DRAFT

Kiln with ESP
process not specified

SOURCE EMISSIONS SURVEY
OF
ESSROC MATERIALS, INC.
EASTERN DIVISION - CEMENT GROUP
KILNS NUMBER 1 AND 2 STACK
FREDERICK, MARYLAND
VOLUME I

NOVEMBER 1991

FILE NUMBER 91-240

METCO ENVIRONMENTAL

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NO PROCESS DESCRIPTION ETC DIFFERENCE—

NO QA/QC

SOURCE EMISSIONS SURVEY
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INTRODUCTION

METCO Environmental, Dallas, Texas, conducted a source emissions survey of ESSROC Materials, Inc., Eastern Division - Cement Group, located in Frederick, Maryland, on November 18, 19, 20, 21, 22, 23, 24, 25, and 26, 1991. The purpose of these tests was to determine the emissions of particulate matter, sulfur dioxide, oxides of nitrogen, carbon monoxide, total hydrocarbons, metals, semivolatile organic compounds, and volatile organic compounds under the following kiln operating conditions:

Condition	Kiln Operating Conditions
I	Kiln Number 1 - Firing Coal and Oil
	Kiln Number 2 - Firing Coal and Tires
II	Kiln Number 1 - Firing Coal and Oil
	Kiln Number 2 - Firing Coal

The sampling followed the procedures set forth in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3, 3A, 4, 5, 6, 6C, 7E, 10, and 25A; Method 3.1 of the "Methods Manual for Compliance with the BIF Regulations"; and in Test Methods for Evaluating Solid Waste, Volume II, Methods 0010 and 0030.

The sampling was observed by Mr. Gene Higg and Ms. Charon Gwyn of the State of Maryland Department of the Environment.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

I - TIRES II - NO TIRES

	Condition I	Condition II
"Front-half" Particulate Matter Emissions - lbs/hr	34.10	40.17
"Front-half" Particulate Matter Emissions - lbs/ton kiln feed	0.42	0.47
Total Particulate Matter Emissions - lbs/hr	36.33	42.43
Total Particulate Matter Emissions - lbs/ton kiln feed	0.45	0.50
Sulfur Dioxide Emissions - ppm	101.8	152.6
Sulfur Dioxide Emissions - lbs/hr	99.7	155.4
Oxides of Nitrogen Emissions - ppm	843	1,342
Oxides of Nitrogen Emissions - lbs/hr	606.0	971.8
Carbon Monoxide Emissions - ppm	42	16
Carbon Monoxide Emissions - lbs/hr	18.3	5.8
Total Hydrocarbons Emissions - ppm	1.4	1.9
Total Hydrocarbons Emissions - lbs/hr	1.0	1.4
Kiln Number 1 Raw Feed - tons/hr	39.9	42.3
Kiln Number 2 Raw Feed - tons/hr	41.1	42.4
Kiln Number 1 Clinker Production - tons/hr	23.5	24.1
Kiln Number 2 Clinker Production - tons/hr	23.6	24.2
Kiln Number 1 Coal Feed - tons/hr	5.0	4.7
Kiln Number 2 Coal Feed - tons/hr	4.3	5.8
Kiln Number 1 Oil Feed - gal/min	8.0	10.3
Kiln Number 2 Oil Feed - gal/min	0	0
Kiln Number 1 Tire Feed Rate - tires/rev	0	0
Kiln Number 2 Tire Feed Rate - tires/rev	2	0

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Metals Emissions

	Condition I Average (lbs/hr)	Condition II Average (lbs/hr)
Arsenic	N.D.	N.D.
Barium	0.013	0.017
Beryllium	N.D.	N.D.
Cadmium	6.44×10^{-4}	4.02×10^{-4}
Chromium	1.42×10^{-3}	2.50×10^{-4}
Lead	0.019	0.034
Mercury	0.010	0.011
Nickel	7.00×10^{-4}	4.33×10^{-4}
Selenium	N.D.	7.33×10^{-3}
Silver	N.D.	N.D.
Zinc	0.022	0.026

N.D. - None detected.

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Semivolatile Organic Compounds

	Condition I Average (lbs/hr)	Condition II Average (lbs/hr)		Condition I Average (lbs/hr)	Condition II Average (lbs/hr)
Phenol	4.49x10^{-3}	5.22x10^{-3}	Acenaphthene	N.D.	N.D.
bis(2-Chloroethyl)ether	N.D.	N.D.	2,4-Dinitrophenol	N.D.	N.D.
2-Chlorophenol	N.D.	N.D.	4-Nitrophenol	N.D.	N.D.
1,3-Dichlorobenzene	N.D.	N.D.	Dibenzofuran	1.03x10^{-3}(E)	1.40x10^{-4}
1,4-Dichlorobenzene	N.D.	N.D.	2,4-Dinitrotoluene	N.D.	N.D.
Benzyl Alcohol	N.D.	N.D.	2,6-Dinitrotoluene	N.D.	N.D.
1,2-Dichlorobenzene	N.D.	N.D.	Diethylphthalate	N.D.	N.D.
2-Methylphenol	N.D.	N.D.	4-Chlorophenyl-phenylether	N.D.	N.D.
bis(2-Chloroisopropyl)ether	N.D.	N.D.	Fluorene	N.D.	N.D.
4-Methylphenol	9.83x10^{-6}(E)	1.62x10^{-4}(E)	4-Nitroaniline	N.D.	N.D.
N-Nitroso-di-n-propylamine	N.D.	N.D.	4,6-Dinitro-2-methylphenol	N.D.	N.D.
Hexachloroethane	N.D.	N.D.	N-Nitrosodiphenylamine(1)	N.D.	N.D.
Nitrobenzene	N.D.	N.D.	4-Bromophenyl-phenylether	N.D.	N.D.
Isophorone	N.D.	N.D.	Hexachlorobenzene	N.D.	N.D.
2-Nitrophenol	N.D.	3.23x10^{-4}(E)	Pentachlorophenol	N.D.	N.D.
2,4-Dimethylphenol	N.D.	N.D.	Phenanthrene	6.57x10^{-4}(E)	9.21x10^{-4}(E)
Benzoic Acid	0.077	0.168	Anthracene	N.D.	N.D.
bis(2-Chloroethoxy)methane	N.D.	N.D.	Di-n-butylphthalate	9.26x10^{-4}(E)	1.98x10^{-4}
2,4-Dichlorophenol	N.D.	N.D.	Fluoranthene	5.27x10^{-5}(E)	N.D.
1,2,4-Trichlorobenzene	N.D.	N.D.	Pyrene	N.D.	N.D.
Naphthalene	0.020	0.011	Butylbenzylphthalate	N.D.	N.D.
4-Chloroaniline	N.D.	N.D.	3,3'-Dichlorobenzidine	N.D.	N.D.
Hexachlorobutadiene	N.D.	N.D.	Benzo(a)anthracene	N.D.	N.D.
4-Chloro-3-methylphenol	N.D.	N.D.	Chrysene	N.D.	N.D.
2-Methylnaphthalene	9.23x10^{-4}(E)	1.22x10^{-3}(E)	bis(2-Ethylhexyl)phthalate	2.84x10^{-3}	4.53x10^{-4}
Hexachlorocyclopentadiene	N.D.	N.D.	Di-n-octylphthalate	N.D.	7.37x10^{-5}(E)
2,4,6-Trichlorophenol	N.D.	N.D.	Benzo(b)fluoranthene	N.D.	N.D.
2,4,5-Trichlorophenol	N.D.	N.D.	Benzo(k)fluoranthene	N.D.	N.D.
2-Chloronaphthalene	N.D.	N.D.	Benzo(a)pyrene	N.D.	N.D.
2-Nitroaniline	N.D.	N.D.	Ideno(1,2,3-cd)pyrene	N.D.	N.D.
Dimethylphthalate	N.D.	N.D.	Dibenz(a,h)anthracene	N.D.	N.D.
Acenaphthylene	7.83x10^{-5}(E)	1.47x10^{-4}(E)	Benzo(g,h,i)perylene	N.D.	N.D.
3-Nitroaniline	N.D.	N.D.			

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS
Kilns Number 1 and 2 Stack
Volatile Organic Compounds

	Condition I Average (lbs/hr)	Condition II Average (lbs/hr)
Chloromethane	0.034	0.018
Bromomethane	7.08×10^{-3}	1.38×10^{-3}
Vinyl Chloride	N.D.	N.D.
Chloroethane	N.D.	N.D.
Methylene Chloride	3.08×10^{-3}	2.95×10^{-4}(E)
Acetone	0.026	0.018
Carbon Disulfide	5.87×10^{-3}	3.03×10^{-3}
1,1-Dichloroethene	N.D.	N.D.
1,1-Dichloroethane	N.D.	N.D.
cis-1,2-Dichloroethene	N.D.	N.D.
trans-1,2-Dichloroethene	N.D.	N.D.
Chloroform	5.51×10^{-5}(E)	N.D.
1,2-Dichloroethane	N.D.	N.D.
Trichlorofluoromethane	N.D.	2.09×10^{-4}
2-Butanone	4.04×10^{-3}	1.84×10^{-3}
1,1,1-Trichloroethane	2.69×10^{-4}	N.D.
Carbon Tetrachloride	N.D.	7.27×10^{-5}(E)
Vinyl Acetate	9.20×10^{-5}(E)	N.D.
Bromodichloromethane	N.D.	N.D.
1,2-Dichloropropane	N.D.	N.D.
cis-1,3-Dichloropropene	N.D.	N.D.
Trichloroethene	9.50×10^{-5}(E)	N.D.
Dibromochloromethane	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.
Benzene	0.446	0.149
trans-1,3-Dichloropropene	N.D.	N.D.
Bromoform	N.D.	N.D.
4-Methyl-2-Pentanone	N.D.	N.D.
2-Hexanone	N.D.	N.D.
Tetrachloroethene	6.33×10^{-5}(E)	7.17×10^{-5}(E)
1,1,2,2-Tetrachloroethane	N.D.	2.71×10^{-5}(E)
Toluene	0.395	0.091
Chlorobenzene	1.99×10^{-3}	5.20×10^{-4}
Ethylbenzene	2.99×10^{-3}	9.19×10^{-4}
Styrene	3.26×10^{-4}	N.D.
Xylenes	0.016	6.11×10^{-3}
1,2-dibromomethane	N.D.	N.D.
Trichlorotrifluoroethane	N.D.	N.D.

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition	Date	Kiln Number 1 Raw Feed (tons/hr)	Kiln Number 2 Raw Feed (tons/hr)	Kiln Number 1 Coal Feed (tons/hr)	Kiln Number 2 Coal Feed (tons/hr)	Kiln Number 1 Oil Feed (gal/min)	Kiln Number 2 Oil Feed (gal/min)	Kiln Number 1 Tire Feed (tires/rev)	Kiln Number 2 Tire Feed (tires/rev)	Kiln Number 1 Clinker Production (tons/hr)	Kiln Number 2 Clinker Production (tons/hr)
I	11/20/91	41.5	38.3	4.9	4.3	7.3	0	0	2	23.7	22.3
	11/21/91	41.3	42.9	5.0	4.4	10.3	0	0	2	23.6	24.5
	11/24/91	37.0	42.0	5.2	4.2	6.5	0	0	2	23.3	24.0
II	11/25/91	41.6	42.2	4.8	5.7	9.7	0	0	0	23.7	24.0
	11/26/91	42.9	42.5	4.5	5.9	10.9	0	0	0	24.5	24.3

METCO ENVIRONMENTAL

SUMMARY OF RESULTS
Kilns Number 1 and 2 Stack - Condition I

Run Number	1	2B	3A
Date	11/20/91	11/21/91	11/24/91
Time	0845-1201	1445-1705	1524-1838
Stack Flow Rate - ACFM	220,213	214,597	209,657
Stack Flow Rate - DSCFM*	102,306	97,858	97,629
% Water Vapor - % Vol.	27.69	28.28	27.42
% CO_2 - % Vol.	16.3	18.2	17.8
% O_2 - % Vol.	7.3	8.2	8.8
% Excess Air @ Sampling Point	56	73	83
Stack Temperature - °F	363	367	353
Stack Pressure - "Hg	29.85	29.68	29.45
Percent Isokinetic	92.6	103.6	100.1
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0484	0.0347	0.0369
grains/cf @ Stack Conditions	0.0224	0.0157	0.0171
lbs/hr	42.40	29.07	30.84
Total Catch grains/dscf*	0.0518	0.0368	0.0390
grains/cf @ Stack Conditions	0.0240	0.0167	0.0181
lbs/hr	45.45	30.89	32.65
Sulfur Dioxide Emissions - ppm	33.2	93.3	179.0
Sulfur Dioxide Emissions - lbs/hr	33.9	91.0	174.2

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Metals Emissions

Run Number	1	2	3A
Date	11/20/91	11/21/91	11/24/91
Time	1432-2020	1149-1422	1150-1406
Stack Flow Rate - ACFM	212,325	221,455	210,774
Stack Flow Rate - DSCFM*	95,903	100,333	100,308
% Water Vapor - % Vol.	29.51	28.99	27.70
% CO_2 - % Vol.	16.3	17.9	16.7
% O_2 - % Vol.	8.9	8.4	9.3
% Excess Air @ Sampling Point	82	76	90
Stack Temperature - °F	365	366	334
Stack Pressure - "Hg	29.85	29.76	29.50
Percent Isokinetic	105.7	105.2	101.7
Volume Dry Gas Sampled - DSCF*	60.778	63.308	61.160

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

	Run Number 1		Run Number 2		Run Number 3A	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Arsenic	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Barium	67.6	0.014	55.7	0.012	53.3	0.012
Beryllium	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cadmium	1.6	3.33×10^{-4}	N.D.	N.D.	7.4	1.60×10^{-3}
Chromium	6.0	1.25×10^{-3}	2.5	5.23×10^{-4}	11.5	2.48×10^{-3}
Lead	41.3	8.60×10^{-3}	47.9	0.010	171.3	0.037
Mercury	60.0	0.012	55.0	0.012	32.0	6.93×10^{-3}
Nickel	5.2	1.08×10^{-3}	N.D.	N.D.	4.7	1.20×10^{-3}
Selenium	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Silver	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Zinc	96.2	0.020	119.2	0.025	93.2	0.020

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Semivolatile Organic Compounds

Run Number	1	2	3A
Date	11/20/91	11/21/91	11/24/91
Time	0850-1238	0815-1313	1130-1522
Stack Flow Rate - ACFM	229,960	217,662	208,633
Stack Flow Rate - DSCFM*	108,400	100,274	101,781
% Water Vapor - % Vol.	26.17	27.96	26.17
% CO_2 - % Vol.	16.3	17.5	17.1
% O_2 - % Vol.	7.3	8.5	8.9
% Excess Air @ Sampling Point	56	77	83
Stack Temperature - °F	368	364	331
Stack Pressure - "Hg	29.85	29.76	29.49
Percent Isokinetic	92.5	108.8	96.5
Volume Dry Gas Sampled - DSCF*	95.109	103.452	99.329

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Semivolatile Organic Compounds

	Run Number 1		Run Number 2		Run Number 3A	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Phenol	24.86	2.74×10^{-3}	39.05	5.00×10^{-3}	34.87	4.72×10^{-3}
bis(2-Chloroethyl)ether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Chlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,3-Dichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,4-Dichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzyl Alcohol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Methylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
bis(2-Chloroisopropyl)ether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methylphenol	1.96(E)	2.95×10^{-4}(E)	N.D.	N.D.	N.D.	N.D.
N-Nitroso-di-n-propylamine	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Hexachloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Isophorone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Nitrophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4-Dimethylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzoic Acid	435.60	0.066	232.56	0.030	1,003.82	0.136
bis(2-Chloroethoxy)methane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4-Dichlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2,4-Trichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Naphthalene	33.09	4.98×10^{-3}	382.12	0.049	47.29	6.40×10^{-3}
4-Chloroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Hexachlorobutadiene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Chloro-3-methylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Methylnaphthalene	5.38(E)	8.09×10^{-4}(E)	8.96(E)	1.15×10^{-3}(E)	5.98(E)	8.09×10^{-4}(E)

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Semivolatile Organic Compounds

	Run Number 1		Run Number 2		Run Number 3A	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Hexachlorocyclopentadiene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4,6-Trichlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4,5-Trichlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Chloronaphthalene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Nitroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dimethylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Acenaphthylene	N.D.	N.D.	1.84(E)	2.35×10^{-4}(E)	N.D.	N.D.
3-Nitroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Acenaphthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4-Dinitrophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Nitrophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibenzofuran	4.25(E)	6.39×10^{-4}(E)	8.47(E)	1.08×10^{-3}(E)	10.18	1.38×10^{-3}
2,4-Dinitrotoluene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,6-Dinitrotoluene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Diethylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Chlorophenyl-phenylether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Fluorene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Nitroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4,6-Dinitro-2-methylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N-Nitrosodiphenylamine(1)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Bromophenyl-phenylether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Hexachlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Pentachlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Phenanthrene	4.05(E)	6.09×10^{-4}(E)	5.30(E)	6.78×10^{-4}(E)	5.06(E)	6.84×10^{-4}(E)
Anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Di-n-butylphthalate	6.57(E)	9.88×10^{-4}(E)	4.92(E)	6.29×10^{-4}(E)	8.61(E)	1.16×10^{-3}(E)
Fluoranthene	1.05(E)	1.58×10^{-4}(E)	N.D.	N.D.	N.D.	N.D.

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Semivolatile Organic Compounds

	Run Number 1		Run Number 2		Run Number 3A	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Pyrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Butylbenzylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
3,3'-Dichlorobenzidine	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(a)anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chrysene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
bis(2-Ethylhexyl)phthalate	24.00	3.61×10^{-3}	22.85	2.92×10^{-3}	14.69	1.99×10^{-3}
Di-n-octylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(b)fluoranthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(k)fluoranthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(a)pyrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ideno(1,2,3-cd)pyrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibenz(a,h)anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(g,h,i)perylene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Volatile Organic Compounds

	Run Number 1A	Run Number 1B	Run Number 1C
Volume Sampled - dscf*	0.715	0.703	0.702

	Run Number 1A		Run Number 1B		Run Number 1C		Average
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr	lbs/hr
Chloromethane	4.822	0.096	3.087	0.063	1.681	0.034	0.064
Bromomethane	0.920	0.018	0.646	0.013	0.242	4.93×10^{-3}	0.012
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	0.049(E)	9.80×10^{-4}(E)	0.983	0.020	0.123	2.51×10^{-3}	7.83×10^{-3}
Acetone	1.118	0.022	2.345	0.048	0.568	0.012	0.027
Carbon Disulfide	0.298	5.96×10^{-3}	0.542	0.011	0.163	3.32×10^{-3}	6.76×10^{-3}
1,1-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorofluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Butanone	0.144	2.88×10^{-3}	0.431	8.77×10^{-3}	0.101	2.06×10^{-3}	4.57×10^{-3}
1,1,1-Trichloroethane	N.D.	N.D.	0.119	2.42×10^{-3}	N.D.	N.D.	8.07×10^{-3}
Carbon Tetrachloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vinyl Acetate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloropropane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	14.495	0.290	50.361	1.025	15.081	0.307	0.541
trans-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromoform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methyl-2-Pentanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Hexanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.	0.028(E)	5.70×10^{-4}(E)	N.D.	N.D.	1.90×10^{-4}(E)
1,1,2,2-Tetrachloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	15.296	0.306	48.722	0.992	15.529	0.316	0.538
Chlorobenzene	0.105	2.10×10^{-3}	0.227	4.62×10^{-3}	0.056	1.14×10^{-3}	2.62×10^{-3}
Ethylbenzene	0.114	2.28×10^{-3}	0.312	6.35×10^{-3}	0.095	1.94×10^{-3}	3.52×10^{-3}
Styrene	N.D.	N.D.	N.D.	N.D.	0.029(E)	5.91×10^{-4}(E)	1.97×10^{-4}(E)
Xylenes	0.571	0.011	1.497	0.030	0.414	8.44×10^{-3}	0.016
1,2-dibromomethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorotrifluoroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)
N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Volatile Organic Compounds

	Run Number 2A	Run Number 2B	Run Number 2C
Volume Sampled - dscf*	0.723	0.719	0.718

	Run Number 2A		Run Number 2B		Run Number 2C		Average
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr	lbs/hr
Chloromethane	0.718	0.013	0.961	0.018	0.624	0.012	0.014
Bromomethane	0.341	6.24×10^{-3}	0.330	6.07×10^{-3}	0.247	4.55×10^{-3}	5.62×10^{-3}
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	0.033(E)	6.04×10^{-4}(E)	0.055(E)	1.01×10^{-3}(E)	0.140	2.58×10^{-3}	1.40×10^{-3}(E)
Acetone	2.114	0.039	0.615	0.011	1.127	0.021	0.024
Carbon Disulfide	0.629	0.012	0.235	4.33×10^{-3}	0.302	5.57×10^{-3}	7.30×10^{-3}
1,1-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroform	N.D.	N.D.	N.D.	N.D.	0.012(E)	2.21×10^{-4}(E)	7.37×10^{-5}(E)
1,2-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorofluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Butanone	0.447	8.18×10^{-3}	0.089	1.64×10^{-3}	0.179	3.30×10^{-3}	4.37×10^{-3}
1,1,1-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Carbon Tetrachloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vinyl Acetate	N.D.	N.D.	N.D.	N.D.	0.045(E)	8.29×10^{-4}(E)	2.76×10^{-4}(E)
Bromodichloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloropropane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	44.811	0.820	11.29	0.208	17.822	0.328	0.452
trans-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromoform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methyl-2-Pentanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Hexanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2,2-Tetrachloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	42.153	0.772	11.624	0.214	17.757	0.327	0.438
Chlorobenzene	0.170	3.11×10^{-3}	0.048(E)	8.83×10^{-4}(E)	0.095	1.75×10^{-3}	1.91×10^{-3}
Ethylbenzene	0.335	6.13×10^{-3}	0.088	1.62×10^{-3}	0.150	2.76×10^{-3}	3.50×10^{-3}
Styrene	N.D.	N.D.	0.069	1.27×10^{-3}	0.058	1.07×10^{-3}	7.80×10^{-4}
Xylenes	1.684	0.031	0.445	8.19×10^{-3}	0.813	0.015	0.018
1,2-dibromomethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorotrifluoroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)
N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition I

Volatile Organic Compounds

	Run Number 4A	Run Number 4B	Run Number 4C
Volume Sampled - dscf*	0.742	0.733	0.732

	Run Number 4A		Run Number 4B		Run Number 4C		Average
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr	lbs/hr
Chloromethane	1.734	0.031	1.152	0.021	1.012	0.019	0.024
Bromomethane	0.200	3.62×10^{-3}	0.159	2.91×10^{-3}	0.238	4.37×10^{-3}	3.63×10^{-3}
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Acetone	N.D.	N.D.	2.937	0.052	1.357	0.025	0.026
Carbon Disulfide	0.015(E)	2.72×10^{-4}(E)	0.359	6.58×10^{-3}	0.207	3.80×10^{-3}	3.55×10^{-3}
1,1-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroform	N.D.	N.D.	0.008(E)	1.47×10^{-4}(E)	0.007(E)	1.28×10^{-4}(E)	9.17×10^{-5}(E)
1,2-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorofluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Butanone	0.217	3.93×10^{-3}	0.307	5.63×10^{-3}	N.D.	N.D.	3.19×10^{-3}
1,1,1-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Carbon Tetrachloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vinyl Acetate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloropropane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	20.213	0.366	22.690	0.416	13.643	0.250	0.344
trans-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromoform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methyl-2-Pentanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Hexanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2,2-Tetrachloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	10.604	0.192	14.881	0.273	8.913	0.164	0.210
Chlorobenzene	0.078	1.41×10^{-3}	0.105	1.92×10^{-3}	0.052	9.54×10^{-4}	1.43×10^{-3}
Ethylbenzene	0.101	1.83×10^{-3}	0.148	2.71×10^{-3}	0.073	1.34×10^{-3}	1.96×10^{-3}
Styrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Xylenes	0.742	0.013	0.995	0.018	0.509	9.34×10^{-3}	0.013
1,2-dibromomethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorotrifluoroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)
N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack
Continuous Monitor Data
Condition I

Date	Time	Oxides of Nitrogen Emissions (ppm)	Oxides of Nitrogen Emissions (lbs/hr)	Sulfur Dioxide Emissions (ppm)	Sulfur Dioxide Emissions (lbs/hr)	Carbon Monoxide Emissions (ppm)	Carbon Monoxide Emissions (lbs/hr)	Total Hydrocarbons Emissions as Propane (ppm)	Total Hydrocarbons Emissions as Propane (lbs/hr)	Oxygen Concentration (% Vol.)
11/20/91	1000-1100	663	485.4	13	13.2	36	16.1	1.0	0.7	9.0
	1100-1200	602	440.8	21	21.4	55	24.5	1.0	0.7	8.8
	1700-1800	601	440.0	5	5.1	50	22.3	1.0	0.7	9.8
	1900-2000	648	474.5	7	7.1	16	7.1	1.0	0.7	9.4
	Average	629	460.2	12	11.7	39	17.5	1.0	0.7	9.3
11/21/91	0900-1000	790	563.1	98	97.1	34	14.8	1.0	0.7	8.7
	1000-1100	808	575.9	59	58.5	20	8.7	1.0	0.7	8.9
	1100-1200	780	555.9	102	101.1	25	10.9	1.2	0.8	8.2
	1200-1300	772	550.2	73	72.3	29	12.6	1.5	1.0	8.2
	1300-1400	762	543.1	70	69.4	18	7.8	1.4	1.0	8.6
	1400-1500	753	536.7	73	72.3	27	11.7	1.4	1.0	8.4
	1500-1600	674	480.4	84	83.2	47	20.4	1.5	1.0	8.1
	1600-1700	685	488.2	52	51.5	36	15.6	1.5	1.0	8.2
	1700-1800	N.D.	N.D.	39	38.6	17	7.4	1.5	1.0	8.3
	Average	753	536.7	72	71.6	28	12.2	1.3	0.9	8.4
11/24/91	1140-1240	1,061	759.4	186	185.1	137	59.7	1.6	1.1	8.9
	1240-1340	875	626.3	141	140.3	48	20.9	1.8	1.2	9.2
	1340-1440	973	696.4	156	155.2	80	34.9	1.5	1.0	8.4
	1500-1600	1,240	887.5	133	132.3	42	18.3	2.0	1.4	8.2
	1600-1700	1,360	973.4	121	120.4	33	14.4	2.0	1.4	8.5
	1700-1800	1,340	959.1	137	136.3	41	17.9	2.0	1.4	8.5
	1800-1900	1,180	844.6	116	115.4	25	10.9	2.0	1.4	8.7
	Average	1,147	821.0	141	140.7	58	25.3	1.8	1.3	8.6

N.D. - No data, monitor malfunction.

METCO ENVIRONMENTAL

METCO ENVIRONMENTAL

SUMMARY OF RESULTS
Kilns Number 1 and 2 Stack - Condition II

Run Number	4	5	6
Date	11/25/91	11/25/91	11/26/91
Time	0710-0923	1410-1635	0715-1010
Stack Flow Rate - ACFM	217,336	205,300	202,533
Stack Flow Rate - DSCFM*	104,528	100,664	99,449
% Water Vapor - % Vol.	27.15	27.96	29.12
% CO_2 - % Vol.	17.8	17.1	18.2
% O_2 - % Vol.	8.2	8.5	8.0
% Excess Air @ Sampling Point	72	76	69
Stack Temperature - °F	338	315	307
Stack Pressure - "Hg	29.75	29.79	29.99
Percent Isokinetic	96.6	95.8	99.6
Particulates Probe, Cyclone & Filter Catch grains/dscf*	0.0487	0.0379	0.0519
grains/cf @ Stack Conditions	0.0233	0.0185	0.0254
lbs/hr	43.63	32.68	44.21
Total Catch grains/dscf*	0.0513	0.0407	0.0543
grains/cf @ Stack Conditions	0.0246	0.0199	0.0266
lbs/hr	45.92	35.08	46.28
Sulfur Dioxide Emissions - ppm	222.1	92.2	143.5
Sulfur Dioxide Emissions - lbs/hr	231.4	92.5	142.2

*** 29.92 "Hg, 68°F (760 mm Hg, 20°C)**

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Metals Emissions

Run Number	4	5	6
Date	11/25/91	11/25/91	11/26/91
Time	1100-1320	1743-1958	1136-1352
Stack Flow Rate - ACFM	215,369	198,767	198,157
Stack Flow Rate - DSCFM*	103,842	98,091	96,944
% Water Vapor - % Vol.	27.40	28.50	29.92
% CO_2 - % Vol.	17.0	18.2	18.7
% O_2 - % Vol.	8.8	8.4	8.2
% Excess Air @ Sampling Point	81	76	73
Stack Temperature - °F	334	305	301
Stack Pressure - "Hg	29.79	29.81	29.99
Percent Isokinetic	100.5	102.0	103.0
Volume Dry Gas Sampled - DSCF*	62.585	59.986	59.865

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

	Run Number 4		Run Number 5		Run Number 6	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Arsenic	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Barium	58.4	0.013	65.0	0.014	114.0	0.024
Beryllium	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cadmium	1.5	3.28×10^{-4}	1.2	2.59×10^{-4}	2.9	6.20×10^{-4}
Chromium	N.D.	N.D.	0.7	1.51×10^{-4}	2.8	5.98×10^{-4}
Lead	93.2	0.020	163.0	0.035	220.0	0.047
Mercury	55.8	0.012	60.0	0.013	34.0	7.27×10^{-3}
Nickel	N.D.	N.D.	N.D.	N.D.	6.1	1.30×10^{-3}
Selenium	N.D.	N.D.	N.D.	N.D.	102.1	0.022
Silver	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Zinc	161.1	0.035	82.9	0.018	117.1	0.025

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Semivolatile Organic Compounds

Run Number	4	5	6
Date	11/25/91	11/25/91	11/26/91
Time	0745-1126	1410-1753	0715-1132
Stack Flow Rate - ACFM	207,653	203,074	203,620
Stack Flow Rate - DSCFM*	100,951	101,681	102,722
% Water Vapor - % Vol.	26.17	26.59	27.39
% CO_2 - % Vol.	17.3	17.5	18.0
% O_2 - % Vol.	8.5	8.4	8.2
% Excess Air @ Sampling Point	76	75	72
Stack Temperature - °F	340	314	304
Stack Pressure - "Hg	29.75	29.79	29.99
Percent Isokinetic	97.6	95.7	98.6
Volume Dry Gas Sampled - DSCF*	99.672	98.477	102.531

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Semivolatile Organic Compounds

	Run Number 4		Run Number 5		Run Number 6	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Phenol	44.36	5.93×10^{-3}	39.66	5.40×10^{-3}	32.75	4.33×10^{-3}
bis(2-Chloroethyl)ether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Chlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,3-Dichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,4-Dichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzyl Alcohol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Methylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
bis(2-Chloroisopropyl)ether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methylphenol	N.D.	N.D.	3.57(E)	4.86×10^{-4}(E)	N.D.	N.D.
N-Nitroso-di-n-propylamine	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Hexachloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nitrobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Isophorone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Nitrophenol	7.26(E)	9.70×10^{-4}(E)	N.D.	N.D.	N.D.	N.D.
2,4-Dimethylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzoic Acid	1,506.16	0.201	994.11	0.135	1,266.34	0.167
bis(2-Chloroethoxy)methane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4-Dichlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2,4-Trichlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Naphthalene	87.29	0.012	103.61	0.014	43.57	5.76×10^{-3}
4-Chloroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Hexachlorobutadiene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Chloro-3-methylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Methylnaphthalene	9.96(E)	1.33×10^{-3}(E)	7.66(E)	1.04×10^{-3}(E)	9.75(E)	1.29×10^{-3}(E)

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Semivolatile Organic Compounds

	Run Number 4		Run Number 5		Run Number 6	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Hexachlorocyclopentadiene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4,6-Trichlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4,5-Trichlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Chloronaphthalene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Nitroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dimethylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Acenaphthylene	1.84(E)	2.46×10^{-4}(E)	1.44(E)	1.96×10^{-4}(E)	N.D.	N.D.
3-Nitroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Acenaphthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4-Dinitrophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Nitrophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibenzofuran	16.93	2.26×10^{-3}	7.65(E)	1.04×10^{-3}(E)	6.75(E)	8.93×10^{-4}(E)
2,4-Dinitrotoluene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,6-Dinitrotoluene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Diethylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Chlorophenyl-phenylether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Fluorene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Nitroaniline	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4,6-Dinitro-2-methylphenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
N-Nitrosodiphenylamine(1)	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Bromophenyl-phenylether	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Hexachlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Pentachlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Phenanthrene	9.72(E)	1.30×10^{-3}(E)	5.68(E)	7.74×10^{-4}(E)	5.20(E)	6.88×10^{-4}(E)
Anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Di-n-butylphthalate	16.60	2.22×10^{-3}	16.55	2.26×10^{-3}	11.08	1.47×10^{-3}
Fluoranthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Semivolatile Organic Compounds

	Run Number 4		Run Number 5		Run Number 6	
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr
Pyrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Butylbenzylphthalate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
3,3'-Dichlorobenzidine	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(a)anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chrysene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
bis(2-Ethylhexyl)phthalate	30.49	4.08×10^{-3}	47.94	6.53×10^{-3}	22.60	2.99×10^{-3}
Di-n-octylphthalate	N.D.	N.D.	1.62(E)	2.21×10^{-4}(E)	N.D.	N.D.
Benzo(b)fluoranthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(k)fluoranthene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(a)pyrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ideno(1,2,3-cd)pyrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibenz(a,h)anthracene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzo(g,h,i)perylene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Volatile Organic Compounds

	Run Number 5A	Run Number 5B	Run Number 5C
Volume Sampled - dscf*	0.765	0.760	0.755

	Run Number 5A		Run Number 5B		Run Number 5C		Average
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr	lbs/hr
[redacted]ne	0.984	0.017	0.809	0.014	1.458	0.026	0.019
[redacted]	0.151	2.63×10^{-3}	0.085	1.49×10^{-3}	N.D.	N.D.	1.37×10^{-3}
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	N.D.	N.D.	N.D.	N.D.	0.028(E)	4.94×10^{-4}(E)	1.65×10^{-4}(E)
[redacted]	1.761	0.031	1.558	0.027	1.956	0.035	0.031
[redacted]	0.329	5.73×10^{-3}	0.261	4.58×10^{-3}	0.228	4.02×10^{-3}	4.78×10^{-3}
1,1-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorofluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
[redacted]	0.184	3.20×10^{-3}	0.152	2.66×10^{-3}	0.142	2.51×10^{-3}	2.79×10^{-3}
1,1,1-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Carbon Tetrachloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vinyl Acetate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloropropane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
[redacted]	10.220	0.178	9.775	0.171	10.388	0.183	0.177
trans-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromoform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methyl-2-Pentanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Hexanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2,2-Tetrachloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
[redacted]	3.920	0.068	4.346	0.076	4.928	0.087	0.077
[redacted]e	0.059	1.03×10^{-3}	0.045(E)	7.89×10^{-4}(E)	0.072	1.27×10^{-3}	1.02×10^{-3}
[redacted]	0.094	1.64×10^{-3}	0.074	1.30×10^{-3}	0.070	1.24×10^{-3}	1.39×10^{-3}
Styrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
[redacted]	0.771	0.013	0.577	0.010	0.529	9.34×10^{-3}	0.011
1,2-dibromomethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorotrifluoroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)
N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Volatile Organic Compounds

	Run Number 6B	Run Number 6C	Run Number 6D
Volume Sampled - dscf*	0.759	0.769	0.770

	Run Number 6B		Run Number 6C		Run Number 6D		Average
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr	lbs/hr
Chloromethane	1.154	0.020	1.064	0.019	2.358	0.041	0.027
Bromomethane	0.154	2.72×10^{-3}	0.176	3.07×10^{-3}	0.143	2.49×10^{-3}	2.76×10^{-3}
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	N.D.	N.D.	0.033(E)	5.76×10^{-4}(E)	0.049(E)	8.54×10^{-4}(E)	4.77×10^{-4}(E)
Acetone	1.932	0.034	1.104	0.019	N.D.	N.D.	0.018
Carbon Disulfide	0.244	4.31×10^{-3}	0.364	6.35×10^{-3}	0.170	2.96×10^{-3}	4.54×10^{-3}
1,1-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorofluoromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Butanone	0.165	2.92×10^{-3}	0.081	1.41×10^{-3}	0.161	2.81×10^{-3}	2.38×10^{-3}
1,1,1-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Carbon Tetrachloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vinyl Acetate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloropropane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	10.489	0.185	7.988	0.139	3.300	0.058	0.127
trans-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromoform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methyl-2-Pentanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Hexanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.	N.D.	N.D.	0.037(E)	6.45×10^{-4}(E)	2.15×10^{-4}(E)
1,1,2,2-Tetrachloroethane	N.D.	N.D.	N.D.	N.D.	0.014(E)	2.44×10^{-4}(E)	8.13×10^{-5}(E)
Toluene	6.158	0.109	1.115	0.019	2.335	0.041	0.056
Chlorobenzene	0.063	1.11×10^{-3}	N.D.	N.D.	0.030(E)	5.23×10^{-4}(E)	5.41×10^{-4}
Ethylbenzene	0.071	1.26×10^{-3}	N.D.	N.D.	0.067(E)	1.17×10^{-3}(E)	8.10×10^{-4}
Styrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Xylenes	0.544	9.62×10^{-3}	0.024(E)	4.19×10^{-4}(E)	0.353	6.15×10^{-3}	5.40×10^{-3}
1,2-dibromomethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorotrifluoroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)
N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack

Condition II

Volatile Organic Compounds

	Run Number 7A	Run Number 7B	Run Number 7C
Volume Sampled - dscf*	0.773	0.770	0.758

	Run Number 7A		Run Number 7B		Run Number 7C		Average
	Total µgs	lbs/hr	Total µgs	lbs/hr	Total µgs	lbs/hr	lbs/hr
Chloromethane	0.444	7.79×10^{-3}	0.643	0.011	0.371	6.64×10^{-3}	8.48×10^{-3}
Bromomethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Vinyl Chloride	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Methylene Chloride	N.D.	N.D.	0.015(E)	2.64×10^{-4}(E)	0.026(E)	4.65×10^{-4}(E)	2.43×10^{-4}(E)
Acetone	0.297	5.21×10^{-3}	0.476	8.38×10^{-3}	N.D.	N.D.	4.53×10^{-3}
Carbon Disulfide	0.018(E)	3.16×10^{-4}(E)	0.076	1.34×10^{-3}	0.007(E)	1.25×10^{-4}(E)	5.94×10^{-4}(E)
1,1-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
trans-1,2-Dichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chloroform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorofluoromethane	0.034(E)	5.96×10^{-4}(E)	N.D.	N.D.	0.072	1.29×10^{-3}	6.29×10^{-4}
2-Butanone	N.D.	N.D.	0.061	1.07×10^{-3}	N.D.	N.D.	3.57×10^{-4}
1,1,1-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Carbon Tetrachloride	0.012(E)	2.10×10^{-4}(E)	0.012(E)	2.11×10^{-4}(E)	0.013(E)	2.33×10^{-4}(E)	2.18×10^{-4}(E)
Vinyl Acetate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromodichloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,2-Dichloropropane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
cis-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Dibromochloromethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	7.370	0.129	9.772	0.017	15.955	0.285	0.144
trans-1,3-Dichloropropene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Bromoform	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
4-Methyl-2-Pentanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2-Hexanone	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tetrachloroethene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1,1,2,2-Tetrachloroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	3.206	0.056	4.515	0.079	15.774	0.282	0.139
Chlorobenzene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethylbenzene	0.013(E)	2.28×10^{-4}(E)	0.025(E)	4.40×10^{-4}(E)	0.056	1.00×10^{-3}	5.56×10^{-4}(E)
Styrene	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Xylenes	0.054(E)	9.47×10^{-4}(E)	0.142	2.50×10^{-3}	0.130	2.33×10^{-3}	1.93×10^{-3}
1,2-dibromomethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Trichlorotrifluoroethane	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)
N.D. - None detected.
E - Estimated. Detected, but below the quantitation limit.

SUMMARY OF RESULTS

Kilns Number 1 and 2 Stack
Continuous Monitor Data
Condition II

Date	Time	Oxides of Nitrogen Emissions (ppm)	Oxides of Nitrogen Emissions (lbs/hr)	Sulfur Dioxide Emissions (ppm)	Sulfur Dioxide Emissions (lbs/hr)	Carbon Monoxide Emissions (ppm)	Carbon Monoxide Emissions (lbs/hr)	Total Hydrocarbons Emissions as Propane (ppm)	Total Hydrocarbons Emissions as Propane (lbs/hr)	Oxygen Concentration (% Vol.)
11/25/91	0715-0815	1,002	740.1	130	133.5	13	5.8	1.5	1.1	8.5
	0815-0915	1,327	980.2	145	148.9	26	11.7	1.5	1.1	7.9
	0915-1015	1,737	1,283.0	52	53.4	17	7.6	1.8	1.3	8.8
	1050-1150	1,542	1,139.0	40	41.1	14	6.3	2.0	1.4	9.0
	1150-1250	1,479	1,092.5	66	67.8	14	6.3	2.0	1.4	9.0
	1250-1350	1,436	1,060.7	116	119.1	15	6.7	2.0	1.4	8.8
	Average	1,421	1,049.3	92	94.0	17	7.4	1.8	1.3	8.7
	1340-1440	1,563	1,121.4	43	42.9	14	6.1	2.0	1.4	8.9
	1440-1540	1,469	1,053.9	41	40.9	12	5.2	2.0	1.4	8.8
	1540-1640	1,384	992.9	61	60.8	12	5.2	2.0	1.4	8.5
	1640-1740	1,393	999.4	62	61.8	12	5.2	2.0	1.4	8.2
	1740-1840	1,394	1,000.1	55	54.9	12	5.2	2.0	1.4	8.4
	1840-1940	1,342	962.8	56	55.9	13	5.7	2.0	1.4	8.1
	Average	1,424	1,021.8	53	52.9	13	5.4	2.0	1.4	8.5
11/26/91	0905-1005	1,331	950.7	136	135.1	13	5.6	2.0	1.4	8.0
	1005-1105	1,209	863.6	130	129.1	13	5.6	2.0	1.4	8.0
	1105-1205	1,148	820.0	233	231.4	21	9.1	2.1	1.4	7.6
	1210-1310	1,108	791.4	235	233.4	23	1.0	2.0	1.4	7.6
	1310-1410	1,115	796.4	240	238.3	24	1.0	2.0	1.4	7.7
	Average	1,182	844.4	195	193.5	19	4.5	2.0	1.4	7.9

DISCUSSION OF RESULTS

The following tests were not considered valid and were repeated.

Condition	Parameter	Run Number	Reason
I	Particulate Matter	2	Not isokinetic
	All	3	Plant operational problems

All of the valid tests performed appeared to be valid representations of the actual emissions during the tests. The indicative parameters calculated from the field data were in close agreement.

Condition	Parameter	Moisture Content Variation (%)	Flow Rate (Q_s) Variation (%)	Deviation from 100% Isokinetic Sampling Rate (%)
I	Particulate Matter/ Sulfur Dioxide	1.7	3.1	7.4
	Metals	3.6	3.0	5.7
	Semivolatiles	4.5	4.7	8.8
II	Particulate Matter/ Sulfur Dioxide	3.7	2.9	4.2
	Metals	4.6	4.2	3.0
	Semivolatiles	2.5	0.9	4.3

The results of the metals were calculated based on values corrected to the applicable blank train values.

The semivolatile organic compounds and volatile organic compounds results were not corrected to the blank train values, due to inconsistent results from the blank train analyses.

The acetone results from the VOST condensates measured during Condition II were not considered valid. Acetone has historically been a contaminant in the condensate blank and was present in the Condition I blank, but was not present in the Condition II blank. The results from the VOST condensates from Condition II were not included in the emission rate calculations.

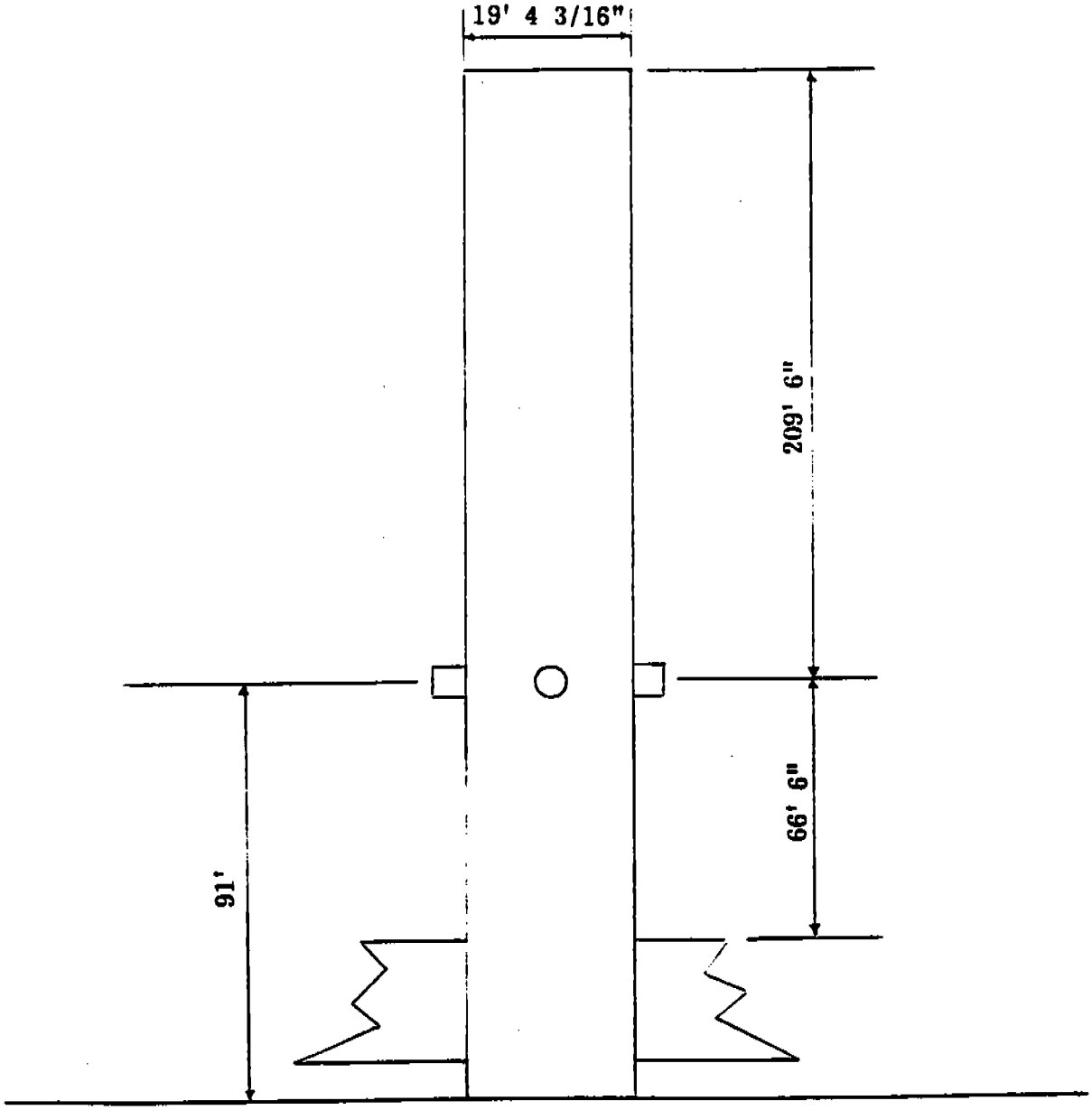
When Run Number 3 was aborted due to plant operational problems, the next volatile organic compounds Run Number was Run Number 4, as opposed to Run Number 3A which was used for the other parameters.

DESCRIPTION OF SAMPLING LOCATION

The sampling location on the Kilns Number 1 and 2 Stack is approximately 91 feet above the ground. The sampling ports are located 66 feet 6 inches (3.44 stack diameters) downstream from the inlets to the stack and 209 feet 6 inches (10.83 stack diameters) upstream from the outlet of the stack.

SAMPLING LOCATION

Kilns Number 1 and 2 Stack



SAMPLING AND ANALYTICAL PROCEDURES

The sampling followed the procedures outlined in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3, 3A, 4, 5, 6, 6C, 7E, 10, and 25A; Method 3.1 of the "Methods Manual for Compliance with the BIF Regulations"; and in Test Methods for Evaluating Solid Waste, Volume II, Methods 0010 and 0030.

A preliminary velocity traverse was made at each of the four ports on the stack, in order to determine the uniformity and magnitude of the flow prior to testing. Several traverse points were checked for cyclonic flow and none was found to be present.

The following number of sample points and sample times were used for each parameter:

Parameter	Number of Ports	Number of Traverse Points Per Port	Total Number of Traverse Points	Isokinetic Sample Time at Each Point (min)
Particulate Matter/ Sulfur Dioxide	4	6	24	5
Metals	4	6	24	5
Semivolatiles	4	6	24	8**
Volatiles	1	1	1	40*

* Not isokinetic.
** Data was recorded at four-minute intervals.

On all tests, the sampling trains were leak-checked at the nozzle at 15 inches of mercury vacuum before each test, and leak-checked at the nozzle after each test at the highest vacuum reading recorded during the test. This was done to predetermine the possibility of a diluted sample.

Also before and after each test, the pitot tube lines were checked for leaks under both a vacuum and a pressure. The lines were also checked for clearance and the manometer was zeroed before each test.

Particulate Matter/Sulfur Dioxide

Triplicate samples for particulate matter and sulfur dioxide were taken at each of the two operating conditions. The samples were taken according to EPA Methods 1, 2, 3, 4, 5, and 6. At the conclusion of each test, the sampling train was purged for fifteen minutes with ambient air at the average sample rate used during each test.

Sampling Train

Glass Nozzle
Heated Glass Probe 248°F ± 25°F
Heated Glass Fiber Filter and Glass Support 248°F ± 25°F

The "back-half" of the sampling train contained the following impingers:

Impinger Number	Contents	Amount	Parameter Collected
1	80% Isopropyl Alcohol	200 ml	Particulate Matter and Sulfur Dioxide
2	6% Hydrogen Peroxide	200 ml	Sulfur Dioxide
3	6% Hydrogen Peroxide	200 ml	Sulfur Dioxide
4	Empty	------	Moisture
5	Silica Gel	200 g	Moisture

The isopropyl alcohol solution was checked for hydrogen peroxide contamination and none was found.

Particulate matter emissions were determined gravimetrically.

The particulate matter collected in Impinger Number 1 was corrected for the sulfur trioxide collected.

Metals

Triplicate samples for metals were taken at each condition. The samples were collected using a combination of EPA Methods 1, 2, 3, 4, 5, and Method 3.1 of the "Methods Manual for Compliance with the BIF Regulations." One blank sample was submitted for each of the two operating conditions.

Sampling Train

Glass Nozzle
Heated Glass Probe 248°F ± 25°F
Heated Quartz Fiber Filter and Teflon Support 248°F ± 25°F

The "back-half" of the metals sampling train contained the following impingers:

Impinger Number	Contents	Amount	Parameter Collected
1	Empty	------	Moisture and Metals
2	5% HNO_3 and 10% H_2O_2	100 ml	Metals
3	5% HNO_3 and 10% H_2O_2	100 ml	Metals
4	4% $KMnO_4$ and 10% H_2SO_4	200 ml	Mercury
5	Empty	------	Moisture
6	Silica Gel	200 g	Moisture

The "front-half" collections of the EPA-type sampling train were also recovered and analyzed for metals.

Semivolatile Organic Compounds

Triplicate samples for semivolatile organic compounds were taken at each condition. The samples were collected using a combination of EPA Methods 1, 2, 3, 4, and 5; and Test Methods for Evaluating Solid Waste, Volume II, November 1986, Method 0010, "Modified Method 5 Sampling Train." One blank sample was submitted for each of the two operating conditions.

Sampling Train

Glass Nozzle
Heated Glass Probe 248°F ± 25°F
Heated Glass Fiber Filter and Teflon Support 248°F ± 25°F
Condenser Coil
XAD - Sorbent Trap
Impinger 1 - Modified Design Empty
Impinger 2 - Modified Design 100 ml 0.1N NaOH
Impinger 3 - Greenburg-Smith Design 100 ml 0.1N NaOH
Impinger 4 - Modified Design Empty
Impinger 5 - Modified Design Silica Gel

All glassware was cleaned with a 1/1 solution of methanol and methylene chloride prior to use.

All glassware connections were sealed with teflon tape.

At the conclusion of each test, the nozzle, probe, and connecting glassware prior to the filter were washed with a 1/1 solution of methanol and methylene chloride, which was recovered for analysis.

The filter, impinger solutions, and condensates were also recovered and analyzed.

Volatile Organic Compounds

Four samples for volatile organic compounds will be taken during each test at each condition. The samples were collected using EPA Method 0030, "Volatile Organic Sampling Train." Twenty liters of sample was collected at 0.5 liters per minute for a total of forty minutes at one sampling point; SLO-VOST. One blank sample was submitted for each of the three tests at each of the two operating conditions.

Sampling Train

Heated Glass Probe 280°F ± 15°F
Condenser
Tenax Sorbent Cartridge
Impinger Empty
Condenser
Tenax/Charcoal Cartridge
Silica Gel

Reference Standard SW-846 Method 0030, November 1986.

The emission rates were calculated using the flow rates from the corresponding semivolatile organic compound test.

The tenax sorbent cartridge and the tenax/charcoal sorbent cartridge from each sample were analyzed separately, except for Run Number 1A.

For all of the gas sampling, the gas was drawn continuously through a heated stainless steel probe, a chilled condenser, and a sample conditioner. The gas was then delivered to the monitors. A Thermo Electron Model 10AR Chemiluminescent $NO-NO_2-NO_x$ Analyzer was used for the Method 7E sampling. The analyzer was operated at ranges of 0 to 1,000 parts per million and 0 to 2,500 parts per million. The following calibration gases were used to calibrate the monitor.

Zero Nitrogen

129 ppm NO_x in N_2 (CC 65219)

220 ppm NO_x in N_2 (BAL 3749)

443 ppm NO_x in N_2 (BAL 3714)

911 ppm NO_x in N_2 (BLM 304)

2,120 ppm NO_x in N_2 (BAL 512)

The sulfur dioxide samples were taken and analyzed according to EPA Method 6C. The samples were analyzed on a Western Research Model 721AT Sulfur Dioxide Analyzer operated at a range of 0 to 500 parts per million. The calibration gases were as follows:

Zero Nitrogen

90 ppm SO_2 in N_2 (BAL 3694)

94 ppm SO_2 in N_2 (BAL 1438)

300 ppm SO_2 in N_2 (BLM 290)

454 ppm SO_2 in N_2 (BAL 2529)

The carbon monoxide samples were taken and analyzed according to EPA Method 10 using the continuous sampling procedure. The samples were analyzed on a Thermo Electron Model 48 Carbon Monoxide Analyzer operated at a range of 0 to 500 parts per million. The calibration gases were as follows:

Zero Nitrogen

92 ppm CO in N_2 (CAL 12396)

255 ppm CO in N_2 (CAL 6328)

453 ppm CO in N_2 (CAL 8598)

The total hydrocarbons samples were taken and analyzed according to EPA Method 25A. The samples were analyzed on a J.U.M. Model VE-7 Total Hydrocarbon Analyzer. A heated sample line was used for the total hydrocarbons sampling. The analyzer was operated at a range of 0 to 100 parts per million. The calibration gases were as follows:

Zero Nitrogen

9 ppm C_3H_8 in N_2 (CAL 7592)

50 ppm C_3H_8 in N_2 (CAL 222)

91 ppm C_3H_8 in N_2 (CAL 10747)

Calibration gas certifications are included in Appendix C.

The oxygen samples were taken and analyzed according to EPA Method 3A. The samples were analyzed using a Teledyne Model 326 Oxygen Analyzer. The analyzer was operated at a range of 0 to 25.0 percent oxygen using the following calibration gases:

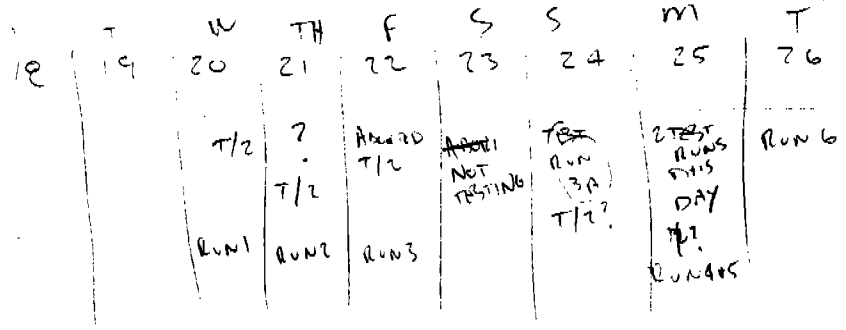
Zero Nitrogen

20.9 percent O_2 (ambient air)

DESCRIPTION OF TESTS

Personnel from METCO Environmental arrived at the plant at 3:00 p.m. on Monday, November 18, 1991. After locating and coordinating with plant personnel, the sampling vans were parked at the base of the Kiln Exhaust Stack at 3:30 p.m. The stack was measured and the equipment was moved onto the stack. Complete set up was delayed due to the lack of monorail brackets, and delays in connecting the step-down transformers to the plant electrical power. The continuous monitor van was set up and the monitors were turned on. Additional preparations were performed until all work was completed at 6:30 p.m.

On Tuesday, November 19, work began at 7:30 a.m. Stack set up was delayed until 11:00 a.m. when the monorail bracket installation was completed. The equipment and monitors were prepared for testing by 2:00 p.m. At 3:30 p.m., it was decided by plant personnel to postpone testing until the next day. The stack inlet ducts were monitored from 4:00 p.m. until 5:00 p.m. The equipment was secured for the night and the monitors were calibrated. All work was completed at 5:30 p.m.



On Wednesday, November 20, work began at 6:00 a.m. The monitors were calibrated and continuous monitoring for oxides of nitrogen, carbon monoxide, total hydrocarbons, sulfur dioxide, and oxygen at the Kilns Number 1 and 2 Stack Inlet Ducts began at 7:19 a.m. Inlet duct monitoring was completed at 8:45 a.m. The sampling trains were prepared for testing. A set of tests on the stack consisted of a particulate matter and sulfur dioxide test, a semivolatile organic compounds sample, a metals test, four volatile organic compounds samples, and continuous monitoring for oxides of nitrogen, carbon monoxide, total hydrocarbons, and sulfur dioxide. The first set of tests while burning tires in Kiln Number 2 began at 8:45 a.m. The monitors were calibrated and continuous monitoring of the stack began at 9:40 a.m. Testing was interrupted from 1:10 p.m. until 4:40 p.m. to make operating adjustments to Kiln Number 1, and from 5:40 p.m. until 7:10 p.m. to make operating adjustments to Kiln Number 2. The first set of tests was completed at 8:20 p.m. The samples were recovered, the monitors were calibrated, and the equipment was secured for the night. All work was completed at 9:30 p.m.

On Thursday, November 21, work began at 6:00 a.m. The monitors were calibrated and continuous monitoring of the Kilns Number 1 and 2 Stack Inlet Ducts began at 7:00 a.m. and was completed at 8:10 a.m. The equipment was prepared for testing and the second set of tests began at

8:15 a.m. Continuous monitoring of the stack began at 8:52 a.m. The particulate matter test was determined to have an isokinetic sampling rate below acceptable limits. The particulate matter test was repeated (Run Number 2A). Testing continued until the completion of the second set of tests at 5:05 p.m. The samples were recovered, the monitors were calibrated, and the equipment was secured for the night. All work was completed at 7:00 p.m.

On Friday, November 22, work began at 6:00 a.m. The monitors were calibrated and monitoring of the Kilns Number 1 and 2 Stack Inlet Ducts began at 7:00 a.m. Inlet duct monitoring was completed at 8:00 a.m. The monitors were calibrated and the sampling equipment was prepared for testing by 8:20 a.m. Testing was delayed while the kiln operations were adjusted. The third set of tests on the Kilns Number 1 and 2 Stack, while burning tires in Kiln Number 2, began at 8:50 a.m. Continuous monitoring of the stack began at 8:30 a.m. Testing was interrupted by tire feed conveyor problems and kiln process monitor problems from 10:10 a.m. until 12:30 p.m. Testing was halted at 2:30 p.m. due to an upset in Kiln Number 2. It was decided by plant personnel to abort the test set. The equipment was secured for the night and the VOST samples were packed for shipment. All work was completed at 6:00 p.m.

On Saturday, November 23, work began at 6:00 a.m. Upon arrival at the plant, it was determined that Kiln Number 2 was not in operation. Personnel returned to the plant at 8:00 a.m., but the kiln was still not operating properly. Personnel departed the plant at 9:30 a.m. and stood by until 1:00 p.m. when plant personnel postponed testing until the following day.

On Sunday, November 24, work began at 8:00 a.m. The equipment was prepared for testing and the monitors were calibrated by 9:30 a.m. Testing was delayed while the kilns were allowed to stabilize. The Kilns Number 1 and 2 Stack Inlet Ducts were continuously monitored beginning at 9:35 a.m. The third set of tests (Run Number 3A) began at 11:30 a.m. Testing was delayed from 3:34 p.m. until 4:32 p.m. to make operational adjustments to Kiln Number 1. The third set of tests was completed at 6:38 p.m. The monitors were calibrated, the samples were recovered, and the equipment was secured for the night. All work was completed at 7:30 p.m.

On Monday, November 25, work began at 6:00 a.m. The equipment was prepared for testing. The Kilns Number 1 and 2 were set to operate at Baseline Conditions. The fourth set of tests began at 7:10 a.m. and the tests were completed at 1:20 p.m. The fifth set of tests began at 2:10 p.m. and the tests were completed at 7:58 p.m. The monitors were calibrated, the samples were recovered, and the equipment was secured for the night. All work was completed at 9:00 p.m.

On Tuesday, November 26, work began at 6:00 a.m. The equipment was prepared for testing and the sixth set of tests began at 7:15 a.m. Continuous monitoring was delayed due to difficulty with moisture freezing and plugging the sample line. Monitoring began at 9:05 a.m. Testing was delayed from 7:28 a.m. until 8:04 a.m. while adjustments were made to the kilns. The sixth set of tests was completed at 1:52 p.m.

The equipment was moved off of the stack and loaded into the sampling vans. The final calibrations were performed on the monitors and the monitor van was prepared for transport. The samples were recovered and packed for transport. The VOST samples were shipped directly to the analytical lab from the sampling site. The remaining samples were transported to METCO Environmental's laboratory in Dallas, Texas, for analysis and evaluation.

Operations at ESSROC Materials, Inc., Eastern Division - Cement Group, Kilns Number 1 and 2 Stack, located in Frederick, Maryland, were completed at 4:50 p.m. on Tuesday, November 26, 1991.

Billy J. Mullins, Jr., P.E.
President

APPENDICES

A. Location of Sampling Points

B. Source Emissions Calculations

C. Calibration Data

D. Field Testing Data

E. Analytical Data

F. Oxides of Nitrogen Monitor and Total Hydrocarbons Monitor Data

G. Carbon Monoxide Monitor and Oxygen Monitor Data

H. Sulfur Dioxide Monitor Data

I. Plant Operational Data

J. Chain of Custody

K. Resumes of Test Personnel

APPENDIX A

Location of Sampling Points

Kilns Number 1 and 2 Stack

The sampling ports are located 66 feet 6 inches (3.44 stack diameters) downstream from the inlets to the stack and 209 feet 6 inches (10.83 stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:

Port and Wall Thickness = 17 3/4 inches

Inside Stack Diameter = 232 3/16 inches

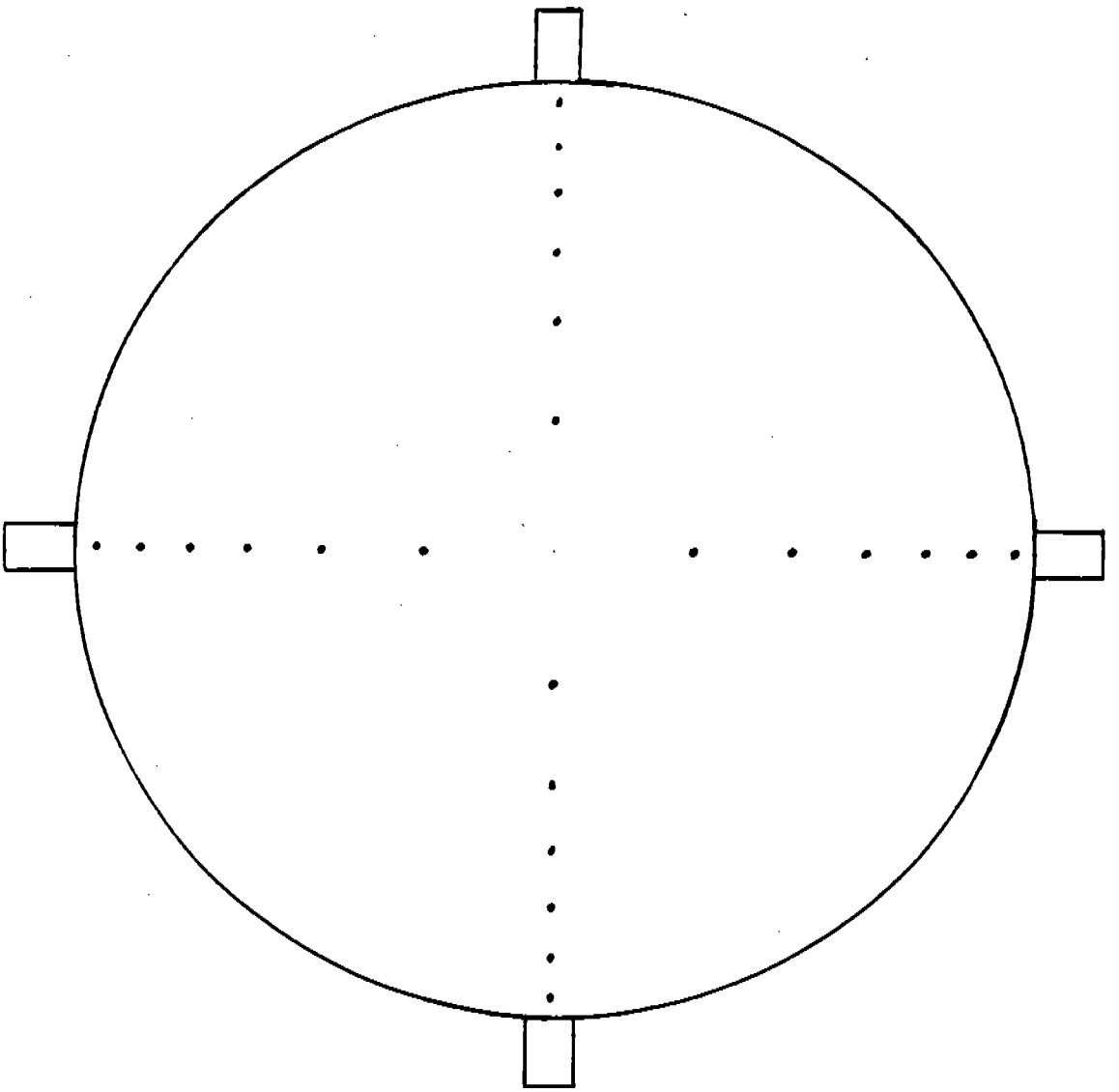
Point Number*	Percent of Diameter From Wall	Distance From Wall
1	2.1	4 3/8 "
2	6.7	15 9/16"
3	11.8	27 3/8 "
4	17.7	41 1/8 "
5	25.0	58 1/16"
6	35.6	82 11/16"

* Calculated as one-half of a twelve-point traverse.

APPENDIX A

Location of Sampling Points

Kilns Number 1 and 2 Stack



APPENDIX B

Nomenclature and Equations

for

Calculation of Source Emissions

Nomenclature for Particulate Calculations

Symbol	English Units	Metric Units	Description
A_s	$in.^2$	m^2	Stack Area
C_{an}	gr/dscf*	g/dscm*	Particulate - probe, cyclone, and filter
C_{ao}	gr/dscf*	g/dscm*	Particulate - total
C_{at}	gr/CF @ stack conditions	g/m^3	Particulate - probe, cyclone, and filter
C_{au}	gr/CF @ stack conditions	g/m^3	Particulate - total
C_{aw}	lbs/hr	kg/hr	Particulate - probe, cyclone, and filter
C_{ax}	lbs/hr	kg/hr	Particulate - total
C_p			Pitot Tube Calibration Factor
D_n	in.	m	Sampling Nozzle Diameter
%EA			Percent Excess Air at sampling point
g	$32.2_{ft/sec^2}$		Acceleration of Gravity
%I			Percent Isokinetic
%M			Percent Moisture in the stack gas by volume
M_d			Mole fraction of dry gas
m_f	mg	mg	Particulate - probe, cyclone, and filter

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
M_{H_2O}	18 lb/lb-mole		Molecular Weight of water
m_t	mg	mg	Particulate - total
MW	lb/lb-mole	g/g-mole	Molecular Weight of stack gas
MW_{air}	28.95 lb/ lb-mole		Molecular Weight of air
MW_d	lb/lb-mole	g/g-mole	Molecular Weight of dry stack gas
P_b	"Hg Absolute	mm Hg	Barometric Pressure
P_m	"H_2O	mm H_2O	Orifice Pressure drop
P_s	"Hg Absolute	mm Hg	Stack Pressure
ΔP	"H_2O	mm H_2O	Velocity Head of stack gas
P_{std}	29.92 "Hg	760 mm Hg	Standard Barometric Pressure
Q_a	ACFM	m^3/hr	Stack Gas Volume at actual stack conditions
Q_s	DSCFM*	dscm/hr*	Stack Gas Volume at 29.92 "Hg, 528°R, dry
R	21.83 "Hg-ft^3/lb-mole°R		Universal Gas Constant
T_m	°F	°C	Average Gas Meter Temperature

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
T_t	min	min	Net time of test
T_s	°F	°C	Stack Temperature
T_{std}	528°R	293°K	Standard Temperature
V_m	ft^3	m^3	Volume of dry gas sampled at meter conditions
$V_{m_{std}}$	dscf*	dscm*	Volume of dry gas sampled @ standard conditions
V_s	fpm	m/sec	Stack velocity @ stack conditions
V_w	ml	ml	Total water collected in impingers and silica gel
$V_{w_{gas}}$	scf*	scm*	Volume of water vapor collected @ standard conditions
ρ_{air}	0.0748 lbs/ft^3		Density of Air
ρ_{H_2O}	1 g/ml		Density of Water
ρ_{man}	51.63 lbs/ft^3		Density of Manometer Oil

Standard Conditions: 29.92 "Hg, 68°F (760 mm Hg, 20°C)

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

Example Particulate Calculations

1. Volume of dry gas sampled at standard conditions.*

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m + 460} \right) \left[\frac{P_b + \frac{P_m}{13.6}}{P_{std}} \right]$$

$$V_{m_{std}} = 17.65\ V_m \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right] = \text{dscf}$$

$$V_{m_{std}} = \text{dscf} \times 0.028317 = \text{dscm}$$

2. Volume of water vapor collected at standard conditions.*

$$V_{w_{gas}} = \frac{(V_m - \text{gms } SO_2 - \text{gms } H_2S)\ {}^{\rho}H_2O\ \ R\ \ T_{std}}{P_{std}\ M_{H_2O}\ 453.6}$$

$$V_{w_{gas}} = 0.0472\ (V_w - \text{gms } SO_2 - \text{gms } H_2S) = \text{scf}$$

$$V_{w_{gas}} = \text{scf} \times 0.028317 = \text{scm}$$

3. Percent moisture in stack gas.

$$\%M = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \%$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

4. Mole fraction of dry gas.

$$M_d = \frac{100 - \%M}{100}$$

5. Average molecular weight of dry stack gas.

$$MW_d = \left[\%CO_2 \times \frac{44}{100}\right] + \left[\%O_2 \times \frac{32}{100}\right] + \left[\%N_2 \times \frac{28}{100}\right] + \left[\%CO \times \frac{28}{100}\right] = \text{lb/lb-mole} = \text{g/g-mole}$$

6. Molecular weight of stack gas.

$$MW = MW_d \times M_d + 18\ (1-M_d) = \frac{\text{lb}}{\text{lb-mole}} = \text{g/g-mole}$$

7. Percent excess air at sampling point.

$$\%EA = \frac{100\ (\%O_2 - 0.5\%\ CO)}{0.265\ (\%N_2) - (\%O_2) + 0.5\ (\%CO)}$$

8. Stack Pressure.

$$P_s = P_b + \frac{\text{stack pressure } "H_2O}{13.6} = "\text{Hg Absolute}$$

$$P_s = "\text{Hg Abs.} \times 25.4 = \text{mm Hg}$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

9. Stack velocity at stack conditions.

$$V_s = C_p\ 60 \left[\frac{2g \times \rho_{man} \times P_{std} \times MW_{air} \times (T_s + 460) \times \Delta P_s}{12 \times \rho_{air} \times P_s \times MW \times T_{std}} \right]^{\frac{1}{2}}$$

$$V_s = 5{,}123.8\ C_p \left[\frac{(T_s + 460) \times \Delta P_s}{P_s \times MW} \right]^{\frac{1}{2}} = \text{fpm}$$

$$V_s = \text{fpm} \times 0.00508 = \text{m/sec}$$

10. Dry stack gas volume at standard conditions.*

$$Q_s = \frac{1}{144} V_s \times A_s \times M_d \times \frac{T_{std}}{T_s + 460} \times \frac{P_s}{P_{std}}$$

$$Q_s = \frac{0.123\ V_s \times A_s \times M_d \times P_s}{T_s + 460} = \text{DSCFM}$$

$$Q_s = \text{DSCFM} \times 1.6990 = \text{dscm/hr}$$

11. Actual stack gas volume at stack conditions.

$$Q_a = \frac{V_s \times A_s}{144} = \text{ACFM}$$

$$Q_a = \text{ACFM} \times 1.6990 = \text{m}^3\text{/hr}$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

12. Percent isokinetic.

$$\%I = \frac{V_{m_{std}} \times (T_s + 460) \times P_{std} \times 100 \times 144}{M_d \times T_{std} \times P_s \times T_t \times V_s \times \frac{\pi D_n^2}{4}}$$

$$\%I = \frac{1039\ V_{m_{std}} \times (T_s + 460)}{M_d \times P_s \times T_t \times V_s \times D_n^2}$$

13. Particulate - probe, cyclone, and filter.

$$C_{an} = \frac{m_f}{V_{m_{std}}} \times \frac{1\ gr}{64.8\ mg}$$

$$C_{an} = 0.0154 \times \frac{m_f}{V_{m_{std}}} = gr/dscf^*$$

$$C_{an} = gr/dscf \times 2.290 = g/dscm^*$$

14. Particulate total.

$$C_{ao} = 0.0154 \times \frac{m_t}{V_{m_{std}}} = gr/dscf^*$$

$$C_{ao} = gr/dscf \times 2.290 = g/dscm^*$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

15. Particulate - probe, cyclone, and filter at stack conditions.

$$C_{at} = C_{an} \times \frac{P_s}{P_{std}} \times \frac{(T_{std})}{(T_s + 460)} \times M_d$$

$$C_{at} = \frac{17.65 \times C_{an} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{at} = gr/CF \times 2.290 = g/m^3$$

16. Particulate - total, at stack conditions.

$$C_{au} = \frac{17.65 \times C_{ao} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{au} = gr/CF \times 2.290 = g/m^3$$

17. Particulate - probe, cyclone, and filter.

$$C_{aw} = C_{an} \times Q_s \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ lb}}{7000 \text{ gr}}$$

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = lbs/hr$$

$$C_{aw} = lbs/hr \times 0.4536 = kg/hr$$

18. Particulate - total.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = lbs/hr$$

$$C_{ax} = lbs/hr \times 0.4536 = kg/hr$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

EXAMPLE CALCULATIONS

$$\text{lbs/hr} = \frac{\text{ppm} \times \text{DSCFM} \times 60 \times \text{MW}}{385.1 \times 10^{6}}$$

MW - SO_2 = 64.07

MW - NO_x = 46.01

MW - CO = 28

MW - THC as Propane = 44

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER: 91-240
JOB NAME: ESSROC MATERIALS, INC.
LOCATION: FREDERICK, MARYLAND
UNIT TESTED: KILN STACK - PART./SO2 TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2A	2B
DATE			11-20-91	11-21-91	11-21-91
BEGIN TIME			845	815	1445
END TIME			1201	1035	1705
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.94 (760)	29.85 (758)	29.77 (756)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	0.663 (16.8)	1.070 (27.2)	1.588 (40.3)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	49.331 (1.397)	63.587 (1.798)	82.871 (2.347)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	66 (19)	75 (24)	80 (27)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	49.641 (1.406)	62.705 (1.776)	80.953 (2.292)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	402.7	529.7	676.2
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	19.007 (0.538)	25.002 (0.708)	31.917 (0.904)
%M	MOISTURE IN STACK GAS BY VOLUME	%	27.69	28.51	28.28

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - PART./SO2 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7231	0.7149	0.7172
CO2		%	16.3	17.1	18.2
O2		%	7.3	8.6	8.2
CO		%	0.0	0.0	0.0
N2		%	76.4	74.3	73.6
%EA	EXCESS AIR @ SAMPLING POINT	%	56.4	77.6	72.5
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	30.90 (30.90)	31.08 (31.08)	31.24 (31.24)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.33 (27.33)	27.35 (27.35)	27.50 (27.50)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H20)	0.033 (0.8)	0.033 (0.8)	0.031 (0.8)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	363 (184)	357 (181)	367 (186)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.85 (758)	29.76 (756)	29.68 (754)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	749 (3.80)	743 (3.77)	730 (3.71)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)	42,342 (27.32)	42,342 (27.32)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	102,386 (173,818)	100,768 (171,205)	97,858 (166,261)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	220,213 (374,142)	218,447 (371,141)	214,597 (364,600)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - PART./SO2 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	120	120	120
Dn	SAMPLING NOZZLE DIAM.	IN. (m)	0.486 (0.012)	0.600 (0.015)	0.600 (0.015)
%I	PERCENT ISOKINETIC	%	92.6	77.9	103.6
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	155.9	147.3	182.2
Mt	PARTICULATE - TOTAL	mg	167.1	155.9	193.6
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF* (g/DSCM)	0.0484 (0.1108)	0.0362 (0.0828)	0.0347 (0.0794)
Cao	PARTICULATE - TOTAL	gr/DSCF* (g/DSCM)	0.0518 (0.1187)	0.0383 (0.0877)	0.0368 (0.0843)
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF (g/m3)	0.0224 (0.0513)	0.0166 (0.0381)	0.0157 (0.0361)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF (g/m3)	0.0240 (0.0550)	0.0176 (0.0403)	0.0167 (0.0382)
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR (Kg/HR)	42.40 (19.23)	31.24 (14.17)	29.07 (13.19)
Cax	PARTICULATE - TOTAL	LBS/HR (Kg/HR)	45.45 (20.62)	33.06 (15.00)	30.89 (14.01)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SULFUR DIOXIDE EMISSION DATA

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - PART./SO2 TRAIN

RUN NUMBER	1	2A	2B
DATE	11-20-91	11-21-91	11-21-91
START TIME	845	815	1445
END TIME	1201	1035	1705
N - NORMALITY OF Ba(ClO4)2	0.0100	0.0100	0.0100
ML(I)- ml IN IMPINGER 2	355	475	455
ML(I)- ml IN IMPINGER 3	295	485	420
ML(A)- ml IN ALIQUOT #2	2.00	2.00	2.00
ML(A)- ml IN ALIQUOT #3	10.00	10.00	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #2	2.20	6.80	6.40
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #3	0.27	0.42	7.87
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	66	75	80
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	49.331	63.587	82.871
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.94	29.85	29.77
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	102,386	100,768	97,858
C(I) - SO2 IN IMPINGER #2 IN mgs	122.12	513.00	462.28
C(I) - SO2 IN IMPINGER #3 IN mgs	2.08	5.74	105.10
C(T) - TOTAL SO2 IN IMPINGERS, IN mgs	124.2	518.7	567.4
ppm SO2	33.2	110.0	93.3
C(SO2) - EMISSION RATE OF SO2, lbs/day	813.2	2,651.2	2,184.0
C(SO2) - EMISSION RATE OF SO2, lbs/hr	33.9	110.5	91.0
Cs - EMISSION RATE OF SULFUR, lbs/day	486.6	1,325.6	1,092.0

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 32 / ML(A)
C(T) = C(I) #2 + C(I) #3
ppm SO2 = 0.7513 * C(T) * [Tm + 460] / Vm * Pb
C(SO2) = ppm SO2 * Qs * 0.0002392

METCO ENVIRONMENTAL

SULFUR TRIOXIDE EMISSION DATA

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - PART./SO2 TRAIN

RUN NUMBER	1	2A	2B
DATE	11-20-91	11-21-91	11-21-91
START TIME	845	815	1445
END TIME	1201	1035	1705
N - NORMALITY OF Ba(ClO4)2	0.0100	0.0100	0.0100
ML(I) - ml IN IMPINGER	470	485	470
ML(A) - ml IN ALIQUOT	10.00	10.00	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE	1.20	0.85	1.20
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Ta - AVERAGE GAS METER TEMPERATURE, DEG.F	66	75	80
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	49.331	63.507	82.871
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.94	29.85	29.77
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	182,386	100,768	97,858
C(I) - SO3 IN IMPINGERS IN mgs	21.6	15.5	21.6
ppm SO3	4.6	2.6	2.8
C(SO3) - EMISSION RATE OF SO3, lbs/day	141.9	79.5	83.4
Cs - EMISSION RATE OF SULFUR, lbs/day	56.7	31.8	33.4

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

$C(I) = ML(I) * [ML(B) - ML(BB)] * N * 40 / ML(A)$

$ppm\ SO3 = 0.6021 * C(I) * [Ta + 460] / Vm * Pb$

$C(SO3) = ppm\ SO3 * Qs * 0.0002991$

$Cs = C(SO3) / 2.5$

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER: 91-240
JOB NAME: ESSROC MATERIALS, INC.
LOCATION: FREDERICK, MARYLAND
UNIT TESTED: KILN STACK - PART./SO2 TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			3A	4	5
DATE			11-24-91	11-25-91	11-25-91
BEGIN TIME			1524	710	1410
END TIME			1838	923	1635
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.54 (750)	29.84 (758)	29.88 (759)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.738 (44.1)	1.888 (48.0)	1.713 (43.5)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	79.150 (2.241)	80.921 (2.291)	77.337 (2.190)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	71 (22)	71 (22)	72 (22)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	78.052 (2.210)	80.635 (2.283)	76.989 (2.180)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	624.6	636.7	633.0
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	29.481 (0.835)	30.052 (0.851)	29.878 (0.846)
%M	MOISTURE IN STACK GAS BY VOLUME	%	27.42	27.15	27.96

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - PART./SO2 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7258	0.7285	0.7284
CO2		%	17.8	17.8	17.1
O2		%	8.8	8.2	8.5
CO		%	0.0	0.0	0.0
N2		%	73.4	74.0	74.4
%EA	EXCESS AIR @ SAMPLING POINT	%	82.6	71.9	75.8
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	31.20 (31.20)	31.18 (31.18)	31.08 (31.08)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.58 (27.58)	27.60 (27.60)	27.42 (27.42)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.030 (0.8)	0.033 (0.8)	0.030 (0.8)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	353 (178)	338 (170)	315 (157)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.45 (748)	29.75 (756)	29.79 (757)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	713 (3.62)	739 (3.75)	698 (3.55)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)	42,342 (27.32)	42,342 (27.32)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	97,629 (165,872)	104,528 (177,593)	100,664 (171,020)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	209,657 (356,207)	217,336 (369,254)	205,300 (348,805)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - PART./SO2 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	120	120	120
Dn	SAMPLING NOZZLE DIAM.	IN. (m)	0.600 (0.015)	0.600 (0.015)	0.600 (0.015)
%I	PERCENT ISOKINETIC	%	100.1	96.6	95.8
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	186.8	255.0	189.4
Mt	PARTICULATE - TOTAL	mg	197.8	268.4	203.3
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF* (g/DSCM)	0.0369 (0.0844)	0.0487 (0.1115)	0.0379 (0.0868)
Cao	PARTICULATE - TOTAL	gr/DSCF* (g/DSCM)	0.0390 (0.0894)	0.0513 (0.1174)	0.0407 (0.0931)
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF (g/m3)	0.0171 (0.0392)	0.0233 (0.0535)	0.0185 (0.0424)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF (g/m3)	0.0181 (0.0414)	0.0246 (0.0563)	0.0199 (0.0456)
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR (Kg/HR)	30.84 (13.99)	43.63 (19.79)	32.68 (14.83)
Cax	PARTICULATE - TOTAL	LBS/HR (Kg/HR)	32.65 (14.81)	45.92 (20.83)	35.08 (15.91)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SULFUR DIOXIDE EMISSION DATA

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - PART./SO2 TRAIN

RUN NUMBER	3A	4	5
DATE	11-24-91	11-25-91	11-25-91
START TIME	1524	710	1410
END TIME	1838	923	1635
N - NORMALITY OF Ba(ClO4)2	0.0100	0.0100	0.0100
ML(I)- ml IN IMPINGER 2	405	420	390
ML(I)- ml IN IMPINGER 3	470	425	475
ML(A)- ml IN ALIQUOT #2	2.00	1.00	1.00
ML(A)- ml IN ALIQUOT #3	2.00	1.00	1.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #2	11.83	7.98	3.02
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #3	3.85	2.10	1.12
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Ts - AVERAGE GAS METER TEMPERATURE, DEG.F	71	71	72
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	79.150	80.921	77.337
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.54	29.84	29.88
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	97,629	104,528	100,664
C(I) - SO2 IN IMPINGER #2 IN mgs	763.34	1,065.79	370.66
C(I) - SO2 IN IMPINGER #3 IN mgs	285.76	278.80	162.64
C(T) - TOTAL SO2 IN IMPINGERS, IN mgs	1,049.1	1,344.6	533.3
ppm SO2	179.0	222.1	92.2
C(SO2) - EMISSION RATE OF SO2, lbs/day	4,180.3	5,554.3	2,221.1
C(SO2) - EMISSION RATE OF SO2, lbs/hr	174.2	231.4	92.5
Cs - EMISSION RATE OF SULFUR, lbs/day	2,090.1	2,777.2	1,110.5

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 32 / ML(A)
C(T) = C(I) #2 + C(I) #3
ppm SO2 = 0.7513 * C(T) * [Ts + 460] / Vm * Pb
C(SO2) = ppm SO2 * Qs * 0.0002392

METCO ENVIRONMENTAL

SULFUR TRIOXIDE EMISSION DATA

JOB NUMBER:	91-240		
JOB NAME:	ESSROC MATERIALS, INC.		
LOCATION:	FREDERICK, MARYLAND		
UNIT TESTED:	KILN STACK - PART./SO2 TRAIN		
RUN NUMBER	3A	4	5
DATE	11-24-91	11-25-91	11-25-91
START TIME	1524	710	1410
END TIME	1838	923	1635
N - NORMALITY OF Ba(ClO4)2	0.0100	0.0100	0.0100
ML(I) - ml IN IMPINGER	415	430	405
ML(A) - ml IN ALIQUOT	10.00	10.00	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE	1.00	2.07	1.50
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Ts - AVERAGE GAS METER TEMPERATURE, DEG.F	71	71	72
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	79.150	80.921	77.337
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.54	29.84	29.88
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	97,629	104,528	100,664
C(I) - SO3 IN IMPINGERS IN mgs	15.8	34.7	23.5
ppm SO3	2.2	4.6	3.3
C(SO3) - EMISSION RATE OF SO3, lbs/day	63.0	143.8	98.0
Cs - EMISSION RATE OF SULFUR, lbs/day	25.2	57.5	39.2

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 40 / ML(A)
ppm SO3 = 0.6021 * C(I) * [Ts + 460] / Vm * Pb
C(SO3) = ppm SO3 * Qs * 0.0002991
Cs = C(SO3) / 2.5

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - PART./SO2 TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			6		
DATE			11-26-91		
BEGIN TIME			715		
END TIME			1010		
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	30.00 (764)		
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.700 (43.2)		
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	77.000 (2.180)		
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	59 (15)		
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	79.095 (2.240)		
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	688.5		
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	32.497 (0.920)		
%M	MOISTURE IN STACK GAS BY VOLUME	%	29.12		

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - PART./SO2 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7088		
CO2		%	18.2		
O2		%	8.0		
CO		%	0.0		
N2		%	73.8		
%EA	EXCESS AIR @ SAMPLING POINT	%	69.2		
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	31.23 (31.23)		
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.38 (27.38)		
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.838 (8.8)		
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	307 (153)		
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.99 (762)		
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	689 (3.50)		
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)		
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS+	DSCFM (DSCM/HR)	99,449 (168,964)		
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	202,533 (344,104)		

+ 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - PART./SO2 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	120		
Dn	SAMPLING NOZZLE DIAM.	IN. (m)	0.600 (0.015)		
%I	PERCENT ISOKINETIC	%	99.6		
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	266.4		
Mt	PARTICULATE - TOTAL	mg	278.9		
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF* (g/DSCM)	0.0519 (0.1188)		
Cao	PARTICULATE - TOTAL	gr/DSCF* (g/DSCM)	0.0543 (0.1244)		
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF (g/m3)	0.0254 (0.0581)		
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF (g/m3)	0.0266 (0.0609)		
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR (Kg/HR)	44.21 (20.05)		
Cax	PARTICULATE - TOTAL	LBS/HR (Kg/HR)	46.28 (20.99)		

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SULFUR DIOXIDE EMISSION DATA

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - PART./SO2 TRAIN

RUN NUMBER	6
DATE	11-26-91
START TIME	715
END TIME	1010
N - NORMALITY OF Ba(ClO4)2	0.0100
ML(I)- ml IN IMPINGER 2	414
ML(I)- ml IN IMPINGER 3	470
ML(A)- ml IN ALIQUOT #2	1.00
ML(A)- ml IN ALIQUOT #3	2.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #2	4.98
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #3	2.70
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	59
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	77.000
Pb - BAROMETRIC PRESSURE, "Hg Abs.	30.08
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	99,449
C(I) - SO2 IN IMPINGER #2 IN mgs	653.13
C(I) - SO2 IN IMPINGER #3 IN mgs	199.28
C(T) - TOTAL SO2 IN IMPINGERS, IN mgs	852.4
ppm SO2	143.5
C(SO2) - EMISSION RATE OF SO2, lbs/day	3,413.7
C(SO2) - EMISSION RATE OF SO2, lbs/hr	142.2
Cs - EMISSION RATE OF SULFUR, lbs/day	1,706.8

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 32 / ML(A)
C(T) = C(I) #2 + C(I) #3
ppm SO2 = 0.7513 * C(T) * [Tm + 460] / Vm * Pb
C(SO2) = ppm SO2 * Qs * 0.0002392

METCO ENVIRONMENTAL

SULFUR TRIOXIDE EMISSION DATA

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - PART./SO2 TRAIN

RUN NUMBER	6
DATE	11-26-91
START TIME	715
END TIME	1010
N - NORMALITY OF Ba(ClO4)2	0.0100
ML(I) - ml IN IMPINGER	480
ML(A) - ml IN ALIQUOT	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE	1.73
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	59
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	77.000
Pb - BAROMETRIC PRESSURE, "Hg Abs.	30.08
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	99,449
C(I) - SO3 IN IMPINGERS IN mgs	32.3
ppm SO3	4.4
C(SO3) - EMISSION RATE OF SO3, lbs/day	129.4
Cs - EMISSION RATE OF SULFUR, lbs/day	51.8

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 40 / ML(A)
ppm SO3 = 0.6021 * C(I) * [Tm + 460] / Vm * Pb
C(SO3) = ppm SO3 * Qs * 0.0002991
Cs = C(SO3) / 2.5

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - METALS TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3A
DATE			11-20-91	11-21-91	11-24-91
BEGIN TIME			1432	1149	1150
END TIME			2020	1422	1406
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.94 (760)	29.85 (758)	29.58 (751)
P(g)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.030 (26.2)	1.128 (28.7)	1.063 (27.0)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	61.377 (1.738)	64.468 (1.826)	61.923 (1.753)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	75 (24)	78 (26)	70 (21)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	60.778 (1.721)	63.388 (1.793)	61.160 (1.732)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	539.0	547.7	496.5
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	25.441 (0.720)	25.851 (0.732)	23.435 (0.664)
%M	MOISTURE IN STACK GAS BY VOLUME	%	29.51	28.99	27.70

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - METALS TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7049	0.7101	0.7230
CO2		%	16.3	17.9	16.7
O2		%	8.9	8.4	9.3
CO		%	0.0	0.0	0.0
N2		%	74.8	73.7	74.0
%EA	EXCESS AIR @ SAMPLING POINT	%	81.5	75.5	90.2
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	30.96 (30.96)	31.20 (31.20)	31.04 (31.04)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.14 (27.14)	27.37 (27.37)	27.43 (27.43)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.031 (0.8)	0.034 (0.9)	0.032 (0.8)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	365 (185)	366 (186)	334 (168)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.85 (758)	29.76 (756)	29.50 (749)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	722 (3.67)	753 (3.83)	717 (3.64)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)	42,342 (27.32)	42,342 (27.32)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	95,903 (162,939)	100,333 (170,466)	100,300 (170,423)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	212,325 (360,740)	221,455 (376,252)	210,774 (358,185)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - METALS TRAIN

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	120	120	120
Dn	SAMPLING NOZZLE DIAM.	IN. (m)	0.520 (0.013)	0.520 (0.013)	0.520 (0.013)
%I	PERCENT ISOKINETIC	%	105.7	105.2	101.7
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	----	----	----
Mt	PARTICULATE - TOTAL	mg	----	----	----
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF* (g/DSCM)	---- (----)	---- (----)	---- (----)
Cao	PARTICULATE - TOTAL	gr/DSCF* (g/DSCM)	---- (----)	---- (----)	---- (----)
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF (g/m3)	---- (----)	---- (----)	---- (----)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF (g/m3)	---- (----)	---- (----)	---- (----)
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR (Kg/HR)	---- (----)	---- (----)	---- (----)
Cax	PARTICULATE - TOTAL	LBS/HR (Kg/HR)	---- (----)	---- (----)	---- (----)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER: 91-240
JOB NAME: ESSROC MATERIALS, INC.
LOCATION: FREDERICK, MARYLAND
UNIT TESTED: KILN STACK - METALS TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			4	5	6
DATE			11-25-91	11-25-91	11-26-91
BEGIN TIME			1100	1743	1136
END TIME			1320	1958	1352
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.88 (759)	29.90 (759)	30.00 (764)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.113 (28.3)	1.000 (25.4)	1.000 (25.4)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	62.961 (1.783)	60.096 (1.702)	59.616 (1.688)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	72 (22)	70 (21)	70 (21)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	62.585 (1.772)	59.986 (1.699)	59.865 (1.695)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	500.5	506.5	541.5
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	23.624 (0.669)	23.907 (0.677)	25.559 (0.724)
%M	MOISTURE IN STACK GAS BY VOLUME	%	27.40	28.50	29.92

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - METALS TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7260	0.7150	0.7088
CO2		%	17.0	18.2	18.7
O2		%	8.8	8.4	8.2
CO		%	0.0	0.0	0.0
N2		%	74.2	73.4	73.1
%EA	EXCESS AIR @ SAMPLING POINT	%	81.0	76.0	73.4
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	31.07 (31.07)	31.25 (31.25)	31.32 (31.32)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.49 (27.49)	27.47 (27.47)	27.33 (27.33)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.034 (0.9)	0.030 (0.8)	0.030 (0.8)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	334 (168)	305 (152)	301 (149)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.79 (757)	29.81 (757)	29.99 (762)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	732 (3.72)	676 (3.43)	674 (3.42)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)	42,342 (27.32)	42,342 (27.32)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	103,842 (176,428)	98,091 (166,657)	96,944 (164,708)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	215,369 (365,912)	198,767 (337,705)	198,157 (336,669)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - METALS TRAIN

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	120	120	120
Dn	SAMPLING NOZZLE DIAM.	IN.	0.520	0.520	0.520
		(m)	(0.013)	(0.013)	(0.013)
%I	PERCENT ISOKINETIC	%	100.5	102.0	103.0
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	----	----	----
Mt	PARTICULATE - TOTAL	mg	----	----	----
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF*	----	----	----
		(g/DSCM)	(----)	(----)	(----)
Cao	PARTICULATE - TOTAL	gr/DSCF*	----	----	----
		(g/DSCM)	(----)	(----)	(----)
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF	----	----	----
		(g/m3)	(----)	(----)	(----)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF	----	----	----
		(g/m3)	(----)	(----)	(----)
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR	----	----	----
		(Kg/HR)	(----)	(----)	(----)
Cax	PARTICULATE - TOTAL	LBS/HR	----	----	----
		(Kg/HR)	(----)	(----)	(----)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER: 91-240
JOB NAME: ESSROC MATERIALS, INC.
LOCATION: FREDERICK, MARYLAND
UNIT TESTED: KILN STACK - M5 TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			11-20-91	11-21-91	11-22-91
BEGIN TIME			850	815	900
END TIME			1238	1313	1425
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.94 (760)	29.85 (758)	29.80 (757)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	0.847 (21.5)	1.007 (25.6)	0.941 (23.9)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	95.371 (2.701)	104.792 (2.967)	77.086 (2.183)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	71 (22)	75 (24)	72 (22)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	95.109 (2.693)	103.452 (2.929)	76.389 (2.163)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	714.4	850.7	620.0
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	33.720 (0.955)	40.153 (1.137)	29.264 (0.829)
%M	MOISTURE IN STACK GAS BY VOLUME	%	26.17	27.96	27.70

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - M5 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7383	0.7204	0.7230
CO2		%	16.3	17.5	16.7
O2		%	7.3	8.5	9.2
CO		%	0.0	0.0	0.0
N2		%	76.4	74.0	74.1
%EA	EXCESS AIR @ SAMPLING POINT	%	56.4	76.5	88.2
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	30.90 (30.90)	31.14 (31.14)	31.04 (31.04)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.52 (27.52)	27.47 (27.47)	27.43 (27.43)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.035 (0.9)	0.031 (0.8)	0.030 (0.8)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	368 (187)	364 (184)	332 (167)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.85 (758)	29.76 (756)	29.71 (755)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	782 (3.97)	740 (3.76)	706 (3.59)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)	42,342 (27.32)	42,342 (27.32)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	100,480 (184,172)	100,274 (170,366)	99,723 (169,429)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	229,960 (390,702)	217,662 (369,888)	207,691 (352,867)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - MM5 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	192	192	148
Dn	SAMPLING NOZZLE DIAM.	IN.	0.517	0.517	0.534
		(m)	(0.013)	(0.013)	(0.014)
%I	PERCENT ISOKINETIC	%	92.5	100.8	98.2
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	----	----	----
Mt	PARTICULATE - TOTAL	mg	----	----	----
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF*	----	----	----
		(g/DSCM)	(----)	(----)	(----)
Cao	PARTICULATE - TOTAL	gr/DSCF*	----	----	----
		(g/DSCM)	(----)	(----)	(----)
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF	----	----	----
		(g/m3)	(----)	(----)	(----)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF	----	----	----
		(g/m3)	(----)	(----)	(----)
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR	----	----	----
		(Kg/HR)	(----)	(----)	(----)
Cax	PARTICULATE - TOTAL	LBS/HR	----	----	----
		(Kg/HR)	(----)	(----)	(----)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION SURVEY

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - MM5 TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			3AH		
DATE			11-24-91		
BEGIN TIME			1130		
END TIME			1522		
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.58 (751)		
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	0.950 (24.1)		
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	100.597 (2.849)		
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	70 (21)		
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	99.329 (2.813)		
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	746.0		
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	35.211 (0.997)		
%M	MOISTURE IN STACK GAS BY VOLUME	%	26.17		

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - M5 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7383		
CO2		%	17.1		
O2		%	8.9		
CO		%	0.0		
N2		%	74.0		
%EA	EXCESS AIR @ SAMPLING POINT	%	83.1		
Md	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	31.09 (31.09)		
Ms	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.67 (27.67)		
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.030 (0.8)		
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	331 (166)		
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.49 (749)		
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	710 (3.61)		
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)		
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	101,781 (172,926)		
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	208,633 (354,467)		

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - MM5 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	192		
Dn	SAMPLING NOZZLE DIAM.	IN.	0.534		
		(m)	(0.014)		
%I	PERCENT ISOKINETIC	%	96.5		
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	----		
Mt	PARTICULATE - TOTAL	mg	----		
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF*	----		
		(g/DSCM)	(----)		
Cao	PARTICULATE - TOTAL	gr/DSCF*	----		
		(g/DSCM)	(----)		
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF	----		
		(g/m3)	(----)		
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF	----		
		(g/m3)	(----)		
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR	----		
		(Kg/HR)	(----)		
Cax	PARTICULATE - TOTAL	LBS/HR	----		
		(Kg/HR)	(----)		

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER:	91-240
JOB NAME:	ESSROC MATERIALS, INC.
LOCATION:	FREDERICK, MARYLAND
UNIT TESTED:	KILN STACK - MM5 TRAIN

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			4	5	6
DATE			11-25-91	11-25-91	11-26-91
BEGIN TIME			745	1410	715
END TIME			1126	1753	1132
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.84 (758)	29.88 (759)	30.08 (764)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	0.944 (24.0)	0.925 (23.5)	0.950 (24.1)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	99.879 (2.828)	98.555 (2.791)	99.806 (2.826)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	69 (21)	69 (21)	58 (14)
V(m[std])	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	99.672 (2.822)	98.477 (2.789)	102.531 (2.903)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	748.5	755.6	819.5
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	35.329 (1.000)	35.664 (1.010)	38.680 (1.095)
%M	MOISTURE IN STACK GAS BY VOLUME	%	26.17	26.59	27.39

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

ESSROC MATERIALS, INC.
FREDERICK, MARYLAND
KILN STACK - MM5 TRAIN

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.7383	0.7341	0.7261
CO2		%	17.3	17.5	18.0
O2		%	8.5	8.4	8.2
CO		%	0.0	0.0	0.0
N2		%	74.2	74.1	73.8
%EA	EXCESS AIR @ SAMPLING POINT	%	76.1	74.8	72.2
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	31.11 (31.11)	31.14 (31.14)	31.21 (31.21)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	27.68 (27.68)	27.64 (27.64)	27.59 (27.59)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H2O)	0.030 (0.8)	0.029 (0.7)	0.030 (0.8)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	340 (171)	314 (157)	304 (151)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.75 (756)	29.79 (757)	29.99 (762)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	706 (3.59)	691 (3.51)	692 (3.52)
As	STACK AREA	(SQ. INCHES) (SQ. METERS)	42,342 (27.32)	42,342 (27.32)	42,342 (27.32)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	100,951 (171,516)	101,681 (172,756)	102,722 (174,525)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	207,653 (352,802)	203,074 (345,023)	203,620 (345,950)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

KILN NO. 2
TEST NO. 6
DATE 11/26/91
TIME 7:15 A.M. to 1:52 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
7 A.M.	23.6	41.3	5.6	0	93	73	180	0
8	24.9	43.6	5.6	0	72	64	235	0
9	23.9	41.8	5.9	0	63	65	238	0
10	24.5	42.9	6.0	0	65	data lost	205	0
11	24.4	42.7	6.1	0	64	"	209	0
12 noon	24.3	42.5	6.1	0	84	"	197	0
1 P.M.	24.3	42.5	6.1	0	62	"	193	0
2 P.M.	24.4	42.7	6.0	0	60	"	193	0

KILN NO. 1
TEST NO. 1A-1B-1C
DATE 11/20/91
TIME 8:44 A.M. to 1:10 P.M.-4:40 to 5:40 P.M.-7:10 to 8:20 P.M.

	TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
#1A	8 A.M.	25.0	43.8	4.5	7.3	165	108	307	0
	9	24.2	42.4	4.5	7.3	162	108	301	0
	10	24.3	42.5	4.7	7.3	168	109	303	0
	11	24.7	43.2	4.9	7.3	171	113	307	0
	12 noon	24.7	43.2	5.0	7.3	168	110	308	0
	1 P.M.	24.6	43.0	5.3	7.3	162	105	305	0
#1B	4 P.M.	14.2	24.8	4.0	7.3	202	126	338	0
	5	24.4	42.8	4.85	7.3	136	99	304	0
	6	24.7	43.2	5.1	7.3	158	98	297	0
#1C	7 P.M.	24.3	42.6	5.2	7.3	154	97	294	0
	8	24.8	43.3	5.4	7.3	153	98	294	0
	9	25.0	43.7	5.4	7.3	153	98	296	0

KILN NO. 2
TEST NO. 1A-1B-1C
DATE 11/20/91
TIME 8:44 A.M. to 1:10 P.M.-4:40 to 5:40 P.M.-7:10 to 8:20 P.M.

	TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
#1A	8 A.M.	21.8	38.1	4.6	0	142	97	402	2
	9	23.6	41.3	4.4	0	132	96	394	2
	10	23.8	41.7	4.4	0	137	97	294	2
	11	24.1	42.2	4.35	0	135	97	402	2
	12 noon	24.0	42.0	4.35	0	133	97	401	2
	1 P.M.	24.0	42.0	4.45	0	130	94	389	2
#1B	4 P.M.	23.8	31.7	4.2	0	128	97	398	2
	5	24.2	42.4	4.0	0	132	96	397	2
	6	17.9	31.4	4.4	0	140	97	394	2
#1C	7 P.M.	13.4	23.4	3.6	0	150	102	414	2
	8	24.6	43.0	4.1	0	128	95	383	2
	9	22.9	40.1	4.7	0	128	93	386	2

KILN NO. 1
TEST NO. 2
DATE 11/21/91
TIME 8:15 A.M. to 5:05 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
8 A.M.	23.9	41.8	4.7	[illegible] 10.3	122	90	302	0
9	25.0	43.8	4.7	[illegible] 10.3	125	93	304	0
10	24.0	42.0	5.0	[illegible] 10.3	145	99	309	0
11	22.5	39.4	5.5	[illegible] 10.3	135.	95	300	0
12 noon	23.4	41.0	5.1	[illegible] 10.3	153	100	314	0
1 P.M.	23.5	41.1	5.1	[illegible] 10.3	144	98	312	0
2	23.5	41.1	4.6	[illegible] 10.3	153	99	312	0
3	23.5	41.1	5.0	[illegible] 10.3	121	87	293	0
4	22.3	39.0	5.1	[illegible] 10.3	148	96	311	0
5	24.2	42.4	5.0	[illegible] 10.3	149	94	297	0

KILN NO. 2
TEST NO. 2
DATE 11/21/91
TIME 8:15 A.M. to 5:05 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
8 A.M.	24.5	42.9	4.8	0	101	83	360	2
9	24.6	43.1	4.5	0	99	83	362	2
10	25.5	44.6	4.4	0	97	84	357	2
11	23.4	41.0	4.4	0	97	83	359	2
12 noon	24.2	42.4	4.3	0	97	84	357	2
1 P.M.	24.3	42.5	4.3	0	97	83	359	2
2	24.2	42.4	4.4	0	99	85	360	2
3	26.0	45.5	4.4	0	91	83	352	2
4	23.1	40.4	4.3	0	100	84	366	2
5	25.4	44.5	4.3	0	99	86	367	2

KILN NO. 1
TEST NO. 4 ABORTED
DATE 11/22/91
TIME 8:50 to 10:10 A.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
9 A.M.	23.7	41.5	5.7	8.7	134	90	284	0
10	23.4	41.0	6.0	8.7	123	87	282	0

KILN NO. 2
TEST NO. ABORTED
DATE 11/22/91
TIME 8:50 A.M. to 10:10 A.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
9 A.M.	24.1	42.2	4.5	0	99	87	374	2
10	24.1	42.2	4.6	0	103	88	371	2

KILN NO. 1
TEST NO. ~~4~~ ABORTED
DATE 11/22/91
TIME 12:30 P.M. to 2:25 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
12 noon	22.2	38.9	5.4	8.7	117	84	304	0
1 P.M.	23.7	41.5	5.3	8.7	111	77	297	0
2	24.6	43.1	6.0	8.7	127	87	300	0
3	24.3	42.5	5.4	8.7	112	78	297	0

KILN NO. 2
TEST NO. [redacted], ABORTED
DATE 11/22/91
TIME 12:30 P.M. to 2:25 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
12 noon	24.3	42.5	4.6	0	102	87	361	2
1	23.2	40.6	4.3	0	98	90	381	2
2	24.0	42.0	4.3	0	92	85	370	2
3	25.1	43.9	4.7	0	124	93	387	2

KILN NO. 1
TEST NO. 3
DATE 11/24/91
TIME 11:30 A.M. to 3:30 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
11: A.M.	17.5	30.6	4.6	6.5	174	132	323	0
12 noon	22.8	39.9	4.8	6.5	175	135	318	0
1 P.M.	24.0	42.0	4.7	6.5	179	134	317	0
2	24.0	42.0	5.2	6.5	178	131	311	0
3	14.7	25.7	5.5	6.5	179	135	328	0

KILN NO. 1
TEST NO. 3 B
DATE 11/24/91
TIME 4:35 P.M. to 6:45 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
4 P.M.	19.0	33.3	5.5	6.5	168	130	320	0
5	22.5	39.4	5.4	6.5	156	120	309	0
6	23.3	40.8	5.5	6.5	130	109	288	0
7	22.5	39.4	5.4	6.5	136	115	292	0

KILN NO. 2
TEST NO. 3A
DATE 11/24/91
TIME 11:30 A.M. to 3:30 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
11 A.M.	23.5	41.1	4.6	0	99	85	376	2
12 noon	23.0	40.3	4.25	0	108	88	376	2
1 P.M.	23.9	41.8	4.25	0	112	91	389	2
2	24.0	42.0	4.6	0	111	89	379	2
3	23.0	40.3	4.4	0	105	86	371	2

KILN NO. 2
TEST NO. 3
DATE 11/24/91
TIME 4:35 P.M. to 6:45 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
4 P.M.	24.6	43.1	4.25	0	95	82	363	2
5	24.6	43.1	4.1	0	88	78	353	2
6	24.0	42.0	3.9	0	88	80	351	2
7	25.4	44.5	3.85	0	92	82	353	2

KILN NO. 1
TEST NO. 4 and 5
DATE 11/25/91
TIME 7:10 A.M. to 8:10 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
7 A.M.	22.6	39.6	5.0	9.7	107	93	284	0
8	23.9	41.8	4.9	9.7	98	84	279	0
9	23.3	40.8	4.8	9.7	104	86	283	0
10	24.0	42.0	4.6	9.7	104	87	286	0
11	23.7	41.5	4.6	9.7	107	91	288	0
12 noon	23.6	41.3	4.5	9.7	107	92	291	0
1 P.M.	23.1	40.4	4.4	9.7	106	91	288	0
2	22.8	39.9	4.4	9.7	109	90	292	0
3	23.6	41.3	4.8	9.7	106	86	283	0
4	24.7	43.2	5.1	9.7	103	84	275	0
5	23.5	41.1	5.0	9.7	93	78	267	0
6	24.2	42.4	5.1	9.7	100	78	261	0
7	24.8	43.4	5.1	9.7	103	82	271	0
8	24.6	43.1	5.1	9.7	100	81	266	0

KILN NO. 2
TEST NO. 4 and 5
DATE 11/25/91
TIME 7:10 A.M. to 8:10 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per rev
7 A.M.	23.4	41.0	5.6	0	115	89	346	0
8	24.3	42.5	5.6	0	110	87	339	0
9	19.8	34.7	5.9	0	111	91	351	0
10	24.5	42.9	5.6	0	107	85	343	0
11	24.3	42.5	5.6	0	98	81	327	0
12 noon	24.7	43.2	5.5	0	92	78	326	0
1 P.M.	22.4	39.2	5.5	0	93	80	331	0
2	24.9	43.6	5.5	0	95	80	328	0
3	23.8	41.7	5.7	0	94	79	331	0
4	25.4	44.5	5.5	0	98	79	333	0
5	24.2	42.4	5.9	0	73	70	297	0
6	24.7	43.2	5.6	0	82	73	307	0
7	25.4	44.5	5.9	0	82	70	299	0
8	25.3	44.3	6.6	0	77	69	298	0

KILN NO. 1
TEST NO. 6
DATE 11/26/91
TIME 7:15 A.M. to 1:52 P.M.

TIME	CLINKER tons/hr.	RAW FEED tons/hr.	COAL tons/hr.	OIL gal/min	PRECIPITATOR DATA Secondary Milliamps inlet	center	outlet	TIRES per/rev
7 A.M.	23.8	41.7	4.5	10.9	106	87	274	0
8	24.5	42.9	4.4	10.9	134	90	268	0
9	24.8	43.4	4.4	10.9	131	89	274	0
10	24.4	42.7	4.4	10.9	129	90	266	0
11	24.9	43.6	4.4	10.9	137	95	265	0
12 noon	24.7	43.2	4.5	10.9	126	91	262	0
1 P.M.	24.1	42.2	4.5	10.9	127	86	259	0
2	24.7	43.2	4.5	10.9	117	81	260	0