Background Report Reference

AP-42 Section Number: 11.17

Background Chapter: 4

Reference Number: 45

Title: Preliminary Test Survey: National Lime and Stone Company, Carey Oh

Monsanto Research Corp.

Monsanto Research Corp.

April 1975

13K - 468 lines called for
15K - 536 - what happened?

PRELIMINARY TEST SURVEY

NATIONAL LIME AND STONE COMPANY

CAREY, OHIO

NOT USED

NO TEST DATA

BY

T. L. PELTIER

W. R. FEAIRHELLER

MONSANTO RESEARCH CORPORATION

DAYTON LABORATORY

DAYTON, OHIO 45407

I. Introduction

The National Lime and Stone Company in Carey, Ohio was visited on 22 April 1975 by Mr. Thomas L. Peltier of MRC and Mr. Thomas Lahre of the National Air Data Branch of EPA. The purpose of the visit was to presurvey the kilns and associated operations prior to sampling the uncontrolled emissions for concentration of sulfur oxides and nitrogen oxide and the concentration and particle size of particulates in the gas stream. This data will be used to determine emission factors for uncontrolled lime kiln operations.

The plant contact was Mr. James L. Withrow, Director of Laboratory and Research. The plant phone number is (419) 396-2611.

After examining the plant and the various processes, which included 2 calcimatic kilns, 7 shaft kilns, and a Schaffer hydrator, Mr. Peltier and Mr. Lahre decided to sample the two calcimatic kilns (#1 preheater and cooler and #2 preheater) for particulate and NO_x emissions. A particle sizing run (cooler and preheater) and an Method 6 run are to be performed on one of the kilns. One of the uncontrolled shaft kilns will be sampled for particulate (Method 5) and particulate sizing and NO_x emissions. An option to be included in the job pricing is 2 Method 5 tests and one Brink particle sizing test on the Schaffer hydrator.

II. Process Description

Lime is produced from limestone at National Lime and Stone by using 2 calcimatic kilns (rotary hearth) and 7 shaft kilns. Hydrated lime is produced by using a Schaffer hydrator.

The calcimatic kilns are fired with natural gas and operate 24 hours/day, 7 days/week. The #1 kiln produces 200 T/day and the #2 kiln produces 250 T/day of pebble lime. A baghouse collector controls the emissions from both the preheater and the cooler of #1 kiln. The #2 kiln emissions are controlled with a baghouse on the cooler outlet and a venturi scrubber on the preheater outlet.

The 7 shaft kilns each produce in excess of 100 T/day of lime on an operating schedule of 24 hr/day, 5 day/week. The kilns are not being used presently because of low lime demand. One of the kilns has a primary cyclone and a venturi scrubber on the outlet. Three of the kilns will no longer be used, while the other 3 have a primary cyclone on the outlet. Venturi scrubbers are also being installed and should be in operation by August. A mist eliminator follows each of the venturi scrubbers.

The shaft kilns are fired with natural gas when it is available. Producer gas with a heating value of 120 Btu/ft^3 is also used for fuel. Four tons of lime are produced for every ton of coal (0.5% sulfur) burned to make producer gas.

The Schaffer hydrator converts quicklime to hydrated lime at a rate of 15 T/hr. Spray nozzles in the exhaust stack suppress the dust and add water to the exothermic reaction to form a product of the reaction containing only 0.5% moisture. The two Raymond mills that grind the hydrated lime have their exhaust controlled with a baghouse collector. The hydrating systems operates on a seasonal cycle with fall and spring being the busy seasons. An 8 hr/day, 5 day/wk work schedule is followed.

III. Sampling Locations

The exhaust gases from the cooler and preheater on the #1 kiln go to a baghouse where the particulate emissions are removed. Figure 1 shows a top view of the exhaust system which is situated approximately 6' above the roof of the building that protects the calcimatic kilns. The cooler exhaust can be directed to either into the preheater exhaust duct or to the cooler exhaust for #2 kiln. A 16" OD horizontal duct leads from the cooler to the 41-1/2" ID horizontal duct used to exhaust the preheater exhaust. The scraper exhaust duct joins the cooler exhaust just prior to the location where the cooler and preheater ducts join. Sampling ports need to be installed in the cooler duct and in the preheater duct. Sampling of the cooler and preheater cannot be performed simultaneously. After the cooler exhaust duct on #1 kiln is sampled, its flow can be redirected to the #2 cooler baghouse and the #1 preheater can then be sampled. The preheater exhaust has a flow rate of 40,000 ACFM at -7 to -10" H_2O pressure and a temperature of 450°F.

The stack of the baghouse used to clean the cooler and preheater exhaust has a 4' ID and is approximately 50' in length. Two 3" ports are located 42' (10.5 diameter) from the nearest upstream disturbance (fan inlet) and 5' (1.25 diameters) from the nearest downstream disturbance (top of stack). A platform is available for sampling at this location.

The exhaust gases from the preheater of the #2 kiln pass through a 48" square duct to a venturi scrubber. A gas flow rate of 52,000 ACFM at -10" H_2O pressure and a temperature of 450°F are commonly found in the stack. Figure 2 shows a top view of the exhaust system for the #2 kiln. The cooler exhaust (33,500 ACFM) is controlled by a baghouse. The duct that leads to the baghouse changes diameter at numerous locations and is located directly above a deep gorge which would make sampling extremely difficult.

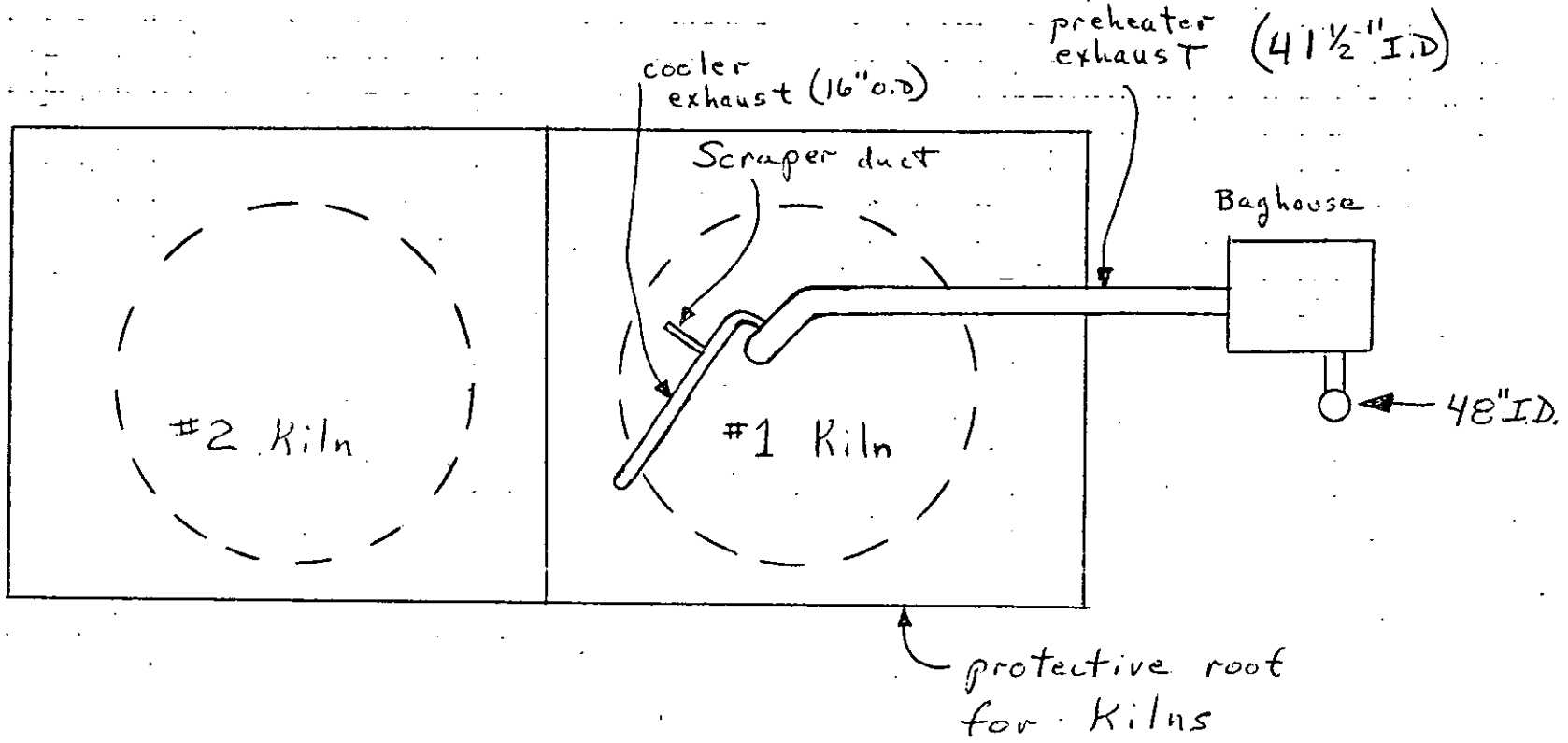


Figure 1. Top View #1 Kiln

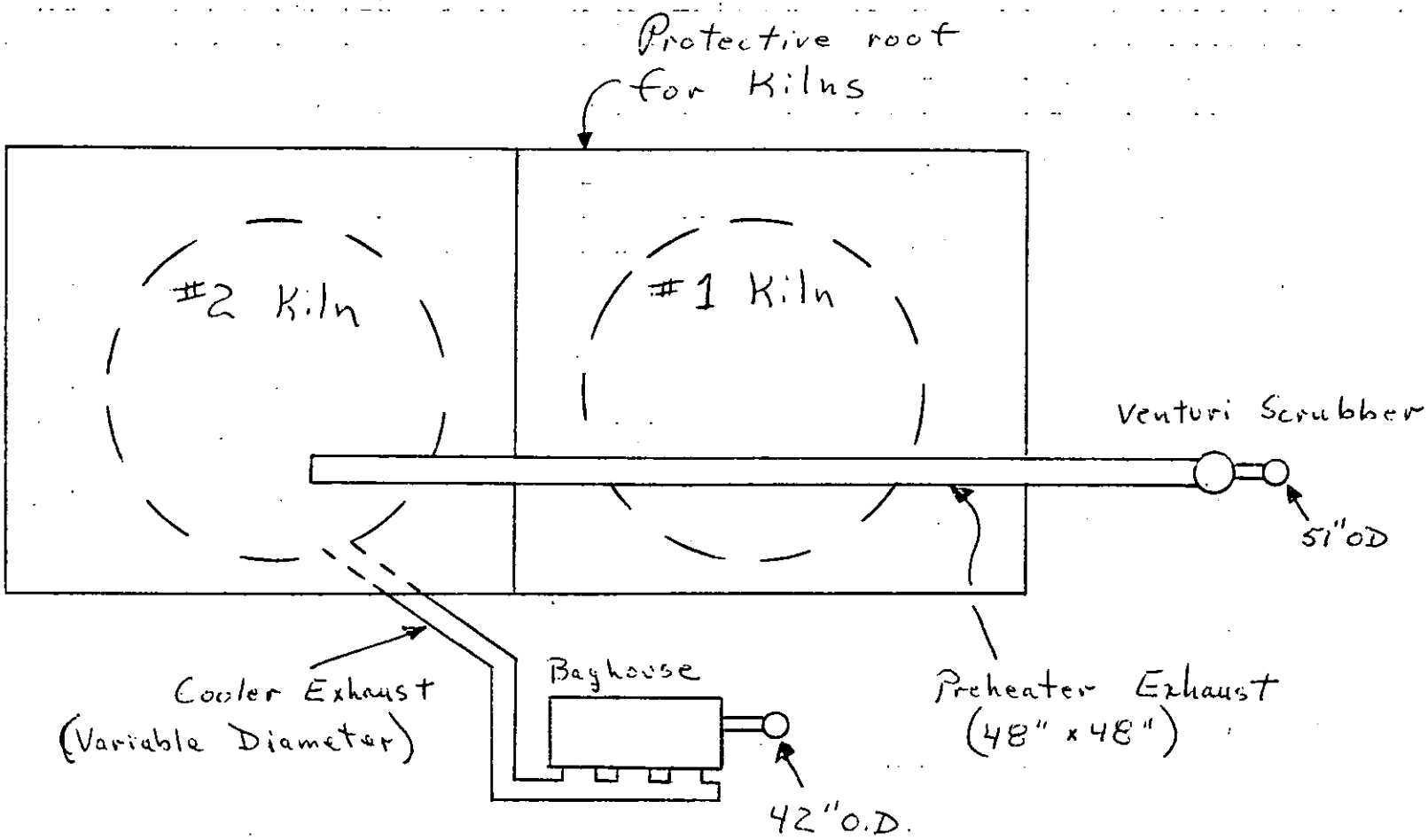


Figure 2. Top View #2 Kiln

However, the material collected in the baghouse is used as product and can be weighed and used to determine an emission rate. The exhaust of the baghouse on the #2 cooler is approximately 40' high and has a 42" OD. There are no ports or permanent platforms.

Figure 3 shows a top view of the seven shaft kilns and their control equipment. One shaft kiln is equipped with a primary cyclone, a venturi scrubber and mist eliminator. Another shaft kiln has a stack with 2-3" ports after the primary cyclone, which is used to remove the larger abrasive particles in the exhaust. The ports in the 30" ID stack after the cyclone are 12' (4.8 diameters) from the nearest upstream disturbance and at least 10 diameters from the nearest downstream disturbance. The ports are situated 4' above a working level which makes sampling possible. The exhaust gases leaving the primary cyclone are at a temperature of 225°F.

The venturi scrubber on the one shaft kiln operates with a 30" H_2O pressure drop across it. The fan is located after the mist eliminator and before the stack. The 30" ID stack has the fan inlet 15' above the ground. There are no ports or permanent platforms on the 40' stack. The other venturi scrubbers will operate at the same conditions as the one presently in use.

The exhaust stack of the Schaffer hydrator has a flow rate of 3000 SCFM and a temperature of 170°F. The exhaust stream which is saturated is about 35% steam. The 30" ID stack has 2-3" ports located 10' (4 diameters) from the nearest upstream disturbance (water spray nozzles) and about 1' (4 diameters) from the top of the stack. A stack extension would be needed before sampling could be done on this stack.

The two Raymond mills that are used to grind the hydrated lime were examined for sampling feasibility. The baghouse which controls the emissions is located inside a building and has no adequate sampling sites prior to or after it. Any possibility of sampling was eliminated after a visual inspection of the operation.

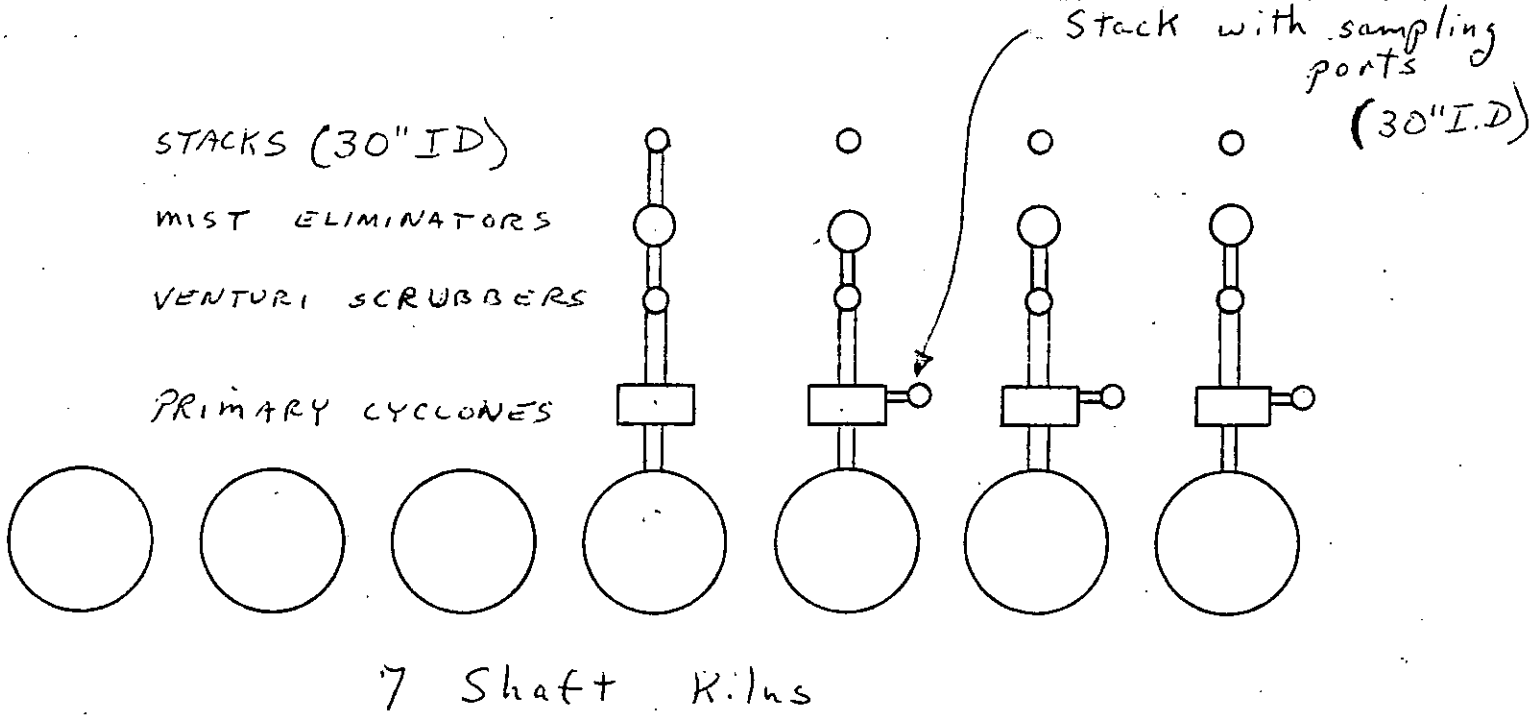


Figure 3. Shaft Kilns

IV. Safety Checklist

A. Personnel Protection Equipment (check if required)

Item	Plant	MRC	Item	Plant	MRC
Safety glasses	✓	✓	Dust masks		
Goggles			Vapor masks		
Side shields			Air purifying		
Face shields			Air supply		
Hard hats	✓	✓	Air packs		
Ear plugs			Chem. res't clothes		
Safety shoes	✓	✓	Heat res't clothes		
Life belt			Chem. res't gloves		
Ladder climbing device			Heat res't gloves		
			First aid		✓
Ground fault interrupt			Fire extinguisher		✓
Grounding clamp			_____		
_____			_____		
			_____		

B. Test Site

1. Ladders

General condition_____ Rest stops_____

Cage_____ Special belts_____

Comments_____

2. Scaffold-platforms

General condition_____ Guardrails_____

Toeboards_____ Screening_____

Comments_____

3. Smoking restrictions_____

4. Vehicle traffic rules No traffic rules

_____

5. Evacuation procedures _____

_____

_____

6. Alarms _____

7. Hospital location Wydote County, Upper Sandusky
Blanchard Valley, Findlay

Phone _____

8. Emergency numbers _____

V. Plant Entry

A. Plant Requirements No pass needed

B. MRC Agreement Bring along insurance papers

C. Potential Problems Confidential matter

VI. Sampling Handling

Method	Cleanup Location	Analysis Location	Shipment		Comments*
			Where to	How	
5	At Plant	Dayton	Dayton	Truck	Wheaton Bottles
6	At Plant	Dayton	Dayton	Truck	Wheaton Bottles
7	At Plant	Dayton	Dayton	Truck	
10	At Plant	At Plant	N.A.	N.A.	
Part. Sizing	At Plant	Dayton	Dayton	Truck	

* Comments to include need for special bottles (Weaton, etc.) and other special handling required.

VII. Level of Effort

Cost Item	Estimated Manhours *	Option #1 **
1. Planning and Administration	16	-
2. Travel	48	-
3. Setup and Cleanup	32	8
4. Field Testing	240 ***	48
5. Laboratory Analysis	92	12
6. Report Preparation	40	-
7/8. Subcontracting	-	-
9. Presurvey	-	-
10. Sub-total Manhours	468	68
11. Cost per Manhour	27.642	27.642
12. Cost of Labor (line 10 times line 11)	12,936	1,880
13. Other Direct Costs (Itemized)		
Install Ports	UNK.	
Scaffolding	UNK.	
14. Total Cost (line 12 plus line 13)	12,936	1,880

* #2 Kiln - 3 Method 5, 2 Method 6

#1 Kiln - 6 Method 5, 2 particle size, Method 7 (12 grab bottle)

Shaft Kiln - 2 Method 5, 2 NO_x (8 grab bottles), 1 particle size

** Option - hydrator

2 Method 5, 1 particle sizing

*** 1 Day for 6 men added in case of rain

6 men on team

A -

B -

C & D -

E & F -

VIII. Field Test Schedule

Time / Day	AM	PM
Sunday		
Monday	Travel (4 hours)	Preliminary Traverse and moisture on #1 & #2 pre-heaters
Tuesday	1 Method 5 (C & D) 1 Method 5 (E & F) 1 SO_2 (A) 1 Particle size (B)	1 Method 5 (C & D) 1 Method 5 (E & F) 1 SO_2 (A) NO_x - (A & B)
Wednesday	1 Method 5 (C & D) 1 Method 5 (E & F) Move equipment to shaft kiln and cooler	Preliminary work on #1 cooler and shaft kiln traverse and moisture
Thursday	1 Method 5 (C & D) 1 Method 5 (E & F) 1 Particle size (A) NO_x (B)	1 Method 5 (C & D) 1 Method 5 (E & F) 1 Particle size (B) (A & B)
Friday	1 Method 5 (E & F) (A, B, C, D) - prepare To Return Home *	Travel Home (4 hours)
Saturday		

* If option 1 is used, one more day will be required

Look at

(1) preheater exhaust from #2 calciner kiln before scrubber (before #1 kiln cooler comes into duct – although Wildhaven says ~~can be bypassed~~ #1 cooler can be bypassed – cooler may be going into baghouse on #1, though)

(2) preheater exhaust from #2 after scrubber + mist eliminator (in stack)

(3) kiln cooler exhaust from #2 kiln before baghouse (before or after heat recuperators) – see about weighing material caught in baghouses to estimate emissions before which

(4) kiln cooler exhaust from #2 kiln after baghouse

(5) ~~this~~ preheater exhaust from kiln #1 – before + after baghouse – see about weighing collected material

(6) cooler on #1 kiln – (find where ducted to?)

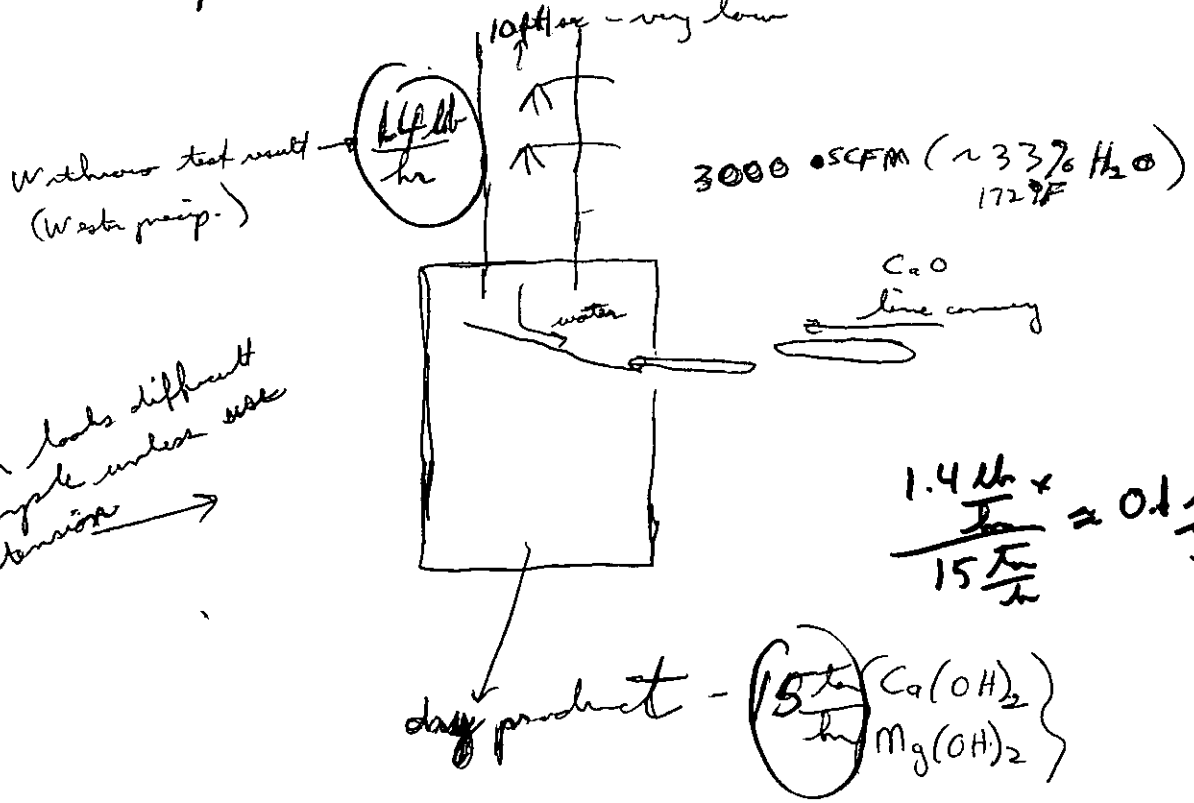
(7) hydrator –

(6) Raymond mills (before + after baghouses)

(7) shaft kilns – after primary cyclone but ~~after~~ before venturi – can be tested

hydrator — Schaefer type — (atmospheric pressure)

product has ± 2% moisture —



$\frac{1.4 \text{ lb}}{\text{Ton}} \times \frac{}{15 \frac{\text{Tn}}{\text{hr}}} \approx 0.1 \frac{\text{lbs}}{\text{Ton hydrate}}$

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2 raymond mills operate on hydrated lime
- new baghouses
- very difficult to test due to duct configuration before baghouse

Sent AP-42 to → NATL LIME & STONE
JAMES WITHROW, VLBSH
Tom PELLETIER, Mankato
APRIL 22, 1975

2 calcinator kilns — 24 hrs/day for 7 days/week
- 1×2" feed - no air movement through bed → fewer emissions

#2) two sources - 250 tons/day
{preheater - through scrubber + mist eliminator → stack
{cooler - direct to atm → heat exchanger + baghouse → own stack
(very little dust collection)
- fired with nat-gas (or producer gas) - calcinates not f
- 33 min/revolution
- can sample inlet of preheater easily

#1) preheater → baghouse → own stack - 200 tons/day
(will be scrubber) 90 min/revolution
- fired with nat gas (or producer gas)
cooler - fed to same baghouse as #2 kiln preheater
- can sample inlet of #1 cooler only
shaft kilns - (7 total) - will probably keep only five operational
- use others for storage only

on one kiln → cyclone → venturi → mist eliminator → exhaust fan → stack
~100 tons/day (~45" water in venturi; cyclone; piping)
on rest (at present) - only primary cyclone now (~4" water, previously)
- each fed into own stack
- each will be equipped with venturi's shortly (this summer)
and mist eliminators

shafts 24 hr/day for 5 days/week

limestone has 0.03 % (by weight) sulfide

PRELIMINARY TEST SURVEY

NATIONAL LIME AND STONE COMPANY
CAREY, OHIO

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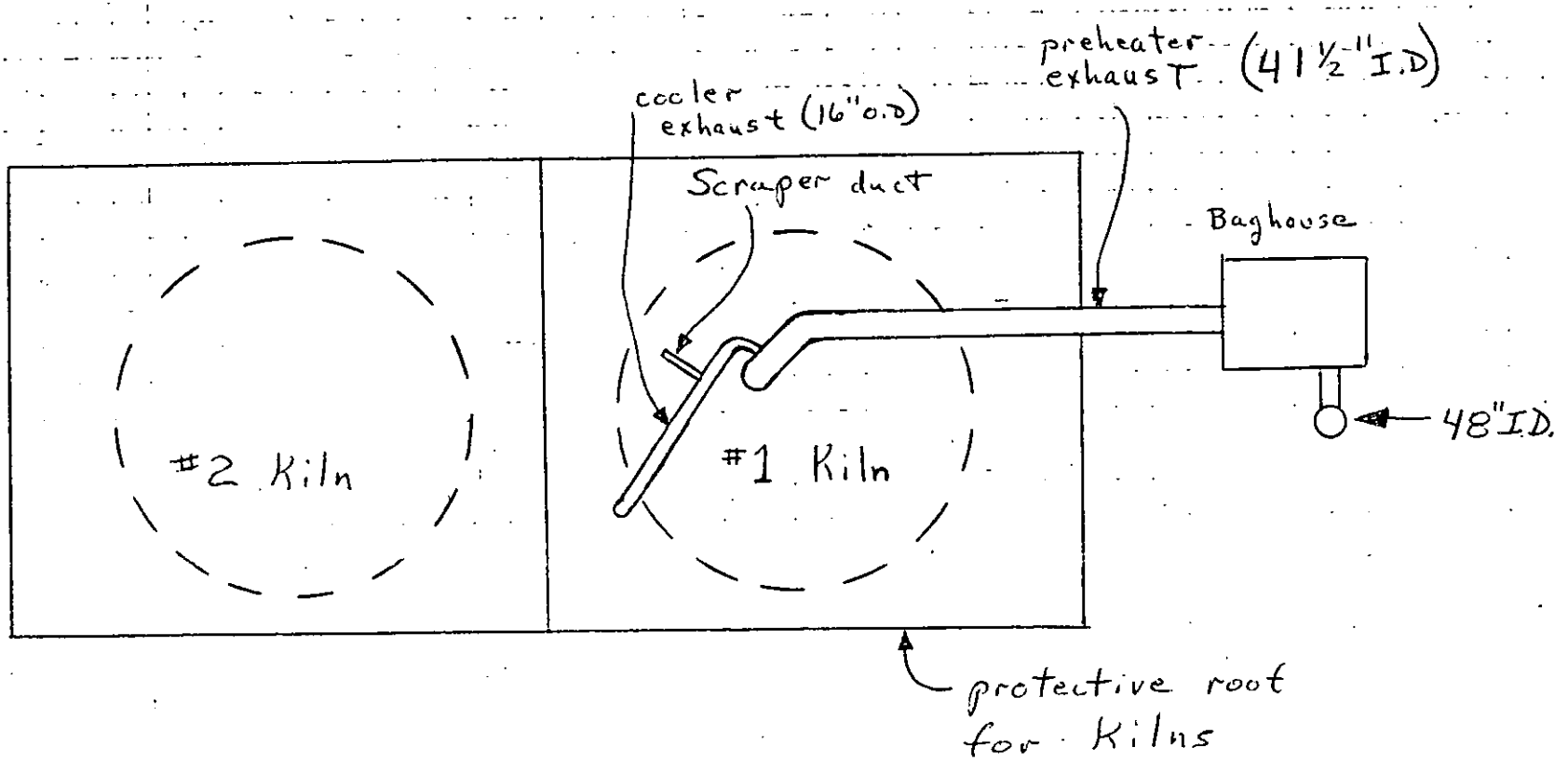
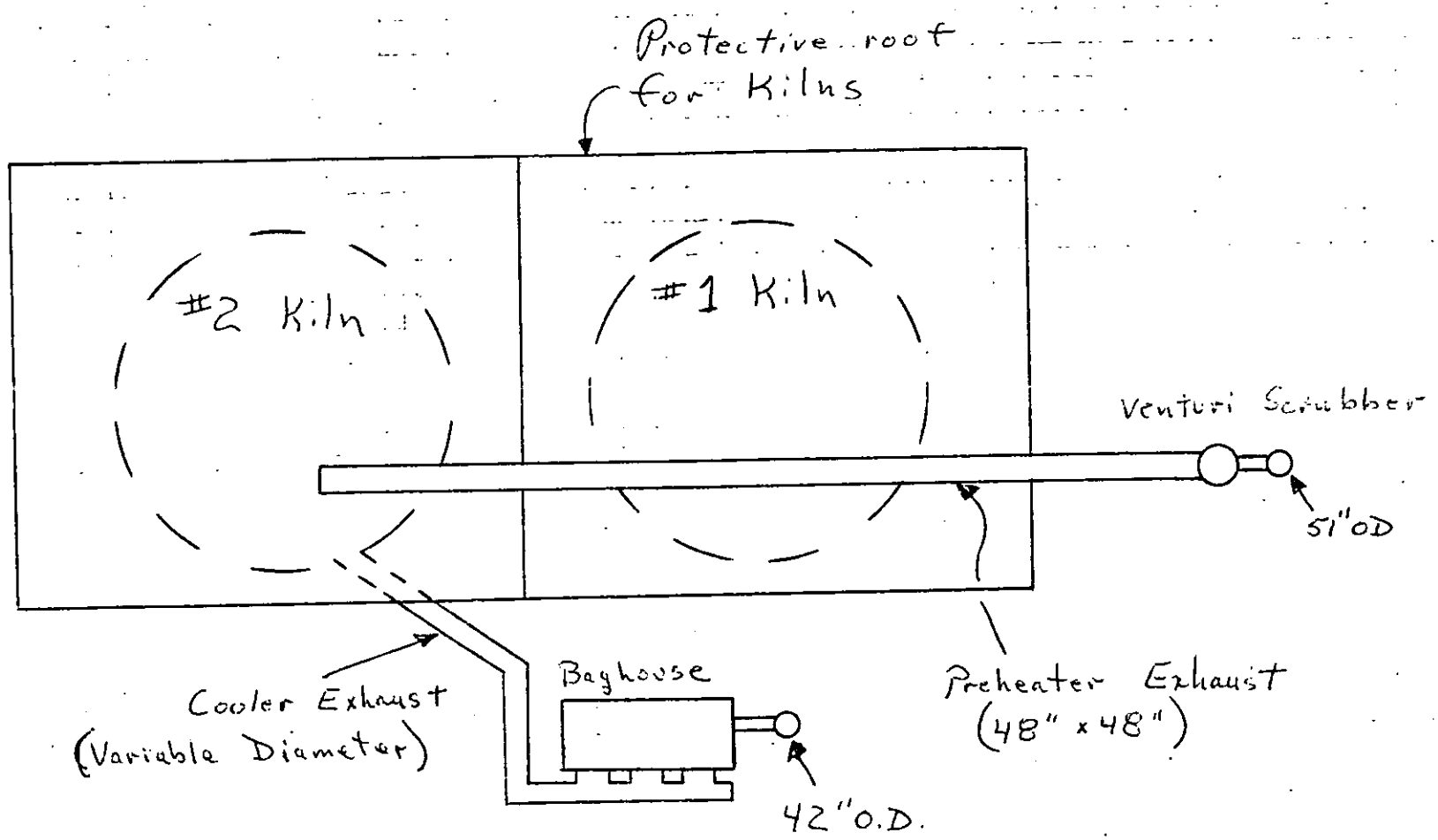


Figure 1. Top View #1 Kiln



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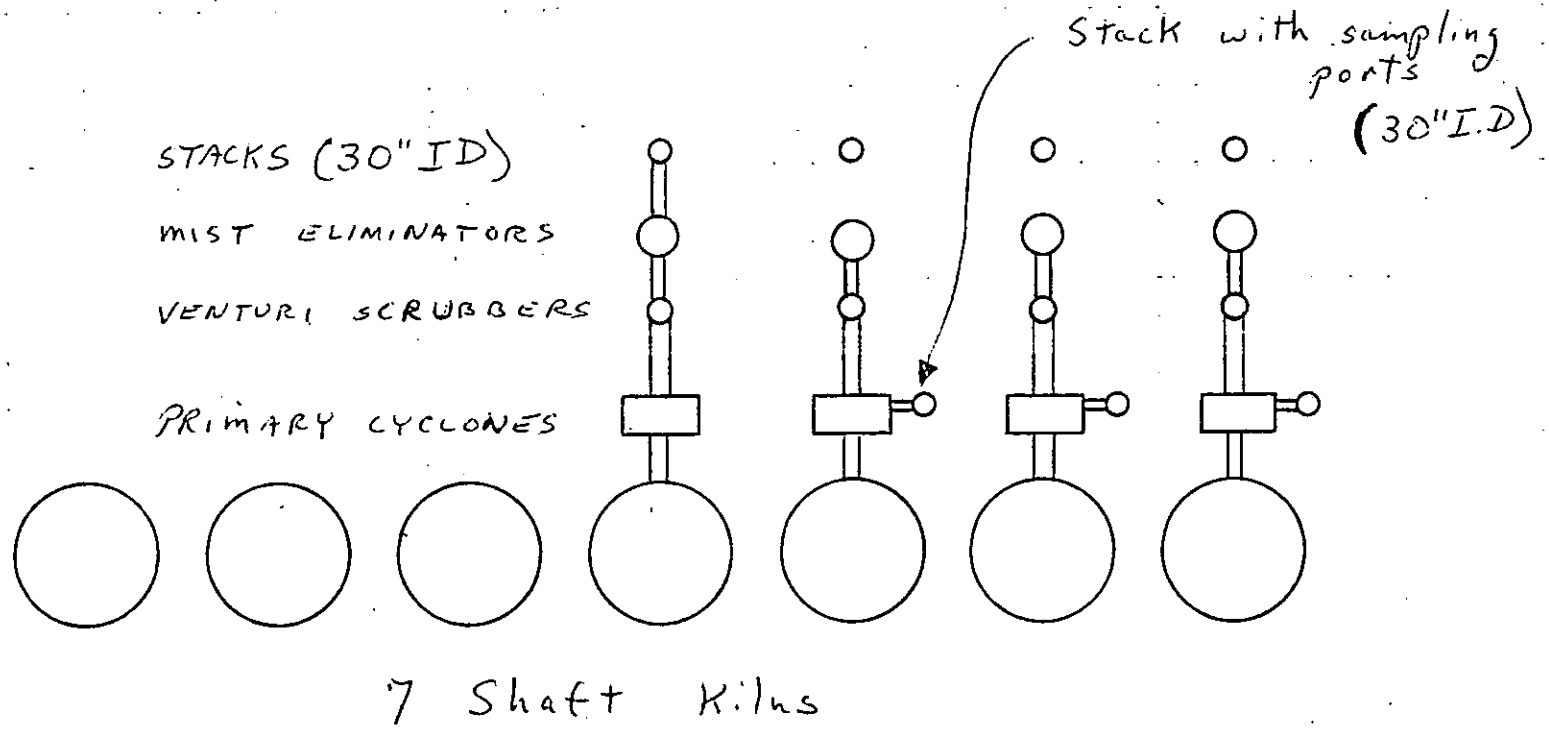

Figure 3. Shaft Kilns

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Ground fault interrupt			Fire extinguisher		✓
Grounding clamp			_____		
_____			_____		
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B. Test Site

1. Ladders

General condition_____ Rest stops_____

Cage_____ Special belts_____

Comments_____

2. Scaffold-platforms

General condition_____ Guardrails_____

Toeboards_____ Screening_____

Comments_____

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4. Vehicle traffic rules No traffic rules

_____

5. Evacuation procedures _____

_____

_____

6. Alarms _____

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C. Potential Problems Confidential matter

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* Comments to include need for special bottles (Weaton, etc.) and other special handling required.

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** Option - hydrator

2 Method 5, 1 particle sizing

*** 1 Day for 6 men added in case of rain

6 men on team

A -

B -

C & D -

E & F -

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* If option 1 is used, one more day will be required