AP42 Section:	10.5
Reference:	14
Title:	A. E. Cavadeas, *RTO Experience In The Wood Products Industry*, Presented at Environmental Challenges: What's New in the Wood Products Industry?, Workshop sponsored by the American Forest and Paper Association, Research Triangle Park, NC, February 4-5, 1997. 2002 supplement

RTO EXPERIENCE IN THE WOOD PRODUCTS INDUSTRY

PRESENTATION FOR:
AMERICAN FOREST AND PAPER ASSOCIATION
ENVIRONMENTAL WORKSHOP
February 4 & 5, 1997

PRESENTED BY:
ANTONE E. CAVADEAS
CORPORATE ENGINEERING MANAGER

PREPARED BY:
LOUISIANA-PACIFIC
ENGINEERING DEPARTMENT
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°) [illegible]

- 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

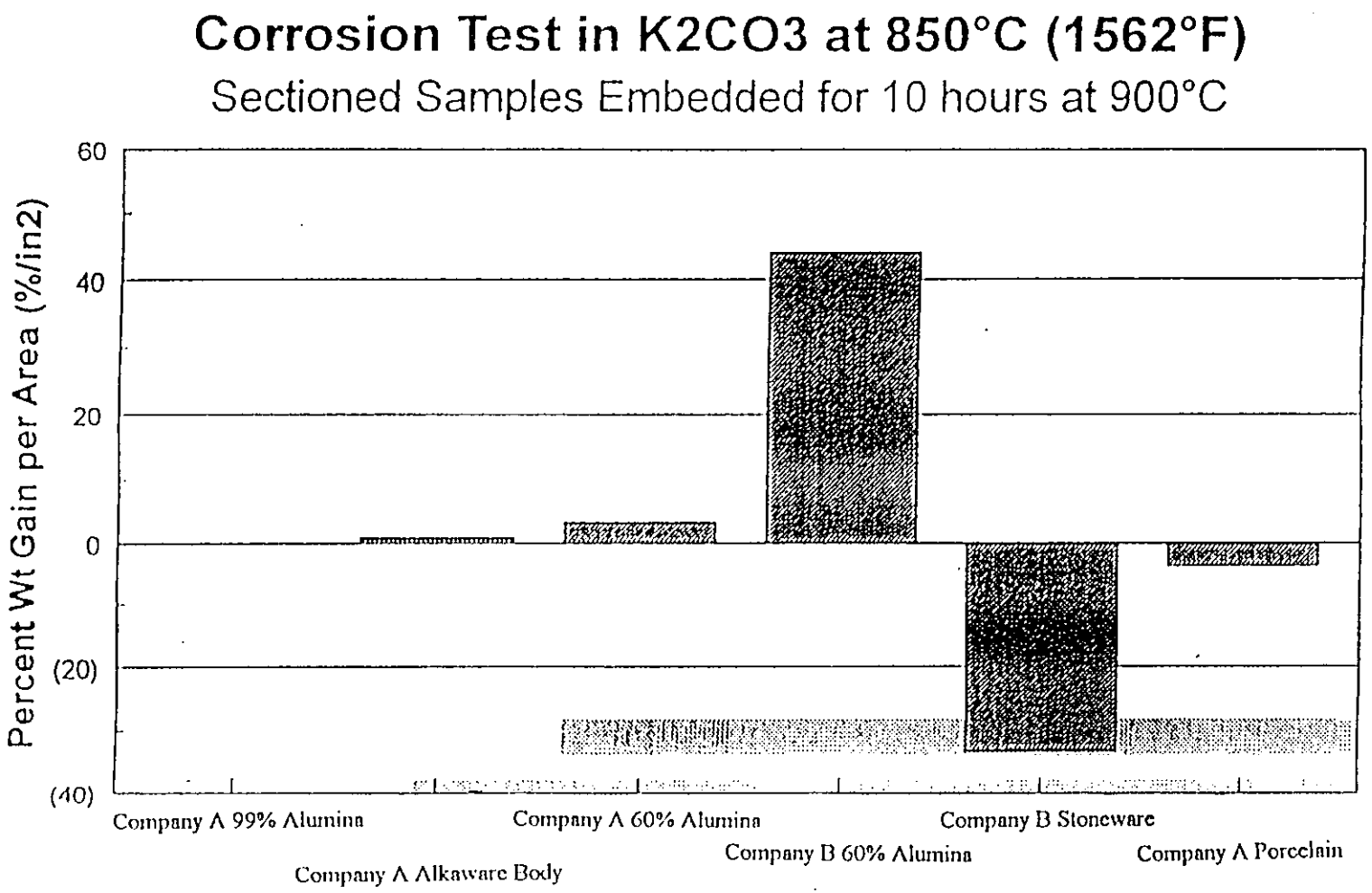
3. International Critical Tables, Vol, IV, p. 69,(1926)
4. Handbook of Chemistry and Physics, 63rd Ed. (1982-83)

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



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