

Emission Testing Report

EMB Test No.: 73-FRT-6

SWIFT AGRICULTURAL CHEMICALS, INC.

Birmingham, Alabama

Prepared by

Roger O. Pfaff
Project Officer

Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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INTRODUCTION

Under the Clean Air Act, as amended, the Environmental Protection Agency is responsible for establishing Federal performance standards for new stationary sources which contribute significantly to air pollution or cause or contribute to the endangerment of public health or welfare. Phosphate fertilizer plants have been included in a listing of such sources.

The Office of Air Quality Planning and Standards establishes performance standards from emission data gathered from the best emission control systems which have been shown to be operable and economically feasible. The granulated NPK fertilizer plant at Swift Agricultural Chemicals in Birmingham, Alabama, was determined to be a well controlled facility. The Emission Measurement Branch conducted source tests at this plant from April 30 to May 3, 1973. The testing was performed by Environmental Engineering, Inc., under contract to EPA. Tests were performed at the outlet of the control system, which consists of the following equipment in series:

- 1) a low pressure water spray chamber
- 2) a venturi water scrubber.

Gases cleaned by the system are from the ammoniator, granulator, dryer, and cooler, all of which are part of the same granulation process. There are no other major air pollution sources in the process, and all gas streams from the process are scrubbed by the same system. Gases from the dryer and cooler pass through cyclones before entering the scrubbers.

Test runs at the outlet of the system were as follows:

- 1) 3 fluoride
- 2) 2 particulate
- 3) 2 ammonia.

One test run for fluorides was performed on the gas entering the scrubbers from the ammoniator-granulator.

SUMMARY AND DISCUSSION OF RESULTS

Test results for P_2O_5 were obtained from the same test runs as fluoride results. The samples were analyzed for both pollutants. Therefore, in this discussion, references to fluoride test runs are applicable to P_2O_5 results as well.

Fluoride tests 2 and 3 at the outlet were run simultaneously to save time because of the frequency of plant shutdowns.

Only two particulate and ammonia tests were run instead of the normal three because of a time shortage caused by frequent plant shutdowns.

COMMENTS

Fluoride test at granulator outlet: This test was run simultaneously with Run 1 for fluorides at the venturi outlet. Sampling was stopped for about 10 minutes at one point due to a plant shutdown. The filter on the granulator test plugged and was changed twice. Only one traverse was used at this test site due to space limitations around the duct.

Run 2 and 3 for fluorides: The filters in both tests were replaced twice during the run. Testing was ended 25 minutes early due to a plant shutdown.

Run 1 particulate: Run 1 for ammonia was taken during the same time period. Both tests were discontinued for 1 hour due to plant equipment problems. The venturi water recirculation system was not working properly for an unknown portion of the test.

Run 2 particulate: Run 2 for ammonia was taken during the same time period. The venturi water pump was shut off for several unknown periods of time during the test. The particulate test only was discontinued for 2.5 hours due to a power failure. Both tests were run to completion.

Summary of Particulate Tests at Outlet
English Units

<u>Run Number</u>	1	2
Date	5-2-73	5-3-73
Volume of Gas Sampled - DSCF ^a	62.56	64.14
Percent Moisture by Volume	10.3	7.5
Average Stack Temperature - °F	127.5	133.5
Stack Volumetric Flow Rate - DSCFM ^b	26,300	28,400
Stack Volumetric Flow Rate - ACFM ^c	33,100	35,000
Percent Isokinetic	98.3	93.2
Percent Excess Air		
Percent Opacity		
Feed Rate - ton/hr	25.0	25.0
<u>Particulates - probe, cyclone,</u> <u>and filter catch</u>		
mg	85.5	352.3
gr/DSCF	0.02105	0.08459
gr/ACF	0.01672	0.06872
lb/hr	4.75	20.62
lb/ton feed	0.190	0.825
<u>Particulates - total catch</u>		
mg	200.8	448.3
gr/DSCF	0.04943	0.10764
gr/ACF	0.03926	0.08745
lb/hr	11.15	26.23
lb/ton feed	0.446	1.05
Percent impinger catch	57.4	21.4

^a Dry standard cubic feet at 70°F, 29.92 in. Hg.

^b Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

^c Actual cubic feet per minute

Summary of Particulate Tests at Outlet
Metric Units

<u>Run Number</u>	1	2
Date	5-2-73	5-3-73
Volume of Gas Sampled - Nm ³ (a)	1.77	1.82
Percent Moisture by Volume	10.3	7.5
Average Stack Temperature - °C	53.1	56.4
Stack Volumetric Flow Rate - Nm ³ /min. (b)	745	805
Stack Volumetric Flow Rate - m ³ /min. (c)	938	991
Percent Isokinetic	98.3	93.2
Percent Excess Air		
Percent Opacity		
Feed Rate - Mton/hr	22.7	22.7
<u>Particulates - probe, cyclone, and filter catch</u>		
mg	85.5	352.3
mg/Nm ³ -	48.17	193.57
mg/m ³	38.34	157.26
kg/hr	2.15	9.35
kg/Mton	0.09495	0.4123
<u>Particulates - total catch</u>		
mg	200.8	448.3
mg/Nm ³	113.12	246.32
mg/m ³	89.85	200.12
kg/hr	5.06	11.9
kg/Mton	0.2230	0.5246
Percent impinger catch	57.4	21.4

^a Dry normal cubic meter at 21.1°C, 760mm Hg.

^b Dry normal cubic meters per minute at 21.1°C, 760mm Hg.

^c Actual cubic meters per minute

Summary of Ammonia Tests at Outlet
English Units

<u>Run Number</u>	1	2
Date	5-2-73	5-3-73
Volume of Gas Sampled - DSCF ^a	33.99	35.95
Percent Moisture by Volume	8.7	5.9
Average Stack Temperature - °F	129.7	137.8
Stack Volumetric Flow Rate - DSCFM ^b	26,100	28,000
Stack Volumetric Flow Rate - ACFM ^c	32,400	34,100
Percent Isokinetic	107.5	106.2
Feed Rate - ton/hr	25.0	25.0

<u>Ammonia</u>		
mg	1.10	0.8
gr/DSCF	0.00050	0.00034
gr/ACF	0.00040	0.00028
lb/hr	0.11	0.08
lb/ton feed	0.00446	0.00329

^a Dry standard cubic feet at 70°F, 29.92 in. Hg.

^b Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

^c Actual cubic feet per minute.

Summary of Ammonia Tests at Outlet

Metric Units

<u>Run Number</u>	1	2
Date	5-2-73	5-3-73
Volume of Gas Sampled - Nm ³ (a)	0.96	1.02
Percent Moisture by Volume	8.7	5.9
Average Stack Temperature - °C	54.3	58.8
Stack Volumetric Flow Rate - Nm ³ /min. (b)	740	792
Stack Volumetric Flow Rate - m ³ /min. (c)	918	966
Percent Isokinetic	107.5	106.2
Feed Rate - Mton/hr	22.7	22.7

Ammonia

mg	1.1	0.8
mg/Nm ³	1.14	0.78
mg/m ³	0.92	0.65
kg/hr	0.05	0.04
kg/Mton	0.00223	0.00164

^a Dry normal cubic meter at 21.1°C, 760 mm Hg.

^b Dry normal cubic meters per minute at 21.1°C, 760 mm Hg.

^c Actual cubic meters per minute.

Summary of Results - Fluoride Tests at Outlet

English Units

<u>Run Number</u>	1	2	3
Date	5-1-73	5-1-73	5-1-73
Volume of Gas Sampled - DSCF ^a	61.69	49.60	52.05
Percent Moisture by Volume	8.4	9.2	9.0
Average Stack Temperature - °F	111.8	111.5	115.0
Stack Volumetric Flow Rate - DSCFM ^b	27,600	28,400	27,000
Stack Volumetric Flow Rate - ACFM ^c	33,100	34,300	32,700
Percent Isokinetic	92.0	89.9	107.2
Percent Excess Air			
Percent Opacity			
Feed Rate - ton/hr	25.0	25.0	25.0

Soluble Fluorides

mg	3.1	1.8	1.5
gr/DSCF	0.00077	0.00056	0.00044
gr/ACF	0.00065	0.00046	0.00037
lb/hr	0.18	0.14	0.10
lb/ton feed	0.00733	0.00545	0.00410

Total Fluorides

mg	3.3	1.8	3.4
gr/DSCF	0.00082	0.00056	0.00101
gr/ACF	0.00068	0.00046	0.00083
lb/hr	0.20	0.14	0.23
lb/ton feed	0.00781	0.00545	0.00930

^a Dry standard cubic feet at 70°F, 29.92 in. Hg.

^b Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

^c Actual cubic feet per minute

Summary of Results - Fluoride Tests at Outlet
Metric Units

<u>Run Number</u>	1	2	3
Date	5-1-73	5-1-73	5-1-73
Volume of Gas Sampled - Nm ³ (a)	1.75	1.40	1.47
Percent Moisture by Volume	8.4	9.2	9.0
Average Stack Temperature - °C	44.3	44.2	46.1
Stack Volumetric Flow Rate - Nm ³ /min. (b)	783	805	763
Stack Volumetric Flow Rate - m ³ /min. (c)	937	972	925
Percent Isokinetic	92.0	89.9	107.2
Percent Excess Air			
Percent Opacity			
Feed Rate - Mton/hr	22.7	22.7	22.7

Soluble Fluorides

mg	3.1	1.8	1.5
mg/Nm ³	1.77	1.28	1.02
mg/m ³	1.48	1.06	0.89
kg/hr	0.08	0.06	0.05
kg/Mton	0.00367	0.00272	0.00205

Total Fluorides

mg	3.3	1.8	3.4
mg/Nm ³	1.89	1.28	2.30
mg/m ³	1.58	1.06	1.90
kg/hr	0.09	0.06	0.11
kg/Mton	0.00390	0.00272	0.00465

^a Dry normal cubic meter at 21.1°C, 760mm Hg.

^b Dry normal cubic meters per minute at 21.1°C, 760mm Hg.

^c Actual cubic meters per minute

Summary of P₂O₅ Tests at Outlet
English Units

<u>Run Number</u>	1	2	3
Date	5-1-73	5-1-73	5-1-73
Volume of Gas Sampled - DSCF ^a	61.69	49.60	52.05
Percent Moisture by Volume	8.4	9.2	9.0
Average Stack Temperature - °F	111.8	111.5	115.0
Stack Volumetric Flow Rate - DSCFM ^b	27,600	28,400	27,000
Stack Volumetric Flow Rate - ACFM ^c	33,100	34,300	32,700
Percent Isokinetic	92.0	89.9	107.2
Percent Excess Air			
Percent Opacity			
Feed Rate - ton/hr	25.0	25.0	25.0

Soluble P₂O₅

mg	6.5	1.6	6.0
gr/DSCF	0.00162	0.00050	0.00178
gr/ACF	0.00135	0.00046	0.00146
lb/hr	0.38	0.12	0.41
lb/ton feed	0.0153	0.00484	0.0164

Total P₂O₅

mg	12.0	1.7	36.0
gr/DSCF	0.00300	0.00053	0.01065
gr/ACF	0.00250	0.00041	0.00877
lb/hr	0.71	0.13	2.46
lb/ton feed	0.0284	0.00514	0.0984

^a Dry standard cubic feet at 70°F, 29.92 in. Hg.

^b Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

^c Actual cubic feet per minute

Summary of P₂O₅ Tests at Outlet
Metric Units

<u>Run Number</u>	1	2	3
Date	5-1-73	5-1-73	5-1-73
Volume of Gas Sampled - Nm ³ (a)	1.75	1.40	1.47
Percent Moisture by Volume	8.4	9.2	9.0
Average Stack Temperature - °C	44.3	44.2	46.1
Stack Volumetric Flow Rate - Nm ³ /min. (b)	783	805	763
Stack Volumetric Flow Rate - m ³ /min. (c)	937	972	925
Percent Isokinetic	92.0	89.9	107.2
Percent Excess Air			
Percent Opacity			
Feed Rate - Mton/hr	22.7	22.7	22.7
<u>Soluble P₂O₅</u>			
mg	6.5	1.6	6.0
mg/Nm ³	3.71	1.14	4.06
mg/m ³	3.10	0.94	3.35
kg/hr	0.17	0.05	0.19
kg/Mton	0.00769	0.00242	0.00820
<u>Total P₂O₅</u>			
mg	12.0	1.7	36.0
mg/Nm ³	6.86	1.21	24.37
mg/m ³	5.72	1.00	20.09
kg/hr	0.32	0.06	1.12
kg/Mton	0.01419	0.00257	0.04923

^a Dry normal cubic meter at 21.1°C, 760mm Hg.

^b Dry normal cubic meters per minute at 21.1°C, 760mm Hg.

^c Actual cubic meters per minute

Summary of Results - Fluoride and P₂O₅ Tests at Granulator Outlet
English Units

<u>Sample Type</u>	Fluoride	P ₂ O ₅
Date	5-1-73	
Volume of Gas Sampled - DSCF ^a	93.26	
Percent Moisture by Volume	5.5	
Average Stack Temperature - °F	103.5	
Stack Volumetric Flow Rate - DSCFM ^b	5475	
Stack Volumetric Flow Rate - ACFM ^c	6369	
Percent Isokinetic	97.0	
Percent Excess Air		
Percent Opacity		
Feed Rate - ton/hr	25.0	

Soluble

mg	5.9	23.7
gr/DSCF	0.00097	0.00391
gr/ACF	0.00084	0.00336
lb/hr	0.05	0.18
lb/ton feed	0.00183	0.00735

Total

mg	5.9	26.5
gr/DSCF	0.00097	0.00438
gr/ACF	0.00084	0.00377
lb/hr	0.05	0.21
lb/ton feed	0.00183	0.00822

^a Dry standard cubic feet at 70°F, 29.92 in. Hg.

^b Dry standard cubic feet per minute at 70°F, 29.92 in. Hg.

^c Actual cubic feet per minute

Summary of Results - Fluoride and P₂O₅ Tests at Granulator Outlet
Metric Units

<u>Sample Type</u>	Fluoride	P ₂ O ₅
Date	5-1-73	
Volume of Gas Sampled - Nm ³ (a)	2.64	
Percent Moisture by Volume	5.5	
Average Stack Temperature - °C	39.7	
Stack Volumetric Flow Rate - Nm ³ /min. (b)	155	
Stack Volumetric Flow Rate - m ³ /min. (c)	180	
Percent Isokinetic	97.0	
Percent Excess Air		
Percent Opacity		
Feed Rate - Mton/hr	22.7	
<u>Soluble</u>		
mg	5.9	23.7
mg/Nm ³	2.23	8.96
mg/m ³	1.92	7.70
kg/hr	0.02	0.08
kg/Mton	0.00092	0.00367
<u>Total</u>		
mg	5.9	26.5
mg/Nm ³	2.23	10.01
mg/m ³	1.92	8.61
kg/hr	0.02	0.09
kg/Mton	0.00092	0.00411

^a Dry normal cubic meter at 21.1°C, 760mm Hg.

^b Dry normal cubic meters per minute at 21.1°C, 760mm Hg.

^c Actual cubic meters per minute

PROCESS DESCRIPTION AND OPERATION

The plant produces several grades of NPK fertilizer. Two of the major grades are 8-8-8 and 5-10-15 (% N- % P_2O_5 - % K_2O). A variety of raw materials containing the basic nutrients nitrogen, phosphorous, and potassium are mixed in the granulator. The wet granules are conveyed to a gas-fired dryer, and finally to a cooler.

Gases from the dryer and cooler are vented to separate cyclones, then to the first stage scrubber. The granulator is exhausted directly to the scrubber. The first stage scrubber is a Heil No. 729 low pressure water scrubber. Water is recirculated from a waste pond.

A 150 hp fan conveys the gas from the first scrubber to a Heil venturi scrubber. Water is recirculated through the venturi scrubber.

A 100 hp fan transports scrubbed gas from the venturi through a stack to the atmosphere.

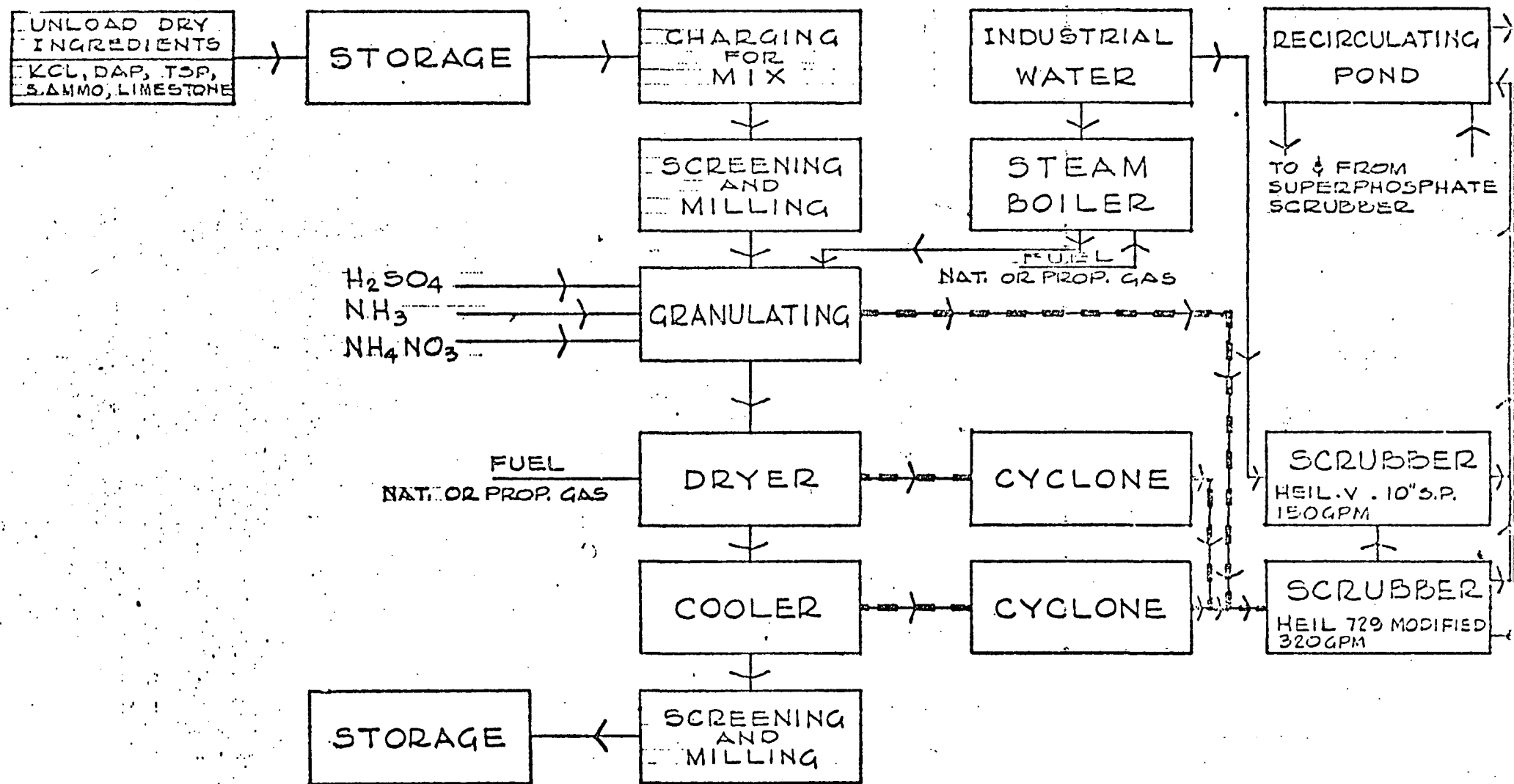


Figure 1
Process Flow Diagram

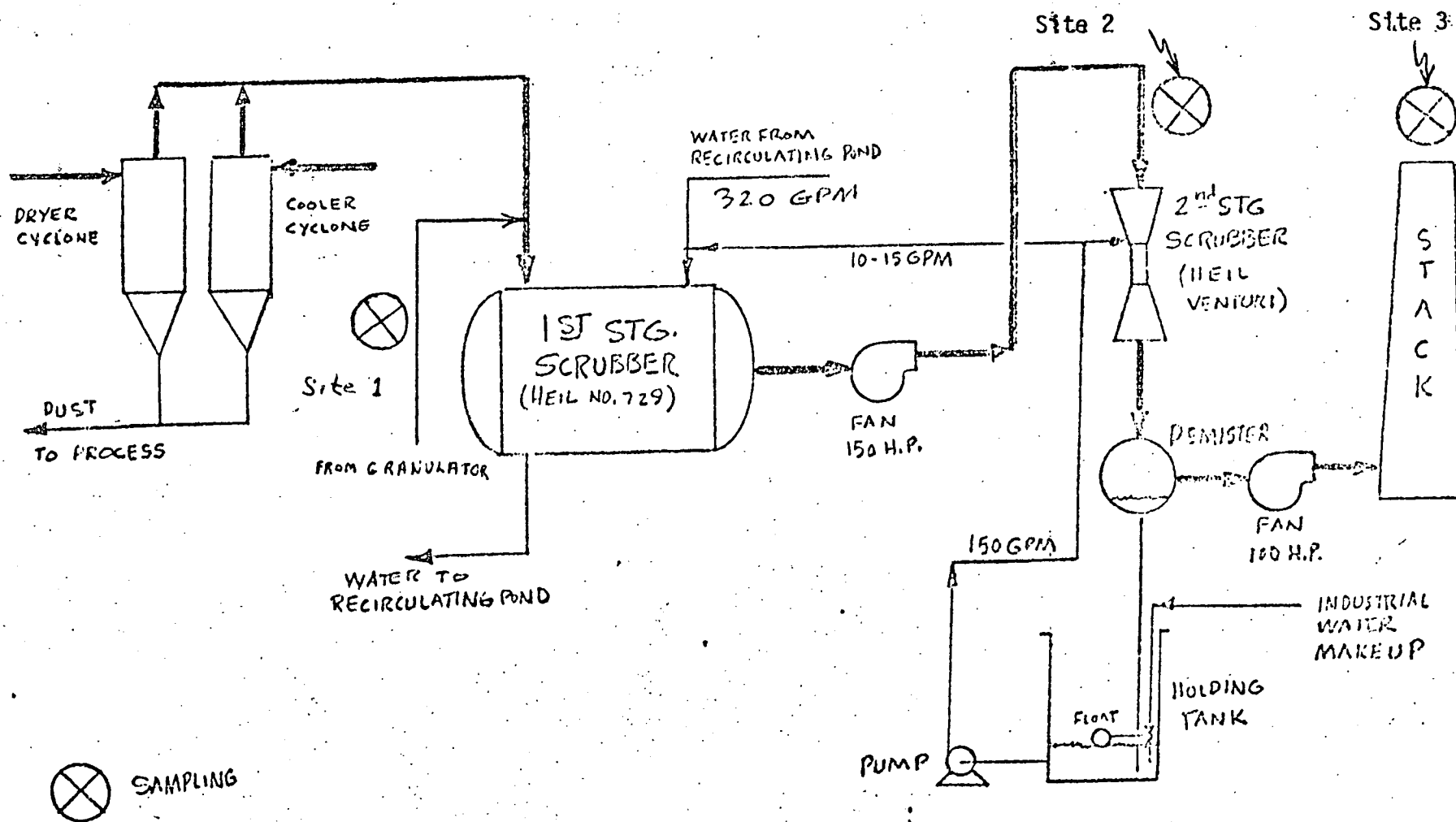


Figure 2
Test Sites

SAMPLING AND ANALYTICAL PROCEDURES

Particulate tests were run using EPA Method 5 particulate train and procedures as published in the Federal Register, August 17, 1971, except that the impinger water wash is evaporated to dryness after organic extraction and weighed.

Fluoride tests were run in accordance with Method 13 for fluorides (See Appendix F). Sampling equipment and procedures are similar to that of Method 5 except that the filter is in the rear of the sampling train and is a paper filter. Fluoride analysis is by the SPADNS Zirconium Lake Method.

Ammonia tests were run using the method outlined in Appendix F. The method is similar to Method 5 except that the impinger solution is 0.1 N H_2SO_4 and only the impingers are analyzed for ammonia.

LOCATION OF SAMPLING SITES

Simultaneous sampling at three sampling sites was originally planned.

Site 1 is the inlet to the first stage scrubber from the ammoniator-granulator. Inlets from the dryer and cooler could not be sampled due to poor locations.

Site 2 is between the first stage and second stage scrubbers. All gas streams pass through the first stage scrubber and into the second stage scrubber past site 2.

Site 3 is the outlet of the second stage scrubber in the stack leading to the atmosphere. This is the final outlet of all gas streams.

Due to clogging problems in the Run 1 fluoride test, sampling was discontinued at site 1 after this first test. Site 2 was never sampled due to high water and ammonia concentrations coupled with high pressure, posing both a safety and a technical problem.

Distance to nearest upstream disturbance - 160 in. (10 diameters)

Type of disturbance - Granulator

Distance to nearest downstream disturbance - 30 in. (2 diameter)

Type of disturbance - Bend

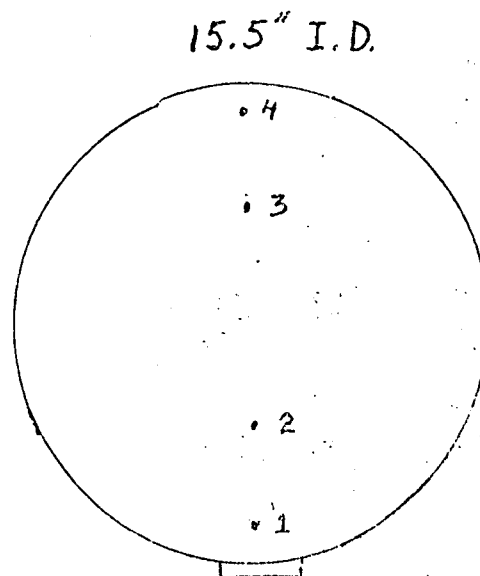


Figure 3
Test Site 1

Distance to nearest upstream disturbance - 30 ft. (9 diameter)

Type of disturbance - Fan

Distance to nearest downstream disturbance - 12 ft. (3 diameter)

Type of disturbance - Stack outlet

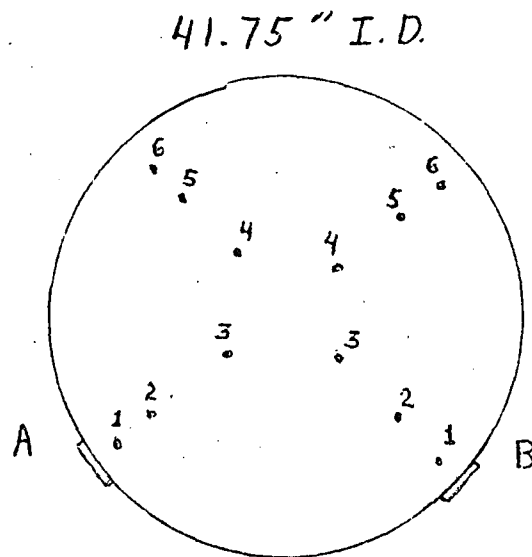


Figure 4
Test Site 3