

Emission Testing Report

EMB Test No.: 73-FRT-15

I N T E R N A T I O N A L M I N E R A L S A N D C H E M I C A L S

Americus, Georgia

Stanley Spruiell
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Environmental Protection Agency
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INTRODUCTION

From June 18-22, 1973, the Environmental Protection Agency tested the emissions from International Minerals and Chemicals in Americus, Georgia. Test data were collected for the purpose of setting standards for phosphate fertilizer plants. Tests were conducted at the inlet and the outlet of the venturi scrubbers for the normal superphosphate plant and the ammoniator-granulator plant. The NSP plant was tested for particulates and fluorides. The ammoniator-granulator was tested for particulates, fluorides, and ammonia. The plan also called for particle sizing tests to be run at both of the outlets using the Brinks Model B impactor. However, because of the high moisture content in the outlets, it was not possible to test for particle size. The test team consisted of members from the EPA and contractors from Environmental Science and Engineering.

Also present at the test site were members from the State of Georgia. They were present to perform parallel tests with the EPA at the NSP scrubber outlet. They wanted to obtain comparative data with the EPA for particulates and fluorides at each of the test sites. However, after the presurvey the EPA decided it would not be possible for both crews to be present anywhere except at the NSP scrubber outlet. The State did parallel particulate tests with the EPA but cancelled parallel fluoride tests because of malfunction in this test equipment.

SUMMARY OF RESULTS

TABLE 1 - Particulate
Superphosphate Scrubber Inlet
(English)

<u>Run Number</u>	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - DSCF ^a	50.28	49.25	50.36
Percent Moisture by Volume	8.7	6.3	11.1
Average Stack Temperature - °F	130	130	130
Stack Volumetric Flow Rate - DSCFM ^b	4856	4876	5250
Stack Volumetric Flow Rate - ACFM ^c	6041	5911	6704
Percent Isokinetic	105.6	103.0	97.8
Feed Rate - ton/hr	20	20	20
<u>Particulates</u> - probe, cyclone, and filter catch			
mg	3679	7980.6	3680.5
gr/DSCF	1.13	2.50	1.13
gr/ACF	0.905	2.06	0.881
lb/hr	46.90	104.3	50.65
lb/ton feed	2.34	5.21	2.53
<u>Particulates</u> - total catch			
mg	4473.4	8495.9	4557.1
gr/DSCF	1.37	2.66	1.39
gr/ACF	1.10	2.19	1.09
lb/hr	57.02	111.0	62.71
lb/ton feed	2.85	5.55	3.14
Percent impinger catch	17.8	6.1	19.2

^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

TABLE 2 - Particulate
Superphosphate Scrubber Outlet
(English)

<u>Run Number</u>	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - DSCF ^a	69.75	69.66	64.23
Percent Moisture by Volume	12.7	13.6	14.8
Average Stack Temperature - °F	123.2	125.6	128.7
Stack Volumetric Flow Rate - DSCFM ^b	4949	4724	4622
Stack Volumetric Flow Rate - ACFM ^c	6324	6124	6109
Percent Isokinetic	99.1	103.7	97.7
Feed Rate - ton/hr	20	20	20
<u>Particulates</u> - probe, cyclone, and filter catch			
mg	163.6	220.3	294.0
gr/DSCF	0.0361	0.0487	0.0705
gr/ACF	0.0283	0.0375	0.0533
lb/hr	1.53	1.97	2.79
lb/ton feed	0.0766	0.0986	0.1396
<u>Particulates</u> - total catch			
mg	437.2	633.6	719.9
gr/DSCF	0.0965	0.1401	0.1726
gr/ACF	0.0755	0.1080	0.1305
lb/hr	4.10	5.67	6.84
lb/ton feed	0.205	0.0986	0.140
Percent impinger catch	62.6	65.2	59.2

^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

TABLE 3 - Particulate
Ammoniator Scrubber Inlet
(English)

<u>Run Number</u>	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - DSCF ^a	85.58	70.01	88.48
Percent Moisture by Volume	8.6	8.5	7.8
Average Stack Temperature - °F	121.1	121.4	123.0
Stack Volumetric Flow Rate - DSCFM ^b	6222	5576	6690
Stack Volumetric Flow Rate - ACFM ^c	7637	6838	8237
Percent Isokinetic	105.6	107.2	101.6
Feed Rate - ton/hr	30	30	30
<u>Particulates</u> - probe, cyclone, and filter catch			
mg	9542.4	8168.3	10570.2
gr/DSCF	1.717	1.797	1.840
gr/ACF	1.398	1.464	1.493
lb/hr	91.58	85.87	105.5
lb/ton feed	3.05	2.86	3.52
<u>Particulates</u> - total catch			
mg	9997.7	8381.4	10850.4
gr/DSCF	1.799	1.844	1.888
gr/ACF	1.465	1.502	1.533
lb/hr	95.95	88.11	108.3
lb/ton feed	3.20	2.94	3.61
Percent impinger catch	4.6	2.5	2.6

^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

TABLE 4 - Particulate
Ammoniator Scrubber Outlet
(English)

<u>Run Number</u>	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - DSCF ^a	90.40	112.45	112.48
Percent Moisture by Volume	6.4	6.4	5.9
Average Stack Temperature - °F	110	110	115
Stack Volumetric Flow Rate - DSCFM ^b	5280	7475	7197
Stack Volumetric Flow Rate - ACFM ^c	5934	8403	8274
Percent Isokinetic	91.3	80.2	90.8
Feed Rate - ton/hr	30	30	30
<u>Particulates</u> - probe, cyclone, and filter catch			
mg	57.80	37.60	93.70
gr/DSCF	0.00985	0.00515	0.01178
gr/ACF	0.00875	0.00458	0.01024
lb/hr	0.45	0.33	0.73
lb/ton feed	0.0148	0.0110	0.0242
<u>Particulates</u> - total catch			
mg	137.30	95.20	175.20
gr/DSCF	0.02339	0.01304	0.02203
gr/ACF	0.02080	0.01159	0.01915
lb/hr	1.06	0.84	1.36
lb/ton feed	0.0353	0.0278	0.0453
Percent impinger catch	57.9	60.5	46.5

^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

TABLE 5 - Fluoride
Superphosphate Scrubber Inlet
(English)

<u>Run Number</u>	1	2	3
Date	6-20-73	6-21-73	6-21-73
Volume of Gas Sampled - DSCF ^a	44.30	46.89	42.59
Percent Moisture by Volume	12.1	9.8	8.8
Average Stack Temperature - °F	130	130	130
Stack Volumetric Flow Rate - DSCFM ^b	4576	4608	4514
Stack Volumetric Flow Rate - ACFM ^c	5911	5801	5620
Percent Isokinetic	98.4	103.4	95.9
Feed Rate - ton/hr	20	20	20
<u>Soluble Fluoride</u>			
mg	11,600	8,990	6,350
gr/DSCF	4.03	2.95	2.30
gr/ACF	3.12	2.34	1.85
lb/hr	158.0	116.5	89.0
lb/ton feed			
<u>Total Fluoride</u>			
mg	11,816	9,140	7,300
gr/DSCF	4.11	3.00	2.64
gr/ACF	3.18	2.38	2.12
lb/hr	161.2	118.5	102.1
lb/ton feed			

^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

TABLE 6 - Fluoride
Superphosphate Scrubber Outlet
(English)

<u>Run Number</u>	1	2	3
Date	6-20-73	6-21-73	6-21-73
Volume of Gas Sampled - DSCF ^a	52.60	49.13	51.54
Percent Moisture by Volume	15.4	14.9	15.7
Average Stack Temperature - °F	133.3	128.9	130.7
Stack Volumetric Flow Rate - DSCFM ^b	3863	3510	3702
Stack Volumetric Flow Rate - ACFM ^c	5181	4645	4954
Percent Isokinetic	95.7	99.1	97.9
Feed Rate - ton/hr	20	20	20
<u>Soluble Fluoride</u>			
mg	397.3	299.3	174.8
gr/DSCF	0.116	0.0938	0.0522
gr/ACF	0.0864	0.0707	0.0389
lb/hr	3.84	2.82	1.66
lb/ton feed	0.192	0.141	0.083
<u>Total Fluoride</u>			
mg	408.4	306.0	176.4
gr/DSCF	0.120	0.0959	0.0527
gr/ACF	0.0894	0.0724	0.0393
lb/hr	3.97	2.88	1.67
lb/ton feed	0.198	0.144	0.084

^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

TABLE 7 - Fluoride
Ammoniator Scrubber Inlet
(English)

<u>Run Number</u>	2	3
Date	6-21-73	6-21-73
Volume of Gas Sampled - DSCF ^a	30.48	30.81
Percent Moisture by Volume	9.3	11.2
Average Stack Temperature - °F	111.9	118.1
Stack Volumetric Flow Rate - DSCFM ^b	7942	7989
Stack Volumetric Flow Rate - ACFM ^c	9801	10,049
Percent Isokinetic	104.4	103.4
Feed Rate - ton/hr	30	30
<u>Soluble Fluoride</u>		
mg	12.5	12.6
gr/DSCF	0.00632	0.00630
gr/ACF	0.00519	0.00501
lb/hr	0.430	0.431
lb/ton feed	0.143	0.0144
<u>Total Fluoride</u>		
mg	30.9	50.8
gr/DSCF	0.0156	0.0254
gr/ACF	0.0128	0.0202
lb/hr	1.06	1.74
lb/ton feed	0.0353	0.0579

^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

TABLE 8 - Fluoride
Ammoniator Scrubber Outlet
(English)

<u>Run Number</u>	1	2	3
Date	6-20-73	6-21-73	6-21-73
Volume of Gas Sampled - DSCF ^a	75.79	130.47	110.63
Percent Moisture by Volume	4.5	5.9	6.6
Average Stack Temperature - °F	120	120	120
Stack Volumetric Flow Rate - DSCFM ^b	6549	7717	7472
Stack Volumetric Flow Rate - ACFM ^c	7484	8950	8731
Percent Isokinetic	79.2 & 84.8 ^d	89.9	76.7
Feed Rate - ton/hr	30	30	30
<u>Soluble Fluoride</u>			
mg	2.36	0.48	0.96
gr/DSCF	0.000480	0.0000567	0.000134
gr/ACF	0.000420	0.0000488	0.000115
lb/hr	0.0269	0.00375	0.00858
lb/ton feed	0.000900	0.000125	0.000286
<u>Total Fluoride</u>			
mg	2.67	1.70	1.54
gr/DSCF	0.000543	0.000201	0.000214
gr/ACF	0.000475	0.000173	0.000183
lb/hr	0.0305	0.0133	0.0137
lb/ton feed	0.00102	0.000443	0.000457

^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

^d Separate calculations in two portions of test due to nozzle change.

TABLE 9 - Ammonia
Ammoniator Scrubber Inlet
(English)

<u>Run Number</u>	1	2	3
Date	6-21-73	6-22-73	6-22-73
Volume of Gas Sampled - DSCF ^a	29.95	25.51	24.11
Percent Moisture by Volume	11.5	9.4	13.1
Average Stack Temperature - °F	120.2	112.3	119.9
Stack Volumetric Flow Rate - DSCFM ^b	7439	6585	6487
Stack Volumetric Flow Rate - ACFM ^c	9389	7992	8318
Percent Isokinetic	109.5	108.7	101.1
Feed Rate - ton/hr	30	30	30
<u>Ammonia</u>			
mg	7,300	9,800	4,900
gr/DSCF	3.75	5.92	3.13
gr/ACF	2.97	4.87	2.44
lb/hr	239	334	174
lb/ton feed	7.97	11.1	5.80

^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.

TABLE 10 - Ammonia
Ammoniator Scrubber Outlet
(English)

<u>Run Number</u>	1	2	3
Date	6-21-73	6-22-73	6-22-73
Volume of Gas Sampled - DSCF ^a	63.79	67.53	47.54
Percent Moisture by Volume	7.56	7.05	8.15
Average Stack Temperature - °F	120	120	120
Stack Volumetric Flow Rate - DSCFM ^b	7444	7600	7520
Stack Volumetric Flow Rate - ACFM ^c	8793	8904	8926
Percent Isokinetic	91.1	94.4	69.6
Feed Rate	30	30	30
<u>Ammonia</u>			
mg	4000	4000	4600
gr/DSCF	0.966	0.912	1.49
gr/ACF	0.817	0.778	1.25
lb/hr	61.6	59.4	96.0
lb/ton feed	2.05	1.98	3.20

^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.

TABLE 11 - Particulate
Superphosphate Scrubber Inlet
(Metric)

Run Number	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - Nm ³ (a)	1.42	1.39	1.43
Percent Moisture by Volume	8.7	6.3	11.1
Average Stack Temperature - °C	54.4	54.4	54.4
Stack Volumetric Flow Rate - Nm ³ /min. (b)	138	138	149
Stack Volumetric Flow Rate - m ³ /min. (c)	171	167	190
Percent Isokinetic	105.6	103.0	97.8
Feed Rate - Mton/hr	18.2	18.2	18.2
<u>Particulates - probe, cyclone, and filter catch</u>			
mg	3679.0	7980.6	3680.5
mg/Nm ³	2578.4	5710.9	2575.6
mg/m ³	2071.5	4707.8	2015.8
kg/hr	21.27	47.31	22.97
kg/Mton	1.17	2.61	1.27
<u>Particulates - total catch</u>			
mg	4473.4	8495.9	4557.1
mg/Nm ³	3135.2	6079.7	3189.0
mg/m ³	2518.8	5011.8	2495.9
kg/hr	25.87	50.36	28.44
kg/Mton	1.43	2.78	1.57
Percent impinger catch	17.8	6.1	19.2

^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

TABLE 12 - Particulate
Superphosphate Scrubber Outlet
(Metric)

<u>Run Number</u>	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - Nm ³ (a)	1.98	1.97	1.82
Percent Moisture by Volume	12.7	13.6	14.8
Average Stack Temperature - °C	50.7	52.0	53.7
Stack Volumetric Flow Rate - Nm ³ /min. (b)	140	134	131
Stack Volumetric Flow Rate - m ³ /min. (c)	179	173	173
Percent Isokinetic	99.1	103.7	97.7
Feed Rate - Mton/hr			
<u>Particulates</u> - probe, cyclone, and filter catch			
mg	163.6	220.3	294.0
mg/Nm ³	8266	111.4	161.3
mg/m ³	64.65	85.91	122.0
kg/hr	0.70	0.89	1.27
kg/Mton	0.0383	0.0493	0.0698
<u>Particulates</u> - total catch			
mg	437.2	633.6	719.9
mg/Nm ³	220.9	320.5	395.0
mg/m ³	172.8	247.1	298.7
kg/hr	1.86	2.57	3.10
kg/Mton	0.102	0.142	0.171
Percent impinger catch	62.6	65.2	59.2

^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

TABLE 13 - Particulate
Ammoniator Scrubber Inlet
(Metric)

Run Number	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - Nm ³ (a)	2.42	1.98	2.51
Percent Moisture by Volume	8.6	8.5	7.8
Average Stack Temperature - °C	49.5	49.7	50.6
Stack Volumetric Flow Rate - Nm ³ /min. (b)	176	158	189
Stack Volumetric Flow Rate - m ³ /min. (c)	216	194	233
Percent Isokinetic	105.6	107.2	101.6
Feed Rate - Mton/hr	27.3	27.3	27.3
<u>Particulates - probe, cyclone, and filter catch</u>			
mg	9542.4	8168.3	10570.2
mg/Nm ³	3930	4111	4210
mg/m ³	3200	3350	3417
kg/hr	41.54	38.95	47.85
kg/Mton	1.53	1.43	1.76
<u>Particulates - total catch</u>			
mg	9997.7	8381.4	10850.4
mg/Nm ³	4117	4219	4322
mg/m ³	3352	3438	3508
kg/hr	43.52	39.96	49.12
kg/Mton	1.60	1.47	1.80
Percent impinger catch	4.6	2.5	2.6

^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

TABLE 14 - Particulate
Ammoniator Scrubber Outlet
(Metric)

<u>Run Number</u>	1	2	3
Date	6-19-73	6-19-73	6-20-73
Volume of Gas Sampled - Nm ³ (a)	2.56	3.18	3.47
Percent Moisture by Volume	6.4	6.4	5.9
Average Stack Temperature - °C	43.3	43.3	46.1
Stack Volumetric Flow Rate - Nm ³ /min. (b)	149	212	204
Stack Volumetric Flow Rate - m ³ /min. (c)	168	238	234
Percent Isokinetic	91.3	80.2	90.8
Feed Rate - Mton/hr	27.3	27.3	27.3
<u>Particulates - probe, cyclone, and filter catch</u>			
mg	57.80	37.60	93.70
mg/Nm ³	22.53	11.78	26.96
mg/m ³	20.03	10.48	23.44
kg/hr	0.20	0.15	0.33
kg/Mton	0.0074	0.0055	0.0121
<u>Particulates - total catch</u>			
mg	137.3	95.20	175.2
mg/Nm ³	53.52	29.83	50.41
mg/m ³	47.59	26.53	43.82
kg/hr	0.48	0.38	0.62
kg/Mton	0.0176	0.0139	0.0226
Percent impinger catch	57.9	60.5	46.5

^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

TABLE 15 - Fluoride
Superphosphate Scrubber Inlet
(Metric)

Run Number	1	2	3
Date	6-20-73	6-21-73	6-21-73
Volume of Gas Sampled - Nm ³ (a)	1.25	1.33	1.21
Percent Moisture by Volume	12.1	9.8	8.8
Average Stack Temperature - °C	54	54	54
Stack Volumetric Flow Rate - Nm ³ /min. (b)	129.5	130.4	127.7
Stack Volumetric Flow Rate - m ³ /min. (c)	167.2	164.2	159.0
Percent Isokinetic	98.4	103.4	95.9

Feed Rate - Mton/hr	18.2	18.2	18.2
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Soluble Fluoride

mg	11,600	8,990	6,350
mg/Nm ³	9,221	6,750	5,262
mg/m ³	7139	5354	4233
kg/hr	71.7	52.9	40.4
kg/Mton	4.0	2.9	2.2

Total Fluoride

mg	11,816	>9,140	7,300
mg/Nm ³	9,404	6,864	6,040
mg/m ³	7,276	5445	4851
kg/hr	73.2	53.8	46.4
kg/Mton	4.0	2.9	2.5

^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

TABLE 16 - Fluoride
Superphosphate Scrubber Outlet
(Metric)

<u>Run Number</u>	1	2	3
Date	6-20-73	6-21-73	6-21-73
Volume of Gas Sampled - Nm ³ (a)	1.49	1.39	1.46
Percent Moisture by Volume	15.4	14.9	15.7
Average Stack Temperature - °C	56.3	53.8	54.8
Stack Volumetric Flow Rate - Nm ³ /min. (b)	109.3	99.34	104.8
Stack Volumetric Flow Rate - m ³ /min. (c)	146.6	131.5	140.2
Percent Isokinetic	95.7	99.1	97.9
Feed Rate - Mton/hr	18.2	18.2	18.2
<u>Soluble Fluoride</u>			
mg	397.3	299.3	174.8
mg/Nm ³	265	215	119
mg/m ³	198	162	89.0
kg/hr	1.74	1.28	0.754
kg/Mton	0.096	0.070	0.042
<u>Total Fluoride</u>			
mg	408.4	306.0	176.4
mg/Nm ³	275	219	121
mg/m ³	205	165	89.9
kg/hr	1.80	1.31	0.758
kg/Mton	0.099	0.071	0.042

^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

TABLE 17 - Fluoride
Ammoniator Scrubber Inlet
(Metric)

<u>Run Number</u>	2	3
Date	6-21-73	6-21-73
Volume of Gas Sampled - Nm^3 (a)	0.863	0.872
Percent Moisture by Volume	9.3	11.2
Average Stack Temperature - $^{\circ}\text{C}$	44.4	47.8
Stack Volumetric Flow Rate - $\frac{\text{Nm}^3}{\text{min.}}$ (b)	224.8	226.1
Stack Volumetric Flow Rate - $\frac{\text{m}^3}{\text{min.}}$ (c)	277.4	284.4
Percent Isokinetic	104.4	103.4
Feed Rate - Mton/hr	27.3	27.3
<u>Soluble Fluoride</u>		
mg	12.5	12.6
mg/Nm^3	14.5	14.4
mg/m^3	11.9	11.4
kg/hr	0.195	0.195
kg/Mton	0.0071	0.0072
<u>Total Fluoride</u>		
mg	30.9	50.8
mg/Nm^3	35.7	58.1
mg/m^3	29.3	46.2
kg/hr	0.481	0.790
kg/Mton	0.018	0.030

^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

TABLE 18 - Fluoride
Ammoniator Scrubber Outlet
(Metric)

Run Number	1	2	3
Date	6-20-73	6-21-73	6-21-73
Volume of Gas Sampled - Nm ³ (a)	1.38+0.760	3.68	3.12
Percent Moisture by Volume	4.5	5.9	6.6
Average Stack Temperature - °C	49	49	49
Stack Volumetric Flow Rate - Nm ³ /min. (b)	185.3	218.4	211.5
Stack Volumetric Flow Rate - m ³ /min. (c)	211.8	253.3	247.1
Percent Isokinetic	79.2+84.8 ^d	89.9	76.7
Feed Rate - Mton/hr	27.3	27.3	27.3
<u>Soluble Fluoride</u>			
mg	2.36	0.48	0.96
mg/Nm ³	1.10	0.130	0.307
mg/m ³	0.961	0.112	0.263
kg/hr	61.5	8.58	19.6
kg/Mton	0.00045	0.000062	0.000143
<u>Total Fluoride</u>			
mg	2.67	1.70	1.54
mg/Nm ³	1.24	0.460	0.490
mg/m ³	1.09	0.396	0.419
kg/hr	69.8	30.4	31.3
kg/Mton	0.00051	0.00022	0.00023

^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

^d Separate calculations in two portions of test due to nozzle change.

TABLE 19 - Ammonia
Ammoniator Scrubber Inlet
(Metric)

<u>Run Number</u>	1	2	3
Date	6-21-73	6-22-73	6-22-73
Volume of Gas Sampled - Nm ³ (a)	0.848	0.722	0.682
Percent Moisture by Volume	11.5	9.4	13.1
Average Stack Temperature - °C	49.0	44.6	48.8
Stack Volumetric Flow Rate - Nm ³ /min. (b)	210.5	186.4	183.6
Stack Volumetric Flow Rate - m ³ /min. (c)	265.7	226.1	235.4
Percent Isokinetic	109.5	108.7	101.1
Feed Rate - Mton/hr	27.3	27.3	27.3
<u>Ammonia</u>			
mg	7,300	9,800	4,900
mg/Nm ³	8580	13,545	7161
mg/m ³	6795	11,143	5583
kg/hr	108.5	151.6	79.0
kg/Mton	4.0	5.6	2.9

^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.

TABLE 20 - Ammonia
Ammoniator Scrubber Outlet
(Metric)

<u>Run Number</u>	1	2	3
Date	6-21-73	6-22-73	6-22-73
Volume of Gas Sampled - Nm ³ (a)	1.81	1.91	1.35
Percent Moisture by Volume	7.6	7.1	8.2
Average Stack Temperature - °C	49	49	49
Stack Volumetric Flow Rate - Nm ³ /min. (b)	210.7	215.1	212.8
Stack Volumetric Flow Rate - m ³ /min. (c)	248.8	252.0	252.6
Percent Isokinetic	91.1	94.4	69.5
Feed Rate - Mton/hr	27.3	27.3	27.3
<u>Ammonia</u>			
mg	4,000	4,000	4,600
mg/Nm ³	2,210	2,087	3,409
mg/m ³	1,869	1,780	2,860
kg/hr	28.0	27.0	43.6
kg/Mton	1.1	1.0	1.6

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.

DISCUSSION OF RESULTS

It was possible to monitor the velocity head only at the NSP scrubber outlet. At the ammoniator scrubber outlet, the stack pressure was too high to allow a continuous reading of velocity. At both of the scrubber inlets, the pitot tubes were constantly being plugged because of the high particulate concentration. In order to get isokinetic flow, a preliminary traverse was done just prior to each test run and these values of velocity head were used.

At the ammoniator scrubber outlet, a suitable length of tygon tubing was used to connect the sampling probe to the impinger box while doing the vertical traverse. This was done because there was no other way to sample the vertical port. This left a length of about five feet between the probe and the impinger box which was unheated. During the horizontal traverse, the probe was connected directly to the impinger box. Vertical and horizontal sampling was done for the particulate and the fluoride tests but only horizontal sampling was done for ammonia.

Because of the location of the ammonia scrubber inlet duct, it could only be sampled across one diameter, that being the horizontal diameter. Also, at the ammoniator scrubber inlet, the probe plugged often. This made it necessary to interrupt sampling to wash out the probe. The probe first plugged with ten minutes remaining in run number 2 for particulates. The contractors were told to end run 2 at that point. The probe plugged more frequently during run number 3 particulates but the run was completed.

PROCESS DESCRIPTION AND OPERATION

The IMC Rainbow Division's, Americus, Georgia, plant produces several grades of NPK fertilizer. During the tests, the plant was manufacturing mainly the product grade 5-10-15; i.e., 5% nitrogen (N_2), 10% (APA) available phosphoric acid expressed as P_2O_5 , and 15% potassium expressed as K_2O . This product is made by mixing raw materials in a reaction vessel, known as an ammoniator, with subsequent drying of the granules.

The normal superphosphate is produced in the plant by reacting phosphate rock and sulfuric acid.

Gases from the ammoniator are treated in a high-pressure Venturi scrubber which removes ammonia, fluorides, and particulate. The presence of the ammonia is due to the fact that anhydrous ammonia is used to react with the phosphate part of superphosphate. Since the phosphate might not react with all the ammonia, sulfuric acid is added to pick up the ammonia in excess.

Gases from the normal superphosphate are heated in two Schuette and Koerting scrubbers in series for removal of particulates and fluorides.

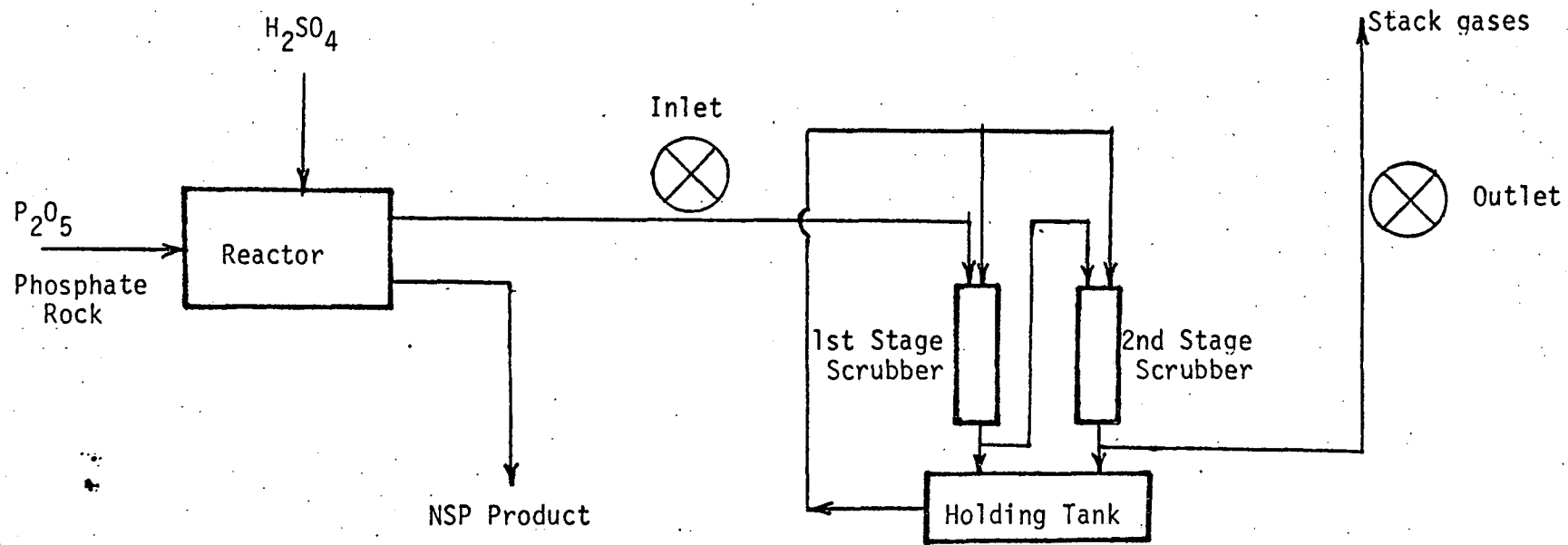
Run number 1 for fluorides was voided because the probe was plugged every three minutes. Beginning with run number 2 for fluorides, the nozzle diameter was changed from .25 to .1875 inches and the sampling time was reduced from two hours to one hour. Whenever the probe plugged, sampling was interrupted and the probe was washed with distilled water. The washings were saved for analysis.

At the NSP scrubber inlet, the probe became plugged. At the midpoint of each run, it was necessary to wash the probe with distilled water. The wash was saved as part of sample to be analyzed.

Run number 2 for fluorides had to be interrupted temporarily because the plant had to shut down at the ammoniator because of an acid leak. The plant was down for about fifteen minutes. Later, the plant went down because the acid line was plugged. It was down for about two hours.

Five test runs, all at the ammoniator outlet, were less than 90 percent isokinetic. Runs 1, 2, and 3 for fluorides, Run 3 for ammonia, and Run 2 for particulate all were under isokinetic because of difficulty in maintaining the desired sample flow rate.

On June 20, 1973, the Brinks Model B Cascade impactor was used to determine particle size distribution at the ammoniator scrubber outlet. At first, the test was run for fifteen minutes isokinetically. The impactor was disassembled and nothing was caught. The impactor was later run for thirty minutes at an underisokinetic rate. Again, nothing was obtained. The reason for getting nothing in the impactor was because the stack gas was moist and the nozzle plugged.



Sampling
Points



Figure 1. Normal Superphosphate Process

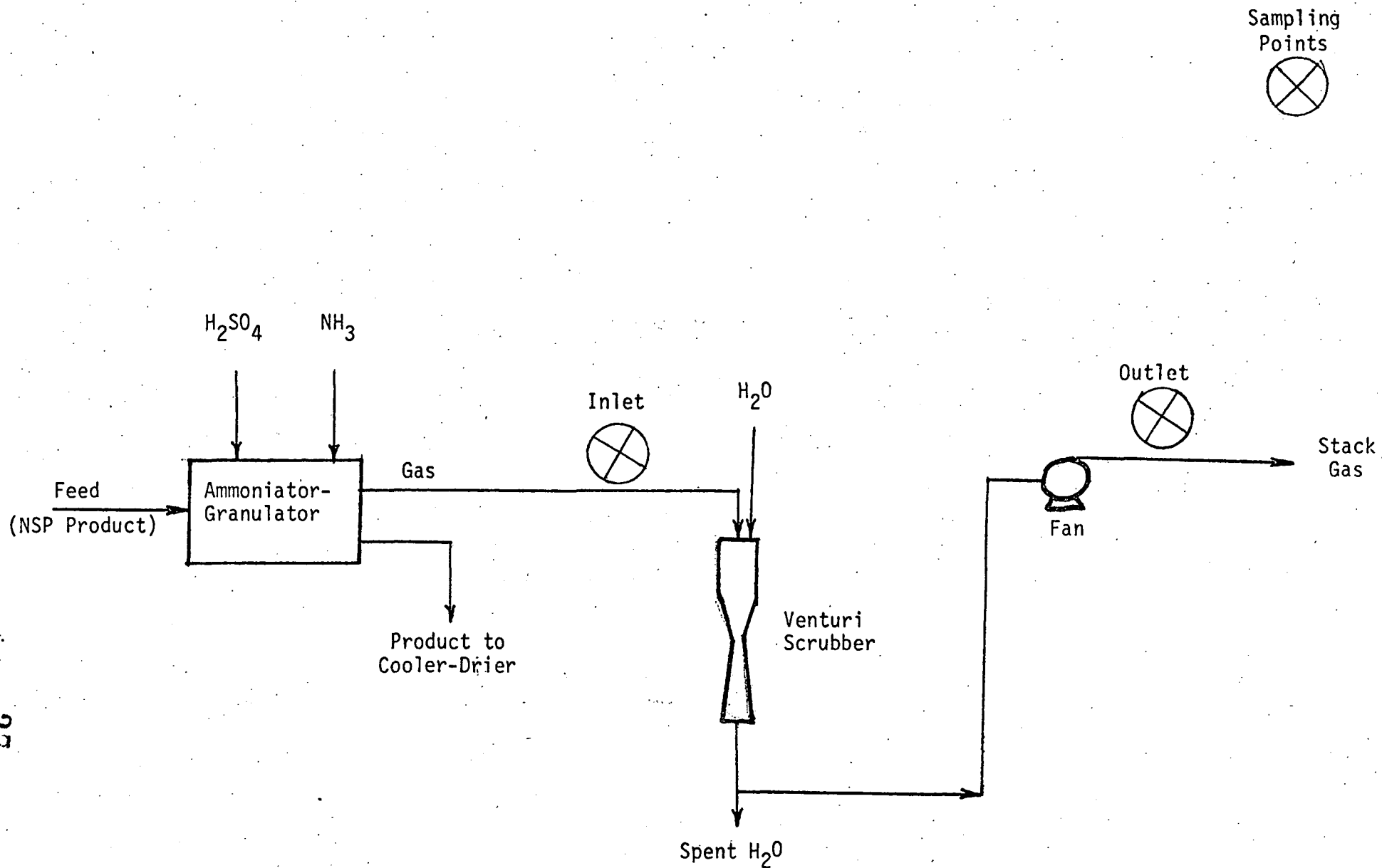


Figure 2. Ammoniator-Granulator Process

SAMPLING AND ANALYTICAL PROCEDURE

Particulate tests were run in accordance with Method 5 as described in the August 17, 1971, Federal Register.

Fluoride tests were run in accordance with tentative Method 13, included in Appendix F. The sample is captured in a modified Method 5 train and analyzed by the SPADNS-Zirconium Lake Method.

Ammonia tests were run according to the method described in Appendix F. The sample is captured in a modified Method 5 train, in a sulfuric acid solution.

Any departures from these methods are described in the "Summary and Discussion of Results."

Distance to nearest upstream disturbance: 10 feet
Type of disturbance: bend

Distance to nearest downstream disturbance: 3 feet
Type of disturbance: junction

Inside diameter of duct: 29 inches
Number of traverse points: 44

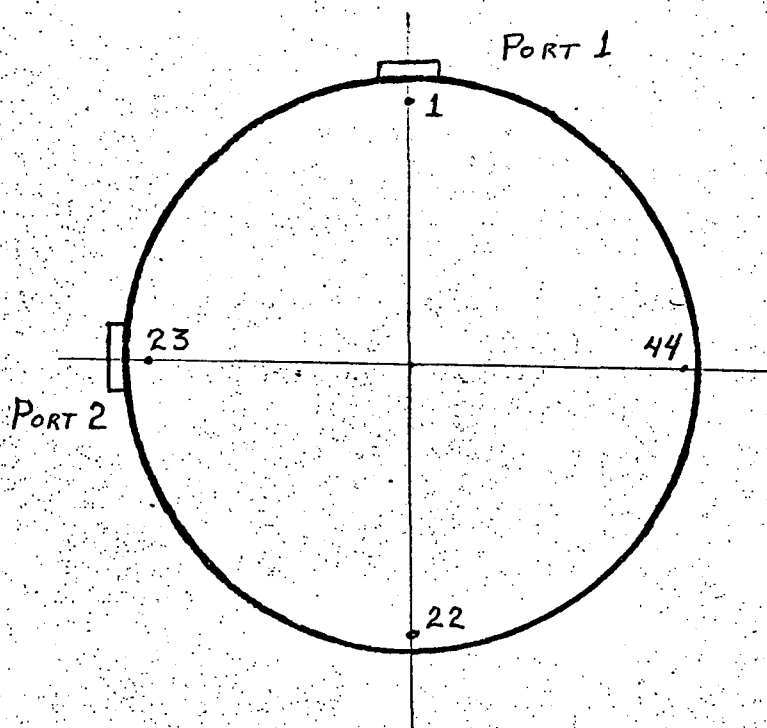


Figure 3
Location of Traverse Points
Inlet of Superphosphate Scrubber

Distance to nearest upstream disturbance: 80 inches
Type of disturbance: junction

Distance to nearest downstream disturbance: 70 feet
Type of disturbance: stack outlet

Inside diameter of duct: 23 inches
Number of traverse points: 20

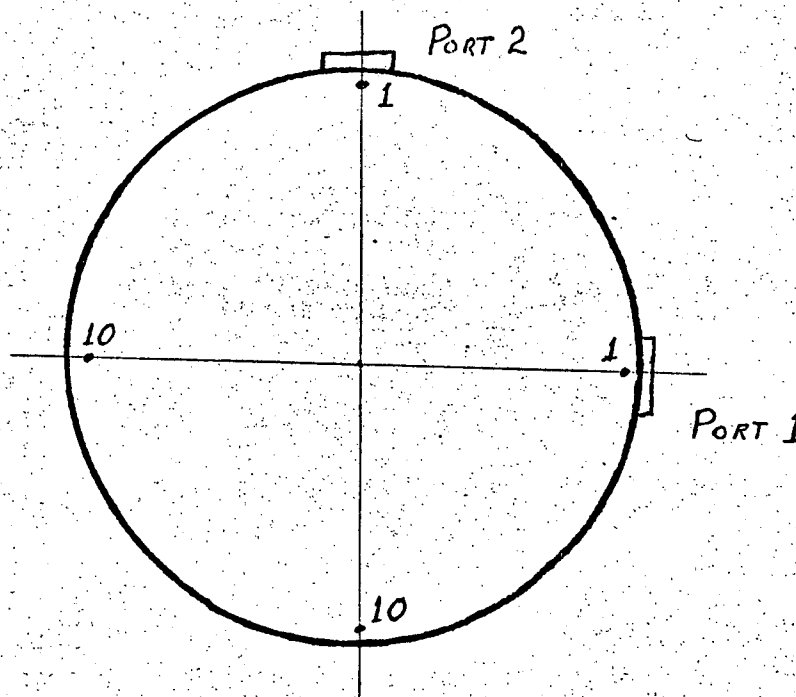


Figure 4
Location of Traverse Points
Outlet of Superphosphate Scrubber

Distance to nearest upstream disturbance: 6 feet
Type of disturbance: fan

Distance to nearest downstream disturbance: 6 feet
Type of disturbance: ammoniator

Inside diameter of duct: 24 inches
Number of traverse points: 12

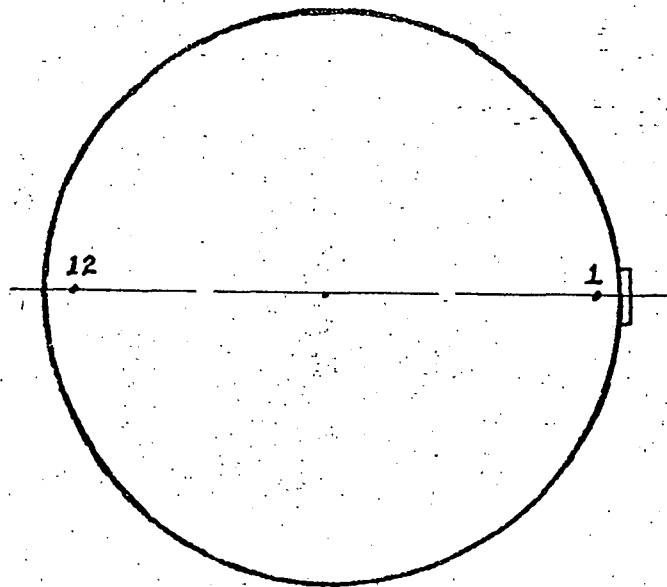


Figure 5
Location of Traverse Points
Inlet of Ammoniator Scrubber

Distance to nearest upstream disturbance: 30 feet
Type of disturbance: elbow

Distance to nearest downstream disturbance: 5 feet
Type of disturbance: damper

Inside diameter of duct: 20 inches
Number of traverse points: 12

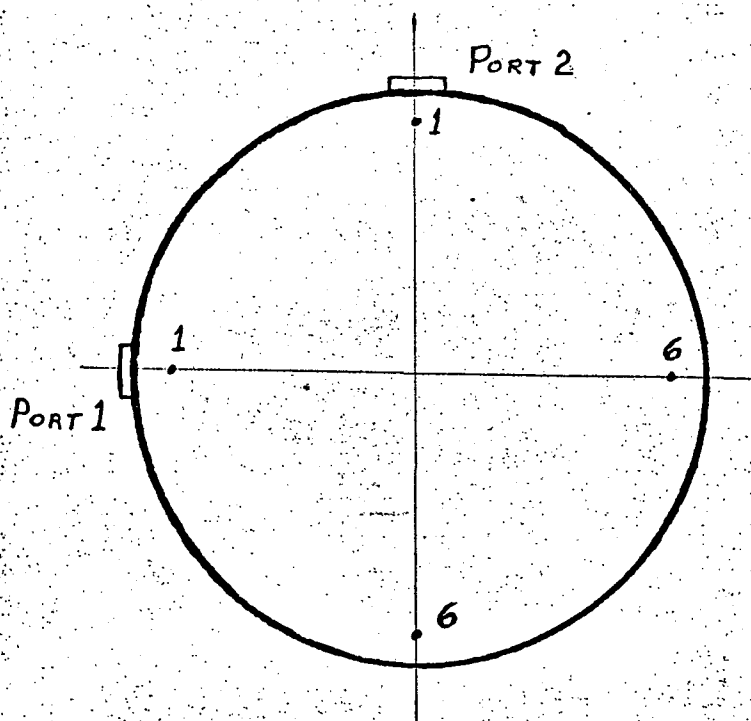


Figure 6
Location of Traverse Points
Outlet of Ammoniator Scrubber