Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

BR: 4
AP 42 - 13

(A)

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DIVISION OF ENVIRONMENTAL MANAGEMENT
Air Quality Section

July 16, 1990

M E M O R A N D U M

TO: Mike Aldridge

FROM: Don Wynne DWW
Washington Regional Office

Subject: Compliance Test No.1 Calciner SO2 Emission
Texasgulf, Inc.
Aurora, NC, Beaufort County

Attached is the compliance test conducted at Texasgulf's No. 1 Calciner by the Texasgulf Environmental Section. Please review the data submitted by Texasgulf.

If you have any questions, please contact me.

5/29/90

$17.76 \frac{lbs\ SO_2}{day} \times \frac{1\ day}{24\ hr} \times \frac{hr}{86\ ton\ P_2O_5}$

$= 0.0086 \frac{lbs\ SO_2}{ton\ P_2O_5}$

5/29/90

$12.27 \frac{lbs\ SO_2}{day} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{82\ ton\ P_2O_5}$

$= 0.0062\ lbs\ SO_2 / ton\ P_2O_5$

5/30/90

$10.91 \frac{lbs\ SO_2}{day} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{82\ ton\ P_2O_5}$

$= 0.0055\ lbs\ SO_2 / ton\ P_2O_5$

Texasgulf Inc.
elf aquitaine group

P.O. Box 48 Aurora, North Carolina 27806

RECEIVED
WASHINGTON OFFICE
JUL 11 1990
D. E. M.

Phosphate Operations
(919) 322-4111

July 05, 1990

Mr. Vic Copelan
Air Quality Section
Division of Environmental Management
N. C. Dept. of EHNR
Post Office Box 1507
Washington, North Carolina 27889

Subject: Source Test Report: Sulfur Dioxide Emission Rate - #1 Calciner

Dear Vic,

As per the requirements of Air Quality Permit No. 2331R10 Specific Conditions and Limitations No. 7, the Number One Calciner has been tested for sulfur dioxide emissions.

Please find attached the subject report. Testing for sulfur dioxide was conducted on 05/29-30/90. The results of the test indicate the sulfur dioxide emission rate to be 0.0177 pounds of SO2/MMBTU's of heat input. The test results show the #1 Calciner to be operating within the permitted limits set forth by Air Quality Permit 2331R10.

If I may provide you with any additional information on this subject please let me know.

Sincerely,

J. Wayne Powell, Supervisor
Environmental Programs

JWP/jc

cc: W. A. Schimming w/Summary
H. M. Breza w/Summary
J. N. Richardson w/Summary
00-05-000
12-01-003-111

No control config.
or process config.
Permitting 733-3340
3:30 6/2/92 Shannon New # 733-1472
Mike Aldridge 733-1470 Vogel →
Low Velocity
Vent. Scrubber
w/cyclonic Knockout.
Was: Vic Copelan
919 946-6481

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D. E. M.

SULFUR DIOXIDE EMISSION RATE TEST

#1 CALCINER

TEXASGULF INC.

AURORA, NORTH CAROLINA

MAY 29 and 30, 1990

PREPARED BY:

JOHN C. CARRERE, JR.

SENIOR ENVIRONMENTAL LAB TECH

REVIEWED BY:

MIKE L. ASBY, SUPERVISOR

ENVIRONMENTAL LABORATORY

REVIEWED BY:

J. WAYNE POWELL, SUPERVISOR

ENVIRONMENTAL PROGRAMS

Executive Summary

On May 29 and 30, 1990, sampling and analyses were conducted to determine the sulfur dioxide emission rate at the #1 Calciner. The sampling was conducted to satisfy (in part) Air Quality Permit No. 2331R10 which specifies annual testing of one (1) Calciner for sulfur dioxide.

The DEM was advised of the sampling dates and chose not to have an observer present during the testing.

The results of this series of runs show the sulfur dioxide emission rate to be 0.0177 pounds per million BTUs of heat input. The allowable sulfur dioxide emission rate, as set forth in the permit, is 0.75 pounds of sulfur dioxide per million BTUs of heat input. Three stack samples were taken.

Performing the stack sampling were Senior Environmental Technicians Ted Davis and Phillip Forest. Senior Environmental Technician Jimmy Hardy performed the analyses.

Production Information
Tons per Hour Feed

Run	Date	Time	TPH
1	29-May-90	14:35 - 16:30	86
2	29-May-90	17:53 - 19:53	82
3	30-May-90	09:25 - 11:25	82

Test Summary - No. 1 Calciner

Sulfur Dioxide Emission Rate Test	05/29/90	05/29/90	05/30/90
	Run 1	Run 2	Run 3
Stack Volume Flow Rate, TSCFM	65,183	67,621	66,208
Sample Volume, DSCF	41.963	43.303	44.568
SO2 Concentration, mg/DSCF	0.1226	0.0823	0.0710
SO2 Concentration, mg/TSCF	0.0858	0.0572	0.0519
SO2 Emission Rate, Lbs./Day	17.76	12.27	10.91
SO2 Emission Rate Lbs/MMBTU	0.0224	0.0163	0.0145
Percent Isokinetic Sampling Rate, %	98.69	100.96	98.90
Average SO2 Emission Rate, Lbs./MMBTU		0.0177	

#1 Calciner

Stack Data Summary Sulfur Dioxide Emission Rate Test

05/29-30/90

Time	Run #	Velocity FPS	Stack Volume FT^3/Min	Temp (oF)
14:35	1	46.264	65183	170
17:53	2	48.095	67621	171
09:25	3	46.125	66208	164

Note: All results are in total standard feet.

SO2 AUDIT SAMPLE

Technician Ted W. Davis

EPA Lot 2422

Titration 1	6.02 ml $Ba(ClO_4)_2$	453.8 mg/dscm
Titration 2	6.00 ml $Ba(ClO_4)_2$	452.3 mg/dscm

Sulfur Dioxide Test Results

Run #1	Run #2	Run #3
24.5	17.0	15.1

Calculations

1) Mg SO2/DSCF = (32.03 x A x C) / (D x E)

2) Mg SO2/TSCF = (32.03 x A x C) / (F x E)

3) Lbs. SO2/Day = (H x I x 0.003175)

4) Lbs.SO2/MMBTU = ((J / (K x 0.83) x 24) x .462)

Where:
- A = Mls of titrant used
- B = Normality of titrant
- C = Liquid sample volume
- D = Gas volume STP
- E = Aliquot of sample used
- F = Gas Volume TSCF
- G = Mg SO2/DSCF
- H = Mg SO2/TSCF
- I = Stack Volumetric Flow Rate FT3
- J = Lbs SO2/Day
- K = Feed Rate, TPH

TEXASGULF memo

Date: 06/23/90

To: Mill Superintendent

From: Environmental Affairs

Subject: Sulfur Dioxide Emission Rate
Calciner #1 Run 1

Sample Date	Production Rate, TPD	Time
05/29/90	1713	14:35

Mg SO2/SCF	Stack Volume STD FT3/Min
0.123 Dry 0.086 Total	65183

SO2 Lbs/Day	SO2 Lbs/mm BTUs
17.765	0.0224

Supervisor, Environmental Laboratory

J. W. Powell
File: ec-15-09-025

The Calciners are limited by permit to 0.75 pounds of SO2/MMBTUS of heat input.

Sulfur Dioxide Emission Rate
Run 1
Calciner #1

Rpt. Date	06/23/90
Smple Date	05/29/90
Smple Time	14:35

Barometric Pressure	29.67	Initial Dry Gas Mtr	886.000
Stack Static Pressure	-0.40	Final Dry Gas Mtr	930.768
Stack Diameter	72	Dry Gas Factor	1.0175
Nozzle Diameter	0.2243	Dry Mole Wt Stk Gas	29.704
Pitot Tube Corr	0.84	Stack Pressure	29.64
Sampling Time in Minutes	96	Feed Rate, TPH	86

	Stk oF	Delta P	Delta H	oF In	oF Out
Pt 1	172	0.45	0.59	114	101
Pt 2	174	0.53	0.70	117	101
Pt 3	172	0.52	0.68	118	102
Pt 4	168	0.50	0.66	118	102
Pt 5	168	0.50	0.66	118	103
Pt 6	169	0.52	0.68	119	103
Pt 7	168	0.54	0.71	119	104
Pt 8	165	0.42	0.55	118	104
Pt 9	172	0.46	0.60	108	100
Pt 10	173	0.58	0.76	113	100
Pt 11	170	0.54	0.71	115	100
Pt 12	170	0.53	0.70	117	101
Pt 13	171	0.54	0.71	117	102
Pt 14	170	0.56	0.74	118	103
Pt 15	170	0.53	0.70	118	103
Pt 16	165	0.48	0.63	118	104
Averages	170	0.5125	0.67	117	102

Stack oR 630 Average Meter Temp oR 569

Gas Volume Collected	44.768
Corrected Gas Volume	45.551
Gas Volume STP	41.963

Impinger Volumes/Weights

	No.1 (mls)	No. 2 (mls)	No.3 (mls)	No. 4 (g) (silica gel
Initial	100	100	101	613.82
Final	372	167	127	630.64

Totals mls of water collected	365
Increase in grams of silica gel	16.82
Total Gas Volume	59.936
Bws	0.2999
One - Bws	0.7001
Wet Molecular Weight of Stack Gas	26.19

Page 2
Calciner #1
Run 1

Stack Pressure	29.641
Stack Velocity FPS	46.264
Stack Volumetric Flow Rate STD Ft3/Min	65183

SO2 Calculations

Liquid Sample Volume, mls	500
Normality of Titrant	0.0098846
Aliquot	10
Mls of Titrant used	0.325
Mg SO2/DSCF	0.1226
Mg SO2/TSCF	0.0858
Lbs SO2/Day	17.76
Lbs SO2/mm BTUs	0.0224

Isokinetic Sampling Rate	98.69

TEXASGULF memo

Date: 06/23/90

To: Mill Superintendent

From: Environmental Affairs

Subject: Sulfur Dioxide Emission Rate
Calciner #1 Run 2

Sample Date	Production Rate, TPD	Time
05/29/90	1633	17:53

Mg SO2/SCF	Stack Volume STD FT3/Min
0.082 Dry 0.057 Total	67621

SO2 Lbs/Day	SO2 Lbs/mm BTUs
12.273	0.0163

Supervisor, Environmental Laboratory

J. W. Powell
File: ec-15-09-025

The Calciners are limited by permit to 0.75 pounds of SO2/MMBTUS of heat input.

Sulfur Dioxide Emission Rate
Run 2
Calciner #1

Rpt. Date 06/23/90
Smple Date 05/29/90
Smple Time 17:53

Barometric Pressure	29.67	Initial Dry Gas Mtr	950.300
Stack Static Pressure	-0.40	Final Dry Gas Mtr	995.874
Stack Diameter	72	Dry Gas Factor	1.0175
Nozzle Diameter	0.2220	Dry Mole Wt Stk Gas	29.704
Pitot Tube Corr	0.84	Stack Pressure	29.64
Sampling Time in Minutes	96	Feed Rate, TPH	82

	Stk oF	Delta P	Delta H	oF In	oF Out
Pt 1	172	0.45	0.57	108	93
Pt 2	173	0.54	0.68	111	93
Pt 3	173	0.56	0.71	112	94
Pt 4	172	0.56	0.71	112	95
Pt 5	174	0.58	0.73	112	95
Pt 6	172	0.58	0.73	112	95
Pt 7	171	0.56	0.71	112	95
Pt 8	167	0.48	0.60	111	95
Pt 9	172	0.55	0.69	108	95
Pt 10	173	0.62	0.78	109	94
Pt 11	172	0.58	0.73	109	94
Pt 12	171	0.54	0.68	104	93
Pt 13	168	0.54	0.68	107	93
Pt 14	170	0.58	0.73	107	93
Pt 15	171	0.56	0.71	108	93
Pt 16	167	0.54	0.68	108	93
Averages	171	0.5513	0.69	109	94

Stack oR 631 Average Meter Temp oR 562

Gas Volume Collected	45.574
Corrected Gas Volume	46.372
Gas Volume STP	43.303

Impinger Volumes/Weights

	No.1 (mls)	No. 2 (mls)	No.3 (mls)	No. 4 (g) (silica gel
Initial	100	100	100	631.82
Final	409	152	122	652.55

Totals mls of water collected	383
Increase in grams of silica gel	20.73
Total Gas Volume	62.308
Bws	0.3050
One - Bws	0.6950
Wet Molecular Weight of Stack Gas	26.13

Page 2
Calciner #1
Run 2

Stack Pressure	29.641
Stack Velocity FPS	48.095
Stack Volumetric Flow Rate STD Ft3/Min	67621

SO2 Calculations

Liquid Sample Volume, mls	500
Normality of Titrant	0.0098846
Aliquot	10
Mls of Titrant used	0.225
Mg SO2/DSCF	0.0823
Mg SO2/TSCF	0.0572
Lbs SO2/Day	12.27
Lbs SO2/mm BTUs	0.0163
Isokinetic Sampling Rate	100.96

TEXASGULF memo

Date: 06/23/90

To: Mill Superintendent

From: Environmental Affairs

Subject: Sulfur Dioxide Emission Rate
Calciner #1 Run 3

Sample Date	Production Rate, TPD	Time
05/30/90	1633	09:25

Mg SO2/SCF	Stack Volume STD FT3/Min
0.071 Dry 0.052 Total	66208

SO2 Lbs/Day	SO2 Lbs/mm BTUs
10.910	0.0145

Supervisor, Environmental Laboratory

J. W. Powell
File: ec-15-09-025

The Calciners are limited by permit to 0.75 pounds of SO2/MMBTUS of heat input.

Sulfur Dioxide Emission Rate
Run 3
Calciner #1

Rpt. Date 06/23/90
Smple Date 05/30/90
Smple Time 09:25

Barometric Pressure	29.96	Initial Dry Gas Mtr	14.702
Stack Static Pressure	-0.40	Final Dry Gas Mtr	60.701
Stack Diameter	72	Dry Gas Factor	1.0175
Nozzle Diameter	0.2243	Dry Mole Wt Stk Gas	29.704
Pitot Tube Corr	0.84	Stack Pressure	29.93
Sampling Time in Minutes	96	Feed Rate, TPH	82

	Stk oF	Delta P	Delta H	oF In	oF Out
Pt 1	175	0.50	0.67	100	82
Pt 2	168	0.50	0.67	100	82
Pt 3	170	0.59	0.79	102	84
Pt 4	169	0.50	0.67	102	84
Pt 5	161	0.53	0.71	102	86
Pt 6	168	0.58	0.78	104	86
Pt 7	169	0.52	0.69	103	87
Pt 8	162	0.42	0.56	105	87
Pt 9	165	0.56	0.75	100	90
Pt 10	156	0.58	0.78	105	91
Pt 11	162	0.58	0.78	106	91
Pt 12	161	0.48	0.64	108	91
Pt 13	158	0.54	0.72	108	91
Pt 14	156	0.54	0.72	108	91
Pt 15	156	0.54	0.72	108	93
Pt 16	172	0.46	0.61	109	92
Averages	164	0.5263	0.70	104	88

Stack oR 624 Average Meter Temp oR 556

Gas Volume Collected	45.999
Corrected Gas Volume	46.804
Gas Volume STP	44.568

Impinger Volumes/Weights

	No.1 (mls)	No. 2 (mls)	No.3 (mls)	No. 4 (g) (silica gel
Initial	100	100	100	612.17
Final	348	156	122	635.29

Totals mls of water collected	326
Increase in grams of silica gel	23.12
Total Gas Volume	61.003
Bws	0.2694
One - Bws	0.7306
Wet Molecular Weight of Stack Gas	26.55

Page 2
Calciner #1
Run 3

Stack Pressure	29.931
Stack Velocity FPS	46.125
Stack Volumetric Flow Rate STD Ft3/Min	66208

SO2 Calculations

Liquid Sample Volume, mls	500
Normality of Titrant	0.0098846
Aliquot	10
Mls of Titrant used	0.2
Mg SO2/DSCF	0.0710
Mg SO2/TSCF	0.0519
Lbs SO2/Day	10.91
Lbs SO2/mm BTUs	0.0145

Isokinetic Sampling Rate	98.90

CALIBRATIONS

Console Pre-Calibration

* 05/10/90		Console	4
*Technician Jimmy Hardy		Number of Runs	8
*Barometric Pressure	29.78	Test Meter Factor	1.0025
*Delta H Setting	0.25	Meter Pressure	29.80
*Test Meter Initial	698.001		
*Test Meter Final	702.828	Test Dry Gas Volume	4.827
*Console Meter Inital	777.254		
*Console Meter Final	782.202	Console Dry Gas Volume	4.948
*Test Meter oF In	74		
*Test Meter oF Out	74	Test Average oR	534
*Console Meter oF In	99		
*Console Meter oF Out	87	Console Average oR	553
*Total Time In Mins.	17.12	Corr Test Meter Vol	4.84
*Delta Ha=	1.7176	y Factor=	1.0122
*Delta H Setting	0.50	Meter Pressure	29.82
*Test Meter Initial	702.828		
*Test Meter Final	707.803	Test Dry Gas Volume	4.975
*Console Meter Inital	782.202		
*Console Meter Final	787.355	Console Dry Gas Volume	5.153
*Test Meter oF In	74		
*Test Meter oF Out	74	Test Average oR	534
*Console Meter oF In	102		
*Console Meter oF Out	90	Console Average oR	556
*Total Time In Mins.	12.680	Corr Test Meter Vol	4.99
*Delta Ha=	1.7644	y Factor=	1.0065
*Delta H Setting	0.75	Meter Pressure	29.84
*Test Meter Initial	707.803		
*Test Meter Final	712.806	Test Dry Gas Volume	5.003
*Console Meter Inital	787.355		
*Console Meter Final	792.513	Console Dry Gas Volume	5.158
*Test Meter oF In	74		
*Test Meter oF Out	74	Test Average oR	534
*Console Meter oF In	109		
*Console Meter oF Out	94	Console Average oR	561.5
*Total Time In Mins.	10.32	Corr Test Meter Vol	5.02
*Delta Ha=	1.7166	y Factor=	1.0206

*Delta H Setting	1.00	Meter Pressure	29.85
*Test Meter Initial	712.806		
*Test Meter Final	717.806	Test Dry Gas Volume	5
*Console Meter Inital	792.513		
*Console Meter Final	797.685	Console Dry Gas Volume	5.172
*Test Meter oF In	74		
*Test Meter oF Out	74	Test Average oR	534
*Console Meter oF In	109		
*Console Meter oF Out	94	Console Average oR	561.5
*Total Time In Mins.	8.920	Corr Test Meter Vol	5.01
*Delta Ha=	1.7119	y Factor=	1.0166

*Delta H Setting	1.25	Meter Pressure	29.87
*Test Meter Initial	717.806		
*Test Meter Final	727.814	Test Dry Gas Volume	10.008
*Console Meter Inital	797.685		
*Console Meter Final	808.014	Console Dry Gas Volume	10.329
*Test Meter oF In	75		
*Test Meter oF Out	74	Test Average oR	534.5
*Console Meter oF In	111		
*Console Meter oF Out	95	Console Average oR	563
*Total Time In Mins.	15.95	Corr Test Meter Vol	10.03
*Delta Ha=	1.7064	y Factor=	1.0200

*Delta H Setting	1.50	Meter Pressure	29.89
*Test Meter Initial	727.814		
*Test Meter Final	737.909	Test Dry Gas Volume	10.095
*Console Meter Inital	808.014		
*Console Meter Final	818.439	Console Dry Gas Volume	10.425
*Test Meter oF In	75		
*Test Meter oF Out	74	Test Average oR	534.5
*Console Meter oF In	110		
*Console Meter oF Out	96	Console Average oR	563
*Total Time In Mins.	14.77	Corr Test Meter Vol	10.12
*Delta Ha=	1.7258	y Factor=	1.0188

Console Calibration
05/10/90

*Delta H Setting	1.75	Meter Pressure	29.91 *
*Test Meter Initial	737.909		*
*Test Meter Final	747.911	Test Dry Gas Volume	10.002 *
*Console Meter Inital	818.439		*
*Console Meter Final	828.752	Console Dry Gas Volume	10.313 *
*Test Meter oF In	75		*
*Test Meter oF Out	74	Test Average oR	534.5 *
*Console Meter oF In	109		*
*Console Meter oF Out	96	Console Average oR	562.5 *
*Total Time In Mins.	13.5	Corr Test Meter Vol	10.03 *
*			*
*Delta Ha=	1.7150	y Factor=	1.0188 *

*			*
*Delta H Setting	2.00	Meter Pressure	29.93 *
*Test Meter Initial	747.911		*
*Test Meter Final	757.915	Test Dry Gas Volume	10.004 *
*Console Meter Inital	828.752		*
*Console Meter Final	839.022	Console Dry Gas Volume	10.27 *
*Test Meter oF In	75		*
*Test Meter oF Out	74	Test Average oR	534.5 *
*Console Meter oF In	112		*
*Console Meter oF Out	97	Console Average oR	564.5 *
*Total Time In Mins.	12.63	Corr Test Meter Vol	10.03 *
*			*
*Delta Ha=	1.7088	y Factor=	1.0263 *

*			*
*Average Delta Ha=	1.7208	Average y Factor=	1.0175 *
*			*

Console Post-Calibration

```
*****************************************************************
* 06/18/90                          Console                   4 *
*Technician Jimmy Hardy             Number of Runs            8 *
*Barometric Pressure        30.01   Test Meter Factor    1.0025 *
*                                                               *
*****************************************************************
*                                                               *
*Delta H Setting             0.25   Meter Pressure        30.03 *
*Test Meter Initial        847.202                              *
*Test Meter Final          852.207   Test Dry Gas Volume   5.005 *
*Console Meter Inital      358.848                              *
*Console Meter Final       364.117   Console Dry Gas Volume 5.269 *
*Test Meter oF In               74                              *
*Test Meter oF Out              74   Test Average oR         534 *
*Console Meter oF In           105                              *
*Console Meter oF Out           96   Console Average oR    560.5 *
*Total Time In Mins.        18.22   Corr Test Meter Vol    5.02 *
*                                                               *
*Delta Ha=                  1.7716   y Factor=            0.9989 *
*****************************************************************
*                                                               *
*Delta H Setting             0.50   Meter Pressure        30.05 *
*Test Meter Initial        852.207                              *
*Test Meter Final          857.211   Test Dry Gas Volume   5.004 *
*Console Meter Inital      364.117                              *
*Console Meter Final       369.354   Console Dry Gas Volume 5.237 *
*Test Meter oF In               75                              *
*Test Meter oF Out              74   Test Average oR       534.5 *
*Console Meter oF In           112                              *
*Console Meter oF Out           96   Console Average oR      564 *
*Total Time In Mins.       12.750   Corr Test Meter Vol    5.02 *
*                                                               *
*Delta Ha=                  1.7282   y Factor=            1.0095 *
*****************************************************************
*                                                               *
*Delta H Setting             0.75   Meter Pressure        30.07 *
*Test Meter Initial        857.211                              *
*Test Meter Final          862.212   Test Dry Gas Volume   5.001 *
*Console Meter Inital      369.354                              *
*Console Meter Final       374.587   Console Dry Gas Volume 5.233 *
*Test Meter oF In               75                              *
*Test Meter oF Out              74   Test Average oR       534.5 *
*Console Meter oF In           114                              *
*Console Meter oF Out           97   Console Average oR    565.5 *
*Total Time In Mins.        10.38   Corr Test Meter Vol    5.01 *
*                                                               *
*Delta Ha=                  1.7157   y Factor=            1.0118 *
*****************************************************************
```

```
*****************************************************************
*Delta H Setting            1.00     Meter Pressure          30.08 *
*Test Meter Initial      862.212                                  *
*Test Meter Final        867.204     Test Dry Gas Volume      4.992 *
*Console Meter Inital    374.587                                  *
*Console Meter Final     379.788     Console Dry Gas Volume   5.201 *
*Test Meter oF In            75                                   *
*Test Meter oF Out            75     Test Average oR            535 *
*Console Meter oF In         115                                   *
*Console Meter oF Out         96     Console Average oR       565.5 *
*Total Time In Mins.       8.920     Corr Test Meter Vol       5.00 *
*                                                                  *
*Delta Ha=                1.6986     y Factor=               1.0146 *
*****************************************************************
*                                                                  *
*Delta H Setting            1.25     Meter Pressure          30.10 *
*Test Meter Initial      867.204                                  *
*Test Meter Final        877.610     Test Dry Gas Volume     10.406 *
*Console Meter Inital    379.788                                  *
*Console Meter Final     390.544     Console Dry Gas Volume  10.756 *
*Test Meter oF In            75                                   *
*Test Meter oF Out            75     Test Average oR            535 *
*Console Meter oF In         110                                   *
*Console Meter oF Out         92     Console Average oR         561 *
*Total Time In Mins.       16.55     Corr Test Meter Vol      10.43 *
*                                                                  *
*Delta Ha=                1.6955     y Factor=               1.0139 *
*****************************************************************
*                                                                  *
*Delta H Setting            1.50     Meter Pressure          30.12 *
*Test Meter Initial      877.610                                  *
*Test Meter Final        887.611     Test Dry Gas Volume     10.001 *
*Console Meter Inital    390.544                                  *
*Console Meter Final     400.886     Console Dry Gas Volume  10.342 *
*Test Meter oF In            75                                   *
*Test Meter oF Out            75     Test Average oR            535 *
*Console Meter oF In         115                                   *
*Console Meter oF Out         94     Console Average oR       564.5 *
*Total Time In Mins.       14.62     Corr Test Meter Vol      10.03 *
*                                                                  *
*Delta Ha=                1.7083     y Factor=               1.0192 *
*****************************************************************
```

Console Calibration
06/18/90

```
*****************************************************************
*Delta H Setting            1.75     Meter Pressure          30.14 *
*Test Meter Initial      897.712                                  *
*Test Meter Final        907.721     Test Dry Gas Volume     10.009 *
*Console Meter Inital    411.308                                  *
*Console Meter Final     421.665     Console Dry Gas Volume  10.357 *
*Test Meter oF In            75                                   *
*Test Meter oF Out            75     Test Average oR           535 *
*Console Meter oF In         117                                   *
*Console Meter oF Out         97     Console Average oR        567 *
*Total Time In Mins.       13.57     Corr Test Meter Vol     10.03 *
*                                                                 *
*Delta Ha=                1.7067     y Factor=               1.0224 *
*****************************************************************
*                                                                 *
*Delta H Setting            2.00     Meter Pressure          30.16 *
*Test Meter Initial      887.611                                  *
*Test Meter Final        897.712     Test Dry Gas Volume     10.101 *
*Console Meter Inital    400.886                                  *
*Console Meter Final     411.308     Console Dry Gas Volume  10.422 *
*Test Meter oF In            75                                   *
*Test Meter oF Out            75     Test Average oR           535 *
*Console Meter oF In         118                                   *
*Console Meter oF Out         96     Console Average oR        567 *
*Total Time In Mins.       12.83     Corr Test Meter Vol     10.13 *
*                                                                 *
*Delta Ha=                1.7120     y Factor=               1.0247 *
*****************************************************************
*                                                                 *
*Average Delta Ha=        1.7171     Average y Factor=       1.0144 *
*                                                                 *
*****************************************************************
```

Highest Delta H Vacuum Runs

06/18/90		Console	4
Technician Jimmy Hardy		Number of Runs	3
Barometric Pressure	30.01	Test Meter Factor	1.0025

Delta H Setting	1.49	Meter Pressure	30.12
Test Meter Initial	816.604		
Test Meter Final	826.604	Test Dry Gas Volume	10
Console Meter Inital	327.012		
Console Meter Final	337.427	Console Dry Gas Volume	10.415
Test Meter oF In	74		
Test Meter oF Out	73	Test Average oR	533.5
Console Meter oF In	107		
Console Meter oF Out	96	Console Average oR	561.5
Total Time In Mins.	14.800	Corr Test Meter Vol	10.03
Delta Ha=	1.7388	y Factor=	1.0094

Delta H Setting	1.49	Meter Pressure	30.12
Test Meter Initial	826.604		
Test Meter Final	836.607	Test Dry Gas Volume	10.003
Console Meter Inital	337.427		
Console Meter Final	347.845	Console Dry Gas Volume	10.418
Test Meter oF In	74		
Test Meter oF Out	74	Test Average oR	534
Console Meter oF In	105		
Console Meter oF Out	96	Console Average oR	560.5
Total Time In Mins.	14.7800	Corr Test Meter Vol	10.03
Delta Ha=	1.7394	y Factor=	1.0067

Delta H Setting	1.49	Meter Pressure	30.12
Test Meter Initial	836.607		
Test Meter Final	846.610	Test Dry Gas Volume	10.003
Console Meter Inital	347.845		
Console Meter Final	358.235	Console Dry Gas Volume	10.39
Test Meter oF In	74		
Test Meter oF Out	74	Test Average oR	534
Console Meter oF In	106		
Console Meter oF Out	95	Console Average oR	560.5
Total Time In Mins.	14.77	Corr Test Meter Vol	10.03
Delta Ha=	1.7371	y Factor=	1.0094

Pre Calibrations

Console Calibration Worksheet

Date 5-10-90 Barometric Press. 29.78 Console # 4 Technician JH Circle One: Pre Post

17.07
12.41

Delta H	Tst Mtr Init	Tst Mtr Final	Tst Mtr dF In	Tst Mtr dF Out	Cnsl Mtr Init	Cnsl Mtr Final	Cnsl Mtr dF In	Cnsl Mtr dF Out	Time
.25	698.001	702.828	74	74	777.254	782.202	99	87	12.12
.50	702.828	707.803	74	74	782.202	787.355	102	96	12.68
.75	707.803	712.806	74	74	787.355	792.513	109	94	10.32
1.00	712.806	717.806	74	74	792.513	797.685	109	94	8.92
1.25	717.806	727.814	75	74	797.685	808.014	111	95	15.95
1.50	727.814	737.909	75	74	808.014	818.439	110	96	14.77
1.75	737.909	747.911	75	74	818.439	828.752	109	96	13.50
2.00	747.911	757.915	75	74	828.752	839.022	112	97	12.63

PRE CALIBRATIONS

Temperature Calibrations

Please Circle One: Pre Post Console 4

Technician J. HARD Date 5/10/90

Instrument		Indicator oF	Actual oF	Difference oF
Dry Gas Meter In	A	70.0	71.1	
(Must agree: +/-5.4 oF)	B	41	41.0	
	C	21	21.0	
Dry Gas Meter Out	A	70.0	71.1	
(Must agree: +/-5.4 oF)	B	41	41.0	
	C	21	21.0	
Impinger Thermometer #_____	A			
(Must agree: +/-2 oF)	B			
	C			
Impinger Thermometer #_____	A			
(Must agree: +/-2 oF)	B			
	C			
Impinger Thermometer #_____	A			
(Must agree: +/-2 oF)	B			
	C			
HotBox Thermometer # _____	A			
(Must agree: +/-5.4 oF)	B			
HotBox Thermometer # _____	A			
(Must agree: +/-5.4 oF)	B			
HotBox Thermometer # _____	A			
(Must agree: +/-5.4 oF)	B			
Probe Heater Assy #_____				
Probe Heater Assy #_____				
Probe Heater Assy #_____				

Pre calciners

Date 5-10-90 Tech J. HARDY

Pre-Calibration

Delta H Magnehelic Console #4

Leak Check @ ✓ " H20 for 3 minutes.

Gauge	Manometer	Delta
.26	.26	0

Leak Check @ ✓ " H20 for 3 minutes.

Gauge	Manometer	Delta
1.06	1.05	+ .01

Leak Check @ ✓ " H20 for 3 minutes.

Gauge	Manometer	Delta
1.72	1.71	.01

Delta P Magnehelic

Leak Check @ ✓ " H20 for 3 minutes.

Gauge	Manometer	Delta
.32	.33	- .01

Leak Check @ ✓ " H20 for 3 minutes.

Gauge	Manometer	Delta
1.00	.99	+ 0.01

Leak Check @ ✓ " H20 for 3 minutes.

Gauge	Manometer	Delta
1.92	1.90	+ .02

Post Calibration SO2

Console Calibration Worksheet

Date 6/15/90 Barometric Press. 30.01 Console # 4 Technician J. HANDY Circle One: Pre Post

Delta H	Tst Mtr Init	Tst Mtr Final	Tst Mtr cF In	Tst Mtr cF Out	Cnsl Mtr Init	Cnsl Mtr Final	Cnsl Mtr cF In	Cnsl Mtr cF Out	Time
.25	847.202	852.207	74	74	358.848	364.117	165	96	18.22
.50	852.207	857.211	75	74	364.117	369.354	112	96	12.75
.75	~~862.212~~ 857.211	862.212	75	74	~~374.587~~ 369.354	374.587	114	97	10.38
1.00	862.212	867.204	75	75	374.587	379.788	115	96	8.92
1.25	867.204	877.610	75	75	379.788	390.544	110	92	16.55
1.50	877.610	887.611	75	75	390.544	400.886	115	94	14.62
1.75	~~887.611~~ 897.712	907.721	75	75	~~400.886~~ 411.308	421.665	~~115~~ 117	~~96~~ 97	13.57
2.00	887.611	897.712	75	75	400.886	411.308	118	96	12.83

LEAK VOLT HS - 000 CFM

1.49 @ 15"

Dry Gas Calibration Worksheet

Q Calcmer 562

1.49	836.604	846.604	74	74	347.012	357.127	166	96	14.80
								95	14.78
1.49	836.607	846.610	74	74	347.845	358.035	166	95	14.77

Leak Check @ 17" Hg = 0.00 cfm

Post Calibration SO_2

Temperature Calibrations

Please Circle One: Pre (Post) Console 4

Technician J. HARDY Date 6/18/90

Instrument		Indicator oF	Actual oF	Difference oF
Dry Gas Meter In	A	73.0	74.0	1
(Must agree: +/-5.4 oF)	B	39	39.0	0
	C	164	163	1
Dry Gas Meter Out	A	74.0	74.0	0
(Must agree: +/-5.4 oF)	B	39	39.0	0
	C	163	163	0
Impinger Thermometer #1	A	44	45.8	1.8
(Must agree: +/-2 oF)	B	72.0	72.4	0.4
	C	157	158.0	1.0
Impinger Thermometer #2	A	34	33.4	0.4
(Must agree: +/-2 oF)	B	72	72.4	0.4
	C	158	157.8	0.2
Impinger Thermometer #3	A	36	35.4	0.6
(Must agree: +/-2 oF)	B	72	72.4	0.4
	C	158	157.8	1.2
HotBox Thermometer #1	A	155	154.6	0.4
(Must agree: +/-5.4 oF)	B	270	273	3
HotBox Thermometer #2	A	[illegible]	[illegible]	0.4
(Must agree: +/-5.4 oF)	B	269	273	4
HotBox Thermometer #3	A	[illegible]	[illegible]	0.4
(Must agree: +/-5.4 oF)	B	271	273	2
Probe Heater Assy #_____				
Probe Heater Assy #_____				
Probe Heater Assy #_____				

Temperature Calibrations cont'd.

Instrument		Indicator oF	Actual oF	Difference %
Stack Thermocouple Assy #5	A	41	40.6	1.0
(Must agree: +/-1.5%)	A	41	40.6	1.0
	A	41	40.5	1.2
	B	72	72	0
	B	72	72	0
	B	72	72	0
	C	162	162.4	0.2
	C	162	162.6	0.4
	C	162	162.6	0.4
Stack Thermocouple Assy #13	A	47	46.6	0.9
(Must agree: +/-1.5%)	A	47	46.6	0.9
	A	48	47.8	0.4
	B	72	72.4	0.6
	B	72	72.4	0.6
	B	72	72.6	0.8
	C	162	162.8	0.5
	C	162	162.8	0.5
	C	162	162.5	0.3
Stack Thermocouple Assy #____	A			
(Must agree: +/-1.5%)	A			
	A			
	B			
	B			
	B			
	C			
	C			
	C			

Page 3 Post Calciner SO_2

[redacted]

Temperature Calibrations cont'd.

Instrument		Indicator oF	Actual oF	Difference %
Stack Thermocouple Assy #8	A	47	47.6	1.3
(Must agree: +/-1.5%)	A	47	47.6	1.3
	A	48	48.0	0
212°@ .8 cfm	B	73	73.4	0.5
	B	74	73.6	0.8
	B	74	74.0	0
	C	166	165.8	0.1
	C	168	167.8	0.1
	C	167	167.0	0
Stack Thermocouple Assy #14	A	53	52.6	0.8
(Must agree: +/-1.5%)	A	53	52.6	0.8
	A	53	52.8	0.4
212°@ .8 cfm	B	73	73.3	0.4
	B	73	73.4	0.4
	B	73	73.4	0.4
	C	168	168	0
	C	169	169	0
	C	169	169	0
Stack Thermocouple Assy #____	A			
(Must agree: +/-1.5%)	A			
	A			
	B			
	B			
	B			
	C			
	C			
	C			

Post Calibration

Date 6/18/90 Tech J. HA[illegible]

Delta [illegible] Magnehelic

Leak Check @ 1.85 " H2O [illegible] or 3 minutes.

Gauge	[illegible]nometer	[illegible]
1.85	[illegible]	

Leak Check @ 1.00 " H2O [illegible] or 3 minutes.

Gauge	[illegible]nometer	[illegible]
1.00	[illegible]	

Leak Check @ .41 " H2O [illegible] or 3 minutes.

Gauge	[illegible]nometer	[illegible]
.41	.41	

Delta [illegible] Magnehelic

Leak Check @ 1.88 " [illegible] or 3 minutes.

Gauge	[illegible]nometer	[illegible]
1.89	[illegible]	

Leak Check @ .96 " [illegible] or 3 minutes.

Gauge	[illegible]nometer	[illegible]
.96	[illegible]	

Leak Check @ .41 [illegible] or 3 minutes.

Gauge	[illegible]nometer	[illegible]
.40	[illegible]	
	[illegible]	

RAW DATA

Run #1

Bot 1

SO_2 STACK SAMPLE WORKSHEET

DATE: 5/29/90

TIME: _____

STACK TEMP.: _____ °F

AVG. METER TEMP.: _____ °F

GAS VOL. COLLECTED: _____ ACF

STACK VOLUME: _____ SCFM

PLANT: CALCINER # 1

WET FEED RATE _____ DRY _____

PRODUCTION RATE: _____

BAROMETRIC PRESSURE: _____

DRY GAS VOLUME: _____

TOTAL GAS VOLUME: _____

SO_2 ANALYSIS

SAMPLE VOLUME	500
ALIQUOT	10
TITRANT	.30/.35
mg SO_2/DRY SCF	
mg SO_2/SCF TOTAL	
LB. SO_2/HR.	
LB. SO_2/DAY	
LB. $SO_2/10^6$ BTU	

$$\text{DRY GAS VOL. STP} = (\text{GAS VOL. COLLECTED}) \left(\frac{528^\circ R}{\text{METER TEMP.}}\right)\left(\frac{\text{BAROMETRIC PRESSURE} + \Delta H/13.6}{29.92''Hg}\right)(Y)$$

TOTAL GAS VOL. STP = DRY GAS VOL. STP + (mls H_2O COLLECTED X 0.04707) + (Δ H SILICA GEL WT. X 0.04715)

$$\text{mg } SO_2/SCF = (32.03) \times \frac{(\text{VOL. TITRANT})\ (N)\ (\text{SAMPLE VOLUME})}{(\text{GAS SAMPLE VOLUME, STP})\ (\text{ALIQUOT})}$$

LBS. SO_2/DAY = (mg SO_2 /TOTAL SCF) X (STACK VOLUME) X (.0032)

$$\text{LBS. } SO_2/10^6 \text{ BTU} = \frac{(\text{LBS. } SO_2/\text{DAY})}{(\text{TPD PRODUCTION})\ (.462)}$$

GEL. WT. 613.82 g BEFORE

GEL. WT. 630.64 g AFTER

Δ _____ ml

IMPINGERS

	1st	2nd	3rd
START	100	100	101
FINISH	252+120	167	127
Δ ml H_2O			

TOTAL mls H_2O COLLECTED: _____

Run #1

TEST #1

Box #1

PLANT CALCINER #1 DATE 5-29-90 TIME 1435 T_s 171 °R

SAMPLE METH 8 METER BOX NO. 4 METER ΔH @ 1.7208 K FACTOR 1.3130738

~~AMBIENT~~ METER TEMP. 113 BAR. PRESSURE 29.67 ASSUMED MOISTURE 30% HEATER BOX SET. 248-25

PROBE LENGTH 8 ft NOZZLE DIAMETER .2243" PROBE HEATER SETTING 8

	POINT #	°F Hot Box	Sampling time Minutes	Velocity Head ΔP	Orfice ΔH	Meter Ft.³ 886.000	°F Meter In	°F Temp. Out	°F Impinger Temp.	°F T s	Vacuum inches Hg
WEST	1 8	220	6	.45	.59	888.6	114	101	70	172	3.2
	2 7	220	12	.53	.70	891.4	117	101	74	174	3.8
	3 6	215	18	.52	.68	894.2	118	102	74	172	3.9
	4 5	210	24	.50	.66	897.0	118	102	74	168	4.0
	5 4	220	30	.50	.66	899.7	118	103		168	4.0
	6 3	220	36	.52	.68	902.5	119	103		169	4.1
	7 2	215	42	.54	.71	905.4	119	104		168	4.8
STOP 1523	8 1	215	48	.42	.55	908.007	118	104		165	4.0
SOUTH START 1539	9 8	210	6	.46	.60	910.7	108	100	71	172	4.2
	10 7	200	12	.58	.76	913.6	113	100	71	173	5.0
	11 6	215	18	.54	.71	916.5	115	100	72	170	5.0
	12 5	210	24	.53	.70	919.4	117	101	70	170	5.0
	13 4	215	30	.54	.71	922.2	117	102		171	5.1
	14 3	215	36	.56	.74	925.1	118	103		170	5.2
	15 2	205	42	.53	.70	928.0	118	103		170	5.2
	16 1	205	48	.48	.63	930.768	118	104		165	5.1
	17										
	18										
	19										
	20										
	21										
	22										
	23										
	24										
	TOTAL										
	AVERAGE					44.768					

METER BOX OPERATOR P.A. FOREST

PROBE & SAMPLE BOX OPERATOR: T.W. DAVIS

DRY GAS FACTOR 1.0175

PITOT LEAK ✓

PRE LEAK CHECK AT 11.2 "Hg = 0.002 C.F.M.

POST LEAK CHECK AT 8.0 "Hg = 0.001 C.F.M.

RED = .94 FOR 20 SEC

GREEN = .54 FOR 20 SEC

Run #1
Box #1
TEST #1

Texasgulf Chemicals Co.

ISOKINETIC WORKSHEET

DATE: 5-29-90 STACK: CALCINER #1 TIME: 1435

METER BOX: #4 OPERATOR P.A. FOREST

1. NOZZLE DIA. (A) 0.2238 " (B) 0.2251 " (C) 0.2239 "

Avg. 0.224

2. ΔH @ 1.7208

3. C_p 0.84 Assy. # 8

4. BAROMETRIC PRESSURE (P_b) 29.67 "Hg

ΔP STATIC -.40

5. STACK PRESSURE (P_s) _____ "Hg = $P_b \pm \frac{\text{INCHES } H_2O}{13.6}$

6. T_d _____ °F

7. T_w _____ °F

8. S. V.P. _____ "Hg

9. V.P. _____ "Hg

10. B_{ws} _____ X 100 = 30 EST % H_2O

11. M_d _____ lb./lb. - MOLE

12. M_s _____ lb./lb. - MOLE

13. T_s 171 °F + 460 = 631 °R

14. T_m 122 + 95 = 113 °F + 460 = 573 °R

15. P_m _____ "Hg $\left(\frac{\text{AVG. } \Delta H}{13.6} + P_b\right)$

Prelimina	
ΔP	
1. .33	16
2. .50	1
3. .62	1
4. .50	17
5. .50	16
6. .60	18
7. .52	17
8. .45	16
9.	
10.	
11.	
12.	

FEED = ~~94 Tons~~
86

$\frac{33}{95} = \frac{x}{94}$
x = 32.7

$\frac{33}{95} = \frac{x}{86}$
95x = 2838
x = 29.9

Run #1

Texasgulf Chemicals Co.

CALCULATIONS

(1) $V.P. = S.V.P. - \left[(3.67 \times 10^{-4}) \cdot (P_s) \cdot (T_d - T_w) \cdot \left[1 + \left(\frac{T_w - 32}{1571}\right)\right]\right]$

$_____ = _____ - \left[(\quad) \cdot (\quad) \cdot (\quad) \cdot \left[1 + (\quad / 1571\right.\right.$

(2) $B_{ws} = \frac{V.P.}{P_s} = _____$

(3) $M_d = \left((0.44) \cdot (\overset{7.4}{\%\ CO_2})\right) + \left((0.32) \cdot (\overset{20.4 - 7.4}{\%\ O_2})\right) + \left((0.28) \cdot (\overset{100 - 20.4}{\%\ CO + \%\ N_2})\right)$

$\underline{29.704} = \left((0.44) \cdot (\overset{3.256}{\quad})\right) + \left((0.32) \cdot (\overset{4.16}{\quad})\right) + \left((0.28) \cdot (\overset{22.288}{\quad} + \quad)\right)$

(4) $M_s = \left[(M_d) \cdot (1 - B_{ws})\right] + \left[(18) \times (B_{ws})\right]$

$\underline{26.193} = \left[(\overset{29.704}{\quad}) \cdot (\overset{.7}{\quad})\right] + \left[(18) \cdot (\overset{.30}{\quad})\right]$ 5.4

383 + 4.8

(5) $\Delta H = K \cdot \Delta P$

$K = (846.72) \cdot (D_n^4) \cdot (\Delta H@) \cdot (C_p^2) \cdot (1 - B_{ws})^2 \cdot \left(\frac{M_d}{M_s} - 1\right) \cdot \left(\frac{P_s}{P_m}\right) \cdot \left(\frac{T_m\ {}^oR}{T_s\ {}^oR}\right)$

$\underline{1.31307 38} = (846.72) \cdot (\overset{.0025311}{\quad}) \cdot (\overset{1.7208}{\quad}) \cdot (\overset{.7056}{\quad}) \cdot (\overset{.49}{\quad}) \cdot (\quad) \cdot \left(\frac{29.704}{26.193}\right)\left(\frac{5}{60}\right)$

(6) $\%\ I = \frac{(T_s\ {}^oR) \cdot (\text{GAS VOL. S.T.P.}) \cdot (P_{std}) \cdot (100)}{(T_{std}\ {}^oR) \cdot (V_s\ \text{ft./sec.}) \cdot (P_s) \cdot (\text{Sampling Time Min.})\ (60)\ (A_n)\ (1-B}$

$_____\ \% = \frac{(\quad {}^oR) \cdot (\quad \text{stp}) \cdot (29.92) \cdot (100)}{(528^oR) \cdot (\quad \text{ft/sec.}) \cdot (\quad \text{"Hg}) \cdot (\quad \text{Min.}) \cdot (60\ \frac{\text{Sec.}}{\text{Min.}}) \cdot (}$

Run # 2

B of 2

SO_2 STACK SAMPLE WORKSHEET

DATE: 5/29/90

TIME: _____

STACK TEMP.: _____ °F

AVG. METER TEMP.: _____ °F

GAS VOL. COLLECTED: _____ ACF

STACK VOLUME: _____ SCFM

PLANT: CALCINER # 1

WET FEED RATE _____ DRY _____

PRODUCTION RATE: _____

BAROMETRIC PRESSURE: _____

DRY GAS VOLUME: _____

TOTAL GAS VOLUME: _____

SO_2 ANALYSIS

SAMPLE VOLUME	500
ALIQUOT	10
TITRANT	.20/.25
mg SO_2/DRY SCF	
mg SO_2/SCF TOTAL	
LB. SO_2/HR.	
LB. SO_2/DAY	
LB. $SO_2/10^6$ BTU	

$$\text{DRY GAS VOL. STP} = (\text{GAS VOL. COLLECTED}) \left(\frac{528^\circ R}{\text{METER TEMP.}}\right) \left(\frac{\text{BAROMETRIC PRESSURE} + \Delta H/13.6}{29.92''Hg}\right) (Y)$$

TOTAL GAS VOL. STP = DRY GAS VOL. STP + (mls H_2O COLLECTED X 0.04707) + (Δ H SILICA GEL WT. X 0.04715)

$$\text{mg } SO_2/\text{SCF} = (32.03) \times \frac{(\text{VOL. TITRANT})\ (N)\ (\text{SAMPLE VOLUME})}{(\text{GAS SAMPLE VOLUME, STP})\ (\text{ALIQUOT})}$$

LBS. SO_2/DAY = (mg SO_2 /TOTAL SCF) X (STACK VOLUME) X (.0032)

$$\text{LBS. } SO_2/10^6 \text{ BTU} = \frac{(\text{LBS. } SO_2/\text{DAY})}{(\text{TPD PRODUCTION})\ (.462)}$$

GEL. WT. 631.82 g BEFORE

GEL. WT. 652.55 g AFTER

Δ 20.73 ml

IMPINGERS

	1st	2nd	3rd
START	100	100	100
FINISH	250+159	152	122
Δ ml H_2O	309	52	22

TOTAL mls H_2O COLLECTED: 383

Run #2
TEST #2
Box #2

PLANT CALCINER #1 DATE 5-29-90 TIME 1753 T_s 171 °R

SAMPLE METH 8 METER BOX NO. 4 METER ΔH @ 1.7268 K FACTOR 1.2600549
meter

AMBIENT TEMP. 113 BAR. PRESSURE 29.67 ASSUMED MOISTURE 30% HEATER BOX SET. 248 ± 25°

PROBE LENGTH 8 E NOZZLE DIAMETER 0.2220" PROBE HEATER SETTING 6

POINT #	°F Hot Box	Sampling time Minutes	Velocity Head ΔP	Orfice ΔH	Meter Ft.³ 950.300	°F Meter In	°F Temp. Out	°F Impinger Temp.	°F T s	Vacuum inches Hg
1 8	200	6	.45	.57	953.2	108	93	65	172	4.1
2 7	200	12	.54	.68	955.6	111	93	63	173	5.1
3 6	205	18	.56	.71	958.5	112	94	64	173	6.0
4 5	205	24	.56	.71	961.5	112	95	64	172	6.0
5 4	205	30	.58	.73	964.4	112	95		174	6.1
6 3	210	36	.58	.73	967.3	112	95		172	6.5
7 2	210	42	.56	.71	970.2	112	95		171	6.2
8 1	210	48	.48	.60	972.918	111	95		167	5.8
9 8	200	6	.55	.69	975.8	108	95	66	172	6.0
10 7	190	12	.62	.78	978.7	109	94	58	173	7.5
11 6	195	18	.58	.73	981.6	109	94	60	172	7.1
12 5	215	24	.54	.68	984.3	104	93		171	6.8
13 4	200	30	.54	.68	987.2	107	93		168	6.3
14 3	205	36	.58	.73	990.1	107	93		170	7.0
15 2	220	42	.56	.71	993.0	108	93		171	7.5
16 1	235	48	.54	.68	995.874	108	93		167	7.4
17										
18										
19										
20										
21										
22										
23										
24										
TOTAL										
AVERAGE					45.574					

WEST

STOP 1841

SOOTH START 1845

BLEW FUSE →

METER BOX OPERATOR D A. FOREST

PROBE & SAMPLE BOX OPERATOR: T. W. DAVIS

DRY GAS FACTOR 1.0175

PRE LEAK CHECK AT 9.0 "Hg = 0.004 C.F.M.

POST LEAK CHECK AT 9.6 "Hg = 0.003 C.F.M.

PITOT LEAK ✓
RED = 0.64 FOR 20 SEC
GREEN = 0.80 FOR 20 SEC

FEED = 81 TONS

Run #2
TEST #2
BOX #2

Texasgulf Chemicals Co.

ISOKINETIC WORKSHEET

DATE: 5-29-90 STACK: CALCINER #1 TIME: 1753

METER BOX: #4 OPERATOR P.A. FOREST

1. NOZZLE DIA. (A) 0.2218 " (B) 0.2215 " (C) 0.2227 "

Avg. 0.2220

2. ΔH @ 1.7208

3. C_p 0.84 Assy. # 14

4. BAROMETRIC PRESSURE (P_b) 29.67 "Hg

5. STACK PRESSURE (P_s) _____ "Hg = $P_b \pm \frac{\text{INCHES } H_2O}{13.6}$

ΔP STATIC _____ "H

6. T_d _____ °F

7. T_w _____ °F

8. S. V.P. _____ "Hg

9. V.P. _____ "Hg

10. B_{ws} _____ X 100 = _____ % H_2O

11. M_d _____ lb./lb. - MOLE

12. M_s _____ lb./lb. - MOLE

13. T_s _____ °F + 460 = _____ °R

14. T_m _____ °F + 460 = _____ °R

15. P_m _____ "Hg $\left(\frac{\text{AVG. } \Delta H}{13.6} + P_b\right)$

Preliminary

ΔP	T_s
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	

Run # 2

Texasgulf Chemicals Co.

CALCULATIONS

(1) $V.P. = S.V.P. - \left[(3.67 \times 10^{-4}) \cdot (P_s) \cdot (T_d - T_w) \cdot \left[1 + \left(\frac{T_w - 32}{1571}\right)\right]\right]$

_____ = _____ $- \left[(\quad) \cdot (\quad) \cdot (\quad) \cdot \left[1 + \left(\frac{\quad}{1571}\right)\right]\right]$

(2) $B_{ws} = \frac{V.P.}{P_s}$ = _____

(3) $M_d = \left((0.44) \cdot (\% CO_2)\right) + \left((0.32) \cdot (\% O_2)\right) + \left((0.28) \cdot (\% CO + \% N_2)\right)$

_____ = $\left((0.44) \cdot (\quad)\right) + \left((0.32) \cdot (\quad)\right) + \left((0.28) \cdot (\quad + \quad)\right)$

(4) $M_s = \left[\left(M_d\right) \cdot \left(1 - B_{ws}\right)\right] + \left[(18) \times (B_{ws})\right]$

_____ = $\left[(\quad) \cdot (\quad)\right] + \left[(18) \cdot (\quad)\right]$

(5) $\Delta H = K \cdot \Delta P$

$K = (846.72) \cdot (D_n^4) \cdot (\Delta H@) \cdot (C_p^2) \cdot (1-B_{ws})^2 \cdot \left(\frac{M_d}{M_s}\right) \cdot \left(\frac{P_s}{P_m}\right) \cdot \left(\frac{T_m\ {}^oR}{T_s\ {}^oR}\right)$

1.2600549 = (846.72) . (.0024289) . (1.7208) . (.7656) . (.49) . (X) . $\left(\frac{29.704}{26.193}\right)\left(\frac{57}{631}\right)$

(6) $\% I = \frac{(T_s\ {}^oR) \cdot (\text{GAS VOL. S.T.P.}) \cdot (P_{std}) \cdot (100)}{(T_{std}\ {}^oR) \cdot (V_s\ \text{ft./sec.}) \cdot (P_s) \cdot (\text{Sampling Time Min.})\ (60)\ (A_n)\ (1-B_{ws})}$

_____ % = $\frac{(\quad {}^oR) \cdot (\quad \text{stp}) \cdot (29.92) \cdot (100)}{(528^oR) \cdot (\quad \text{ft/sec.}) \cdot (\quad \text{"Hg}) \cdot (\quad \text{Min.}) \cdot (60\ \frac{\text{Sec.}}{\text{Min.}}) \cdot (\quad)}$

Run #3

Box 3

SO_2 STACK SAMPLE WORKSHEET

DATE: 5-30-90

TIME: _____

STACK TEMP.: _____ °F

AVG. METER TEMP.: _____ °F

GAS VOL. COLLECTED: _____ ACF

STACK VOLUME: _____ SCFM

PLANT: CALCINER # 1

WET FEED RATE _____ DRY _____

PRODUCTION RATE: _____

BAROMETRIC PRESSURE: _____

DRY GAS VOLUME: _____

TOTAL GAS VOLUME: _____

SO_2 ANALYSIS

SAMPLE VOLUME	500
ALIQUOT	10
TITRANT	0.20 , 0.20
mg SO_2/DRY SCF	
mg SO_2/SCF TOTAL	
LB. SO_2/HR.	
LB. SO_2/DAY	
LB. $SO_2/10^6$ BTU	

$$\text{DRY GAS VOL. STP} = (\text{GAS VOL. COLLECTED}) \left(\frac{528^\circ R}{\text{METER TEMP.}}\right)\left(\frac{\text{BAROMETRIC PRESSURE} + \Delta H/13.6}{29.92''Hg}\right)(Y)$$

TOTAL GAS VOL. STP = DRY GAS VOL. STP + (mls H_2O COLLECTED X 0.04707) + (ΔH SILICA GEL WT. X 0.04715)

$$\text{mg } SO_2/\text{SCF} = (32.03) \times \frac{(\text{VOL. TITRANT})\ (N)\ (\text{SAMPLE VOLUME})}{(\text{GAS SAMPLE VOLUME, STP})\ (\text{ALIQUOT})}$$

LBS. SO_2/DAY = (mg SO_2 /TOTAL SCF) X (STACK VOLUME) X (.0032)

$$\text{LBS. } SO_2/10^6 \text{ BTU} = \frac{(\text{LBS. } SO_2/\text{DAY})}{(\text{TPD PRODUCTION})\ (.462)}$$

GEL. WT. 612.17 g BEFORE

GEL. WT. 635.29 g AFTER

Δ 23.12 ml

IMPINGERS

	1st	2nd	3rd
START	100	100	100
FINISH	229 + 119	156	122
Δ ml H_2O	248	56	22

TOTAL mls H_2O COLLECTED: 326

Run #3
TEST #3
Box #3

6.8
21.2

PLANT CALCINER #1 DATE 5-30-90 TIME 0925 T_s 171 °R

SAMPLE METH 8 METER BOX NO. 4 METER ΔH @ 1.7208 K FACTOR 1.3336252

AMBIENT TEMP. 95 (METER) BAR. PRESSURE 29.96 ASSUMED MOISTURE 28% HEATER BOX SET. 248 ± 25

PROBE LENGTH 8E NOZZLE DIAMETER 0.2243 " PROBE HEATER SETTING 8

POINT #	°F Hot Box	Sampling time Minutes	Velocity Head ΔP	Orfice ΔH	Meter Ft.³ 14.702	°F Meter In	°F Meter Out	°F Impinger Temp.	°F T s	Vacuum inches Hg
~~1~~ 8	240	6	.56	.67	17.8	100	82	62	175	3.5
2 7	250	12	.50	.67	20.1	100	82	58	168	4.0
3 6	245	18	.59	.79	23.1	102	84	58	170	5.1
4 5	245	24	.50	.67	26.0	102	84	—	169	5.0
5 4	245	30	.53	.71	28.8	102	86	—	161	5.6
6 3	250	36	.58	.78	31.8	104	86	—	168	5.2
7 2	250	42	.52	.69	34.8	103	87	—	169	5.2
8 1	255	48	.42	.56	37.184	105	87	—	162	4.6
9 8	230	6	.56	.75	40.1	100	90	63	165	6.0
10 7	255	12	.58	.78	43.3	105	91	62	156	6.7
11 6	270	18	.58	.78	46.1	106	91	68	162	7.0
12 5	230	24	.48	.64	49.3	108	91	58	161	6.1
13 6	240	30	.54	.72	52.0	108	91	—	158	5.8
14 3	255	36	.54	.72	55.2	108	91	—	156	5.5
15 2	200	42	.54	.72	58.1	108	93	—	156	5.5
16 1	245	48	.46	.61	60.701	109	92	—	172	5.5
17										
18										
19										
20										
21										
22										
23										
24										
TOTAL										
AVERAGE										

~~WE~~ SOUTH

METER BOX OPERATOR Ted W Davis

PROBE & SAMPLE BOX OPERATOR: J. A. HARDY

DRY GAS FACTOR _____

PITOT LEAK ✓
RED - .50 FOR 20 SEC
GREEN .64 FOR 20 SEC

PRE LEAK CHECK AT 12.0 "Hg = 0.005 C.F.M.

POST LEAK CHECK AT 7. "Hg = 0.000 C.F.M.

Run # 3
TEST #3
BOX #3

Texasgulf Chemicals Co.

ISOKINETIC WORKSHEET

DATE: 5-30-90 STACK: CALCINER #1 TIME: _____

METER BOX: # 4 OPERATOR D.A. FOREST

1. NOZZLE DIA. (A) 0.2238 " (B) 0.2251 " (C) 0.2239 "

Avg. 0.224

2. ΔH @ 1.7208

3. C_p 0.84 Assy. # 8

4. BAROMETRIC PRESSURE (P_b) 29.96 "Hg

ΔP STATIC -.40 "H

5. STACK PRESSURE (P_s) _____ "Hg = $P_b \pm \frac{\text{INCHES } H_2O}{13.6}$

6. T_d _____ °F

7. T_w _____ °F

8. S. V.P. _____ "Hg

9. V.P. _____ "Hg

10. B_{ws} _____ X 100 = 28 % EST % H_2O

11. M_d 29.704 lb./lb. - MOLE

12. M_s 26.427 lb./lb. - MOLE

13. T_s 171 °F + 460 = 631 °R

14. T_m 95 °F + 460 = 555 °R

15. P_m _____ "Hg $\left(\frac{\text{AVG. } \Delta H}{13.6} + P_b\right)$

Preliminary

ΔP	T_s
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	

FEED = 82 TONS

$\frac{33}{95} = \frac{x}{82}$

$95x = 2706$

$x = 28$

Run #3

Texasgulf Chemicals Co.

CALCULATIONS

(1) $V.P. = S.V.P. - \left[(3.67 \times 10^{-4}) \cdot (P_s) \cdot (T_d - T_w) \cdot \left[1 + \left(\frac{T_w - 32}{1571}\right)\right]\right]$

_____ = _____ $- \left[(\quad) \cdot (\quad) \cdot (\quad) \cdot \left[1 + (\quad / 1571\right.\right.$

(2) $B_{ws} = \frac{V.P.}{P_s}$ = 28% Est

(3) $M_d = \left((0.44) \cdot (\% CO_2)\right) + \left((0.32) \cdot (\% O_2)\right) + \left((0.28) \cdot (\% CO + \% N_2)\right)$

29.704 = $\left((0.44) \cdot (\quad)\right) + \left((0.32) \cdot (\quad)\right) + \left((0.28) \cdot (\quad + \quad)\right)$

(4) $M_s = \left[(M_d) \cdot (1 - B_{ws})\right] + \left[(18) \times (B_{ws})\right]$

26.427 = $\left[(29.704) \cdot (.72)\right] + \left[(18) \cdot (.28)\right]$ 5.04

(5) $\Delta H = K \cdot \Delta P$

$K = (846.72) \cdot (D_n^4) \cdot (\Delta H@) \cdot (C_p^2) \cdot (1-B_{ws})^2 \cdot \left(\frac{M_d}{M_s}\right) \cdot \left(\frac{P_s}{P_m}\right) \cdot \left(\frac{T_m\ {}^oR}{T_s\ {}^oR}\right)$

1.3336252 = (846.72) . (.0025311) . (1.7208) . (.7056) . (.5184) . (X) . $\left(\frac{29.704}{26.427}\right)\left(\frac{555}{631}\right)$

(6) $\% I = \frac{(T_s\ {}^oR) \cdot (\text{GAS VOL. S.T.P.}) \cdot (P_{std}) \cdot (100)}{(T_{std}\ {}^oR) \cdot (V_s\ \text{ft./sec.}) \cdot (P_s) \cdot (\text{Sampling Time Min.})\ (60)\ (A_n)\ (1-B_{ws})}$

_____ % = $\frac{(\quad {}^oR) \cdot (\quad \text{stp}) \cdot (29.92) \cdot (100)}{(528^oR) \cdot (\quad \text{ft/sec.}) \cdot (\quad \text{Hg}) \cdot (\quad \text{Min.}) \cdot (60\ \frac{\text{Sec.}}{\text{Min.}}) \cdot (\quad \text{ft}}$

SO_2 AUDIT SAMPLE

1st RUN

$$C\ SO_2 = 32.03 \quad \frac{(6.02)(.0098846)\ (100/20)}{.021}$$

$C\ SO_2 = 453.8$ ppm

2nd RUN

$$C\ SO_2 = 32.03 \quad \frac{(6.0)\ (.0098846)\ (100/20)}{.021}$$

$C\ SO_2 = 452.3$ ppm

Audit Sample was run on EPA Lot no. 2922 concentration of 470 ppm.

STANDARDIZATION OF BARIUM PERCHLORATE

Date: 5/21/90

1) Prepare 0.01N $Ba(CLO_4)_2$ by weighing 1.95 grams of $Ba(ClO_4)_2 \cdot 3\ H_2O$ and dissolve in 200 ml of deionized water. Bring to a liter volume with 2-propanol.

2) Obtain ACS certified Sulfuric Acid in the concentration range of 0.02N.

3) Pipette 20 ml of certified H_2SO_4 to a casserole dish and add 80 ml of 100% 2-propanol. Add 2 drops of Thorin indicator and titrate with the $Ba(ClO_4)_2$ solution. Repeat titrations twice for a total of three titrations.

Titrations $Ba(ClO_4)_2$	40.45	1st Run
	40.45	2nd Run
	40.50	3rd Run
	40.467	Average

4) Determine exact normality of $Ba(ClO_4)_2$ by:

$$\frac{(\text{Normality of } H_2SO_4) \times (\text{mls of } H_2SO_4)}{\text{mls of } Ba(ClO_4)_2)}$$

Normality $Ba(ClO_4)_2$ .0098846

Revised 03/19/90

Isopropanol Peroxide Check

ABS. = .000 @ 352 nm

J. C. Hauck 5/21/90

LOT # 894111

Cyclonic Flow Test

Plant CALCINER #1 Technician(s) P.A. FOREST / J.A. HARDY

Date 5-29-90 Time 1315

WEST PORT

Point #	Delta P	Angle Alpha
1	.47	10
2	.60	0
3	.52	0
4	.55	0
5	.46	0
6	.56	5
7	.50	5
8	.40	10
	Average	

Average absolute Alpha must not be greater than 20 degrees.

Cyclonic Flow Test

Plant CALCINER #1 Technician(s) P.A. FOREST / J.A. HARDY

Date 5-29-90 Time 1305

SOUTH PORT

Point #	Delta P	Angle Alpha
1	.45	12
2	.54	1
3	.62	0
4	.45	0
5	.46	0
6	.49	0
7	.52	5
8	.47	10
Average		

Average absolute Alpha must not be greater than 20 degrees.