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:	9
Title:	Particulate Analysis Of Calcinator Exhaust At Western Gypsum Company, Kramer, Callahan and Associates, Rosario, NM, April 1979. Unpublished.

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AP-42 Section 8.14
Reference Number
9

PARTICULATE ANALYSIS
of
CALCINATOR EXHAUST

at

WESTERN GYPSUM COMPANY
ROSARIO, NEW MEXICO

by

Kramer, Callahan & Associates

April, 1979

Introduction

Calcinator emissions from Western Gypsum's Rosario Facility were sampled on April 5, 1979 by Kramer, Callahan & Associates and analysed for total particulate matter. The facility is located approximately 40 miles north of Albuquerque on I-25 and east of the interstate about 3 miles. Individuals present during the sampling included:

1. Gary Kramer and Bill Rista --Kramer, Callahan & Assoc.
2. Marvin Fields, Engineer, Western Gypsum Co.
3. Robert Malone, K & P Inc. Sales Engineers.

Gases discharged from the calcinator were passed through a bag-house dust collector prior to discharge to the stack. Sampling locations on the stack are illustrated in the attached drawing.

New Mexico Air Quality Control Regulation #503 permits an emission rate of 690 mg/m^3 for gypsum processing plants.

Methods & Procedures

All procedures used followed those set forth in the Federal Register, Thursday, August 18, 1977, pages 41776-82. A 40-point traverse was sampled for two minutes per point through a ½" nozzle. The sampling train used was a MISCO Model 7200 Source Sampler which is identical in operation to that shown in Method 5 of the Federal Register referenced above. Gas analyses were performed with an Industro Model Burrell Analyser, and all filters and particulate catches were weighed on a Sartorius analytical balance (0.1 mg sensitivity). Probes, nozzles and associated glassware upstream from the filter were cleaned with acetone which was collected in a jar with lid for transport to the KCA laboratory in Albuquerque. Jars were emptied and rinsed with acetone into tared beakers for evaporation. Filters were dessicated for at least 24 hours prior to reweighing. All samples were in the custody of Gary Kramer at all times.

Results & Discussion

Test data and calculated results are summarized in Table 1; original data and calculations are listed in Appendix 1. Equipment calibration data is attached as Appendix 2.

Over 30 DSCF of gas was collected for each sample over an 80 minute period at an isokinetic rate of 95-102%. Average emissions were 10.1 mg/m^3 which is much less than the allowable 690 mg/m^3.

WESTERN GYPSUM COMPANY
STACK SAMPLING LOCATION

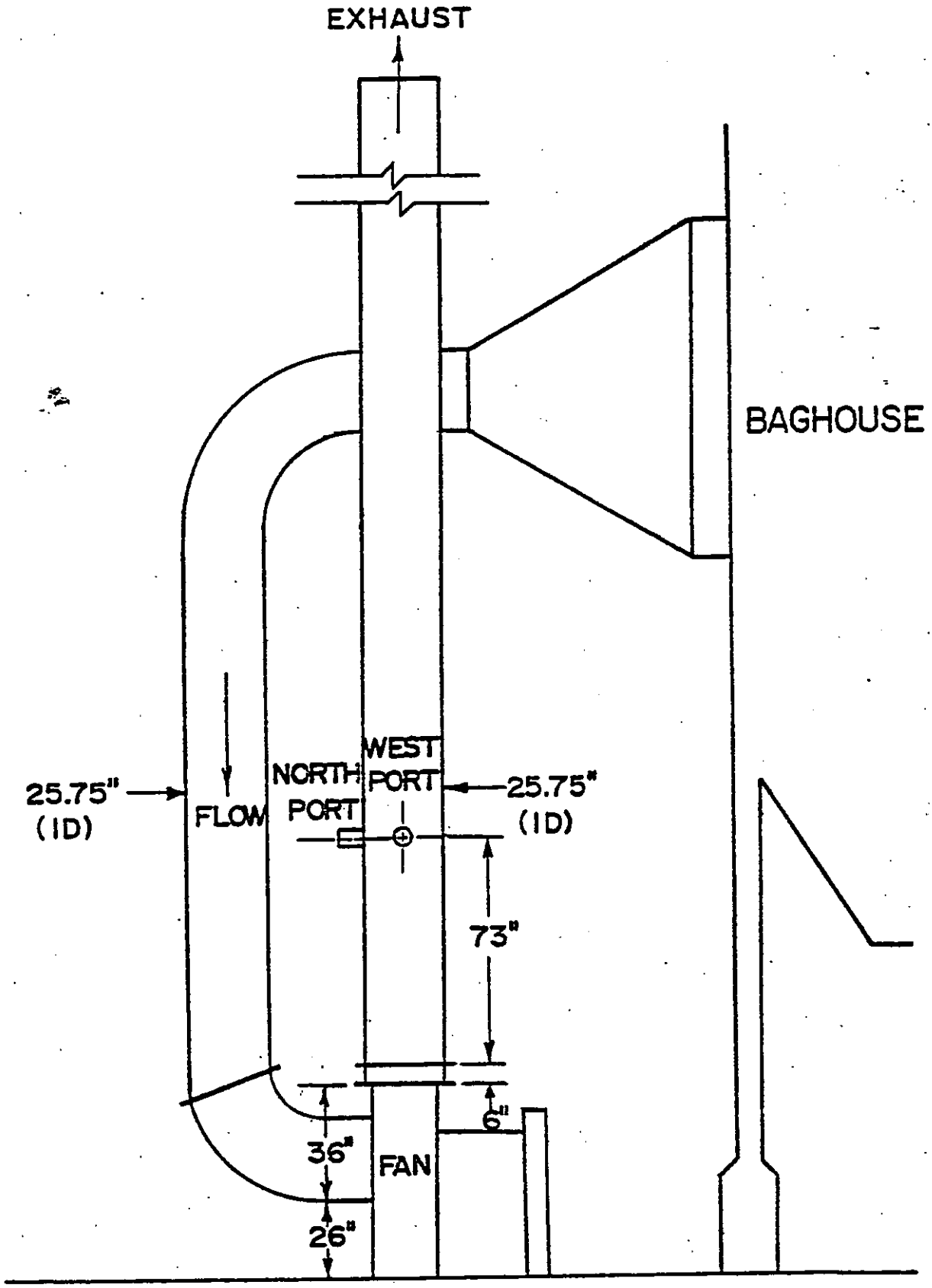

Table 1

TEST DATA

	TEST NO. 1	2	3	4	5
V..... Actual metered volume (CF)	44.42	58.7	59.85		
Pb .... Barometric pressure ("Hg)	24.65	24.65	24.65		
T_m..... Ave. dry gas meter temp. (^oF)	78.5	85.7	89.3		
W..... Particulate collected (mg)		13.9	14.2		
V_w..... Total H_2O collected (ml)	226.2	208.4	244.5		
CO_2.... Carbon dioxide in stack gas, %	3.6	3.6	3.6		
O_2..... Oxygen in stack gas, %	14.4	14.4	14.4		
N_2..... Nitrogen in stack gas, %	81	81	81		
P_s..... Absolute stack pressure ("Hg)	24.65	24.65	24.65		
T_s..... Average stack gas temp. (^oF)	247	260	257		
C_p..... S-type pitot correction factor	0.77	0.77	0.77		
ΔP..... Average velocity pressure ("H_2O)	0.44	0.78	0.77		
A..... Area of stack (ft^2)	3.62	3.62	3.62		
t..... Sample time (minutes)	80	80	80		
D_n..... Nozzle diameter (in.)	1/4	1/4	1/4		
ΔH.....Pressure drop across orifice ("H_2O)	0.835	1.38	1.42		

CALCULATED RESULTS

$V_m$std..Corrected metered volume (SCF)	36.1	47.15	47.77		
$V_w$std..Volume of water collected (SCF)	10.72	9.88	11.6		
B_{wo}... H_2O in stack gas (% by vol.)	22.9	17.3	19.5		
MW.... Molecular wt. of stack gas (wet)	26.7	27.32	27.07		
MW_d... Molecular wt. of stack gas (dry)	29.27	29.27	29.27		
F..... Mole fraction dry stack gas	0.771	0.817	0.805		
$V_s$ave..Average velocity of stack gas (fpm)	2715	3606	3582		
$Q_s$ave..Average stack flow rate (SCFM,dry)	4680	6547	6401		
Q .....Average stack flow rate (ACFM,dry)	7578	10665	10438		
I..... Isokinetic rate, average (%)	102.1	95.3	98.8		
c_s'.... Particulates conc. in stack gas (gr/DSCF)	0.0041	0.0045	0.0046		
W_m.... Particulates conc. in stack gas (mg/m^3)	9.5	10.4	10.5		
G .... Particulates conc. in stack gas (lb/hr)	0.17	0.26	0.25		
Plant processing rate, lb per hour	22000	22000	22000		

APPENDIX 1

ORIGINAL DATA & CALCULATIONS

CALCULATION SUMMARY - RUN 1

$$V_{M_{STD}} = 17.71(44.42)\left[\frac{24.65 + 0.835/13.6}{538.5}\right] = 36.1 \text{ DSCF}$$

$$V_{W_{STD}} = 0.0474(226.2) = 10.72$$

$$B_{WO} = 10.72/46.82 = 22.9\%$$

$$MW = \left(44(0.36) + 32(0.144) + 0.01(40) + 0.81(28)\right) 0.771 + 18(0.229)$$

$$= 29.27(0.771) + 18(0.229) = 26.7$$

$$V_{S_{AVE}} = 85.48(0.77)\left[\frac{0.44(707)}{26.7(24.65)}\right]^{1/2} = 45.25 \text{ fps}$$

$$Q_{S_{AVE}} = 1062.83(0.771)(45.25)(3.62)\left(\frac{24.65}{707}\right) = 4680 \text{ DSCFM}$$

$$C_s' = 0.0154\left(\frac{1.9 + 7.8}{36.1}\right) = 0.0041 \text{ gr/DSCF}$$

$$G = 0.000143(60)(4680)(0.0041) = 0.17 \text{ lbs/Hr.}$$

$$I = \frac{1032(707)(36.1)}{60(45.25)(80)(0.771)(24.65)(0.0625)} = 102.1$$

$$C_{mg/m^3} = 35.3146\left(\frac{1.9 + 7.8}{36.1}\right) = 9.5 \text{ mg/m}^3$$

PARTICULATES SAMPLING AND ANALYSIS DATA

Plant Name and Location WESTERN GYPSUM

Run No. 1 Date 4/5/79 Time 1100 Ambient Temp. °F 55

Bar. Press.,in. Hg. 24.65 Stack Location BAGHOUSE STACK

Stack Diameter, in. 25.75 Stack Pressure, in Hg 24.65

Plant Operator FIELDS P_s/P_m 1.00

Processing Rate 11 TONS/HR.

Filter Assembly MISCO Filter No. 13

Silica Gel No. — Acetone Jar No. 11 Acetone Bkr No. 11

Probe Tip Diameter, in. 1/4 Assumed Moisture, % 17%

Probe Length, Ft. 7 1/2' Cp 0.77 Δ H@ 1.7

Calculator Setting ΔP=1 Δ#=1.85

Orsat Analysis Data

CO_2	3.7	3.6	3.5
$CO_2 + O_2$	17.9	18.0	17.9
$CO_2 + O_2 + CO$	17.9	18.0	17.9

Moisture Content

Impinger #1	310
Impinger #2	114
Impinger #3	)
Total initial H_2O	200
Net Impinger H_2O	214
Net H_2O in Silica Gel	12.2
Total H_2O Collected	226.2

Leak Test

Initial 0.005cfm @ 10" Hg

Final .004 @ 15" Hg.

PARTICULATES SAMPLING DATA

Plant Name and Location WESTERN GYPSUM ROSARIO Run No. 1

Point	Time	Gas Meter Rdg. Ft^3	ΔP Pitot Rdg. "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum "Hg. gauge	Hot Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
1	0	338.880	.79	1.41	1.44	79	81	2	225	50	245
2	4	342.200	.79	1.44	1.44	80	80	2	225	50	245
3	6	345.600	.84	1.64	1.65	83	82	3	225	55	250
4	8	349.150	.80	1.69	1.69	84	82	3	225	55	251
5	10	353.600	.83	1.58	1.58	84	83	3	225	55	253
6	12	356.150	.80	1.48	1.48	85	83	3	225	55	255
7	14	358.600	.76	1.40	1.40	85	83	3½	225	55	255
8	16	362.690	.89	1.27	1.27	86	84	2	225	55	254
9	18	365.400	.55	1.05	1.05	85	84	2	225	55	252
10	20	369.050	.28	.52	.52	84	84	1	225	55	249
11	22	371.625	.20	.37	.37	84	84	1	225	55	248
12	24	373.450	.18	.33	.33	83	84	1	225	55	245
13	26	375.180	.15	.27	.27	83	84	1	225	55	243
14	28	377.280	.14	.26	.26	81	84	1	225	55	240
15	30	379.500	.10	.185	.185	81	84	1	225	55	240
16	32	381.100	.10	.185	.185	81	84	1	225	55	238
17	34	383.600	.08	.145	.145	80	84	1	225	55	236
18	36	386.200	.08	.145	.145	80	84	1	225	55	230
	40	387.205									
		42.715	0.94	0.835	0.835	77.4	76.8	1.5	220	52	247
corrected		44.42				80.4					707

78.5

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PARTICULATES SAMPLING DATA

Plant Name and Location Western Gypsum / Rosario Run No. 1

Point	Time	Gas Meter Rdg. Ft^3	ΔP Pitot Rdg. "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum "Hg. gauge	Hot Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
1	0	354.490	.43	.80	.80	60	61	1	200	50	250
2	4	356.600	.45	.82	.82	61	61	1	200	50	250
3	6	357.700	.46	.82	.82	63	62	1	200	50	251
4	8	358.810	.48	.84	.85	64	64	1	200	50	252
5	10	359.920	.50	.86	.86	67	65	1	200	50	253
6	12	361.090	.50	.86	.86	70	66	1	200	50	254
7	14	362.170	.51	.88	.88	72	68	1	200	50	255
8	16	363.350	.51	.88	.88	73	69	1	200	50	255
9	18	364.350	.51	.88	.88	74	70	1	200	50	256
10	20	365.560	.48	.84	.84	75	71	1	200	50	255
11	22	366.670	.45	.82	.82	75	72	1	205	50	255
12	24	367.800	.44	.81	.81	76	73	1	205	50	254
13	26	368.900	.43	.80	.80	77	75	1	210	50	252
14	28	370.000	.40	.74	.74	78	76	1	210	50	250
15	30	370.150	.36	.66	.66	78	76	<1	210	50	249
16	32	372.100	.36	.66	.66	79	78	<1	220	50	248
17	34	373.100	.32	.59	.59	80	79	<1	225	50	245
18	36	374.030	.27	.50	.50	81	79	<1	225	50	240
	40	375.685									

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CALCULATION SUMMARY - RUN 2

$$V_{M\,STD} = 17.71\,(58.7)\left[\frac{24.65 + 1.38/13.6}{545.7}\right] = 47.15 \text{ DSCF}$$

$$V_W = 0.0474\,(208.4) = 9.88 \text{ SCF}$$

$$B_{WO} = 9.88/57.13 = 17.3\%$$

$$M.W. = 29.27(0.827) + 18(0.173) = 27.32$$

$$V_{S\,ACT} = 85.48\,(0.77)\left[\frac{(0.78)(720)}{24.65\,(27.32}\right]^{1/2} = 60.1 \text{ fps}$$

$$Q_{S\,NC} = 1062.83\,(0.827)(60.1)(3.62)\left(\frac{24.65}{720}\right) = 6547 \text{ DSCFM}$$

$$C_S' = 0.0154\left(\frac{5.8 + 8.1}{47.15}\right) = 0.0045 \text{ gr/DSCF}$$

$$G = 0.000143\,(60)(6547)(0.0045) = 0.26 \text{ lbs/HR}$$

$$I = \frac{1032(720)(47.15)}{60(60.1)(80)(24.65)(0.827)(0.0625)} = 95.3\%$$

$$C_{mg/m^3} = 35.3146\left(\frac{5.8 + 8.1}{47.15}\right) = 10.4 \text{ mg/m}^3$$

PARTICULATES SAMPLING AND ANALYSIS DATA

Plant Name and Location Western Gypsum

Run No. 2 Date 1300 4/5/74 Time 1300 Ambient Temp. °F 65

Bar. Press.,in. Hg. 24.65 Stack Location Baghouse dschg.

Stack Diameter, in. 25.75 Stack Pressure, in Hg 24.65

Plant Operator FIELDS P_s/P_m 1.0

Processing Rate 11 Tons/Hour

Filter Assembly MSCO Filter No. 14

Silica Gel No. — Acetone Jar No. 12 Acetone Bkr No. 12

Probe Tip Diameter, in. 1/4" Assumed Moisture, % 20

Probe Length, Ft. 7 1/2 Cp 0.77 Δ H@ 1.7

Calculator Setting ΔP=1 ΔH = 1.7

Orsat Analysis Data

CO_2	3.6	____	____
$CO_2 + O_2$	17.8	____	____
$CO_2 + O_2 + CO$	17.8	____	____

Moisture Content

Impinger #1	264
Impinger #2	130
Impinger #3	
Total initial H_2O	200
Net Impinger H_2O	194
Net H_2O in Silica Gel	14.4
Total H_2O Collected	208.4

Leak Test

Initial .001 @ 5" Hg

Final .000 @ 5" Hg

0

PARTICULATES SAMPLING DATA

Plant Name and Location WESTERN GYPSUM - ROSARIO Run No. 2

Point	Time	Gas Meter Rdg. Ft^3	ΔP Pitot Rdg. "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum "Hg. gauge	Hot Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
1	0	397.288	1.0	1.85	1.85	79	78	3	185	50	252
2	4	400.900	1.0	1.85	1.85	76	76	3	190	50	251
3	6	401.900	1.0	1.85	1.85	77	76	3	190	50	251
4	8	403.400	.91	1.8	1.80	80	77	3	200	50	251
5	10	404.900	.97	1.80	1.80	81	77	3	206	50	252
6	12	406.500	.96	1.75	1.75	82	78	3	205	50	253
7	14	408.050	.97	1.8	1.8	83	78	3	210	50	251
8	16	409.630	.99	1.8	1.8	84	79	3	210	50	252
9	18	411.220	.93	1.7	1.7	84	79	3	215	50	252
10	20	412.700	.81	1.5	1.5	85	80	3	215	50	250
11	22	414.450	.79	1.45	1.45	85	80	3	215	50	250
12	24	416.200	.68	1.15	1.15	85	81	2	225	50	255
13	26	417.125	.60	1.00	1.00	83	81	2	225	50	255
14	28	418.330	.71	1.30	1.30	84	81	2	225	50	260
15	30	419.630	.68	1.15	1.15	85	82	2	225	50	260
16	32	420.940	.61	1.05	1.05	85	82	2	230	55	262
17	34	422.200	.55	.94	.94	85	83	2	230	55	270
18	36	423.460	.55	.94	.94	85	84	2	230	55	270
	40	425.780									

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PARTICULATES SAMPLING DATA

Plant Name and Location WESTERN GYPSUM - ROSARIO Run No. 2

Point	Time	Gas Meter Rdg. Ft^3	ΔP Pitot Rdg. "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum "Hg. gauge	Hot Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
1	0	425,160	.72	1.22	1.22	81	83	2	230	55	260
2	4	428.160	.74	1.25	1.25	85	84	2	230	55	255
3	6	429.720	.62	1.05	1.05	85	84	2	230	55	255
4	8	431 000	.67	1.15	1.15	85	84	2	230	55	255
5	10	432 360	.73	1.25	1.25	85	84	2	230	55	260
6	12	433 760	.73	1.25	1.25	86	84	2	230	55	260
7	14	435.000	.78	1.33	1.33	87	85	2	230	55	259
8	16	436.400	.98	1.66	1.66	88	85	2	225	55	260
9	18	437.910	.98	1.66	1.66	88	86	2	225	55	261
10	20	439 450	1.00	1.70	1.70	90	86	3	225	55	263
11	22	441.100	.95	1.60	1.60	90	87	3	225	55	265
12	24	442.550	.86	1.45	1.45	90	87	3	225	55	268
13	26	444 050	.80	1.36	1.36	89	87	2	225	55	270
14	28	445.550	.74	1.25	1.25	89	87	2	225	55	270
15	30	446.820	.68	1.15	1.15	89	87	2	225	55	270
16	32	448.150	.64	1.10	1.10	89	88	2	225	55	275
17	34	449,400	.58	1.00	1.00	89	88	2	225	55	276
18	36	450.650	.54	.93	.93	89	88	2	225	55	270
	46	453.040									
		55.792	0.78	1.38	1.38	84.7	82.7	2.4	220	53	260
Corrected		58.7				88.7					

Avg: 85.7

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CALCULATION SUMMARY – RUN 3

$$V_{M\,STD} = 17.71(59.85)\left[\frac{24.65 + 1.92/13.6}{549.3}\right] = 47.77\ DSCF$$

$$V_{W\,STD} = 0.0474\ (244.5) = 11.6\ SCF$$

$$B_{WO} = 11.6/59.36 = 19.5\%$$

$$M.W. = 29.27\,(0.805) + 18(0.195) = 27.07$$

$$V_{S\,AVG} = 85.48(0.77)\left[\frac{0.77\,(712)}{27.07\,(24.65)}\right]^{1/2} = 59.7\ fps$$

$$Q_{S\,AVG} = 1062.83(0.805)(59.7)(3.62)\left(\frac{24.65}{712}\right) = 6401\ DSCFM$$

$$C_S' = 0.0154\left(\frac{5.7 + 8.5}{47.77}\right) = 0.0046\ gr./DSCF$$

$$G = 0.000143\,(66)(6401)(0.0046) = 0.25\ lbs/HR$$

$$I = \frac{1032(712)(47.77)}{60(59.7)(80)(24.65)(0.805)(0.0625)} = 98.8\%$$

$$C_{mg/m^3} = 35.3146\left(\frac{5.7 + 8.5}{47.77}\right) = 10.5\ mg/m^3$$

PARTICULATES SAMPLING AND ANALYSIS DATA

Plant Name and Location WESTERN GYPSUM

Run No. 3 Date 4/5 Time 1500 Ambient Temp. °F 65

Bar. Press.,in. Hg. 24.65 Stack Location BAGHOUSE DISCH

Stack Diameter, in. 25.75 Stack Pressure, in Hg 24.65

Plant Operator FIELDS P_s/P_m 1.0

Processing Rate _____

Filter Assembly MISCO Filter No. 11

Silica Gel No. — Acetone Jar No. 2 Acetone Bkr No. 2

Probe Tip Diameter, in. 1/4 Assumed Moisture, % _____

Probe Length, Ft. 7½' Cp 0.77 Δ H@ 1.7

Calculator Setting ΔP=1 ΔH=1.85

Orsat Analysis Data

CO_2	_____	____	____
$CO_2 + O_2$	_____	____	____
$CO_2 + O_2 + CO$	_____	____	____

Moisture Content

Impinger #1	296
Impinger #2	135
Impinger #3	_____
Total initial H_2O	200
Net Impinger H_2O	231
Net H_2O in Silica Gel	13.5
Total H_2O Collected	244.5

Leak Test

Initial 0.005 cfm @ 5" Hg

Final .005 @ 5" Hg

PARTICULATES SAMPLING DATA

Plant Name and Location Western Gypsum Rosario Run No. 3

Point	Time	Gas Meter, ft^3 Rdg.	Δ P Pitot Rdg. "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum "Hg. gauge	Hot Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
1	0	480.088	.65	1.20	1.20	86	87	1	230	60	249
2	4	484.630	.70	1.30	1.30	89	88	1	230	60	250
3	6	488.000	.70	1.3	1.30	90	88	1	230	60	249
4	5	492.450	.75	1.40	1.40	91	89	1	230	60	250
5	10	498.770	.80	1.48	1.48	92	90	2	230	60	251
6	12	504.200	.78	1.45	1.45	92	90	2	230	60	250
7	14	491.650	.84	1.55	1.55	92	90	2	230	60	250
8	16	513.150	.84	1.55	1.55	93	90	2	230	60	252
9	18	494.730	.88	1.65	1.65	93	90	2½	230	60	250
10	20	496.300	.90	1.67	1.67	93	90	2½	230	60	250
11	22	497.700	.88	1.65	1.65	93	91	2½	230	60	250
12	24	499.400	.80	1.48	1.48	93	91	2½	230	60	249
13	26	501.830	.75	1.40	1.40	93	91	2	230	60	248
14	25	503.450	.70	1.3	1.3	94	92	2	230	60	245
15	30	503.660	.64	1.2	1.2	94	92	2	230	60	246
16	32	505.010	.59	1.1	1.1	93	92	2	230	60	245
17	34	506.300	.55	1.03	1.03	92	92	2	230	60	245
18	36	507.550	.55	1.02	1.02	92	92	2	230	60	244
	40	510.017									
		56.795	0.77	1.42	1.42	88.3	86.3	2½	225	56	252
		59.85				92.3					

89.3

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PARTICULATES SAMPLING DATA

Plant Name and Location Western Gypsum Rosario Run No. 3

Point	Time	Gas Meter Rdg. Ft^3	ΔP Pitot Rdg. "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Vacuum "Hg. gauge	Hot Box Temp. °F	Impinger Temp. °F	Stack Temp. °F
1	0	443.180	.75	1.65	1.65	76	79	3	195	55	265
2	4	448.400	.95	1.75	1.75	78	78	3	195	55	260
3	6	451.815	.95	1.75	1.75	80	79	3	200	55	260
4	8	457.300	.95	1.75	1.75	80	79	3	205	50	260
5	10	460.505	.95	1.75	1.75	81	80	3	205	50	260
6	12	463.350	.92	1.70	1.70	83	80	3	210	50	260
7	14	468.900	.72	1.30	1.30	84	80	3	210	50	260
8	16	464.425	.90	1.65	1.66	86	81	3	220	50	260
9	18	467.600	.92	1.70	1.70	86	82	3	220	50	260
10	20	468.600	.95	1.75	1.75	87	82	3	220	50	255
11	22	470.100	.88	1.60	1.60	88	84	3	225	50	260
12	24	471.600	.85	1.60	1.60	88	84	3	225	50	255
13	26	473.130	.80	1.50	1.50	87	85	3	225	50	251
14	28	474.650	.70	1.30	1.30	89	85	3	225	50	250
15	30	476.000	.60	1.12	1.12	90	86	2	225	50	250
16	32	477.300	.52	.96	.96	89	86	2	225	50	250
17	34	478.600	.50	.93	.93	90	86	2	230	55	250
18	36	479.900	.45	.84	.84	89	87	2	230	55	245
	40	480.083									

kramer, callahan & associates

ACETONE WASH, SILICA GEL AND FILTER WEIGHT RECORDS

FACILITY Western Gypsum

TESTING DATES 4/5/79

DATE OF TARE WEIGHING 1/5/79 WEIGHED BY G. Kramer

DATE OF FINAL WEIGHING 1/11/79 WEIGHED BY G. Kramer

FILTER NO.	TARE WEIGHT, GM.	FINAL WEIGHT, GM.	PARTICULATE WT, GM.
11	0.5949	0.6006	5.7 mg
13	0.5888	0.5907	1.9 mg
14	0.5819	0.5877	5.8 mg
A 2	64.0706	64.0791	8.5 mg
A 11	64.1254	64.1332	7.8 mg
A 12	63.6032	63.6113	8.1 mg

APPENDIX 2

Equipment Calibration Data

ORIFICE AND METER CALIBRATION

Date 10/5/78 Control Module No. 7249

Barometric pressure, P_b = 24.97 in. Hg Dry gas meter No. 83

Orifice manometer setting, ΔH, in. H_2O	Gas volume wet test meter V_w, ft^3	Gas volume dry gas meter V_d, ft^3	Temperature: Wet Test Meter t_w, °F	Temperature: Dry gas meter Inlet t_{di}, °F	Temperature: Dry gas meter Outlet t_{do}, °F	Temperature: Dry gas meter Average t_d, °F	Time θ, min.	γ	$\Delta H_@$
0.5	5	4.842	74	81	76	78.5	10.9	1.04	1.60
1.0	5	4.825	79.5	81	84	85.5	7.9	.045	1.69
2.0	10	9.495	80	94	86	90	11.3	.0644	1.72
3.0	10	9.374	80	98	90	94	9.17	1.0817	1.68
4.0	10	9.205	79	96	90	93	7.97	1.0957	1.69
5.0	10	9.087	79	100	94	97	6.85	1.1111	
						Average			

Calculations

ΔH	$\frac{\Delta H}{13.6}$	γ $\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$	$\Delta H_@$ $\frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\,\theta}{V_w}\right]^2$
0.5	0.0368	1.0398	1.60
1.0	0.0737	1.0447	1.69
2.0	0.147	1.0664	1.72
3.0	0.294	1.0817	1.68
4.0	0.431	1.0957	1.69
5.0	0.588	1.1111	1.55

γ = Ratio of accuracy of wet test meter to dry test meter.

$\Delta H_@$ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O.

PITOT TUBE CALIBRATION SHEET

Pitot Tube No. 1 Pitot Length 7½ Calibration Date 2/26/79

Wind Tunnel Location E/A WAREHOUSE Calibrated By G. Kramer

Nozzle Size: 1/4"

P_L	P_S	C_P
0.48	0.77	0.78
0.615	1.05	0.76
0.69	1.15	0.77
0.50	0.80	0.78
0.285	0.475	0.77
0.225	0.36	0.78
0.22	0.35	0.78
	AVE:	0.77

Nozzle Size: 3/8"

P_L	P_S	C_P
0.225	0.375	0.77
0.23	0.39	0.76
0.375	0.605	0.78
0.45	0.725	0.78
0.515	0.885	0.76
0.58	1.00	0.75
0.56	0.96	0.76
	AVE:	0.77

Nozzle Size: 3/16"

P_L	P_S	C_P
0.235	0.385	0.77
0.555	0.915	0.77
0.385	0.600	0.79
0.91	1.45	0.78
0.46	0.71	0.80

Nozzle Size: 3/16"

P_L	P_S	C_P
0.300	048	0.78
1.13	1.70	0.81
	AVE:	0.79

Nomenclature: P_L = Velocity pressure (inches water) measured with Standard Pitot

P_S = Velocity pressure (inches water) measured with S Pitot .

C_p = S pitot correction factor = $0.99(P_L/P_S)^{\frac{1}{2}}$

TESTING APPARATUS CALIBRATION DATA

Temperature Indicators

Hg Thermometer Bath Temp. °F	Gas Meter Inlet, °F	Gas Meter Outlet, °F	Impinger, °F
76.6	73	76.5	76
100	95.5	100.5	100
120.9	115	121.5	121
62.6	64	63	63
41.9	42	42	42

Thermocouple

Hg. Thermom.	Thermocouple
97	95
106	105
131	130
153	150
168	165
181	180
195	195

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STATE OF NEW MEXICO

Environmental Improvement Agency

AIR QUALITY SOURCE SAMPLING REPORT #65

~~Republic Housing Corporation~~ Western Gypsum
(Gypsum Wallboard Plant)
Rosario, New Mexico

October 1, 1974

REPORT PREPARED BY

Brian C. Page

Brian Page
Junior Engineer

REPORT REVIEWED BY

J David Duran

J. David Duran
Supervisor
Enforcement Section

ABSTRACT

The ~~Republic Housing Corporation~~ Western Gypsum, operating a Gypsum Wallboard Plant at Rosario, New Mexico was tested on July 2 and 3, 1974. Three tests were performed on the baghouse using the Joy EPA train.

The results of the tests performed on the baghouse showed the plant to be in compliance with Air Quality Regulation #503.

Air Quality Regulation #503, however, does not apply to fugitive dust emissions which were extensive.

TABLE OF CONTENTS

INTRODUCTION

1. Purpose of Test

   These tests were conducted to determine compliance with Regulation #503 for the baghouse of the gypsum wallboard plant located at Rosario, New Mexico, owned by Republic Housing.

2. Equipment Tested

   The equipment tested was a gypsum wallboard plant.

3. Name and Location of Company Operating Equipment

   Republic Housing Corporation is located at 1100 Mercantile Bank Building in Dallas, Texas.

4. Location of Equipment

   The gypsum wallboard plant is located east of Highway I-25 at Rosario, New Mexico.

5. Date of Test

   Tests were performed on July 2 and 3, 1974.

6. Operating Conditions during Tests

   The plant was operating at full capacity with three impaction mills running.

7. Location of Sample Port

   Access to the port was gained by utilizing six sections of scaffolding. The EPA samples were taken at the exit of a rectangular duct approximately 25 feet from the ground.

8. Names of Personnel Conducting Test

   Personnel conducting tests were Brian Page, Jack Ellvinger, Elaine Brown, and Jim Shinas.

9. Company Personnel Present During Test

   Mr. Petty, Plant Superintendent, was present at the plant during testing but did not observe test procedures.

10. Tests Performed

    Three total particulate tests were performed with the Joy EPA train according to procedures specified by the Federal Register, December 23, 1971.

DESCRIPTION OF PROCESS

Gypsum is a naturally occurring mineral in the form of calcium sulfate combined with two molecules of water of crystallization ($CaSO_4.2H_2O$). The Rosario gypsum used by Republic Housing for its wallboard is approximately 97% pure.

After the rock is mined, it is crushed to 3/4" size and taken by conveyor belt to the plant processing site where it is stored in large bins. From these bins, the gypsum then goes through a process called flash calcination. Flash calcination is the process whereby by $CaSO_4.2H_2O$ is pulverized and heated to about 320°F. In this process, the gypsum loses about 3/4 of its water of crystallization and becomes calcium sulfate hemihydrate ($CaSO_4.\frac{1}{2}H_2O$), also called calcined gypsum. This is a flash process because the gypsum is pulverized by an impaction mill and heated with hot air from a natural gas kiln simultaneously.

This calcined gypsum is then taken through cyclones, one for each of the impaction mills, using both forced and draft air. The heavier material drops out inside the cyclones and is transported to another storage area by a screw conveyor. The emissions from the cyclones are ducted into a Precipitair electrostatic precipitator for final collection. Emissions from the ~~precipitator are then re-~~ leased into the atmosphere through a 51-foot stack.

precipitator replaced by baghouse

The captured calcined gypsum is combined with old newspaper and water to a pulp consistency. This paste is then spread on heavy paper, formed, layered, and cut to yield a finished wallboard of various thicknesses after drying. The width of the wallboard is cut to the desired size by rotatory saws. The duct from these saws is ducted into the baghouse.

SAMPLING AND ANALYTICAL PROCEDURES

Pre-Test

Before leaving the Air Quality Technical Support Facility in Santa Fe, the filters to be used with the Joy EPA system were weighed and sealed in manila envelopes. Upon arrival at the plant, scaffolding was set up, enabling the Environmental Improvement Agency (EIA) source sampling team to gain access to the sample port. A test for carbon monoxide was performed on the scaffolding platform to determine if gas masks were necessary. A velocity and temperature traverse were performed next, followed by a moisture determination. This information was then used to set the nomograph, which was used as an aid in achieving isokinetic sampling. The sample box was assembled and leak-checked at 18 inches of mercury vacuum. The probe was then attached to the sample box and both were pre-heated to 250°F before sampling was started.

Test

Due to the rectangular design of the outlet on the baghouse, only one point could be tested. A velocity traverse was done to determine what the average velocity across the outlet was. The point of average velocity for the outlet was sampled for one hour with readings being taken every fifteen minutes.

Post-Test

The equipment was leak-checked again after each test. For the first two tests, the probe was cleaned at the test site, whereas at the end of the third test, the probe was sealed and cleaned at the Air Quality Technical Support Facility in Santa Fe. The probe was cleaned with acetone, and these acetone washings were placed in sample jars and labeled appropriately. The impinger water in the sample boxes was measured, and the silica gel weighed to determine the moisture content of the stack gas. The sample box was then sealed and sent back to the Air Quality Technical Support Facility for cleaning. At the Air Quality Technical Support Facility the cyclones and front half of the filter holders were washed with acetone, and the catches were placed in the appropriately labeled sample jars. All the sample jars were then sent to the Albuquerque Laboratory for analysis. The filters were desiccated for 48 hours and re-weighed so that the amount of particulate collected could be measured.

SUMMARY OF RESULTS

A partial summary of results for the three EPA samples is given in the following table:

Table L. Process Rate 22000 lb/hr gypsum

Test No.	Sample Time (min)	Stack Flow (SCFM)	Emissions (mg/m^3)	Isokinetics (%)
1	60	2916.3	353.5	102.1
2	60	2591.1	354.9	96.2
3	60	2573.8	502.2	90.6
Average	--	--	403.5	--

A complete set of results can be found in Table II in the "Calculation" section of this report.

DISCUSSION AND CONCLUSIONS

In concluding the calculations, it was found that the exhaust gas emission rate of the baghouse was 438.45 mg/m^3. Air Quality Regulation #503 allows an exhaust gas emissions rate of 690 mg/m^3. The source does have a fugitive dust problem which is caused by dumping fine particulate from the baghouse to the ground approximately every fifteen minutes.

CALCULATIONS

NOMENCLATURE

A = Area of stack ($ft.^2$)

Cp = S-type pitot tube correction factor

Dn = Sampling nozzle diameter, inches

Ds = Stack diameter, ft.

F = Mole fraction of dry gas

$\underline{\Delta H}$ = Pressure drop across the orifice, inches H_2O

I = Percent isokinetic sampling, %

Lc = Volume of condensate from condenser, milliliters

Md = Dry molecular weight of the stack gas, lb./lb. mole

Mw = Wet molecular weight of the stack gas, lb./lb. mole

$\underline{\Delta P}$ = Velocity head, inches H_2O

Pb = Barometric pressure, inches Hg

Ps = Absolute stack pressure, inches Hg

Pvc = Vapor pressure of water at condenser conditions

Q = Stack gas flow rate at stack conditions, acfm

Q(std) = Stack gas flow rate at STP ($70^{\circ}F$, 29.92 inches Hg) scfm (dry)

t = Sampled time, minutes

Tm = Meter temperature, $^{\circ}F$

Tc = Condenser temperature, $^{\circ}F$

Ts = Stack gas temperature, $^{\circ}F$

V = Meter volume of gas at meter conditions, cf

Vc = Equivalent gaseous volume of condensed water, cf

Vmc = Meter volume of gas at condenser conditions, cf

Vs = Velocity of stack gas, fpm

V(std) = Meter volume of gas at STP ($70^{\circ}F$, 29.92 inches Hg), scf (dry)

Vw = Water vapor volume through the meter at condenser conditions, cf

V_{wf} = Volume of water collected in impingers and silica gel, milliliters

V_{wv} = Volume of water vapor collected at STP (70°F, 29.92 inches Hg), scf

W = Weight of the collected particulate, milligrams

$W_{g(std)}$ = Stack gas particulate at STP (70°F, 29.92 inches Hg), grains/scf (dry)

$W_{m(std)}$ = Stack gas particulate at STP (70°F, 29.92 inches Hg), mg/m^3 (dry)

Wt = Emissions, lb./hr.

% CO_2 = Percent carbon dioxide by volume, %

% H_2O = Percent moisture in stack gas by volume, %

% N_2 = Percent nitrogen in stack gas by volume, %

% O_2 = Percent oxygen in stack gas by volume, %

PARTICULATE STACK SAMPLING EQUATIONS

Volume of gas sampled:

$$V_{(std)} = \frac{17.7(V)\quad (Pb + \frac{\Delta H}{13.6})}{Tm + 460} = \text{scf (dry)}$$

Weight of particulate in stack gas:

$$Wg_{(std)} = .0154\ \frac{W}{V_{(std)}} = \text{grains/scf (dry)}$$

$$Wm_{(std)} = 35.3146\ \frac{W}{V_{(std)}} = \text{mg/m}^3\ \text{(dry)}$$

Volume of moisture collected, if expressed as a vapor:

$$Vwv = .0474\ (Vwf) = \text{scf}$$

Portion of stack gas volume which is moisture:

$$\%\ H_2O = \frac{100\quad (Vwv)}{V_{(std)} + Vwv} = \%$$

Fraction of stack gas volume which is dry:

$$F = \frac{100 - \%\ H_2O}{100} =$$

Molecular weight of dry stack gas:

$$Md = \%\ CO_2(.44) + \%\ O_2(.32) + \%\ N_2(.28) = \text{lb./lb. mole}$$

Molecular weight of wet stack gas:

$$Mw = Md(F) + 18(1 - F) = \text{lb./lb. mole}$$

Velocity of the stack gas:

$$Vs = \frac{5129\ Cp\sqrt{\Delta P}\ \sqrt{Ts + 460}}{\sqrt{Ps\ Mw}} = \text{fpm}$$

Stack gas flow rate:

$$Q = Vs(As) = \text{acfm}$$

$$Q_{(std)} = \frac{17.7(Vs)(A)(F)(Ps)}{Ts + 460} = \text{scfm (dry)}$$

Isokinetic sampling validation expression:

$$I = \frac{1032\ (Ts + 460)\ V_{(std)}}{Vs(t)(Ps)(F)(Dn)^2} = \%$$

Particulate emission rate:

$$Wt = 8.6\ \times 10^{-3}\ [Wg_{(std)}][Q_{(std)}] = \text{lb./hr.}$$

RESULTS

Table II.

		Run #1	Run #2	Run #3
1.	Sample Volume (SCF)	32.56	27.27	25.50
2.	Stack Gas Particulate (grains/SCF) dry	.1545	.2008	.2195
3.	Stack Gas Particulate (mg/m^3) dry	353.5	354.9	502.2
4.	Volume of Water Vapor (SCF)	.474	.090	.284
5.	Percent Moisture (percent)	1.43	.35	1.10
6.	Mole Fraction (dry gas)	.99	.997	.99
7.	Dry Molecular Weight (lb./lb. - mole)	28.92	28.94	28.94
8.	Wet Molecular Weight (lb./lb. - mole)	28.76	28.90	28.82
9.	Stack Velocity (FPM)	3900.6	3484.9	3475.9
10.	Stack Flow (Actual Q) ($ft.^3/min.$)	3783.6	3380.4	3371.6
11.	Stack Flow (Standard) Qstd ($Ft^3/min.$)	2916.3	2591.1	2573.8
12.	Percent Isokinetics	102.1	96.2	90.6
13.	Emissions (lb./hr.)	3.51	4.02	4.20

Air Quality Regulation #503 allows 690 mg/m^3.

Information for Table II was taken from particulate stack sampling equation sheet.

PARTICULATE DATA

Table III.

Test No.	Filter Weight (mg)	Probe and Wash (mg)	Total Particulate (mg)
1	170.8	170.1	326.01
2	175.3	180.26	354.86
3	180.1	183.29	362.69

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JERRY APODACA
GOVERNOR

GEORGE S. GOLDSTEIN, Ph.D.
SECRETARY FOR HEALTH & ENVIRONMENT

NEW MEXICO HEALTH ENVIRONMENT department

STATE OF NEW MEXICO

AIR QUALITY SOURCE SAMPLING REPORT #152

AMERICAN GYPSUM WALLBOARD PLANT
ALBUQUERQUE, NEW MEXICO

ABSTRACT

The American Gypsum Wallboard Plant in Albuquerque, New Mexico was tested on April 24 and 25, 1978 at the request of the Albuquerque Department of Environmental Health. Three tests were performed to determine particulate emissions from the calcination process and the results were turned over to the City for further action.

REPORT PREPARED BY

JIMMY T. ROMERO
STACK SAMPLING TEAM LEADER

REPORT REVIEWED BY

J. DAVID DURAN
PROGRAM MANAGER

TABLE OF CONTENTS

INTRODUCTION

1. Name and Address of Company Tested

   Hudspeth McDowell Enterprises
   American U.S. Gypsum Wallboard Plant
   Los Angeles and Jefferson, NE
   Albuquerque, NM 87103
   CONTACT: Charles Googe, Plant Manager
   (505) 898-4811, Ext. 30

2. Location of Equipment Tested

   The equipment is located approximately 5 miles north of Albuquerque, on the east side of Pan American Frontage Road.

3. Date of Testing

   April 24 and 25, 1978

4. Description

   Gypsum or hydrated calcium sulfate, is a naturally occurring mineral that is an important building material. When heated, gypsum loses its water of hydration, it becomes plaster of paris, or when blended with fillers, it serves as wall plaster. In both cases, the material hardens as water reacts with it to form the solid crystalline hydrate.

   The usual method of calcination of gypsum consists of grinding the mineral and placing it in large, externally heated calciners. Complete calcination of 1 ton (0.907 MT) of plaster takes about 3 hours and requires about 1.0 million Btu (0.25 million Kcal.).

Emissions

The process of calcining gypsum appears to be devoid of any air pollutants because it involves simply the relatively low temperature removal of the water of hydration. However, the gases created by the release of the water of crystalization carry gypsum rock dust and partially calcined gypsum dust into the atmosphere. In addition, dust emissions occur from the grinding of gypsum before calcining and from the mixing of the calcined gypsum with filler. The exhaust gases are vented to the atmosphere through a 25 foot stack.

Process

American Gypsum mines its ore near Cuba, New Mexico and transports it by truck to the plant site in Albuquerque. The ore is then crushed and fed to Raymond Mills for pulverization prior to entering the kettles. In the kettles, calcination takes place whereby temperatures of 340^0F drive off 3/4 of the water of crystallization from the ore; and calcium sulfate hemihydrate ($Ca\ SO_4\ 1/2\ H_2O$), also called calcined gypsum, is produced. The calcined gypsum is stored in hoppers and used as needed to produce the finished wallboard product.

5. Description of the Sampling Location

Two sampling ports were located at 3.5 equivalent diameters from an elbow, located one diameter from the fan, and two equivalent diameters upstream from the stack exit. Slightly negative velocity heads were encountered in one quadrant of the stack as seen on Figure 1. These points were not sampled during testing.

6. Personnel Present During Testing

Arun Dhawan	-	Junior Engineer - 2nd test
Jimmy T. Romero	-	Environmental Technician III - 3 tests
Michael J. Owen	-	Environmental Technician III - 3 tests
Jim Shinas	-	Environmental Technician III - 3 tests
Dick Kerr	-	Engineer - Albuquerque Environmental Health Dept.

SAMPLING PROCEDURES

The procedure followed Methods 1 and 5 as described in EPA Federal Register, Volume 42, No. 160, Thursday, August 18, 1977. The sampling train was assembled as shown in Figure 2.

The following were deviations of the procedure:

Twenty seven (27) points were tested instead of the forty (40) required by Method 1. Four points were eliminated due to the close proximity of the points to the stack wall and the rest were eliminated because of the negative velocity heads encountered.

SUMMARY OF RESULTS

The following table summarizes the results of the three tests performed:

	Test 1	Test 2	Test 3	Average
Concentration mg/m^3	47.5	74.7	65.9	62.7
Concentration gr/scf	.02	.03	.03	.026
Emission rate lb/hr.	3.7	6.2	5.2	5.0
Gypsum Production Rate ton/hr.	15	15	15	15
Percent of Isokinetic Testing	108	103	105	

DISCUSSION AND CONCLUSION

The slightly negative velocity heads encountered in one quadrant of the of the stack did not appear to be a result of cyclonic flow in the stack but rather as a result of localized disturbances created by the uneven distribution of the flow. It is not believed that elimination of the traverse points along this quadrant significantly affected the results.

Previous tests performed on the same source in May of 1973 show comparable results both in emission rates and flow rates. In future testing, a stack extension or straightening vanes should be considered as means of smoothing out the uneven flow distribution.

The average stack gas concentration of 62.7 mg/m^3 appear to be in compliance with Albuquerque's Air Quality Regulation 903 which limits the concentration to 690 mg/m^3. The results have been provided to that office for final determination.

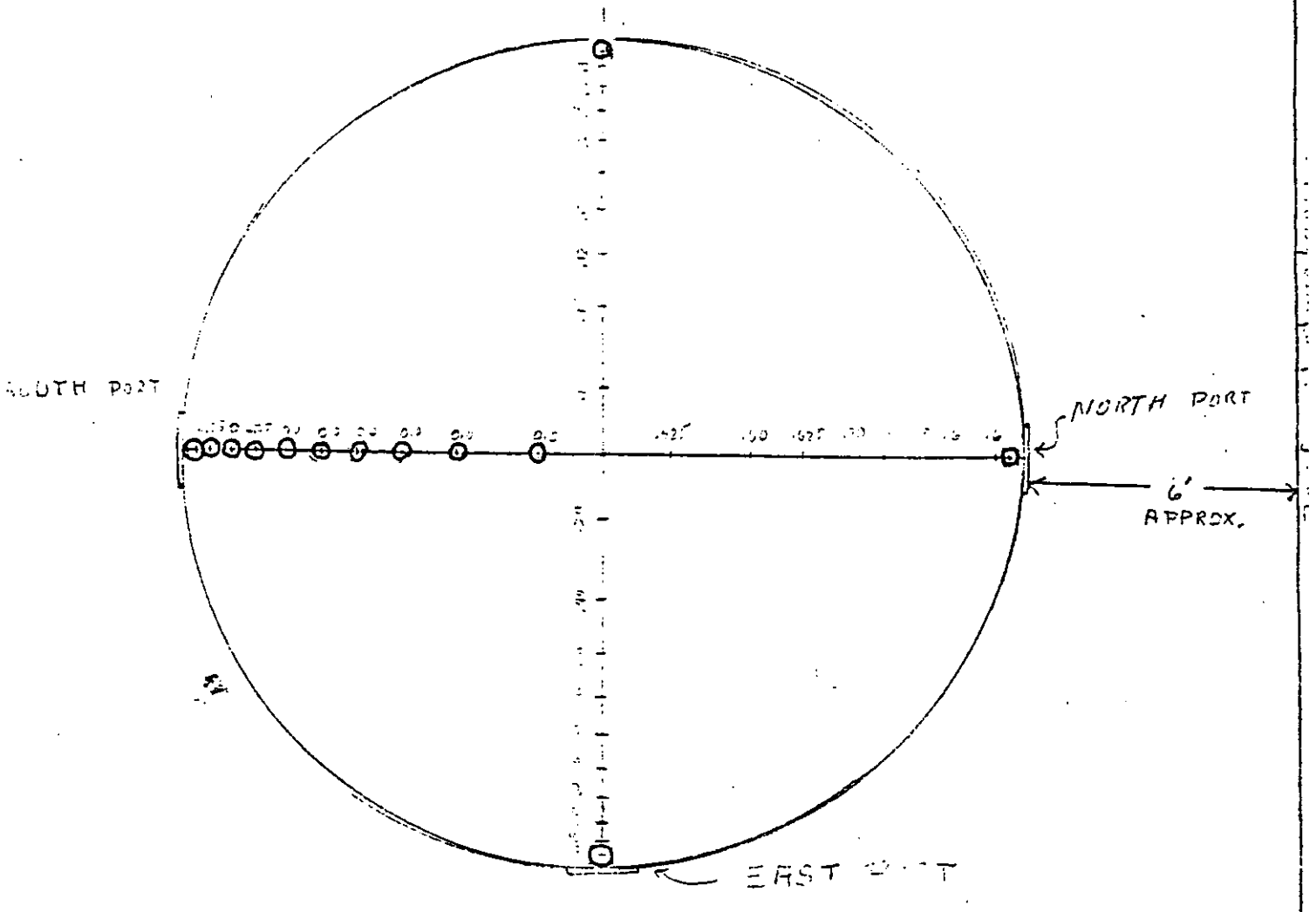


Figure 1. Cross Section of Stack and Velocity Traverse Points (inches of H_2O) American Gypsum, Albuquerque

Circled points indicates those not tested due to zero or negative velocity heads and close proximity to the stack wall.

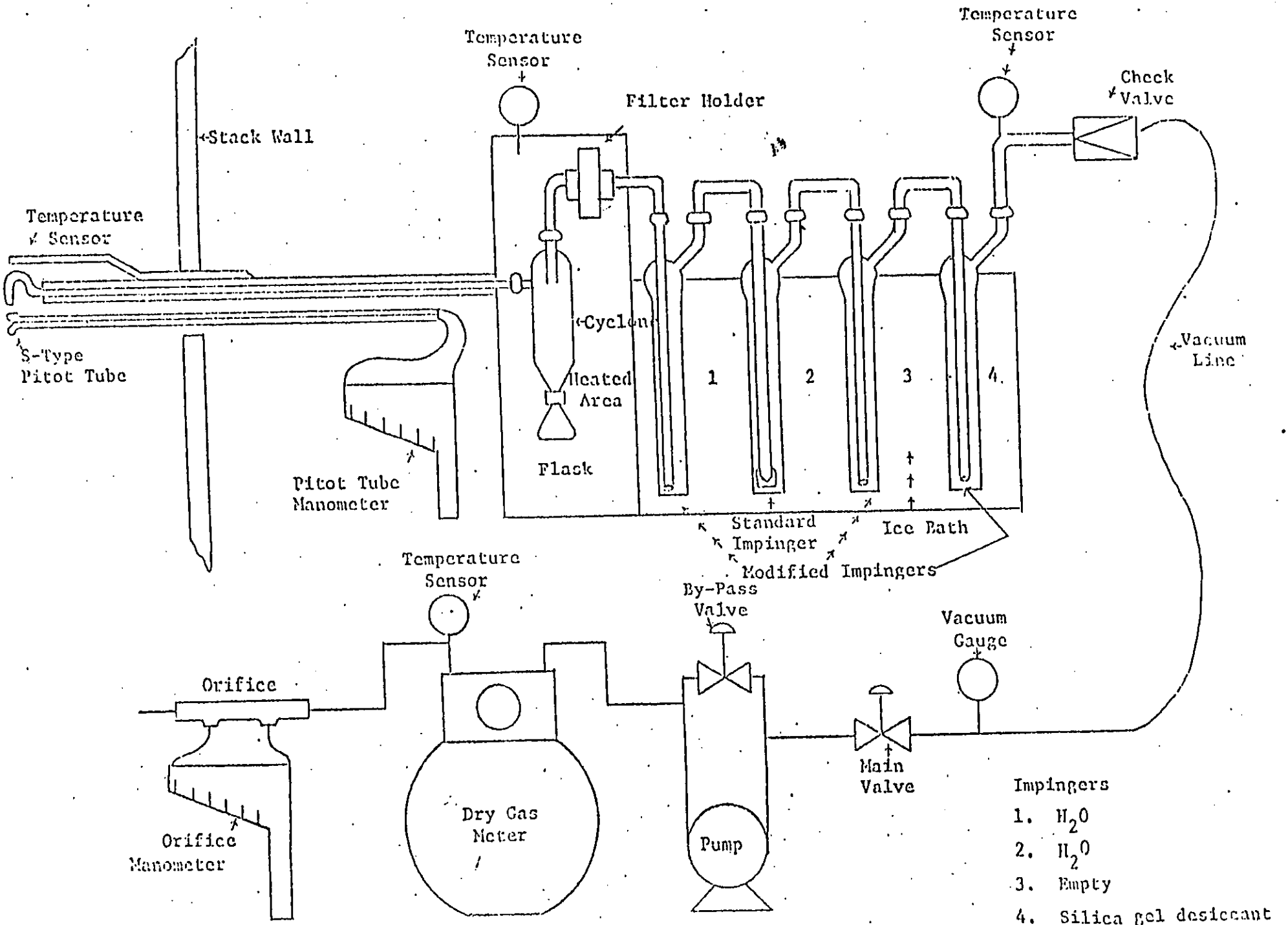


Figure 2. PARTICULATE SAMPLING TRAIN

CALCULATIONS

NOMENCLATURE

A	=	Area of Stack ($ft.^2$)
Cp	=	S-type pitot tube correction factor
Dn	=	Sampling nozzle diameter, inches
Ds	=	Stack diameter, feet
F	=	Mole fraction of dry gas
ΔH	=	Pressure drop across the orifice, inches H_2O
I	=	Percent isokinetic sampling, %
Lv	=	Volume of condensate from condenser, milliliters
Md	=	Dry molecular weight of the stack gas, lb./lb. mole
Mw	=	Wet molecular weight of the stack gas, lb./lb. mole
ΔP	=	Velocity head, inches H_2O
Pb	=	Barometric pressure, inches Hg
Ps	=	Absolute stack pressure, inches Hg
Pvc	=	Vapor pressure of water at condenser conditions
Q	=	Stack gas flow rate at stack conditions, acfm
Q(std)	=	Stack gas flow rate at STP (68^0F, 29.92 inches Hg), scfm (dry)
t	=	Sampled time, minutes
Tm	=	Meter temperature, ^0F
Tc	=	Condenser temperature, ^0F
Ts	=	Stack gas temperature, ^0F
V	=	Meter volume of gas at meter conditions, cf
Vc	=	Equivalent gaseous volume of condensed water, cf
Vmc	=	Meter volume of gas at condenser conditions, cf
Vs	=	Velocity of stack gas, fpm
V(std)	=	Meter volume of gas at STP (68^0F, 29.92 inches Hg), scf (dry)
Vw	=	Water vapor volume through the meter at condenser conditions, cf
Vwf	=	Volume of water collected in impingers and silica gel, milliliters
Vwv	=	Volume of water vapor collected at STP (68^0F, 29.92 inches Hg), scf
W	=	Weight of the collected particulate, milligrams
Wg(std)	=	Stack gas particulate at STP (68^0F, 29.92 inches Hg), grains/scf (dry)
Wm(std)	=	Stack gas particulate at STP (68^0F, 29.92 inches Hg), mg/m^3 (dry)
Wt	=	Emissions, lb./hr.
% CO_2	=	Percent carbon dioxide by volume, %
% H_2O	=	Percent moisture in stack gas by volume, %
% N_2	=	Percent nitrogen in stack gas by volume, %
% O_2	=	Percent oxygen in stack gas by volume, %

PARTICULATE STACK SAMPLING EQUATIONS

Volume of gas sampled:

$$V_{(std)} = \frac{17.65(V)\quad (Pb + \frac{\Delta H}{13.6})}{Tm + 460} = \text{scf (dry)}$$

Weight of particulate in stack gas:

$$Wg_{(std)} = .0154\ \frac{W}{V_{(std)}} = \text{grains/scf (dry)}$$

$$Wm_{(std)} = 35.3146\ \frac{W}{V_{(std)}} = \text{mg/m}^3\ \text{(dry)}$$

Volume of moisture collected, if expressed as a vapor:

$$Vwv = .0474\ (Vwf) = \text{scf}$$

Portion of stack gas volume which is moisture:

$$\%\ H_2O = \frac{100\quad (Vwv)}{V_{(std)} + Vwv} = \%$$

Fraction of stack gas volume which is dry:

$$F = \frac{100 - \%\ H_2O}{100} =$$

Molecular weight of dry stack gas:

$$Md = \%\ CO_2\ (.44) + \%\ O_2\ (.32) + \%\ N_2\ (.28) = \text{lb./lb. mole}$$

Molecular weight of wet stack gas:

$$Mw + Md\ (F) + 18\ (1\text{-}F) = \text{lb./lb. mole}$$

Velocity of the stack gas:

$$Vs = 5124\ Cp\sqrt{\frac{\Delta P\quad Ts + 460}{Ps\ Mw}} = \text{fpm}$$

Stack gas flow rate:

$$Q = Vs\ (A) = \text{acfm}$$

$$Q_{(std)} = \frac{17.65\ (Vs)\ (A)\ (F)\ (Ps)}{Ts + 460} = \text{scfm (dry)}$$

Isokinetic sampling validation expression:

$$I = \frac{1039\ (Ts + 460)\ V_{(std)}}{Vs\ (t)\ (Ps)\ (F)\ (Dn)^2} = \%$$

Particulate emission rate:

$$Wt = 8.6 \times 10^{-3}\ [Wg_{(std)}]\ [Q_{(std)}] = \text{lb./hr.}$$

TEST DATA

	Test No. 1	2	3
V..... Actual metered sample volume (CF)	31.77	41.79	40.24
Pb..... Barometric pressure (Hg")	24.72	24.8	24.8
T_m..... Ave. dry gas meter temp (^{0}F)	70	70	70
W..... Total particulate collected (mg)	35.27	73.27	62.27
V_{wf}..... Total H_2O collected from impingers (ML)	138	164	170
$\%CO_2$..... Percent carbon dioxide in stack gas (dry)	0	0	0
$\%O_2$..... Percent oxygen in stack gas (dry)	21	21	21
$\%N_2$..... Percent nitrogen in stack gas (dry)	79	79	79
P_s..... Absolute static stack pressure (Hg")	24.7211	24.822	24.822
T_s..... Average stack gas temperature (^{0}F)	170°	170°	190°
C_p..... S-type pitot tube correction factor	.82	.82	.82
ΔP..... Velocity head (H_2O")	.6495	.6681	.65
A..... Area of stack (ft.^{2})	14.19	14.19	14.19
t..... Sample time (minutes)	81.5	108	108
D_n..... Sampling nozzle diameter (inches)	.1910	.1910	.1910
ΔH..... Pressure drop across orifice (H_2O")	.40	.37	.36

CALCULATED RESULTS

$V_{(std)}$..... Corrected metered volume (SCF)	26.234	34.6494	33.3634
$Ws_{(std)}$..... Weight of particulate in stack gas (grains/SCF)	.0207	.032557	.02879
$Wm_{(std)}$..... Weight of particulate in stack gas (mg/m^3)	47.4783	74.67664	65.91175
V_{wv}..... Volume of water vapor collected (SCF)	6.5412	7.7736	8.058
$\%H_2O$..... Percent H_2O in stack gas by volume	19.94	18.32	19.45
F..... Mole fraction of stack gas (dry)	.8006	.8168	.8055
Md..... Dry molecular weight of stack gas (lb/lb-mole)	28.84	28.84	28.84
M_w..... Wet molecular weight of stack gas (lb/lb-mole)	26.6785	26.8541	26.7316
V_s..... Velocity of stack gas (FPM)	2669.7623	2731.8202	2705.8469
Q..... Actual stack volumetric flow (ACFM)	37883.93	38764.53	38395.97
$Q_{(std)}$..... Stack volumetric flow (SCFM)	21666.32	22079.27	20904.89
I..... Percent isokinetics	108.62	103.18	104.94
E..... Particulate emission rate (lb/hr)	3.75021	6.18445	5.16694

American Gypsum Co.
P. O. Box 6345
Albuquerque, New Mexico
87197

Received 11-14-79
by PJM

TEST DATA

	Test No. 1	2	3
..... Actual metered sample volume (CF)	31.77	41.79	40.24
Pb..... Barometric pressure (Hg")	24.72	24.8	24.8
T_m..... Ave. dry gas meter temp (^0F)	70.	70.	70.
W..... Total particulate collected (mg)	.3527	73.27	62.27
V_{wf}..... Total H_2O collected from impingers (ML)	138	164	170
$\%CO_2$..... Percent carbon dioxide in stack gas (dry)	0	0	0
$\%O_2$..... Percent oxygen in stack gas (dry)	21	21	21
$\%N_2$..... Percent nitrogen in stack gas (dry)	79	79	79
P_s..... Absolute static stack pressure (Hg")	24.7211	24.822	24.822
T_s..... Average stack gas temperature (^0F)	170°	170°	170°
C_p..... S-type pitot tube correction factor	.82	.82	.82
ΔP..... Velocity head (H_2O")	.6495	.6681	.65
A..... Area of stack ($ft.^2$)	14.19	14.19	14.19
t..... Sample time (minutes)	81.5	108	108
D_n..... Sampling nozzle diameter (inches)	.1910	.1910	.1910
ΔH..... Pressure drop across orifice (H_2O")	.40	.37	.36

CALCULATED RESULTS

$V_{(std)}$..... Corrected metered volume (SCF)	26.234	34.6444	33.3634
$W_{g(std)}$..... Weight of particulate in stack gas (grains/SCF)	.0207	.03257	.02874
$W_{m(std)}$..... Weight of particulate in stack gas (mg/m^3)	47.47283	74.67664	65.91175
V_{wv}..... Volume of water vapor collected (SCF)	6.5412	7.7736	8.058
$\%H_2O$..... Percent H_2O in stack gas by volume	19.94	18.32	19.45
F..... Mole fraction of stack gas (dry)	.8006	.8168	.8055
M_d..... Dry molecular weight of stack gas (lb/lb-mole)	28.84	28.84	28.84
M_w..... Wet molecular weight of stack gas (lb/lb-mole)	26.6785	26.8541	26.7316
V_s..... Velocity of stack gas (FPM)	2669.7623	2731.8202	2705.8467
Q..... Actual stack volumetric flow (ACFM)	37883.93	38764.53	38395.47
$Q_{(std)}$..... Stack volumetric flow (SCFM)	21666.39	22019.27	20904.89
I..... Percent isokinetics	108.62	103.18	104.94
E..... Particulate emission rate (lb/hr)	3.75021	6.18445	5.14654

CALIBRATIONS

Pitot Tube	CP W/O	Cp W ¼ Nozzle	Date	By
#112	.83	.82	4/18/78	J. Shinas

Probe Tip	Size	Actual Size		
D	3/16	.184	4/18/78	J. Romero

EPA Box	MCF	ΔH@		
#1	1.00	1.55	4/03/78	M. Owen

Probe Temp. Sensor	Average Diviation		
#112	-0-	3/20/78	J. Shinas

RECEIVED MAR 0 4 1980

Revised: February, 1976

Send to:
New Source Review Section
Air Quality Division
Environmental Improvement Agency
P.O. Box 2348
Santa Fe, New Mexico 87503
Telephone No. (505) 827-2813

APPLICATION FOR PERMIT TO CONSTRUCT OR MODIFY AND CERTIFICATE OF REGISTRATION FOR MINERAL PROCESSING PLANTS LOCATED WITHIN THE STATE OF NEW MEXICO (1,2)

FOR EIA USE ONLY
Application No. 270
App. Rec'd. Date: 12-10-79
Date App. Complete:
Reviewed By:
Approved/Disapproved:
Date:
AQCR: County:
Date St. Operation:
Date Perf. Test/Insp:

Amended 12-10-79
~~Amended 12-12-79~~

Please answer all questions applicable to your specific operation, and products.

SECTION 1 - GENERAL DATA

1. Name of Company: WHITE MOUNTAIN GYPSUM CO. 2. Date Submitted: ~~November 2, 197~~

3. Main Office Address: 20 First Plaza, Suite 304, Albuquerque, New Mexico 87102 Phone: 505-247-2357

Person to Contact: David A. Grady Title: Attorney Phone: 505-247-2357

4. Name and Mailing Address(or location) of new plant or plant modification: Mailing - same as above; Plant location - N.E. cor Section 8, Township 23 North, Range 1 East-Rio Arriba County, New Mexico Is U.S.G.S. quadrangular map or equivalent attached? yc

5. Describe briefly the type and capacity of the plant and nature of modifications (if applicable) and products: Surface mining, crushing, calcining gypsum rock and plaster board manufacturing

Date of anticipated startup of the new or modified facility: November 1980

6. Class of land at plant site (private, State, Federal, Indian, etc.): Private

7. Is this site permanent? Yes If not, how long is it expected to be occupied? N.A.

8. Normal operating schedule: 24 hours per day, 6 days per week, 4 weeks per month, 12 months per year.

9. Specify peak operating periods: .

10. Specify percent annual production by quarters: Dec.-Feb. 25%, Mar.-May 25%, June-Aug. 25%, Sep.-Nov. 25%

Notes: (1) Submitted in accordance with Air Quality Control Regulation No. 702 Permits, and Regulation No. 703 Registration. This form to be used for crushers, screening operations, etc. or complete mills that process lead, zinc, copper, iron ore, potash, pumice, mica, perlite, gypsum, fluorspar, etc. Separate forms are to be used for copper smelting and refining facilities, asphalt concrete plants, sand & gravel processing, and natural gas plants and petroleum refiner
(2) See separate Supplementary Instructions for further notes to each section of this application.

Unit No.[1]	Type of Unit[2]	Unit Manufacturer	Rated Capacity Million BTU/Hr.[3]	FUEL DATA [4],[5] Fuel Type[5]	Amount Per Year[6]	Heat Content[7]	Percent Sulfur[8]	Percent Ash[8]
214	CALCINING MILL	DELTA STEEL	6.0 - 3.02	NATURAL GAS	20.84	1045 BTU/cuft	GAS	CO. OF NEW MEXICO
215	" "	" "	6.0 - 3.02	" "	20.84	"	"	"
216	" "	" "	6.0 - 3.02	" "	20.84	"	"	"
217	" "	" "	6.0 - 3.02	" "	20.84	"	"	"
218	" "	" "	6.0 - 3.02	" "	20.84	"	"	"
392	PLASTERBOARD	COE MFG. CO.	20.0 - 15.5	" "	107.152	"	"	"
393	PLASTERBOARD	COE MFG. CO.	20.0 - 15.5	" "	107.152	"	"	"
394	PLASTERBOARD	COE MFG. CO.	20.0 - 15.5	" "	107.152	"	"	"

SECTION 3 - MATERIALS PROCESSED AND PRODUCED

A. RAW MATERIALS PROCESSED

Type	Composition[1]	Condition[2]	Quantity[1]
GYPSUM ROCK	$CaSO_4:2H_2O$	APPROX. 2% MOISTURE	605 TONS/24HRS.
STARCH	- - - - - -	BAGGED MATERIAL	4 TONS/24HRS.
PAPER	- - - - - -	6FT. DIA. 4FT. WIDE ROLLS	46 TONS/24HRS.
PULPED PAPER	- - - - - -	3% WATER SOLUTION	9.2 TONS/24HRS.

B. MATERIALS PRODUCED (DO NOT INCLUDE EMISSIONS AND PRODUCTS LISTED IN SECTIONS 4, 8, and 9)

CALCINED GYPSUM		BONE DRY, 95% THRU 100 MESH	490 TONS/24HRS.
PLASTERBOARD	CALCINE GYPSUM & ABOVE RAW MAT	DRY SHEETS ½"x 4'x 8-16'	691,000 sq.ft./24HRS.
SOIL CONDITIONER	$CaSO_4:2H_2O$	1/8" DIA. APPROX. 2% MOIST	PRODUCTION AS REQUIRED TO MAINTAIN 200 TON SUPPLY

C. If operation includes mining, is ore mined underground or in an open pit? OPEN PIT

D. Approximate area of tailings piles at this location: *DNA acres. Give approximate chemical composition of tailings, if known *THERE ARE NO TAILINGS

Describe measures, if any used to control wind erosion of tailings

SECTION 4 - UNIT EMISSIONS

Unit No.[1]	Process or Operation[2]	Quantity of Gases Discharged[3]	ESTIMATES OF AIR POLLUTANTS						Basis of Estimates[8]
			Pollutant No. 1		Pollutant No. 2		Pollutant No. 3[7]		
			Type[4]	Quantity[5]	Type[4]	Quantity	Type[4]	Quantity	
214	CALCINING MILL	10,000CFM	GYPSUM DUST	INTO PROCESS[6]					
215	" "	" "	"	"					
216	" "	" "	"	"					
217	" "	" "	"	"					
218	" "	" "	"	"					
	CRUSHERS, BINS	6,750 CFM	"	1157 * 4165 *					SIMILAR EQUIP.

*NOTE! This is total loading to Baghouse 118

SECTION 5 - AIR POLLUTION CONTROL EQUIPMENT, EMISSIONS TO ATMOSPHERE[1]

Unit No.[2]	GAS CLEANING EQUIPMENT		AIR POLLUTANTS EMITTED TO STACKS[4]						Control Efficiency	
	Type[3]	Manufacturer and Model No.	Pollutant No. 1		Pollutant No. 2		Pollutant No. 3[6]		% by Weight	How Determined[7]
			Type[5]	Quantity	Type[5]	Quantity	Type[5]	Quantity		

SECTION 4 - UNIT EMISSIONS

Unit No.[1]	Process or Operation[2]	Quantity of Gases Discharged[3]	ESTIMATES OF AIR POLLUTANTS						Basis of Estimates[4]
			Pollutant No. 1		Pollutant No. 2		Pollutant No. 3[7]		
			Type[5]	Quantity	Type[5]	Quantity	Type[5]	Quantity	
219	HI EFF CYCLONE	10,000CFM	GYPSUM DUST	286 [6] 1030 [6]					SIMILAR EQUIP.
220	"	" "	"	286 1030					" "
221	"	" "	"	286 1030					" "
222	"	" "	"	286 1030					" "
223	"	" "	"	286 1030					" "
260	DUST PICK-UP FAN	2325CFM		199 717.4					" "

NOTE! ITEMS-219, 220, 221, 222, 223 and 260 Discharge into Baghouse #246 and is returned to process.

Total loading to #246 = 1629/5867.4

SECTION 5 - AIR POLLUTION CONTROL EQUIPMENT, EMISSIONS TO ATMOSPHERE[1]

Unit No.[2]	GAS CLEANING EQUIPMENT		AIR POLLUTANTS EMITTED TO STACKS[8]						Control Efficiency	
	Type[3]	Manufacturer and Model No.	Pollutant No. 1		Pollutant No. 2		Pollutant No. 3[8]		Raw Weight	How Determined[9]
			Type[5]	Quantity	Type[5]	Quantity	Type[5]	Quantity		
				[7]						

SECTION 4 - UNIT EMISSIONS

Unit No.[1]	Process or Operation[2]	Quantity of Gases Discharged[3]	ESTIMATES OF AIR POLLUTANTS: Pollutant No. 1 Type[5]	Pollutant No. 1 Quantity	Pollutant No. 2 Type[5]	Pollutant No. 2 Quantity	Pollutant No. 3[7] Type[5]	Pollutant No. 3[7] Quantity	Basis of Estimates[8]
392	BOARD DRYER	30,000CFM ACFM	H_2O	7,500 (a) 27,000 (b)					SIMILAR EQUIP.
393	" "	10,000CFM	"	2,250 8,100					" "
394	" "	10,000CFM	"	2,250 8,100					" "
391	WET END SEAL	4,000CFM	"	500 1,800					" "
395	DRY END SEAL	30,000CFM	"	12,500 45,000					" "
405	TRIM SAWS	3,500CFM	GYP DUST	910 * 3,250 *					"

*NOTE: This is total loading to Baghouse 406.

10 grains per CF loading

Note: emissions from baghouse are higher at request of applicant. He prefers a safety factor for his protection

SDCAPCD 12-10-79 @ 99.9%, # 11.13 lbs/hr

SECTION 5 - AIR POLLUTION CONTROL EQUIPMENT, EMISSIONS TO ATMOSPHERE[1]

Unit No.[2]	GAS CLEANING EQUIPMENT: Type[3]	Manufacturer and Model No.	AIR POLLUTANTS EMITTED TO STACKS[4]: Pollutant No. 1 Type	Pollutant No. 1 Quantity	Pollutant No. 2 Type[5]	Pollutant No. 2 Quantity	Pollutant No. 3[6] Type[5]	Pollutant No. 3[6] Quantity	Control Efficiency: By Weight	Control Efficiency: How Determined
118	REVERSE JET BAGHOUSE	NOT AVAILABLE	GYP. DUST	1.16 (a) 4.17 (b)					ANTICIP. MFG. RATIO 99.9%	& FIELD TEST***
246	REVERSE JET BAGHOUSE	" "		11.13 40.06					"	"
406	REVERSE JET BAGHOUSE	" "		.91 3.25					"	"
									"	"

NOTE: ALL DUST COLLECTED BY DUST COLLECTORS ITEMS #118 AND #246 IS RETURNED TO PROCESS

Loading to 118 = 1157/4165; loading to 246= 1629/5867.4; loading to 406 = 910/3250

***Equipment will be pulse-jet unit, fully insulated; similar to Flex-Kleen Corp. unit

Building Height 30 ft. high (main plant)

Section 5 - (Continued)

Capital Investments (optional)

Approximate expected capital investment of new X or modified air pollution control equipment $ 500,000.00

Capital investment and installation date(s) of already installed process and air pollution control equipment: N.A.

Section 6 - Stack Data

Unit No.	Stack Height, Ft.	Inside Diameter, Ft.	Exit Gas Conditions (1) Temperature °F	Velocity Ft./Sec.	Moisture % by Volume	Sampling Ports Number	Size	Location (2)
118	60	15" x 24"	75 - 100	50	.6%	2	3	2 Ports, 90° From Each Other, 3 1/2" Diam.
246	40	42" x 60"	300	50	1.5%	2	3	" " "
406	15	11" x 18"	75 - 100	50	.3%	2	3	" " "
341	33	2 Ft.	250	22	.3%	2	3	" " "
30[illegible]	33	3' - 6"	400	50	.78%	2	3	" " "
69[illegible]	33	3' - 6"	400	15	.7%	2	3	" " "
294	33	3' - 6"	400	15	2%		3	" " "
39[illegible]	33	4' - 0"	250	40	9.6%	2	3	" " "
	Stacks 118, 246 and 406 are rectangular ducts; others are round.							

Location of 110/120 V ac electrical power nearest to stack: WITHIN 10 TO 15 FT.

What provisions are made for accessibility to stack sampling ports? Directly accessible on roof of building.

Section 7 - Emission Measurement Equipment

Unit No.	Pollutant	Type of Instrument(1)	Manufacturer - Model No.	Range(2)	Sensitivity	Accuracy
		N.A.				

SECTION 8 - HAZARDOUS AIR POLLUTANTS[1], OTHER TOXIC CHEMICALS

A. Describe any hazardous air pollutants and toxic chemicals used or emitted in plant processes.[2]

Unit[3]	Description of Chemicals[4]	Quantity Emitted to Atmosphere[5]	How, Where Emitted[6]

SECTION 9 - WASTE PRODUCT DISPOSAL

A. Auxiliary Incineration: Will auxiliary incineration be used? _____. If so, what type of unit? _____
Normal on-site combustion operating schedule: _____ hours per day, _____, days per week, _____ weeks per year.
Seasonal or peak combustion operating periods (specify): _____

B. Waste Products or Emissions

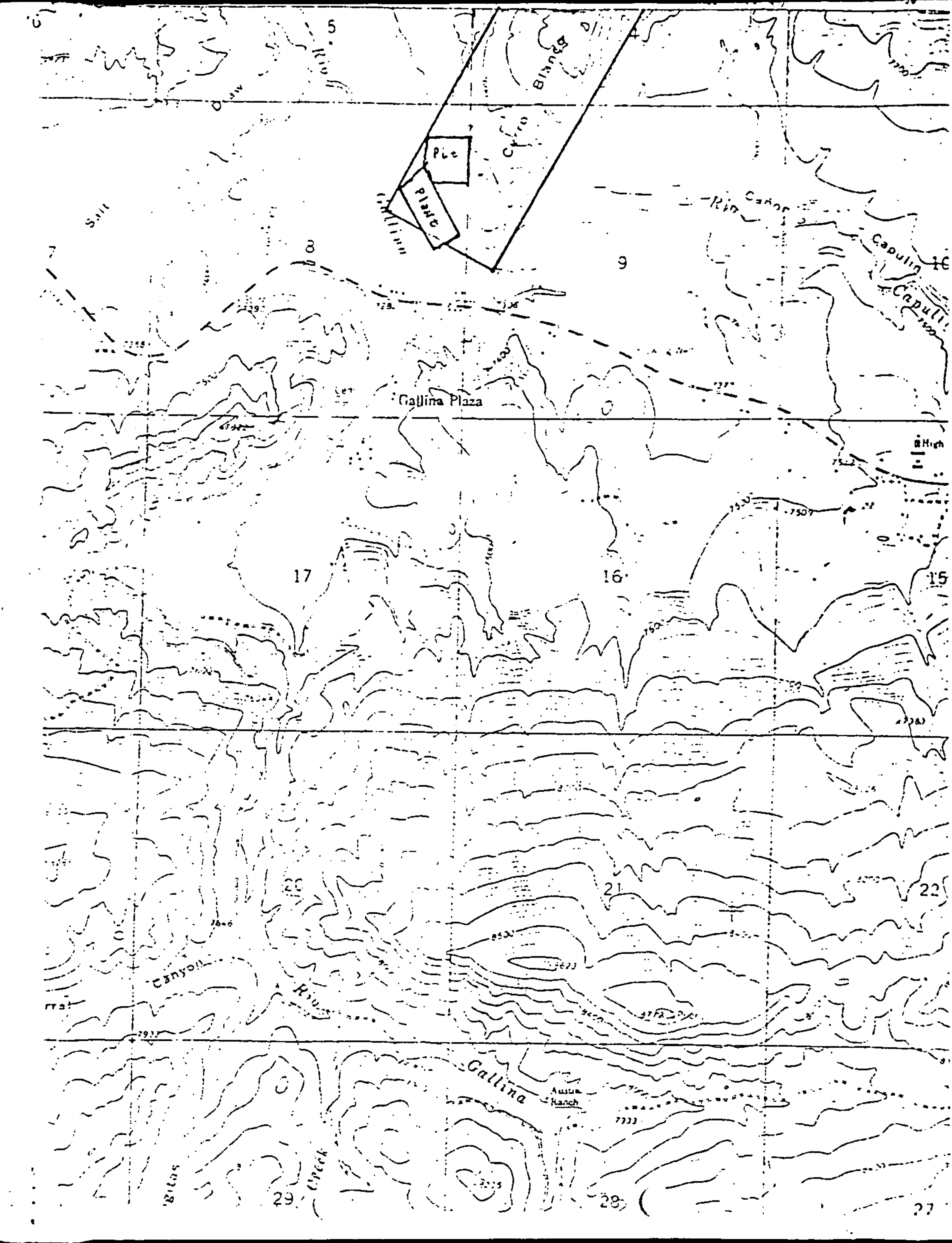
Private on leased land - assisting property owner - reclaiming @ 1 acre per year

Unit No.[1]	Waste Material		Method of Disposal[4]	Incinerator Capacity Lb. per Hr.	Auxiliary Fuel Used[5]	Type and Efficiency of Air Cleaning Equipment[6]	Estimate of Air Pollutants, if any	
	Type[2]	Amount[3]					Type[7]	Quantity per Year[8]
406	PLASTER BD TRIM	26 TONS	SANITARY LANDFILL	DNA	DNA	REVERSE JET BAGHOUSE 99.9%	DNA	DNA
414	REJECT PLASTER BD	1000 TONS	"	DNA	DNA	DNA	DNA	DNA

SECTION 10 - CERTIFICATION

I, the undersigned, a responsible officer of the applicant company, certify that, to the best of my knowledge, the information stated on this application, together with associated drawings, specifications and other data, give a true and complete representation of the planned new plant or modifications to an existing plant with respect to air pollution sources and control equipment. I also understand that any significant omissions, errors, or misrepresentations in these data will be cause for revocation of part or all of this permit.

Name (type) M. S. Riddle Signed M. S. Riddle Title President



Pit
Plaza
Gallina Plaza
Capulin
Austin Ranch
Gallina
Canyon
Rio
17
16
15
20
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8
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