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.

Background Report Reference

AP-42 Section Number: 11.17

Background Chapter: 4

Reference Number: 35

Title: Particulate Emission Test Efficiency Evaluation to Allied Products Corporation

Alabama Air Pollution Control Commission

Alabama Air Pollution Control Commission

May 1974

see NEDS data

Scrubber

John Dale

Rotary kiln: 81 lb/ton (product) after multiclone

0.65 lb/ton (product) after multiclone + venturi scrubber

ALABAMA AIR POLLUTION CONTROL COMMISSION

Allied Products Company
Alabaster Alabama

ALABAMA AIR POLLUTION CONTROL COMMISSION

645 SOUTH McDONOUGH STREET

MONTGOMERY, ALABAMA 36104

N

NOT USED

TEST METHODS NOT SPECIFIED. EMISSION RATE UNITS NOT SPECIFIED

PARTICULATE EMISSION TEST
EFFICIENCY EVALUATION
ALLIED PRODUCTS CORPORATION
ALABASTER LIME DIVISION
ALABASTER, ALABAMA
MAY 27-30, 1974

PREPARED BY:

ALABAMA AIR POLLUTION CONTROL COMMISSION
STAFF OF FIELD SERVICES SECTION

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CHAPTER I

INTRODUCTION

This is a report of particulate testing performed at Allied Products Company (Facility No. 411-0017), Alabaster, Alabama. These tests were conducted May 28-30, 1974 to evaluate the efficiency of horizontal venturi scrubber application on lime kilns.

The sampling locations were in the 5 foot square duct upstream of the induced draft and in the separator stack downstream from the scrubber on the No. 2 kiln.

The plant accepts quarried limestone and manufactures quicklime in two rotary kilns. A portion of the quicklime produced is further processed by grinding and blending to form a briquetted flux material for use in steel making processes.

Mr. Jim Naish, Marketing Manager, and Mr. Frank Rikard, Allied Products Company, were present during the entire tests and were responsible for the process operation so that the maximum processing rate was maintained throughout the tests. Mr. Wayne Shookman, Mr. Richard Seay, Mr. Tim Owen and Mr. Floyd Ledbetter of the Field Services Section performed the tests for the Alabama Air Pollution Control Commission. Mr. Ronnie Watkins represented the Engineering Services Section during the tests.

CHAPTER II

SUMMARY OF FLOW PARAMETERS AND EMISSIONS RATES

Tables I and II are summaries of the results of the tests performed on the venturi inlet and outlet, respectively.

Source testing recorded emissions of 1287.01 #/hr., 1886.59 #/hr., 807.46 #/hr. respectively in the inlet duct. Simultaneous testing in the outlet stack revealed emissions of 12.22 #/hr., 12.49 #/hr., and 8.25 #/hr. respectively. These figures yield an average inlet loading of 1365.9 #/hr.* and a corresponding outlet emission of 10.899 #/hr. This resulted in an efficiency of 99.2%.

It may also be noted that a process rate of 16.84 Tons/Hr. was maintained during the test period.

Inlet: $\frac{1366\ lb/hr}{16.8\ Ton/hr\ (product)} \approx 81\ \frac{lb}{Ton\ product}$ (after multiclone)

Outlet: $\frac{11\ lb/hr}{16.8\ Ton/hr} \approx 0.65\ \frac{lb}{Ton}$

* This average does not include the 1287.01 #/hr. recorded during the first inlet test. This figure was discounted due to an isokenitic rate below the minimum limit.

TABLE 1

TEST EVALUATION

ALLIED PRODUCTS 411-0017 5/31/74
CONDUCTED BY AAPCC STAFF SCRBBR INLET

PARAMETER	RUN 1	RUN 2	RUN 3
AVG DELTA H	1.25	1.72	1.63
AVG SQRT DELTA P	0.84	0.80	0.78
BAROMETRIC PRESS	29.75	29.65	29.55
STACK PRESS	29.60	29.50	29.40
METER TEMP	105.15	101.59	102.37
STACK TEMP	700.00	685.00	690.00
VOLUME METERED	56.42	65.30	65.64
VOLUME METERED STD	52.76	61.32	61.33
TOTAL VOLUME H20	66.20	89.80	69.20
VOLUME H20 VAPOR	3.13	4.25	3.28
% MOISTURE	5.61	6.49	5.07
MOL WT DRY	29.59	29.59	29.59
MOL WT WET	28.94	28.83	29.00
AVG STACK VEL	71.19	68.19	66.32
FLOW RATE ACTUAL	106785.08	102286.88	99482.58
FLOW RATE STD	45558.65	43652.35	42764.60
PART WT	11292.60	20079.30	8773.20
CONCENTRATION	3.2957	5.0421	2.2028
PART MASS RATE	1287.01	1886.59	807.46
% ISOKINETIC	86.04	104.37	106.55

EVALUATED BY JRS

TABLE 2

TEST EVALUATION

ALLIED PRODUCTS 411-0017 5/31/74
CONDUCTED BY AAPCC STAFF SCRBBR OUTLET

PARAMETER	RUN 1	RUN 2	RUN 3
AVG DELTA H	2.72	2.52	2.20
AVG SQRT DELTA P	0.87	0.85	0.79
BAROMETRIC PRESS	29.75	29.65	29.56
STACK PRESS	29.79	29.69	29.60
METER TEMP	110.23	107.39	105.34
STACK TEMP	121.40	134.20	135.00
VOLUME METERED	85.03	81.93	77.14
VOLUME METERED STD	79.09	76.30	71.82
TOTAL VOLUME H2O	311.20	308.35	306.20
VOLUME H2O VAPOR	14.75	14.61	14.51
% MOISTURE	15.71	16.07	16.80
MOL WT DRY	29.59	29.59	29.59
MOL WT WET	27.76	27.72	27.64
AVG STACK VEL	53.23	53.02	49.50
FLOW RATE ACTUAL	59603.56	59365.89	55425.55
FLOW RATE STD	45595.01	44098.04	40632.21
PART WT	160.70	163.80	110.50
CONCENTRATION	0.0312	0.0330	0.0236
PART MASS RATE	12.22	12.49	8.25
% ISOKINETIC	102.18	101.92	104.12

EVALUATED BY JRS

TABLE 3

PARAMETER SHEET

(Inlet)

	Run I	Run II	Run III
$\overline{\Delta h}$	1.257	1.726	1.63
$\sqrt{p}$	0.842	0.809	0.786
P_b	29.75	29.65	29.55
P_s	29.60	29.50	29.40
P_m	29.84	29.78	29.67
$\overline{t_m}$	105.15	101.59	102.37
$\overline{t_s}$	700	685	690
t_a	85	75	73
V_m	56.42	65.30	65.64
V_m std	52.76	61.32	61.33
V_{1c}	66.20	89.80	69.20
V_w std	3.13	4.25	3.28
B_{wo}	5.61	6.49	5.07
M_d	29.59	29.59	29.59
M_w	28.94	28.83	29.00
V_s	71.19	67.89	65.88
Q_a	106,785.08	102,286.88	99,482.58
Q_s	45,558.65	43,652.35	42,764.60
M_n	11,292.6	20,079.3	8,773.2
C'_s	3.2957	5.0421	2.2028
PMR	1,287.01	1,886.59	807.46
A_n	0.00034	0.00034	0.00034
A_s	25.0	25.0	25.0
%I	86.04	103.91	105.81
C_p	0.85	0.85	0.85

	Run I	Run II	Run III
K_p	85.48	85.48	85.48
$AH_@$	2.12	2.12	2.12
MCF	1.0149	1.0149	1.0149
θ	99	99	99

Orsat Reading

%	CO_2	7.8
%	O_2	8.6
%	N_2	83.6
%	CO	0

Initial Values for Setting Nomograph

	Runs 1, 2, & 3
$AH_@$	2.15
tm	110
% H_{20}	5
P_s/P_m	0.968

TABLE 4

PARAMETER SHEET

(Outlet)

	Run I	Run II	Run III
$\overline{\Delta h}$	2.725	2.52	2.20
$\sqrt{p}$	0.874	0.859	0.799
P_b	29.75	29.65	29.56
P_s	29.79	29.69	29.60
P_m	29.95	29.84	29.72
$\overline{t_m}$	110.23	107.39	105.34
$\overline{t_s}$	121.4	134.2	135.0
t_a	85	75	73
V_m	85.03	81.93	77.14
V_m std	79.09	76.30	71.82
V_{lc}	311.20	308.35	306.20
V_w std	14.75	14.61	14.51
B_{wo}	15.71	16.07	16.80
M_d	29.59	29.59	29.59
M_w	27.76	27.72	27.64
V_s	53.23	53.02	49.50
Q_a	59,603.56	59,365.89	55,425.55
Q_s	45,595.01	44,098.04	40,632.21
M_n	160.7	163.8	110.5
C'_s	0.0312	0.0330	0.0236
PMR	12.22	12.49	8.25
A_n	0.00033	0.00033	0.00033
A_s	18.66	18.66	18.66
%I	102.18	101.92	104.12
C_p	0.85	0.85	0.85

	Run I	Run II	Run III
K_p	85.48	85.48	85.48
$\triangle$ H@	2.15	2.15	2.15
MCF	.9949	.9949	.9949
θ	96	96	96

Orsat Readings

%	CO_2	7.8
%	O_2	8.6
%	N_2	83.6
%	CO	0

Initial Values for Setting Nomograph

	Runs 1, 2, & 3
$\triangle$ H@	2.15
t_m	110
$\%H_2O$	18
P_s/P_m	1.0

CHAPTER III

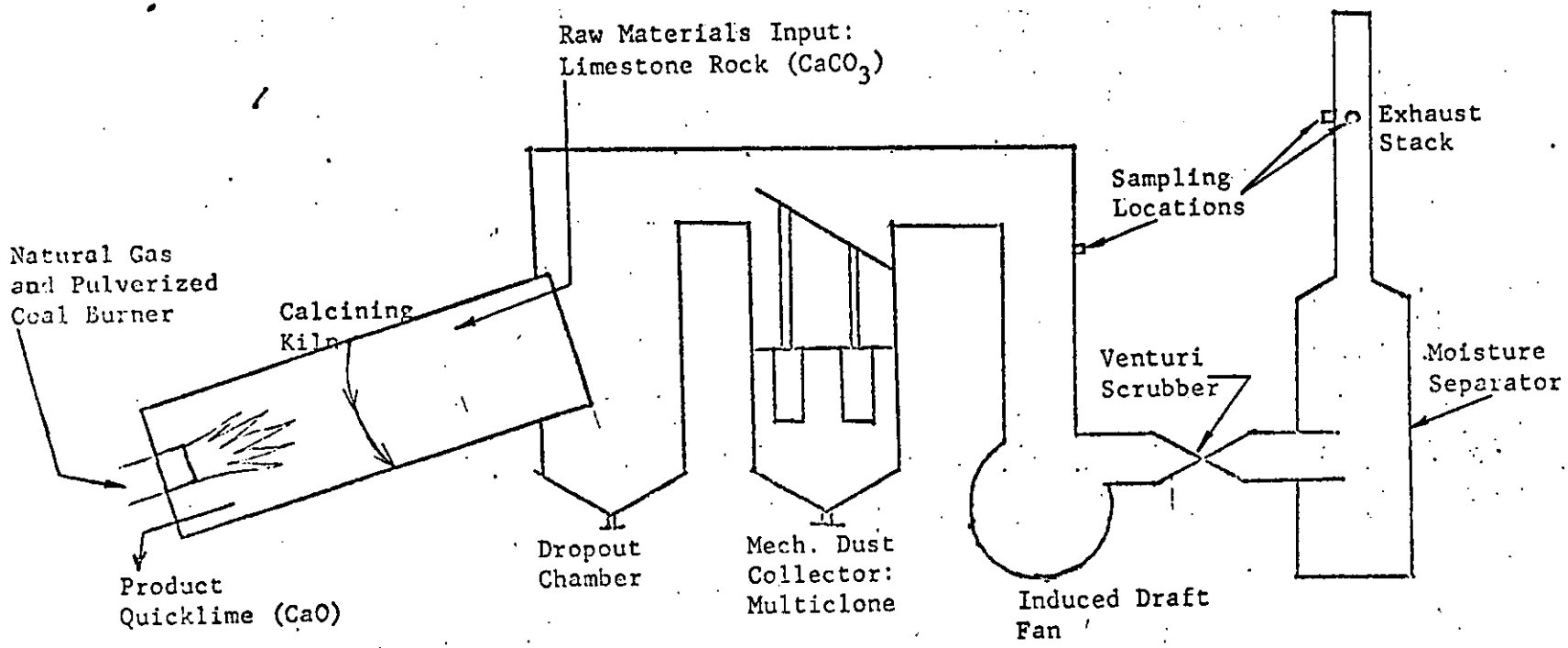
DESCRIPTION OF PROCESS OPERATION

The tests described in this report were conducted at an average production rate of 16.84 tons/hr. product The operating capacity for this kilm is 350 tons/day.

The feed, which consists of limestone rock, is delivered continuously to the kilm by a conveying system. The kiln, on which the tests were conducted, is an 8' 6" x 250' revolving cylinder.

The fuel, a mixture of 50% coal and 50% natural gas, enters the end opposite of the feed and is combusted resulting in a temperature of approximately 2000°F. Although a temperature around 1500°F results in decomposition of the limestone to CaO and CO_2, higher temperatures are necessary to complete the calcinating process within a reasonable retention time. The product, CaO, is allowed to cool and then is shipped in bulk by rail.

The gases resulting from combustion and calcinating are drawn out of the kilm at the feed end of the kilm and forced through a venturi scrubbing system. The venturi operates with a 15" W. G. pressure drop and 1062 GPM scrubbing water. The scrubbed air enters the entrainment separator and exhausts through the stack at a temperature of approximately 120°F. The water from the scrubbing system empties into an old quarry.



FLOW DIAGRAM- CALCINING KILN No.2 - Allied Products Corp.
Alabaster Lime Division