MEMORANDUM

TO: John Reynolds

FROM: Bill Proses

DATE: June 14, 1996

SUBJECT: Sulfuric Acid Plant Compliance Test Reports

Bill Thomas requested that I send you the attached compliance tests. I hope they provide the information you need.

CMCM

CARGILL
FERTILIZER, INC.

P.O. Box 9002 - Bartow, Florida 33830 - Telephone 941-534-9610 - FAX 941-534-9680

Certified Mail P 013 142 583

Febuary 27, 1996

Mr. B. Proses
Florida Dept, of Environmental Protection
3804 Coconut Palm Drive
Tampa, Florida 33619

Subject: Cargill Fertilizer, Inc Testing - Bartow Plant
Compliance Test Results
#5 SULFURIC ACID PLANT AC53-271436
AIRS 105-0046-033

Dear Sir:

Please find enclosed a copy of the compliance test conducted on the aboved mentioned facility. As noted in the tests the facility was well within the limits of the permit.

If you have any questions or need additional information, feel free to give me a call at (813) 534-9616.

Sincerely,

David Blanc
Environmental Specialist

EMISSIONS TESTING
of the
CARGILL FERTILIZER, INC.
SULFURIC ACID PLANT NO. 5
Bartow, Florida

January 29, 1996

FDEP Permit No. AC53-271436

SES Reference No. 95S270

Project Participants

Byron E. Nelson
Mark S. Gierke
David W. Nichols

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

EMISSIONS TESTING
of the
CARGILL FERTILIZER, INC.
SULFURIC ACID PLANT NO. 5
Bartow, Florida

January 29, 1996

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Calibration Data
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1.0 INTRODUCTION

Southern Environmental Sciences, Inc. conducted sulfur dioxide, sulfuric acid mist, and nitrogen oxides emissions tests and a visible emissions evaluation of the Cargill Fertilizer, Inc. Sulfuric Acid Plant No. 5 on January 29, 1996. This plant is located on State Road 60, West of Bartow, Florida. Testing was performed to determine if the plant was operating in compliance with requirements of the Florida Department of Environmental Protection (FDEP).

2.0 SUMMARY OF RESULTS

The plant was found to be in compliance with all applicable emission limiting standards. Results of the nitrogen oxides, sulfur dioxide and sulfuric acid mist tests are summarized in Table 1.

Allowable sulfur dioxide emissions from this source are limited to a maximum of 4 pounds per ton of 100% sulfuric acid produced and 433.3 pounds per hour. The average measured sulfur dioxide emission rate was 3.55 pounds per ton of 100% sulfuric acid produced and 327.3 pounds per hour.

Allowable sulfuric acid mist emissions from this source are limited to a maximum of 0.15 pounds per ton of 100% sulfuric acid produced and 16.25 pounds per hour. The average measured sulfuric acid mist emission rate was 0.02 pounds per ton of 100% sulfuric acid produced and 1.52 pounds per hour.

TABLE 1. EMISSIONS TEST SUMMARY

Company: CARGILL FERTILIZER, INC.
Source: Bartow - Sulfuric Acid Plant No. 5

	Run 1	Run 2	Run 3
Date of Run	01/29/96	01/29/96	01/29/96
Production Rate (TPH 100% Acid)	92.3	92.3	92.3
Start Time (24-hr. clock)	0946	1125	1254
End Time (24-hr. clock)	1049	1227	1356
Vol. Dry Gas Sampled Meter Cond. (DCF)	53.102	53.565	53.914
Gas Meter Calibration Factor	1.010	1.010	1.010
Barometric Pressure at Barom. (in. Hg.)	30.12	30.12	30.12
Elev. Diff. Manom. to Barom. (ft.)	190	190	190
Vol. Gas Sampled Std. Cond. (DSCF)	54.138	53.929	53.928
Vol. Liquid Collected Std. Cond. (SCF)	0.00	0.00	0.00
Moisture in Stack Gas (% Vol.)	0.00	0.00	0.00
Molecular Weight Dry Stack Gas	30.00	30.00	30.00
Molecular Weight Wet Stack Gas	30.00	30.00	30.00
Stack Gas Static Press. (in. H2O gauge)	-0.41	-0.43	-0.40
Stack Gas Static Press. (in. Hg. abs.)	29.90	29.90	29.90
Average Square Root Velocity Head	0.840	0.829	0.830
Average Orifice Differential (in. H2O)	2.531	2.577	2.628
Average Gas Meter Temperature (°F)	66.5	73.2	76.8
Average Stack Gas Temperature (°F)	149.9	150.3	151.7
Pitot Tube Coefficient	0.84	0.84	0.84
Stack Gas Vel. Stack Cond. (ft./sec.)	49.75	49.13	49.23
Effective Stack Area (sq. ft.)	35.78	35.78	35.78
Stack Gas Flow Rate Std. Cond. (DSCFM)	92,411	91,193	91,179
Stack Gas Flow Rate Stack Cond. (ACFM)	106,820	105,482	105,704
Net Time of Run (min.)	60	60	60
Nozzle Diameter (in.)	0.250	0.250	0.250
Percent Isokinetic	102.6	103.5	103.5

$\frac{328\ lb/hr \times 60}{92{,}000\ DSCM} = 0.21\ \frac{lb}{scf}$

TABLE 1. EMISSIONS TEST SUMMARY (con't)

Company: CARGILL FERTILIZER, INC.
Source: Bartow - Sulfuric Acid Plant No. 5

	Run 1	Run 2	Run 3	
Date of Run	01/29/96	01/29/96	01/29/96	
Production Rate (TPH 100% Acid)	92.3	92.3	92.3	
Start Time (24-hr. clock)	0946	1125	1254	
End Time (24-hr. clock)	1049	1227	1356	
				Average
H_2SO_4 Emissions (lb./hr.)	**1.60**	**1.59**	**1.36**	**1.52**
H_2SO_4 Emissions (lb./ton of 100% acid)	**0.017**	**0.017**	**0.015**	**0.02**
Allowable H_2SO_4 Emissions (lbs./hr.)				**16.25**
Allowable H_2SO_4 Emissions (lb./ton of 100% acid)				**0.15**
SO_2 Emissions (lb./hr.)	**329.5**	**326.5**	**326.00**	**327.3**
SO_2 Emissions (lb./ton of 100% acid)	**3.57**	**3.54**	**3.53**	**3.55**
Allowable SO_2 Emissions (lbs./hr.)				**433.3**
Allowable SO_2 Emissions (lbs./ton of 100% acid)				**4.0**
Method 8 Measured SO_2 Conc. (PPM)	**358**	**359**	**359**	**359**
Continuous Monitor SO_2 Conc. (PPM)	**370**	**370**	**370**	**370**
Percent Difference	**3.4**	**3.0**	**3.1**	**3.2**
NOx Emissions (ppm)	**14.6**	**15.8**	**16.8**	**16**
NOx Emissions (lb./hr.)	**9.7**	**10.3**	**10.9**	**10.3**
NOx Emissions (lbs/ton of 100% acid)	**0.10**	**0.11**	**0.12**	**0.11**
Allowable NOx Emissions (lbs./hr.)				**13**
Allowable NOx Emissions (lbs./ton of 100% acid)				**0.12**

Note: Standard conditions 68°F, 29.92 in. Hg

The allowable nitrogen oxides emission rate for this source is 0.12 pounds per ton of 100% sulfuric acid produced and 13 pounds per hour. The average measured nitrogen oxides emission rate was 0.11 pounds per ton of 100% sulfuric acid produced and 10.3 pounds per hour.

A visible emissions evaluation was performed over a one hour period. The maximum opacity observed was zero percent with a maximum 6 minute average of zero percent, well within the allowable limit of ten percent.

3.0 PROCESS DESCRIPTION

The No. 5 Sulfuric Acid plant is a 2600 TPD (approximately) sulfur-burning, add-on double-conversion, double-absorption plant of Leonard-Monsanto design. Sulfur is burned with dried atmospheric oxygen to produce sulfur dioxide (SO_2). The sulfur dioxide is catalytically oxidized to sulfur trioxide (SO_3) over a vanadium pentoxide catalyst bed. The sulfur trioxide so produced is absorbed in 98% sulfuric acid. The acid flows from each absorbing tower are combined to provide product acid. By the use of an intermediate absorbing tower, the partial pressure of sulfur dioxide in the final converter is increased to drive the conversion reaction to a greater degree of completion, thus providing greater efficiency and cleaner atmospheric emissions.

The permitted process rate for this source is 2600 tons per day, based upon 100 percent H_2SO_4. Process rates during the test period were determined by plant personnel.

4.0 SAMPLING PROCEDURES

4.1 Methods

All sampling was performed using methods currently acceptable to the FDEP. Sulfur dioxide and sulfuric acid mist sampling and analyses were conducted in accordance with EPA Method 8 - Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions from Stationary Sources, 40 CFR 60, Appendix A. Nitrogen oxides sampling was conducted in accordance with EPA Method 7E - Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure), 40 CFR 60, Appendix A. The visible emissions evaluation was performed using procedures described in EPA Method 9 - Visual Determination of the Opacity of Emissions from Stationary Sources, 40 CFR 60, Appendix A.

The effluent gas stream was considered to be dry and the water vapor volume and moisture content were assumed to be zero percent as described in section 6.4 of EPA Method 8.

4.2 Sampling Locations

Locations of the sample ports and stack dimensions are shown in Figure 1. Sulfuric acid mist and sulfur dioxide emissions were sampled by conducting horizontal traverses through each of two ports located at a ninety degree angle from one another on the circular stack. Twenty four sample points were chosen in accordance with EPA Method 1 - Sample and Velocity Traverses for Stationary Sources, 40 CFR 60, Appendix A.

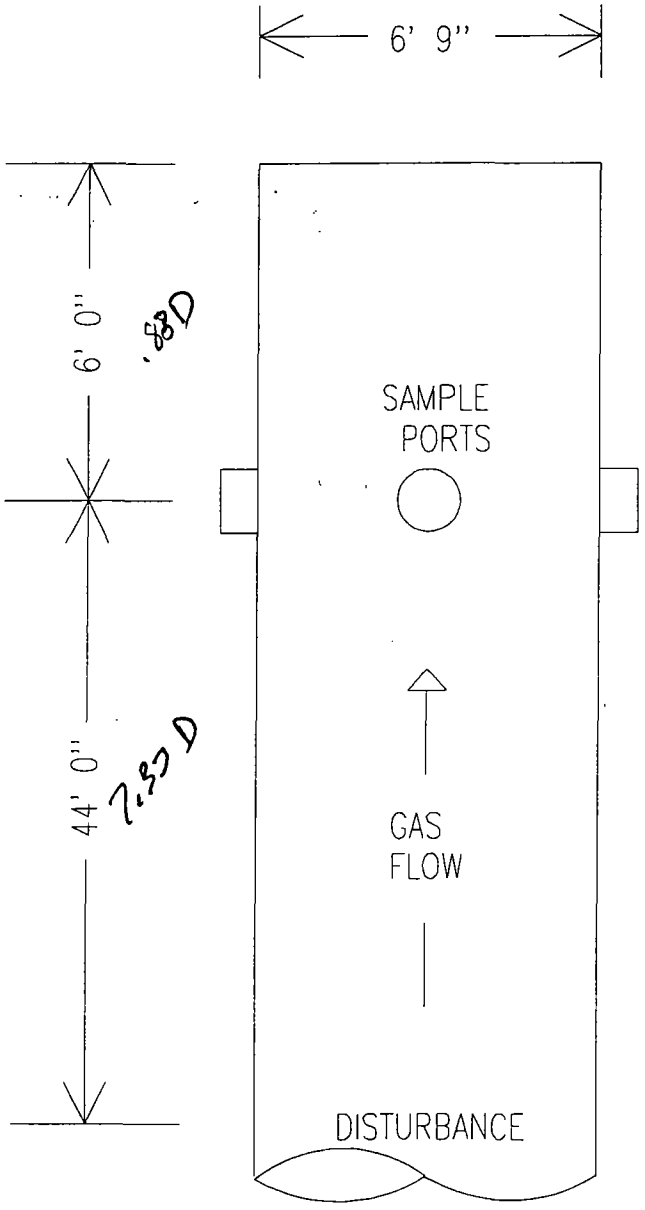


Figure 1. Stack Dimensions and Sample Port Locations, Cargill Fertilizer, Inc., Sulfuric Acid Plant No. 5, Bartow, Florida.

Nitrogen oxides sampling was performed from the same sampling ports as the sulfuric acid mist and sulfur dioxide sampling.

4.3 Sampling Trains

The sulfuric acid mist and sulfur dioxide sampling train consisted of a stainless steel nozzle, a Nutech Corporation 8 foot heated borosilicate glass lined probe, a glass filter bypass tube, a glass fiber filter and four impingers arranged as shown in Figure 2. The first impinger was charged with 100 milliliters of 80 percent isopropanol. The second and third impingers were each charged with 100 milliliters of 3 percent hydrogen peroxide and the fourth impinger was charged with indicating silica gel desiccant. The impingers were cooled in an ice and water bath during sampling. A Nutech Corporation control console was used to monitor the gas flow rates and stack conditions during sampling.

The nitrogen oxides sampling train consisted of a stainless steel probe, heated teflon sample line, condenser and a Thermo Environmental Instruments, Inc. Model 10S Chemiluminescent NO/NO_x Analyzer.

4.4 Sample Collection

Prior to sulfuric acid mist and sulfur dioxide sampling, the pitot tubes were checked for leaks and the manometers were zeroed. A pretest leak check of the sample line was conducted by sealing the nozzle and applying a 15" Hg vacuum. A leak rate of less than 0.02 cubic feet per minute (CFM) was considered acceptable. Sample was collected

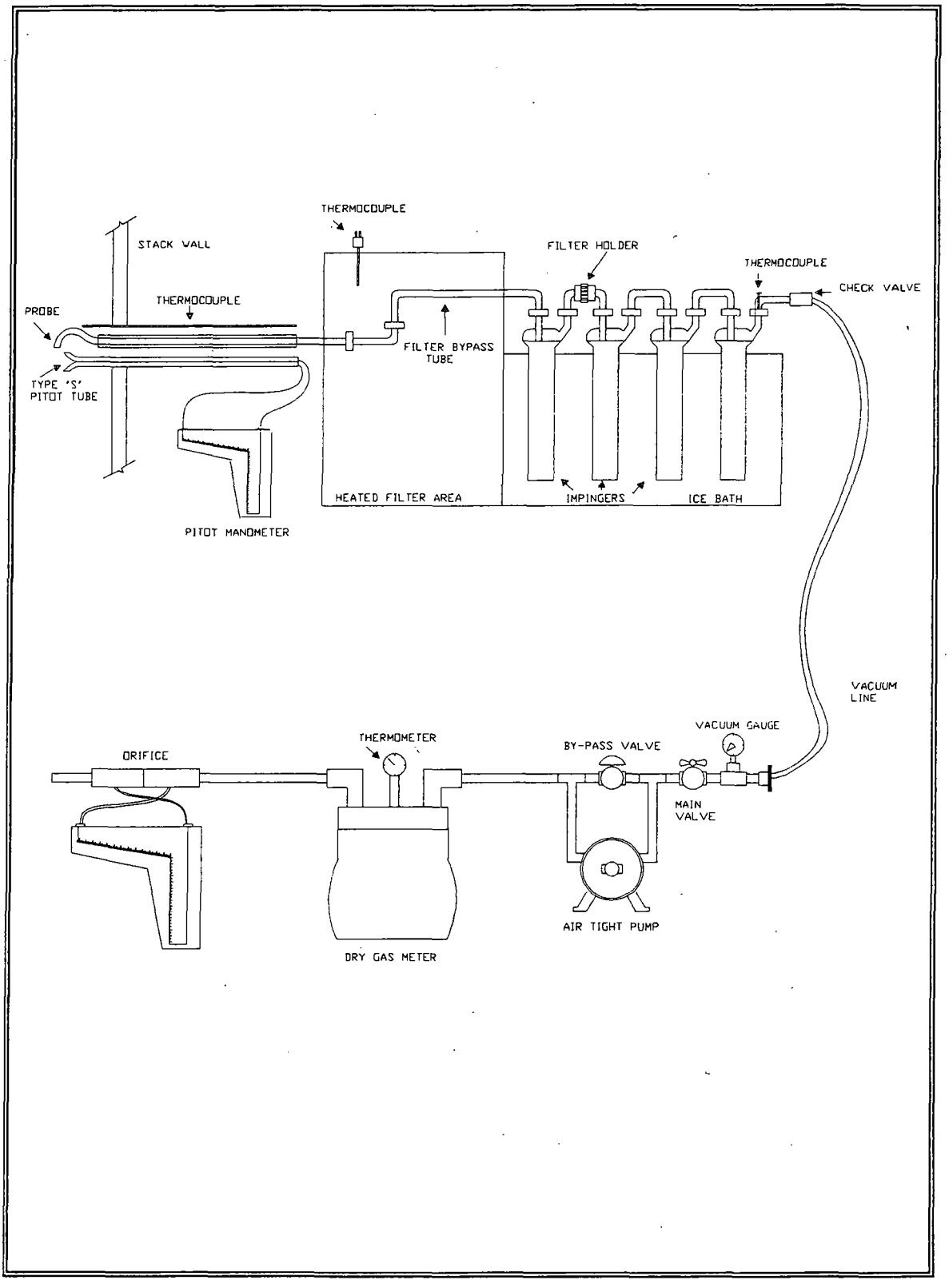


Figure 2. EPA Method 8 Sampling Train.

isokinetically for two and one half minutes at each of the points sampled.

The nitrogen oxides analyzer was calibrated immediately prior to the beginning of the test by introducing known gases into the instrument through the sampling system. Zero and a mid-range calibration gas were introduced after each run to check for instrument drift.

Nitrogen oxides sampling was conducted simultaneously with sulfuric acid mist and sulfur dioxide.

4.5 Sample Recovery

A post test leak check of the sulfuric acid mist and sulfur dioxide sampling train was performed at the completion of each run by sealing the nozzle and applying a vacuum equal to or greater than the maximum value reached during the sample run. A leak rate of less than 0.02 CFM or 4 percent of the average sampling rate (whichever was less) was considered acceptable. The probe was then disconnected, the ice bath was drained and the remaining part of the sample train was purged by drawing charcoal filtered air through the system for fifteen minutes at the average flow rate used during sampling. The nozzle and probe were then rinsed with 80 percent isopropanol and the rinsings were placed into a clean polyethylene container along with the contents of the first impinger. The glass fiber filter was removed from the holder with forceps and placed in the same container. The filter bypass tube, first impinger, front half of the filter holder and associated connecting glassware were then rinsed with 80 percent isopropanol and the

rinsings were added to the above container. The second and third impingers, associated connecting glassware, and back half of the filter holder were rinsed with distilled, deionized water into a clean polyethylene container. This container also held the impinger solutions for transportation back to the laboratory for subsequent analysis.

5.0 ANALYTICAL PROCEDURE

5.1 Pretest Preparation

The 3 percent hydrogen peroxide solution was prepared from 30 percent reagent grade hydrogen peroxide and distilled, deionized water on the morning of the test. The 80 percent isopropanol solution was prepared from 100 percent reagent grade isopropanol and distilled, deionized water. Both solutions were kept and transported on ice to and from the sampling location. The impingers were charged as described in section 4.3.

5.2 Analysis

After recovery, the samples were analyzed using procedures outlined in EPA Method 8 - Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions From Stationary Sources, 40 CFR 60, Appendix A. Duplicate titration results were obtained in milliliters of barium perchlorate titrant. The averages of these titration values were used to compute the sulfur dioxide and sulfuric acid mist concentrations.

APPENDIX

Project Participants

Certification

Visible Emissions Evaluation

Process Operational Data

Laboratory Data

Field Data Sheets

Calibration Data

Calculations and Symbols

PROJECT PARTICIPANTS AND CERTIFICATION

CARGILL FERTILIZER, INC.
Sulfuric Acid Plant No. 5

Bartow, Florida

January 29, 1996

Project Participants:

Byron E. Nelson Mark S. Gierke David W. Nichols	Conducted the field testing.
Byron E. Nelson	Performed the visible emissions evaluation.
David Blanc (Cargill)	Provided process rates.
R.E. Burk (Cargill)	Performed laboratory analyses.
Kenneth M. Roberts	Computed test results.
Kenneth M. Roberts	Prepared the final test report.

Certification:

I certify that to my knowledge all data submitted in this report is true and correct.

Kenneth M. Roberts

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

1204 North Wheeler Street, Plant City, Florida 33566 (813)752-5014

VISIBLE EMISSIONS EVALUATION

COMPANY: Cargill Fertilizer

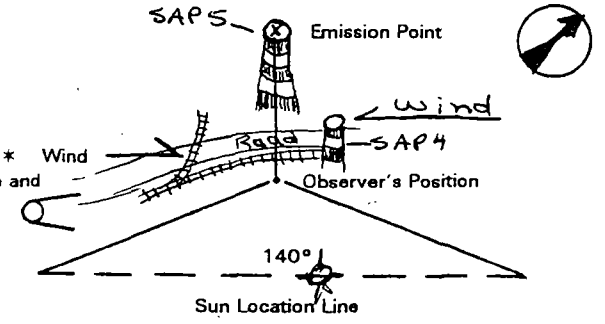
UNIT: Sulfuric Acid Plant No. 5

ADDRESS: Highway 60 West

Bartow, Florida

PERMIT NO. AC 53-271436	COMPLIANCE? YES ☑ NO ☐
PROCESS RATE 92.3 TPH 100% Acid	PERMITTED RATE 108.3 TPH (2600 TPD)
PROCESS EQUIPMENT: Sulfuric acid plant	
CONTROL EQUIPMENT: Double absorption	
OPERATING MODE: Continuous	AMBIENT TEMP. (°F) START ~65 STOP ~70
HEIGHT ABOVE GROUND LEVEL START ~200' STOP ~200'	HEIGHT REL. TO OBSERVER START ~200' STOP ~200'
DISTANCE FROM OBSERVER START ~500' STOP ~500'	DIRECTION FROM OBSERVER START 315° STOP 315°
EMISSION COLOR: None	PLUME TYPE: NA CONTIN. ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT NO ☑ YES ☐	IS WATER DROPLET PLUME ATTACHED ☐ DETACHED ☐ NA
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED START: Stack exit STOP: Stack exit	
DESCRIBE BACKGROUND START: Sky STOP: Sky	
BACKGROUND COLOR START White STOP White	SKY CONDITIONS START 70% Clouds STOP 70% Clouds
WIND SPEED (MPH) START 3-5 STOP 3-5	WIND DIRECTION START NE STOP NE
AVERAGE OPACITY FOR HIGHEST PERIOD 0%	RANGE OF OPAC. READINGS MIN. 0% MAX. 0%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



COMMENTS

OBSERVATION DATE	START TIME	STOP TIME
1/29/96	0946	1046

SEC MIN	0	15	30	45	SEC MIN	0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0

Observer: Byron Nelson

Certified by: FDEP Thru ETA Certified at: Tampa Florida

Date Certified: 8/30/95 Exp. Date: 3/1/96

I certify that all data provided to the person conducting the test was true and correct to the best of my knowledge:

Signature:

Title:

PROCESS OPERATIONAL DATA

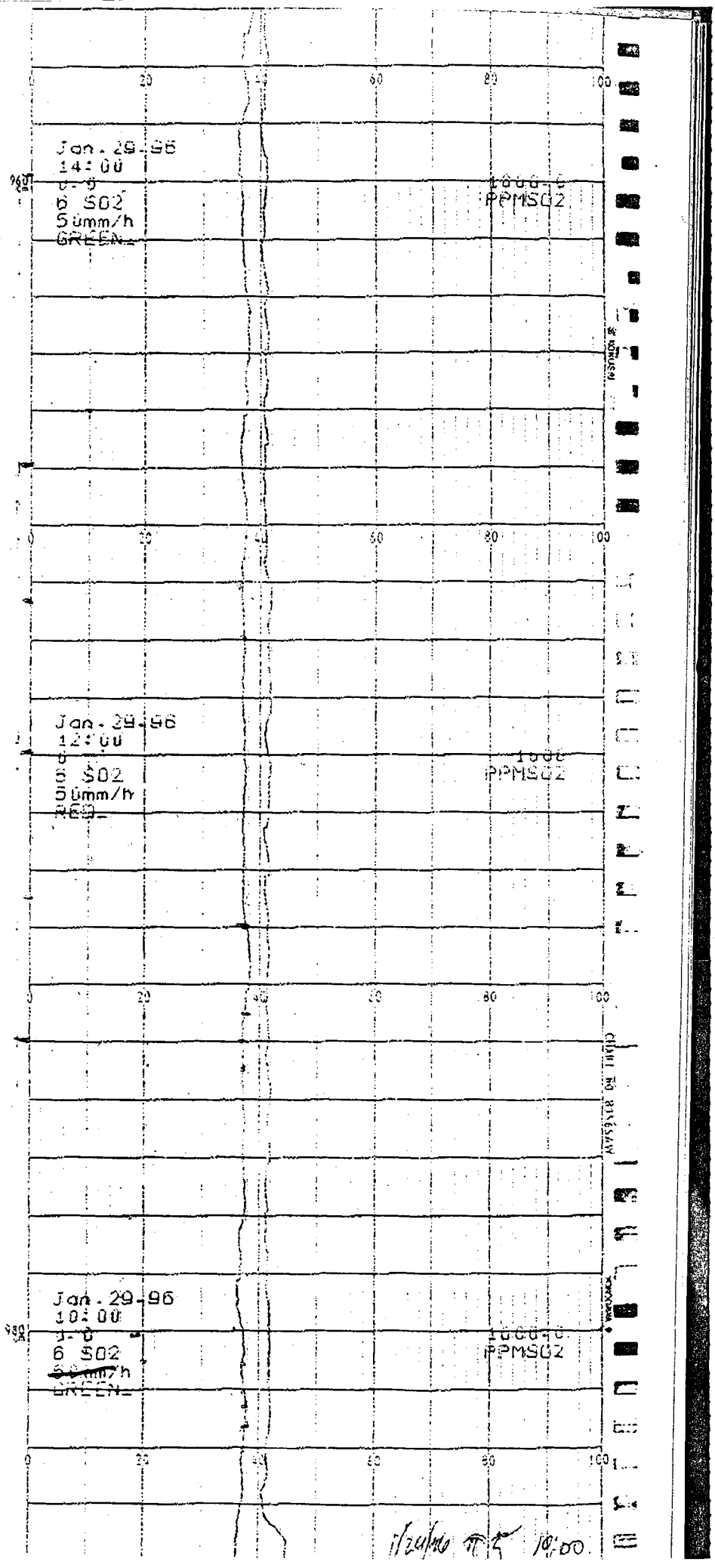
Plant Name: Cargill Fertilizer, Inc. Bartow, FL
Test For: Sulfur Dioxide and Acid Mist Time Sampled: 9:45 - 1:45
Test Date: January 29, 1996
Source ID: #5 SULFURIC ACID PLANT Test Type: Compliance Test
Test Conducted By: Southern Environmental Sciences, Inc.

#5 SULFURIC ACID PLANT (5SAP)

PARAMETERS	UNITS	9:45am	10:45am	11:45am	12:45pm	1:45pm		Average
PRODUCTION RATE	TPH	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	92.3
TURBO BLOWER								
RPM	cycles/min	4110	4110	4110	4110	4110		4110
Outlet Press. H20	H20	250	250	250	250	250		250
ABSORB TOWER								
Acid In <85	C	72	72	72	72	72		72
FINAL TOWER								
Acid Temp In <112	C	86	86	86	86	86		86
Acid Temp Out <85	C	64	64	64	65	65		64.4
Water Temp In	C	27	27	27	30	30		28.2
Water Temp Out	C	40	40	40	44	44		41.6
DRYING TOWER								
Acid In Temp	C	56	56	56	59	59		57.2
Acid Temp Out <60	C	29	29	29	32	32		30.2
SULFUR BURNER								
Gas Exit Temp	C	1151	1153	1153	1152	1152		1152.2
STACK EMISSIONS								
Dupont SO2 Anal <400	ppm	368	354	354	363	363		360.4
SO2	lbs/ton	3.33	3.24	3.24	3.31	3.31		3.286
O2	%	4.1	4.2	4.2	4.2	4.2		4.18
DRYING TOWER								
% H2S04	%	95.6	95.5	95.5	95.6	95.6		95.56

N:\USER\PRIVATE\ENV\STACK\STKFRM_S.WK3

Operator Name _____ Signature _____


Jan.29.96
14:00
6 SO2
5mm/h
GREEN
PPMSO2
Jan.29.96
12:00
6 SO2
5mm/h
PPMSO2
Jan.29.96
10:00
6 SO2
PPMSO2

H2SO4 and SO2 Titrations

Source: #5 SAP Date 1-30-96

H2SO4 Analysis:

	Aliquot	Aliquot Factor	ml Ba(ClO4)2
Run 1–A	100/5000	5	2.90
Run 1–B	〃	〃	2.90
Run 1–C			
Average			
Run 2–A	100/5000	5	2.90
Run 2–B	〃	〃	2.90
Run 2–C			
Average			
Run 3–A	100/5000	5	2.48
Run 3–B	〃	〃	2.48
Run 3–C			
Average			

H2SO4 Blank: 0.02–

Normality of Ba(ClO4)2 0.009944

SO2 Analysis

	Aliquot	Aliquot Factor	ml Ba(ClO4)2
Run 1–A	5/1000	200	22.82–
Run 1–B	〃	〃	22.81
Run 1–C			
Average			
Run 2–A	5/1000	200	22.82
Run 2–B	〃	〃	22.82
Run 2–C			
Average			
Run 3–A	5/1000	200	22.80
Run 3–B	〃	〃	22.78
Run 3–C			
Average			

SO2 Blank: 0.01

Analyst: R. E. Burnett

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

1204 North Wheeler Street ☐ Plant City, Florida ☐ 33566 ☐ (813) 752 -5014

CHAIN OF CUSTODY RECORD
Analytical Request

Compliance

Client	Cargill	Send Report To	Byron Nelson
Project No.	955270	Address	1204 N. wheeler ST
Project Name	Sulfuric Acid Plant #5		Plant city, Fl 33566
Project Manager	David Nichols	Requested Due Date	

ITEM NO.	SAMPLE DESCRIPTION	TIME SAMPLED	MATRIX	PRESERVATIVES	REQUESTED ANALYSIS	ANALYSIS METHOD
1	80% IPA - Imp #1	Run #1			SO2/ACID MIST	METHOD 8
1	3% H^2O^2 - Imp 2&3	1				
2	80% IPA - Imp #1	Run #2				
2	3% H^2O^2 - Imp #2&3	1				
3	80% IPA - Imp #1	Run #3				
3	3% H^2O^2 - Imp #2&3	1				
B	80% IPA	Blank				
B	3% H^2O^2	1				

Sampled By (PRINT)	David Nichols	Sample Recieved By (Print	Don Jernstrom	Recieved for Analysis By (PRINT)	
Sampler Signature	David Nichols	Signature	Don Jernstrom	Signature	
Date Sampled	1/29/96	Date Recieved	1/29/96	Date Recieved	

Comments: _____

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

FIELD DATA SHEET

Company: Cargill-Bartow
Source: Sulfuric Acid Plant #5
Operator(s): D. Nichols / M. Gierke

Dimensions Dia.☐ "
L x W☐ 81
Stack Static Press. ("H_2O) -.41
Meter Box No. 004
Meter ΔH@ 1.882
Meter Correction Factor 1.010
Pitot Cp 0.84
Nozzle ID #20
Nozzle Dia. (inches) .250
Probe Length/Liner 8' Glass

Assumptions:
% Moisture 0
Stack Temp. 155
Meter Temp. 70
Md/Ms 1.0
K Factor 3.72

Run Number 1
Date 1/29/96
24 hr Time at Start 0946
24 hr Time at End 1049
Filter No(s). —
Impinger Set No. —
Barometric Press. ("Hg) 30.12
Elev.Diff. Mano. to Barom. (ft) 190'
Ambient Temperature (°F) 60

Sample Train Leak Check:
Initial 0.012 CFM@ 15 "Hg
Final 0.012 CFM@ 9 "Hg
Initial Pitot Tube (-) ✓ (+) ✓
Final Pitot Tube (-) ✓ (+) ✓

Point No.	Sample Time (min.)	Meter Vol. Vm (ft³)	Velocity Head,ΔP ("H_2O)	Orifice Diff., ΔH ("H_2O)	Stack Temp., Ts (°F)	Meter Temp., Tm (°F)	Hot Box Temp. (°F)	Exit Temp. (°F)	Pump Vacuum ("Hg)	Other
1	0	805.701	.61	2.27	145	61	NA	56	5.0	
2	2.5	807.70	.65	2.42	148	61		53	5.0	
3	5	809.85	.71	2.64	149	62		53	5.5	
4	7.5	812.06	.75	2.79	150	62		56	6.0	
5	10	814.30	.78	2.90	151	63		54	6.5	
6	12.5	816.63	.79	2.94	151	63		53	6.5	
7	15	819.03	.79	2.94	151	64		53	6.5	
8	17.5	821.30	.80	2.98	151	64		52	6.5	
9	20	823.63	.77	2.87	151	65		52	6.5	
10	22.5	826.08	.77	2.87	151	66		52	6.5	
11	25	828.26	.58	2.16	149	67		50	5.0	
12	27.5	830.28	.56	2.09	148	67		50	5.0	
13	30	832.23	.62	2.31	146	67		58	5.0	
14	32.5	834.33	.64	2.38	149	67		52	5.0	
15	35	836.45	.74	2.76	151	68		52	6.0	
16	37.5	838.70	.78	2.90	152	69		53	6.5	
17	40	841.02	.79	2.94	152	69		53	6.5	
18	42.5	843.37	.80	2.98	152	69		54	6.5	
19	45	845.70	.80	2.98	152	70		54	6.5	
20	47.5	848.13	.77	2.87	152	70		54	6.5	
21	50	850.39	.75	2.79	152	70		55	6.0	
22	52.5	852.71	.65	2.42	149	70		55	5.5	
23	55	854.83	.56	2.09	148	71		56	5.0	
24	57.5	856.83	.55	2.05	148	71		56	5.0	
	60	858.803								

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

FIELD DATA SHEET

Company: Cargill - Bartow
Source: H_2SO_4 #5
Operator(s): M. Burke / D. Nichols

Run Number: 2
Date: 7/29/96
24 hr Time at Start: 1125
24 hr Time at End: 1227
Filter No(s).:
Impinger Set No.: —
Barometric Press. ("Hg): 30.12
Elev.Diff. Mano. to Barom. (ft): 190
Ambient Temperature (°F): 65

Dimensions Dia.○: 8'
L x W□:
Stack Static Press. ("H_2O): -.43
Meter Box No.: 004
Meter ΔH@: 1.882
Meter Correction Factor: 1.010
Pitot Cp: .84
Nozzle ID: #20
Nozzle Dia. (inches): .250
Probe Length/Liner: 8'6lglss

Assumptions:
% Moisture: 0
Stack Temp.: 155
Meter Temp.: 70
Md/Ms: 1.0
K Factor: 3.72

Sample Train Leak Check:
Initial 0.008 CFM@ 15 "Hg
Final 0.010 CFM@ 12 "Hg
Initial Pitot Tube (-) ✓ (+) ✓
Final Pitot Tube (-) ✓ (+) ✓

Point No.	Sample Time (min.)	Meter Vol. Vm (ft^3)	Velocity Head, ΔP ("H_2O)	Orifice Diff., ΔH ("H_2O)	Stack Temp., Ts (°F)	Meter Temp., Tm (°F)	Hot Box Temp. (°F)	Exit Temp. (°F)	Pump Vacuum ("Hg)	Other
1	0	873.10	.51	1.90	142	69	N/A	65	4.5	
2	2.5	874.95	.63	2.35	145	70		63	5.0	
3	5	877.20	.71	2.64	148	69		62	5.0	
4	7.5	879.41	.75	2.79	150	70		62	5.5	
5	10	881.65	.78	2.90	150	70		62	6.0	
6	12.5	884.00	.79	2.94	151	70		62	6.5	
7	15	886.36	.77	2.87	152	71		62	6.0	
8	17.5	888.70	.79	2.94	152	72		63	6.0	
9	20	891.11	.75	2.79	152	72		63	6.0	
10	22.5	893.45	.71	2.64	152	73		63	6.0	
11	25	895.71	.62	2.31	150	73		64	5.5	
12	27.5	897.92	.55	2.05	150	74		64	5.0	
13	30	899.95	.58	2.16	151	73		63	5.0	
14	32.5	902.00	.69	2.57	148	74		64	5.0	
15	35	904.15	.71	2.64	151	74		62	5.5	
16	37.5	906.41	.77	2.87	152	75		62	6.0	
17	40	908.75	.78	2.90	152	75		63	6.0	
18	42.5	911.12	.78	2.90	152	75		64	6.0	
19	45	913.50	.77	2.87	153	75		65	6.5	
20	47.5	916.10	.80	2.98	153	76		64	7.0	
21	50	918.25	.78	2.90	153	76		64	7.0	
22	52.5	920.67	.63	2.35	152	77		63	5.0	
23	55	922.94	.51	1.90	150	77		65	5.0	
24	57.5	924.81	.45	1.68	146	77		65	5.0	
	60	926.665								

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

FIELD DATA SHEET

Company: Cargill-Bartow
Source: H_2SO_4 #5
Operator(s): M. Burke / D. Nichols

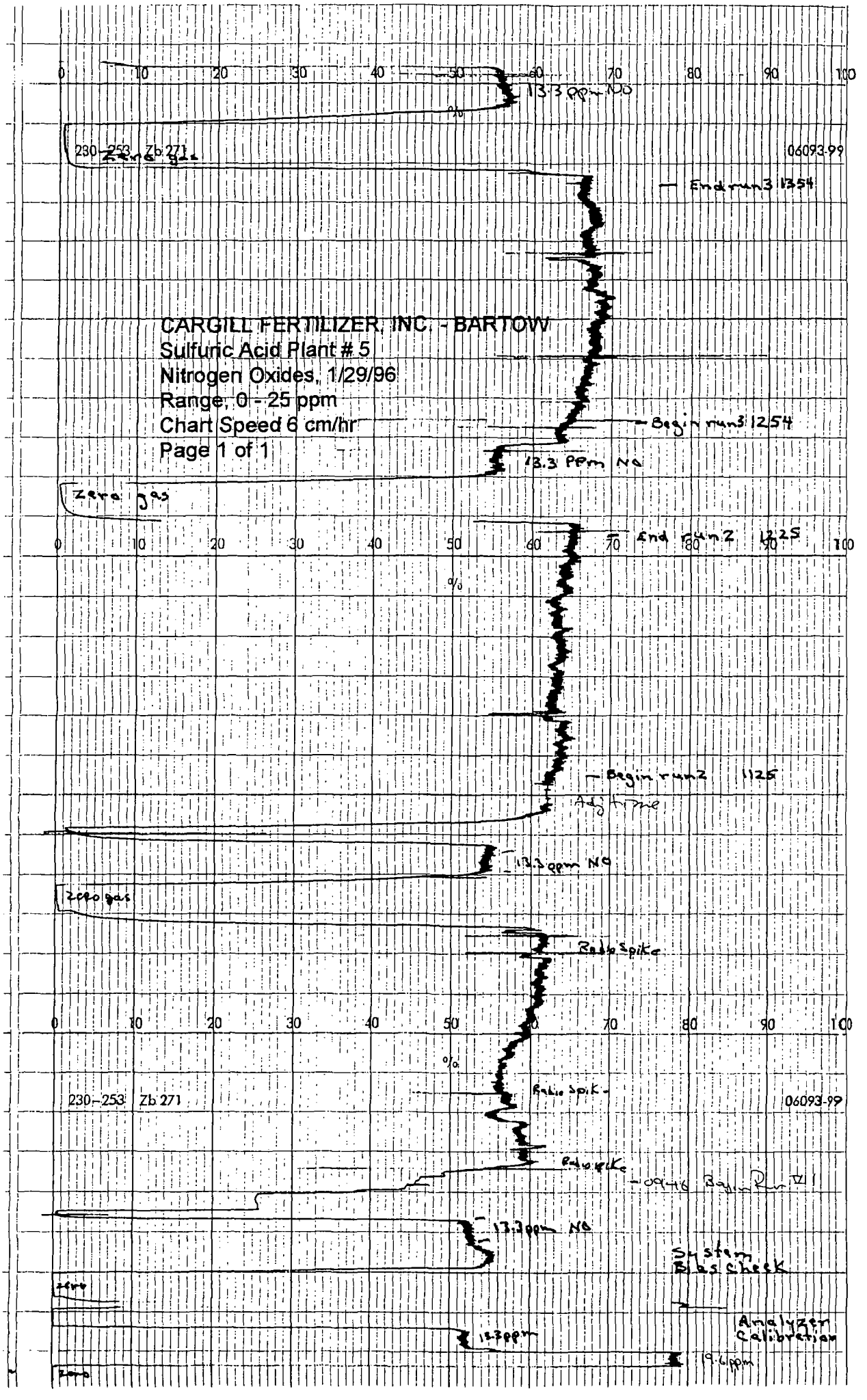
Dimensions Dia. / L x W□: 81"
Stack Static Press. ("H_2O): -.40
Meter Box No.: 004
Meter ΔH@: 1.882
Meter Correction Factor: 1.010
Pitot Cp: .84
Nozzle ID: #20
Nozzle Dia. (inches): .250
Probe Length/Liner: 8'6"/SS

Assumptions:
% Moisture: 0
Stack Temp.: 150
Meter Temp.: 75
Md/Ms: 1.0
K Factor: 3.79

Run Number: 3
Date: 4/29/96
24 hr Time at Start: 1254
24 hr Time at End: 1356
Filter No(s).: —
Impinger Set No.: —
Barometric Press. ("Hg): 30.12
Elev.Diff. Mano. to Barom. (ft): 190
Ambient Temperature (°F): 75

Sample Train Leak Check:
Initial 0.000 CFM@ 15 "Hg
Final 0.007 CFM@ 10 "Hg
Initial Pitot Tube (-) ✓ (+) ✓
Final Pitot Tube (-) ✓ (+) ✓

Point No.	Sample Time (min.)	Meter Vol. Vm (ft³)	Velocity Head, ΔP ("H_2O)	Orifice Diff., ΔH ("H_2O)	Stack Temp., Ts (°F)	Meter Temp., Tm (°F)	Hot Box Temp. (°F)	Exit Temp. (°F)	Pump Vacuum ("Hg)	Other
1	0	940.586	.55	2.08	146	76	N/A	65	5.0	
2	2.5	942.60	.68	2.58	150	76		64	5.0	
3	5	945.36	.72	2.73	151	77		63	5.0	
4	7.5	947.00	.80	3.03	152	77		62	6.5	
5	10	949.48	.82	3.11	153	79		63	6.5	
6	12.5	951.85	.80	3.03	152	79		62	6.5	
7	15	954.30	.78	2.96	153	79		63	6.0	
8	17.5	956.67	.78	2.96	153	79		63	6.0	
9	20	959.03	.77	2.92	153	80		64	6.0	
10	22.5	961.46	.66	2.50	153	80		64	5.5	
11	25	963.74	.62	1.97	152	80		65	5.0	
12	27.5	965.70	.54	2.05	150	80		64	5.0	
13	30	967.711	.60	2.27	151	79		64	5.0	
14	32.5	970.00	.67	2.16	150	80		63	5.0	
15	35	972.04	.65	2.46	151	80		62	5.0	
16	37.5	974.20	.76	2.88	153	80		58	5.0	
17	40	976.84	.79	2.99	153	82		57	5.0	
18	42.5	978.53	.78	2.96	153	82		57	6.0	
19	45	980.90	.76	2.88	153	82		57	6.0	
20	47.5	983.30	.79	2.99	153	82		58	6.5	
21	50	985.70	.75	2.84	153	82		59	6.5	
22	52.5	988.04	.72	2.73	153	83		59	6.0	
23	55	990.62	.56	2.12	152	83		59	5.0	
24	57.5	992.44	.49	1.86	148	82		59	5.0	
	60	994.50								


CARGILL FERTILIZER, INC. - BARTOW
Sulfuric Acid Plant # 5
Nitrogen Oxides, 1/29/96
Range, 0 - 25 ppm
Chart Speed 6 cm/hr
Page 1 of 1
0 10 20 30 40 50 60 70 80 90 100
%
13.3 ppm NO
230-253 Zb 271
06093-99
End run3 1354
Begin run3 1254
13.3 PPm NO
zero gas
End run2 1225
Begin run2 1125
Adj time
13.3 ppm NO
zero gas
Ratio Spike
Ratio spik
Ratio Spike
09-16 Begin Run 1
13.3ppm NO
System Bias Check
zero
13.3ppm
Analyzer Calibration
19.6ppm
zero

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

1204 North Wheeler St. Plant City, Florida 33566 (813) 752-5014

NITROGEN OXIDES ANALYZER CALIBRATION DATA

EPA METHOD 7E

COMPANY	CARGILL FERTILIER, INC. - BARTOW
SOURCE	SULFURIC ACID PLANT # 5
OPERATOR	B. NELSON
DATE	01/29/96
RUN #'S	ALL
INSTRU. SPAN RANGE	25

	Cylinder value (PPM)	Analyzer calibration responses (PPM)	Absolute difference (PPM)	Difference (% of Span)
Zero	0	0	0	0.0
Mid-range	13.3	13	0.3	1.2
High-range	19.6	19.6	0	0.0

SYSTEM CALIBRATION BIAS AND DRIFT DATA

		Initial Values			Final Values		
		Analyzer calibration response (PPM)	System calibration response (PPM)	System calibration bias (% of span)	System calibration response (PPM)	System calibration bias (% of span)	Drift (% of span)
Run 1	Zero	0	0	0.0	0	0.0	0.0
	Upscale	13.0	13.1	0.4	13.6	2.4	2.0
Run 2	Zero	0	0	0.0	0	0.0	0.0
	Upscale	13.0	13.6	2.4	13.9	3.6	1.2
Run 3	Zero	0	0	0.0	0	0.0	0.0
	Upscale	13.0	13.9	3.6	13.9	3.6	0.0

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response - Analyzer Cal.}}{\text{Span}} \times 100$$

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

NOZZLE CALIBRATION

Date: 1/29/96 by: M Steele

Nozzle ID	Run No.	D_1 (INCHES)	D_2 (INCHES)	D_3 (INCHES)	ΔD (INCHES)	D_{AVG} (INCHES)
#20	1-3	.251	.250	.250	~~.250~~ .001	.250

where: D_1, D_2, D_3 = Nozzle diameter measured on a different diameter (inches). Tolerance = 0.001 inches

ΔD = Maximum difference in any two measurements (inches). Tolerance = 0.004 inches

D_{avg} = Average of D_1, D_2, D_3

****

SAMPLE POINT LOCATIONS

Company: Cargill Fertilizer, Bartow

Source: H_2SO_4 #5

Date: 1/29/96

Stack/Duct Dimensions: 91" dia

Port Length: N/A

Points corrected for port length?
Yes ☐ No ☒

Sketch of Stack/Duct

Point No.	Distance from Duct Wall (inches)
1	1.7
2	5.4
3	9.6
4	14.3
5	20.3
6	28.8
7	52.2
8	60.8
9	66.7
10	71.4
11	75.6
12	79.3

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

Dry Gas Meter Calibration

Meter Box Number : 004 Barometric Pressure: 30.00
Date: 6/26/95 Wet Test Meter # : 656687

Orifice Manometer Setting (DELTA H) in. H2O	Gas Volume		Temperature		Time (Theta) min	Yi	Delta H@i in. H2O
	Wet Test Meter (Vw) ft.^3	Dry Gas Meter (Vd) ft.^3	Wet Test Meter (Tw) Deg F	Dry Gas Meter (Td) Deg F			
0.50	5.094	5.110	67.5	75.5	13.11	1.011	1.818
1.00	5.094	5.084	67.0	75.3	9.32	1.015	1.835
1.50	10.188	10.172	67.0	77.0	15.45	1.017	1.885
2.00	10.188	10.204	66.5	74.0	13.42	1.008	1.903
3.00	10.188	10.225	67.5	77.0	10.98	1.007	1.908
4.00	10.188	10.205	69.0	77.3	9.57	1.004	1.943
						1.010	1.882
						Max. Diff.	0.124

$$Yi = \frac{Vw\ Pb\ (td + 460)}{Vd\ (Pb + Delta\ H/13.6)\ (Tw + 460)}$$

$$Delta\ H@ = \frac{.0317\ (Delta\ H)}{Pb\ (td+460)} \quad [(tw+460)\ (theta) / Vw]^2$$

where:

Vw= Gas Volume passing through the std test meter, ft.^3.

Vd = Gas Volume passing through the dry gas meter, ft^3

Tw = Temperature of the gas in the std test meter, deg. F.

Td = Average temperature of the gas in the dry gas meter, Deg F.

Delta H = Pressure differential across orifice, in. H20.

Yi = Ratio of accuracy of std test meter to dry gas meter for each run.

Y = Average ratio of accuracy of std test meter to dry gas meter.

Pb = Barometric pressure, in. Hg.

Theta = Time of calibration run, min.

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

POSTTEST DRY GAS METER CALIBRATION FORM

Meter Box Number: 004
Date: 02/08/96
Barometric Pressure: 30.26
Wet Test Meter #: P-576
Pretest Y: 1.010

Orifice Manometer setting (Delta H) in. H20	Gas volume: Wet Test Meter (Vw) ft.^3	Gas volume: Dry Gas Meter (Vd) ft.^3	Temperature: Wet Test Meter (Tw) Deg F	Temperature: Dry Gas Meter (Td) Deg F	Time (Theta) min	Vacuum Setting in. Hg	Yi
3.00	10.188	10.426	57.00	78.00	11.34	10.00	1.010
3.00	10.188	10.562	59.00	82.00	11.56	10.00	1.000
3.00	10.188	10.562	61.00	86.00	11.75	10.00	1.004
						Average	**1.004**
			Acceptable Limits		**0.960**	**to**	**1.06**

$$Yi = \frac{Vw\ Pb\ (td + 460)}{Vd\ (Pb + Delta\ H/13.6)\ (Tw + 460)}$$

Where:

Vw = Gas Volume passing through the wet test meter, ft.^3.
Vd = Gas volume passing through the dry gas meter, ft^3.
Tw = Temperature of the gas in the wet test meter, deg F.
Tdi = Temperature of the inlet gas of the dry gas meter, Deg F.
Tdo = Temperature of the outlet gas of the dry gas meter, Deg F.
Td = Average temperature of the gas in the dry gas meter, Deg F.
Delta H = Pressure differential across orifice, in. H2O.
Yi = Ratio of accuracy of wet test meter to dry gas meter for each run.
Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y +/- 0.05Y.
Pb = Barometric pressure, in. Hg.
Theta = Time of calibration run, min.

THERMOMETER CALIBRATIONS

Ref.	Wet Test Meter		Dry Gas Meter	
deg F	Inlet deg F	Outlet deg F	Inlet deg F	Outlet deg F
57.0	n/a	59.0	59.0	58.0
Difference	n/a	2.0	2.0	1.0

Quality Control Limit +/- 5 deg F

PYROMETER CALIBRATION

Pyrometer # = Box 004
Cal. Date = 4/10/95
Cal. By Mark Gierke
Cal. Unit = Transmation. Inc. Model 1064P, Thermocouple Calibrator
Cal. Unit SN = B76413
Cal. Unit Cal. Date =4/5/95

Calibrator Reading	Pyrometer Reading
0	1
50	49
100	98
200	200
300	300
400	399
500	497
750	749
1000	998
1250	1248
1500	1496
1750	1743
1990	1986

Southern Environmental Sciences, Inc.

TYPE S PITOT TUBE INSPECTION FORM

PITOT TUBE ID NUMBER	008
INSPECTION DATE	June 22, 1995
INSPECTED BY	M. Gale

PITOT TUBE ASSEMBLY LEVEL?	(YES)	NO
PITOT TUBE OPENINGS DAMAGED?	YES (explain below)	(NO)

ANGLE	MEASUREMENT	LIMITS
$\alpha 1$	1 °	<10°
$\alpha 2$	1 °	<10°
$\beta 1$	2 °	<5°
$\beta 2$	1 °	<5°
γ	2 °	
θ	1 °	
A	1.002 inches	
$z = A \sin \gamma$	.035 inches	< 1/8 inch
$w = A \sin \theta$	.017 inches	< 1/32 inch
P_A	.502 inches	
P_B	.500 inches	
D_T	.376 inches	

COMMENTS: _____

CALIBRATION REQUIRED?	YES	(NO)

SOUTHERN ENVIRONMENTAL SCIENCES, INC.
THERMOMETER CALIBRATIONS

Callbrated By: M. Glerke Date: 6/21/95 ALL TEMPERATURES ARE IN DEGREES RANKIN

			ICE BATH			TEPID WATER			BOILING WATER			HOT OIL		
ID No.	Type	Range	STD. Temp	Therm. Temp	Deg. or % Diff.	STD. Temp	Therm. Temp	Deg. or % Diff.	STD. Temp	Therm. Temp	Deg. or % Diff.	STD. Temp	Therm. Temp	Deg. or % Diff.
2.5' PA	PT	2460	494	496	0.4%	534	536	0.4%	670	672	0.3%	954	950	0.2%
2.5' PB	PT	2460	494	495	0.2%	534	534	0.0%	674	673	0.15%	950	948	0.3%
3'P	PT	2460	494	497	0.6%	534	535	0.2%	672	674	0.3%	942	945	0.2%
3' INC	PT	2460	494	496	0.4%	534	536	0.4%	672	673	0.15%	948	950	0.3%
5'PA	PT	2460	494	497	0.6%	534	535	0.2%	675	672	0.45%	955	958	0.2%
5'PB	PT	2460	494	497	0.6%	534	536	0.4%	676	678	0.3%	946	944	0.2%
5' PC	PT	2460	494	497	0.6%	533	535	0.4%	668	671	0.45%	950	948	0.2%
8'P	PT	2460	494	496	0.4%	533	535	0.4%	668	671	0.45%	950	952	0.2%
10'P	PT	2460	494	495	0.2%	533	535	0.4%	670	668	0.3%	952	950	0.2%
001	BM	600				534	532	2						
002	BM	600				534	532	2						
003	BM	600				534	533	1						
004	PT	2460				534	533	0.2%						
005	PT	2460				534	532	0.4%						
280-01B	PT	2460				534	534	0.0%						
SS300	PT	2460	494	496	0.4%	534	531	0.6%	670	673	0.45%	950	954	0.4%
SS301	PT	2460	494	496	0.4%	534	530	0.8%	670	672	0.3%	952	950	0.2%
SS110	BM	680	494	495	1	534	532	2	670	673	3			
SS306	BM	680	494	495	1	534	530	4	670	674	4			
SS211	PT	2460	494	495	0.2%	534	533	0.2%	670	670	0			
I2	BM	680	494	491	3	534	533	1	670	670	0			
LAB I4	BM	680	494	494	0	534	533	1	670	670	0			
I5	BM	710	494	490	4	534	532	2	670	669	1			
I1	BM	680	494	496	2	534	532	2	670	669	1			
I3	BM	960	494			534	530	4	670	672	2	946	945	0.1%
T1	PT	2460	494	496	0.4%	534	532	0.4%	670	672	0.3%	950	945	0.5%
T2	PT	2460	494	497	0.6%	534	532	0.4%	670	672	0.3%	950	953	0.3%
T3	PT	2460	494	497	0.6%	534	532	0.4%	670	672	0.3%	950	954	0.4%
T4	PT	2460	494	497	0.6%	534	533	0.2%	670	673	0.45%	950	954	0.4%
T5	PT	2460	494	496	0.4%	534	532	0.4%	670	672	0.3%	954	956	0.2%
T6	PT	2460	494	496	0.4%	534	533	0.2%	670	673	0.45%	954	957	0.3%
T7	PT	2460	494	496	0.4%	534	533	0.2%	670	673	0.45%	954	958	0.4%
5'VP	PT	2460	494	497	0.6%	534	536	0.4%	670	674	0.3%	954	954	0.2%

QUALITY CONTROL LIMITS: Impinger Thermometers +/- 2 deg, Bimetallic Thermometers (BM) +/- 5 deg, Pyrometers/Thermocouples (PT) +/- 1.5%

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

1204 North Wheeler St. Plant City, Florida 33566 (813) 752-5014

NOX EMISSIONS TEST CALCULATIONS

COMPANY: CARGILL FERTILIER, INC. - BARTOW
SOURCE: SULFURIC ACID PLANT # 5
TEST DATE: 01/29/96
ATA ANALYST: B. NELSON

RUN NO.	AVERAGE CONC. (PPM)	STACK PRESS (in. Hg)	STACK FLOWRATE (dscfm)	EMISSIONS (mg/m3)	(lbs/ft3)	(lbs/hr)
1	14.6	29.90	92,411	27.9	1.74E-06	9.7
2	15.8	29.90	91,193	30.2	1.89E-06	10.3
3	16.8	29.90	91,179	32.1	2.01E-06	11.0
AVERAGE	15.7	29.9	91,594	30.1	1.88E-06	10.3

FORMULAS: mg/m3 = ppm x .041573 x molecular wt.

$$\text{lb/ft3} = \frac{\text{mg/m3}}{35.31\ \text{ft3/m3} \times 1000\ \text{mg/g} \times 453.59\ \text{g/lb}}$$

lb/hr = lb/ft3 x flowrate x 60 min/hr

where:

Pstd =	29.92 "Hg
Tstd =	528 deg R
Molecular Wt. of NOx =	46

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

EMISSIONS TEST CALCULATIONS

Plant: CARGILL FERTILIZER, INC. Test Date: 1/29/96
Unit: Bartow - Sulfuric Acid Plant No. 5
Run No: 2 Calculated By: K. Baldwin

Pbar = (Pbar at barom.) - (Elev. diff. barom. to manom., ft.) x (.1/100)
= 30.12 - 190 x (0.1/100) = 29.93

$$Pm = Pbar + \frac{Delta\ H}{13.6} = 29.93 + \frac{2.577318}{13.6} = 30.12$$

$$Vm(std) = (Vm)(Y)\frac{(Tstd,deg\ R)(Pm)}{(Tm,deg\ R)(Pstd)}$$

$$= 53.565 \times 1.01 \times \frac{528}{533.2083} \times \frac{30.11951}{29.92}$$

= 53.929

Vw(std) = Vlc x (.04715) = 0 x 0.04715 = 0

$$Bws = \frac{Vw(std)}{Vw(std) + Vm(std)} = \frac{0}{0 + 53.92942} = 0$$

Bws @ saturation = ERR
1 - Bws = 1 USE LOWER BWS

Md = 0.44(%CO2) + .32(%O2) + .28(%N2+%CO)
= .44 x 0 + .32 x 0 + 0.28 x 78
= assume 30

Ms = Md(1-Bws) + 18(Bws) = 30 x 1 + 18 x 0
= 30

$$Ps = Pbar + \frac{(Pg,\ in.\ H2O)}{13.6} = 29.93 + \frac{-0.43}{13.6} = 29.90$$

Vs = 85.49(Cp)(avg sqrt delta P)[sqrt((Ts,deg R)/(Ps)(Ms))]
= 85.49 x 0.84 x 0.829374 x sqrt 462.6277 / 29.89838 x 30
= 42.77

$$An = \frac{(Nozzle\ diam,\ in./12)^2 \times 3.14}{4} = \frac{0.25/12)^2 \times 3.14}{4} = 0.000341$$

$$\%I = \frac{(.09450)(Ts,deg\ R)(Vm(std)}{(Ps)(Vs)(An)(Sample\ Time)(1-Bws)}$$

$$= \frac{0.0945 \times 610.2917 \times 53.92942}{29.89838 \times 49.12801 \times 0.000341 \times 60 \times 1}$$

= 103.5

SOUTHERN ENVIRONMENTAL SCIENCES, INC.

EMISSIONS TEST CALCULATIONS

Plant: CARGILL FERTILIZER, INC. Test Date: 1/29/96
Unit: Bartow - Sulfuric Acid Plant No. 5
Run No: 2 Calculated By: K. Pollard

$$As = \frac{(\text{Stack Diam., ft.})^2 \times 3.14}{4} = \frac{6.75^2 \times 3.14}{4} = 35.78$$

$$As.eff = \frac{As(\text{total No. pts.} - \text{No. neg. pts.})}{(\text{Total No. pts.})} = \frac{35.78 \times (24) - (0)}{(24)} = 35.78467$$

$$Q = 60(As,eff)(Vs) = 60 \times 35.78 \times 49.13 = 105,482$$

$$Qstd = \frac{(Q)(Tstd)(Ps)(1-Bws)}{(Ts,\text{deg R})(Pstd)} = \frac{105,482 \times 528 \times 29.90 \times 1}{610.2917 \times 29.92}$$

$$= 91,193$$

$$PMR(SO2) = \frac{(Vt-Vtb)(N)(Vsoln/Va)(32.03)(Qstd)60}{1000(453.6)(Vm(std))}$$

$$= \frac{22.82 \times 0.009994 \times 200 \times 32 \times 91192.7 \times 60}{1000 \times 453.6 \times 53.92942}$$

$$= 326.5$$

$$PMR(H2SO4) = \frac{(Vt-Vtb)(N)(Vsoln/Va)(49.04)(Qstd)60}{1000(453.6)(Vm(std))}$$

$$= \frac{2.9 \times 0.009994 \times 5 \times 49.04 \times 91192.7 \times 60}{1000 \times 453.6 \times 53.92942}$$

$$= 1.59$$

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NOMENCLATURE USED IN STACK SAMPLING CALCULATIONS

A_n = Cross-sectional area of nozzle, ft^2

A_s = Cross-sectional area of stack, ft^2

B_{ws} = Water vapor in gas stream, proportion by volume

C_p = Pitot coefficient

C_s = Pollutant concentration, gr/DSCF

F_d = Ratio of gas generated to heat value of fuel, DSCF/mm BTU

ΔH = Average pressure differential across orifice, in. H_2O

%I = Isokinetic variation, %

M_d = Molecular weight of dry gas

M_n = Total amount of pollutant collected, mg

M_s = Molecular weight of stack gas

N = Normality of barium perchlorate titrant

$\sqrt{\Delta P_{avg}}$ = Average of the square roots of the velocity heads

P_{bar} = Barometric pressure at the sampling site, in. Hg

P_g = Stack gas static pressure, in. H_2O

P_m = Absolute pressure at the dry gas meter, in. Hg

P_s = Absolute stack pressure, in. Hg

PMR = Pollutant mass rate, lb/hr

P_{std} = Standard absolute pressure, 29.92 in. Hg

θ = Total sampling time, minutes

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NOMENCLATURE USED IN STACK SAMPLING CALCULATIONS
(Continued)

Q = Stack gas flowrate, ACFM

Q_{std} = Stack gas flowrate, DSCFM

T_m = Absolute average meter temperature, °R

T_s = Absolute average stack gas temperature, °R

T_{std} = Standard absolute temperature, 528 °R

V_a = Volume of sample aliquot titrated, ml

V_{lc} = Liquid collected in impingers and silica gel, grams

V_m = Sample volume at meter conditions, DCF

$V_{m(std)}$ = Sample volume at standard conditions, DSCF

V_s = Stack gas velocity, ft/sec

V_{soln} = Total volume of solution, ml

V_t = Volume of barium perchlorate titrant used for the sample, ml

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml

$V_{w(std)}$ = Volume of water vapor in sample corrected to standard conditions, SCF

Y = Dry gas meter calibration factor

13.6 = Specific gravity of mercury