Louisiana-Pacific Corporation

RTO EXPERIENCE IN THE WOOD PRODUCTS INDUSTRY

PRESENTATION FOR:
AMERICAN FOREST AND PAPER ASSOCIATION
ENVIRONMENTAL WORKSHOP
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HAYWARD, WISCONSIN

LOUISIANA-PACIFIC CORPORATION
RTO APPLICATIONS

- CURRENTLY USING THREE VENDORS - HUNTINGTON ENERGY SYSTEMS, SMITH ENGINEERING, REECO

• 22	UNITS ON OSB DRYERS
• 12	UNITS ON OSB PRESSES
• 3	UNITS COMBINED OSB DRYER AND PRESS
• 6	UNITS ON MDF DRYERS
• 1	UNIT ON MDF PRESSES
• 1	UNIT ON PLYWOOD DRYERS
45	UNITS TOTAL

1/97

RTO PILOT EXPERIENCE

- SPRING 1993 - SMITH ENGINEERING - URANIA, LOUISIANA MDF DRYER AND OSB DRYER

  MDF CONTROL - FIBER CYCLONE
  OSB CONTROL - MULTICLONES

- SPRING 1993 - HUNTINGTON ENERGY SYSTEMS URANIA, LOUISIANA OSB DRYER

  MULTICLONE CONTROL

- SPRING 1993 - REECO - SILSBEE, TEXAS OSB DRYER

  MULTICLONE CONTROL

- SPRING 1993 - HUNTINGTON ENERGY SYSTEMS - HAYWARD, WIS OSB DRYER

  EFB CONTROL

RTO PILOT EXPERIENCE

- **URANIA, LOUISIANA**

	Smith	Huntington	Reeco
MDF VOC DRE	96.2		
PM DRE	81.4		
OSB VOC DRE	100.0	99.64	
PM DRE	89.0	91.84	

- **SILSBEE, TEXAS OSB**

VOC DRE			99.0
PM DRE			87.3

- **HAYWARD, WISCONSIN OSB**

VOC DRE		99.0	
PM DRE		69.5	

FIRST OPERATING RTOs

- NOVEMBER 1993 - CHILCO, IDAHO OSB - COMBINATION
  - PRESS/DRYER RTO 160,000 ACFM
  - DRYER HAS WESP FOR TSP CONTROL

- NOVEMBER 1993 - URANIA, LOUISIANA MDF - THREE UNITS
  - PRESS 80,000 ACFM
  - TWO DRYER RTOs 106,000 ACFM EACH
  - NO SECONDARY TSP CONTROL PRIOR TO RTO

- JANUARY 1994 - HAYWARD, WISCONSIN OSB - FOUR UNITS
  - TWO PRESS RTOs 100,000 ACFM EACH
  - TWO DRYER RTOs 120,000 ACFM EACH
  - DRYER RTOs were originally preceded by EFBs.
    - Wet scrubbers were installed in early 1995 and replaced with WESPs later 1995

- JANUARY 1994 - HANCEVILLE, ALABAMA OSB - THREE UNITS
  - ONE PRESS RTO 120,000 ACFM
  - TWO DRYER RTOs 141,000 ACFM EACH (five dryers total)
  - Dryer RTOs are preceded by multiclones

- FIRST VENEER DRYER RTO INSTALLED NOVEMBER 1996 AT CLEVELAND, TEXAS
  - 72,000 ACFM
  - NO TSP CONTROL PRIOR TO RTO

RTO SIZING CRITERIA

- AIR VELOCITY THROUGH HEAT RECOVERY CHAMBERS - LESS THAN 200 FEET/MINUTE
- TSP FROM PROCESS LESS THAN .05 gr/DSCF (in the beginning) LESS THAN .02 gr/DSCF (current specifications)
- 95% THERMAL EFFICIENCY (typically determined without burner combustion air)
- TYPICAL OSB DRYER DESIGN FLOW - 60,000 ACFM
- TYPICAL OSB PRESS DESIGN FLOW RANGE 100,000 ACFM - 120,000 ACFM
- FUEL INJECTION CAPABILITY
- LOW NOx BURNERS

RTO PERFORMANCE

- TYPICALLY RUN AT 1500°F-1550°F COMBUSTION CHAMBER TEMPERATURE
- 95% VOC REDUCTION EXCEPT FOR VERY LOW INLET CONCENTRATIONS (LESS THAN 20 ppmvC)
- TYPICAL NOx ADDITION OF 10 ppm - 20 ppm
- TYPICAL CO REDUCTION OF 70% - 80%

RESULTS OF PARTICLE SIZE DISTRIBUTION[1]
LINE 1 CORE DRYER SCRUBBER INLET
CASCADE IMPACTOR SAMPLING

STAGE	um	%≥
Preimpactor	8.3	28.8
1	5.3	28.9
2	3.5	29.0
3	2.2	29.3
4	1.3	29.5
5	0.83	29.7
6	0.51	31.3
7	0.28	61.6

um Aerodynamic Equivalent Diameter in microns

%≥ Relative Cumulative Frequency - percent by mass of aerosol with diameters greater than stated size

1. Interpoll Labs Report No. 5-5204 - L/P Hayward, Hayward, Wisconsin

TABLE 1
DAWSON CREEK OSB MILL
INLET VS OUTLET OF E-TUBE

ELEMENTS	INLET (MICROGRAMS)	OUTLET (MICROGRAMS)	REDUCTION (%)
CALCIUM	1706	47	97%
POTASSIUM	15350	1910	88%
MAGNESIUM	255	9	97%
SODIUM	2580	250	90%
SULFUR	1265	132	90%

NOTES:

1. Analysis was performed using Inductively Coupled Plasma (ICP) Spectroscopy
2. Values on Table are absolute weights (micrograms)
3. Sample volumes were nearly identical for all tests (approximately 49 sdcf)
4. To convert to concentration (gr/sdcf) multiply by 3.1×10^{-7}
5. Results are filters only :
   - **A)** Outlet average of tests 1&2
   - **B)** Inlet test 3

Summary of E-Tube WESP Test Results

Louisiana-Pacific Corporation

Sagola OSB Plant

Test Average, December 4, 1996

PARAMETER	INLET CONCENTRATION (grains/scfd)	OUTLET CONCENTRATION (grains/scfd)	REMOVAL EFFICIENCY (%)
Total Front Half Particulate (FH)	**0.17000**	**0.00580**	**96.6%**
Front Half Potassium (K)	0.02300	0.00041	98.2%
Front Half Sodium (Na)	0.01700	0.00045	97.4%
Total Back Half Particulate (BH)	**0.20000**	**0.02973***	**85.1%***
Back Half Potassium (K)	0.00580	0.00126*	78.3%*
Back Half Sodium (Na)	0.00180	0.00021	88.2%
Total Particulate (FH+BH)	**0.37000**	**0.0371***	**90.0%***
Total Potassium (K)	0.02920	0.00181*	93.8%*
Total Sodium (Na)	0.01850	0.00066	96.4%
			* Runs #2 & #3 only

Notes:

1) efficiency based on concentration
2) inlet sample on surface dryer
3) metals by ICP

GEOENERGY
International Corporation

THE BIG CONCERN - CERAMIC DETERIORATION DUE TO INORGANIC PARTICULATE

- WESPs have been installed after OSB dryer systems operating at high temperatures (+1500°)
- Rotary Bed Protectors (RBP) installed after OSB drying systems operating at low-moderate temperatures (800° - 1400°)
- 60% alumina ceramic saddles were installed at Hanceville, Alabama OSB dryer RTO in October, 1996 to study effects on high alumina
- OSB and MDF press units have operated with no apparent negative effects on ceramic media or insulation
- MDF dryer RTO in Oroville, California is preceded by two RBPs (September, 1996)
- MDF dryer RTOs in Urania, Louisiana are not preceded by TSP control which allows substantial buildup on RTO cold face which results in high frequency bake-out requirements.

RTO BAKE-OUT WASH-OUT EXPERIENCE

	BAKE-OUT FREQUENCY	WASH-OUT FREQUENCY
• PRESS UNITS		
a. OSB PRESS RTO	1-3 MONTHS	
b. MDF PRESS RTO	1 MONTH	
• DRYER UNITS		
a. OSB DRYER RTO'S	1-3 MONTHS	
b. OSB DRYER RTO (MULTICLONE OR ROTARY BED PROTECTOR CONTROL)		1-2 MONTHS
c. MDF DRYER RTO		
1. KNOCK-OUT BOX CONTROL	1 WEEK	3 MONTHS
2. ROTARY BED PROTECTOR CONTROL	4-6 MONTHS	
d. OSB DRYER RTO (HIGH ALUMINA MEDIA) (MULTICLONE CONTROL)	3-4 WEEKS	? 3 MONTHS ?
e. PLYWOOD DRYER RTO	1-2 MONTHS	

MELTING POINT OF ALKALI & ALKALINE EARTH SALTS 3, 4

	°C	°F
Na_2CO_3	850	1563
K_2CO_3	910	1672
$CaCO_3$	898	1648
Na_2SO_4	885	1625
K_2SO_4	1069	1956
$K_2Ca(SO_4)_2\ H_20$	1004	1839
Na_2CO_3-K_2CO_3 60% - 40%	704	1300

3. International Critical Tables, Vol, IV, p. 69,(1926)
4. Handbook of Chemistry and Physics, 63rd Ed. (1982-83)

Physical Properties of Ceramics are Important for Corrosion Resistance

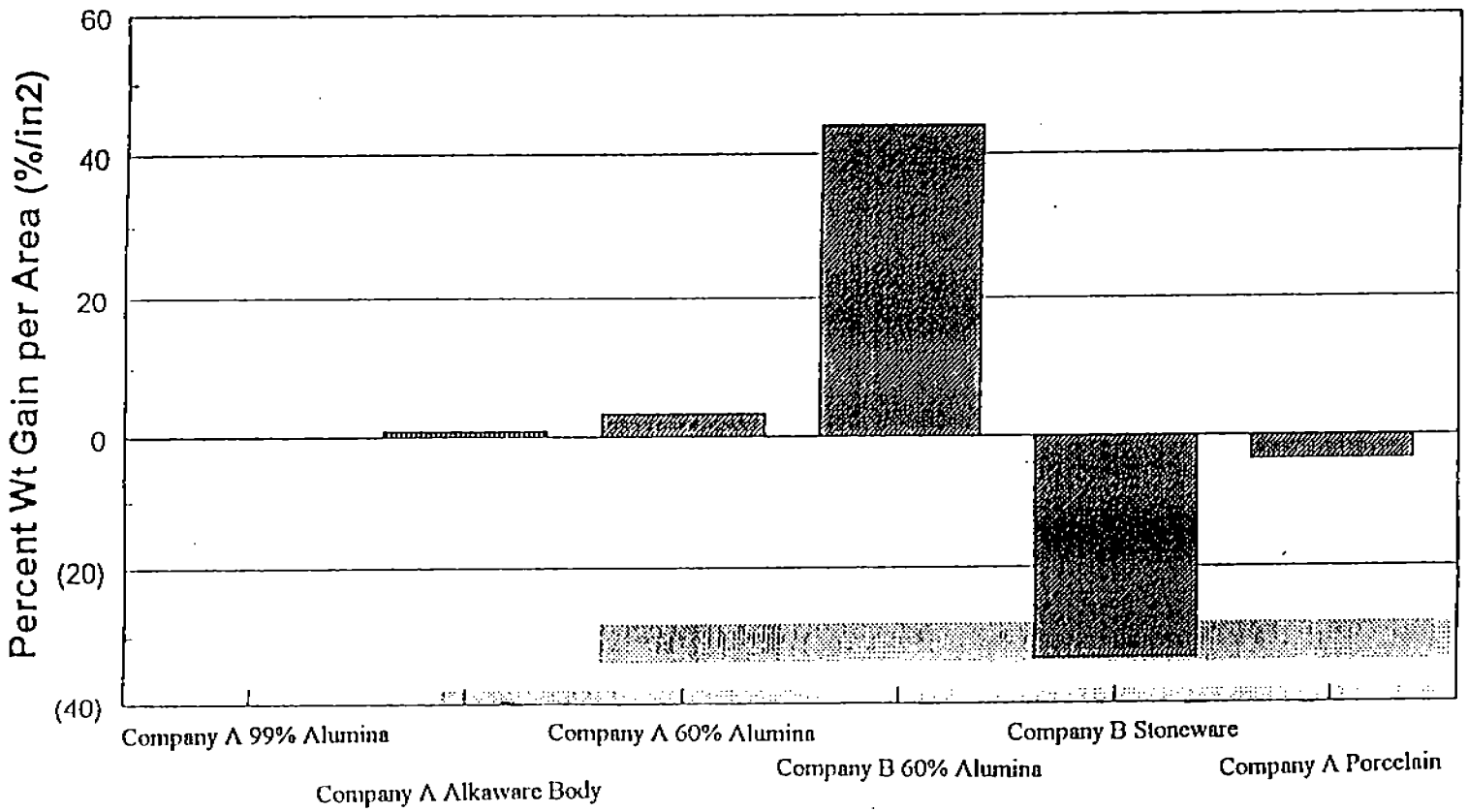
- High Water Absorption means more Porosity
- More Porosity means more Surface Area
- More Surface Area means more Reaction
- Higher Rate of Corrosion means Earlier Plugging and Increased Pressure Drop

K2CO3 Corrosion Test - Percent Weight Gain/Area

TESTS DONE AT THE UNIVERSITY OF AKRON

Corrosion Test in K2CO3 at 850°C (1562°F)

Sectioned Samples Embedded for 10 hours at 900°C



ASH COMPOSITION
%

	HOULTON ME - OSB	SAGOLA MI - OSB	URANIA LA - MDF	URANIA LA - OSB	CHILCO ID - OSB	ATHENS GA - OSB
CA	15.00	12.20	10.20	12.70	12.40	7.70
MG	3.00	2.20	2.40	5.00	3.40	2.90
NA	0.40	4.30	35.00	29.90	1.70	5.50
K	17.20	8.40	19.60	44.30	13.30	7.00
FE	0.18	0.16	0.34	0.19	0.65	0.29
MN	0.58	0.11	2.30	2.40	2.20	1.40
CU	0.02	0.01	0.15	0.01	0.01	0.02
BTU*	8,137	8,203	8,198	8,432	8,235	8,356
ASH**	1.50	1.70	0.60	0.60	0.90	0.70

* Wood Fuel Heat Value
** % of Wood Fuel

OTHER OPERATING PROBLEMS

- TEMPERATURE LIMITATIONS ON PROXIMITY SWITCHES
- AIR LEAKAGE THROUGH RTO CAN BE EXPENSIVE - PERIODICALLY REVIEWED
- BACK UP FUEL (PROPANE) VAPORIZING SYSTEM CAN BE QUITE INVOLVED AND NEED MAINTENANCE
- SPECIAL ATTENTION TO INSULATION AND HEAT TRACING ON PROPANE VALVES AND DISTRIBUTION SYSTEM IN COLD CLIMATES
- ACCESS FOR EFFICIENT CERAMIC REMOVAL AND REPLACEMENT