

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/

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State of Ohio Environmental Protection Agency

Northeast District Office

2110 E. Aurora Road
Twinsburg, Ohio 44087-1969
(216) 425-9171
FAX (216) 487-0769

AP-42 Section 11.4
Reference 13
Report Sect. _____
Reference _____

G. _____
Governor
Donald R. Schregardus
Director

March 16, 1993

Re: Stack Test Data
Elkem Metals
Ashtabula, OH

Mr. Richard Marnshaw
Midwest Research Institute
Suite 350
401 Harrison Oaks Blvd.
Cary, N.C. 27513

Dear Mr. Marnshaw:

Enclosed are the Method 5 test results for a calcium carbide electric arc furnace at the Elkem Metals Company in Ashtabula, Ohio. This air contaminant source is primarily controlled by a baghouse with additional control by a set of scrubbers. In 1989 both stacks from each control system were tested. The scrubbers were found to emit only 0.18 pounds per hour of particulate emissions and had less than 1% of the volumetric, exhaust flow rate than the baghouse exhaust. For these reasons the Ohio EPA allowed the testing of the baghouse exhaust stack for the compliance demonstration conducted on September 21, 1992.

For particulate emission tests only the non-condensibles are considered for compliance demonstration purposes. Orstat analysis were performed for both tests. No unusual test conditions were noted during either test. During the 1992 test the average differential pressure drop across the baghouse was -2.5 "H₂O and ranged from -1.5" to -3.5".

Enclosed are the test results as requested, a diagram of the process and a discussion of the results from the annual report (still in draft form). If you have any further questions or comments please contact me at (216) 963-1205.

Sincerely,

Christine McPhee
Environmental Specialist II
Division of Air Pollution Control

CM.ko

enclosures

LABORATORY SUMMARY SHEET

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Elkem Metals Company

#13 Furnace Baghouse Exhaust Stack

Particulate Emission Evaluation

DATE: September 21, 1992	Symbol	Units	RUN # 1	RUN # 2	RUN # 3
1 Sampling Time	t	minutes	60.0 ✓	60.0 ✓	60.0 ✓
2 Barometric Pressure	Pb	in. Hg	28.63 ✓	28.63 ✓	28.63 ✓
3 Static Pressure	Pg	in. H2O	0.15 ✓	0.15 ✓	0.15 ✓
Stack Pressure	Ps	in. Hg	28.64 ✓	28.64 ✓	28.64 ✓
4 Gas Meter Volume	Vm	cu. ft.	37.87 ✓	41.53 ✓	40.44 40.45 ✓
5 Stack Area	A	sq. ft.	50.27 ✓	50.27 ✓	50.27 ✓
6 Nozzle Diameter	Dn	dec. in.	0.25 ✓	0.25 ✓	0.25 ✓
7 Meter Temperature		degrees F	110.3 110.29	120.67	121.23
	Tm	degrees R	570.3	580.6	581.2
8 Stack Temperature		degrees F	124.71	136.879	132.5
	Ts	degrees R	584.7	596.8	592.1
9 Velocity Head	^P	in. H2O	0.551 0.5536	0.5914	0.568 ✓
10 Orifice Pressure	^H	in. H2O	1.12 ✓	1.31 ✓	1.20 ✓
11 Carbon dioxide	CO2	%	0.0 ✓	0.0 ✓	0.0 ✓
12 Oxygen	O2	%	21.0 ✓	21.0 ✓	21.0 ✓
13 Carbon monoxide	CO	%	0.0 ✓	0.0 ✓	0.0 ✓
14 Nitrogen	N2	%	79.0 ✓	79.0 ✓	79.0 ✓
15 Pitot Coefficient	Cp		0.84 ✓	0.84 ✓	0.84 ✓
16 Water Collected	Vlc	ml	8.0 ✓	9.2 ✓	9.5 ✓
Sample Weight:	Mn				
17 - Probe		g	0.0181 ✓	0.0178 ✓	0.0226 ✓
18 - Filter		g	0.0188 ✓	0.0251 ✓	0.0251 ✓
19 - Impingers		g	0.0002 ✓	0.0002 ✓	0.0001 ✓



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Environmental
Incorporated**

P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

Report

TEST RESULTS

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Elkem Metals Company

#13 Furnace Baghouse Exhaust Stack

Particulate Emission Evaluation

DATE: September 21, 1992	Symbol	Units	RUN # 1	RUN # 2	RUN # 3
Time of Day			1111 1221	1254 1404	1422 1531
1 Gas Volume-dry, std.	Vmstd	cu. ft.	33.65	36.26	35.26
2 Condensate Vapor Vol.	Vwstd	cu. ft.	0.38	0.43	0.45
3 Gas Stream Moisture	Bws	vol.dec	0.0111	0.0118	0.0125
4 Mol.Wt-flue gas (dry)	Msd	lb/lb mo.	28.84	28.84	28.84
5 Mol.Wt-flue gas (wet)	Ms	lb/lb mo.	28.72	28.71	28.70
6 Flue Gas Velocity	Vs	ft/sec	33.36	36.16	34.62
7 Flue Gas Volume-Actual	ACFM	cu. ft.	100,612	109,041	104,398
8 Flue Gas Volume-Std.	DSCFM	cu. ft.	86,008	91,257	88,001
9 Particulate Conc.	Cs				
- Probe		gr/dscf	0.0083	0.0076	0.0099
- Filter		gr/dscf	0.0086	0.0107	0.0110
- Impingers		gr/dscf	0.0001	0.0071	0.0035
- Total *		gr/dscf	0.0169	0.0183	0.0209
10 Emission Rate	E				
- Probe		lb/hr	6.119	5.924	7.459
- Filter		lb/hr	6.355	8.354	8.285
- Impingers		lb/hr	0.068	5.574	2.603
- Total *		lb/hr	12.474	14.278	15.744
11 Isokinetic Rate	I	%	96.1	97.7	98.5

* Totals do NOT include impinger weight (condensibles not included)

TEST RESULTS

Elkem Metals Incorporated

Furnace # 13, Baghouse Exhaust

Particulate Emission Evaluation

DATE: March 21, 1989	Symbol	Units	RUN # 1	RUN # 2	RUN # 3
Time of Day			0922 1035	1100 1207	1235 1343
1 Gas Volume-dry, std.	Vmstd	cu. ft.	41.99	42.38	44.36
2 Condensate Vapor Vol.	Vwstd	cu. ft.	0.06	0.11	0.09
3 Gas Stream Moisture	Bws	vol. dec	0.0015	0.0025	0.0021
4 Mol. Wt-flue gas (dry)	Msd	lb/lb mo.	28.84	28.84	28.84
5 Mol. Wt-flue gas (wet)	Ms	lb/lb mo.	28.82	28.81	28.82
6 Flue Gas Velocity	Vs	ft/sec	40.13	40.32	40.71
7 Flue Gas Volume-Actual	ACFM	cu. ft.	121,046	121,607	122,778
8 Flue Gas Volume-Std.	DSCFM	cu. ft.	113,135	113,515	115,071
9 Particulate Conc.	Cs				
- Probe		gr/scf	0.0033	0.0032	0.0028
- Filter		gr/scf	0.0031	0.0054	0.0037
- Impingers		gr/scf	0.0127	0.0201	0.0125
- Total *		gr/scf	0.0064	0.0086	0.0065
10 Emission Rate	E				
- Probe		lb/hr	3.207	3.117	2.779
- Filter		lb/hr	3.029	5.278	3.602
- Impingers		lb/hr	12.329	19.518	12.316
- Total *		lb/hr	6.236	8.395	6.381
11 Isokinetic Rate	I	x	91.2	91.8	94.8

* Totals DO NOT include impinger weights.



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Phone (216) 526-0990

ORSAT ANALYSIS DATA

Company Elken Metals - Ashtabula, Ohio
 Location Furnace # 13 - Baghouse Exhaust
 Date March 21, 1989

	RUN # 1	RUN # 2	RUN # 3
ORSAT DATA			
Sample 1			
CO2 Reading	0.0	0.0	0.0
O2 Reading	21.0	21.0	21.0
CO Reading	21.0	21.0	21.0
Sample 2			
CO2 Reading	0.0	0.0	0.0
O2 Reading	21.0	21.0	21.0
CO Reading	21.0	21.0	21.0
Sample 3			
CO2 Reading	0.0	0.0	0.0
O2 Reading	21.0	21.0	21.0
CO Reading	21.0	21.0	21.0
AVERAGES			
% CO2	0.0	0.0	0.0
% O2	21.0	21.0	21.0
% CO	0	0	0
% N2	79.0	79.0	79.0



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TEST RESULTS SUMMARY

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Elken Metals Incorporated

Lake Road East

Ashtabula, Ohio

Furnace # 13, Baghouse Exhaust

Particulate Emission Evaluation

Conducted - March 21, 1989

PARAMETER	RUN # 1	RUN # 2	RUN # 3
Particulate Emissions			
Pounds/hour	6.24	8.40	6.38
Grains/dacf	0.0064	0.0086	0.0065
System Flow Rates			
Feet/second	40.13	40.32	40.71
ACFM	121,046	121,607	122,778
SCFM	113,135	113,515	115,071
Moisture Content			
Volume percent	0.15	0.25	0.21
Sample Location Temperature			
Degrees Fahrenheit	97	97	95

Flow Rate - Furnace Outlet

TEMP

Feet/second

ACFM

99.8
103.45
121,838

98.1
108.24
127,484

Avg.
98.95

Per conversation w/ Tom Hukler
M.K. 4/20/89

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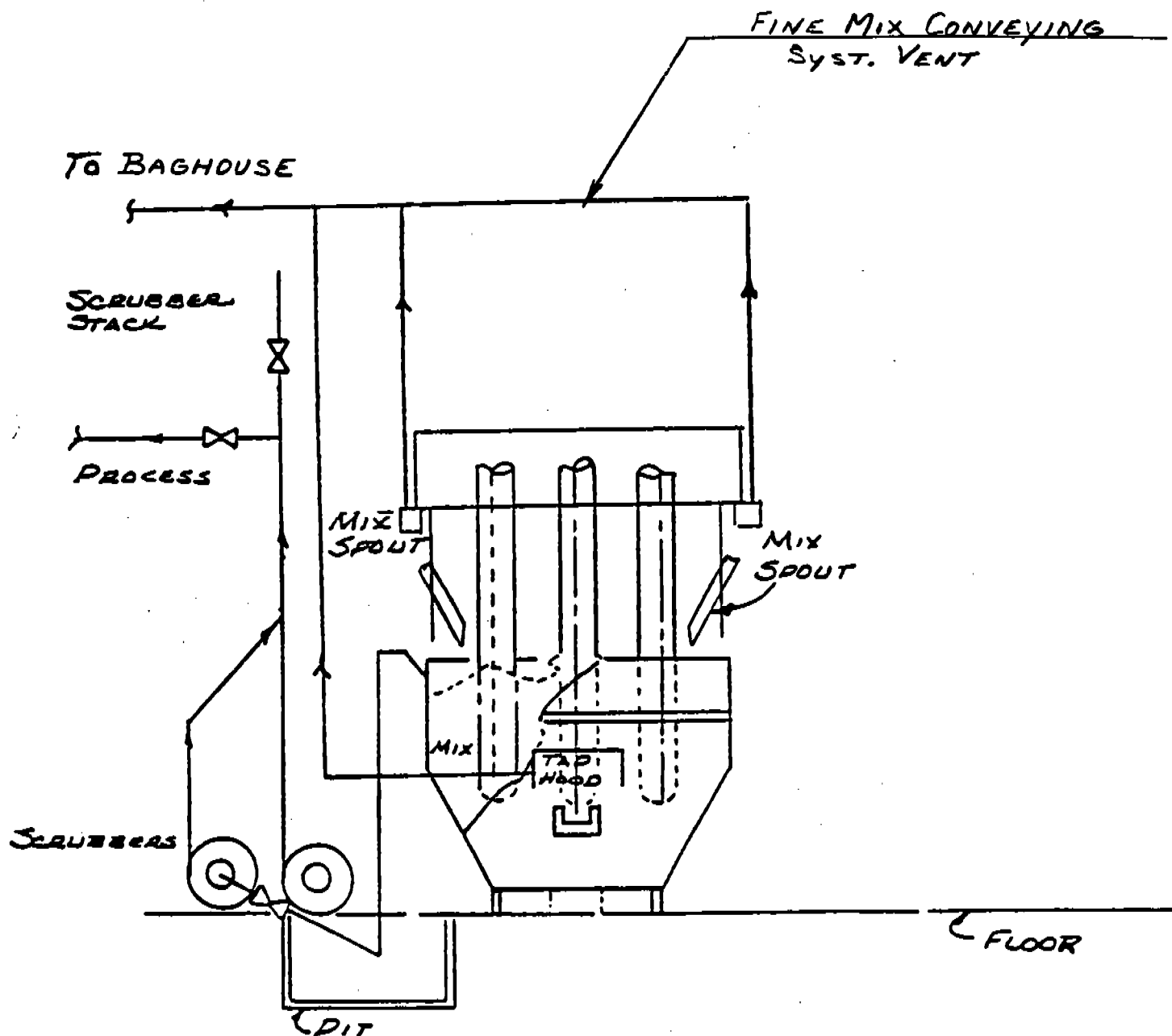
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Phone (216) 526-0990

ACE #13
#51

ASHTABULA, OHIO
PLANT 60616

PROCESS EQUIPMENT

WEST ELEVATION - FURNACE 13



Elkem Metals Company
02-04-01-0003

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AIR EMISSIONS CALCULATIONS

$$1.52 \times 10^{-4} \text{ \#TSP/\#feed} \times 1,817,281 \text{ \#feed/yr} \times \text{yr}/519 \text{ hr} \\ = 0.53 \text{ \#TSP/hr}$$

Potential

Assume that the maximum hourly emission rate is 1.87 #TSP/hr if the $PWR_{\max} = 12,000 \text{ \#feed/hr}$.

$$1.87 \text{ \#TSP/hr} \times 8760 \text{ hr/yr} \times \text{ton}/2000\# = 8.19 \text{ TPY}$$

Allowable

PTI 02-4835 states that the allowable rate is 0.01 grains/dscf. And the emissions are limited to 3.0 #TSP/hr and 13.1 TPY.

(P902) Closed-Top FeSi Electric Arc Furnace - Furnace #20

(P903) Open-Top FeSi Electric Arc Furnace #23 & Ladle Treat Area #1

(P905) Calcium Carbide Electric Arc Furnace with a Fine Feed Mix System, Furnace #13

Actual

TSP emissions are controlled by a baghouse and a scrubber. The scrubber exhaust is often vented to a lime kiln (P009 or P010) because the CO content has some heat value. Once the scrubber exhaust enters the lime kiln the control system of the kiln handles those emissions. The scrubber exhaust may instead be flared to burn the CO gas. At a test conducted on 3-21-89 the scrubber exhaust was found to emit 0.18 #/hr of TSP.

A test conducted on the baghouse exhaust emissions on 9-21-92 determined the average emission rate to be 14.16 #/hr. If the scrubber exhaust is flared then the rate could be 14.34 #/hr. The

AIR EMISSIONS CALCULATIONS

average production rate during the test was 12.4 ton/hr. A maximum emission factor would be:

$$(14.34 \text{ \#TSP/hr}) / (12.4 \text{ ton product/hr}) = 1.156 \text{ \#TSP/ton product}$$

Elkem states that the annual raw material input was 49,586 ton/yr in 1991. The estimated actual emissions would be:

$$1.156 \text{ \#TSP/ton product} \times 46,586 \text{ ton raw mtl./yr} \\ \times \text{ton/2000\#} = 26.93 \text{ TPY}$$

$$26.926708 \text{ ton/yr} \times 2000\#/\text{ton} \times \text{yr}/8172 \text{ hr} = 6.59 \text{ \#/hr}$$

Potential

$\text{PWR}_{\text{max}} = 14.5 \text{ ton/hr}$ so that the estimated potential emissions would be:

$$1.156 \text{ \#TSP/ton product} \times 14.5 \text{ ton raw mtl/hr} = 16.76 \text{ \#/hr}$$

$$16.76 \text{ \#/hr} \times 8760 \text{ hr/yr} \times \text{ton/2000\#} = 73.40 \text{ TPY}$$

Allowable

If the $\text{PWR}_{\text{max}} = 14.5 \text{ ton/hr}$ then OAC Rule 3745-17-11, Table I gives an allowable emission rate of:

$$4.1(14.5 \text{ ton/hr})^{0.67} = 24.60 \text{ \#/hr}$$

$$24.60 \text{ \#/hr} \times 8760 \text{ hr/yr} \times \text{ton/2000\#} = 107.7 \text{ TPY}$$

(P906) Calcium Carbide Electric Arc Furnace with a Fine Feed Mix System, Furnace #14

Actual

Since this is a standby source for P905; it did not operate in 1991. The emissions were 0 #TSP/hr and 0 TPY.

Potential

Since this source is essentially similar to P905 the potential emissions of 16.76 #/hr and 73.40 TPY would be the same also.

Allowable

Same as for P905, which is 24.60 #/hr and 107.7 TPY.



State of Ohio Environmental Protection Agency

P.O. Box 1049, 1800 WaterMark Dr.
Columbus, Ohio 43266-0149

Division of Air Pollution Control

George V. Voinovich
Governor

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Comments:

If you have any questions or need more
information, contact Christine McPhee at
(216) 963-1200

(216) 487-0769 Christine McPhee

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER 02-04-01-0003 (P010)
FACILITY NAME Elkam Metals Company
SOURCE DESCRIPTION (OR SCC CODE) Ferrosilicon alloys manufac-
during and calcium carbide manufacturing
CONTROL EQUIPMENT Venturi Scrubber

DATE(S) OF TEST 12-17-91

FINAL TEST REPORT RECEIVED ON 3-18-92

POLLUTANT(S) TESTED TSP

TEST METHOD Method 5

TEST FIRM Enviroge, Inc.

EMISSION RATES*:

ACTUAL (lb(s)/hr) 20.47 ALLOWABLE** 42.6 ¹⁶lb/hr (PWR max)

OPERATING RATES*: Feed rate of limestone
Due. 39.67 tons/hr max during
38.72 tons/hr MAXIMUM** last test PWR max = 40.5 tons/hr

EMISSION FACTOR***

COMMENTS: The minimum feed rate during Run #1 was 37.83
tons/hr of limestone or 93.4 % of the PWR max.

I HEREBY VERIFY THAT THE INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSES AND CALCULATIONS ARE:

☒ AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

☐ AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

March 23, 1992
DATE OF REVIEW

Christine McPhee
REVIEWED BY

- * BASED ON 3 RUN AVERAGE
** SPECIFY APPLICABLE UNITS
*** SPECIFY IN UNITS OF MASS/INPUT

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER 0204010003 P905
FACILITY NAME Elkem Metals Co.
SOURCE DESCRIPTION (OR SCC CODE) Calcium Carbide Furnace #13
CONTROL EQUIPMENT ICA Baghouse + Buffalo Forge Scrubber
DATE(S) OF TEST Sept. 21, 1992
FINAL TEST REPORT RECEIVED ON Oct. 13, 1992
POLLUTANT(S) TESTED TSP
TEST METHOD Method 5
TEST FIRM Enviroge Environmental, Inc.
EMISSION RATES*:
ACTUAL (lb(s)/hr) 14.34 ALLOWABLE** 24.6

OPERATING RATES*:

DURING TEST** Ave. of 12.4 ton/hr MAXIMUM** 14.5 ton/hr

EMISSION FACTOR*** Ave. operating rate = production rate; Max op. rate = Max Raw Mat. Input

COMMENTS: Test only sampled emissions from baghouse + determined rate of 14.16 $\frac{lb}{hr}$ TSP. Stack test of 3-21-89 also tested scrubber + found 0.18 $\frac{lb}{hr}$ TSP. Note scrubber emissions are often reported to a lime kiln (P009 or P010) so there are no ambient emissions from this point.
I HEREBY VERIFY INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSES AND CALCULATIONS ARE:

- ☒ AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.
- ☐ AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

10-29-92
DATE OF REVIEW

Christine McPhee
REVIEWED BY

- * BASED ON 3 RUN AVERAGE
** SPECIFY APPLICABLE UNITS
*** SPECIFY IN UNITS OF MASS/INPUT

OHIO EPA TESTS

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg. F	110.3	120.7	121.2	
9/21/92 <i>furnace w/ baghouse</i>	Moisture	vol.dec.	0.0111	0.0118	0.0125	
	Oxygen	% vol.	21	21	21	
	Volumetric flow, actual	acfm	100612	109041	104398	
	Volumetric flow, standard	dscfm	86008	91257	88001	
	Percent isokinetic		96.1	97.7	98.5	
Circle: Production or feed rate		TPH	12.4	12.4	12.4	
Capacity:		feed				
Pollutant concentrations:						
	Filterable PM	gr/dscf	0.0169	0.0183	0.0209	
	Condensable PM	gr/dscf	0.0001	0.0071	0.0035	
Pollutant mass flux rates:						
	Filterable PM	lb/hr	12.47	14.28	15.74	
	Condensable PM	lb/hr	0.068	5.57	2.6	
Emission factors:						
	Filterable PM	lb/ton	1.01	1.15	1.27	1.14
	Condensable PM	lb/ton	0.005484	0.449	0.210	0.22

Something wrong w/ these data.

inorganic

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg. F	97	97	95	
3/21/89 <i>furnace w/ baghouse</i>	Moisture	% vol.	0.15	0.25	0.21	
	Oxygen	% vol.	21	21	21	
	Volumetric flow, actual	acfm	121046	121607	122778	
	Volumetric flow, standard	dscfm	113135	113515	115071	
	Percent isokinetic		91.2	91.8	94.8	
Circle: Production or feed rate		TPH	12.4	12.4	12.4	
Capacity:		feed				
Pollutant concentrations:						
	Filterable PM	gr/dscf	0.0064	0.0086	0.0065	
	Condensable PM	gr/dscf	0.0127	0.0201	0.0125	
Pollutant mass flux rates:						
	Filterable PM	lb/hr	6.236	8.395	6.381	
	Condensable PM	lb/hr	12.329	19.518	12.316	
Emission factors:						
	Filterable PM	lb/ton	0.50	0.68	0.51	0.56
	Condensable PM	lb/ton	0.99	1.57	0.99	1.19

← from 9/21/92 test. Not recorded for 3/21/89 test.
Downrate 1.

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