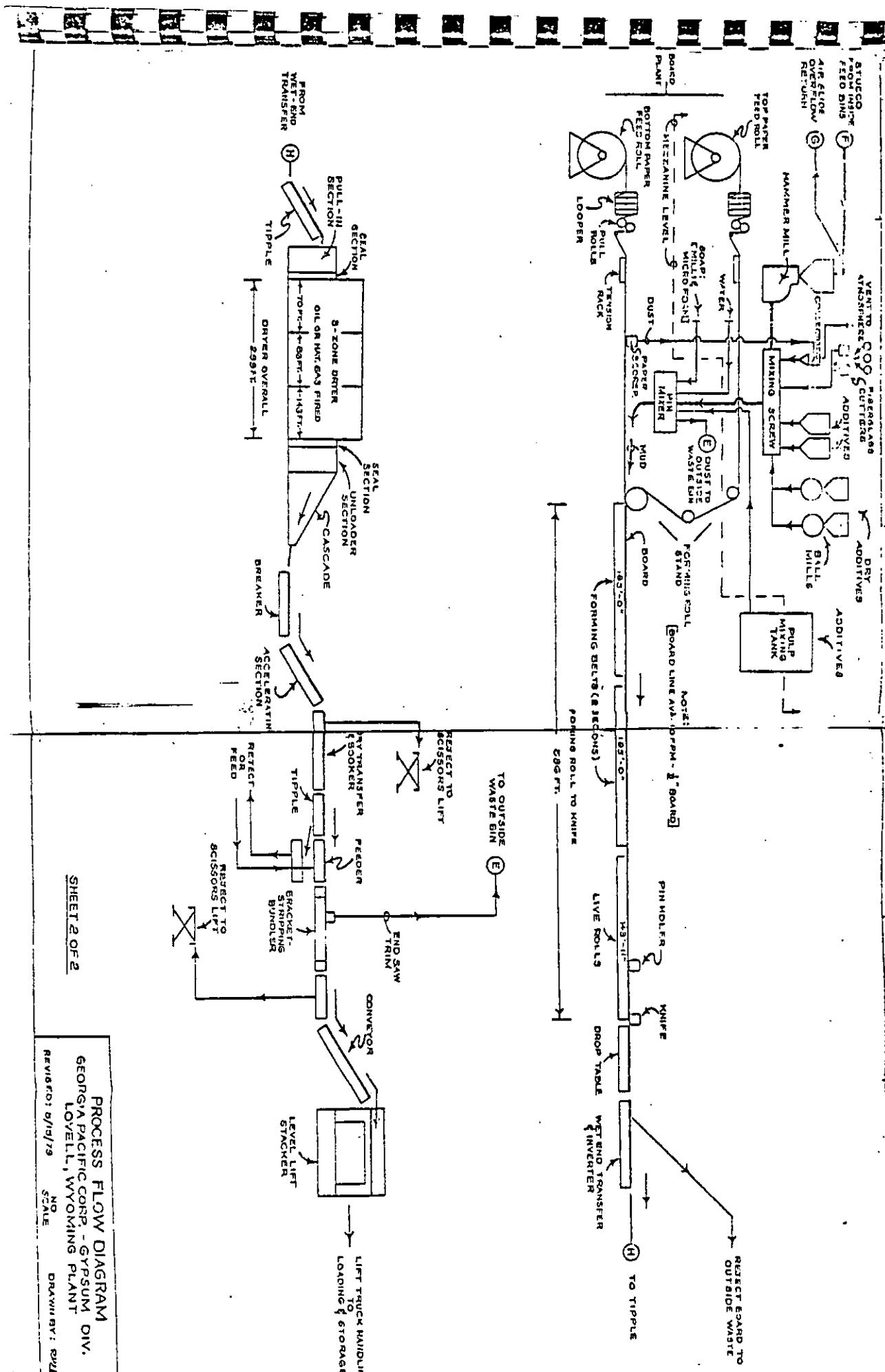
Precipitator Data

INLET RECTIFIER

<u>Spark Rate (Sparks/min.)</u>	<u>Test #1</u> <u>Start</u>	<u>End</u>	<u>Test #2</u> <u>Start</u>	<u>End</u>	<u>Test #3</u> <u>Start</u>	<u>End</u>	<u>Test #4</u> <u>Start</u>	<u>End</u>
Spark Rate (sparks/min.)	12	28	60	25	60	25	60	40
Primary Voltage (V.)	405	350	340	350	340	370	340	360
Secondary Current (mA)	40	28	20	28	22	30	20	28
Primary Current (A)	31	25	22	25	22	26	20	25

OUTLET RECTIFIER

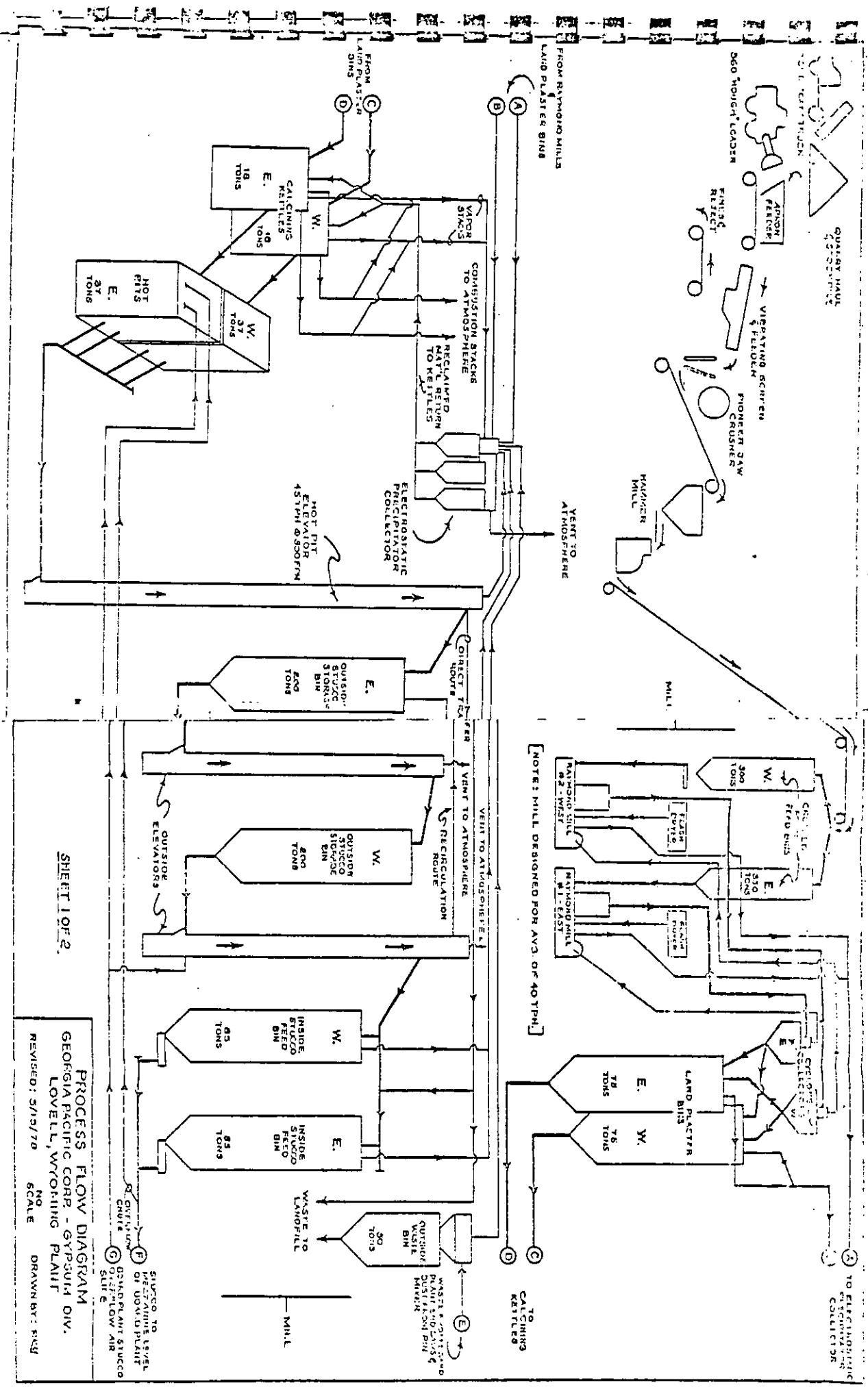
Primary Voltage (V.)	300	300	290	280	300	300	300	300
Secondary Voltage (K. V.)	52	52	50	46	55	50	50	51
Primary Current (A.)	45	56	50	52	52	56	48	46
Secondary Current (mA)	300	290	280	280	280	280	250	280



PROCESS FLOW DIAGRAM
GEORGIA PACIFIC CORP. - GYPSUM DIV.
LOVELL, WYOMING PLANT

PROCESS FLOW DIAGRAM
GEORGIA PACIFIC CORP. - GYPSUM DIV.
LOVELL, WYOMING PLANT

SHEET 2 OF 2



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