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

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

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Industrial Boilers

Emission Test Report
Boston Edison Company
Everett, Massachusetts

INDUSTRIAL BOILERS

Emission Test Report

BOSTON EDISON COMPANY
BOILER NO. 7
Everett, Massachusetts

September 29 - October 2, 1981

Technical Directives 14 and 15

Prepared for

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Research Triangle Park
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by

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CONTENTS

Figures iv
Tables v

1. Introduction. 1
2. Summary of Results. 4
   Description of monitoring 4
   Test results. 4
3. Process Description and Monitoring. 22
   Process description 22
   Process monitoring. 25
4. Location of Sampling Points 32
   Control system inlet. 32
   Control system exhaust (outlet) 32
5. Sampling and Analytical Procedures. 36
   Summary 36
   Sampling. 36
   Sample analyses 38
   Oil sampling and analyses 39
   Sample handling 39
   Data reduction. 39
   Quality assurance 39

Appendices

A. Field sampling data sheets and computer coding forms. A-1
B. Printouts of sampling results B-1
C. Analytical methods for sulfuric acid and sulfate determinations. C-1
D. Analytical Data D-1
E. Project Participants. E-1

FIGURES

Number		Page
1	Location of Boston Edison Company Mystic River Station.	2
2	Schematic diagram of Boston Edison boiler installation	3
3	Unit seven boiler process flow diagram	25
4	Exhaust gas flow configuration for 7A south inlet duct at Boston Edison. (Ref. Buell drawing provided by Boston Edison Company) . . .	33
5	Inlet duct sampling for 7A south and 7B north at Boston Edison Company Mystic River Station. .	33
6	Photos of south inlet and ports at north inlet at Boston Edison Company Mystic River Station. .	34
7	Stack and sample port heights at Boston Edison .	35
8	Traverse point locations for Boiler No. 7 stack at Boston Edison	35
9	Dual-probe sampling train.	37

TABLES

Number		Page
1	Source Sampling and Analyses at Boston Edison Company Boiler No. 7 in Everett, Masschusetts. .	5
2	Emission Data for Boston Edison Company Mystic River Station Boiler No. 7 in Everett, Massachusetts (Metric Units)	6
3	Emission Data for Boston Edison Company Mystic River Station Boiler No. 7 in Everett, Massachusetts (English Units).	7
4	Summary of Differences Between Method 5 and Method 5B Results at Outlet of Boston Edison Company Mystic River Station Boiler No. 7 (September 30 - October 2, 1981)	9
5	Inlet Data for Boston Edison Company Mystic River Station Boiler No. 7 in Everett, Massachusetts (Metric Units)	10
6	Inlet Data for Boston Edison Company Mystic River Station Boiler No. 7 in Everett, Massachusetts (English Units).	11
7	Summary of Duration of Sampling, Stack Temperature, Stack Flow Rate, Sample Volume, Sample Water Content, and Static Pressure at Boston Edison Company Mystic River Station Boiler No. 7 in Everett, Massachusetts.	12
8	Summary of Integrated Gas Analysis Results at Boston Edison Company Mystic River Station Boiler No. 7 in Everett, Massachusetts (September 30 - October 2, 1981)	13
9	Summary of Fuel Oil Analysis at Boston Edison Company Boiler No. 7 in Everett, Massachusetts (September 30 - October 2, 1981)	15

TABLES (continued)

Number		Page
10a	Summary of Method 9 Plume Opacity Observations at Boston Edison Company Boiler No. 7 in Everett, Massachusetts (September 30, 1981)	16
10b	Summary of Method 9 Plume Opacity Observations at Boston Edison Company Boiler No. 7 in Everett, Massachusetts (October 1, 1981).	18
10c	Summary of Method 9 Plume Opacity Observations at Boston Edison Company Boiler No. 7, in Everett, Massachusetts (October 2, 1981).	20
11	Results of Baking at 160°C and 176°C on Particulate Masses	21
12	Boiler Process Data.	27
13	Electrostatic Precipitator Process Data: Run 1.	28
14	Electrostatic Precipitator Process Data: Run 2.	29
15	Electrostatic Precipitator Process Data: Run 3.	30

SECTION 1

INTRODUCTION

Emissions from Boiler No. 7 at the Boston Edison Company's Mystic River Station, Everett, Massachusetts, were tested September 30 - October 2, 1981 by Monsanto Research Corporation (MRC). Figure 1 shows the location of the plant. This work was performed for the Emissions Measurement Branch of the US Environmental Protection Agency (EPA) under Contract No. 68-02-3547, Work Assignment No. 2.

The boiler tested is a 1.9×10^6 kg/hr (4.2×10^6 lb/hr) capacity oil-fired utility boiler. It is equipped with two 45 kV electrostatic precipitators (ESP). Figure 2 is a schematic diagram of the installation showing the locations sampled.

The purpose of the sampling program was to determine the effect of raising the temperature of the filter and probe on an EPA Method 5 train from 120°C (248°F) to 160°C (320°F) and of baking the filter at 160°C (320°F) on the amounts of particulate, sulfate, and sulfuric acid emissions measured downstream of the electrostatic precipitator. Method 5 testing with the filter and probe at 160 ± 14°C (320 ± 25°F) and baked at a temperature of 160 ± 11°C (320 ± 20°F) will be referred to as Method 5B testing.

Although the objective of this contract (No. 68-02-3547, work assignment No. 2) is to provide technical support data for industrial boilers, the utility boiler sampled at Boston Edison Company was deemed satisfactory to meet these objectives.

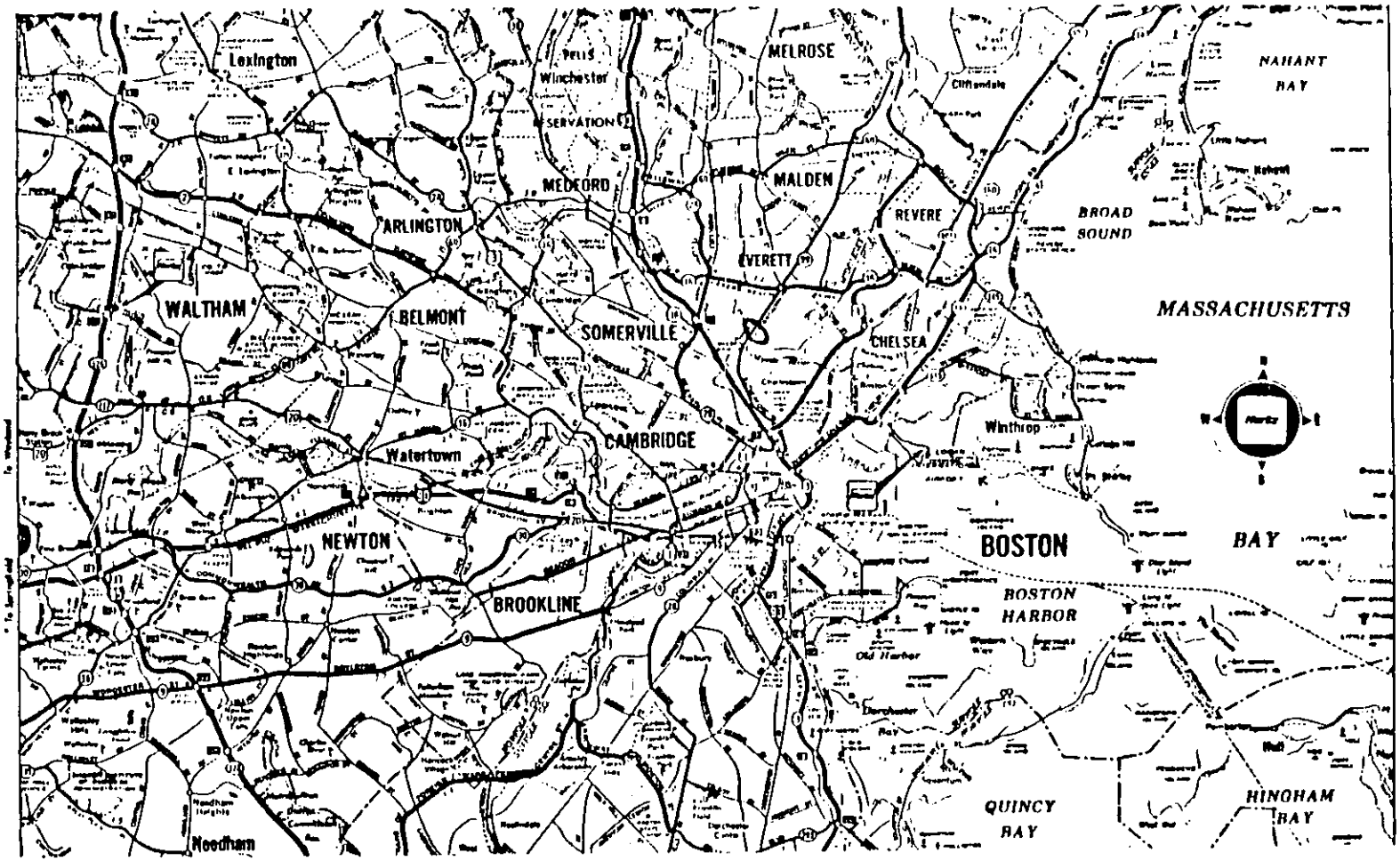


Figure 1. Location of Boston Edison Company Mystic River Station.

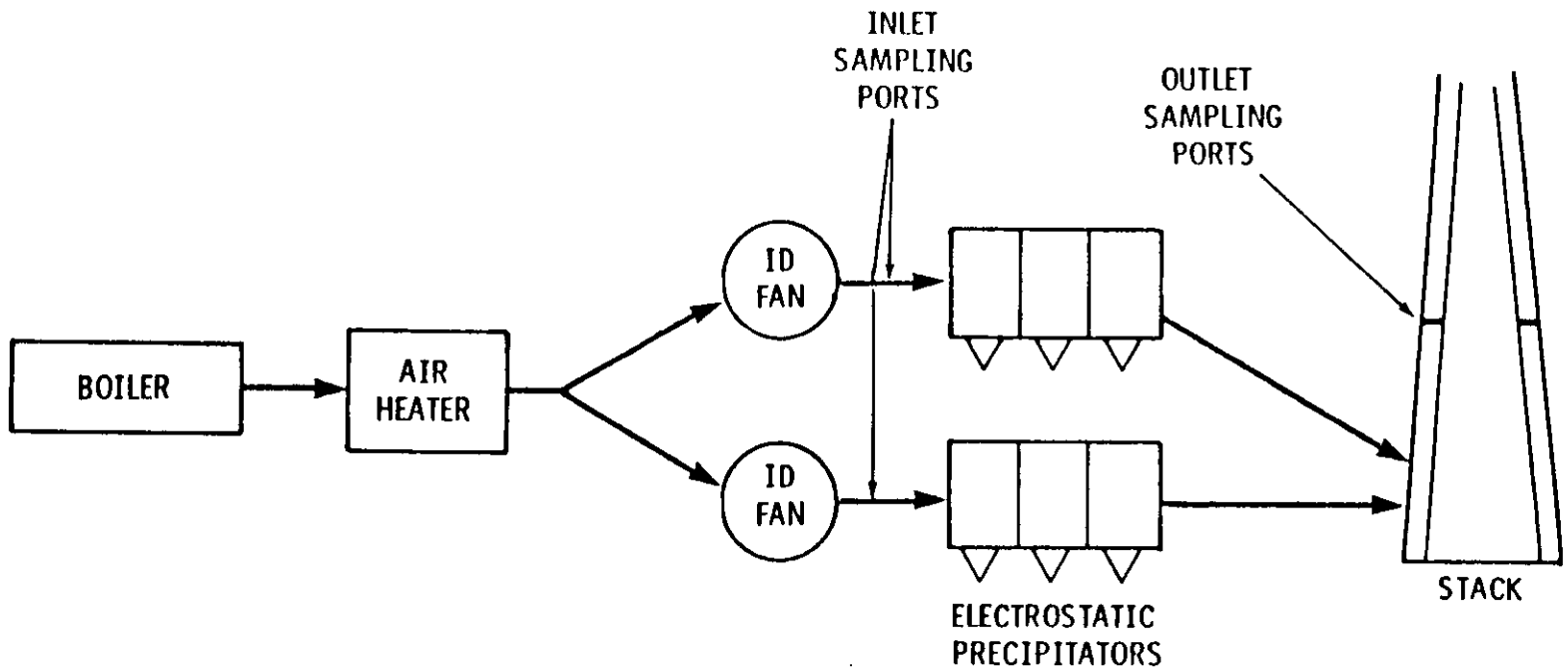


Figure 2. Schematic diagram of Boston Edison boiler installation.

SECTION 2

SUMMARY OF RESULTS

DESCRIPTION OF MONITORING

Table 1 summarizes the monitoring that was performed at the Boston Edison plant. It consisted of three simultaneous runs of Methods 5 and 5B at the stack, downstream of the two ESP, and Method 5 at the inlet ducts, prior to the two ESP. A special dual-probe stack test system was used for sampling by Methods 5 and 5B simultaneously through the stack sample ports. Sample volumes of at least 1.7 dry standard m^3 (60 dry standard ft^3) were taken during the stack sampling. The boiler was running under normal, steady-state conditions (i.e., continuous soot blowing, at least 80% of full capacity) during the emission testing.

The oil burned was considered to be representative of normal feed. The Boston Edison Company provided analyses of the No. 6 fuel oil burned.

The filters and dried acetone washes of the Method 5 and 5B runs were weighed, baked, and weighed again; this process was repeated until the sample weight did not change more than 4 mg between successive weighings. They were then analyzed for sulfuric acid and sulfates.

Methods 1 through 4 were used during all Method 5 sampling runs as in typical compliance monitoring. In addition, the plume opacity was measured during all tests by EPA Method 9.

TEST RESULTS

The particulate, sulfuric acid, and sulfate emissions measured by EPA Methods 5 and 5B are summarized in Tables 2 and 3 (particulate emissions represent all emissions measured by weighing the Methods 5 and 5B samples and include sulfates and sulfuric acid). Table 2 shows the percent reduction in particulate mass that was caused by baking the samples. As Table 2 shows, the weight of the Method 5 samples after baking was 62% to 80% of the weight before baking. The weight of the Method 5B samples after baking was 67% to 81% of the weight before baking. Table 3 shows the percents of the Method 5 concentrations represented by the Method 5B concentrations measured simultaneously at the same location. Particulate concentrations measured by Method 5B were 29% to 88% of the Method 5

TABLE 1. SOURCE SAMPLING AND ANALYSES AT BOSTON EDISON COMPANY BOILER NO. 7 IN EVERETT, MASSACHUSETTS

SAMPLING AND ANALYSIS REQUIREMENTS

MRC Job No. 101.[illegible]

Contract No.: [illegible] | Assignment Number: [illegible] | Technical Directive: [illegible]

Company Name: [illegible] | Company Location: [illegible]

Industry: Utility Boiler | Process: Oil Fired | Control Equipment: Two Electrostatic Precipitators

Date	Total no. of samples	Sample type	Sampling method	Sample collected by	Minimum sampling time	Minimum volume gas sampled ft^3	Initial Analysis Type	Initial Analysis Method	Initial Analysis By	Final Analysis Type	Final Analysis Method
9/30	2	Particulate and bag at exhaust	1-4, 5, and 5B		240 min	~150	Velocity, temp., O_2, H_2O, CO,	1-4		Particulate	Methods 5 and 5B
							CO_2			SO_3, H_2SO_4	10/10/80 procedure
	1	Particulate and bag at Inlet North	1-4, 5		90 min	50	Same as above			Same as above (not Method 5B)	
	1	Particulate and bag at Inlet South	1-4, 5		87.5 min	22	Same as above			Same as above (not Method 5B)	
	1	Plume Opacity	9		Simultaneous with above		Visual observation	9			
10/1	2	Particulate and bag at exhaust	1-4, 5, and 5B		120 min	~75	Velocity, temp., O_2 H_2O, CO,	1-4		Particulate	Methods 5 and 5B
							CO_2			SO_3, H_2SO_4	10/10/80 procedure
	1	Particulate and bag Inlet North	1-4, 5		90 min	50	Same as above			Same as above (not Method 5B)	
	1	Particulate and bag Inlet South	1-4, 5		90 min	72	Same as above			Same as above (not Method 5B)	
	1	Plume Opacity	9		Simultaneous with above		Visual observation	9			
10/2	2	Particulate and at exhaust	1-4, 5, and 5B		120 min	~75	Velocity, temp., O_2, H_2O, CO,	1-4		Particulate	Methods 5 and 5B
							CO_2			SO_3, H_2SO_4	10/10/80 procedure
	1	Particulate and bag at Inlet North	1-4, 5		90 min	50	Same as above			Same as above (not Method 5B)	
	1	Particulate and bag at Inlet South	1-4, 5		90 min	68	Same as above			Same as above (not Method 5B)	
	1	Plume opacity	9		Simultaneous with above		Visual observation	9			

TABLE 2. EMISSION DATA FOR BOSTON EDISON COMPANY MYSTIC RIVER STATION BOILER NO. 7 IN EVERETT, MASSACHUSETTS (METRIC UNITS)

Run number	Date	Sampling method	Pollutant	Average emissions Actual g/dscm	kg/hr	ng/J	Corrected to 12% CO_2[a], g/dscm	Percent isokinetic	Percent difference in sample weight caused by baking sample[b]
1	9-30-81		Particulate						
		5	-Before baking	0.086	155	28.1	0.083	98.0	
		5B	-Before baking	0.054	97	17.7	0.053	98.6	
		5	-After baking	0.017	31	5.7	0.016	98.0	80
		5B	-After baking	0.015	28	5.1	0.015	98.6	71
		5	Sulfuric acid	0.0019	3.46	0.6	0.0018	98.0	
		5B	Sulfuric acid	0.0011	2.04	0.4	0.0011	98.6	
		5	Sulfate	0.0044	7.82	1.4	0.0043	98.0	
		5B	Sulfate	0.0029	5.16	0.9	0.0028	98.6	
2	10-01-81		Particulate						
		5	-Before baking	0.126	224	44.0	0.134	100.5	
		5B	-Before baking	0.060	106	21.0	0.064	101.1	
		5	-After baking	0.040	70	13.9	0.042	100.5	69
		5B	-After baking	0.011	20	3.9	0.012	101.1	81
		5	Sulfuric acid	0.0035	6.22	1.2	0.0037	100.5	
		5B	Sulfuric acid	0.0012	2.05	0.4	0.0013	101.1	
		5	Sulfate	0.0098	17.37	3.4	0.0104	100.5	
		5B	Sulfate	0.0047	8.23	1.6	0.0050	101.1	
3	10-02-81		Particulate						
		5	-Before baking	0.090	165	30.2	0.092	95.6	
		5B	-Before baking	0.057	100	19.4	0.058	100.8	
		5	-After baking	0.034	63	11.7	0.036	95.6	62
		5B	-After baking	0.019	33	6.1	0.019	100.8	67
		5	Sulfuric acid	0.0019	3.49	0.7	0.0019	95.6	
		5B	Sulfuric acid	0.0015	2.70	0.5	0.0015	100.8	
		5	Sulfate	0.0166	30.62	5.7	0.0169	95.6	
		5B	Sulfate	0.0096	16.80	3.1	0.0098	100.8	

[a]This is the concentration normalized to 12% CO_2. $C = C \times \frac{12}{\%CO_2}$; where C is the measured concentration in the stack, and $\%CO_2$ is the percent CO_2 measured in the stack.

[b]$\frac{\text{weight before baking - weight after baking}}{\text{weight before baking}} \times 100$

TABLE 3. EMISSION DATA FOR BOSTON EDISON COMPANY MYSTIC RIVER STATION BOILER NO. 7 IN EVERETT, MASSACHUSETTS (ENGLISH UNITS)

Run number	Date	Sampling method	Pollutant	Average emissions: Actual gr/dscf	Average emissions: lb/hr	Average emissions: lb/mm Btu	Corrected to 12% CO_2[a], gr/dscf	Percent isokinetic	Percent of Method 5 gr/dscf represented by Method 5B gr/dscf at outlet
1	9-30-81		Particulate						
		5	-Before baking	0.038	342	0.065	0.037	98.0	
		5B	-Before baking	0.024	214	0.041	0.023	98.6	63
		5	-After baking	0.008	68	0.013	0.008	98.0	
		5B	-After baking	0.007	61	0.012	0.007	98.6	88
		5	Sulfuric acid	0.0008	7.63	0.001	0.0008	98.0	
		5B	Sulfuric acid	0.0005	4.51	0.001	0.0005	98.6	63
		5	Sulfate	0.0019	17.25	0.003	0.0018	98.0	
		5B	Sulfate	0.0013	11.37	0.002	0.0013	98.6	68
2	10-01-81		Particulate						
		5	-Before baking	0.055	494	0.102	0.058	100.5	
		5B	-Before baking	0.026	233	0.049	0.028	101.1	47
		5	-After baking	0.017	155	0.033	0.018	100.5	
		5B	-After baking	0.005	43	0.009	0.005	101.1	29
		5	Sulfuric acid	0.0015	13.72	0.003	0.0016	100.5	
		5B	Sulfuric acid	0.0005	4.51	0.001	0.0005	101.1	33
		5	Sulfate	0.0043	38.28	0.008	0.0045	100.5	
		5B	Sulfate	0.0020	18.14	0.004	0.0021	101.1	47
3	10-02-81		Particulate						
		5	-Before baking	0.039	365	0.070	0.040	95.6	
		5B	-Before baking	0.025	221	0.045	0.025	100.8	64
		5	-After baking	0.015	138	0.027	0.015	95.6	
		5B	-After baking	0.008	72	0.014	0.008	100.8	53
		5	Sulfuric acid	0.0008	7.69	0.002	0.0008	95.6	
		5B	Sulfuric acid	0.0007	5.95	0.001	0.0007	100.8	88
		5	Sulfate	0.0073	67.50	0.013	0.0074	95.6	
		5B	Sulfate	0.0042	37.04	0.007	0.0043	100.8	58

[a]This is the concentration normalized to 12% CO_2. $C = C \times \frac{12}{\%CO_2}$; where C is the measured concentration in the stack, and $\%CO_2$ is the percent CO_2 measured in the stack.

particulate concentrations after both samples were baked. For the unbaked samples, Method 5B concentrations were 47% to 64% of the Method 5 concentrations. Sulfuric acid concentrations measured on the Method 5B samples were 33% to 88% of the baked Method 5 samples. Sulfate concentrations measured on the Method 5B samples were 47% to 68% of the baked Method 5 samples. These results are based on baking to a constant weight (i.e., weight loss less than 10 mg). Between 1 and 3 bakings at 160°C (320°F) were required to achieve constant weight.

Computer printouts of the particulate emission rates are provided in Appendix B.

The differences between Method 5 and 5B emissions are summarized in Table 4 (using the baked methods 5 and 5B filters). This table also summarizes what percent of the differences between Method 5 and 5B particulate emissions (baked) can be accounted for by differences in the amounts of sulfuric acid (and sulfuric acid and sulfates combined) measured on the baked samples collected by Method 5 versus 5B. Approximately 3% to 47% of the amount of difference in Method 5 versus 5B particulate emissions are accounted for by the amounts of measured sulfuric acid emissions. Sulfuric acid and sulfates combined account for 27% to 137% of the difference in Method 5 versus 5B particulate emissions.

Results for particulate analyses at the inlets north and south are shown in Tables 5 and 6. The weight of the Method 5 particulate samples after baking was 90% to 92% of the weight before baking for inlet north and 89% to 95% for inlet south.

Table 7 summarizes the duration of the Method 5 and 5B sampling, the sample volumes, the stack temperatures, the stack flow rates, the water content, and the static pressure of the flue gas. Differences in the stack temperature, flow rate, and water content associated with the Method 5 and 5B outlet samples are an indicator of the precision of the results.

Table 8 summarizes the flue gas carbon dioxide, carbon monoxide, oxygen, and nitrogen concentrations in integrated Method 3 samples taken at the exhaust of the trains used to collect Method 5 and 5B samples. These values were used to calculate ng/J, lb/10^6 Btu, and results at 12% CO_2 in Tables 2 and 3. Due to problems encountered with Method 3 sample bag collection at the back end of the Method 5 train at both inlets and the subsequent ORSAT analysis, molecular weights, and O_2, N_2, and CO_2 concentrations for the inlets were assumed to be equal to the outlet concentrations for each run (see Table 8). Since relatively little ambient air is introduced into the duct system due to the positive pressure of the ducts and ESP, the stack concentrations for M.W., O_2, N_2, and CO_2 represent approximate concentrations at the inlet ducts. Concentrations for run 3 were averaged from runs 1 and 2 because a leak in the sample bags contaminated the samples making the ORSAT analysis invalid.

TABLE 4. SUMMARY OF DIFFERENCES BETWEEN METHOD 5 AND METHOD 5B RESULTS AT OUTLET OF BOSTON EDISON COMPANY MYSTIC RIVER STATION BOILER NO. 7 (SEPTEMBER 30 - OCTOBER 2, 1981)

Run number	Pollutant	Method 5[a] minus Method 5B emissions kg/hr	Method 5[a] minus Method 5B emissions lb/hr	Percent of difference in particulate emissions kg/hr (lb/hr) represented by difference in sulfuric acid emissions	Percent of difference in particulate emissions kg/hr (lb/hr) represented by difference in sulfuric acid and sulfates combined
1	Particulate[a]	3	7		
	Sulfuric acid	1.4	3.1	47	
	Sulfates	2.7	5.9		
	Sulfuric acid and sulfates	4.1	9.0		137
2	Particulate[a]	50	112		
	Sulfuric acid	4.2	9.2	8	
	Sulfates	9.1	20.1		
	Sulfuric acid and sulfates	13.3	29.3		27
3	Particulate[a]	30	66		
	Sulfuric acid	0.8	1.7	3	
	Sulfates	13.8	30.5		
	Sulfuric acid and sulfates	14.6	32.2		49

[a]Emissions measured using masses after baking samples.

TABLE 5. INLET DATA FOR BOSTON EDISON COMPANY MYSTIC RIVER STATION BOILER NO. 7 IN EVERETT, MASSACHUSETTS (METRIC UNITS)

Run number	Date	Sampling method	Pollutant	Inlet north average emissions: Actual g/dscm	Inlet north average emissions: kg/hr	Inlet north average emissions: Corrected to 12% CO_2[a], g/dscm	Inlet south average emissions: Actual g/dscm	Inlet south average emissions: kg/hr	Inlet south average emissions: Corrected to 12% CO_2[a], g/dscm
1	9-30-81		Particulate						
		5	-Before baking	0.325	310	0.315	0.609	547	0.589
		5	-After baking	0.292	279	0.283	0.550	494	0.532
		5	Sulfuric acid	0.0011	2.0	0.0011	0.0019	3.5	0.0018
		5	Sulfate	0.0029	5.2	0.0028	0.0044	7.8	0.0043
2	10-01-81		Particulate						
		5	-Before baking	0.416	416	0.442	0.304	288	0.323
		5	-After baking	0.384	381	0.408	0.271	257	0.288
		5	Sulfuric acid	0.0012	2.0	0.0013	0.0035	6.2	0.0037
		5	Sulfate	0.0047	8.2	0.0050	0.0098	17.4	0.0104
3	10-02-81		Particulate						
		5	-Before baking	0.439	433	0.446	0.295	279	0.300
		5	-After baking	0.401	394	0.408	0.279	264	0.284
		5	Sulfuric acid	0.0015	2.7	0.0015	0.0019	3.5	0.0019
		5	Sulfate	0.0096	16.8	0.0098	0.0166	30.6	0.0169

[a]This is the concentration normalized to 12% CO_2. $C = C \times \frac{12}{\%CO_2}$; where C is the measured concentration in the inlet duct and $\%CO_2$ is the percent CO_2 measured in the inlet duct.

TABLE 6. INLET DATA FOR BOSTON EDISON COMPANY MYSTIC RIVER STATION BOILER NO. 7 IN EVERETT, MASSACHUSETTS (ENGLISH UNITS)

Run number	Date	Sampling method	Pollutant	Inlet north average emissions: Actual gr/dscf	Inlet north average emissions: lb/hr	Inlet north average emissions: Corrected to 12% CO_2[a], gr/dscf	Inlet south average emissions: Actual gr/dscfm	Inlet south average emissions: lb/hr	Inlet south average emissions: Corrected to 12% CO_2[a], gr/dscf
1	9-30-81		Particulate						
		5	-Before baking	0.142	684	0.137	0.266	1,206	0.257
		5	-After baking	0.128	616	0.124	0.240	1,088	0.232
		5	Sulfuric acid	0.0005	4.5	0.0005	0.0008	7.6	0.0008
		5	Sulfate	0.0013	11.4	0.0013	0.0019	17.2	0.0018
2	10-01-81		Particulate						
		5	-Before baking	0.182	914	0.193	0.133	634	0.144
		5	-After baking	0.168	840	0.178	0.119	566	0.126
		5	Sulfuric acid	0.0005	4.5	0.0005	0.0015	13.7	0.0016
		5	Sulfate	0.0020	18.1	0.0021	0.0043	38.3	0.0046
3	10-02-81		Particulate						
		5	-Before baking	0.192	954	0.195	0.129	616	0.131
		5	-After baking	0.176	868	0.179	0.122	582	0.124
		5	Sulfuric acid	0.0007	5.9	0.0007	0.0008	7.7	0.0008
		5	Sulfate	0.0042	37.0	0.0043	0.0073	67.5	0.0074

[a]This is the concentration normalized to 12% CO_2. $C = C \times \frac{12}{\%CO_2}$; where C is the measured concentration in the stack, and $\%CO_2$ is the percent CO_2 measured in the stack.

TABLE 7. SUMMARY OF DURATION OF SAMPLING, STACK TEMPERATURE, STACK FLOW RATE, SAMPLE VOLUME, SAMPLE WATER CONTENT, AND STATIC PRESSURE AT BOSTON EDISON COMPANY MYSTIC RIVER STATION BOILER NO. 7 IN EVERETT, MASSACHUSETTS

Run number	Location	Sampling method	Duration of sampling, min	Measured stack temperature °C	Measured stack temperature °F	Stack flow rate dscm/min x 10^4	Stack flow rate dscf/min x 10^5	Sample volume dscm	Sample volume dscf	Sample water content, %	Stack static pressures cm H_2O	Stack static pressures in. H_2O
1	Outlet	5	240	167	333	2.99	10.58	4.65	164.3	9.3	-4.6	-1.8
	Outlet	5B	240	167	333	2.98	10.52	3.86	136.3	9.7	-4.6	-1.8
	Inlet North	5	90	189	372	1.60	5.63	1.42	50.0	9.6	+2.4	+0.95
	Inlet South	5	87.5	190	374	1.50	5.28	0.63	22.1	7.9	+3.8	+1.5
2	Outlet	5	120	183	361	2.97	10.48	2.33	82.2	10.8	-4.6	-1.8
	Outlet	5B	120	183	361	2.94	10.38	1.93	68.0	11.9	-4.6	-1.8
	Inlet North	5	90	191	376	1.65	5.84	1.44	50.9	8.7	+2.4	+0.95
	Inlet South	5	90	193	379	1.58	5.58	2.05	72.4	9.7	+3.8	+1.5
3	Outlet	5	120	183	361	3.08	10.86	2.33	82.2	10.4	-4.6	-1.8
	Outlet	5B	120	183	361	2.91	10.28	1.93	68.1	11.5	-4.6	-1.8
	Inlet North	5	90	191	376	1.64	5.79	1.45	51.2	10.3	+2.4	+0.95
	Inlet South	5	90	193	380	1.58	5.57	1.93	68.1	11.2	+3.8	+1.5

TABLE 8. SUMMARY OF INTEGRATED GAS ANALYSIS RESULTS AT BOSTON EDISON COMPANY MYSTIC RIVER STATION BOILER NO. 7 IN EVERETT, MASSACHUSETTS (SEPTEMBER 30 - OCTOBER 2, 1981)

Run number	Location	Sampling method before Method 3 bag	CO_2, %	CO, %	O_2, %	N_2, %	Dry molecular weight, kg/kg mole (lb/lb mole)
1	Outlet	5 and 5B[a]	12.4	0.0	5.0	82.6	30.2
	Inlet North	5	12.4	0.0	5.0	82.6	30.2
	Inlet South	5	12.4	0.0	5.0	82.6	30.2
2	Outlet	5 and 5B	11.3	0.0	6.1	82.6	30.1
	Inlet North	5	11.3	0.0	6.1	82.6	30.1
	Inlet South	5	11.3	0.0	6.1	82.6	30.1
3	Outlet	5 and 5B	11.8[b]	0.0	5.5[b]	82.6[b]	30.1
	Inlet North	5	11.8	0.0	5.5	82.6	30.1
	Inlet South	5	11.8	0.0	5.5	82.6	30.1

[a]One bag collected for 5 and 5B trains to represent outlet.

[b]Average of runs 1 and 2 due to leak in sample bag.

Fuel oil samples and analytical results were obtained from Boston Edison Company and are shown in Table 9.

Tables 10a, 10b, and 10c show a summary of the plume opacity observations. Average opacities between 0.6 and 11.4 were observed during all three runs. Due to poor weather conditions opacity observations during run 3 were difficult. Plume opacity data sheets are in Appendix A-1.

Table 11 summarizes the results of the baking of the particulate samples. The filters and acetone washes were weighed, baked at 160°C (320°F) to constant weight, and baked again at 176°C (350°F) to constant weight. Baking to a constant weight is a less than 10 mg weight loss between bakings. Between 1 and 3 bakes were required for each sample at 160°C to achieve a constant weight and only 1 bake was required at 176°C. The baking procedure is described in more detail in Section 5. Appendix D-2 gives a detailed breakdown of the weights after each baking. Values from Table 11 before baking and baking at 160°C were used to determine emissions rates in Tables 2-6.

Appendix D-5 contains a summary of information on the precision and accuracy of the sulfate, and sulfuric acid analysis. Six quality control samples of sulfuric acid were prepared from 0.2 N sulfuric acid and analyzed with the stack samples. The measured amounts of sulfuric acid were between 77% and 107% of the "true" values. The results of the analysis of two EPA sulfate quality control samples showed a 102% to 143% recovery of sulfate. A blank filter was also analyzed as a quality control sample; 2.85 mg of sulfate was measured on this filter. The lowest amount of sulfate observed on a stack sample was 8.8 mg. In addition, EPA Method 6 round-robin SO_x vials were used as QC/QA check on titrations. Results showed an 100.0% average recovery on 18 samples.

Appendix D-2 contains information on the precision and accuracy of particulate analysis. The filter and acetone wash for each sample were analyzed using the procedure outlined in Section 5. Every sample was weighed to a constant weight (i.e., a less than 10 mg weight loss between successive weighings). However, the actual maximum value constant weight was 3.6 mg and the average for all weighings was ± 0.6 mg. In addition, blank filters and acetone washes were analyzed as a QC/QA check.

TABLE 9. SUMMARY OF FUEL OIL ANALYSIS AT BOSTON EDISON COMPANY BOILER NO. 7 IN EVERETT, MASSACHUSETTS (September 30 - October 2, 1981)[a]

Run No. (Date)	Gravity, API at 60°F	Heat content, Btu/lb	Heat content, Btu/gal	Carbon residue, %	Sulfur, %	Viscosity SSF[b] at 122°F	Viscosity SSU[c] at 100°F	Ash, %	Vanadium, ppm	Sodium, ppm	Carbon, %	Hydrogen, %	Nitrogen, %	Oxygen, %
Run 1 (9-30-81)	13.4	18,477	150,269	14.04	1.99	179	4,014	0.08	400	44	86.20	11.05	0.36	0.33
Run 2 (10-1-81)	12.9	18,451	150,579	14.23	1.90	185	4,164	0.09	483	44	86.20	11.08	0.36	0.39
Run 3 (10-2-81)	13.2	18,466	150,438	14.10	1.91	188	4,225	0.10	483	46	86.23	11.17	0.37	0.25

[a]All values are average of two analyses.

[b]Saybolt Fural seconds.

[c]Saybolt Universal seconds.

TABLE 10a. SUMMARY OF METHOD 9 PLUME OPACITY OBSERVATIONS AT BOSTON EDISON COMPANY BOILER NO. 7 IN EVERETT, MASSACHUSETTS (September 30, 1981)

Date: 9-31-81
Type of Discharge: Stack
Height of Point of Discharge: 500 ft
Wind Direction: NW
Color of Plume: Brown to bluish white
Observer Name: Vasudev B. Kulkarni
Distance from Observer to Discharge Point: 2,500 ft - 4,000 ft
Sampling Time: 1 10:25 - 10:49
2 11:01 - 12:01
3 12:10 - 13:10
4 13:15 - 14:15
5 16:00 - 17:00
6 17:03 - 17:26

Type of Plant: Utility Boiler
Location of Discharge: Electrostatic Precipitator Exhaust
Description of Sky: Partly cloudy
Wind Velocity: 15-20 mph
Location of Observation: After plume height
Duration of Observation: 287 min total[a]
Direction of Observer from Discharge Point: NE
Height of Observation Point: Ground level

Summary of average opacity

Set number	Time Start	Time End	Opacity Sum	Opacity Average	Number of blanks indicating unreadable due to clouds
1[b]	10:25	10:30	100	6.3	8
2	10:31	10:36	35	5.8	18
3	10:37	10:42	-	-	24
4	10:43	10:48	-	-	24
5	11:01	11:06	200	8.3	0
6	11:07	11:12	165	6.9	0
7	11:13	11:18	185	7.7	0
8	11:19	11:24	150	6.5	1
9	11:25	11:30	120	5.7	3
10	11:31	11:36	180	7.8	1
11	11:37	11:42	200	8.7	1
12	11:43	11:48	125	7.8	8
13	11:49	11:54	60	5.5	13
14	11:55	12:00	60	4.6	11
15	12:10	12:15	190	13.6	10
16	12:16	12:21	185	8.4	2
17	12:22	12:27	195	11.5	7
18	12:28	12:33	50	8.3	18
19	12:34	12:39	115	6.8	7
20	12:40	12:45	225	9.4	0
21	12:46	12:51	280	11.7	0
22	12:52	12:57	135	6.1	2
23	12:58	13:03	180	9.0	4
24	12:04	13:09	190	10.6	6

(continued)

TABLE 10a (continued).

Summary of average opacity					
Set number	Time Start	Time End	Opacity Sum	Opacity Average	Number of blanks indicating unreadable due to clouds
25	13:15	13:20	155	6.5	0
26	13:21	13:26	155	7.0	2
27	13:27	13:32	180	7.5	0
28	13:33	13:38	235	10.2	1
29	13:39	13:44	235	9.8	0
30	13:45	13:50	165	7.2	1
31	13:51	13:56	240	10.4	1
32	13:57	14:02	205	8.5	0
33	14:03	14:08	150	7.1	3
34	14:09	14:14	115	5.5	3
35	16:00	16:05	175	9.7	6
36	16:06	16:11	40	6.7	18
37	16:12	16:17	25	6.3	20
38	16:18	16:23	85	10.6	16
39	16:24	16:29	35	4.4	16
40	16:30	16:35	-	-	24
41	16:36	16:41	155	9.7	8
42	16:42	16:47	50	12.5	20
43[c]	16:48	16:53	50	6.3	16
44	16:54	16:59	200	8.3	0
45	17:03	17:08	220	9.2	0
46	17:09	17:14	395	16.5	0
47	17:15	17:20	125	9.6	11
48	17:21	17:26	35	5	17

Average all sets except 3,4, and 40: 8.3

[a]Total observation time includes periods when no opacity readings could be obtained because of transient conditions.

[b]Test started.

[c]Test ended.

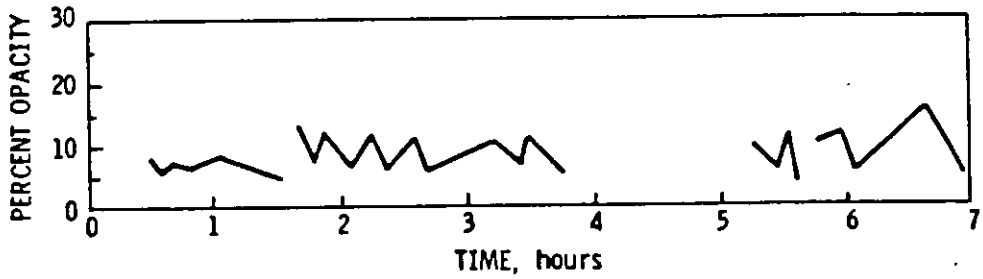


TABLE 10b. SUMMARY OF METHOD 9 PLUME OPACITY OBSERVATIONS AT BOSTON EDISON COMPANY BOILER NO. 7 IN EVERETT, MASSACHUSETTS (October 1, 1981).

Date: 10-1-81
Type of Lischarge: Stack
Height of Point of Discharge: 500 ft
Wind Direction: NW
Color of Plume: Bluish white
Observer Name: Vasudev B. Kulkarni
Distance from Observer to Discharge Point: 2,500 ft
Sampling Time: 1 11:15 - 12:15
2 13:30 - 12:45
3 13:15 - 14:15
4 14:30 - 15:16
5 15:30 - 16:30

Type of Plant: Utility Boiler
Location of Discharge: Electrostatic Precipitator Exhaust
Description of Sky: Overcast
Wind Velocity: 5-10 mph
Location of Observation: Varied
Duration of Observation: 166 min total[a]
Direction of Observer from Discharge Point: SW
Height of Observation Point: Ground level

Summary of average opacity

Set number	Time Start	Time End	Opacity Sum	Opacity Average	Number of blanks indicating unreadable due to clouds
1	11:15	11:20	155	6.5	0
2	11:21	11:26	130	5.9	2
3	11:27	11:32	50	8.3	18
4	11:33	11:38	95	4.0	0
5[b]	11:39	11:44	55	2.3	0
6	11:45	11:50	95	5.9	8
7	11:51	11:56	40	5.0	16
8	11:57	12:02	120	5.0	0
9	12:03	12:08	185	7.7	0
10	12:09	12:14	75	5.0	0
11	12:30	12:35	60	6.7	15
12	12:36	12:41	145	6.0	0
13	12:42	12:45	40	4.0	14
14	13:15	13:20	30	5.0	18
15	13:21	13:26	115	4.8	0
16	13:27	13:32	65	7.2	15
17	13:33	13:38	230	9.6	0
18	13:39	13:44	25	5.0	19
19	13:45	13:50	110	4.6	0
20	13:51	13:56	100	4.2	0
21	13:57	13:02	140	9.3	9
22	14:03	13:08	140	7.0	4
23	14:09	14:14	170	8.5	4
24	14:30	14:35	55	2.3	0

(continued)

TABLE 10b (continued).

Summary of average opacity					
Set number	Time Start	Time End	Opacity Sum	Opacity Average	Number of blanks indicating unreadable due to clouds
25[c]	14:36	14:41	20	0.8	0
26	14:42	14:47	25	1.0	0
27	14:48	14:53	0	0	0
28	14:54	14:59	15	0.6	0
29	15:00	15:05	85	3.5	0
30	15:06	15:11	5	0.5	14
31	15:12	15:16	30	1.9	8
32	15:30	15:35	55	2.3	0
33	15:36	15:41	90	3.8	0
34	15:42	15:47	35	1.5	0
35	15:48	15:53	40	1.7	0
36	15:54	15:59	95	4.0	0
37	16:00	16:05	40	3.6	13
38	16:06	16:11	155	7.0	2
39	16:12	16:17	130	5.4	0
40	16:18	16:23	95	4.0	0
41	16:24	16:29	90	3.8	0

Average all sets : 4.5

[a]Total observation time includes periods when no opacity readings could be obtained because of transient conditions.

[b]Test started.

[c]Test ended.

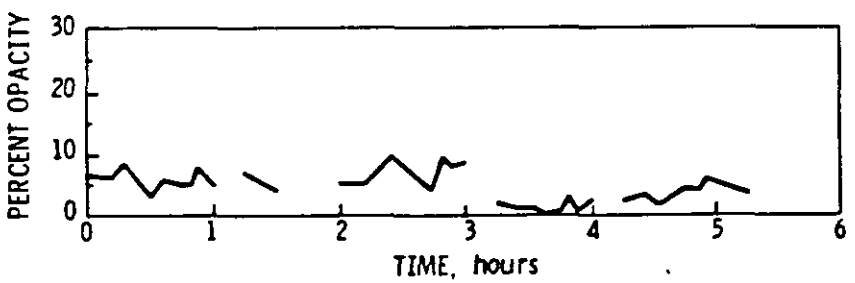


TABLE 10c. SUMMARY OF METHOD 9 PLUME OPACITY OBSERVATIONS AT BOSTON EDISON COMPANY BOILER NO. 7 IN EVERETT, MASSACHUSETTS (October 2, 1981).

Date: 10-2-81
Type of Discharge: Stack
Height of Point of Discharge: 500 ft
Wind Direction: SW
Color of Plume: Not specified
Observer Name: Vasudev B. Kulkarni
Distance from Observer to Discharge Point: 700 ft - 1,000 ft
Sampling Time: 1 11:10 - 12:10
2 12:15 - 1:15

Type of Plant: Utility Boiler
Location of Discharge: Electrostatic Precipitator Exhaust
Description of Sky: Overcast
Wind Velocity: 5 mph
Location of Observation: Varied
Duration of Observation: 120 min total[a]
Direction of Observer from Discharge Point: NW
Height of Observation Point: Ground level

Summary of average opacity

Set number	Time Start	Time End	Opacity Sum	Opacity Average	Number of blanks indicating unreadable due to clouds
-[b]	10:00	11:00[c]	-	-[c]	24
1	11:10	11:15	0	0.0	0
2	11:16	11:21	-	-	24
3	11:22	11:27	-	-	24
4	11:28	11:33	-	-	24
5	11:34	11:39	-	-	24
6	11:40	11:45	-	-	24
7	11:46	11:51	-	-	24
8	11:52	11:57	-	-	24
9	12:15	12:20	0	0.0	0
10[d]	12:21	12:26	10	0.7	10
11	12:27	12:32	35	1.5	0
12	12:33	12:38	0	0.0	0
13	12:39	12:44	50	2.1	0
14	12:45	12:50	35	1.5	0
15	12:51	12:56	25	1.0	0
16	12:57	13:02	10	0.4	0
17	13:03	13:08	0	0.0	8
18	13:09	13:14	0	0.0	6

Average all sets except 2-8: 0.7

[a]Total observation time includes periods when no opacity readings could be obtained because of transient conditions.

[b]Test started.

[c]Readings between 10:00 and 11:10 were not possible due to overcast conditions.

[d]Test ended.

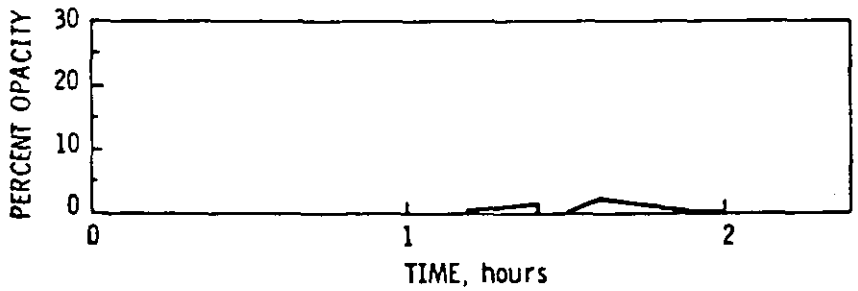


TABLE 11. RESULTS OF BAKING AT 160°C AND 176°C ON PARTICULATE MASSES[a]

Run number	Sample number	Before baking weight, mg	Weight after baking at 160°C, mg[c]	Weight after baking at 176°C, mg[d]
1	OH[b]	203.3	57.8	53.5
	OL	388.1	76.8	76.4
	IN	449.2	404.5	399.7
	IS	381.0	343.9	341.3
2	OH	113.6	21.0	18.0
	OL	287.9	90.3	87.7
	IN	600.6	552.3	547.0
	IS	640.5	572.6	563.2
3	OH	107.5	35.1	33.1
	OL	202.1	76.6	73.7
	IN	639.5	582.3	580.0
	IS	571.8	539.9	532.2

[a]Values for total sample (filter plus acetone wash). All samples weighed to a constant weight.

[b]OH = Outlet high (Method 5B); OL = outlet low (Method 5); IN = inlet north; IS = inlet south.

[c]Required between 1 and 3 bakes to achieve constant weight.

[d]Required only 1 bake to achieve constant weight.

SECTION 3

PROCESS DESCRIPTION AND MONITORING
(supplied by Radian Corporation)

This chapter presents a generalized description of the boiler and electrostatic precipitator processes. Both processes are discussed individually in the following two subsections. Process descriptions include flow diagrams and descriptions, equipment design data, typical operating conditions and performance data.

The process data collected during runs one, two and three are tabulated and any process upsets or abnormalities that occured during the testing period are discussed. In addition, general comments on the process operation are included.

PROCESS DESCRIPTION

Boiler System Description

The Boston Edison Company's Unit Seven is a 585 megawatt utility boiler/generator system that supplies electrical power to a central grid system. The unit seven boiler fires a high sulfur, high vanadium residual oil and is typically based loaded at or near 560 megawatts.

Designed by Combustion Engineering, Unit Seven is a controlled circulation, tangentially fired utility boiler (cyclone type). In the tangential firing system, the furnace itself constitutes the burner. Fuel and air are introduced to the furnace through four wired box assemblies, located in the furnace corners. The fuel and air streams from the windbox nozzles are directed to a firing circle in the center of the furnace. The rotative and cyclonic action that is characteristic of this type of firing is most effective in turbulently mixing the burning fuel in a constantly changing air and gas atmosphere. The air and fuel streams are vertically adjustable by means of movable nozzle tips. This tilting allows adjustments for maximum combustion efficiency to be made.

Six levels of oil guns are used. The second elevation guns fire steam atomized light oil to light and bring the unit up to temperature and pressure. The other five elevations of guns fire steam

atomized heavy oil to carry unit load. Four overfire air registers are used to admit secondary air into the furnace as a means of controlling NO_x emissions. These registers are normally set in the 20 percent open position.

Figure 3 shows a generalized flow diagram of the unit seven boiler system. Combustion air is preheated to 450°F and introduced into the boiler, with the fuel, through one of 4 windbox assemblies. Combustion air is supplied by two forced draft fans having a combined horse power of 2090 (shaft horse power). Combustion flue gases exit the furnace and enter the economizer where incoming boiler feedwater is preheated. The feed water flow is upward through the economizer, that is, counter current to the flue gas flow. The flue gas leaves the economizer at 590°F and the flow is split into north and south side flows. The south side flow supplies combustion air preheat energy for combustion air preheater one while the north side supplies combustion air preheater two. After exiting the combustion air preheaters, each flue gas stream passes through a 2490 horsepower (shaft horsepower) induced draft fan before entering the electrostatic precipitator (ESP). The ESP, described in the next section, treats the north and south side flue gas streams independently. Fly ash from the ESP hoppers is reinjected on a continuous basis. Reinjection is used to burn residual carbon in the fly ash and to increase the mass percent of vanadium in the fly ash. Fly ash is sold to a concern that extracts the vanadium and uses it as an alloy.

The Unit Seven boiler is designed to produce superheated steam at a temperature and pressure of 1005°F and 2440 psig, respectively. The design excess air value is three percent. However, during testing the excess air values ranged between 6.0 and 7.5 percent. The watch engineer indicated that an excess air value of about 6 percent and a carbon monoxide concentration of less than 50 parts per million indicate the most efficient combustion conditions.

Electrostatic Precipitator Description

After the flue gas exits both combustion air preheaters one and two, each side passes through an I.D. fan and then enters a Buell modular electrostatic precipitator (model BA1.4X44K44-8.2P). The precipitator is a split flow unit, with flue gas from preheater one entering the south side and flue gas from preheater two entering the north side. Both the north and south sides have two sections each, with 4 modules per section. This yields a total of eight modules per side. Current is supplied to each side by a bank of 10 three phase transformer/rectifier panels. Panel A supplies DC current to module 1, panel B supplies module 2 and so on. After leaving the precipitator, flue gases from both sides are combined and exhausted to a common stack. Pressure drop through the unit does not exceed 3 inch w.g.

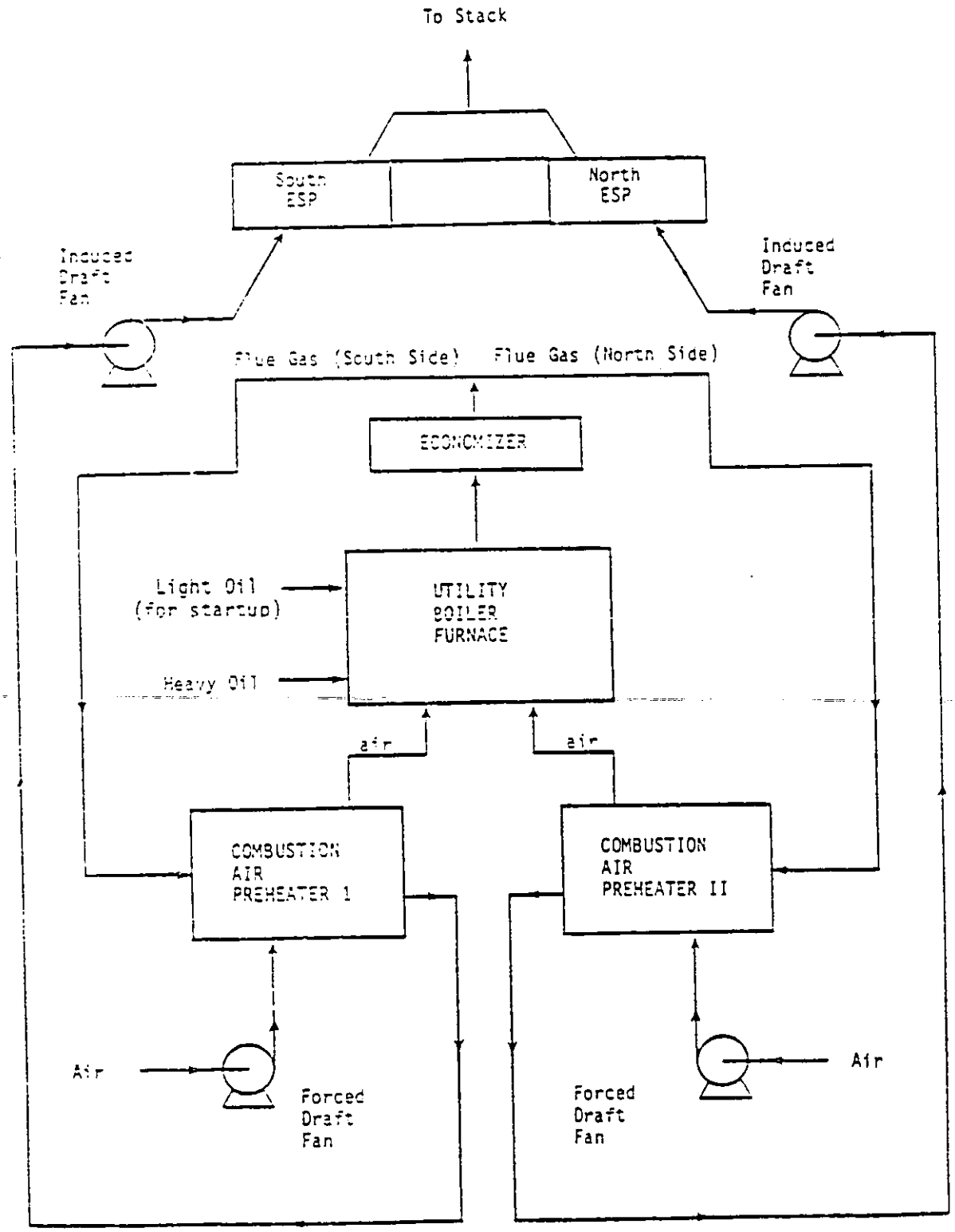


Figure 3. Unit seven boiler process flow diagram.

The precipitator uses a straight wire emitter electrode and flat plate collecting electrode configuration. Total emitting wire length is 168960 ft. and total collecting plate area is 253,440 ft^2. At full load, (580 MW, 1,910,000 acfm) this plate area yields a specific collection area (SCA) of 133 ft^2/1000 acfm (design SCA).

Electrode cleaning is done on a continuous cycle using a combined rapper/vibrating cleaning system. Buell impact rappers are used for cleaning the collecting plate electrodes and Buell vibrators are used for cleaning the emitting wire electrodes. Rapping and vibrating systems are controlled independently and can be adjusted in intensity and frequency. The maximum collecting plate area rapped at any instant is 2700 ft^2 or 1.1 percent of the total plate area.

Particulate emission compliance tests (Method 5) have been conducted by Boston Edison Company that demonstrate a particulate removal efficiency of between 85 and 93 percent. These tests were conducted near full load with the boiler firing a 1 percent sulfur residual fuel oil.

PROCESS MONITORING

Boiler and Precipitator Process Data Monitoring of Plant Processes During Testing

The boiler and precipitator processes were monitored during testing for the following reasons:

1. To insure that the boiler was operating near capacity and at a relatively steady state;

2. To insure that the boiler was operating within normal tolerances;

3. To insure that all precipitator modules were operating normally;

4. To record process data used in determining emission rates; (pounds emitted/MM Btu)

5. To record process data used as a qualitative guideline to document normal boiler and ESP operation.

Eight boiler process parameters were monitored during testing. These parameters are listed here with a description of the location at which the measurements were made.

1. Steam production rate - (10^3 lb/hr)

2. Steam temperature - average superheater outlet temperature (°F)

3. Steam pressure - average superheater outlet pressure (psig)

4. Flue gas oxygen - measured on a dry basis after the economizer at the north and south sides (percent)

5. Flue gas temperature - measured at north and south sides after the economizer (°F)

6. Combustion air temperature - measured after preheaters one (south) and two (north) (°F)

7. Opacity - measured at north and south sides after the economizer (percent)

8. Fuel oil flow - (gpm)

Three precipitator process parameters were monitored during testing. These include: primary voltage (volts), primary current (amps-a.c.), and precipitator current (amps d.c.).

Process Data

Table 12 lists all boiler process data while Tables 13, 14, and 15 list all precipitator data for runs one, two and three, respectively. A discussion of the process operations during testing is presented in the next subsection.

Discussion of Process Data

In general, the boiler maintained steady state operation throughout the testing period. In addition, boiler load remained relatively constant within a range of 590 to 595 megawatts. There were no major process upsets during runs one, two or three.

Prior to the start of each test, Boston Edison personal measured the flue gas carbon monoxide content and percent excess air. This was used as an indicator of efficient combustion and steady state operations. For each test, these indicators were very close to the values normally used by Boston Edison to achieve efficient combustion (6% excess air, <50 ppm CO). Excess air values ranged from 6.0 to 7.5% and carbon monoxide concentrations ranged from trace to 90 ppm.

Table 12 shows a 95.2 percent south side opacity value occuring at 11:46. This is a false reading in that the opacity meter light burned out just prior to 11:46.

During run two, the nozzle tilt angle was changed in a effort to increase combustion efficiency. Adjustment occured between 1:00 and 1:30, during which time the flue gas oxygen dropped from 2.16 (south) and 2.19 (north), to 1.84 (south) and 1.65 (north). There was no significant change in opacity as a result of the nozzle tilt angle adjustment.

TABLE 12. BOILER PROCESS DATA

	Time	Generator Load (MW)	Fuel Oil Flow(GPM)	Steam Flow 10^3 lb/hr	Steam Properties Temp(F)	Steam Properties Pressure(PSIG)	Flue Gas Oxygen South(%)	Flue Gas Oxygen North(%)	Opacity South(%)	Opacity North(%)	Combustion Air Temp South(F)	Combustion Air Temp North(F)	Flue Gas Exit Temp South(F)	Flue Gas Exit Temp North(F)
	10:07	593.8	613	3764	999	2535	1.90	1.99	10.6	9.1	462	478	655	657
	Start Run 1 10:17													
	10:37	594.0	622	3760	1000	2530	2.15	2.46	12.4	9.1	459	479	655	658
	11:07	597.3	622	3784	998	2548	2.19	2.56	13.9	9.8	459	479	657	658
	11:37	595.3	613	3763	1002	2536	2.15	2.57	17.0	10.5	461	479	657	658
	12:08	596.0	622	3757	1002	2532	2.23	2.60	15.0	9.8	458	482	659	660
avg	12:38	589.4	613	3710	1003	2501	2.31	2.76	12.6	10.9	460	480	656	658
Run 1	13:08	592.2	613	3741	1002	2521	2.00	2.37	11.9	-	459	480	657	658
= 593.1 mw	13:38	592.7	613	3729	1002	2518	2.29	2.62	12.1	12.3	458	480	656	658
	14:08	590.9	613	3733	997	2509	2.19	2.44	13.3	12.7	456	479	655	657
	14:38	592.9	613	3733	1017	2518	2.21	2.73	10.7	12.3	456	479	656	658
	15:08	591.8	613	3735	1003	2501	2.31	2.59	11.1	12.1	455	478	655	657
	15:38	591.4	613	3736	1000	2506	2.20	2.50	10.9	11.6	456	477	656	656
	16:08	592.5	613	3739	1000	2516	2.36	2.75	16.0	11.5	457	477	657	657
	16:38	592.9	613	3744	1000	2518	2.34	2.66	11.4	11.3	456	477	657	658
	Finish 16:50													
	Start Run 2 10:40													
	10:10	592.5	622	3781	994	2540	2.29	2.23	13.5	11.4	458	476	658	657
	10:41	594.2	613	3790	996	2542	2.15	2.29	15.1	11.5	459	478	659	659
	11:11	596.4	622	3806	993	2559	2.16	2.16	12.4	11.5	459	477	660	659
	11:41	594.5	622	3790	1003	2545	2.05	2.11	13.3	11.2	459	478	659	660
avg	12:11	595.1	622	3782	1000	2541	2.11	2.22	13.9	11.5	459	478	661	660
Run 2	12:41	595.8	613	3788	999	2530	2.16	2.19	16.7	10.6	459	478	660	661
= 594.5 mw	13:11	594.2	622	3788	994	2545	1.84	1.65	15.0	10.8	459	477	659	658
	13:41	593.8	622	3781	996	2535	1.81	1.72	15.1	11.3	459	478	658	658
	14:11	592.9	613	3786	990	2539	1.69	1.51	16.3	11.1	459	477	656	656
	14:26	594.7	622	3788	997	2546	1.89	1.90	13.3	11.4	458	479	657	658
	Finish 14:30													
	Start Run 3 9:57													
	9:46	591.1	613	3745	998	2554	1.80	1.46	14.9	9.0	461	485	657	660
	10:16	588.7	613	3743	1000	2538	1.86	1.74	10.6	9.0	461	485	658	660
	10:46	587.4	613	3727	999	2537	1.94	1.79	11.7	8.8	461	484	657	660
avg	11:16	589.6	613	3744	1000	2538	1.90	1.62	13.2	8.8	461	483	657	659
Run 3	11:46	590.5	613	3744	990	2561	1.98	1.81	95.2	10.5	460	484	657	660
= 584.3 mw	12:16	587.8	613	3716	997	2554	1.95	1.70	10.1	10.4	461	483	655	659
	12:47	589.8	613	3729	1001	2512	1.96	1.98	7.9	10.9	461	484	658	660
	Finish 12:45													

TABLE 13. ELECTROSTATIC PRECIPITATOR PROCESS DATA: RUN 1

Time	Panel Number	South Side Primary Current (Amps A/C)	South Side Primary Voltage (Volts A/C)	South Side ESP Current (Amps D/C)	North Side Primary Current (Amps A/C)	North Side Primary Voltage (Volts A/C)	North Side ESP Current (Amps D/C)
Run 1 (Start 10:17)							
10:40	A1	55	275	0.3	70	280	0.4
	A2	25	250	0.1	70	300	0.4
	B1	160	375	1.1	200	350	1.5
	B2	180	375	1.4	210	400	1.7
	C1	225	325	1.5	230	320	1.7
	C2	160	275	1.1	200	300	1.4
	D1	170	340	1.2	170	325	1.2
	D2	160	330	1.2	160	340	1.2
	E1	170	360	1.3	170	320	1.2
	E2	160	325	1.2	150	310	1.1
11:40	A1	70	300	0.3	60	275	0.4
	A2	20	275	0.1	50	275	0.3
	B1	190	400	1.5	200	350	1.5
	B2	130	330	0.9	220	400	1.8
	C1	210	320	1.5	230	320	1.8
	C2	160	280	1.0	190	290	1.4
	D1	170	340	1.2	170	320	1.2
	D2	160	330	1.1	160	330	1.2
	E1	170	350	1.3	170	320	1.2
	E2	160	320	1.2	150	310	1.1
12:50	A1	100	325	0.6	100	30	0.8
	A2	10	250	0.1	120	350	0.4
	B1	200	400	1.6	200	340	1.5
	B2	110	320	1.7	220	400	1.7
	C1	210	320	1.5	230	320	1.7
	C2	160	280	1.0	190	290	1.4
	D1	160	280	1.0	190	290	1.4
	D2	160	340	1.2	160	320	1.2
	E1	170	350	1.3	170	320	1.2
	E2	160	320	1.2	150	310	1.1
14:00	A1	165	365	1.2	130	360	0.8
	A2	160	305	1.2	20	310	0.2
	B1	195	335	1.5	200	380	1.6
	B2	215	375	1.7	195	400	1.5
	C1	230	320	1.8	225	320	1.6
	C2	195	290	1.4	160	275	1.1
	D1	165	325	1.2	165	340	1.2
	D2	160	330	1.2	160	330	1.2
	E1	170	320	1.3	175	355	1.3
(Finish 14:40)	E2	155	310	1.1	165	325	1.2

TABLE 14. ELECTROSTATIC PRECIPITATOR PROCESS DATA: RUN 2

Time	Panel Number	South Side Primary Current (Amps A/C)	South Side Primary Voltage (Volts A/C)	South Side ESP Current (Amps D/C)	North Side Primary Current (Amps A/C)	North Side Primary Voltage (Volts A/C)	North Side ESP Current (Amps D/C)
Run 2 (Start 10:40) 11:00	A1	100	340	0.8	80	340	0.5
	A2	130	380	0.8	30	300	0.3
	B1	200	360	1.5	200	390	1.5
	B2	200	390	1.8	200	400	1.6
	C1	230	320	1.8	215	335	1.6
	C2	195	300	1.5	160	285	1.1
	D1	165	325	1.2	165	350	1.2
	D2	160	340	1.2	160	330	1.2
	E1	170	370	1.2	175	360	1.3
	E2	155	310	1.1	160	325	1.2
12:00	A1	150	390	1.2	100	360	0.7
	A2	120	380	0.9	35	280	0.3
	B1	197	350	1.3	200	405	1.6
	B2	210	400	1.7	190	380	1.5
	C1	230	370	1.8	215	335	1.6
	C2	195	300	1.5	160	290	1.1
	D1	165	325	1.2	167	345	1.2
	D2	160	335	1.2	158	332	1.2
	E1	170	320	1.3	175	355	1.3
	E2	155	310	1.2	160	325	1.2
13:00	A1	130	350	0.9	110	300	0.7
	A2	120	380	0.8	50	300	0.3
	B1	197	350	1.5	200	490	1.6
	B2	200	385	1.5	203	375	1.6
	C1	230	370	1.8	215	335	1.6
	C2	195	300	1.5	160	290	1.1
	D1	165	325	1.2	167	345	1.2
	D2	160	335	1.2	158	332	1.2
	E1	170	320	1.3	175	355	1.3
	E2	155	310	1.2	160	325	1.2
14:00	A1	148	365	1.0	100	350	0.1
	A2	110	350	0.7	50	300	0.3
	B1	195	360	1.5	200	395	1.6
	B2	206	380	1.7	205	385	1.6
	C1	230	320	1.8	215	330	1.4
	C2	195	295	1.4	160	285	1.1
	D1	165	322	1.2	167	345	1.2
	D2	160	335	1.2	160	332	1.2
	E1	170	320	1.2	175	355	1.3
(Finish 14:30)	E2	155	308	1.1	160	325	1.2

TABLE 15. ELECTROSTATIC PRECIPITATOR PROCESS DATA: RUN 3

Time	Panel Number	South Side Primary Current (Amps A/C)	South Side Primary Voltage (Volts A/C)	South Side ESP Current (Amps D/C)	North Side Primary Current (Amps A/C)	North Side Primary Voltage (Volts A/C)	North Side ESP Current (Amps D/C)
Run 3 (Start 9:57)							
10:15	A1	150	300	1.0	70	280	0.4
	A2	120	360	0.8	30	270	0.3
	B1	197	360	1.5	205	405	1.6
	B2	220	395	1.7	205	375	1.6
	C1	230	330	1.8	215	335	1.6
	C2	195	300	1.5	160	290	1.0
	D1	165	325	1.8	165	345	1.2
	D2	160	335	1.2	160	335	1.2
	E1	170	320	1.3	175	360	1.3
	E2	155	310	1.1	160	325	1.2
11:15	A1	125	350	0.9	90	330	0.4
	A2	135	370	1.0	40	270	0.3
	B1	195	350	1.5	205	403	1.6
	B2	215	402	1.8	205	380	1.6
	C1	230	325	1.8	215	335	1.6
	C2	195	300	1.5	160	290	1.0
	D1	165	320	1.2	165	345	1.2
	D2	160	335	1.2	160	330	1.2
	E1	170	320	1.3	175	360	1.3
	E2	155	310	1.1	160	325	1.2
12:15	A1	150	360	1.0	70	320	0.5
	A2	145	375	1.2	50	290	0.3
	B1	195	355	1.5	205	400	1.6
	B2	220	400	1.8	205	380	1.6
	C1	230	325	1.8	215	340	1.6
	C2	195	300	1.4	160	290	1.1
	D1	165	325	1.3	165	350	1.2
	D2	160	335	1.2	160	335	1.2
	E1	170	320	1.3	175	360	1.3
	E2	150	305	1.1	165	325	1.2
12:45	A1	155	360	0.9	90	330	0.5
	A2	110	340	0.7	30	265	0.2
	B1	197	358	1.5	200	400	1.6
	B2	217	400	1.8	205	390	1.5
	C1	232	320	1.8	216	338	1.6
	C2	196	300	1.4	170	295	1.1
	D1	155	325	1.2	167	348	1.2
	D2	160	335	1.2	160	335	1.2
	E1	170	322	1.2	174	358	1.3
	E2	152	305	1.0	163	325	1.2
(finish 12:45)							

Tables 13, 14, and 15 indicate the electrostatic precipitator was operating normally and that all modules remained in service throughout the testing period. Intermittant sparkover occured in the first module (ESP inlet) of both the north and south sides (module one corresponds to panels A1 and A2 for both sides). Boston Edison personal indicated this spark-over was a normal condition. Approximately 80 percent of all precipitated particles are collected in module one and as a result the high increases the opportunity for spark over to occur.

SECTION 4

LOCATION OF SAMPLING POINTS

Emissions to the atmosphere from Boiler No. 7 were measured in the smoke stack. Inlet ducts to the electrostatic precipitators, 7A south and 7B north, were also sampled (see Figure 2).

CONTROL SYSTEM INLET

Twelve, 10 cm (4 in.) ID sampling ports were located on the two identical, 6.1 m (20 ft) long (1.4 diameters) and approximately 6.4 m by 3.4 m (21 ft by 11 ft) inlet ducts. Two sets of turning vanes were located 0.8 m (2.5 ft) (0.17 diameters) upstream of the ports and 2.3 m (7.5 ft) (0.5 diameters) downstream of the ports (see Figure 4).

A 36 point traverse was used at both inlet ducts, 6 ports and 6 points per port (see Figure 5). Due to the short distance from the turning vanes to the sampling ports, criteria for EPA Method 1 could not be met, however based on the preliminary velocity traverse the 36 point traverse used was the best alternative to obtain acceptable measurements. Two photographs of the inlet ports are shown in Figure 6.

CONTROL SYSTEM EXHAUST (OUTLET)

Four, 3 in. ID ports were located on a 152 m (500 ft) long, 6.5 m (21.3 ft) diameter smokestack, 41 m (135 ft) (6.3 diameters) from the flue gas inlet and 75 m (245 ft) (11.5 diameters) from the stack outlet (See Figure 7). The site met all criteria for an acceptable measurement site for particulate traverses under EPA Methods 1 and 5 procedures.

A 24 point traverse was used at this location, with six points being sampled at each port as shown in Figure 8. A two stack configuration is used at the site; an inner masonry stack (21.3 ft diameter) for flue gas surrounded by a second concrete stack. A 3-ft wide platform in the 6 ft space between the two stacks, was available at the sampling ports. The ports were 1.2 m (4 ft) above the platform. A special dual-probe with heated flexible tubing was used for sampling Methods 5 and 5B simultaneously at the stack sampling ports.

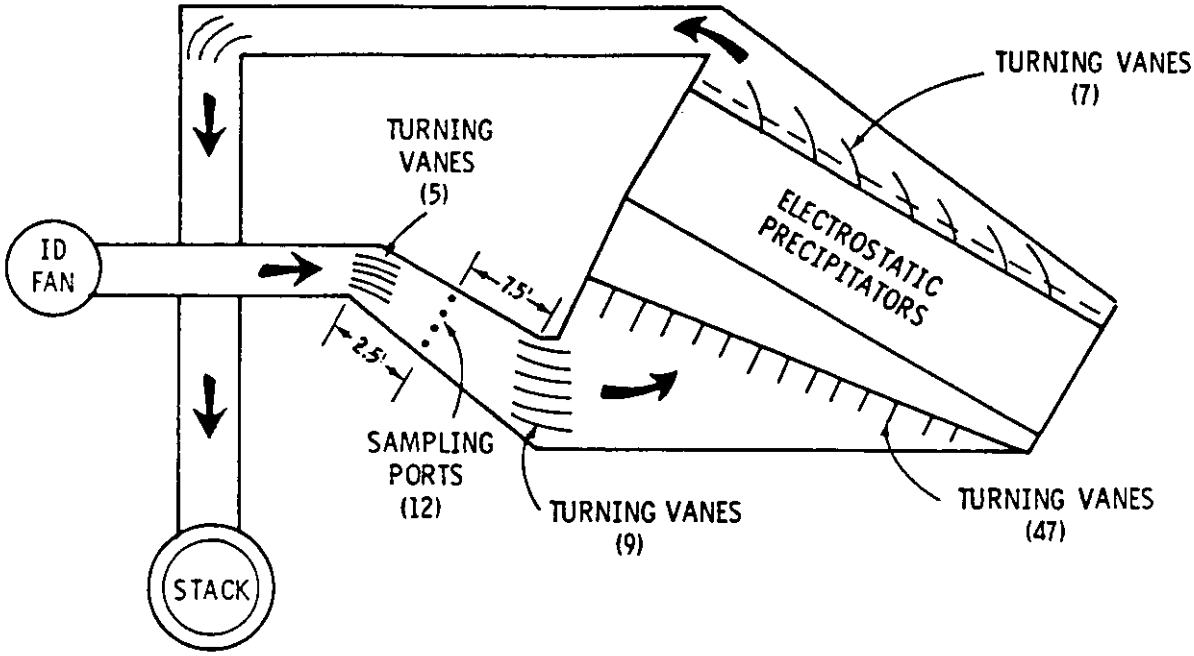


Figure 4. Exhaust gas flow configuration for 7A south inlet duct at Boston Edison. (ref. Buell drawing provided by Boston Edison Company).

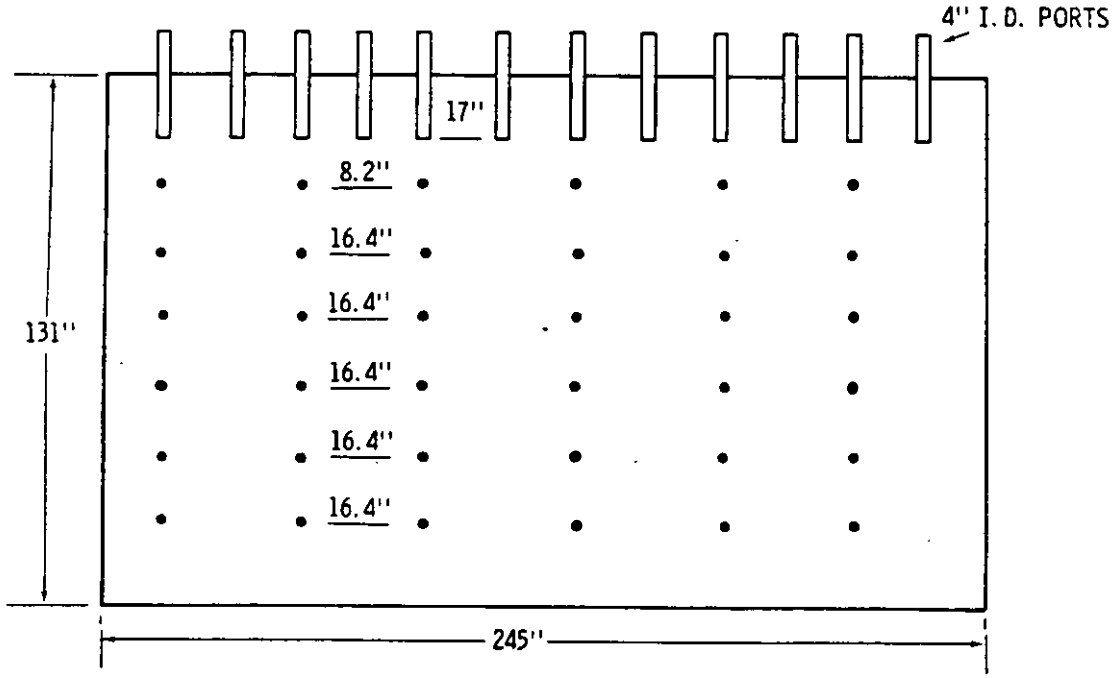
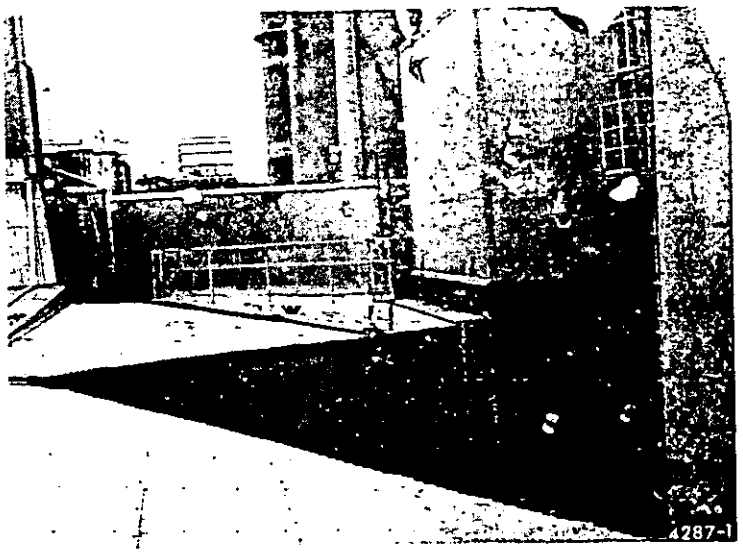
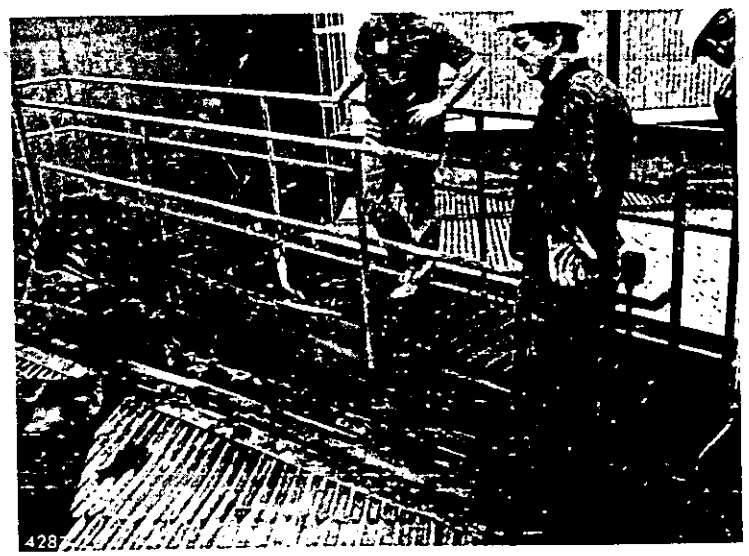


Figure 5. Inlet duct sampling for 7A south and 7B north at Boston Edison Company Mystic River Station.



South Inlet



North Inlet Ports

Figure 6. Photos of south inlet and ports at north inlet at Boston Edison Company Mystic River Station.

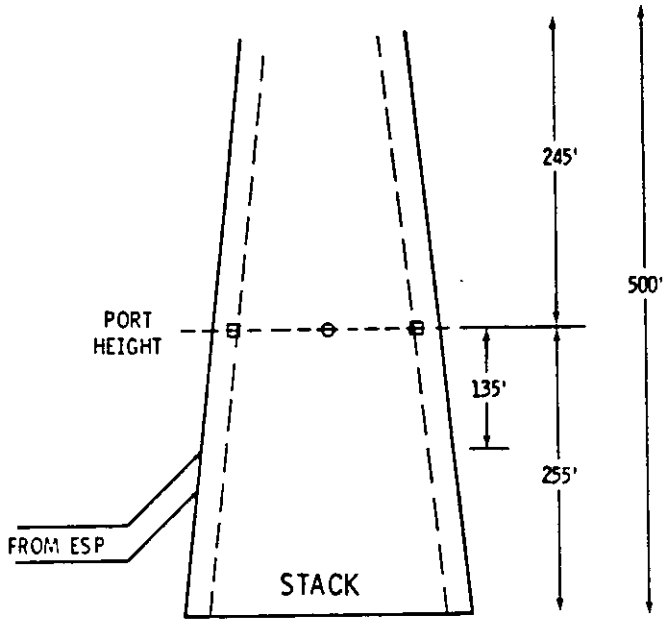
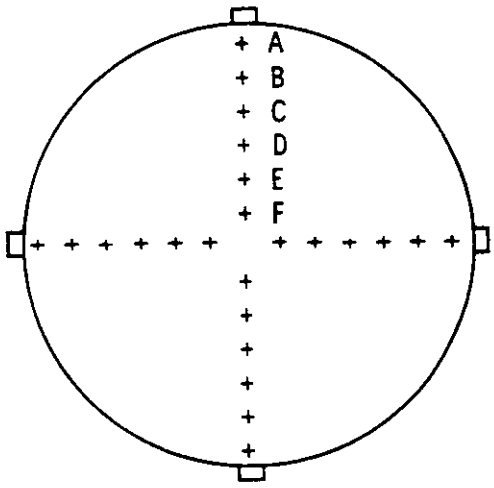


Figure 7. Stack and sample port heights at Boston Edison.



TRAVERSE POINT NO.	DISTANCE FROM INSIDE WALL
A	5.3"
B	16.9"
C	29.7"
D	44.6"
E	63.0"
F	89.7"

STACK ID = 252"

Figure 8. Traverse point locations for Boiler No. 7 stack at Boston Edison.

SECTION 5

SAMPLING AND ANALYTICAL PROCEDURES

SUMMARY

The sampling and analysis methods used at each site are shown in Table 1. Three simultaneous runs of Methods 5 and 5B sampling occured at the stack downstream of all air pollution control equipment and Method 5 sampling occured at both inlet ducts. A special dual-probe stack test system was used for simultaneous sampling of Methods 5 and 5B through the stack ports. The flue gas velocity, temperature, flow rate, oxygen content, and carbon dioxide content were measured by EPA Methods 1-4 during all test sampling runs of each location (outlet, inlet north, inlet south). Integrated Method 3 samples were taken from the exhaust of the Method 5 trains. In addition, EPA Method 9, plume opacity, was observed.

The Method 5 and 5B samples (filters and dried probe washes) were weighed, baked at 160°C (320°F) for 3 hours and weighed, and then baked again at 176°C (350°F) and weighed, prior to sulfuric acid and sulfate analysis. The sulfuric acid and sulfates analyses used procedures supplied to MRC by EPA on 10 October 1980.

SAMPLING

Heated glass-lined probes and Reeve Angel Type 934 AH filters were used for the Method 5 and 5B stack testing. The filter temperatures were monitored using thermocouples installed in the oven. A special dual-probe stack test system was used for stack testing by Methods 5 and 5B simultaneously through the same individual stack ports. Flexible teflon-lined heated probe lines were used to connect the probes to the filters. Figure 9 is a schematic diagram of the dual-probe system. The nozzle centers of the Method 5 and 5B trains were approximately 3.8 cm (1.5 in.) apart in this system. Stainless steel probes and Reeve Angel Type 934 AH filters were used at the inlets for Method 5 sampling.

Method 5 and 5B stack sample volumes of at least 60 cubic feet were taken. Method 5 inlet sample volumes of at least 50 cubic feet were taken, when possible. The probes, nozzles, and filter holders were rinsed with acetone. When Methods 5 and 5B were used, Methods 1 through 4 were also used, as in compliance monitoring.

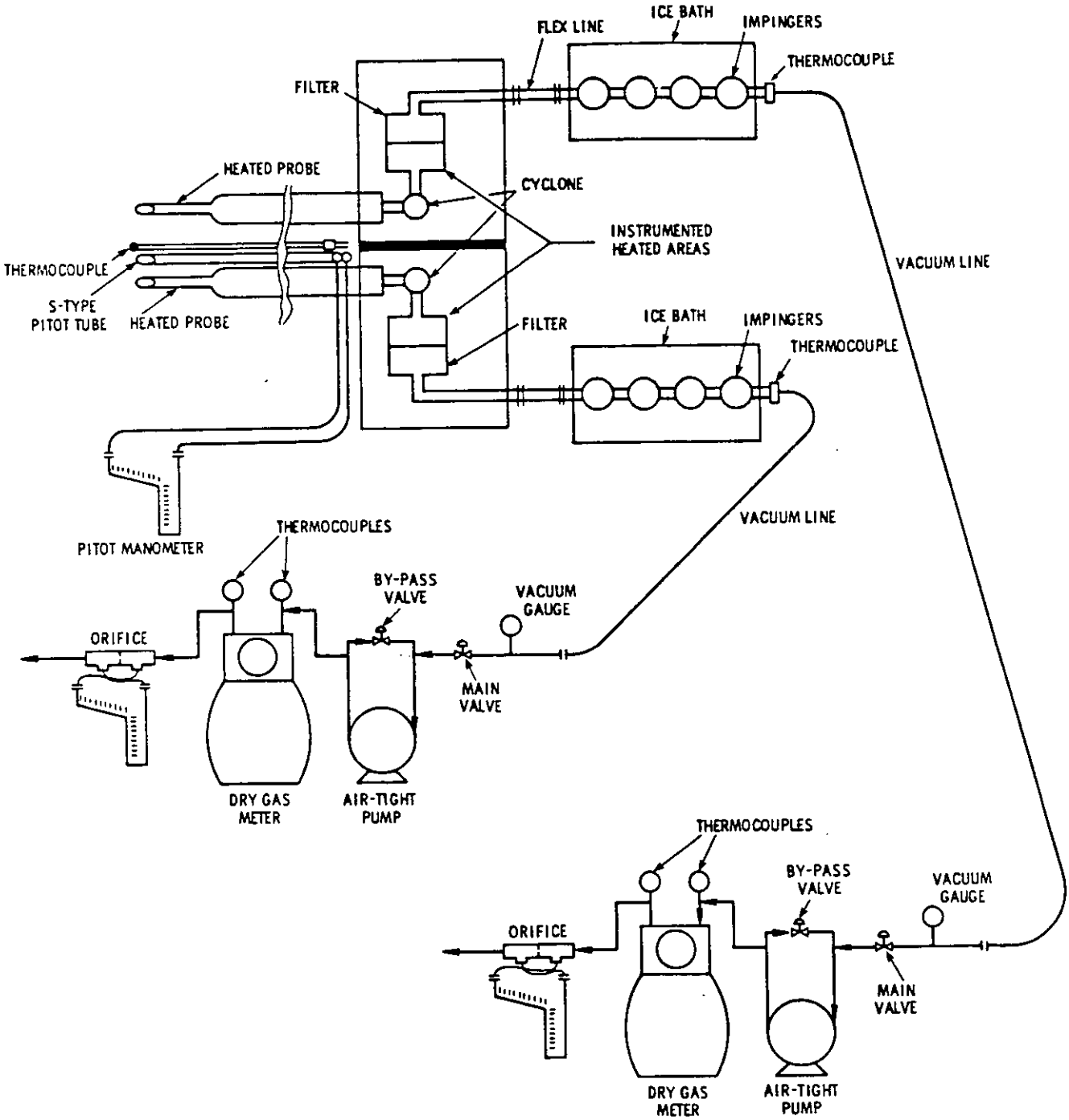


Figure 9. Dual-probe sampling train.

SAMPLE ANALYSES

EPA provided the general methods to be used for particulates, sulfuric acid and sulfate analysis on the Method 5 and 5B samples at a meeting on 10 October 1980. Gary McAlister clarified these procedures on 24 October 1980, and further refinement of the procedures occurred during the analysis of samples collected during previous emission testing under this work assignment. The procedures used are summarized in Appendix C.

After the probe washes and filters were dried and weighed (using standard Method 5 procedures), the Method 5 and 5B samples were baked at an average temperature of 160 ± 11°C (320 ± 20°F) for 3 hours to a constant weight (i.e., a less than 10 mg weight loss between consecutive bakings). Between 1 and 3 bakings for each sample were required at 160°C to achieve constant weight. After the 160°C baking, all samples were baked at 176°C (350°F) to a constant weight. Only 1 bake was required at 176°C to achieve the constant weight. As a quality control step, after each baking, the sample was weighed to constant weight (i.e., a less than 4 mg weight change between consecutive weighings). This particulate analysis procedure is shown in detail in Appendix C. Room temperature isopropanol was added to each sample. The samples soaked for at least 12 hours, then the filter in isopropanol was ultrasonically extracted for 30 minutes. The extracts were filtered and analyzed for sulfuric acid using the barium-thorin titration. This isopropanol extraction and analysis procedure was performed twice on every sample. Those portions of the extracts that were not titrated will be bottled and retained.

After the sulfuric acid extraction with isopropanol, water was added to the filters and solid residues. After they soaked for at least 12 hours, they were ultrasonically extracted for 30 minutes. The extracts were filtered, passed through a Rexyn-101 ion exchange column, and analyzed for sulfates (using barium-thorin titration). The water extraction and sulfate analysis procedure was performed twice on every sample, and the untitrated water extracts were bottled and retained.

After all extractions, the filters and solid residues were dried and saved under dry nitrogen in a refrigerator, along with the untitrated extracts. These samples will be saved for no more than 6 months.

Blank filters and residue from the evaporation of clean acetone were analyzed when the stack samples were analyzed, along with standards and quality assurance audit samples of sulfate and sulfuric acid.

OIL SAMPLING AND ANALYSES

Fuel oil samples and analytical results were obtained from Boston Edison Company and are shown in Table 9.

SAMPLE HANDLING

Filter contents were transferred into closed clean containers. Sampling equipment (i.e., probe and tip) was brushed and rinsed with acetone and the rinse collected in a bottle. This occured at sampling location or at the MRC sampling truck located near the stack. Access to the samples was limited by storing them in a locked truck, except when being handled by authorized individuals. The samples were shipped in the truck to the MRC Dayton Laboratory for analysis. Records of the chain of custody of the samples were maintained and are shown in Appendix D-6.

DATA REDUCTION

MRC's computer and programmable calculators were used to reduce the analytical and field data to determine results. The "F" values used to determine ng/joule (lb/10^6 Btu) emissions were taken from the boiler emission regulations in 40 CFR 60.45(f)(4)(ii).

Appendix A contains copies of all raw field sampling data sheets and coding sheets for data processing.

Appendix B contains complete computer printouts of the results of the sampling.

Appendix C contains the detailed analytical methods used.

Appendix D contains sample analysis data and a summary of the results of the quality control and assurance procedures.

Appendix E identifies the people performing the sampling, analysis, and data reduction.

QUALITY ASSURANCE

MRC's usual quality assurance procedures were applied to the stack testing by EPA Methods 1 through 5B. These included all of the applicable procedures specified in the Federal Register for Methods 1 through 5 and the procedures specified in the EPA Guidelines for the Development of Quality Assurance Programs for these methods.

MRC's Quality Control and Quality Assurance supervisor prepared quality assurance audit samples simulating the anticipated sulfuric acid and sulfate content of boiler stack samples. The content of the audit samples were known only to her and the chemists preparing the audit samples, not to the chemists performing the

analysis. MRC analyzed blank filters, samples of acetone, standards, and quality assurance audit samples when the stack samples are analyzed.

The accuracy of the data used in computerized data processing will be checked by comparing the printout of the data used to calculate results with the raw field data used to code the computer input.

APPENDIX A

FIELD SAMPLING DATA SHEETS AND COMPUTER CODING FORMS

A-1 Field Sampling Data Sheets. A-2

Preliminary Data. A-3
Run 1 . . . . . A-9
Run 2 . . . . . A-46
Run 3 . . . . . A-76

A-2 Computer Input Sheets A-106

A-3 Post-Test Meter and Orifice System Calibration Sheets A-112

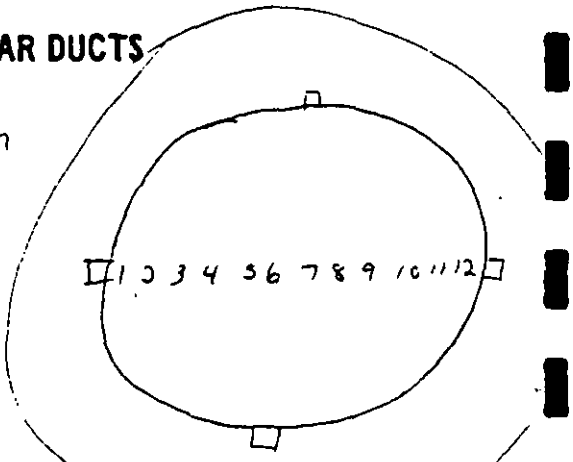
SECTION A-1

FIELD SAMPLING DATA SHEETS

PRELIMINARY DATA

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Boston Edison Mystic River Station
DATE 9-28-81
SAMPLING LOCATION Outlet
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) _____
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) 16 1/8"
STACK I.D., (DISTANCE A - DISTANCE B) 21' - 252"
NEAREST UPSTREAM DISTURBANCE _____
NEAREST DOWNSTREAM DISTURBANCE _____
CALCULATOR DLH



SCHEMATIC OF SAMPLING LOCATION

24 pt traverse - 12/diameter - 6/hole

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATI FROM OUTSIDE OF NIPP (SUM OF COLUMNS 4 &
1	.021	252	5.29 - 5 1/4"	16 1/8"	21 3/8
2	.067	↓	16.88 - 16 7/8	↓	33 -
3	.118	↓	29.74 - 29 3/4	↓	45 7/8
4	.177	↓	44.60 - 44 5/8	↓	60 3/4
5	.250	↓	63.00 - 63	↓	79 1/8
6	.356	↓	89.71 - 89 6/8	↓	105 7/8

EPA (Dur) 232
4/72

TRAVERSE POINT LOCATIONS FOR RECTANGULAR DUCTS

PLANT Boston Edison Mystic River Plant

DATE Sept. 28, 1981

SAMPLING LOCATION Inlet - North

INSIDE STACK DIMENSIONS _____ X _____

INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE. (Distance B) 17"

EQUIVALENT STACK I.D. 202 sq in

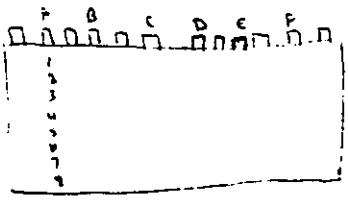
NEAREST UPSTREAM DISTURBANCE ~ 7.5'

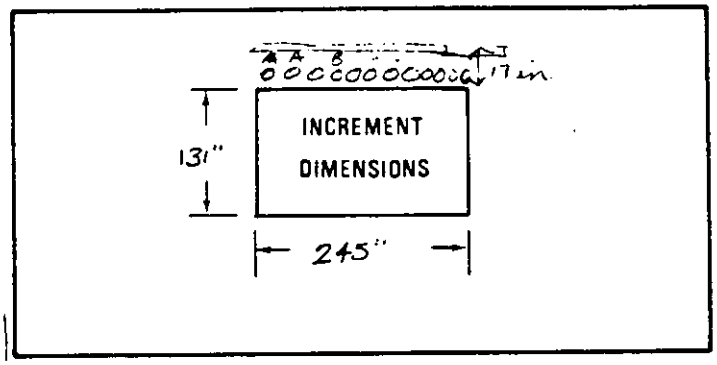
NEAREST DOWNSTREAM DISTURBANCE ~ 2.5'

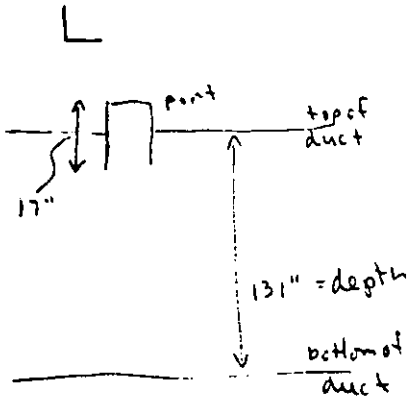
NUMBER OF TRAVERSE POINTS 48 ARRAY 6 ports X 8 points

CALCULATOR Barrett

ILLUSTRATE PORT LOCATIONS AND STACK DIMENSIONS







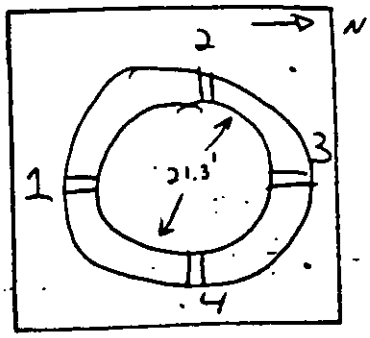
TRAVERSE POINT NUMBER	INSIDE OF NEAR WALL TO TRAVERSE POINT (Distance A)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF DISTANCES A+B)	PORT LOCATION	DISTANCE FROM EDGE OF STACK
1	8.2"	17	25.2	A	
2	24.6"	17	41.6	B	
3	41.0"	17	58.0	C	
4	57.4"	17	74.4	D	
5	43.8"	17	90.8	E	
6	90.2"	17	107.2	F	
7	106.6"	17	123.6		
8	123.6	17	131.8		

$$DS = \sqrt{\frac{4 \times L \times W}{\pi}} = \sqrt{\frac{4 \times 131 \times 245}{\pi}} = 202''^{\square} = 1.4\,ft^2$$

A-5

: Outlet

PLANT Boston Edison Mystic
DATE 9-29-81 RUN NO. preliminary
STACK DIAMETER OR DIMENSIONS, m(in.) 21.3 ft
BAROMETRIC PRESSURE, ~~mm Hg~~ (in. Hg) 29.69
CROSS SECTIONAL AREA, $m^2(ft^2)$ 356 ft^2
OPERATORS Meadows / Harris
PITOT TUBE I.D. NO. # 10-18
AVG. COEFFICIENT, C_p = ~0.76
LAST DATE CALIBRATED
Static = 1.8"



SCHEMATIC OF STACK CROSS SECTION

	Traverse Pt. No.	Vel. Hd., Δp ~~mm~~ (in.) H_2O	Stack Temperature t_s, ~~°C~~ (°F)	Stack Temperature T_s, °K (°R)	P_g mm Hg (in.Hg)	$\sqrt{\Delta p}$
#1	1	1.4				1.18
	2	1.7	348°F			1.30
	3	1.7				1.30
	4	1.8				1.34
	5	1.9				1.38
	6	2.0				1.41
#4	1	1.3				1.14
	2	1.7				1.30
	3	1.85				1.36
	4	1.80				1.34
	5	1.90				1.38
	6	1.90				
						15.93
			Average			1.32

Figure 2-5. Velocity traverse data.

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison Mystic Station
DATE 9-29-81
SAMPLING TIME (24-hr CLOCK) 9-29-81
SAMPLING LOCATION Outlet
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)
ANALYTICAL METHOD Fyrite
AMBIENT TEMPERATURE 80°F
OPERATOR Medows

COMMENTS: Preliminary traverse – Fyrite analysis

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2							8.5	44/100	3.74
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)							12.0	32/100	3.84
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)							0.0	28/100	0
N_2 (NET IS 100 MINUS ACTUAL CO READING)							79.5	28/100	22.26
								TOTAL	29.84

FPA (Dir) 230

METHOD 2

STACK GAS VELOCITY CALCULATIONS

Plant Boston Edison Mystic Station

Date 9-29-81 Outlet

Test No. preliminary

Area of stack (ft^2) = A = 356 ft^2

Pitot tube coefficient, type S = CP = 0.76

Temperature (average) of stack (°F) = TS = 348 °F

Average of square root of velocity head (in H_2O)$^{1/2}$ = $\sqrt{\Delta p}$ = 1.32

Absolute pressure of stack gas in Hg = PS = 29.56

note PS = Barometric pressure (in Hg) - (static pressure (in H_2O)/13.6)
29.64 + − 1.8 /13.6

Percent moisture = M = 12 % assume

Molecular weight of stack gas - (lbs/lb mole) = MS = 29.84

VS = stack gas velocity (f.p.s.)

$$VS = 85.48 \times CP \times \sqrt{\frac{TS+460}{PS \times MS}} \times (\sqrt{\Delta p})ave$$

$$VS = 85.48 \times .76 \times \sqrt{\frac{349+460}{29.56 \times 29.84}} \times \left(1.32 \right) = \frac{82.1}{sec} ft$$

Q_S = volumetric flow rate (SCFM)

$$Q_S = 60 \times (1-(M \times 10^{-2})) VS \times A \times \left(\frac{530}{TS+460}\right) \times \left(\frac{PS}{29.92}\right)$$

$$Q_S = 60 \times (1- .12) \times 82.1 \times 356 \times \left(\frac{530}{349+460}\right) \times \left(\frac{29.56}{29.92}\right) = 1.8 \times 10^6 \text{ scfm}$$

RUN 1

Outlet (OH) (5B) Outlet (OL) (5) Inlet north (IN) Inlet south (IS)	Nomograph Data Field Data Clean-up Data Dry Molecular Weight Data Isokinetic Calculations

Plume Opacity

A-1
Run 1

29.94

NOMOGRAPH DATA (HP-65)

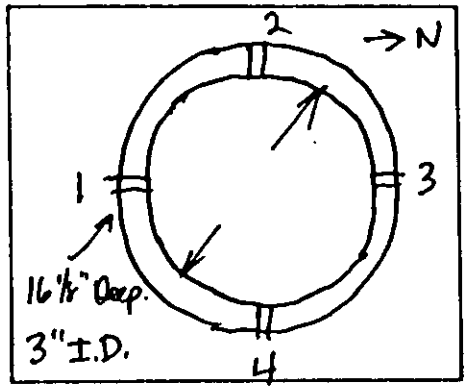
PLANT Boston Edison
DATE 9-29-81
SAMPLING LOCATION outlet
used both for OL + OH

USED ON RUN NO.:
CALCULATOR: DJH

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNIT
1	Run card			—
2	Initialize program		A	0.00
3	Enter average T_m (meter temp. °F + 460) If meter temp. unknown, use ambient + 20°F	~70 530 °R	R/S	T_m
4	Enter P_m (Barometric pressure at meter)	29.92 − (250 ft) × .1/100 ft = 29.67 In. Hg	R/S	T_m/P_m
5	Enter P_s (static pressure in stack) [P_m ± .073 x stack gauge pressure in In. H_2O]	29.67 − 1.8/13.6 = 29.54 In. Hg	R/S	P_s
6	Enter average T_s (stack temperature + 460)	348+460 = 808 °R	R/S	P_s/T_s
7	Enter B_{ms} (mole fraction of H_2O vapor in gas stream)	0.12 Fraction of H_2O	R/S	Fracti Dry
8	Enter MD (molecular weight of dry gas)	29.84 lbs/lb mole	R/S	molecular of stack gas lbs/lb mol
9	Enter C_p (type "S" pitot tube coefficient)	— .76	R/S	
10	Enter average Δ_p Highest Δ_p (2.0)	1.75 In. H_2O	R/S	D_n theo (nozzle dia. in inches)
11	Initialize "B"	—	B	—
12	Enter actual D_n	#6 → .186 #1 → .186 In.	R/S	
13	Enter $\Delta H_@$ (Calibrated pressure differential across orifice)	#1 − 1.94 In. H_2O #6 − 2.00	R/S	.605 .189 K factor
14_1	Enter actual Δ_{p_1}	Δp 2.0 ΔH = 1.75 " 1.7 " 1.49 .204 − 1.94 → K = .876		ΔH_1 In. H_2O
14_2	Enter actual Δ_{p_2}	Δp = 2.0 ΔH = 1.25 " 1.7 " 1.06 .186 − 2.00 → K = .624		ΔH In. H_2O
14_3	Enter actual Δ_{p_3}		E	ΔH In. H_2O

EPA METHOD 5
FIELD DATA

PLANT BOSTON EDISON
DATE 9-30-81
SAMPLING LOCATION OUTLET
SAMPLE TYPE PARTICULATE 320°F
RUN NUMBER 1-OH
OPERATOR F. MEADOWS
AMBIENT TEMPERATURE 80°F
BAROMETRIC PRESSURE 29.69
STATIC PRESSURE, (P_s) -1.8" H_2O
FILTER NUMBER (s) 054122
PITOT TUBE No. & Cp. 0.76 #10-18



SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE 11' PYREX
NOZZLE I.D. 0.186
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 2
METER BOX NUMBER 6
METER ΔH@ 2.00
K FACTOR 0.624
PRE-TEST LEAK CHECK RATE 0.016 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE _____ CFM @ ____ "Hg
REFERENCE Δp _____

Page 1 of 3

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	PROBE FLEX LINE °F
~~[illegible]~~		1017	546.667	—	—	—	—	—	—	—	—	—	—	—
1-6	5.0	1022	549.645	1.9	1.22	1.22	361	75	78	2.8	342	66	358	346
1-6	10.0	1027	552.505	1.9	1.22	1.22	361	79	77	2.8	341	68	381	344
1-5	15.0	1032	555.400	1.9	1.22	1.22	361	81	77	2.8	340	70	321	343
1-5	20.0	1037	558.165	1.8	1.12	1.12	361	81	77	2.8	339	72	260	341
1-4	25.0	1042	560.855	1.7	1.06	1.06	361	80	76	2.5	337	73	224	339
1-4	30.0	1047	563.650	1.8	1.12	1.12	361	80	76	2.6	334	75	213	337
1-3	35.0	1052	566.421	1.75	1.10	1.10	361	82	75	2.6	331	76	210	331
1-3	40.0	1057	569.205	1.75	1.10	1.10	360	84	75	2.6	329	75	208	325
1-2	45.0	1102	571.779	1.60	1.00	1.00	359	86	75	2.6	325	76	207	319
1-2	50.0	1107	574.420	1.60	1.00	1.00	359	84	76	2.6	324	75	204	314
1-1	55.0	1112	576.780	1.30	0.82	0.82	357	84	76	2.0	322	74	195	310
1-1	60.0	1117	579.150	1.30	0.82	0.82	358	83	76	2.0	320	73	189	306
			Leak check	0.0	@	3" Hg								

* 616.410

PLANT BOSTON-EDISON DATE 9-30-81 RUN NO. 1-OH

PAGE 2 of 3

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	PROBE FLEX LINE °F
		1144	579.250											
4-6	65.0	1149	582.191	2.00	1.28	1.28	360	77	77	3.0	330	73	366	317
4-6	70.0	1154	585.165	2.05	1.28	1.28	360	80	76	3.0	328	72	382	316
4-5	75.0	1159	588.106	2.00	1.28	1.28	360	83	77	3.0	327	74	309	316
4-5	80.0	1204	591.041	2.00	1.28	1.28	360	83	76	3.0	324	75	262	317
4-4	85.0	1209	594.025	2.00	1.28	1.28	360	84	77	3.0	323	75	228	317
4-4	90.0	1214	597.000	2.00	1.28	1.28	360	85	77	3.0	322	75	216	318
4-3	95.0	1219	599.872	1.95	1.22	1.22	360	86	77	3.0	322	76	211	319
4-3	100.0	1224	602.745	1.95	1.22	1.22	360	86	77	3.0	320	76	205	31[illegible]
4-2	105.0	1229	605.570	1.85	1.15	1.15	360	87	78	2.8	320	76	199	318
4-2	110.0	1234	608.385	1.85	1.15	1.15	360	87	78	2.8	321	77	196	318
4-1	115.0	1239	610.821	1.35	0.84	0.84	358	87	78	2.3	322	79	187	317
4-1	120.0	1244	613.337	1.50	0.94	0.94	358	87	79	2.5	323	79	187	316
		POST-TEST		Leak check 0 @ 3" Hg.										
		PRE TEST	~~613.360~~	Leak check 0 @ 5" Hg										
3-6	125.00	1421 1426	613.372 ~~[illegible]~~	2.0	~~1.28~~	~~1.28~~	~~359~~	~~85~~	~~84~~	~~3.0~~	~~332~~	~~71~~	~~327~~	341
3-6	130.00	1431	616.910 619.410	2.0	1.28	1.28	359	89	84	3.0	331	70	376	33[illegible]
3-5	135.00	1436	622.385	2.0	1.28	1.28	359	92	85	3.0	327	72	355	33[illegible]
3-5	140.00	1441	625.361	2.0	1.28	1.28	359	93	85	3.0	324	73	267	32[illegible]
3-4	145.00	1446	628.400	2.0	1.28	1.28	358	93	85	3.0	324	75	250	31[illegible]
3-4	150.00	1451	631.420	2.0	1.28	1.28	359	94	85	3.0	324	75	238	31[illegible]
3-3	155.00	1456	634.361	1.9	1.20	1.20	358	93	85	2.9	319	72	232	31[illegible]
3-3	160.00	1501	637.300	1.9	1.20	1.20	358	93	87	2.9	316	70	226	31[illegible]
3-2	165.00	1506	640.220	1.9	1.20	1.20	358	94	86	2.9	316	70	219	31[illegible]

PLANT Boston Edison DATE 9-30-81 RUN NO. 1-014

Page 3 of 3

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	PROBE FLEX LINE °F
3-1	175.0	1516	645.855	1.70	1.06	1.06	357	94	86	2.8	315	69	201	316
3-1	180.0	1521	648.518	1.60	1.00	1.00	356	93	86	2.8	315	70	199	316
		1550												
2-6	185.0	1555	651.570	2.05	1.30	1.30	360	82	84	3.1	303	64	369	300
2-6	190.0	1600	654.650	2.05	1.30	1.30	360	87	83	3.1	270	60	392	298
2-5	195.0	1605	657.625	2.00	1.28	1.28	359	89	83	3.1	289	63	364	29[illegible]
2-5	200.0	1610	660.615	2.00	1.28	1.28	359	87	83	3.1	300	68	281	29[illegible]
2-4	205.0	1615	663.547	1.95	1.22	1.22	359	85	82	3.0	312	69	235	29[illegible]
2-4	210.0	1620	666.540	2.00	1.28	1.28	359	84	82	3.1	322	69	217	290
2-3	215.0	1625	669.566	2.05	1.30	1.30	360	84	82	3.2	333	71	202	298
2-3	220.0	1630	672.580	2.05	1.30	1.30	360	84	81	3.2	336	72	190	30[illegible]
2-2	225.0	1635	675.420	1.80	1.12	1.12	359	84	81	3.0	337	73	185	31[illegible]
2-2	230.0	1640	678.186	1.75	1.10	1.10	359	82	81	2.9	340	75	181	32[illegible]
2-1	235.0	1645	680.590	1.30	0.82	0.82	358	82	80	2.5	337	77	175	32[illegible]
2-1	240.0	1650	682.973	1.30	0.82	0.82	358	81	80	2.5	335	77	169	32[illegible]
			POST TEST	LEAK		CHECK	0		@	4" Hg				
								79.9	74.8					
								77.4						
				63.43	5	3.11								

Un

CLEAN-UP DATA

Plant Boston Edison

Comments:

Date 9/29/81

Sampling Location Outlet

Sample Type EPA-5B

Run Number 1-OH

Sample Box Number

Clean-up Man Harris/Meadows/Stokes

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	296 ml	156 ml	10 ml	ml	ml
Initial Vol.	100 ml	100 ml	- ml	ml	ml
Net Vol.	196 ml	56 ml	10 ml	ml	ml

Total Net Volume in Impingers 262 ml

SILICA GEL

Final Weight	g	267.3 g		g
Initial Weight	~~200~~ g	229.2 g		g
Net Weight	g	38.1 g		g

Total Net Weight in Silica Gel 38.1 g

Total Moisture 301.1 g

Filter Number(s) 1922054-122

MRC 7/73

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison
DATE 9/10/11/81
SAMPLING TIME (24-hr CLOCK)
SAMPLING LOCATION Outlet 1-OH 1-OL
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Int
ANALYTICAL METHOD Orsat
AMBIENT TEMPERATURE 70°F
OPERATOR Meadows

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	12.6		12.4		12.4		12.4	44/100	5.455
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	~~4.9~~	4.9	~~5.0~~	50	~~5.0~~	5.0	5.0	32/100	1.6
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)	~~0~~	0		0		0	0.0	28/100	0
N_2 (NET IS 100 MINUS ACTUAL CO READING)							82.6	28/100	23.128
								TOTAL	30.18

A-15

EPA (Dur) 230

ISOKINETIC CALCULATION

Plant Boston Edison

Run # 1-OUT Date 9/30/81

Location OUTLET Initials DRD

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 301.1 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 136.31 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.69 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 537.4 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (136.31)(29.69)}{(537.4)(301.1)}} = 0.10$$

9.67

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 5.0 %

" CO " " " " = CO = 0 %

" CO_2 " " " " = CO_2 = 12.4 %

$N_2 = 100 - (O_2 + CO_2 \bullet CO) = 100 - (\quad + \quad + \quad)$

Percent N_2 by volume dry basis = N_2 = 82.6 %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (12.5) + 0.32 \, (5.0) + 0.28 \, (82.6 + 0)$

5.50 1.60 23.13 M_d = 30.2

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (30.33)\ [1 - (0.10)] + 18\ (0.10)$ = 29.01

VELOCITY

Pitot Tube coefficient, type S = C_p = .76

Average Absolute Stack Temp. (°F + 460) = T_s = 793 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.35 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 29.54 in.Hg

Stack gas velocity = V_s

$$V_s = (85.48)\ (C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\ (0.76)\left[\sqrt{\frac{(793)}{(29.54)(29.01)}}\right]\left[1.35\right]$$

= 84.37 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.13 $in.H_2O$

Total sampling time = θ = 240 min.

Diameter of nozzle = d_n = 0.186 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^2) = 54.54 \times 10^{-4}\ (0.186)^2$ = 1.887×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\ (T_s)}{(\theta)\ (V_s)\ (P_s)\ (A)}\left[0.00267\ (V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]$$

11945.8

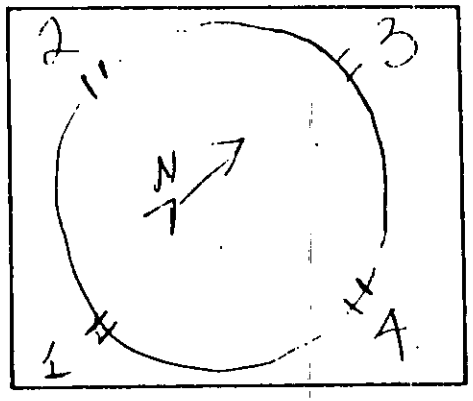
$$I = \frac{(1.667)\ (793)}{(240)\ (84.37)\ (29.54)\ (1.887\times10^{-4})}\left[0.00267\ (301.1) + \frac{(136.31)}{(557.4)}\left(29.54 + \frac{(1.13)}{13.6}\right)\right]$$

I = 97.86 %

A-17

EPA METHOD 5
FIELD DATA

PLANT Boston Edison
DATE 9/30/81
SAMPLING LOCATION outlet
SAMPLE TYPE Particulate (250°F)
RUN NUMBER 1-OL
OPERATOR DSH + SS + FM
AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.69 (adj)
STATIC PRESSURE (P) −1.8
FILTER NUMBER (S) 054-127
PITOT TUBE No. & Cp. 10-18, 0.76



SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE 10' glass
NOZZLE I.D. 0.204
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER ΔH@ 1.94
K FACTOR 0.876
PRE-TEST LEAK CHECK RATE .005 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE ____ CFM @ ____ "Hg
REFERENCE Δp ____

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	Flex line °F
1-6	0	10:17	773.475	1.9	1.65	1.65	see	~~79~~	~~82~~	7.5	~~216~~	~~66~~	402	~~250~~
1-6	5	10:22	776.950	1.9	1.65	1.65	1-OH	79	82	6.5	216	66	402	250
1-5	10	10:27	780.360	1.9	1.65	1.65		82	81	6.5	218	67	430	250
1-5	15	10:32	783.187	1.8	1.56	1.56		85	81	6.2	227	68	287	236
1-4	20	10:37	787.285	1.7	1.48	1.48		86	81	7.0	232	69	201	230
1-4	25	10:42	790.535	1.8	1.56	1.56		85	80	7.5	247	70	out	225
1-3	30	10:47	794.000	1.75	1.52	1.52		86	80	7.5	254	71	—	220
1-3	35	10:52	797.3—	1.75	1.52	1.52		89	80	7.5	258	72	—	217
1-2	40	10:57	800.660	1.60	1.40	1.40		90	80	6.9	260	72	—	220
1-2	45	11:02	803.900	1.60	1.40	1.40		91	80	6.8	260	73	—	223
1-1	50	11:07	807.065	1.30	1.12	1.12		91	80	5.5	259	73	—	228
1-1	55	11:12	809.970	1.30	1.12	1.12		90	80	5.6	256	73	—	~~[illegible]~~
—	60	11:17	812.857	—	—	—		89	80	—	555	73	—	—

PLANT Boston Edison DATE 9/30/81 RUN NO. 1-OL

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK) 11:44	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	Flo
4-6	60	~~812.915~~	812.915	2.0	1.72	1.72	see	78	79	8.0	245	75	375	out
4-6	65	11 49	816.425	2.05	1.77	1.77	1-OH	79	78	8.2	251	68	409	—
4-5	70	11 54	820.250	2.0	1.72	1.72		81	78	8.2	255	70	369	—
4-5	75	11 59	823.565	2.0	1.72	1.72		81	78	8.2	259	71	out	—
4-4	80	1204	827.085	2.0	1.72	1.72		82	78	8.2	261	71	214	—
4-4	85	1209	830.620	2.0	1.72	1.72		83	78	8.2	261	68	190	—
4-3	90	1214	834.150	1.95	1.69	1.69		83	78	8.2	259	69	196	—
4-3	95	1219	837.675	1.95	1.69	1.69		84	78	8.2	253	69	195	—
4-2	100	1224	841.200	1.85	1.60	1.60		84	78	7.5	246	69	188	—
4-2	105	1229	844.655	1.85	1.60	1.60		84	78	7.6	241	70	out	out
4-1	110	1234	848.105	1.35	1.17	1.17		83	78	5.8	237	71	191	—
4-1	115	1239	851.100	1.50	1.30	1.30		85	78	6.5	241	71	out	—
—	120	1244	854.332	Leak Check @ 9" Hg										
			~~854.592~~											
3-6	120	1421	854.462	2.0	1.72	1.72		85	83	7.2	281	69	352	22
3-6	125	1426	857.700	2.0	1.72	1.72		90	84	7.2	277	66	397	19
3-5	130	1431	861.230	2.0	1.72	1.72		95	84	7.2	271	69	371	17
3-5	135	1436	864.800	2.0	1.72	1.72		84	97	7.2	259	68	270	16
3-4	140	1441	—	2.0	1.72	1.72		97	85	7.2	250	68	217	15
3-4	145	1446	871.950	2.0	1.72	1.72		98	86	7.2	246	70	212	15
3-3	150	1451	875.555	1.9	1.65	1.65		99	86	6.9	237	69	210	14
3-3	155	1456	879.099	1.9	1.65	1.65		99	87	6.9	236	68	227	13
3-2	160	1501	882.630	1.9	1.65	1.65		100	87	6.9	243	66	226	13
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PLANT Boston Edison DATE 9/30/81 RUN NO. 1-OL

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	Flc, °F
3-1	170	1511	889.655	1.07	1.48	1.48	Sec.	101	88	6.3	254	61	212	123
3-1	175	1516	893.040	1.6	1.40	1.40	1-OH	101	89	6.0	264	63	205	116
—	180	1521	896.332	—	—	—	Run	—	—					
2-6	180	1550	896.332	2.05	1.77	1.77	—	84	86	7.5	306	65	375	82
2-6	185	1555	899.900	2.05	1.77	1.77	Sec	87	85	7.5	279	61	367	97
2-5	190	1600	903.570	2.00	1.72	1.72	1-OH	91	85	7.5	259	63	345	
2-5	195	1605	907.120	2.00	1.72	1.72		88	84	7.4	243	66	out	104
2-4	200	1610	910.705	1.95	1.69	1.69		85	83	7.4	236	67	189	106
2-4	205	1615	914.270	2.00	1.72	1.72		84	83	7.5	236	68	212	107
2-3	210	1620	917.850	2.05	1.77	1.77		84	83	7.6	247	69	213	108
2-3	215	1625	921.465	2.05	1.77	1.77		83	82	7.8	253	70	203	109
2-2	220	1630	925.100	1.80	1.56	1.56		83	81	8.0	249	70	201	111
2-2	225	1635	928.545	1.75	1.52	1.52		82	80	7.9	266	71	196	112
2-1	230	1640	931.910	1.30	1.12	1.12		83	81	5.3	263	72	192	112
2-1	235	1645	934.860	1.30	1.12	1.12		82	80	5.3	258	72	out	110
—	240	1650	937.790											
				POST TEST LEAK			CHECK	0	@	9.6"	Hg			
								87.4	82.1					
				avg $\sqrt{\Delta P}$				8.5						
				1.38										

CLEAN-UP DATA

Plant Boston Edison

Comments:

Date 9/29/81

Sampling Location Outlet

Sample Type EPA-5

Run Number 1-OL

Sample Box Number

Clean-up Man Harris/Meadows/Stokes

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	340 ml	151 ml	9 ml	ml	ml
Initial Vol.	100 ml	100 ml	- ml	ml	ml
Net Vol.	240 ml	51 ml	9 ml	ml	ml

Total Net Volume in Impingers 300 ml

SILICA GEL

Final Weight	g	271.8 g	g
Initial Weight	~~200~~ g	229.2 g	g
Net Weight	g	42.6 g	g

Total Net Weight in Silica Gel 42.6 g

Total Moisture 342.6 g

Filter Number(s) 1922054-27

MRC 7/73

ISOKINETIC CALCULATION

Plant BOSTON EDISON MYSTIC RIVER PLANT

Run # 1-OL Date SEPT. 30, 1981

Location OUTLET Initials DRD

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 342.6 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 164.315 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.69 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 545 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (164.315)(29.69)}{(545)(342.6)}} = .09$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 5 %

" CO " " " " = CO = 0 %

" CO_2 " " " " = CO_2 = 12.4 %

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (\quad + \quad + \quad)$

Percent N_2 by volume dry basis = N_2 = 82.6 %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (12.4) + 0.32 \, (5) + 0.28 \, (82.6 + 0)$

5.456 1.6 23.128

M_d = 30.184

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (\ \ )\ [1 - (.09)] + 18\ (.09)$ = 29.09

30.184 .91 1.62

VELOCITY

Pitot Tube coefficient, type S = C_p = .76

Average Absolute Stack Temp. (°F + 460) = T_s = 793 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.38 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 29.54 in.Hg

Stack gas velocity = V_s

$$V_s = (85.48)\ (\ C_p\ )\left[\sqrt{\frac{(\ T_s\ )}{(\ P_s\ )\ (\ M_s\ )}}\right]\left[\sqrt{\Delta p}\ \right]$$

$$V_s = (85.48)\ (.76)\left[\sqrt{\frac{(793)}{(29.54)\ (29.09)}}\right]\left[1.38\right]$$

4.96

= 86.12 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.59 in.H_2O

Total sampling time = θ = 240 min.

Diameter of nozzle = d_n = 0.204 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^{\ 2}) = 54.54 \times 10^{-4}\ (0.204)^2$ = 2.27×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\ (\ T_s\ )\left[0.00267\ (V_{LC}\ ) + \frac{(\ V_m\ )}{(\ T_m\ )}\left(P_{bar} + \frac{(\ \Delta H\ )}{13.6}\right)\right]}{(\ \theta\ )\ (\ V_s\ )\ (\ P_s\ )\ (\ A\ )}$$

$$I = \frac{(1.667)\ (793)\left[0.00267\ (3426) + \frac{(1643)}{(545)}\left(29.69 + \frac{(1.59)}{13.6}\right)\right]}{(240)\ (86.12)\ (29.54)\ (2.27 \times 10^{-4})}$$

I = 94.42 %

NOMOGRAPH DATA (HP-65)

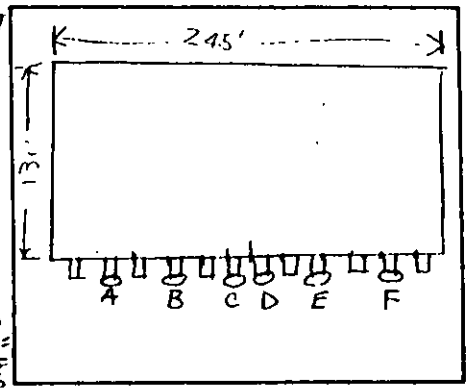
PLANT Boston Edison Mystic River Plant
DATE Sept. 30 1981
SAMPLING LOCATION Inlet - North

USED ON RUN NO.: 1-IN
CALCULATOR: Barrett

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Run card			—
2	Initialize program		A	0.00
3	Enter average T_m (meter temp. °F + 460) If meter temp. unknown, use ambient + 20°F	540 °R	R/S	540 T
4	Enter P_m (Barometric pressure at meter)	29.95 In. Hg	R/S	18.03 T_m/P
5	Enter P_s (static pressure in stack) [P_m ± .073 x stack gauge pressure in In. H_2O]	30.02 In. Hg	R/S	3002 P
6	Enter average T_s (stack temperature + 460)	889 °R	R/S	.03 P_s/T
7	Enter B_{ms} (mole fraction of H_2O vapor in gas stream)	.11 Fraction of H_2O	R/S	.89 Fraction Dry
8	Enter MD (molecular weight of dry gas)	29.5 lbs/lb mole	R/S	28.24 M molecular wt of stack g lbs/lb mol
9	Enter C_p (type "S" pitot tube coefficient)	.76	R/S	836.14
10	Enter average Δ_p 1.45 Highest Δ_p (_____)	1.45 In. H_2O	R/S	D_n theo. (nozzle dia in inches)
11	Initialize "B"	—	B	—
12	Enter actual D_n .204	.204 In.	R/S	—
13	Enter $\Delta H_@$ (Calibrated pressure differential across orifice)	1.9 In. H_2O	R/S	.81 K fact
14_1	Enter actual Δ_{p_1}		E	ΔH_1 In. H_2
14_2	Enter actual Δ_{p_2}		E	ΔH In. H_2
14_3	Enter actual Δ_{p_3} A-24		E	ΔH In. H_2O

EPA METHOD 5
FIELD DATA

PLANT Boston Edison Mystic River Plant
DATE September 30, 1981
SAMPLING LOCATION INLET-NORTH
SAMPLE TYPE M5-IN-RT
RUN NUMBER [illegible]-IN-[illegible]
OPERATOR Barbeit
AMBIENT TEMPERATURE [illegible]
BAROMETRIC PRESSURE 29.95
STATIC PRESSURE, (P_s) 30.02 ← 0.07
FILTER NUMBER (s) 1922054-62
PITOT TUBE No. & Cp. .76



PROBE LENGTH AND TYPE 12' Stainless Steel
NOZZLE I.D. 0.204
ASSUMED MOISTURE, % 11
SAMPLE BOX NUMBER 7
METER BOX NUMBER 2
METER ΔH@ 1.90
K FACTOR .81
PRE-TEST LEAK CHECK RATE .003 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE .008 CFM @ 12 "Hg
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 2.5 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
A1	0	10.54	691.592	.32	.26	.26	368	77	78	2	250	81	227
2	2.5	11.02	692.471	.30	.25	.25	368	78	78	2	229	79	216
3	5.0	11.04	693.162	.36	.29	.29	367	77	77	2	231	82	197
4	7.5	Power Failure	693.145	.34	.27	.27	366	76	77	2	232	72	197
5	10.0		695.322	.65	.52	.52	366	77	76	2.5	247	70	216
6	12.5		695.486	.89	.72	.72	364	78	76	3	250	68	260
	15.0		696.755	[illegible]	.97	.97	363	77	76	3	259	67	280
B1	0		697.705	1.1	.89	.89	371	79	78	4	251	75	190
2	2.5		698.552	1.0	.81	.81	371	80	78	4	246	73	188
3	5.0		699.795	.89	.68	.68	370	82	78	4	241	72	193
4	7.5		700.863	1.1	.89	.89	368	84	78	4	236	70	195
5	10.0		702.036	1.6	1.3	1.3	366	85	78	5	237	68	238
6	12.5		703.492	2.1	1.7	1.7	364	87	79	6	241	70	298
	15.0	12.20	704.106				5143	1037	2401				

PLANT Boston Edison Mystic River Plant DATE Sept. 30, 1981 RUN NO. ~~[illegible]~~ 1-IN

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
C1	0	1232	705.106	2.0	1.60	1.6	371	82	81	7	274	79	222
2	2.5		706.825	1.8	1.4	1.4	368	81	80	7	274	72	222
3	5.0		708.394	1.2	.97	.97	371	82	80	6	266	73	216
4	7.5		709.738	1.6	.85	.85	371	83	80	5	262	73	215
5	10.0		710.925	1.4	1.1	1.1	371	85	80	6	262	73	262
6	12.5		712.345	1.8	1.4	1.4	368	86	80	6	263	74	299
	15.0		713.809	~~1.6~~	~~.85~~		~~372~~	~~83~~					
D1	0	~~[illegible]~~	713.809	1.7	1.3	1.3	372	82	81	7	235	72	225
2	2.5		715.320	1.4	1.1	1.1	374	82	81	7	228	71	226
3	5.0		717.125	1.2	.97	.97	373	82	81	6	223	70	221
4	7.5		718.160	1.1	.89	.89	373	86	81	6	245	70	217
5	10.0		719.424	1.0	.81	.81	374	88	81	6	260	71	231
6	12.5		720.672	1.2	.97	.97	374	89	81	6	271	73	308
	15.0		721.944										
E1	0	1335	721.944	2.6	2.1	2.1	378	81	81	11	273	79	271
2	2.5		723.700	2.5	2.0	2.0	378	81	81	11	267	69	269
3	5.0		725.452	2.4	1.9	1.9	379	81	81	11	261	68	256
4	7.5		727.498	2.1	1.7	1.7	379	82	81	11	256	68	250
5	10.0		729.262	1.5	1.2	1.2	380	84	81	9	247	70	289
6	12.5		730.964	1.7	1.3	1.3	379	86	81	9	244	72	333
	15.0		732.984				6733	1503	~~1440~~ 1453				
								2540					

PLANT Boston Edison Mystic River Plant DATE Sept. 30, 1981 RUN NO. 1-IN

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H_2O) DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
F1	0	14.16	732.384	2.1	1.7	1.7	375	84	83	11	287	78	265
2	2.5		734.105	1.9	1.5	1.5	376	83	83	11	286	73	250
3	5.0		735.995	1.6	1.3	1.3	378	83	83	10	275	75	231
4	7.5		737.378	1.4	1.1	1.1	376	86	83	9	268	78	233
5	10.0		738.816	1.1	.89	.89	376	87	83	8	265	76	240
6	12.5		740.268	1.3	1.1	1.1	376	87	83	8	255	75	307
A-27	15.0		741.482				8657	1310 ~~1240~~ 305D	490 ~~820~~				
								84.7	84				
			49.89				13762						
							382.28						
				$\bar{v}$ = 43.50									
				1.12									
				44.73 / 3.46 / 41.27									

CLEAN-UP DATA

Plant Boston Edison

Date 9/28/81

Sampling Location Inlet

Sample Type EPA-5

Run Number 1-IN

Sample Box Number

Clean-up Man Barrett/Day

Comments:

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	166 ml	116 ml	3 ml	ml	ml
Initial Vol.	100 ml	100 ml	ml	ml	ml
Net Vol.	66 ml	16 ml	3 ml	ml	ml

Total Net Volume in Impingers 85 ml

SILICA GEL

Final Weight	223.7 g	g	g
Initial Weight	200 g	g	g
Net Weight	23.7 g	g	g

Total Net Weight in Silica Gel 23.7 g

Total Moisture 108.7 g

Filter Number(s) ~~1922054-48~~ 1922054-62

MRC 7/73

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison
DATE 10/1/81
SAMPLING TIME (24-hr CLOCK)
SAMPLING LOCATION Inlet North 1-IN
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Int.
ANALYTICAL METHOD Orsat
AMBIENT TEMPERATURE ~~70°F~~ 70°F
OPERATOR Meadows

COMMENTS:
O_2 Numbers appear ~~low~~ high, CO_2 appear low; ambient air may have contaminated sample.
Use outlet data for ORSAT analyses

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	9.6		9.6		9.5		9.6	44/100	4.224
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)		8.5		8.4		8.5	8.5	32/100	2.72
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)		0		0		0	0	28/100	0
N_2 (NET IS 100 MINUS ACTUAL CO READING)							81.9	28/100	22.932
								TOTAL	29.84

A-29

EPA (Dur) 230

ISOKINETIC CALCULATION

Plant BOSTON EDISON MYSTIC RIVER PLANT

Run # ~~IN #1~~ 1-IN Date SEPT. 30, 1981

Location INLET - NORTH Initials DB

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 108.7 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 49.89 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.95 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 544 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (49.89)(29.95)}{(544)(108.7)}} \qquad \frac{558280}{59132.8} = 9.44$$

= 9.58 .09

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 8.5 % a

" CO " " " " = CO = 0 % a

" CO_2 " " " " = CO_2 = 9.6 % a

N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (+ +)

Percent N_2 by volume dry basis = N_2 = 81.9 % a

Dry molecular weight = M_d

M_d = 0.44 (CO_2) + 0.32 (O_2) + 0.28 (N_2 + CO)

M_d = 0.44 (9.6) + 0.32 (8.5) + 0.28 (81.9 + 0)

4.22 2.72 22.9

M_d = 29.84 a

a use run 1 data when redoing calculations

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (\ \ )\ [1 - (.09)] + 18\ (.09)$ = 28.80

29.84 1.62

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = ~~371.95~~ °R 832

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.21 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 30.02 in.Hg

Stack gas velocity = V_s

$$V_s = (85.48)\ (C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\ (0.76)\left[\sqrt{\frac{(\cancel{372})\ 832}{(30.02)\ (28.80)}}\right]\left[\cancel{1.27}\ 1.15\right]$$

= ~~51.56~~ 73.29 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.10 in.H_2O

Total sampling time = θ = 90 min.

Diameter of nozzle = d_n = 0.204 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^{\ 2}) = 54.54 \times 10^{-4}\ (.204)^2$ = 2.27×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\ (T_s)\left[0.00267\ (V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]}{(\theta)\ (V_s)\ (P_s)\ (A)}$$

$$I = \frac{(1.667)\ (\cancel{372}\ 832)\left[0.00267\ (108.7) + \frac{(49.89)}{(544)}\left(29.95 + \frac{(1.10)}{13.6}\right)\right]}{(90)\ (\cancel{56.54}\ 73.29)\ (30.02)\ (2.27 \times 10^{-4})}$$

$$I = \frac{\cancel{5144}\ \cancel{4447}}{\cancel{6478}} \times 93.94$$

NOMOGRAPH DATA (HP-65)

PLANT Boston Edison
DATE 9-30-81
SAMPLING LOCATION Inlet South

USED ON RUN NO.: 1 Is
CALCULATOR: Jones

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Run card			—
2	Initialize program		A	0.00
3	Enter average T_m (meter temp. °F + 460) If meter temp. unknown, use ambient + 20°F	540 °R	R/S	540 T
4	Enter P_m (Barometric pressure at meter)	29.9 In. Hg	R/S	18.06 T_m/P
5	Enter P_s (static pressure in stack) [P_m ± .073 x stack gauge pressure in in. H_2O]	~~+.05~~ 30.01 In. Hg	R/S	30.01 P
6	Enter average T_s (stack temperature + 460)	830 °R	R/S	0.04 P_s/T
7	Enter B_{ms} (mole fraction of H_2O vapor in gas stream)	.11 Fraction of H_2O	R/S	0.89 Fractio Dry
8	Enter MD (molecular weight of dry gas)	29.5 lbs/lb mole	R/S	29.24 M molecular wt of stack g lbs/lb mo
9	Enter C_p (type "S" pitot tube coefficient)	.77 —	R/S	780.90
10	Enter average Δ_p Highest Δ_p (_____)	1.15 In. H_2O	R/S	D_n theo. 0. (nozzle dia in inches)
11	Initialize "B"	—	B	—
12	Enter actual D_n	0.24 In.	R/S	—
13	Enter $\Delta H_@$ (Calibrated pressure differential across orifice)	In. H_2O 1.98 = 0.19	R/S	K facti 0.
14_1	Enter actual Δ_{p_1}		E	ΔH_1 In. H_2
14_2	Enter actual Δ_{p_2}		E	ΔH In. H_2
14_3	Enter actual Δ_{p_3}		E	ΔH In. H_2O

EPA METHOD 5
FIELD DATA

PLANT BOSTON EDISON
DATE 9-30-81
SAMPLING LOCATION INLET - SOUTH
SAMPLE TYPE PARTICULATE - METHOD 5
RUN NUMBER 1-IS
OPERATOR CJ & SC
AMBIENT TEMPERATURE 60° - 70°
BAROMETRIC PRESSURE 29.95
STATIC PRESSURE, (P_s) 1.5 IN H_2O
FILTER NUMBER (s) 1922054-33
PITOT TUBE No. & Cp. 0.77

PROBE LENGTH AND TYPE S.S.
NOZZLE I.D. 0.138
ASSUMED MOISTURE, % 11
SAMPLE BOX NUMBER 6
METER BOX NUMBER 7
METER ΔH@ 1.82
K FACTOR 0.19
PRE-TEST LEAK CHECK RATE 0.018 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE 0.000 CFM @ 5 "Hg
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

1 OF 3

READ AND RECORD ALL DATA EVERY 2.5 MINUTES

A-3

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
A-1	0	1047	266.285	1.20	0.23	0.23	372	70	70	3.0	267	68	366
2	2.5		266.953	1.20	0.23	0.23	371	71	70	3.0	261	68	376
3	5.0		267.600	1.20	0.23	0.23	370	72	70	3.0	261	66	382
4	7.5		268.285	1.20	0.23	0.23							
5	10.0		268.900	0.25	0.10	0.10	370	74	71	2.5	256	67	390
6	12.5			DID NOT SAMPLE POINT # 6									
B-1	15.0		269.570	0.15	0.03	0.03	373	78	78	2.0	256	78	248
2	17.5		270.302	2.20	0.42	0.42	373	74	75	3.5	259	76	269
3	20.0		271.150	2.00	0.38	0.38	372	73	75	3.5	260	76	362
4	22.5		271.901	1.70	0.32	0.32	372	73	75	3.5	262	77	381
5	25.0		272.601	1.50	0.29	0.29	375	75	75	3.5	262	78	395
6	27.5		273.335	1.50	0.29	0.29	379	75	76	3.5	263	77	398
C-1	30.0	1313	274.223	2.50	0.48	0.48	372	77	78	4.0	261	77	277
2	32.5		275.000	1.80	0.34	0.34	372	76	78	3.5	261	77	319

EPA METHOD 5
FIELD DATA

PLANT Boston Edison
DATE 9-30-81
SAMPLING LOCATION Inlet South
SAMPLE TYPE Method 5
RUN NUMBER 1-IS
OPERATOR CJ, S.C.
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.95
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)
PITOT TUBE No. & Cp.

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER ΔH@
K FACTOR 0.19
PRE-TEST LEAK CHECK RATE ____ CFM @ ____ "Hg
POST TEST LEAK CHECK RATE ____ CFM @ ____ "Hg
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

2 of 3

READ AND RECORD ALL DATA EVERY ____ MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
C - 4	37.5		276.210	1.10	0.21	0.21	378	76	78	3.0	253	73	
5	40.0		276.801	1.00	0.19	0.19	364	75	76	3.0	252	75	
6	42.5		277.450	1.20	0.23	0.23	376	74	76	3.0	251	74	
D - 1	45.0	1452	278.200	1.70	0.32	0.32	374	72	73	3.0	246	73	
2	47.5	1455	278.918	1.40	0.27	0.27	373	70	70	3.5	242	71	
3	50.0		279.535	1.10	0.21	0.21	374	68	69	3.0	241	71	
4	52.5		280.230	1.30	0.25	0.25	374	68	69	3.2	248	67	
5	55.0		281.000	1.50	0.29	0.29	377	69	68	3.5	248	65	
6	57.5		281.767	1.70	0.32	0.32	381	69	68	3.5	250	64	
E - 1	60.0		282.480	1.50	0.29	0.29	373	66	66	3.5	264	67	
2	62.5		283.090	1.00	0.19	0.19	374	66	66	3.0	259	65	
3	65.0		283.655	0.85	0.16	0.16	375	67	66	3.0	265	67	347
4	67.5		284.250	1.00	0.19	0.19	376	68	66	3.0	263	65	370
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	65	[redacted]

EPA METHOD 5
FIELD DATA

PLANT _____
DATE _____
SAMPLING LOCATION ENLET - SOUTH
SAMPLE TYPE _____
RUN NUMBER 1-FS
OPERATOR CJ
AMBIENT TEMPERATURE _____
BAROMETRIC PRESSURE _____
STATIC PRESSURE, (P_s) _____
FILTER NUMBER (s) _____
PITOT TUBE No. & Cp. _____

SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE _____
NOZZLE I.D. _____
ASSUMED MOISTURE, % _____
SAMPLE BOX NUMBER _____
METER BOX NUMBER _____
METER ΔH@ _____
K FACTOR _____
PRE-TEST LEAK CHECK RATE _____ CFM @ ____ "Hg
POST TEST LEAK CHECK RATE _____ CFM @ ____ "Hg
REFERENCE Δp _____

3 of 3

READ AND RECORD ALL DATA EVERY _____ MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
F - 1	75.0		285.723	0.30	0.06	0.06	376	64	65	2.5	254	71	
2	77.5		286.100	0.35	0.07	0.07	375	66	65	2.5	258	70	
3	80.0		286.495	0.40	0.08	0.08	375	67	66	2.5	256	70	
4	82.5		287.050	0.80	0.15	0.15	374	68	66	3.0	256	69	
5	85.0		287.655	1.00	0.19	0.19	376	69	66	3.0	248	68	
6	87.5		288.400	1.50	0.29	0.29	376	69	66	3.0	253	67	

CLEAN-UP DATA

Plant Boston Edison

Comments:

Date 9/28/81

Sampling Location Inlet

Sample Type EPA-5

Run Number 1-IS

Sample Box Number

Clean-up Man Jones/Cheng

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	233 ml	ml	ml	ml	ml
Initial Vol.	200 ml	~~100~~ ml	ml	ml	ml
Net Vol.	33 ml	ml	ml	ml	ml

Total Net Volume in Impingers _____ ml

SILICA GEL

Final Weight	g	235.9 g	g
Initial Weight	~~200~~ g	229.2 g	g
Net Weight	g	6.7 g	g

Total Net Weight in Silica Gel 6.7 g

Total Moisture 39.7 g

Filter Number(s) 192205433

MRC 7/73

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison
DATE 10/1/81
SAMPLING TIME (24-hr CLOCK)
SAMPLING LOCATION Inlet South 1-IS
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Int.
ANALYTICAL METHOD Orsat
AMBIENT TEMPERATURE 70°F
OPERATOR Meadows

COMMENTS: Data may not be accurate due to problems w/ sampling pump not collecting ~~accurate~~ representative sample (ie. taking in ambient air)

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	5.8		5.8		5.9		5.8	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)		13.2		13.1		13.1	13.1	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)		0		0		0	0	28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)							81.1	28/100	
								TOTAL	

Use Data from outlet Run 1

A-37

EPA (Dur) 230

ISOKINETIC CALCULATION

Plant Boston Edison

Run # 1-IS Date 9/30/81

Location Inlet - South Initials TT

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 39.7 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 22.12 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.95 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 531 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (22.12)(29.95)}{(531)(39.7)}} = 78.5\%$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = ~~[illegible]~~ 5.0 [a] %

" CO " " " " = CO = ~~[illegible]~~ 0 [a] %

" CO_2 " " " " = CO_2 = ~~[illegible]~~ 12.4 [a] %

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (\quad + \quad + \quad)$ [a]

Percent N_2 by volume dry basis = N_2 = ~~[illegible]~~ 82.6 %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (5.5) + 0.32 \, (13.1) + 0.28 \, (82.1 + 0)$ [a]

M_d = ~~29.45~~ 30.18

[a] use data from Run 1 outlet

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (\cancel{29.42}\ 30.18)\ [1 - (.0785)] + 18\ (.0785)$ = ~~28.55~~ 29.22

VELOCITY

Pitot Tube coefficient, type S = C_p = .76

Average Absolute Stack Temp. (°F + 460) = T_s = 834 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.06 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 30.01 in.Hg

Stack gas velocity = V_s

$$V_s = (85.48)\ (C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\ (.76)\left[\sqrt{\frac{(834)}{(30.01)(29.55)}}\right]\left[1.06\right]$$

= 67.94 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = .23 in.H_2O

Total sampling time = θ = 87.5 min.

Diameter of nozzle = d_n = .138 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^{\ 2}) = 54.54 \times 10^{-4}\ (\quad)^2$ = 1.039×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\ (T_s)}{(\theta)}\ \frac{\left[0.00267\ (V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]}{(V_s)\ (P_s)\ (A)}$$

$$I = \frac{(1.667)\ (834)}{(87.5)}\ \frac{\left[0.00267\ (39.7) + \frac{(22.12)}{(531)}\left(29.95 + \frac{(.23)}{13.6}\right)\right]}{(67.94)\ (30.01)\ (1.039 \times 10^{-4})}$$

I = 101.58 %

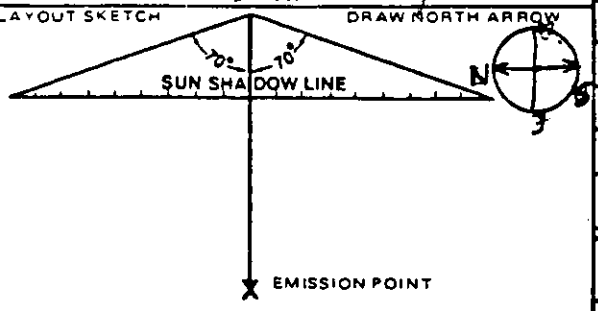
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Edison Mystic Plant
ADDRESS	Boston
STATE / ZIP / TELEPHONE	
SOURCE ID NUMBER	
OBSERVATION DATE	Sept 30, 1981
PROCESS	Elec. Generation Stk.
OPERATING MODE	
CONTROL EQUIPMENT	ESP
OPERATING MODE	
DESCRIBE EMISSION POINT	Tall stack @ 500 ft
HEIGHT ABOVE GROUND LEVEL	@ 500 ft
HEIGHT RELATIVE TO OBSERVER	@ 500 ft
DISTANCE FROM OBSERVER	@ 400 ft
DIRECTION FROM OBSERVER	SE
DESCRIBE EMISSIONS	Light Bluish White Smoke. Emissions are particulate, SO_2 some NO_x.
EMISSION COLOR	Brown & Bluish White
PLUME TYPE	CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT	NO ☒ YES ☐
IF YES, IS PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED	Just after the plume height.
DESCRIBE BACKGROUND	Blue Sky
BACKGROUND COLOR	Sky Blue
SKY CONDITIONS	Partly White Clouds (@ 30% cover)
WIND SPEED	18 MPH
WIND DIRECTION	NW
AMBIENT TEMPERATURE	55°F
RELATIVE HUMIDITY	

COMMENTS: Some time ~~pieces~~ patches of clouds would obstruct or make the smoke unreadable. Lots of white clouds so no readings recorded.

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT)	Vasudev B. Kulkarni
ORGANIZATION	PCS Inc.
CERTIFIED BY	Commonwealth of KY Div. of Air Pollution
DATE	May 21 '81
START TIME	10:25 AM
STOP TIME	10:49 AM

	0	15	30	45		0	15	30	45
1	10	5	5	5	31				
2	5	5	10	5	32				
3	—	—	10	5	33				
4	5	5	—	—	34				
5	—	—	—	5	35				
6	5	5	10	—	36				
7	—	—	5	5	37				
8	5	10	5	—	38				
9	—	—	—	—	39				
10	—	—	—	—	40				
11	—	—	—	—	41				
12	—	—	5	—	42				
13	—	—	—	—	43				
14	—	—	—	—	44				
15	—	—	—	—	45				
16	—	—	—	—	46				
17	—	—	—	—	47				
18	—	—	—	—	48				
19	—	—	—	—	49				
20	—	—	—	—	50				
21	—	—	—	—	51				
22	—	—	—	—	52				
23	—	—	—	—	53				
24	—	—	—	—	54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY FOR FOR HIGHEST PERIOD

NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS — MINIMUM — MAXIMUM

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

TITLE — DATE

OBSERVER'S SIGNATURE: V B Kulkarni — DATE: 9/30/81 A-40

VERIFIED BY

Baldwin St.

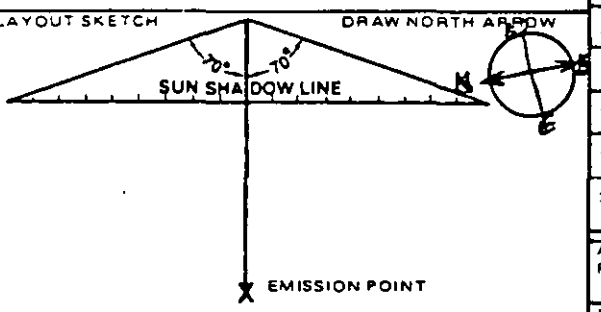
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic Plant	OBSERVER'S NAME (PRINT): VASUDEV B. KULKARNI
ADDRESS: Boston	ORGANIZATION: PCS Inc.
STATE / ZIP / TELEPHONE	CERTIFIED BY: Commonwealth of Kentucky Div of Air Pollution — DATE: May 21, 1981
SOURCE ID NUMBER / OBSERVATION DATE: Sept 30 1981	START TIME: 11:01 AM — STOP TIME: 12:01 PM
PROCESS: Elec. Generation / OPERATING MODE	
CONTROL EQUIPMENT: ESP / OPERATING MODE	
DESCRIBE EMISSION POINT: A tall stack @ 500 ft from all fired boilers	
HEIGHT ABOVE GROUND LEVEL: @ 500 ft / HEIGHT RELATIVE TO OBSERVER: @ 500 ft.	
DISTANCE FROM OBSERVER: @ 2500 ft. / DIRECTION FROM OBSERVER: NE	
DESCRIBE EMISSIONS: Particulate, NOx, SOx.	
EMISSION COLOR: Brownish white. Bluish / PLUME TYPE: CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐	
WATER DROPLETS PRESENT: NO ☒ YES ☐ / IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐	
AT WHAT POINT WAS OPACITY DETERMINED: Just after the plume ht.	
DESCRIBE BACKGROUND: The Sky.	
BACKGROUND COLOR: Sky Blue / SKY CONDITIONS: Partly cloudy	
WIND SPEED: 20 MPH / WIND DIRECTION: NW	
AMBIENT TEMPERATURE: 50-55°F / RELATIVE HUMIDITY:	

COMMENTS: Wherever blanks indicate unreadable due to clouds.

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



	0	15	30	45		0	15	30	45	
1	10	10	10	5	31	5	5	5	10	60
2	5	10	5	5	32	—	5	5	10	45
3	5	10	5	10	33	10	10	10	15	75
4	10	5	5	10	34	10	5	10	10	65
5	10	5	5	10	35	10	10	5	5	60
6	10	15	10	15	36	5	5	5	10	[illegible]
7	5	10	10	5	37	10	10	15	10	75
8	5	5	5	10	38	5	10	10	10	60
9	0	5	10	5	39	10	5	10	5	[illegible]
10	5	10	15	15	40	5	10	—	5	55
11	10	10	10	10	41	5	10	10	10	75
12	5	5	5	10	42	10	5	10	10	60
13	5	5	10	10	43	5	5	5	5	50
14	10	10	5	5	44	—	10	10	10	50
15	5	5	5	5	45	5	10	5	10	55
16	5	5	10	5	46	10	10	10	10	65
17	5	5	5	10	47	—	5	—	—	35
18	20	15	15	5	48	—	—	—	—	55
19	10	10	5	10	49	—	—	—	—	35
20	5	5	10	10	50	—	—	—	—	30
21	5	5	5	10	51	5	5	5	5	45
22	5	5	5	5	52	5	—	—	—	25
23	5	5	5	5	53	—	—	5	5	30
24	—	5	10	5	54	5	10	5	5	[illegible]
25	5	10	5	10	55	5	5	5	5	70
26	—	—	—	5	56	5	5	5	5	[illegible]
27	5	5	5	10	57	5	0	5	—	35
28	5	0	5	5	58	—	—	—	—	[illegible]
29	10	5	5	5	59	5	5	—	—	35
30	5	5	5	5	60	—	—	—	—	20

AVERAGE OPACITY FOR FOR HIGHEST PERIOD / NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS — MINIMUM — MAXIMUM

OBSERVER'S SIGNATURE: V.B. Kulka... / DATE: 9/30/81 A-4

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VERIFIED BY / TITLE / DATE

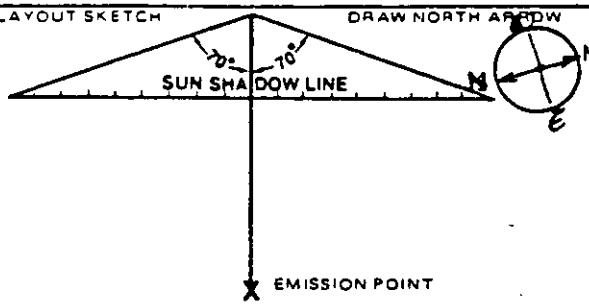
9/81

Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Edison Mystic Plant
ADDRESS	Boston
STATE	
ZIP	
TELEPHONE	
SOURCE ID NUMBER	
OBSERVATION DATE	Sept 30, 1981
PROCESS	Elec Generation
OPERATING MODE	
CONTROL EQUIPMENT	ESP
OPERATING MODE	
DESCRIBE EMISSION POINT	Final Stack @ 500 ft
HEIGHT ABOVE GROUND LEVEL	@ 500 ft
HEIGHT RELATIVE TO OBSERVER	@ 500 ft
DISTANCE FROM OBSERVER	@ 1500 ft
DIRECTION FROM OBSERVER	NE
DESCRIBE EMISSIONS	Particulate, NOx, SOx.
EMISSION COLOR	~~Brown~~ White Bluish
PLUME TYPE	CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☒ YES ☐
IF YES, IS PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED	Just after the plume left
DESCRIBE BACKGROUND	The Sky
BACKGROUND COLOR	Sky Blue
SKY CONDITIONS	@ 20-25% White clouds covered.
WIND SPEED	15-20 MPH
WIND DIRECTION	NW
AMBIENT TEMPERATURE	55°F
RELATIVE HUMIDITY	
COMMENTS	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT)	VASUDEV B. KULKARNI
ORGANIZATION	PCS Inc.
CERTIFIED BY	Commonwealth of Kentucky Div. of Air Pollution
DATE	May 21, 1981
START TIME	12:10 PM
STOP TIME	1:10 PM

	0	15	30	45		0	15	30	45
1	15	15	10	10	31	10	5	5	10
2	—	—	10	15	32	10	10	10	10
3	20	20	15	15	33	10	10	10	10
4	15	10	10	—	34	10	10	5	5
5	10	—	—	—	35	10	10	5	10
6	—	—	—	—	36	15	15	10	10
7	—	—	5	5	37	5	5	10	15
8	5	5	5	5	38	10	10	5	5
9	10	5	10	10	39	10	10	10	10
10	10	10	15	10	40	10	15	15	15
11	10	5	10	10	41	10	15	20	20
12	10	10	5	15	42	15	15	10	15
13	15	15	15	15	43	10	10	10	5
14	10	10	15	15	44	5	5	5	—
15	—	—	—	—	45	5	5	—	10
16	—	—	—	10	46	5	5	5	5
17	10	10	10	10	47	5	5	5	10
18	10	10	10	5	48	5	5	5	5
19	10	10	5	5	49	5	10	10	10
20	—	—	—	—	50	5	—	—	—
21	—	—	—	—	51	—	5	10	10
22	—	—	10	10	52	10	10	5	10
23	—	—	—	—	53	5	5	10	10
24	—	—	—	—	54	10	10	15	15
25	—	—	—	—	55	10	10	10	10
26	—	—	—	5	56	—	—	—	—
27	5	5	10	5	57	—	10	10	5
28	10	5	5	5	58	5	5	10	10
29	5	5	10	10	59	10	10	15	20
30	10	10	5	5	60	15	15	—	10

AVERAGE OPACITY FOR FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS	MINIMUM MAXIMUM
OBSERVER'S SIGNATURE	V. B. Kulkarni
DATE	9/30/81
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS. SIGNATURE	
VERIFIED BY	
TITLE	
DATE	

A-42

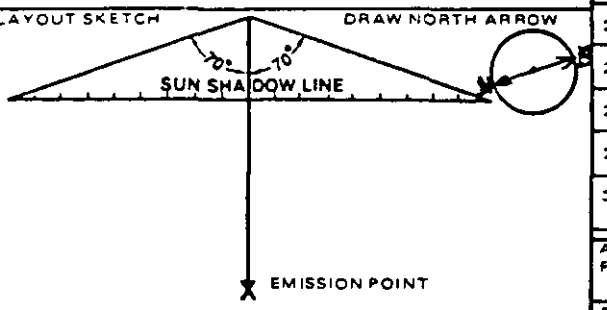
9/81

Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Edison Mystic Plant
ADDRESS	Boston
STATE / ZIP / TELEPHONE	
SOURCE ID NUMBER	
OBSERVATION DATE	Sept 30, 1981
PROCESS	Elec Generating Station
OPERATING MODE	
CONTROL EQUIPMENT	ESP
OPERATING MODE	
DESCRIBE EMISSION POINT	Metal stack @ 500 ft level
HEIGHT ABOVE GROUND LEVEL	@ 500 ft
HEIGHT RELATIVE TO OBSERVER	@ 500 ft
DISTANCE FROM OBSERVER	@ 2500 ft
DIRECTION FROM OBSERVER	NE
DESCRIBE EMISSIONS	SO_x, NO_x & Particulate
EMISSION COLOR	Bluish White
PLUME TYPE	CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☒ YES ☐
IF YES, IS PLUME	ATTACHED ☒ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED	Just after the plume left.
DESCRIBE BACKGROUND	The Sky
BACKGROUND COLOR	Sky Blue
SKY CONDITIONS	20-30% White Clouds
WIND SPEED	15 MPH
WIND DIRECTION	NW
AMBIENT TEMPERATURE	58°F
RELATIVE HUMIDITY	
COMMENTS	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT)	Vasudev B. Kulkarni
ORGANIZATION	PCS Inc
CERTIFIED BY	Commonwealth of Ky Div of Air Pollution
DATE	May 21, 1981

START TIME 1:15 PM — STOP TIME 2:15 PM

	0	15	30	45		0	15	30	45	
1	5	5	10	10	31	10	5	10	5	60
2	10	10	10	10	32	5	5	10	10	70
3	5	5	5	5	33	5	5	5	10	[illegible]
4	5	5	5	5	34	10	10	10	5	[illegible]
5	5	10	5	5	35	5	10	5	10	[illegible]
6	5	5	5	5	36	5	5	5	—	[illegible]
7	5	5	5	—	37	10	—	5	10	40
8	—	5	5	10	38	5	5	5	5	40
9	10	5	5	10	39	10	15	10	10	[illegible]
10	10	10	10	10	40	15	15	20	15	105
11	10	5	5	5	41	15	20	15	5	10
12	5	5	5	10	42	5	5	10	10	5[illegible]
13	10	15	10	5	43	10	15	10	15	90
14	10	10	5	5	44	5	10	10	5	60
15	5	5	5	5	45	5	10	15	10	60
16	5	5	5	5	46	10	10	10	5	55
17	5	5	10	10	47	5	5	5	10	55
18	10	10	10	10	48	10	5	5	5	65
19	10	10	5	10	49	5	10	5	10	[illegible]
20	5	—	10	10	50	10	5	10	10	70
21	10	10	15	10	51	—	5	—	5	55
22	10	15	10	10	52	5	5	5	10	70
23	10	10	10	10	53	10	10	10	5	75
24	10	15	10	10	54	5	5	5	—	60
25	5	5	10	15	55	—	5	5	10	55
26	15	10	15	15	56	5	5	5	5	75
27	10	10	10	5	57	—	5	—	5	[illegible]
28	10	15	10	10	58	5	5	5	5	65
29	10	10	10	5	59	5	5	5	5	55
30	10	10	5	5	60	5	5	10	5	55

AVERAGE OPACITY FOR FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS	MINIMUM MAXIMUM
OBSERVER'S SIGNATURE	V. B. Kulkarni
DATE	9/30/81
VERIFIED BY	
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS. SIGNATURE	
TITLE	
DATE	

9/81

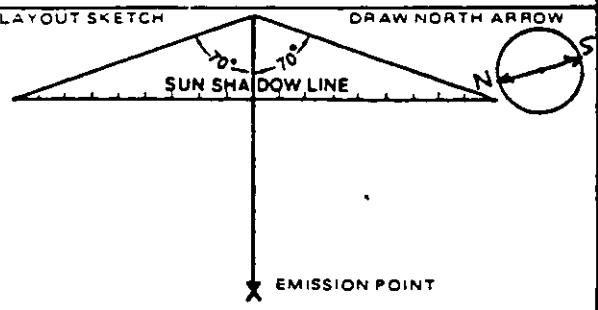
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Edison Mystic Plant	OBSERVER'S NAME (PRINT): Vasudev B Kulkarni
ADDRESS: Boston	ORGANIZATION: PCS Inc.,
STATE / ZIP / TELEPHONE	CERTIFIED BY: Commonwealth of KY Div. of Air Pollution — DATE: May 21, 1981
SOURCE ID NUMBER / OBSERVATION DATE: Sept 30, 1981	START TIME: 4:00 PM — STOP TIME: 5:00 P.M.
PROCESS: Elec. Generation / OPERATING MODE	
CONTROL EQUIPMENT: ESP / OPERATING MODE	
DESCRIBE EMISSION POINT: A 500 ft tall stack	
HEIGHT ABOVE GROUND LEVEL: @ 500 ft / HEIGHT RELATIVE TO OBSERVER: @ 500 ft	
DISTANCE FROM OBSERVER: @ 2500 ft / DIRECTION FROM OBSERVER: NE	
DESCRIBE EMISSIONS: Parti, Nox, SOx etc	
EMISSION COLOR: Brownish Bluish White / PLUME TYPE: CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐	
WATER DROPLETS PRESENT: NO ☒ YES ☐ / IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐	
AT WHAT POINT WAS OPACITY DETERMINED: Just after the Plume rise.	
DESCRIBE BACKGROUND: Blue Sky	
BACKGROUND COLOR: Sky Blue / SKY CONDITIONS: Partly cloudy @ 30-35%	
WIND SPEED: 15 MPH / WIND DIRECTION: NW	
AMBIENT TEMPERATURE: 53°F / RELATIVE HUMIDITY	
COMMENTS: Where no reading, indicates the clouds obstructed.	

	0	15	30	45		0	15	30	45
1	10	10	15	15	31	—	—	—	—
2	10	15	10	10	32	—	—	—	—
3	10	10	15	10	33	—	—	—	—
4	—	—	—	10	34	—	—	—	—
5	5	5	5	5	35	—	—	—	—
6	5	—	—	—	36	—	—	—	—
7	—	—	—	—	37	—	—	—	—
8	—	—	—	—	38	—	—	—	—
9	—	—	—	—	39	5	5	10	5
10	—	—	—	—	40	10	10	10	10
11	—	—	5	5	41	10	15	10	15
12	5	5	10	10	42	10	10	10	10
13	10	5	5	5	43	15	10	15	10
14	—	—	—	—	44	—	—	—	—
15	—	—	—	—	45	—	—	—	—
16	—	—	—	—	46	—	—	—	—
17	—	—	—	—	47	—	—	—	—
18	—	—	—	—	48	—	—	—	—
19	—	—	—	—	49	—	—	—	—
20	—	—	—	—	50	—	—	—	—
21	—	—	—	—	51	—	—	—	—
22	5	10	10	15	52	—	—	—	—
23	15	10	10	10	53	—	—	—	—
24	—	—	—	—	54	10	10	15	15
25	—	—	—	—	55	10	10	10	10
26	5	5	5	5	56	5	10	10	10
27	5	5	5	10	57	5	5	10	10
28	—	—	—	—	58	15	15	10	5
29	—	—	—	—	59	5	5	5	5
30	—	—	—	—	60	5	5	10	10

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



AVERAGE OPACITY FOR FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS: MINIMUM — MAXIMUM	
OBSERVER'S SIGNATURE: V B. Kulkarni — DATE: 9/30/81	I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS. SIGNATURE
VERIFIED BY	TITLE — DATE

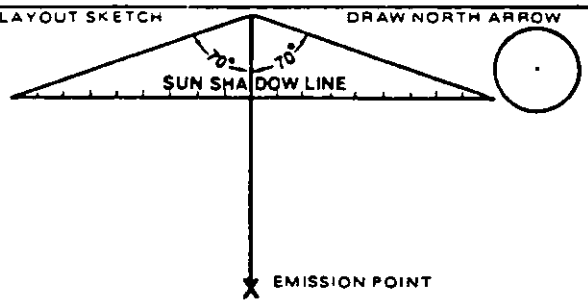
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Edison Mystic Plant
ADDRESS	Boston
STATE / ZIP / TELEPHONE	
SOURCE ID NUMBER	
OBSERVATION DATE	Sept. 30, 1981
PROCESS	Elec. Generation
OPERATING MODE	
CONTROL EQUIPMENT	ESP
OPERATING MODE	
DESCRIBE EMISSION POINT	A @500 ft tall stack
HEIGHT ABOVE GROUND LEVEL	@ 500 ft
HEIGHT RELATIVE TO OBSERVER	@ 500 ft
DISTANCE FROM OBSERVER	@ 2500 ft
DIRECTION FROM OBSERVER	NE
DESCRIBE EMISSIONS	Parti, NO_x SO_x etc
EMISSION COLOR	Brown Bluish White
PLUME TYPE	CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT	NO ☒ YES ☐
IF YES, IS PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED	Just off the plume Rise.
DESCRIBE BACKGROUND	Blue Sky
BACKGROUND COLOR	Sky Blue
SKY CONDITIONS	Partly Cloudy @ 30%
WIND SPEED	15-17 MPH
WIND DIRECTION	NW
AMBIENT TEMPERATURE	58°F
RELATIVE HUMIDITY	

COMMENTS: Early Stop due to Sun behind Clouds & so Smoke could not be read.

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT)	Vasudev B. Kulkarni
ORGANIZATION	PCS Inc.
CERTIFIED BY	Commonwealth of KY Div. of Air Pollution
DATE	May 21, 1981
START TIME	5:03 A.M.
STOP TIME	5:26 P.M.

	0	15	30	45		0	15	30	45	
1	10	10	10	10	31					40
2	10	15	15	10	32					[illegible]
3	10	5	10	5	33					[illegible]
4	5	5	10	10	34					30
5	5	5	10	10	35					[illegible]
6	10	10	10	10	36					[illegible]
7	10	10	10	10	37					40
8	15	10	10	15	38					30
9	20	15	20	20	39					75
10	20	20	20	25	40					[illegible]
11	25	20	25	20	41					[illegible]
12	15	15	10	15	42					57
13	10	10	10	15	43					45
14	15	10	10	10	44					[illegible]
15	10	5	10	5	45					30
16	5	—	—	—	46					5
17	—	—	—	—	47					
18	—	—	—	—	48					
19	5	—	—	—	49					5
20	—	—	5	5	50					10
21	5	5	5	5	51					20
22	—	—	—	—	52					
23	—	—	—	—	53					
24					54					
25					55					
26					56					
27					57					
28					58					
29					59					
30					60					

AVERAGE OPACITY FOR FOR HIGHEST PERIOD

NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS — MINIMUM — MAXIMUM

OBSERVER'S SIGNATURE — DATE

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

VERIFIED BY — TITLE — DATE

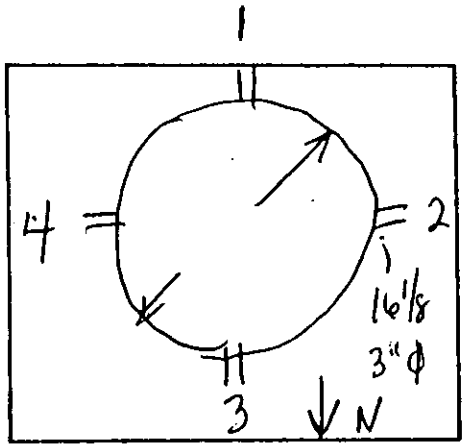
9/81

RUN 2

Outlet (OH) (5B) Outlet (OL) (5) Inlet north (IN) Inlet south (IS)	Field Data Clean-up Data Dry Molecular Weight Data Isokinetic Calculations
Plume Opacity	

EPA METHOD 5
FIELD DATA

PLANT BOSTON - EDISON
DATE 10-1-81
SAMPLING LOCATION OUTLET
SAMPLE TYPE PARTICULATE 320
RUN NUMBER 2-OH
OPERATOR F. MEADOWS
AMBIENT TEMPERATURE 82
BAROMETRIC PRESSURE 29.88 adj
STATIC PRESSURE, (P_s) -1.8" H2O
FILTER NUMBER (s) 206697-22
PITOT TUBE No. & Cp. 0.76 # 10-18



PROBE LENGTH AND TYPE 11' PYREX w/10' Heated Teflon Flexible connector
NOZZLE I.D. 0.186
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 2
METER BOX NUMBER 6
METER ΔH@ 2.00
K FACTOR
PRE-TEST LEAK CHECK RATE 0.01 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE ____ CFM @ ____ "Hg
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

Page 1 of 2

READ AND RECORD ALL DATA EVERY 5.0 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	FLEX LINE °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F					
~~2-6~~	0	1040	683.157	—	—	—	—	—	—	—	—	—	—	
2-6	5	1045	686.220	2.10	1.30	1.30	360	78	80	2.0	327	67	288	357
2-5	10	1050	689.190	2.05	1.28	1.28	361	78	80	2.0	319	67	313	357
2-4	15	1055	692.105	2.00	1.26	1.26	361	77	79	2.0	319	68	272	356
2-3	20	1100	695.042	2.00	1.26	1.26	361	79	78	2.0	325	71	223	355
2-2	25	1105	697.855	1.80	1.12	1.12	361	79	77	2.0	327	72	207	354
2-1	30	1110	700.342	1.40	0.88	0.88	360	78	76	1.8	327	74	192	352
3-6	35	1127 1132	703.316	2.05	1.28	1.28	362	79	74	2.0	304	66	367	310
3-5	40	1137	706.233	1.95	1.22	1.22	361	81	74	2.1	316	63	346	311
3-4	45	1142	709.147	1.95	1.22	1.22	361	81	74	2.1	320	63	271	312
3-3	50	1147	712.086	2.00	1.26	1.26	361	81	74	2.1	323	64	227	315
3-2	55	1152	714.980	1.90	1.20	1.20	360	81	74	2.0	325	65	205	317
3-1	60	1157	717.272	1.30	0.82	0.82	358	81	75	1.7	328	66	187	318
			Leak check		0 @	6"	Hg							

A-4

Page D 13

PLANT Boston Edison DATE 10-2-84 RUN NO. 2-04

Page 2 of 2

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	FLG LINE
		1252	717.424											
4-6	65	1257	720.462	2.00	1.26	1.26	363	77	77	2.1	327	66	268	300
4-5	70	1302	723.363	1.90	1.20	1.20	363	81	77	2.1	332	64	330	312
4-4	75	1307	726.366	2.00	1.26	1.26	363	81	77	2.1	320	63	262	320
4-3	80	1312	729.320	1.90	1.20	1.20	361	82	77	2.1	333	66	237	323
4-2	85	1317	732.163	1.80	1.12	1.12	360	84	77	2.1	334	67	213	329
4-1	90	1322	734.580	1.30	0.82	0.82	359	84	78	1.8	332	69	199	325
		1335												
1-6	95	1340	737.495	1.95	1.20	1.20	361	77	78	2.1	333	68	260	303
1-5	100	1345	740.402	1.90	1.20	1.20	361	79	78	2.1	325	67	317	304
1-4	105	1350	743.285	1.90	1.20	1.20	360	80	77	2.1	323	66	258	309
1-3	110	1355	746.095	1.80	1.12	1.12	360	81	77	2.0	319	66	227	316
1-2	115	1400	748.851	1.75	1.08	1.08	359	81	77	2.0	319	66	205	322
1-1	120	1405	751.262	1.30	0.82	0.82	357	81	77	1.8	320	65	191	328
				leak test	- dead stopped @ 5" Hg									
				$\sqrt{\Delta P}$										
			*67.953	1.3507	1.15	1.15	361	80	77					

*Corrected for leak check

CLEAN-UP DATA

Plant BOSTON EDISON Comments:

Date 10/1/81

Sampling Location

Sample Type

Run Number 2-OH

Sample Box Number

Clean-up Man STOKES/MEADOWS/HARRIS

250
92
342

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	342 ml	ml	ml	ml	ml
Initial Vol.	200 ml	~~[illegible]~~ ml	– ml	ml	ml
Net Vol.	142 ml	ml	ml	ml	ml

Total Net Volume in Impingers 142 ml

SILICA GEL

Final Weight	248.3	g	g	g
Initial Weight	200.0 ~~[illegible]~~	g	g	g
Net Weight		g	g	g

Total Net Weight in Silica Gel 48.3 g

Total Moisture 190.3 g

Filter Number(s) 206697-22

MRC 7/73

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison Company Mystic Station COMMENTS:
DATE 10/1/81
SAMPLING TIME (24-hr CLOCK) 10/1/81
SAMPLING LOCATION outlet (OH & CL)
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE
OPERATOR Meadows

A-50 RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2							11.3	44/100	4.972
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)							6.1	32/100	1.952
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)							0.0	28/100	0
N_2 (NET IS 100 MINUS ACTUAL CO READING)							82.6	28/100	23.128
								TOTAL	30.052

ISOKINETIC CALCULATION

Plant BOSTON EDISON

Run # 2-OH Date 10-1-81

Location OUTLET Initials FM

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 190.3 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 67.953 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.88 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 539 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (67.953)(29.88)}{(539)(190.3)}} = 0.1191$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 6.1 %

" CO " " " " = CO = 0 %

" CO_2 " " " " = CO_2 = 11.3 %

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (6.1 + 0 + 11.3)$

Percent N_2 by volume dry basis = N_2 = 82.6 %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (11.3) + 0.32 \, (6.1) + 0.28 \, (82.6 + 0)$

M_d = 30.05

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (30.5)\ [1 - (.1191)] + 18\ (.1191)$ = 28.61

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = 821 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.3507 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 29.75 in.Hg

Stack gas velocity = V_s

$$V_s = (85.48)\ (C_p) \left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right] \left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\ (.76) \left[\sqrt{\frac{(821)}{(29.75)(28.61)}}\right] \left[1.3507\right]$$

= 86.18 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.15 in.H_2O

Total sampling time = θ = 120 min.

Diameter of nozzle = d_n = 0.186 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^2) = 54.54 \times 10^{-4}\ (.186)^2$ = 1.887×10^{-4} sq.ft.

I = percent Isokinetic

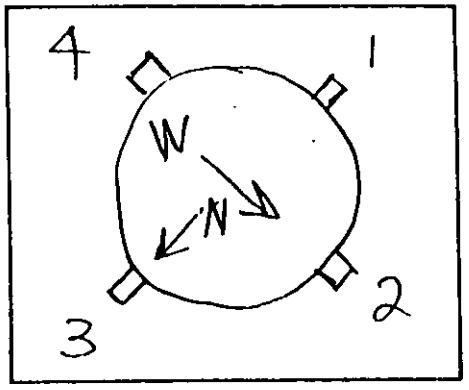
$$I = \frac{(1.667)\ (T_s)}{(\theta)} \frac{\left[0.00267\ (V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]}{(V_s)\ (P_s)\ (A)}$$

$$I = \frac{(1.667)\ (821)}{(120)} \frac{\left[0.00267\ (190.3) + \frac{(67.953)}{(539)}\left(29.88 + \frac{(1.15)}{13.6}\right)\right]}{(86.18)\ (29.75)\ (1.887 \times 10)^{-4}}$$

I = 101.0 %

EPA METHOD 5
FIELD DATA

PLANT Boston Edison
DATE 10/1/81
SAMPLING LOCATION Outlet
SAMPLE TYPE Particulate (248)
RUN NUMBER 2-OL
OPERATOR ~~82~~ DLH
AMBIENT TEMPERATURE 82
BAROMETRIC PRESSURE 29.88
STATIC PRESSURE, (P) -1.8" H_2O
FILTER NUMBER (s) 206697-21
PITOT TUBE No. & Cp. 10-18-0.76



SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE 10' glass
NOZZLE I.D. .204
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER ΔH@ 1.94
K FACTOR
PRE-TEST LEAK CHECK RATE 0.01 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE ____ CFM @ ____ "Hg
REFERENCE Δp

READ AND RECORD ALL DATA EVERY 5 MINUTES flex line not heating

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
2-6	0	1040	938.100	2.1	1.82	1.82	~~360~~	79	81	5.0	235	58	out
2-5	5	1045	941.535	2.05	1.77	1.77	~~361~~	81	80	5.0	222	58	—
2-4	10	1050	945.125	2.0	1.72	1.72	see	81	80	5.0	230	63	—
2-3	15	1055	948.675	2.0	1.72	1.72	2-OH	81	80	5.0	257	66	—
2-2	20	1100	952.220	1.8	1.56	1.56	|	82	81	4.6	270	69	—
2-1	25	1105	955.615	1.4	1.22	1.22	|	80	79	3.9	257	70	—
~~2~~	30	1110	958.674	—	—	—	—	—	—	—	—	—	—
3-6	30	1127	958.654	2.05	1.77	1.77	See Run	75	75	5.2	251	65	318
3-5	35	1132	962.270	1.95	1.69	1.69	2-OH	83	74	5.0	237	58	330
3-4	40	1137	965.785	1.95	1.69	1.69	|	83	75	5.0	247	61	235
3-3	45	1142	969.290	2.0	1.72	1.72	|	83	74	5.2	263	63	out
3-2	50	1147	972.805	1.9	1.65	1.65	|	83	75	5.0	255	63	—
3-1	55	1152	976.290	1.3	1.12	1.12	|	83	76	4.1	242	63	—
~	60	1157	979.234	—	—	—	|	—	—	—	—	—	—

PLANT Boston Edison DATE 10/1/81 RUN NO. 2-OL

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
4-6	60	1252	979.425	2.0	1.72	1.72	see run	77	76	5.2	267	65	255
4-5	65	1257	982.975	1.9	1.65	1.65	2-OH	83	76	5.0	250	62	317
4-4	70	1302	986.455	2.0	1.72	1.72		85	76	5.1	249	64	251
4-3	75	1307	990.000	1.9	1.65	1.65		85	77	5.1	273	66	213
4-2	80	1312	993.520	1.8	1.56	1.56		86	77	5.1	262	66	out
4-1	85	1317	997.010	1.3	1.12	1.12		86	77	4.9	250	67	—
~	90	1322	999.997	—	—	—	—	—	—	—	—	—	—
1-6	90	1335	999.997	1.95	1.65	1.65		77	77	5.5	253	68	215
1-5	95	1340	003.410	1.9	1.65	1.65		81	77	5.5	249	66	313
1-4	100	1345	006.925	1.9	1.65	1.65		82	77	5.3	243	66	236
1-3	105	1350	010.420	1.8	1.56	1.56		86	77	5.3	245	67	out
1-2	110	1355	013.900	1.75	1.52	1.52		89	78	5.3	249	69	out
1-1	115	1400	017.295	1.3	1.12	1.12		88	78	4.3	252	69	—
~	120	1405	020.758	~	—	~	~	—	—	—	—	—	—

leak test - dead stopped @ 7" Hg

CLEAN-UP DATA

Plant BOSTON EDISON Comments:

Date 10/1/81

Sampling Location

Sample Type

Run Number 2-OL

Sample Box Number

Clean-up Man STOKES/MEADOWS/HARRIS

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	231 ml	124 ml	2m ml	ml	ml
Initial Vol.	100 ml	100 ml	0m ml	ml	ml
Net Vol.	131 ml	24 ml	2m ml	ml	ml

Total Net Volume in Impingers 156 ml

SILICA GEL

Final Weight	249.6 g	g	g
Initial Weight	200 g	g	g
Net Weight	49.6 g	g	g

Total Net Weight in Silica Gel ~~205.6~~ 49.6 g

Total Moisture 205.6 g

Filter Number(s) 206697-21

MRC 7/73

ISOKINETIC CALCULATION

Plant BOSTON (MYSTIC) EDISON

Run # 2-OL Date 10-1-81

Location OUTLET Initials

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 205.6 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 82.158 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.88 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 542.46 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (82.16)(29.88)}{(542.46)(205.6)}} = 0.108$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 6.1 %

" CO " " " " = CO = 0 %

" CO_2 " " " " = CO_2 = 11.3 %

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (6.1 + 11.3 + 0)$

Percent N_2 by volume dry basis = N_2 = 82.6 %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (11.3) + 0.32 \, (6.1) + 0.28 \, (82.6 + 0)$

M_d = 30.05

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (30.05)\ [1 - (.108)] + 18\ (.108)$ = 28.75

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = 821 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.3507 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 29.75 in.Hg

Stack gas velocity = V_s

$$V_s = (85.48)\ (C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\ (0.76)\left[\sqrt{\frac{(821)}{(29.75)(28.75)}}\right]\left[1.3507\right]$$

= 85.97 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.58 in.H_2O

Total sampling time = θ = 120 min.

Diameter of nozzle = d_n = 0.204 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^2) = 54.54 \times 10^{-4}\ (.204)^2$ = 2.270×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\ (T_s)}{(\theta)} \frac{\left[0.00267\ (V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]}{(V_s)\ (P_s)\ (A)}$$

$$I = \frac{(1.667)\ (821)}{(120)} \frac{\left[0.00267\ (205.6) + \frac{(82.158)}{(542)}\left(29.88 + \frac{(1.58)}{13.6}\right)\right]}{(85.97)\ (29.75)\ (2.270)\times 10^{-4}}$$

I = 100.1 %

NOMOGRAPH DATA (HP-65)

PLANT Boston Edison
DATE 10/1/81
SAMPLING LOCATION Inlet-North

USED ON RUN NO.: 2-IN
CALCULATOR: IT

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Run card			—
2	Initialize program		A	0.00
3	Enter average T_m (meter temp. °F + 460) If meter temp. unknown, use ambient + 20°F	~~820~~ 520 °R	R/S	T_m
4	Enter P_m (Barometric pressure at meter)	29.95 In. Hg	R/S	T_m/P_m
5	Enter P_s (static pressure in stack) [P_m ± .073 x stack gauge pressure in In. H_2O]	30.02 In. Hg	R/S	P_s
6	Enter average T_s (stack temperature + 460)	830 °R	R/S	P_s/T_s
7	Enter B_{ms} (mole fraction of H_2O vapor in gas stream)	.10 Fraction of H_2O	R/S	Fraction Dry
8	Enter MD (molecular weight of dry gas)	29.5 lbs/lb mole	R/S	Ms molecular wt of stack gas lbs/lb mole
9	Enter C_p (type "S" pitot tube coefficient)	.76	R/S	
10	Enter average Δ_p Highest Δ_p (_____)	1.45 In. H_2O	R/S	D_n theo. (nozzle dia. in inches)
11	Initialize "B"	—	B	—
12	Enter actual D_n	.204 In.	R/S	—
13	Enter $\Delta H_@$ (Calibrated pressure differential across orifice)	1.9 In. H_2O	R/S	.86 K factor
14_1	Enter actual Δ_{p_1}		E	ΔH_1 In. H_2O
14_2	Enter actual Δ_{p_2}		E	ΔH In. H_2O
14_3	Enter actual Δ_{p_3}		E	ΔH In. H_2O

EPA METHOD 5
FIELD DATA

PLANT Boston Edison
DATE Oct 1, 1981
SAMPLING LOCATION INLET-NORTH
SAMPLE TYPE M5
RUN NUMBER 2-IN-[illegible]
OPERATOR BARRETT
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.95
STATIC PRESSURE, (P_s) 30.02
FILTER NUMBER (s) 1922054-113
PITOT TUBE No. & Cp. .76

PROBE LENGTH AND TYPE 12' Stainless Steel
NOZZLE I.D. .204
ASSUMED MOISTURE, % 09
SAMPLE BOX NUMBER 7
METER BOX NUMBER 2
METER ΔH@ 1.90
K FACTOR ~~.89~~ .86
PRE-TEST LEAK CHECK RATE .012 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE _____ CFM @ ____ "Hg
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

A-59

READ AND RECORD ALL DATA EVERY 2.5 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
A1	0	10.56	742.658	.39	.34	.34	372	66	66	2	242	72	220
2	2.5		743.608	.35	.30	.38	377	68	66	2	247	72	217
3	5.0		744.355	.45	.38	.38	370	70	66	2	247	72	215
4	7.5		745.178	.69	.59	.59	369	74	66	2	249	71	227
5	10.0		746.195	.95	.81	.81	368	76	66	2	254	70	261
6	12.5		747.344	1.1	.94	.94	368	76	67	2	260	68	306
7	15.0		748.719										
B1	0	11.23	748.719	1.1	.94	.94	368	79	68	3	269	77	274
2	2.5		749.976	.98	.84	.84	371	72	68	3	280	74	244
3	5.0		750.154	.92	.79	.79	370	76	68	3	275	73	222
4	7.5		752.446	1.3	1.1	1.1	368	79	68	3	276	72	220
5	10.0		753.672	1.7	1.5	1.5	369	80	68	4	275	71	239
6	12.5		755.109	2.4	2.0	2.0	368	81	68	4	273	71	289
	15.0		756.617										

2064

PLANT Boston Edison Mystic River Pl. DATE Oct. 1, 1981 RUN NO. 2-IN

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
C1	0	11.49	756.617	2.5	2.2	2.2	375	69	69	6	278	74	294
2	2.5		758.538	1.7	1.5	1.5	374	71	69	5	288	70	264
3	5.0		759.965	1.5	1.3	1.3	373	75	69	5	286	71	235
4	7.5		761.358	1.8	1.5	1.5	373	77	68	5	279	70	229
5	10.0		762.849	1.6	1.4	1.4	373	69	69	5	253	75	272
6	12.5 (11:30)	13:29	767.129 / 767.875	1.6 / 1.8	1.5	1.5	369 / 369	70 / 70	70 / 70	4 / 5	225 / 235	71 / 68	229 / 271
	15.0		769.418	Leak check			Stop → 763.782		.008				
D1	0	13:29	769.418	1.7	1.5	1.5	364	70	70	6	288	69	285
2	2.5		770.969	1.5	1.3	1.3	376	72	70	6	279	63	260
3	5.0		772.415	1.3	1.1	1.1	376	75	70	6	268	65	246
4	7.5		773.758	1.1	.95	.95	376	77	70	6	275	68	246
5	10.0		775.070	1.0	.86	.86	375	79	70	6	275	71	246
6	12.5		776.315	.97	.83	.83	374	80	70	6	267	73	304
	15.0		777.560										
E1	0	1451	777.560	2.7	2.3	2.3	375	73	71	3	228	70	252
2	2.5		779.476	2.6	2.2	2.2	378	75	71	3	223	67	238
3	5.0		781.315	2.4	2.1	2.1	378	79	71	3	224	66	227
4	7.5		783.242	1.9	1.6	1.6	379	81	71	3	232	69	248
5	10.0		784.085	1.5	1.3	1.3	378	82	71	3	243	71	287
6	12.5		786.295	1.4	1.2	1.2	378	83	72	3	258	72	289
	15.0		787.814						77.83				
				22.19									

PLANT Boston Edison Mystic Rive DATE Oct. 1, 1981 RUN NO. 2-IN

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
F1	0	14.15	787.814	2.3	2.0	2.0	372	75	72	3	279	75	262
2	2.5		789.886	1.7	1.5	1.5	375	78	72	3	273	68	263
3	5.0		791.356	1.6	1.4	1.4	375	82	73	3	270	66	287
4	7.5		792.776	1.4	1.2	1.2	377	83	73	3	265	67	262
5	10.0		794.242	1.2	1.0	1.0	376	84	73	3	260	68	296
6	12.5		795.584	1.2	1.0	1.0	376	85	73	3	256	67	302
	15.0		796.932	1.96	Post	Leak	Check		.00	3.5	7" Hg		
			54.27										
		time during shutdown	3.34	1.1818	1.26								
			50.93										

CLEAN-UP DATA

Plant Boston Edison

Date 9/30/81

Sampling Location Inlet South

Sample Type EPA-5

Run Number 2-IS

Sample Box Number

Clean-up Man Jones/Chang

Comments: Silica gel includes weight of cup

IMPINGERS

94
250
344

	#1	#2	#3	#4	#5
Final Vol.	344 ml	ml	ml	ml	ml
Initial Vol.	200 ml	ml	ml	ml	ml
Net Vol.	144 ml	ml	ml	ml	ml

Total Net Volume in Impingers _____ ml

SILICA GEL

Final Weight	249.9 g	g	g
Initial Weight	225.0 g	g	g
Net Weight	24.9 g	g	g

Total Net Weight in Silica Gel 24.9 g

Total Moisture 168.9 g

Filter Number(s) 1922054-3

MRC 7/73

ISOKINETIC CALCULATION

Plant BOSTON EDISON

Run # 2 - IS Date 10-1-81

Location INLET Initials [illegible]

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 168.9 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 72.356 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.90 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 516 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (72.356)(29.90)}{(516)(168.9)}} = 0.097$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = — % 6.1

" CO " " " " = CO = — % 0

" CO_2 " " " " = CO_2 = — % 11.

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (\quad + \quad + \quad)$ —

Percent N_2 by volume dry basis = N_2 = — % 83

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (\quad) + 0.32 \, (\quad) + 0.28 \, (\quad + \quad)$

M_d = — 30.0

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (\quad)\ [1 - (\quad)] + 18\ (\quad)$ = 28.5 from Run #1

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = 839 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.142 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 30.00 in.Hg

Stack gas velocity = V_s

$$V_s = (85.48)\ (C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\ (0.76)\left[\sqrt{\frac{(839)}{(30.00)(28.5)}}\right]\left[1.142\right]$$

= ~~64.35~~ 73.49 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 2.24 $in.H_2O$

Total sampling time = θ = 90 min.

Diameter of nozzle = d_n = 0.240 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^2) = 54.54 \times 10^{-4}\ (0.24)^2$ = 3.142×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\ (T_s)}{(\theta)}\ \frac{\left[0.00267\ (V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]}{(V_s)\ (P_s)\ (A)}$$

$$I = \frac{(1.667)\ (839)}{(90)}\ \frac{\left[0.00267\ (168.9) + \frac{(72.356)}{(516)}\left(29.90 + \frac{(2.24)}{13.6}\right)\right]}{(\cancel{64.35}\ 73.49)\ (30.00)\ (3.142 \times 10^{-4})}$$

A-70

I = ~~109.0~~ ~~95.4~~ 104.8

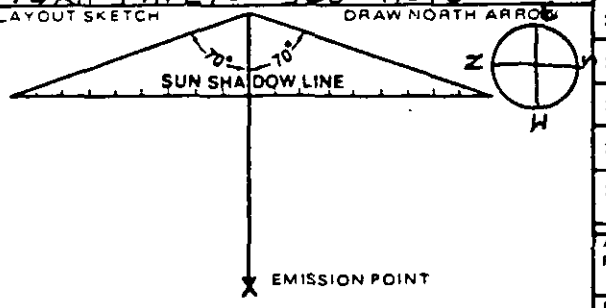
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic Plant	OBSERVER'S NAME (PRINT): Vasudev B. Kulkarni
ADDRESS: Boston	ORGANIZATION: PCS Inc.
	CERTIFIED BY: Commonwealth of KY Div. of Air Pollution — DATE: May 21, '81
STATE: Mass — ZIP: — TELEPHONE:	START TIME: 11:15 am — STOP TIME: 12:15 PM
SOURCE ID NUMBER: — OBSERVATION DATE: Oct 1 1981	
PROCESS: — OPERATING MODE:	
CONTROL EQUIPMENT: ESP — OPERATING MODE:	
DESCRIBE EMISSION POINT: A tall stack @ 500 ft	
HEIGHT ABOVE GROUND LEVEL: @ 500 ft — HEIGHT RELATIVE TO OBSERVER: @ 500 ft.	
DISTANCE FROM OBSERVER: @ 4000 ft. — DIRECTION FROM OBSERVER: SE	
DESCRIBE EMISSIONS: Particulate, SOx, NOx.	
EMISSION COLOR: Bluish White. — PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☒ YES ☐ — IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐	
AT WHAT POINT WAS OPACITY DETERMINED: @ 20-25 ft above the stack.	
DESCRIBE BACKGROUND: Over Cast with white & dark clouds.	
BACKGROUND COLOR: Grayish White — SKY CONDITIONS: Over Cast	
WIND SPEED: 5-10 mph — WIND DIRECTION: NW	
AMBIENT TEMPERATURE: 53°F — RELATIVE HUMIDITY: (70%) (Guess)	

COMMENTS: The readings are the best possible there was no sunlight. Only dispersed light was available. TURN PAPER SEE NOTE

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



	0	15	30	45		0	15	30	45	
1	5	10	5	10	31	10	10	10	5	[illegible]
2	10	10	5	10	32	5	5	5	5	55
3	5	10	10	10	33	5	5	5	5	55
4	10	5	5	5	34	5	5	5	5	45
5	5	5	5	5	35	–	–	–	–	20
6	0	5	5	0	36	–	–	–	–	10
7	0	0	0	0	37	–	–	–	–	0
8	0	5	10	10	38	–	–	–	–	25
9	5	10	10	10	39	–	–	–	–	35
10	15	10	10	5	40	–	–	–	–	40
11	5	5	5	5	41	5	5	5	5	[illegible]
12	5	5	–	–	42	5	5	5	5	[illegible]
13	–	–	–	–	43	5	5	0	0	10
14	–	–	–	–	44	5	0	0	0	5
15	–	–	–	–	45	0	0	5	5	[illegible]
16	–	–	–	–	46	5	5	5	10	25
17	–	–	5	10	47	10	10	5	5	45
18	10	10	5	10	48	10	10	10	10	75
19	5	10	5	5	49	10	15	10	10	70
20	10	10	5	5	50	10	10	10	5	65
21	5	5	5	5	51	5	5	5	5	40
22	0	0	5	0	52	5	5	5	10	30
23	5	5	5	0	53	10	10	5	10	50
24	0	0	0	0	54	10	5	5	5	25
25	0	0	0	0	55	5	5	5	5	20
26	5	0	5	5	56	5	0	0	5	25
27	5	5	5	5	57	5	5	0	0	20
28	5	5	5	5	58	0	0	0	0	[illegible]
29	0	0	0	0	59	0	5	5	5	15
30	0	0	0	0	60	5	5	5	5	[illegible]

AVERAGE OPACITY FOR FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS: MINIMUM	MAXIMUM
OBSERVER'S SIGNATURE	DATE
VERIFIED BY	I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS. SIGNATURE
	TITLE — DATE

9/81 Please see the Note on the other side.

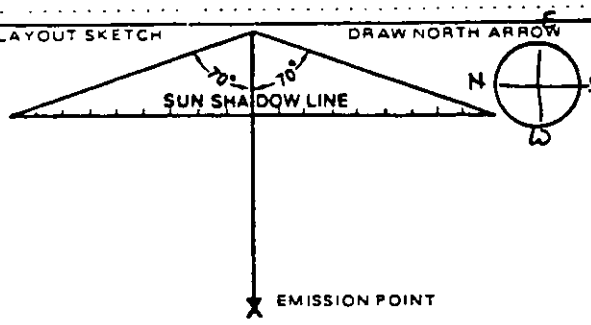
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic Plant	OBSERVER'S NAME (PRINT): Vasudev B. Kulkarni
ADDRESS: Boston	ORGANIZATION: PCS Inc.
	CERTIFIED BY: Commonwealth of KY Div. of Air Pollution — DATE: May 21, 1981
STATE: Mass — ZIP: — TELEPHONE:	START TIME: 12:30 P.M. — STOP TIME: 12:45 P.M.
SOURCE ID NUMBER: — OBSERVATION DATE:	
PROCESS: — OPERATING MODE:	
CONTROL EQUIPMENT: ESP — OPERATING MODE:	
DESCRIBE EMISSION POINT: Tall stack @ 500 ft	
HEIGHT ABOVE GROUND LEVEL: @ 500 ft — HEIGHT RELATIVE TO OBSERVER: @ 500 ft	
DISTANCE FROM OBSERVER: @ 4000 ft — DIRECTION FROM OBSERVER: SE	
DESCRIBE EMISSIONS: Particulate, SOx, NOx etc.	
EMISSION COLOR: Bluish White — PLUME TYPE: CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐	
WATER DROPLETS PRESENT: NO ☒ YES ☐ — IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐	
AT WHAT POINT WAS OPACITY DETERMINED: Just before plume started dispersing.	
DESCRIBE BACKGROUND: Overcast with white & dark clouds	
BACKGROUND COLOR: Grayish white — SKY CONDITIONS: Over Cast.	
WIND SPEED: 5-10 mph. — WIND DIRECTION: NW.	
AMBIENT TEMPERATURE: 47°F — RELATIVE HUMIDITY: (>65%) (Guess)	
COMMENTS: Turn paper See note.	

	0	15	30	45		0	15	30	45
1	5	10	10	5	31				
2	5	10	5	5	32				
3	—	—	—	—	33				
4	—	—	—	—	34				
5	—	—	—	—	35				
6	—	—	—	5	36				
7	5	5	10	10	37				
8	10	10	10	10	38				
9	10	5	10	5	39				
10	5	5	5	5	40				
11	5	0	0	0	41				
12	5	5	5	5	42				
13	—	—	5	5	43				
14	5	5	5	5	44				
15	0	0	5	5	45				
16	~~5~~	~~5~~			46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



AVERAGE OPACITY FOR FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS: MINIMUM — MAXIMUM	
OBSERVER'S SIGNATURE — DATE	I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS. SIGNATURE
VERIFIED BY	TITLE — DATE

A-72

9/81 Please see the Note on the other side.

Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic Plant

ADDRESS: Boston

STATE | ZIP | TELEPHONE

SOURCE ID NUMBER | OBSERVATION DATE

PROCESS: Elec. Generation | OPERATING MODE

CONTROL EQUIPMENT: ESP | OPERATING MODE

DESCRIBE EMISSION POINT: 500 ft Stack with 3 other stacks.

HEIGHT ABOVE GROUND LEVEL: @ 500 ft | HEIGHT RELATIVE TO OBSERVER: @ 500 ft

DISTANCE FROM OBSERVER: @ 2500 ft | DIRECTION FROM OBSERVER: SW

DESCRIBE EMISSIONS

EMISSION COLOR: Bluish White BUT at present shows a greyish brown color | PLUME TYPE: CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐ | IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED: Just before plume leveled off.

DESCRIBE BACKGROUND: Over Cast, White, Greyish Clouds

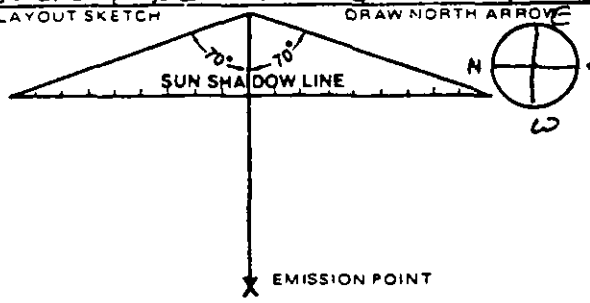
BACKGROUND COLOR: Greyish white | SKY CONDITIONS: Over Cast.

WIND SPEED | WIND DIRECTION

AMBIENT TEMPERATURE: 45-50° F | RELATIVE HUMIDITY: (assumed) > 65 %

COMMENTS: Where no readings are noted, it is due to the mixing of the emissions (smoke) from the tall stack & the other 3 stacks.

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S SIGNATURE | DATE

VERIFIED BY

OBSERVER'S NAME (PRINT): Vasudev B. Kulkarni

ORGANIZATION: PCC Inc.

CERTIFIED BY: Commonwealth of KY Div. of Air Pollution | DATE: May 22, 8

START TIME: 1:15 P.M. | STOP TIME: 2:15 P.M.

	0	15	30	45		0	15	30	45
1	0	0	0	5	31	0	0	0	0
2	5	5	5	5	32	15	15	10	10
3	0	0	0	0	33	10	5	5	10
4	0	0	0	0	34	5	5	5	5
5	0	0	0	0	35	5	5	0	0
6	0	0	0	5	36	0	0	0	0
7	5	5	5	5	37	0	5	0	0
8	5	10	10	10	38	5	5	5	0
9	10	5	5	0	39	0	0	5	5
10	0	5	0	0	40	5	0	5	5
11	0	0	10	5	41	5	5	5	0
12	5	5	5	5	42	5	10	10	5
13	5	5	5	5	43	5	5	5	—
14	10	5	10	10	44	—	—	—	—
15	10	—	—	—	45	—	—	—	—
16	—	—	—	—	46	10	5	5	5
17	—	—	—	—	47	10	15	15	15
18	—	—	—	—	48	10	15	10	10
19	0	0	0	0	49	10	10	10	15
20	5	5	5	10	50	15	10	10	10
21	10	10	10	10	51	5	5	5	5
22	15	15	15	20	52	5	5	5	5
23	20	15	15	15	53	5	5	0	0
24	15	10	5	5	54	—	—	—	—
25	—	—	—	—	55	—	—	—	—
26	—	—	—	—	56	5	5	5	5
27	—	—	—	—	57	10	15	15	10
28	—	—	—	—	58	10	10	10	10
29	—	—	—	5	59	5	10	10	5
30	5	5	5	5	60	5	5	10	10

AVERAGE OPACITY FOR FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS: MINIMUM | MAXIMUM

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

TITLE | DATE

A-73

9/81

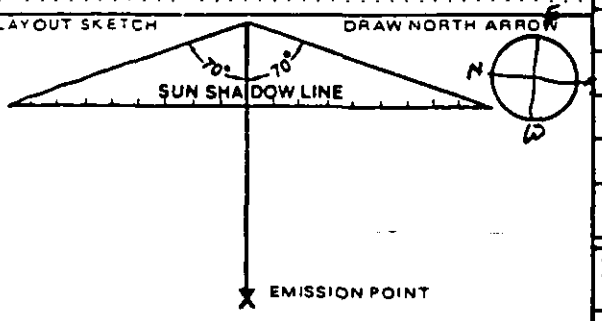
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic Plant	OBSERVER'S NAME (PRINT): Vasudev B. Kulkarni
ADDRESS: Boston	ORGANIZATION: PCS Inc.
STATE: Mass. / ZIP: / TELEPHONE:	CERTIFIED BY: Commonwealth of KY Div. of Air Pollution / DATE: May 21, 1981
SOURCE ID NUMBER: / OBSERVATION DATE:	START TIME: 2:30 P.M / STOP TIME: 3:16 P.M
PROCESS: Elec. Generation / OPERATING MODE:	
CONTROL EQUIPMENT: ESP / OPERATING MODE:	
DESCRIBE EMISSION POINT: 500 ft tall stack with 3 of the stack @ 350 ft	
HEIGHT ABOVE GROUND LEVEL: @ 500 ft / HEIGHT RELATIVE TO OBSERVER: @ 500 ft	
DISTANCE FROM OBSERVER: @ 2500 ft / DIRECTION FROM OBSERVER: SW	
DESCRIBE EMISSIONS:	
EMISSION COLOR: Bluish White but looks brownish black due to no sunshine & clouds. / PLUME TYPE: CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐	
WATER DROPLETS PRESENT: NO ☒ YES ☐ / IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐	
AT WHAT POINT WAS OPACITY DETERMINED: Just ~~above~~ ~~the~~ at the out let from stack. (See fig)	
DESCRIBE BACKGROUND: Over cast white to Dark clouds (Gray)	
BACKGROUND COLOR: Grayish White / SKY CONDITIONS: Over Cast.	
WIND SPEED: 5-10 mPH / WIND DIRECTION: NW	
AMBIENT TEMPERATURE: 48°F / RELATIVE HUMIDITY: (> 70%) assumed	
COMMENTS: SEE NOTE (TURN PAGE)	

	0	15	30	45		0	15	30	45
1	0	0	0	0	31	0	5	5	5
2	0	0	0	0	32	0	0	5	5
3	5	0	0	0	33	5	5	5	10
4	5	5	5	5	34	5	5	5	5
5	5	5	5	5	35	0	5	5	5
6	5	5	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	–	–	–	–
9	0	0	0	0	39	–	–	–	–
10	0	0	0	0	40	–	–	–	–
11	5	0	0	5	41	–	–	0	0
12	5	5	0	0	42	0	0	0	5
13	0	0	0	0	43	5	0	5	5
14	0	0	0	0	44	5	5	5	0
15	0	0	0	0	45	0	0	0	0
16	5	5	5	5	46	0	0	0	0
17	5	0	0	0	47				
18	0	0	0	0	48				
19	0	0	0	0	49				
20	0	0	0	0	50				
21	0	0	0	0	51				
22	0	0	0	0	52				
23	0	0	0	0	53				
24	0	0	0	0	54				
25	0	0	0	0	55				
26	0	0	0	0	56				
27	0	0	0	0	57				
28	0	0	0	0	58				
29	0	0	0	0	59				
30	0	5	5	5	60				

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



AVERAGE OPACITY FOR FOR HIGHEST PERIOD: / NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS: MINIMUM / MAXIMUM

OBSERVER'S SIGNATURE: / DATE:

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE:

VERIFIED BY: / TITLE: / DATE:

9/81

Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic Plant

ADDRESS: Boston

STATE: Mass. | ZIP: | TELEPHONE:

SOURCE ID NUMBER: | OBSERVATION DATE: Oct 1, 1981

PROCESS: Elec. Generation | OPERATING MODE:

CONTROL EQUIPMENT: ESP. | OPERATING MODE:

DESCRIBE EMISSION POINT: A 500ft tall stack with 3 other smaller stack

HEIGHT ABOVE GROUND LEVEL: @500ft | HEIGHT RELATIVE TO OBSERVER: @500ft

DISTANCE FROM OBSERVER: @ 2500 ft | DIRECTION FROM OBSERVER: SW

DESCRIBE EMISSIONS: SOx, NOx Particulate

EMISSION COLOR: Guess white but at present conditions seems brownish. | PLUME TYPE: CONTINUOUS ☒ INTERMITTENT ☐ FUGITIVE ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐ | IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED: @ 50-70ft above exit

DESCRIBE BACKGROUND: Cloudy & over cast + partial shower.

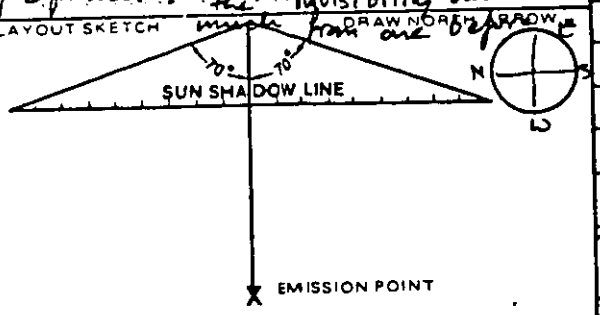
BACKGROUND COLOR: Over cast sky | SKY CONDITIONS: Over Cast

WIND SPEED: 5 MPH | WIND DIRECTION: NW

AMBIENT TEMPERATURE: 45°F | RELATIVE HUMIDITY: (>70-80%) (Guess)

COMMENTS: Started Raining at @ 3:50 P.M. (drizzle)
The readings are unapprovable to my opinion. Charged site due to the invisibility but not the smoke from are beyond

SOURCE LAYOUT SKETCH



OBSERVER'S SIGNATURE | DATE

VERIFIED BY

OBSERVER'S NAME (PRINT): Vasudev B. Kulkarni

ORGANIZATION: PCS Inc.

CERTIFIED BY: Commonwealth of KY Div. of Air Pollute. | DATE: May 21, 1981

START TIME: 3:30 P.M. | STOP TIME: 4:30 P.M.

	0	15	30	45		0	15	30	45
1	0	0	5	0	31	–	–	–	–
2	5	5	5	0	32	–	–	–	–
3	5	5	5	5	33	–	–	–	–
4	0	0	0	0	34	–	5	5	5
5	0	5	5	5	35	0	5	5	5
6	0	0	0	0	36	5	0	0	5
7	0	0	0	0	37	0	5	5	5
8	0	5	5	5	38	5	5	–	–
9	5	5	5	5	39	5	5	10	10
10	0	0	0	5	40	10	5	5	5
11	5	5	5	5	41	5	10	10	10
12	5	5	10	10	42	10	10	10	10
13	10	10	10	5	43	15	15	10	10
14	0	0	0	0	44	5	5	5	5
15	0	0	0	0	45	10	5	5	5
16	0	0	0	0	46	0	5	5	5
17	0	0	0	0	47	5	5	5	5
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	5	5	5
20	0	0	0	0	50	5	10	5	5
21	0	0	0	0	51	10	5	0	5
22	0	0	0	0	52	0	0	0	0
23	5	5	5	5	53	0	0	5	5
24	5	5	5	5	54	5	10	5	0
25	5	0	5	5	55	0	0	5	5
26	5	5	5	5	56	5	0	5	5
27	0	5	5	5	57	0	5	0	0
28	0	5	0	5	58	5	10	5	0
29	0	5	5	10	59	0	5	5	5
30	10	0	0	0	60	10	5	5	5

AVERAGE OPACITY FOR FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS MINIMUM MAXIMUM

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SIGNATURE

TITLE | DATE

A-75

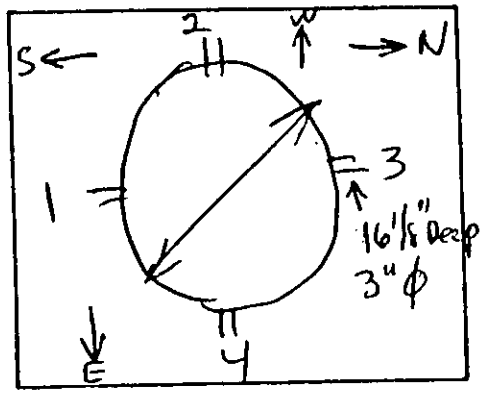
9/81

RUN 3

Outlet (OH) (5B) Outlet (OL) (5) Inlet north (IN) Inlet south (IS)	Field Data Clean-up Data Dry Molecular Weight Data Isokinetic Calculations
Plume Opacity	

EPA METHOD 5
FIELD DATA

PLANT Boston Edison
DATE 10-2-81
SAMPLING LOCATION OUTLET
SAMPLE TYPE PARTICULATE 320°F
RUN NUMBER 3-OH
OPERATOR F. MEADOWS
AMBIENT TEMPERATURE ~~84~~ 73°F
BAROMETRIC PRESSURE 29.48
STATIC PRESSURE, (P_s) −1.8 "H2O
FILTER NUMBER (s) 1922 054-116
PITOT TUBE No. & Cp. 0.86 # 10-18



SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE 11' PYREX w/10' FLEXIBLE connect
NOZZLE I.D. 0.186
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 2
METER BOX NUMBER 6
METER ΔH@ 2.00
K FACTOR
PRE-TEST LEAK CHECK RATE 0.003 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE ____ CFM @ ____ "Hg
REFERENCE Δp

0948 Test shut down due to problem with X.S. Air Restart @ 1000

Page 1 of 2

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	FLE LINE °F
		0940	751.468											
1-6	5.0	0945	754.468	2.00	1.26	1.26	361	74	76	3.0	334	65	271	34
1-5	10.0	~~0950~~ 1002	757.370	1.90	1.20	1.20	361	76	76	3.0	334	64	315	34
1-4	15.0	~~0955~~ 1007	760.276	1.90	1.20	1.20	361	77	75	3.0	335	63	324	34
1-3	20.0	~~1000~~ 1012	763.156	1.90	1.20	1.20	361	79	75	3.0	332	63	263	33
1-2	25.0	~~1005~~ 1017	765.889	1.70	1.07	1.07	361	80	75	2.7	332	64	221	33
1-1	30.0	~~1010~~ 1022	768.259	1.25	0.79	0.79	361	80	75	2.2	330	66	197	33
		1031												
4-6	35.0	1036	770.237	2.00	1.26	1.26	361	76	74	3.1	340	66	271	31
4-5	40.0	1041	774.160	1.90	1.20	1.20	361	82	74	3.0	332	62	326	31
4-4	45.0	1046	777.068	1.90	1.20	1.20	360	83	75	3.0	330	63	255	31
4-3	50.0	1051	780.050	2.00	1.26	1.26	360	83	75	3.1	331	62	241	30
4-2	55.0	1056	782.965	1.90	1.20	1.20	360	83	75	3.0	331	63	211	31
4-1	60.0	1101	785.386	1.30	0.82	0.82	357	83	75	2.3	329	65	196	31

Leak check vac at 5" Hg

PLANT Boston Edison DATE 10-7-81 RUN NO. 3-OH

Page 2 of 2

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H_2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH, in. H_2O) ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F	FLEX LINE OF
		1136	785.495											
3-6	65.0	1141	788.478	2.00	1.26	1.26	362	77	77	3.0	309	63	259	300
3-5	70.0	1146	791.450	2.00	1.26	1.26	363	79	77	3.0	315	61	301	313
3-4	75.0	1151	794.366	1.90	1.20	1.20	362	80	77	3.0	316	61	258	321
3-3	80.0	1156	797.271	1.90	1.20	1.20	362	81	77	3.0	316	61	235	326
3-2	85.0	1201	799.991	1.70	1.07	1.07	361	81	77	2.8	324	63	212	332
3-1	90.0	1206	802.397	1.30	0.82	0.82	358	82	77	2.4	330	65	197	337
	—	1214	—											
2-6	95.0	1219	805.356	2.00	1.26	1.26	360	81	77	3.2	317	63	287	331
2-5	100.0	1224	808.333	2.00	1.26	1.26	361	84	77	3.2	334	63	320	334
2-4	105.0	1229	811.295	2.00	1.26	1.26	361	84	78	3.2	303	63	260	340
2-3	110.0	1234	814.270	2.00	1.26	1.26	361	84	78	3.2	310	64	234	339
2-2	115.0	1239	817.185	1.90	1.20	1.20	361	84	78	3.1	319	66	219	336
2-1	120.0	1244	819.656	1.30	0.82	0.82	358	83	78	2.5	321	66	207	334
				Post test leak check				0 @ 5" Hg.						
				$\Sigma\sqrt{\Delta p}$										
Totals			68.079	32.2798		27.53								
Averages			corrected for leak check					78.5						
				$\overline{\sqrt{\Delta p}}$ = 1.35		1.147	360.63							

CLEAN-UP DATA

Plant Boston Edison

Date 10/1/81

Sampling Location Outlet @

Sample Type

Run Number 3-OH

Sample Box Number

Clean-up Man

Comments:

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	122 ml	138 ml	105 ml	ml	ml
Initial Vol.	100 ml	100 ml	0 ml	ml	ml
Net Vol.	22 ml	38 ml	105 ml	ml	ml

Total Net Volume in Impingers 165 ml

SILICA GEL

Final Weight	249.1 g	g	g
Initial Weight	232.6 g	g	g
Net Weight	16.5 g	g	g

Total Net Weight in Silica Gel 16.5 g

Total Moisture 181.5 g

Filter Number(s) 1922054-116

MRC 7/73

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison Mystic Station
DATE 12/5/81
SAMPLING TIME (24-hr CLOCK) 10/2/81
SAMPLING LOCATION 3 Outlet
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE
OPERATOR Day

COMMENTS: Data no good; due to time delay in analysis ambient air entered bag

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	4.0		4.0		3.7			44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	20.0		18.8		18.8			32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

use average of Runs 1 and 2 for

A-80

ISOKINETIC CALCULATION

Plant Boston Edison Mystic Station

Run # 3 OH Date 10-2-81

Location outlet Initials DRD

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 181.5 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 68.079 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.48 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 538.5 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (68.079)(29.48)}{(538.5)(181.5)}} = 0.115$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 5.55 [a] %

" CO " " " " = CO = 0.0 %

" CO_2 " " " " = CO_2 = 11.85 [a] %

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (\quad + \quad + \quad)$

Percent N_2 by volume dry basis = N_2 = 82.6 [a] %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (11.85) + 0.32 \, (5.55) + 0.28 \, (82.6 + 0)$

5.214 1.776 23.128

M_d = 30.118

[a] averaged from Runs 1 & 2

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\,[1 - (B_{ws})] + 18\,(B_{ws})$

$M_s = (30.18)\,[1 - (.115)] + 18\,(.115)$ = 28.72

26.65 + 2.07

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = 820.63 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.35 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 29.35 in.Hg

29.48 - 1.8/13.6

Stack gas velocity = V_s

$$V_s = (85.48)\,(C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\,(0.76)\left[\sqrt{\frac{(820.63)}{(29.35)(28.72)}}\right]\left[1.35\right] = 86.53 \text{ FPS}$$

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.147 in.H_2O

Total sampling time = θ = 120 min.

Diameter of nozzle = d_n = 0.186 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\,(d_n^2) = 54.54 \times 10^{-4}\,(0.186)^2$ = 1.887×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\,(T_s)}{(\theta)\,(V_s)\,(P_s)\,(A)}\left[0.00267\,(V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]$$

$$I = \frac{(1.667)\,(820.63)}{(120)\,(86.53)\,(29.35)\,(1.887\times10^{-4})}\left[0.00267\,(181.5) + \frac{(68.079)}{(538.5)}\left(29.48 + \frac{(1.147)}{13.6}\right)\right]$$

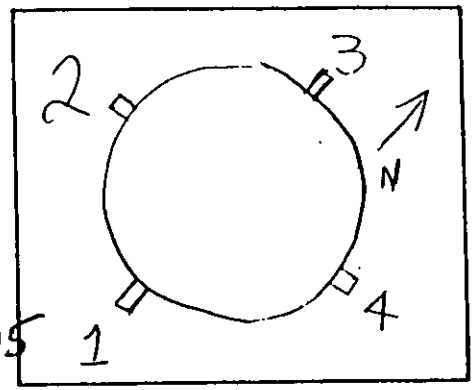
5175

I = ~~[illegible]~~ %

100.4

EPA METHOD 5
FIELD DATA

PLANT Boston Edison
DATE 10/7/81
SAMPLING LOCATION Outlet
SAMPLE TYPE Particulate (248)
RUN NUMBER 3-OL
OPERATOR DLH, LS, FM
AMBIENT TEMPERATURE 73
BAROMETRIC PRESSURE 29.48
STATIC PRESSURE, (P_s) −1.8 "H_2O
FILTER NUMBER (s) 1922-054-115
PITOT TUBE No. & Cp. 10-18 0.76



SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE 10' glass
NOZZLE I.D. 0.204
ASSUMED MOISTURE, % 12
SAMPLE BOX NUMBER 1
METER BOX NUMBER 1
METER ΔH@ 1.99
K FACTOR
PRE-TEST LEAK CHECK RATE 0.002 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE ___ CFM @ ___ "Hg
REFERENCE Δp — NA —

READ AND RECORD ALL DATA EVERY 5 MINUTES Flex line not heating

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
1-6	0	0940	20.468	2.0	1.72	1.72	See run	75	77	6.2	226	62	out
1-5	5	0945	24.125	1.9	1.65	1.65	3-OH	77	77	5.6	236	61	271
1-4	10	1002	27,580	1.9	1.65	1.65		77	75	5.5	265	63	305
1-3	15	1007	31.065	1.9	1.65	1.65		82	76	5.5	244	64	223
1-2	20	1012	34,550	1.7	1.48	1.48		85	76	5.3	228	63	220
1-1	25	1017	37.915	1.25	1.08	1.08		86	76	4.2	293	65	249
~	30	1022	40.885	~	~	~	~	~	~	~	~	~	~
4-6	30	1031	40.885	2.0	1.72	1.72		80	77	6.2	263	67	360
4-5	35	1036	44.450	1.9	1.65	1.65		84	76	5.9	243	65	368
4-4	40	1041	47.965	1.9	1.65	1.65		85	77	5.9	240	66	253
4-3	45	1046	51.455	2.0	1.72	1.72		86	77	6.2	263	66	275
4-2	50	1051	55.025	1.9	1.65	1.65		85	77	6.2	253	67	267
4-1	55	1056	58.535	1.3	1.12	1.12		84	77	4.7	251	67	255
—	60	1101	61.545	~	~	~	~	~	~	~	~	~	~

0998 shut down - plant trouble
Restart 1000

PLANT 10/2/81 DATE Boston Edison RUN NO. 3-LO 3-OL

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
3-6	60	1136	61,636	2.0	1.72	1.72	See run	77	77	6.6	250	68	316
3-5	65	1141	65,180	2.0	1.72	1.72	3-OH	82	77	6.4	255	64	392
3-4	70	1146	68,745	1.9	1.65	1.65		84	77	6.2	247	65	317
3-3	75	1151	72,250	1.9	1.65	1.65		85	77	6.2	237	67	290
3-2	80	1156	75,745	1.7	1.48	1.48		88	77	5.7	252	67	275
3-1	85	1201	79,100	1.3	1.12	1.12		89	78		261	68	260
~~2~~	90	1206	82,050										
~~2~~-6	90	1214	82,050	2.0	1.72	1.72		81	78	6.4	243	64	308
2-5	95	1219	—	2.0	1.72	1.72		86	78	6.4	243	62	392
2-4	100	1224	89,139	2.0	1.72	1.72		88	78	6.5	267	63	254
2-3	105	1229	92,700	2.0	1.72	1.72		89	78	6.5	259	65	267
2-2	110	1234	96,245	1.9	1.65	1.65		89	79	6.5	256	66	263
2-1	115	1239	99,765	1.3	1.12	1.12		88	79	4.8	240	66	255
—	120	1244	102,748										
				POST TEST		LEAK	CHECK		0	@ 7	"Hg		
				2 √ΔP									
Totals			82.189	32.279		37.73							
				L corrected for leak check									
				√ΔP									
Avg.				1.35		1.57	36.063	80.48					

CLEAN-UP DATA

Plant Boston Edison

Date 10/1/81

Sampling Location Outlet

Sample Type EPA-5

Run Number 3-OL

Sample Box Number

Clean-up Man Hughes / Thalman

Comments:

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	253 ml	120 ml	2 ml	ml	ml
Initial Vol.	100 ml	100 ml	0 ml	ml	ml
Net Vol.	153 ml	20 ml	2 ml	ml	ml

Total Net Volume in Impingers 175 ml

SILICA GEL

Final Weight	246.6 g	g	g
Initial Weight	226.7 g	g	g
Net Weight	19.9 g	g	g

Total Net Weight in Silica Gel 19.9 g

Total Moisture 194.9 g

Filter Number(s) 1922054-115

MRC 7/73

ISOKINETIC CALCULATION

Plant Boston Edison Mystic Station

Run # 3 OL Date 10-2-81

Location outlet Initials DRD

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 194.9 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 82.189 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.48 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 540.48 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (82.189)(29.48)}{(540.48)(194.9)}} = 0.104$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 5.55 [a] %

" CO " " " " = CO = 0.0 %

" CO_2 " " " " = CO_2 = 11.85 [a] %

N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (+ +)

Percent N_2 by volume dry basis = N_2 = 82.6 [a] %

Dry molecular weight = M_d

M_d = 0.44 (CO_2) + 0.32 (O_2) + 0.28 (N_2 + CO)

M_d = 0.44 (11.85) + 0.32 (5.55) + 0.28 (82.6 + 0.0)

M_d = 30.118

a averaged from Runs 1 & 2

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\ [1 - (B_{ws})] + 18\ (B_{ws})$

$M_s = (\underset{29.119}{\ }) [1 - (\underset{.104}{\ })] + 18\ (\underset{.104}{\ })$ = 28.86

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = 820.63 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.35 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 29.35 in.Hg

$29.48 - \frac{1.8}{13.6}$

Stack gas velocity = V_s

$$V_s = (85.48)\ (C_p) \left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right] \left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\ (0.76) \left[\sqrt{\frac{(820.63)}{(29.35)(28.86)}}\right] \left[1.35\right]$$

= 86.32 FPS

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.57 in.H_2O

Total sampling time = θ = 120 min.

Diameter of nozzle = d_n = 0.204 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\ (d_n^2) = 54.54 \times 10^{-4}\ (0.204)^2$ = 2.2692×10^{-4} sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\ (T_s)}{(\theta)} \frac{\left[0.00267\ (V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]}{(V_s)\ (P_s)\ (A)}$$

$$I = \frac{(1.667)\ (820.63)}{(120)} \frac{\left[0.00267\ (194.9) + \frac{(82.189)}{(540.48)}\left(29.48 + \frac{(1.57)}{13.6}\right)\right]}{(86.32)\ (29.35)\ (2.2692 \times 10^{-4})}$$

5.

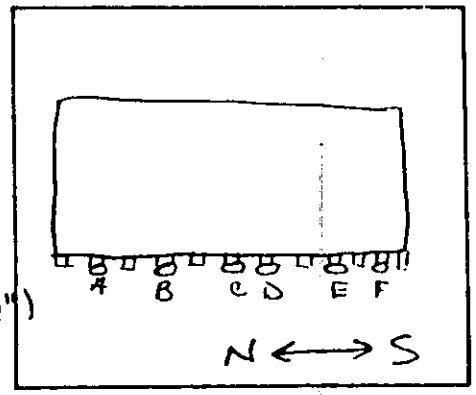
6868.

I = 99.54 %

1/80

EPA METHOD 5
FIELD DATA

PLANT Boston
DATE Oct. 2, 1981
SAMPLING LOCATION INLET-NORTH
SAMPLE TYPE M5
RUN NUMBER 3-IN
OPERATOR Barrett
AMBIENT TEMPERATURE 73
BAROMETRIC PRESSURE 29.95
STATIC PRESSURE, (P_s) 30.02 (.952")
FILTER NUMBER (s)
PITOT TUBE No. & Cp. .76



SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE 12' Stainless Steel
NOZZLE I.D. .209
ASSUMED MOISTURE, % 9
SAMPLE BOX NUMBER 7
METER BOX NUMBER 2
METER ΔH@ 1.90
K FACTOR .86
PRE-TEST LEAK CHECK RATE .004 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE .004 CFM @ 7 "Hg
REFERENCE Δp

READ AND RECORD ALL DATA EVERY 2.5 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
A1	0	9:42	797.474	.36	.31	.31	358	59	62	2	284	67	224
2	2.5	9:46 9:50 Shut down	798.212	.32	.27	.27	372	59	62	2	279	71	220
3	5.0		798.905	.38	.33	.33	372	64	64	2	267	70	231
4	7.5		799.646	.69	.60	.60	371	69	64	2	259	67	280
5	10.0		800.742	1.0	.86	.86	369	68	64	2	247	64	283
6	12.5		801.885	1.1	.94	.94	371	69	64	2	239	64	
	15.0		803.172	~~1.1~~	~~.94~~	~~.94~~							
B1	0	10:11	803.172	1.1	.94	.94	370	67	66	2	228	68	297
2	2.5		804.434	.95	.82	.82	374	68	66	2	228	63	309
3	5.0		805.719	.74	.64	.64	371	71	66	2	231	61	299
4	7.5		806.824	.81	.70	.70	372	72	66	2	223	63	300
5	10.0		807.840	1.6	1.4	1.4	371	72	67	2	234	63	322
6	12.5		809.315	1.8	1.5	1.5	367	73	67	3	243	63	300

PLANT Boston Edison, Mystic R.P. DATE Oct 2, 1981 RUN NO. 3-IN

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
C1	0	1032	810.827	2.5	2.2	2.2	376	69	68	4	280	66	270
2	2.5		812.697	1.7	1.5	1.5	375	70	68	3	274	63	267
3	5		814.300	1.4	1.2	1.2	375	74	67	3	268	64	240
4	7.5		815.729	1.5	1.3	1.3	375	76	66	3	255	63	230
5	10		817.174	1.7	1.5	1.5	375	76	68	3	246	63	271
6	12.5		818.657	2.0	1.7	1.7	372	77	68	4	235	63	306
	15.0		820.322										
D1	0	1058	820.322	1.8	1.5	1.5	378	69	68	5	245	69	230
2	2.5		821.989	1.6	1.4	1.4	378	70	68	3	247	66	229
3	5.0		823.519	1.3	1.1	1.1	378	73	68	3	247	66	229
4	7.5		824.912	1.2	1.0	1.0	378	75	68	3	240	66	250
5	10.0		826.318	1.0	.86	.86	379	77	68	3	233	66	272
6	12.5		827.465	1.1	.95	.95	378	79	69	3	241	65	308
	15.0		828.804										
E1	0		828.804	3.0	2.6	2.6	381	65	70	5	278	76	263
2	2.5		830.756	2.7	2.3	2.3	381	74	70	5	280	65	270
3	5.0		832.810	2.4	2.1	2.1	381	76	70	5	284	65	217
4	7.5		834.346	2.0	1.7	1.7	381	79	71	5	290	69	219
5	10.0		836.005	2.2	1.9	1.9	381	82	71	6	288	72	238
6	12.5		837.732	1.6	1.4	1.4	381	83	71	5	285	68	270
	15.0		839.264										

A-8

PLANT Boston Edison DATE Oct. 2, 1981 RUN NO. 3-IN

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
F1	0	1206	839.269	2.4	2.1	2.1	380	72	72	6	225	65	237
2	2.5		840.112	2.1	1.8	1.8	380	72	72	6	228	61	237
3	5.0		842.878	1.7	1.5	1.5	380	72	72	6	228	61	241
4	7.5		844.322	1.4	1.2	1.2	379	78	72	5	228	63	240
5	10		845.960	1.2	1.0	1.0	379	81	72	5	237	66	288
6	12.5		847.284	1.4	1.2	1.2	379	84	72	5	255	72	308
A+90	15.0		848.689										
				2 Σ√Δp									
Total			51.215	42.801		37.01	13,521		2532.5				
				√Δp									
Avg.				1.149		1.028	375.58		70.35				

CLEAN-UP DATA

Plant Boston Edison

Date 10/2/81

Sampling Location Inlet North

Sample Type EPA-5

Run Number 3-IN

Sample Box Number

Clean-up Man

Comments: Silca Gel includes wt of Cap.

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	189 ml	118 ml	2 ml	ml	ml
Initial Vol.	100 ml	100 ml	0 ml	ml	ml
Net Vol.	89 ml	18 ml	2 ml	ml	ml

Total Net Volume in Impingers 109 ml

SILICA GEL

Final Weight	245.7 g	g	g
Initial Weight	2209 g	g	g
Net Weight	14.8 g	g	g

Total Net Weight in Silica Gel 14.8 g

Total Moisture 123.8 g

Filter Number(s) 20697-24

MRC 7/73

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison Mystic
DATE 10/5/81
SAMPLING TIME (24-hr CLOCK) 10/2/81
SAMPLING LOCATION 3 Inlet North
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS)
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE
OPERATOR Day

COMMENTS: Data no good; due to time delay in analysis, air entered bag
ambient air into system

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	8.9		8.1		~~6.8~~			44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	18.8		17.75		17.8			32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

4

CO_2 8.0
O_2 17.4

used one mae

PA. 0

ISOKINETIC CALCULATION

Plant Boston Edison Mystic

Run # 3 - I N Date 10-2-81

Location Inlet North Initials DRD

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 123.8 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 51.215 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.95 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 530.35 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (51.215)(29.95)}{(530.35)(123.8)}} = 0.1028$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 7.95 [a] %

" CO " " " " = CO = 0.0 %

" CO_2 " " " " = CO_2 = 10.0 [a] %

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (\quad + \quad + \quad)$

Percent N_2 by volume dry basis = N_2 = 82.05 [a] %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (10.0) + 0.32 \, (7.95) + 0.28 \, (82.05 + 0)$

4.4 2.544 22.974

M_d = 29.918

[a] Average from Runs 1 and 2 outlet

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\,[1 - (B_{ws})] + 18\,(B_{ws})$

$M_s = (\underset{29.98}{\ }) [1 - (\underset{.1028}{\ })] + 18\,(\underset{.1028}{\ }) = 28.69$

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = 835.58 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.189 $(in.H_2O)^{1/2}$

Absolute pressure of stack $\underset{29.95}{P_{bar}} \pm \frac{p}{13.6}$ = P_s = 30.02 in.Hg

$\frac{.952}{13.6}$

Stack gas velocity = V_s

$$V_s = (85.48)\,(C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\,(0.76)\left[\sqrt{\frac{(835.58)}{(30.02)(28.69)}}\right]\left[1.189\right] = 76.08 \text{ FPS}$$

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 1.028 in.H_2O

Total sampling time = θ = 90 min.

Diameter of nozzle = d_n = .204 ~~0.264~~ ~~.250~~ in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\,(d_n^{\,2}) = 54.54 \times 10^{-4}\,(.204)^2 = \cancel{2.2648}\ 2.2698 \times 10^{-4}$ sq.ft.

~~3.193~~

I = percent Isokinetic

$$I = \frac{(1.667)\,(T_s)}{(\theta)\,(V_s)\,(P_s)\,(A)}\left[0.00267\,(V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]$$

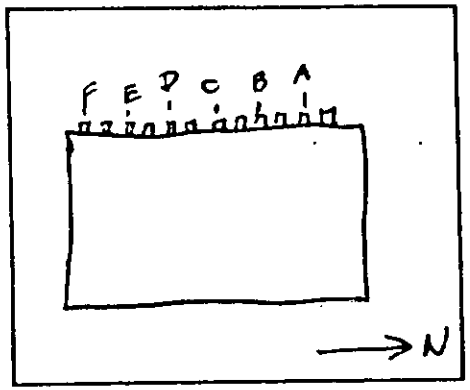
$$I = \frac{(1.667)\,(835.58)}{(90)\,(76.08)\,(30.02)\,(\cancel{2.2648}\ 2.2698 \times 10^{-4})}\left[0.00267\,(133.8) + \frac{(51.215)}{(530.35)}\left(29.95 + \frac{(1.028)}{13.6}\right)\right]$$

4499.

I = 96.43 %

EPA METHOD 5
FIELD DATA

PLANT Boston Edison
DATE 10-2-81
SAMPLING LOCATION INLET-South
SAMPLE TYPE PARTICULATE
RUN NUMBER 3-IS
OPERATOR CJ SC
AMBIENT TEMPERATURE 60
BAROMETRIC PRESSURE 29.65
STATIC PRESSURE, (P_s) 1.5" H_2O
FILTER NUMBER (s)
PITOT TUBE No. & Cp. 0.76



PROBE LENGTH AND TYPE S.S.
NOZZLE I.D. 0.240
ASSUMED MOISTURE, % 10.0
SAMPLE BOX NUMBER 6
METER BOX NUMBER 7
METER ΔH@ 1.82
K FACTOR 1.54
PRE-TEST LEAK CHECK RATE 0.016 CFM @ 15 "Hg
POST TEST LEAK CHECK RATE 0.014 CFM @ 12 "Hg
REFERENCE Δp

FLEXLINE TEMP. = 250° SCHEMATIC OF TRAVERSE POINT LAYOUT

0949 STOP
1002 RE-START

1 OF 2

READ AND RECORD ALL DATA EVERY 2.5 MINUTES

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
—	0.0	0945	363.190	-	-	-	—	-	-	-	—	—	—
A-1	2.5		365.090	1.40	2.20	2.20	374	56	56	6.5	230	57	197
2	5.0		367.100	1.50	2.30	2.30	373	59	56	6.0	235	55	255
3	7.5	1002	369.175	1.60	2.50	2.50	375	60	58	6.2	261	57	404
4	10.0		371.270	1.60	2.50	2.50	376	63	58	6.2	258	55	405
5	12.5		373.220	1.40	2.20	2.20	373	66	59	6.0	259	56	406
6	15.0	1012	375.175	1.40	2.20	2.20	372	68	59	6.0	255	57	407
B-1	17.5	1023	377.600	2.20	3.40	3.40	381	63	61	8.5	270	61	312
2	20.0		380.000	2.20	3.40	3.40	389	64	61	8.5	266	60	342
3	22.5		382.250	1.80	2.80	2.80	386	67	61	8.5	271	63	375
4	25.0		384.310	1.50	2.30	2.30	390	69	61	7.5	268	65	388
5	27.5		386.325	1.40	2.20	2.20	389	70	62	7.5	270	66	397
6	30.0	1038	388.329	1.40	2.20	2.20	390	71	62	7.5	264	67	401
C-1	32.5		390.590	2.00	3.10	3.10	372	65	64	9.0	269	63	369

PLANT Boston Edison DATE 10-2-81 RUN NO. 3-IS

20:2

TRAVERSE POINT NUMBER	ELAPSED SAMPLING TIME, min	CLOCK TIME (24 hr. CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F	PROBE TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F				
C-3	37.5		394.565	1.40	2.20	2.20	378	67	63	7.5	266	61	395
4	40.0		396.330	1.30	2.00	2.00	371	69	63	7.2	262	62	402
5	42.5		398.100	1.30	2.00	2.00	376	70	63	7.5	259	61	405
6	45.0	1102	399.910	1.30	2.00	2.00	376	71	63	7.5	258	61	408
D-1	47.5	1113	402.050	1.80	2.80	2.80	378	66	64	10.0	257	65	367
2	50.0		404.000	1.50	2.30	2.30	380	66	64	9.0	257	61	394
3	52.5		405.680	1.20	1.85	1.85	388	68	64	7.5	251	62	405
4	55.0		407.502	1.30	2.00	2.00	398	71	64	8.5	261	63	416
5	57.5		409.440	1.50	2.30	2.30	388	70	64	9.0	260	64	422
6	60.0		411.487	1.60	2.50	2.50	379	70	64	10.5	253	64	425
E-1	62.5		412.800	1.00	1.50	1.50	380	65	65	7.5	263	66	428
2	65.0		414.390	0.80	1.20	1.20	380	65	64	7.0	261	61	431
3	67.5		415.900	0.87	1.30	1.30	384	66	64	7.5	259	60	432
4	70.0		417.770	1.30	2.00	2.00	385	69	66	9.5	259	61	433
5	72.5		419.870	1.60	2.50	2.50	385	70	64	11.5	259	62	434
6	75.0	1157	421.955	1.50	2.30	2.30	386	70	64	11.5	259	62	434
F-1	77.5	1205	423.050	0.40	0.62	0.62	372	66	64	6.0	256	67	375
2	80.0		424.200	0.45	0.70	0.70	378	66	64	6.0	255	66	387
3	82.5		425.590	0.70	1.10	1.10	379	69	64	7.5	255	65	394
4	85.0		427.350	1.20	1.85	1.85	381	70	64	9.0	258	64	397
5	87.5		429.340	1.40	2.20	2.20	380	71	64	11.5	258	65	398
6	90.0	1220	431.332	1.40	2.20	2.20	383	72	64	12.0	256	66	401

CLEAN-UP DATA

Plant Boston Edison

Date ~~[illegible]~~ 10/1/81

Sampling Location Inlet South

Sample Type EPA - 5

Run Number 3 - IS

Sample Box Number

Clean-up Man Jones / Chung

Comments: Silica gel includes weight of cup

248
107
355

IMPINGERS

	#1	#2	#3	#4	#5
Final Vol.	355 ml	ml	ml	ml	ml
Initial Vol.	200 ml	~~[illegible]~~ ml	~~[illegible]~~ ml	ml	ml
Net Vol.	155 ml	ml	ml	ml	ml

Total Net Volume in Impingers 155 ml

SILICA GEL

Final Weight	254.0 g	g	g
Initial Weight	227.2 g	g	g
Net Weight	26.8 g	g	g

Total Net Weight in Silica Gel 26.8 g

Total Moisture 181.8 g

Filter Number(s) 206697-25

MRC 7/73

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Boston Edison Mystic Station
DATE 10/5/81 analysis ~~10/2/81 collection~~
SAMPLING TIME (24-hr CLOCK) 10/2/81
SAMPLING LOCATION 3 Inlet South
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) RUN #3 OUTLET INLET-SOUTH
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE
OPERATOR Day

COMMENTS: Data no good; due to time delay in analysis ambient air entered bag

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	9.75		9.25		9.45			44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	17.6		17.0		17.0			32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

use average of runs 1 + 2 for

A-98

ISOKINETIC CALCULATION

Plant Boston Edison Mystic

Run # 3-IS Date 10-2-81

Location Inlet South Initials DRD

MOISTURE

Net volume of liquid collected in impingers and silica gel = V_{1c} = 181.8 ml

Net volume of gas through dry gas meter at meter conditions = V_m = 68.142 cu.ft.

Barometric Pressure - absolute = P_{bar} = 29.65 in.Hg

Average absolute meter temperature (°F + 460) = T_m = 524.75 °R

Moisture, proportion by volume = B_{ws}

$$B_{ws} = \frac{1}{1 + \frac{373.63 \, (V_m)(P_{bar})}{(T_m)(V_{1c})}}$$

$$= \frac{1}{1 + \frac{373.63 \, (68.142)(29.65)}{(524.75)(181.8)}} = 0.112$$

MOLECULAR WEIGHT

Percent O_2 by volume dry basis = O_2 = 5.55[a] %

" CO " " " " = CO = 0.0[a] %

" CO_2 " " " " = CO_2 = 11.85[a] %

$N_2 = 100 - (O_2 + CO_2 + CO) = 100 - (\quad + \quad + \quad)$

Percent N_2 by volume dry basis = N_2 = 82.60[a] %

Dry molecular weight = M_d

$M_d = 0.44 \, (CO_2) + 0.32 \, (O_2) + 0.28 \, (N_2 + CO)$

$M_d = 0.44 \, (11.85) + 0.32 \, (5.55) + 0.28 \, (82.6 + 0)$[a]

5.21 1.776 23.13

M_d = 30.12

a Averages from Runs 1 and 2 outlet

1/80

MOLECULAR WEIGHT (Continued)

Stack gas molecular weight = M_s

$M_s = (M_d)\,[1 - (B_{ws})] + 18\,(B_{ws})$

$M_s = (30.12)\,[1 - (.112)] + 18\,(.112)$ = 28.76

VELOCITY

Pitot Tube coefficient, type S = C_p = 0.76

Average Absolute Stack Temp. (°F + 460) = T_s = 840.22 °R

Average of the square root of Δp = $\sqrt{\Delta p}$ = 1.196 $(in.H_2O)^{1/2}$

Absolute pressure of stack $P_{bar} \pm \frac{p}{13.6}$ = P_s = 29.76 in.Hg

29.65 + 1.5/13.6

Stack gas velocity = V_s

$$V_s = (85.48)\,(C_p)\left[\sqrt{\frac{(T_s)}{(P_s)(M_s)}}\right]\left[\sqrt{\Delta p}\right]$$

$$V_s = (85.48)\,(.76)\left[\sqrt{\frac{(840.22)}{(29.76)(28.76)}}\right]\left[1.196\right] = 76.98 \text{ FPS}$$

ISOKINETIC PERCENT

Average pressure drop across orifice = ΔH = 2.15 in.H_2O

Total sampling time = θ = 90 min.

Diameter of nozzle = d_n = 0.240 in.

Area of nozle = A

$A = 54.54 \times 10^{-4}\,(d_n^2) = 54.54 \times 10^{-4}\,(0.240)^2$ = ~~2.26 98~~ 3.142 $\times 10^{-4}$ sq.ft.

I = percent Isokinetic

$$I = \frac{(1.667)\,(T_s)}{(\theta)\,(V_s)\,(P_s)\,(A)}\left[0.00267\,(V_L) + \frac{(V_m)}{(T_m)}\left(P_{bar} + \frac{(\Delta H)}{13.6}\right)\right]$$

$$I = \frac{(1.667)\,(840.22)}{(90)\,(76.98)\,(29.76)\,(3.142 \times 10^{-4})}\left[0.00267\,(181.8) + \frac{(67.142)}{(524.75)}\left(29.65 + \frac{(2.15)}{13.6}\right)\right]$$

I = 94.2 %

NOMOGRAPH DATA (HP-65)

PLANT _____ USED ON RUN NO.: 3-IS

DATE _____ CALCULATOR: _____

SAMPLING LOCATION _____

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Run card			—
2	Initialize program		A	0.00
3	Enter average T_m (meter temp. °F + 460) If meter temp. unknown, use ambient + 20°F	516 °R	R/S	T_m
4	Enter P_m (Barometric pressure at meter)	29.70 In. Hg	R/S	T_m/P_m
5	Enter P_s (static pressure in stack) [P_m ± .073 x stack gauge pressure in In. H_2O]	29.81 In. Hg	R/S	P_s
6	Enter average T_s (stack temperature + 460)	839 °R	R/S	P_s/T_s
7	Enter B_{ms} (mole fraction of H_2O vapor in gas stream)	.10 Fraction of H_2O	R/S	Fraction Dry
8	Enter MD (molecular weight of dry gas)	29 lbs/lb mole	R/S	MW molecular wt of stack gas lbs/lb mole
9	Enter C_p (type "S" pitot tube coefficient)	.76 —	R/S	
10	Enter average Δ_p Highest Δ_p (_____)	1.25 In. H_2O	R/S	D_n theo. (nozzle dia. in inches)
11	Initialize "B"	—	B	—
12	Enter actual D_n	.240 In.	R/S	—
13	Enter $\Delta H_@$ (Calibrated pressure differential across orifice)	1.82 In. H_2O	R/S	K factor
14_1	Enter actual Δ_{p_1}		E	ΔH_1 In. H_2O
14_2	Enter actual Δ_{p_2}		E	ΔH In. H_2O
14_3	Enter actual Δ_{p_3} A-101		E	ΔH In. H_2O

NOMOGRAPH DATA (HP-65)

PLANT Boston Edison

DATE 10-2-81

SAMPLING LOCATION INLET SOUTH

USED ON RUN NO.: 3-IS

CALCULATOR: HP-65

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Run card			—
2	Initialize program		A	0.00
3	Enter average T_m (meter temp. °F + 460) If meter temp. unknown, use ambient + 20°F	516 °R	R/S	516 T_m
4	Enter P_m (Barometric pressure at meter)	29.70 In. Hg	R/S	17.37 T_m/P
5	Enter P_s (static pressure in stack) [P_m ± .073 x stack gauge pressure in In. H_2O]	29.81 In. Hg	R/S	29.81 P
6	Enter average T_s (stack temperature + 460)	839 °R	R/S	0.04 P_s/T
7	Enter B_{ms} (mole fraction of H_2O vapor in gas stream)	0.10 Fraction of H_2O	R/S	0.90 Fraction Dry
8	Enter MD (molecular weight of dry gas)	29.0 lbs/lb mole	R/S	27.90 M molecular wt of stack g lbs/lb mol
9	Enter C_p (type "S" pitot tube coefficient)	0.76 —	R/S	785.24
10	Enter average Δ_p Highest Δ_p (7.50)	1.25 In. H_2O	R/S	D_n theo. (nozzle dia in inches)
11	Initialize "B"	—	B	—
12	Enter actual D_n	0.240 In.	R/S	—
13	Enter $\Delta H_@$ (Calibrated pressure differential across orifice)	~~1.625~~ 1.82 In. H_2O	R/S	K facto 1.54
14_1	Enter actual Δ_{p_1}		E	ΔH_1 In. H_2
14_2	Enter actual Δ_{p_2}		E	ΔH In. H_2
14_3	Enter actual Δ_{p_3}		E	ΔH In. H_2O

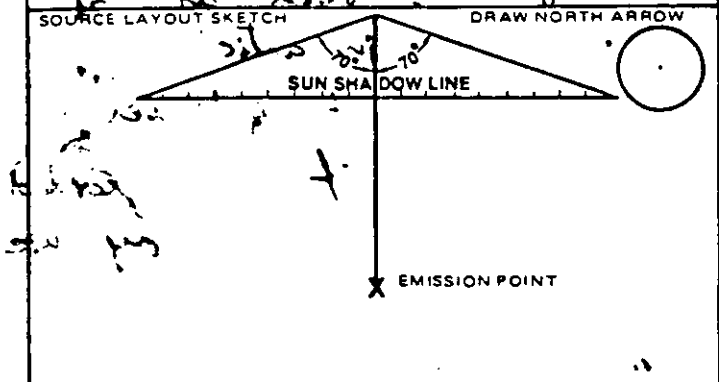
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic River	OBSERVER'S NAME (PRINT): V. B. Kulkarni
ADDRESS: Boston	ORGANIZATION: PCS Inc.
STATE / ZIP / TELEPHONE	CERTIFIED BY: Commonwealth of Ky Div. of Air Pollution — DATE: May 21, 1981
SOURCE ID NUMBER / OBSERVATION DATE: Oct 2, 81	START TIME: 10:00 AM — STOP TIME: 11:00 AM
PROCESS / OPERATING MODE	
CONTROL EQUIPMENT: ESP / OPERATING MODE	
DESCRIBE EMISSION POINT: A 500 ft tall stack	
HEIGHT ABOVE GROUND LEVEL: ~500 ft / HEIGHT RELATIVE TO OBSERVER: ~500 ft	
DISTANCE FROM OBSERVER: ~1000 ft / DIRECTION FROM OBSERVER: NW	
DESCRIBE EMISSIONS	
EMISSION COLOR / PLUME TYPE: CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐	
WATER DROPLETS PRESENT: NO ☐ YES ☐ / IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐	
AT WHAT POINT WAS OPACITY DETERMINED	
DESCRIBE BACKGROUND: Totally over cast sky.	
BACKGROUND COLOR: Dark & thick clouds sky / SKY CONDITIONS: Over Cast	
WIND SPEED: 5-8 MPH / WIND DIRECTION: SW	
AMBIENT TEMPERATURE: 45°F / RELATIVE HUMIDITY: (Rainy) > 80% (Guess)	
COMMENTS: [illegible] on the other [illegible] the page.	

	0	15	30	45		0	15	30	45
1					31	—	—	—	—
2					32	—	—	—	—
3					33	—	—	—	—
4					34	—	—	—	—
5					35	—	—	—	—
6					36	—	—	—	—
7		SEE COMMENTS			37	—	—	—	—
8					38	—	—	—	—
9					39	—	—	—	—
10					40	—	—	—	—
11					41	—	—	—	—
12					42	—	—	—	—
13					43				
14					44				
15					45				
16					46				
17					47		SEE COMMENTS		
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26	—	—	—	—	56				
27	—	—	—	—	57				
28	—	—	—	—	58				
29	—	—	—	—	59				
30	—	—	—	—	60				

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



AVERAGE OPACITY FOR FOR HIGHEST PERIOD — NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS — MINIMUM — MAXIMUM

OBSERVER'S SIGNATURE — DATE

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

VERIFIED BY — TITLE — DATE

A-103

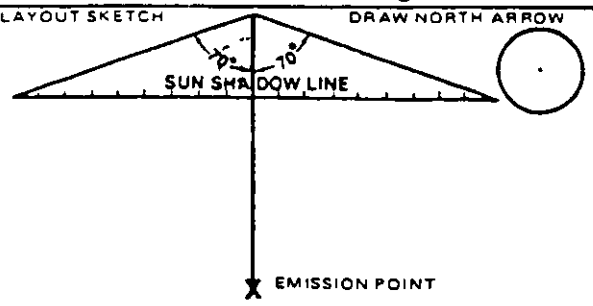
9/81

Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Boston Edison Mystic River
ADDRESS	Boston
STATE	
ZIP	
TELEPHONE	
SOURCE ID NUMBER	
OBSERVATION DATE	Oct 2, 1981
PROCESS	
OPERATING MODE	
CONTROL EQUIPMENT	ESP
OPERATING MODE	
DESCRIBE EMISSION POINT	A 500 ft high Stack
HEIGHT ABOVE GROUND LEVEL	@ 500 ft
HEIGHT RELATIVE TO OBSERVER	@ 500 ft
DISTANCE FROM OBSERVER	@ 1000 ft
DIRECTION FROM OBSERVER	NW
DESCRIBE EMISSIONS	
EMISSION COLOR	
PLUME TYPE	CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐
WATER DROPLETS PRESENT	NO ☐ YES ☐
IF YES, IS PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT WAS OPACITY DETERMINED	
DESCRIBE BACKGROUND	Totally overcast sky
BACKGROUND COLOR	Dark to White Clouds
SKY CONDITIONS	Over Cast
WIND SPEED	5 MPH
WIND DIRECTION	SW
AMBIENT TEMPERATURE	50°F
RELATIVE HUMIDITY	>80% (Guess)
COMMENTS	See note on the other side of the page

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVER'S NAME (PRINT)	V. B. Kulkarni
ORGANIZATION	PCS Inc.
CERTIFIED BY	Commonwealth of KY Div. of Air Pollution
DATE	May 21, 1981
START TIME	11:10 AM
STOP TIME	12:10 P.M.

	0	15	30	45		0	15	30	45
1	0	0	0	0	31	—	—	—	—
2	0	0	0	0	32	—	—	—	—
3	0	0	0	0	33	—	—	—	—
4	0	0	0	0	34	—	—	—	—
5	0	0	0	0	35	—	—	—	—
6	0	0	0	0	36	—	—	—	—
7	—	—	—	—	37	—	—	—	—
8	—	—	—	—	38	—	—	—	—
9	—	—	—		39	—	—	—	—
10					40	—	—	—	—
11					41				
12					42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

SEE COMMENT

See Comment

AVERAGE OPACITY FOR FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS	MINIMUM MAXIMUM
OBSERVER'S SIGNATURE	DATE
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS. SIGNATURE	
VERIFIED BY	TITLE / DATE

A-104

9/81

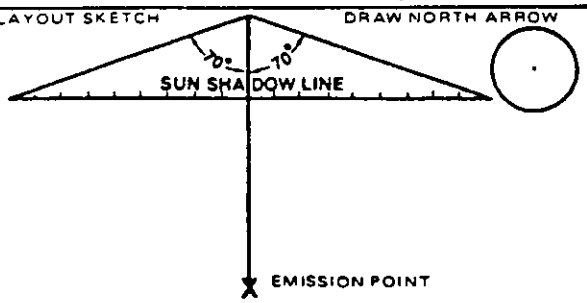
Monsanto

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Boston Edison Mystic Plant	OBSERVER'S NAME (PRINT): V. B. Kulkarni
ADDRESS: Boston	ORGANIZATION: PCS Inc.
	CERTIFIED BY: Commonwealth of Ky Div. of Air Pollution — DATE: May 21, 1981
STATE / ZIP / TELEPHONE	START TIME: 12:15 P.M. — STOP TIME: 1:15 pm
SOURCE ID NUMBER / OBSERVATION DATE	
PROCESS: Elec. Generation / OPERATING MODE	
CONTROL EQUIPMENT: ESP / OPERATING MODE	
DESCRIBE EMISSION POINT: A 500 ft tall Stack	
HEIGHT ABOVE GROUND LEVEL: @ 500 ft / HEIGHT RELATIVE TO OBSERVER: @ 500 ft	
DISTANCE FROM OBSERVER: @ 700 ft / DIRECTION FROM OBSERVER	
DESCRIBE EMISSIONS	
EMISSION COLOR / PLUME TYPE: CONTINUOUS ☐ INTERMITTENT ☐ FUGITIVE ☐	
WATER DROPLETS PRESENT: NO ☐ YES ☐ / IF YES, IS PLUME: ATTACHED ☐ DETACHED ☐	
AT WHAT POINT WAS OPACITY DETERMINED	
DESCRIBE BACKGROUND: Totally over cast sky	
BACKGROUND COLOR: Dark white Clouds Sky / SKY CONDITIONS: Over Cast	
WIND SPEED: 5 MPH / WIND DIRECTION: SW	
AMBIENT TEMPERATURE: 47°F / RELATIVE HUMIDITY: > 85% (Cloudy) (Rainy)	
COMMENTS: See note on the other side of the page.	

	0	15	30	45		0	15	30	45	
1	0	0	0	0	31	0	0	0	0	
2	0	0	0	0	32	0	0	0	0	
3	0	0	0	0	33	0	0	0	0	
4	0	0	0	0	34	0	0	0	0	
5	0	0	0	0	35	0	5	5	5	15
6	0	0	0	0	36	5	5	5	5	20
7	0	0	0	0	37	0	0	0	0	
8	0	0	0	0	38	0	0	0	0	
9	0	0	—	—	39	0	0	5	5	10
10	—	—	—	—	40	5	5	5	0	15
11	—	—	—	—	41	0	0	0	0	
12	5	5	0	0	42	0	0	0	0	10
13	5	0	0	5	43	0	5	5	0	20
14	0	0	0	0	44	0	0	0	0	
15	5	0	0	0	45	0	0	0	0	5
16	0	5	5	5	46	0	0	0	0	15
17	5	0	0	0	47	0	0	0	0	5
18	0	0	0	0	48	0	0	0	0	
19	0	0	0	0	49	0	0	0	0	
20	0	0	0	0	50	0	0	0	0	
21	0	0	0	0	51	0	0	0	0	
22	0	0	0	0	52	0	0	0	0	
23	0	0	0	0	53	—	—	—	—	
24	0	0	0	0	54	—	—	—	—	
25	0	0	0	0	55	—	—	—	—	
26	5	0	5	5	56	—	—	0	0	15
27	5	5	5	5	57	0	0	0	0	20
28	0	5	5	5	58	0	0	0	0	15
29	0	0	0	0	59	0	0	0	0	
30	0	0	0	0	60	0	0	0	0	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



AVERAGE OPACITY FOR FOR HIGHEST PERIOD | NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS — MINIMUM — MAXIMUM

OBSERVER'S SIGNATURE | DATE

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.
SIGNATURE

VERIFIED BY | TITLE | DATE

9/81

SECTION A-2

COMPUTER INPUT SHEETS

EPA - METHOD 5 - COMPUTER INPUT DATA

Company Boston Edison Mystic Station

Job No. 101.1229

Workup by Duane R. Day

Data checked by

	TT	PB	VM	VW					DN	MF	MT	DS	PM	C_p
Run #	Dur. of Run Min.	Bar. Press. in Hg	Vol. Dry Gas dcf	Total H_2O Collected ml	% CO_2	% O_2	% N_2	% CO	Probe Tip Diameter inches	Part. (front) mg	Part. (total) mg	* Stack Dia. inches	Static Stack Press. in H_2O	Pitot Tube Coeff
1-OH (SB)	240	29.69	136.31	301.1	12.4	5.0	82.6	0.0	0.186			255	-1.8	0.76
1-OL (S)	240	29.69	164.3	342.6	12.4	5.0	82.6	0.0	0.204			255	-1.8	0.76
1-IN	90	29.95	49.89	108.7	12.4	5.0	82.6	0.0	0.204			202	+0.952	0.76
1-IS	87.5	29.95	22.12	39.7	12.4	5.0	82.6	0.0	0.138			202	+1.5	0.76

A-107

* For rectangular ducts, Ds = [illegible] / $\sqrt{\pi}$

EPA - METHOD 5 - COMPUTER INPUT DATA

Company Boston Edison Mystic Station

Job No. 101.1229

Workup by Duane R. Day

Data checked by

	TT	PB	VM	VW					DN	MF	MT	DS	PM	C_p
Run #	Dur. of Run Min.	Bar. Press. in Hg	Vol. Dry Gas dcf	Total H_2O Collected ml	% CO_2	% O_2	% N_2	% CO	Probe Tip Diameter inches	Part. (front) mg	Part. (total) mg	* Stack Dia. inches	Static Stack Press. in H_2O	Pitot Tube Coeff
2-OH (SO)	120	29.88	67.95	190.3	11.3	6.1	82.6	0.0	0.186			255	-1.8	0.76
2-OL (S)	120	29.88	82.16	205.6	11.3	6.1	82.6	0.0	0.204			255	-1.8	0.76
2-IN	90	29.95	50.93	101.6	11.3	6.1	82.6	0.0	0.204			202	+0.95	0.76
2-IS	90	29.90	72.36	168.9	11.3	6.1	82.6	0.0	0.240			202	+1.5	0.76

A-108

* [illegible]

EPA - METHOD 5 - COMPUTER INPUT DATA

Company Boston Edison Mystic Station

Job No. 101. 1229

Workup by Duane R. Day

Data checked by

	TT	PB	VM	VW					DN	MF	MT	DS	PM	C_p
Run #	Dur. of Run Min.	Bar. Press. in Hg	Vol. Dry Gas dcf	Total H_2O Collected ml	% CO_2	% O_2	% N_2	% CO	Probe Tip Diameter inches	Part. (front) mg	Part. (total) mg	* Stack Dia. inches	Static Stack Press. in H_2O	Pitot Tube Coeff
3-OH (5B)	120	29.48	68.079	181.5	11.85[a]	5.55[a]	82.6[a]	0.0	0.186			255	-1.8	0.76
3-OL (5)	120	29.48	82.189	94.9	11.85[a]	5.55[a]	82.6[a]	0.0	0.204			255	-1.8	0.76
3-IN	90	29.95	51.22	123.8	11.85[a]	5.55[a]	82.6[a]	0.0	0.204			202	+0.95	0.76
3-IS	90	29.65	68.14	181.8	11.85[a]	5.55[a]	82.6[a]	0.0	0.240			202	+1.5	0.76

a Averaged from runs 1 and 2

1-109

Computer Input Data

Boston Edison 101.1221

Run No.		(I) Particulate, MF before baking, Total mg	(II) Particulate, MF after baking to constant weight Total mg	
1	OH	203.3	57.8	[illegible]
	OL	388.1	76.8	[illegible]
	IN	449.2	404.5	[illegible]
	IS	381.0	343.9	[illegible]
2.	OH	113.6	21.0	26.5
	OL	287.9	90.3	98.3
	IN	600.6	552.3	[illegible]
	IS	640.5	572.6	577.5
3	OH	107.5	35.1	[illegible]
	OL	202.1	76.6	[illegible]
	IN	639.5	582.3	[illegible]
	IS	571.8	539.9	543.6

$\Sigma\Delta = 69$

$\bar{x}\Delta = 5.8$

Duane R. Day 10/27/81

a constant weight at 160°C (320°F)

Computer Input Data

Boston Edison 10/.1221

Run No.		Sulfuric Acid, MF III mg	Sulfate, MF IV mg
1	OH	4.28	10.80
	OL	8.67	19.6
	IN	≤ 2.70	92.80
	IS	2.28	79.70
2	OH	2.20	8.84
	OL	7.99	22.3
	IN	≤ 3.17	151.
	IS	≤ 3.25	189.
3	OH	2.89	18.0
	OL	4.26	37.4
	IN	≤ 3.19	142.
	IS	≤ 1.77	141.

Duane R Day 10/27/81

SECTION A-3

POST-TEST METER AND ORIFICE SYSTEM CALIBRATION SHEETS

POST-TEST METER AND ORIFICE SYSTEM CALIBRATION

DATE 10/15/81 CONSOLE/DRY GAS METER NO. 002 PLANT [illegible]

OPERATOR [illegible] JOB NUMBER 01.1339 PRETEST Y 0.998

PRETEST ΔH@ 1.70 @ 2.5" ΔH 1.40 avg

Post Test Leak Check – OK – 0.006" Hg at 22.2" Hg

* Orifice Manometer Setting In. H_2O ΔH	System Vacuum Level in. Hg	WET TEST METER GAS VOLUMES AND TEMPERATURES						DRY TEST METER GAS VOLUMES AND TEMPERATURES						Total Test Time Minutes θ	Barometer Reading, Inches Hg P_b
		Initial		Final				Initial	Final						
		ft^3 V_{w_i}	Temp. °F T_{w_i}	ft^3 V_{w_f}	Temp. °F T_{w_f}	Net Volume ft^3 V_w	Avg. Temp. °F T_w	ft^3 V_{d_i}	ft^3 V_{d_o}	Temp. °F T_{d_i}	Temp. °F T_{d_o}	Net Volume ft^3 V_d	Avg. Temp. °F T_d		
2.50	7.0	26.662	72	31.750	72	5.088	72	52.158	57.305	87	75	5.147	81	6.00	29.35
2.50	7.0	31.750	72	36.373	72	4.623	72	57.305	61.951	91	75	4.646	83	5.46	29.35

A-1-8

* Check at least every 2 minutes and adjust if needed.

CALCULATIONS

$$Y = \frac{(V_w)(P_b)(T_d + 460)}{(V_d)\left(P + \frac{\Delta H}{13.6}\right)(T_w + 460)}$$

$$\Delta H@ = \frac{0.0317\ (\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)\ \theta}{(V_w)}\right]^2$$

Calc. By:

Checked By:

Date:

ΔH	GAMMA CALCULATIONS	Y	ΔH@ CALCULATIONS	ΔH@
2.50	$\frac{(5.088)(29.35)(81 + 460)}{(5.147)\left(29.35 + \frac{2.5}{13.6}\right)(72 + 460)}$	1.005	$\frac{0.0317\ (2.5)}{(29.35)(81 + 460)}\left[\frac{(72 + 460)(6.00)}{(5.088)}\right]^2$	1.96
2.50	$\frac{(4.623)(29.35)(83 + 460)}{(4.646)\left(29.35 + \frac{2.5}{13.6}\right)(72 + 460)}$	1.009	$\frac{0.0317\ (2.5)}{(29.35)(83 + 460)}\left[\frac{(72 + 460)(5.46)}{(4.623)}\right]^2$	1.96
	$\frac{(\quad)(\quad)(\quad + 460)}{(\quad)\left(\quad + \frac{\quad}{13.6}\right)(\quad + 460)}$		$\frac{0.0317\ (\quad)}{(\quad)(\quad + 460)}\left[\frac{(\quad + 460)(\quad)}{(\quad)}\right]^2$	

POST-TEST METER AND ORIFICE SYSTEM CALIBRATION

DATE 10/15/81 CONSOLE/~~DRY GAS METER~~ NO. 006 PLANT Boston Edison

OPERATOR JR McKeel JOB NUMBER 101.1229 PRETEST γ 1.002

PRETEST ΔH@ 2.01 @ ΔH of 1 & 1.5" H_2O

Post Test Leak check – OK – 0.002 cfm @ 27" Hg

* Orifice Manometer Setting In. H_2O ΔH	System Vacuum In. Hg	WET TEST METER GAS VOLUMES AND TEMPERATURES						DRY TEST METER GAS VOLUMES AND TEMPERATURES						Total Test Time Minutes θ	Barometer Reading, Inches Hg P_b
		Initial		Final		Net Volume	Avg. Temp.	Initial	Final			Net Volume	Avg. Temp.		
		ft^3 V_{w_i}	Temp. °F T_{w_i}	ft^3 V_{w_f}	Temp. °F T_{w_f}	ft^3 V_w	°F T_w	ft^3 V_{d_i}	ft^3 V_{d_o}	Temp. °F T_{d_i}	Temp. °F T_{d_o}	ft^3 V_d	°F T_d		
1.30	4.6	38.113	70	41.921	70	3.808	70	21.468	25.313	80	73	3.845	76.5	6.34	29.31
1.30	4.6	41.921	70	46.366	70	4.445	70	25.313	29.818	87	73	4.505	80	7.43	

A-14

* Check at least every 2 minutes and adjust if needed.

γ = 1.000

ΔH@ = 2.04

CALCULATIONS

$$\gamma = \frac{(V_w)(P_b)(T_d + 460)}{(V_d)\left(P + \frac{\Delta H}{13.6}\right)(T_w + 460)}$$

$$\Delta H@ = \frac{0.0317\ (\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)\ \theta}{(V_w)}\right]^2$$

Calc. By:

Checked By:

Date:

ΔH	GAMMA CALCULATIONS	γ	ΔH@ CALCULATIONS	ΔH@
	$\frac{(3.808)(29.31)(76.5 + 460)}{(3.845)\left(29.31 + \frac{1.3}{13.6}\right)(70 + 460)}$	0.999	$\frac{0.0317\ (1.3)}{(29.31)(76.5 + 460)}\left[\frac{(70 + 460)(6.34)}{(3.808)}\right]^2$	2.04
	$\frac{(4.445)(29.31)(80 + 460)}{(4.505)\left(29.31 + \frac{1.3}{13.6}\right)(70 + 460)}$	1.002	$\frac{0.0317\ (1.3)}{(29.31)(80 + 460)}\left[\frac{(70 + 460)(7.43)}{(4.445)}\right]^2$	2.04
	$\frac{(\quad)(\quad)(\quad + 460)}{(\quad)\left(\quad + \frac{\quad}{13.6}\right)(\quad + 460)}$		$\frac{0.0317\ (\quad)}{(\quad)(\quad + 460)}\left[\frac{(\quad + 460)(\quad)}{(\quad)}\right]^2$	

POST-TEST METER AND ORIFICE SYSTEM CALIBRATION

DATE 10/19/81 CONSOLE/~~DRY GAS METER~~ NO. 007 PLANT Boston Edison

OPERATOR [illegible] JOB NUMBER 101.1229 PRETEST Y 1.004

PRETEST ΔH@ 1.84 @ ΔH of 2.0

Post Test Leak Check – OK – 0.003 cfm @ 29" Hg

* Orifice Manometer Setting In. H_2O ΔH	System Vacuum In. Hg	WET TEST METER GAS VOLUMES AND TEMPERATURES						DRY TEST METER GAS VOLUMES AND TEMPERATURES						Total Test Time Minutes θ	Barometer Reading, Inches Hg P_b
		Initial		Final		Net Volume	Avg. Temp.	Initial	Final	Temp.	Temp.	Net Volume	Avg. Temp.		
		ft^3 V_{w_i}	Temp. °F T_{w_i}	ft^3 V_{w_f}	Temp. °F T_{w_f}	ft^3 V_w	°F T_w	ft^3 V_{d_i}	ft^3 V_{d_o}	°F T_{d_i}	°F T_{d_o}	ft^3 V_d	°F T_d		
2.00	16.9	72.022	70	78.862	70	6.840	70	34.931	41.778	71	69	6.847	70	9.00	29.32
2.00	17.5	78.862	70	88.302	70	9.440	70	41.778	51.211	70	70	9.433	71	12.40	29.32
2.00	10.4	89.268	70	94.615	70	5.347	70	52.161	57.498	73	70	5.331	71.5	7.00	29.32

A-11

• Check at least every 2 minutes and adjust if needed.

Y = 0.998

ΔH@ avg = 1.96"

CALCULATIONS

$$Y = \frac{(V_w)(P_b)(T_d + 460)}{(V_d)\left(P + \frac{\Delta H}{13.6}\right)(T_w + 460)}$$

$$\Delta H@ = \frac{0.0317\ (\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)\ \theta}{(V_w)}\right]^2$$

Calc. By:

Checked By:

Date:

ΔH	GAMMA CALCULATIONS	Y	ΔH@ CALCULATIONS	ΔH@
	$\frac{(6.840)(29.32)(70 + 460)}{(6.847)(29.32 + \frac{2}{13.6})(70 + 460)}$	0.994	$\frac{0.0317\ (2)}{(29.32)(70 + 460)}\left[\frac{(70 + 460)(9)}{(6.84)}\right]^2$	1.98
	$\frac{(9.440)(29.32)(71 + 460)}{(9.433)(29.32 + \frac{2}{13.6})(70 + 460)}$	0.998	$\frac{0.0317\ (2)}{(29.32)(71 + 460)}\left[\frac{(70 + 460)(12.4)}{(9.44)}\right]^2$	1.97
	$\frac{(5.347)(29.32)(71.5 + 460)}{(5.331)(29.32 + \frac{2}{13.6})(70 + 460)}$	1.001	$\frac{0.0317\ (2)}{(29.32)(71.5 + 460)}\left[\frac{(70 + 460)(7)}{(5.347)}\right]^2$	1.96

POST-TEST METER AND ORIFICE SYSTEM CALIBRATION

DATE 10/16/81 CONSOLE/~~DRY GAS METER~~ NO. 001 PLANT Boston Edison

OPERATOR [illegible] JOB NUMBER 101. 1229 PRETEST γ 1.004

PRETEST ΔH@ 1.96 @ 1.5" H2O ΔH

Post Test Leak Check — OK — 0.005 cfm @ 26.2" Hg

* Orifice Manometer Setting In. H_2O ΔH	System Vacuum In. Hg	WET TEST METER GAS VOLUMES AND TEMPERATURES						DRY TEST METER GAS VOLUMES AND TEMPERATURES						Total Test Time Minutes θ	Barometer Reading, Inches Hg P_b
		Initial		Final		Net Volume ft^3 V_w	Avg. Temp. °F T_w	Initial	Final	Temp. °F T_{d_i}	Temp. °F T_{d_o}	Net Volume ft^3 V_d	Avg. Temp. °F T_d		
		ft^3 V_{w_i}	Temp. °F T_{w_i}	ft^3 V_{w_f}	Temp. °F T_{w_f}			ft^3 V_{d_i}	ft^3 V_{d_o}						
1.72	8.8	58.487	71	63.398	71	4.911	71	14.102	19.132	88	75	5.030	81.5	7.00	29.37
1.72	88	63.398	71	68.377	71	4.979	71	19.132	24.212	88	76	5.080	82	7.10	29.37

A-1-8

* Check at least every 2 minutes and adjust if needed.

γ = 0.994 @ ΔH of 1.72

ΔH@ = 1.96 @ ΔH of 1.72

CALCULATIONS

$$\gamma = \frac{(V_w)(P_b)(T_d + 460)}{(V_d)\left(P + \frac{\Delta H}{13.6}\right)(T_w + 460)}$$

$$\Delta H@ = \frac{0.0317\ (\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)\ \theta}{(V_w)}\right]^2$$

Calc. By:

Checked By:

Date:

ΔH	GAMMA CALCULATIONS	γ	ΔH@ CALCULATIONS	ΔH@
1.72	$\frac{(4.911)(29.37)(81.5 + 460)}{(5.030)\left(29.37 + \frac{1.72}{13.6}\right)(71 + 460)}$	0.991	$\frac{0.0317\ (1.72)}{(29.37)(81.5 + 460)}\left[\frac{(71 + 460)(7.00)}{(4.911)}\right]^2$	1.96
1.72	$\frac{(4.979)(29.37)(54.2 + 460)}{(5.080)\left(29.37 + \frac{1.72}{13.6}\right)(71 + 460)}$	0.996	$\frac{0.0317\ (1.72)}{(29.37)(82 + 460)}\left[\frac{(71 + 460)(7.10)}{(4.979)}\right]^2$	1.96
	$\frac{(\quad)(\quad)(\quad + 460)}{(\quad)(\quad + 460)}$		$\frac{0.0317\ (\quad)}{(\quad)(\quad + 460)}\left[\frac{(\quad + 460)(\quad)}{(\quad)}\right]^2$	

APPENDIX B

PRINTOUTS OF SAMPLING RESULTS

Particulate[a] B-2
Sulfuric Acid B-23
Sulfate. B-28

[a]Inlet data for each run and location is presented only in particulate results section.

PARTICULATE

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 1-IN

TT 90.0	PB 29.95	VM 49.890	VW 108.7
CO2 12.4	O2 5.0	N2 82.6	CO 0.0
DN 0.204	MF 449.20	MT 0.00	DS 202.0
PM 0.952	CP 0.760		

DELH	TM1	TM2	TS	DELP
0.260	77.0	78.0	368.0	0.320
0.250	78.0	78.0	368.0	0.300
0.290	77.0	77.0	367.0	0.360
0.270	76.0	77.0	366.0	0.340
0.520	77.0	76.0	366.0	0.650
0.720	78.0	76.0	364.0	0.890
0.890	79.0	78.0	371.0	1.100
0.810	80.0	78.0	371.0	1.000
0.680	82.0	78.0	370.0	0.890
0.890	84.0	78.0	368.0	1.100
1.300	85.0	78.0	366.0	1.600
1.700	87.0	79.0	364.0	2.100
1.600	82.0	81.0	371.0	2.000
1.400	81.0	80.0	368.0	1.800
0.970	82.0	80.0	371.0	1.200
0.850	83.0	80.0	371.0	1.600
1.100	85.0	80.0	371.0	1.400
1.400	86.0	80.0	368.0	1.800
1.300	82.0	81.0	372.0	1.700
1.100	82.0	81.0	374.0	1.400
0.970	82.0	81.0	373.0	1.200
0.890	86.0	81.0	373.0	1.100
0.810	88.0	81.0	374.0	1.000
0.970	89.0	81.0	374.0	1.200
2.100	81.0	81.0	378.0	2.600
2.000	81.0	81.0	378.0	2.500
1.900	81.0	81.0	379.0	2.400
1.700	82.0	81.0	379.0	2.100
1.200	84.0	81.0	380.0	1.500
1.300	86.0	81.0	379.0	1.700
1.700	84.0	83.0	375.0	2.100
1.500	83.0	83.0	376.0	1.900
1.300	83.0	83.0	378.0	1.600
1.100	86.0	83.0	376.0	1.400
0.890	87.0	83.0	376.0	1.100
1.100	87.0	83.0	376.0	1.300

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 2-IN

TT 90.0	PB 29.95	VM 50.930	VW 101.6
CO2 11.3	O2 6.1	N2 82.6	CO 0.0
DN 0.204	MF 600.60	MT 0.00	DS 202.0
PM 0.952	CP 0.760		

DELH	TM1	TM2	TS	DELP
0.340	66.0	66.0	372.0	0.390
0.380	68.0	66.0	377.0	0.350
0.380	70.0	66.0	370.0	0.450
0.590	74.0	66.0	369.0	0.690
0.810	76.0	66.0	368.0	0.950
0.940	76.0	67.0	368.0	1.100
0.940	69.0	68.0	368.0	1.100
0.840	72.0	68.0	371.0	0.980
0.790	76.0	68.0	370.0	0.920
1.100	79.0	68.0	368.0	1.300
1.500	80.0	68.0	369.0	1.700
2.000	81.0	68.0	368.0	2.400
2.200	69.0	69.0	375.0	2.500
1.500	71.0	69.0	374.0	1.700
1.300	75.0	69.0	373.0	1.500
1.500	77.0	68.0	373.0	1.800
1.400	69.0	69.0	373.0	1.600
1.500	70.0	70.0	369.0	1.600
1.500	70.0	70.0	364.0	1.700
1.300	72.0	70.0	376.0	1.500
1.100	75.0	70.0	376.0	1.300
0.950	77.0	70.0	376.0	1.100
0.860	79.0	70.0	375.0	1.000
0.830	80.0	70.0	374.0	0.970
2.300	73.0	71.0	375.0	2.700
2.200	75.0	71.0	378.0	2.600
2.100	79.0	71.0	378.0	2.400
1.600	81.0	71.0	379.0	1.900
1.300	82.0	71.0	378.0	1.500
1.200	83.0	72.0	378.0	1.500
2.000	75.0	72.0	372.0	2.300
1.500	78.0	72.0	375.0	1.700
1.400	82.0	73.0	375.0	1.600
1.200	83.0	73.0	377.0	1.400
1.000	84.0	73.0	376.0	1.200
1.000	85.0	73.0	376.0	1.200

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 3-IN

TT 90.0	PB 29.95	VM 51.220	VW 123.8
CO2 11.8	O2 5.5	N2 82.6	CO 0.0
ON 0.204	MF 639.50	MT 0.00	DS 202.0
PM 0.952	CP 0.760		

DELH	TM1	TM2	TS	DELP
0.310	59.0	62.0	358.0	0.360
0.270	59.0	62.0	372.0	0.320
0.330	64.0	64.0	372.0	0.380
0.600	63.0	64.0	371.0	0.690
0.860	68.0	64.0	369.0	1.000
0.940	69.0	64.0	371.0	1.100
0.940	67.0	66.0	370.0	1.100
0.820	68.0	66.0	374.0	0.950
0.640	71.0	66.0	371.0	0.740
0.700	72.0	66.0	372.0	0.810
1.400	72.0	67.0	371.0	1.600
1.500	73.0	67.0	367.0	1.800
2.200	69.0	68.0	376.0	2.500
1.500	70.0	68.0	375.0	1.700
1.200	74.0	67.0	375.0	1.400
1.300	76.0	66.0	375.0	1.500
1.500	76.0	68.0	375.0	1.700
1.700	77.0	68.0	375.0	2.000
1.500	69.0	68.0	378.0	1.800
1.400	70.0	68.0	378.0	1.600
1.100	73.0	68.0	378.0	1.300
1.000	75.0	68.0	378.0	1.200
0.860	77.0	68.0	379.0	1.000
0.950	79.0	69.0	378.0	1.100
2.600	65.0	70.0	381.0	3.000
2.300	74.0	70.0	381.0	2.700
2.100	76.0	70.0	381.0	2.400
1.700	79.0	71.0	381.0	2.000
1.900	82.0	71.0	381.0	2.200
1.400	83.0	71.0	381.0	1.600
2.100	72.0	72.0	380.0	2.400
1.800	72.0	72.0	380.0	2.100
1.500	72.0	72.0	380.0	1.700
1.200	78.0	72.0	379.0	1.400
1.000	81.0	72.0	379.0	1.200
1.200	84.0	72.0	379.0	1.400

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 1-IS

TT 87.5	PB 29.95	VM 22.120	VW 39.7
CO2 12.4	O2 5.0	N2 82.6	CO 0.0
DN 0.138	MF 381.00	MT 0.00	DS 202.0
PM 1.500	CP 0.760		

DELH	TM1	TM2	TS	DELP
0.230	70.0	70.0	372.0	1.200
0.230	71.0	70.0	371.0	1.200
0.230	72.0	70.0	370.0	1.200
0.230	72.0	70.0	370.0	1.200
0.100	74.0	71.0	370.0	0.250
0.030	78.0	78.0	373.0	0.150
0.420	74.0	75.0	373.0	2.200
0.380	73.0	75.0	372.0	2.000
0.320	73.0	75.0	372.0	1.700
0.290	75.0	75.0	375.0	1.500
0.290	75.0	76.0	379.0	1.500
0.480	77.0	78.0	372.0	2.500
0.340	76.0	78.0	372.0	1.800
0.210	76.0	78.0	371.0	1.100
0.210	76.0	78.0	378.0	1.100
0.190	75.0	76.0	364.0	1.000
0.230	74.0	76.0	376.0	1.200
0.320	72.0	73.0	374.0	1.700
0.270	70.0	70.0	373.0	1.400
0.210	68.0	69.0	374.0	1.100
0.250	68.0	69.0	374.0	1.300
0.290	69.0	68.0	377.0	1.500
0.320	69.0	68.0	381.0	1.700
0.290	66.0	66.0	373.0	1.500
0.190	66.0	66.0	374.0	1.000
0.160	67.0	66.0	375.0	0.850
0.190	68.0	66.0	376.0	1.000
0.180	69.0	66.0	376.0	0.950
0.170	70.0	66.0	376.0	0.900
0.060	64.0	65.0	376.0	0.300
0.070	66.0	65.0	375.0	0.350
0.080	67.0	66.0	375.0	0.400
0.150	68.0	66.0	374.0	0.800
0.190	69.0	66.0	376.0	1.000
0.290	69.0	66.0	376.0	1.500

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 2-IS

TT 90.0	PB 29.90	VM 72.360	VW 168.9
CO2 11.3	O2 6.1	N2 82.6	CO 0.0
DN 0.240	MF 640.50	MT 0.00	DS 202.0
PM 1.500	CP 0.760		

DELH	TM1	TM2	TS	DELP
0.750	53.0	53.0	379.0	0.450
0.750	54.0	53.0	379.0	0.450
0.840	57.0	53.0	380.0	0.500
1.500	58.0	53.0	380.0	0.900
1.700	60.0	53.0	387.0	1.000
2.500	60.0	53.0	398.0	1.500
1.700	55.0	54.0	377.0	1.000
1.700	57.0	54.0	379.0	1.000
1.700	60.0	54.0	380.0	1.000
1.800	61.0	54.0	381.0	1.100
2.500	62.0	54.0	385.0	1.500
3.300	63.0	54.0	386.0	2.000
2.700	56.0	55.0	378.0	1.600
2.000	56.0	55.0	379.0	1.200
2.000	58.0	55.0	380.0	1.200
2.000	61.0	55.0	381.0	1.200
2.300	62.0	55.0	384.0	1.400
2.700	63.0	55.0	377.0	1.600
3.200	56.0	56.0	376.0	1.900
3.700	56.0	55.0	378.0	2.200
2.700	56.0	55.0	377.0	1.600
2.800	57.0	55.0	378.0	1.700
2.300	57.0	55.0	380.0	1.400
1.700	59.0	55.0	380.0	1.000
3.500	55.0	55.0	378.0	2.200
3.000	55.0	55.0	377.0	1.800
3.000	55.0	55.0	376.0	1.800
2.700	55.0	55.0	380.0	1.600
2.200	56.0	55.0	382.0	1.300
2.200	57.0	55.0	380.0	1.300
1.300	56.0	56.0	367.0	0.750
2.500	57.0	56.0	374.0	1.500
2.500	58.0	56.0	374.0	1.500
2.300	58.0	56.0	376.0	1.400
2.300	58.0	56.0	374.0	1.400
2.300	59.0	56.0	378.0	1.400

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 3-IS

TT 90.0	PB 29.65	VM 68.140	VW 181.8
CO2 11.8	O2 5.5	N2 82.6	CO 0.0
DN 0.240	MF 571.80	MT 0.00	DS 202.0
PM 1.500	CP 0.760		

DELH	TM1	TM2	TS	DELP
2.200	56.0	56.0	374.0	1.400
2.300	59.0	56.0	373.0	1.500
2.500	60.0	58.0	375.0	1.600
2.500	63.0	58.0	376.0	1.600
2.200	66.0	59.0	373.0	1.400
2.200	68.0	59.0	372.0	1.400
3.400	63.0	61.0	381.0	2.200
3.400	64.0	61.0	389.0	2.200
2.800	67.0	61.0	386.0	1.800
2.300	69.0	61.0	390.0	1.500
2.200	70.0	62.0	389.0	1.400
2.200	71.0	62.0	390.0	1.400
3.100	65.0	64.0	372.0	2.000
2.800	65.0	63.0	373.0	1.800
2.200	67.0	63.0	378.0	1.400
2.000	69.0	63.0	371.0	1.300
2.000	70.0	63.0	376.0	1.300
2.000	71.0	63.0	376.0	1.300
2.800	66.0	64.0	378.0	1.800
2.300	66.0	64.0	380.0	1.500
1.850	68.0	64.0	388.0	1.200
2.000	71.0	64.0	388.0	1.300
2.300	70.0	64.0	388.0	1.500
2.500	70.0	64.0	379.0	1.600
1.500	65.0	65.0	380.0	1.000
1.200	65.0	64.0	380.0	0.800
1.300	66.0	64.0	384.0	0.870
2.000	69.0	66.0	385.0	1.300
2.500	70.0	64.0	385.0	1.600
2.300	70.0	64.0	386.0	1.500
0.620	66.0	64.0	372.0	0.400
0.700	66.0	64.0	378.0	0.450
1.100	69.0	64.0	379.0	0.700
1.850	70.0	64.0	381.0	1.200
2.200	71.0	64.0	380.0	1.400
2.200	72.0	64.0	383.0	1.400

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	IN HG	29.95	29.95	29.95	29.95	29.90	29.65
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.104	1.260	1.287	0.231	2.240	2.153
VM	VOL DRY GAS(METER CON)	DCF	49.890	50.930	51.220	22.120	72.360	68.140
TM	AVG GAS METER TEMP	DEG F	81.3	72.7	70.2	70.9	56.2	64.7
VMSTD	VOL DRY GAS (STD COND)	DSCF	48.85	50.70	51.23	22.04	74.39	68.32
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	SCF	5.120	4.785	5.831	1.870	7.955	8.563
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.396	1.461	1.493	1.201	1.343	1.389
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	372.	373.	376.	374.	379.	380.
PM	STACK PRESSURE(STATIC)	IN H2O	0.95	0.95	0.95	1.50	1.50	1.50
PS	STACK PRESSURE (ABS)	IN HG	30.02	30.02	30.02	30.06	30.01	29.76
VS	AVG STACK GAS VELOCITY	FPM	4377.	4502.	4552.	4036.	4379.	4496.
DS	STACK DIAMETER	INCHES	202.00	202.00	202.00	202.00	202.00	202.00
AS	STACK AREA	SQ IN	32047.4	32047.4	32047.4	32047.4	32047.4	32047.4
QS	STACK FLOW RT(DRY STD)	DSCFM	563391.	584300.	578798.	528684.	557547.	557838.
QA	STACK FLOW RT(ACTUAL)	ACFM	974186.	1001952.	1013108.	898247.	974515.	1000643.
DN	PROBE TIP DIAMETER	INCHES	0.204	0.204	0.204	0.138	0.240	0.240
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	449.20	600.60	639.50	381.00	640.50	571.80
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	GR/DSCF	0.1416	0.1824	0.1922	0.2662	0.1326	0.1289
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0816	0.1060	0.1094	0.1562	0.0756	0.0716
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	LB/HR	683.715	913.552	953.597	1206.288	633.583	616.184
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.000

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	CM HG	76.07	76.07	76.07	76.07	75.95	75.31
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.803	3.200	3.268	0.587	5.690	5.469
VM	VOL DRY GAS(METER CON)	DCM	1.413	1.442	1.451	0.626	2.049	1.930
TM	AVG GAS METER TEMP	DEG C	27.4	22.6	21.2	21.6	13.4	18.2
VMSTD	VOL DRY GAS (STD COND)	DNCM	1.38	1.44	1.45	0.62	2.11	1.93
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	NCM	0.145	0.136	0.165	0.053	0.225	0.242
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	CM H2O	3.545	3.711	3.792	3.052	3.411	3.529
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG C	189.	190.	191.	190.	193.	193.
PM	STACK PRESSURE(STATIC)	CM H2O	2.42	2.42	2.42	3.81	3.81	3.81
PS	STACK PRESSURE (ABS)	CM HG	76.25	76.25	76.25	76.35	76.23	75.59
VS	AVG STACK GAS VELOCITY	MPM	1334.	1372.	1388.	1230.	1335.	1370.
DS	STACK DIAMETER	CM	513.08	513.08	513.08	513.08	513.08	513.08
AS	STACK AREA	SQ CM	206769.5	206769.5	206769.5	206769.5	206769.5	206769.5
QS	STACK FLOW RT(DRY STD)	DNCMPM	15955.	16547.	16392.	14972.	15790.	15798.
QA	STACK FLOW RT(ACTUAL)	ACMPM	27589.	28375.	28691.	25438.	27598.	28338.
DN	PROBE TIP DIAMETER	CM	0.518	0.518	0.518	0.351	0.610	0.610
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	449.20	600.60	639.50	381.00	640.50	571.80
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	G/DNCM	0.3241	0.4176	0.4400	0.6094	0.3035	0.2950
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	G/ACM	0.1868	0.2427	0.2505	0.3574	0.1730	0.1639
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	KG/HR	310.133	414.387	432.552	547.172	287.393	279.501
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0.000

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 1-OH

TT 240.0	PB 29.69	VM 136.310	VW 301.1
CO2 12.4	O2 5.0	N2 82.6	CO 0.0
DN 0.186	MF 203.30	MT 0.00	DS 255.0
PM -1.800	CP 0.760		

DELH	TM1	TM2	TS	DELP
1.220	75.0	78.0	361.0	1.900
1.220	79.0	77.0	361.0	1.900
1.220	81.0	77.0	361.0	1.900
1.120	81.0	77.0	361.0	1.800
1.060	80.0	76.0	361.0	1.700
1.120	80.0	76.0	361.0	1.800
1.100	82.0	75.0	361.0	1.750
1.100	84.0	75.0	360.0	1.750
1.000	86.0	75.0	359.0	1.600
1.000	84.0	76.0	359.0	1.600
0.820	84.0	76.0	357.0	1.300
0.820	83.0	76.0	358.0	1.300
1.280	77.0	77.0	360.0	2.000
1.280	80.0	76.0	360.0	2.050
1.280	83.0	77.0	360.0	2.000
1.280	83.0	76.0	360.0	2.000
1.280	84.0	77.0	360.0	2.000
1.280	85.0	77.0	360.0	2.000
1.220	86.0	77.0	360.0	1.950
1.220	86.0	77.0	360.0	1.950
1.150	87.0	78.0	360.0	1.850
1.150	87.0	78.0	360.0	1.850
0.840	87.0	78.0	358.0	1.350
0.940	87.0	79.0	358.0	1.500
1.280	89.0	84.0	359.0	2.000
1.280	92.0	85.0	359.0	2.000
1.280	93.0	85.0	359.0	2.000
1.280	93.0	85.0	358.0	2.000
1.280	94.0	85.0	359.0	2.000
1.200	93.0	85.0	358.0	1.900
1.200	93.0	87.0	358.0	1.900
1.200	94.0	86.0	358.0	1.900
1.150	94.0	86.0	358.0	1.850
1.060	94.0	86.0	357.0	1.700
1.000	93.0	86.0	356.0	1.600
1.300	82.0	84.0	360.0	2.050
1.300	87.0	83.0	360.0	2.050
1.280	89.0	83.0	359.0	2.000
1.280	87.0	83.0	359.0	2.000
1.220	85.0	82.0	359.0	1.950
1.280	84.0	82.0	359.0	2.000
1.300	84.0	82.0	360.0	2.050
1.300	84.0	81.0	360.0	2.050
1.120	84.0	81.0	359.0	1.800
1.100	82.0	81.0	359.0	1.750
0.820	82.0	80.0	358.0	1.300
0.820	81.0	80.0	358.0	1.300

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 2-OH

TT 120.0	PB 29.88	VM 67.953	VW 190.3
CO2 11.3	O2 6.1	N2 82.6	CO 0.0
DN 0.186	MF 113.60	MT 0.00	DS 255.0
PM -1.800	CP 0.760		

DELH	TM1	TM2	TS	DELP
1.300	78.0	80.0	360.0	2.100
1.280	78.0	80.0	361.0	2.050
1.260	77.0	79.0	361.0	2.000
1.260	79.0	78.0	361.0	2.000
1.120	79.0	77.0	361.0	1.800
0.880	78.0	76.0	360.0	1.400
1.280	79.0	74.0	362.0	2.050
1.220	81.0	74.0	361.0	1.950
1.220	81.0	74.0	361.0	1.950
1.260	81.0	74.0	361.0	2.000
1.200	81.0	74.0	360.0	1.900
0.820	81.0	75.0	358.0	1.300
1.260	77.0	77.0	363.0	2.000
1.200	81.0	77.0	363.0	1.900
1.260	81.0	77.0	363.0	2.000
1.200	82.0	77.0	361.0	1.900
1.120	84.0	77.0	360.0	1.800
0.820	84.0	78.0	359.0	1.300
1.200	77.0	78.0	361.0	1.950
1.200	79.0	78.0	361.0	1.900
1.200	80.0	77.0	360.0	1.900
1.120	81.0	77.0	360.0	1.800
1.080	81.0	77.0	359.0	1.750
0.820	81.0	77.0	357.0	1.300

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 3-OH

TT 120.0	PB 29.48	VM 68.079	VW 181.5
CO2 11.8	O2 5.5	N2 82.6	CO 0.0
DN 0.186	MF 107.50	MT 0.00	DS 255.0
PM -1.800	CP 0.760		

DELH	TM1	TM2	TS	DELP
1.260	74.0	76.0	361.0	2.000
1.200	76.0	76.0	361.0	1.900
1.200	77.0	75.0	361.0	1.900
1.200	79.0	75.0	361.0	1.900
1.070	80.0	75.0	361.0	1.700
0.790	80.0	75.0	361.0	1.250
1.260	76.0	74.0	361.0	2.000
1.200	82.0	74.0	361.0	1.900
1.200	83.0	75.0	360.0	1.900
1.260	83.0	75.0	360.0	2.000
1.200	83.0	75.0	360.0	1.900
0.820	83.0	75.0	357.0	1.300
1.260	77.0	77.0	362.0	2.000
1.260	79.0	77.0	363.0	2.000
1.200	80.0	77.0	362.0	1.900
1.200	81.0	77.0	362.0	1.900
1.070	81.0	77.0	361.0	1.700
0.820	82.0	77.0	358.0	1.300
1.260	81.0	77.0	360.0	2.000
1.260	84.0	77.0	361.0	2.000
1.260	84.0	78.0	361.0	2.000
1.260	84.0	78.0	361.0	2.000
1.200	84.0	78.0	361.0	1.900
0.820	83.0	78.0	358.0	1.300

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 1-OL

TT 240.0	P8 29.69	VM 164.300	VW 342.6
CO2 12.4	O2 5.0	N2 82.6	CO 0.0
DN 0.204	MF 388.10	MT 0.00	DS 255.0
PM -1.800	CP 0.760		

DELH	TM1	TM2	TS	DELP
1.650	79.0	82.0	361.0	1.900
1.650	82.0	81.0	361.0	1.900
1.650	85.0	81.0	361.0	1.900
1.560	86.0	81.0	361.0	1.800
1.480	85.0	80.0	361.0	1.700
1.560	86.0	80.0	361.0	1.800
1.520	89.0	80.0	361.0	1.750
1.520	90.0	80.0	360.0	1.750
1.400	91.0	80.0	359.0	1.600
1.400	91.0	80.0	359.0	1.600
1.120	90.0	80.0	357.0	1.300
1.120	89.0	80.0	358.0	1.300
1.720	78.0	79.0	360.0	2.000
1.770	79.0	78.0	360.0	2.050
1.720	81.0	78.0	360.0	2.000
1.720	81.0	78.0	360.0	2.000
1.720	82.0	78.0	360.0	2.000
1.720	83.0	78.0	360.0	2.000
1.690	83.0	78.0	360.0	1.950
1.690	84.0	78.0	360.0	1.950
1.600	84.0	78.0	360.0	1.850
1.600	84.0	78.0	360.0	1.850
1.170	83.0	78.0	358.0	1.350
1.300	85.0	78.0	358.0	1.500
1.720	85.0	83.0	359.0	2.000
1.720	90.0	84.0	359.0	2.000
1.720	95.0	84.0	359.0	2.000
1.720	84.0	97.0	359.0	2.000
1.720	97.0	85.0	358.0	2.000
1.720	98.0	86.0	359.0	2.000
1.650	99.0	86.0	358.0	1.900
1.650	99.0	87.0	358.0	1.900
1.650	100.0	87.0	358.0	1.900
1.600	100.0	88.0	358.0	1.850
1.480	101.0	88.0	357.0	1.700
1.400	101.0	89.0	356.0	1.600
1.770	84.0	86.0	360.0	2.050
1.770	87.0	85.0	360.0	2.050
1.720	91.0	85.0	359.0	2.000
1.720	88.0	84.0	359.0	2.000
1.690	85.0	83.0	359.0	1.950
1.720	84.0	83.0	359.0	2.000
1.770	84.0	83.0	360.0	2.050
1.770	83.0	82.0	360.0	2.050
1.560	83.0	81.0	359.0	1.800
1.520	82.0	80.0	359.0	1.750
1.120	83.0	81.0	358.0	1.300
1.120	82.0	80.0	358.0	1.300

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 2-OL

TT 120.0	PB 29.88	VM 82.158	VW 205.6
CO2 11.3	O2 6.1	N2 82.6	CO 0.0
DN 0.204	MF 287.90	MT 0.00	DS 255.0
PM -1.800	CP 0.760		

DELH	TM1	TM2	TS	DELP
1.820	79.0	81.0	360.0	2.100
1.770	81.0	80.0	361.0	2.050
1.720	81.0	80.0	361.0	2.000
1.720	81.0	80.0	361.0	2.000
1.560	82.0	81.0	361.0	1.800
1.220	80.0	79.0	360.0	1.400
1.770	75.0	75.0	362.0	2.050
1.690	83.0	74.0	361.0	1.950
1.690	83.0	75.0	361.0	1.950
1.720	83.0	74.0	361.0	2.000
1.650	83.0	75.0	360.0	1.900
1.120	83.0	76.0	358.0	1.300
1.720	77.0	76.0	363.0	2.000
1.650	83.0	76.0	363.0	1.900
1.720	85.0	76.0	363.0	2.000
1.650	85.0	77.0	361.0	1.900
1.560	86.0	77.0	368.0	1.800
1.120	86.0	77.0	359.0	1.300
1.650	77.0	77.0	361.0	1.950
1.650	81.0	77.0	361.0	1.900
1.650	82.0	77.0	360.0	1.900
1.560	86.0	77.0	360.0	1.800
1.520	89.0	78.0	359.0	1.750
1.120	88.0	78.0	357.0	1.300

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING

INPUT DATA FOR RUN 3-OL

TT 120.0	PB 29.48	VM 82.189	VW 94.9
CO2 11.8	O2 5.5	N2 82.6	CO 0.0
DN 0.204	MF 202.10	MT 0.00	DS 255.0
PM -1.800	CP 0.760		

DELH	TM1	TM2	TS	DELP
1.720	75.0	77.0	361.0	2.000
1.650	77.0	77.0	361.0	1.900
1.650	77.0	75.0	361.0	1.900
1.650	82.0	76.0	361.0	1.900
1.480	85.0	76.0	361.0	1.700
1.080	86.0	76.0	361.0	1.250
1.720	80.0	77.0	361.0	2.000
1.650	84.0	76.0	361.0	1.900
1.650	85.0	77.0	360.0	1.900
1.720	86.0	77.0	360.0	2.000
1.650	85.0	77.0	360.0	1.900
1.120	84.0	77.0	357.0	1.300
1.720	77.0	77.0	362.0	2.000
1.720	82.0	77.0	363.0	2.000
1.650	84.0	77.0	362.0	1.900
1.650	85.0	77.0	362.0	1.900
1.480	88.0	77.0	361.0	1.700
1.120	89.0	78.0	358.0	1.300
1.720	81.0	78.0	360.0	2.000
1.720	86.0	78.0	361.0	2.000
1.720	88.0	78.0	361.0	2.000
1.720	89.0	78.0	361.0	2.000
1.650	89.0	79.0	361.0	1.900
1.120	88.0	79.0	358.0	1.300

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING
EPA 90 PROGRAM CALCULATION
(English Units)

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-OL
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	120.0
PB	BAROMETRIC PRESSURE	IN HG	29.69	29.88	29.48	29.69	29.88	29.48
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.156	1.149	1.147	1.584	1.584	1.572
VM	VOL DRY GAS(METER CON)	DCF	136.310	67.953	68.079	164.300	82.158	82.189
TM	AVG GAS METER TEMP	DEG F	82.8	78.4	78.4	84.7	79.8	80.5
VMSTD	VOL DRY GAS (STD COND)	DSCF	131.96	66.75	65.98	158.68	80.58	79.43
VW	TOTAL H2O COLLECTED	ML	301.1	190.3	181.5	342.6	205.6	94.9
VWG	VOL H2O VAPOR(STD CON)	SCF	14.182	8.963	8.549	16.136	9.684	4.470
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5.33
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.947
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.6
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.3
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	29.5
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.829	1.833	1.819	1.832	1.833	1.819
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	359.	361.	361.	359.	361.	361.
PM	STACK PRESSURE(STATIC)	IN H2O	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80
PS	STACK PRESSURE (ABS)	IN HG	29.56	29.75	29.35	29.56	29.75	29.35
VS	AVG STACK GAS VELOCITY	FPM	5143.	5169.	5173.	5143.	5158.	5107.
DS	STACK DIAMETER	INCHES	255.00	255.00	255.00	255.00	255.00	255.00
AS	STACK AREA	SQ IN	51070.5	51070.5	51070.5	51070.5	51070.5	51070.5
QS	STACK FLOW RT(DRY STD)	DSCFM	1052424.	1037691.	1028746.	1057948.	1048088.	1086149.
QA	STACK FLOW RT(ACTUAL)	ACFM	1823912.	1833114.	1834524.	1823914.	1829216.	1811208.
DN	PROBE TIP DIAMETER	INCHES	0.186	0.186	0.186	0.204	0.204	0.20
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	95.
MF	PARTICULATE (FRONT)	MG	203.30	113.60	107.50	388.10	287.90	202.1
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.0
CAN	PARTICULATE (FRONT)	GR/DSCF	0.0237	0.0262	0.0251	0.0377	0.0550	0.039
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0136	0.0148	0.0140	0.0218	0.0314	0.023
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
CAW	PARTICULATE (FRONT)	LB/HR	213.982	233.071	221.213	341.505	494.237	364.71
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.00
			1-56	2-56	3-56			

14 OCTOBER 1981

BOSTON EDISON MYSTIC
PARTICULATE DATA BEFORE BAKING
EPA 90 PROGRAM CALCULATION
(Metric Units)

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	12
PB	BAROMETRIC PRESSURE	CM HG	75.41	75.90	74.88	75.41	75.90	74
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.936	2.919	2.914	4.024	4.024	3.
VM	VOL DRY GAS(METER CON)	DCM	3.860	1.924	1.928	4.653	2.327	2.
TM	AVG GAS METER TEMP	DEG C	28.2	25.8	25.8	29.3	26.6	2
VMSTD	VOL DRY GAS (STD COND)	DNCM	3.74	1.89	1.87	4.49	2.28	2
VW	TOTAL H2O COLLECTED	ML	301.1	190.3	181.5	342.6	205.6	94.
VWG	VOL H2O VAPOR(STD CON)	NCM	0.402	0.254	0.242	0.457	0.274	0.
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	1
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	8
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	3
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	2
DELP	AVG STACK VELOCITY HEAD	CM H2O	4.645	4.657	4.620	4.654	4.657	4.62
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.
TS	STACK TEMPERATURE	DEG C	182.	183.	183.	182.	183.	1
PM	STACK PRESSURE(STATIC)	CM H2O	-4.57	-4.57	-4.57	-4.57	-4.57	-4
PS	STACK PRESSURE (ABS)	CM HG	75.08	75.56	74.54	75.08	75.56	74.
VS	AVG STACK GAS VELOCITY	MPM	1568.	1575.	1577.	1568.	1572.	155
DS	STACK DIAMETER	CM	647.70	647.70	647.70	647.70	647.70	647
AS	STACK AREA	SQ CM	329506.7	329506.7	329506.7	329506.7	329506.7	3295
QS	STACK FLOW RT(DRY STD)	DNCMPM	29805.	29387.	29134.	29961.	29682.	30
QA	STACK FLOW RT(ACTUAL)	ACMPM	51653.	51914.	51954.	51653.	51803.	5129
DN	PROBE TIP DIAMETER	CM	0.472	0.472	0.472	0.518	0.518	0.
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	
MF	PARTICULATE (FRONT)	MG	203.30	113.60	107.50	388.10	287.90	20
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.
CAN	PARTICULATE (FRONT)	G/DNCM	0.0543	0.0600	0.0574	0.0862	0.1259	0.
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.
CAT	PARTICULATE (FRONT)	G/ACM	0.0312	0.0338	0.0321	0.0498	0.0719	0.
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.
CAW	PARTICULATE (FRONT)	KG/HR	97.062	105.721	100.342	154.907	224.186	16
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0

29 OCTOBER 1981

DBa ON EDISON MYSTIC
PARTICULATE DATA AFTER BAKING
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	IN HG	29.95	29.95	29.95	29.95	29.90	29.65
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.104	1.260	1.287	0.231	2.240	2.153
VM	VOL DRY GAS(METER CON)	DCF	49.890	50.930	51.220	22.120	72.360	68.140
TM	AVG GAS METER TEMP	DEG F	81.3	72.7	70.2	70.9	56.2	64.7
VMSTD	VOL DRY GAS (STD COND)	DSCF	48.85	50.70	51.23	22.04	74.39	68.32
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	SCF	5.120	4.785	5.831	1.870	7.955	8.563
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.396	1.461	1.493	1.201	1.343	1.389
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	372.	373.	376.	374.	379.	380.
PM	STACK PRESSURE(STATIC)	IN H2O	0.95	0.95	0.95	1.50	1.50	1.50
PS	STACK PRESSURE (ABS)	IN HG	30.02	30.02	30.02	30.06	30.01	29.76
VS	AVG STACK GAS VELOCITY	FPM	4377.	4502.	4552.	4036.	4379.	4496.
DS	STACK DIAMETER	INCHES	202.00	202.00	202.00	202.00	202.00	202.00
AS	STACK AREA	SQ IN	32047.4	32047.4	32047.4	32047.4	32047.4	32047.4
QS	STACK FLOW RT(DRY STD)	DSCFM	563391.	584300.	57879A.	528684.	557547.	557838.
QA	STACK FLOW RT(ACTUAL)	ACFM	974186.	1001952.	1013108.	898247.	974515.	1000643.
DN	PROBE TIP DIAMETER	INCHES	0.204	0.204	0.204	0.138	0.240	0.240
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	404.50	552.30	582.30	343.90	572.60	539.90
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	GR/DSCF	0.1275	0.1678	0.1751	0.2403	0.1185	0.1217
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0735	0.0975	0.0997	0.1409	0.0676	0.0676
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	LB/HR	615.678	840.084	868.303	1088.825	566.416	581.807
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.000

NCR BUSINESS FORMS, INC., MO

29 OCTOBER 1981

DB@ ON EDISON MYSTIC
PARTICULATE DATA AFTER BAKING
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	CM HG	76.07	76.07	76.07	76.07	75.95	75.31
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.803	3.200	3.268	0.587	5.690	5.469
VM	VOL DRY GAS(METER CON)	DCM	1.413	1.442	1.451	0.626	2.049	1.930
TM	AVG GAS METER TEMP	DEG C	27.4	22.6	21.2	21.6	13.4	18.2
VMSTD	VOL DRY GAS (STD COND)	DNCM	1.38	1.44	1.45	0.62	2.11	1.93
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	NCM	0.145	0.136	0.165	0.053	0.225	0.242
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	CM H2O	3.545	3.711	3.792	3.052	3.411	3.529
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG C	189.	190.	191.	190.	193.	193.
PM	STACK PRESSURE(STATIC)	CM H2O	2.42	2.42	2.42	3.81	3.81	3.81
PS	STACK PRESSURE (ABS)	CM HG	76.25	76.25	76.25	76.35	76.23	75.59
VS	AVG STACK GAS VELOCITY	MPM	1334.	1372.	1388.	1230.	1335.	1370.
DS	STACK DIAMETER	CM	513.08	513.08	513.08	513.08	513.08	513.08
AS	STACK AREA	SQ CM	206769.5	206769.5	206769.5	206769.5	206769.5	206769.5
QS	STACK FLOW RT(DRY STD)	DNCMPM	15955.	16547.	16392.	14972.	15790.	15798.
QA	STACK FLOW RT(ACTUAL)	ACMPM	27589.	28375.	28691.	25438.	27598.	28338.
DN	PROBE TIP DIAMETER	CM	0.518	0.518	0.518	0.351	0.610	0.610
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	404.50	552.30	582.30	343.90	572.60	539.90
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	G/DNCM	0.2919	0.3840	0.4007	0.5501	0.2713	0.2786
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	G/ACM	0.1682	0.2232	0.2281	0.3226	0.1547	0.1547
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	KG/HR	279.272	381.062	393.862	493.891	256.926	263.908
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

DRa ON EDISON MYSTIC
PARTICULATE DATA AFTER BAKING
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-OL
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	120.0
PB	BAROMETRIC PRESSURE	IN HG	29.69	29.88	29.48	29.69	29.88	29.48
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.156	1.149	1.147	1.584	1.584	1.572
VM	VOL DRY GAS(METER CON)	DCF	136.310	67.953	68.079	164.300	82.158	82.169
TM	AVG GAS METER TEMP	DEG F	82.8	78.4	78.4	84.7	79.8	80.5
VMSTD	VOL DRY GAS (STD COND)	DSCF	131.96	66.75	65.98	158.68	80.58	79.43
VW	TOTAL H2O COLLECTED	ML	301.1	190.3	181.5	342.6	205.6	94.9
VWG	VOL H2O VAPOR(STD CON)	SCF	14.182	8.963	8.549	16.136	9.684	4.470
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5.33
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.947
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	29.5
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.829	1.833	1.819	1.832	1.833	1.819
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	359.	361.	361.	359.	361.	361.
PM	STACK PRESSURE(STATIC)	IN H2O	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80
PS	STACK PRESSURE (ABS)	IN HG	29.56	29.75	29.35	29.56	29.75	29.35
VS	AVG STACK GAS VELOCITY	FPM	5143.	5169.	5173.	5143.	5158.	5107.
DS	STACK DIAMETER	INCHES	255.00	255.00	255.00	255.00	255.00	255.00
AS	STACK AREA	SQ IN	51070.5	51070.5	51070.5	51070.5	51070.5	51070.5
QS	STACK FLOW RT(DRY STD)	DSCFM	1052424.	1037691.	1028746.	1057948.	1048088.	1086149.
QA	STACK FLOW RT(ACTUAL)	ACFM	1823912.	1833114.	1834524.	1823914.	1829216.	1811208.
DN	PROBE TIP DIAMETER	INCHES	0.186	0.186	0.186	0.204	0.204	0.204
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	95.6
MF	PARTICULATE (FRONT)	MG	57.80	21.00	35.10	76.80	90.30	76.60
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	GR/DSCF	0.0067	0.0048	0.0082	0.0075	0.0173	0.0149
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0039	0.0027	0.0046	0.0043	0.0099	0.0089
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	LB/HR	60.837	43.085	72.229	67.579	155.018	138.233
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

DAB ON EDISON MYSTIC
PARTICULATE DATA AFTER BAKING
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-OL
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	120.0
PB	BAROMETRIC PRESSURE	CM HG	75.41	75.90	74.88	75.41	75.90	74.88
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.936	2.919	2.914	4.024	4.024	3.993
VM	VOL DRY GAS(METER CON)	DCM	3.860	1.924	1.928	4.653	2.327	2.328
TM	AVG GAS METER TEMP	DEG C	28.2	25.8	25.8	29.3	26.6	26.9
VMSTD	VOL DRY GAS (STD COND)	DNCM	3.74	1.89	1.87	4.49	2.28	2.25
VW	TOTAL H2O COLLECTED	ML	301'1	190.3	181.5	342.6	205.6	94.9
VWG	VOL H2O VAPOR(STD CON)	NCM	0.402	0.254	0.242	0.457	0.274	0.127
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5.33
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.947
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	29.5
DELP	AVG STACK VELOCITY HEAD	CM H2O	4.645	4.657	4.620	4.654	4.657	4.620
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG C	182.	183.	183.	182.	183.	183.
PM	STACK PRESSURE(STATIC)	CM H2O	-4.57	-4.57	-4.57	-4.57	-4.57	-4.57
PS	STACK PRESSURE (ABS)	CM HG	75.08	75.56	74.54	75.08	75.56	74.54
VS	AVG STACK GAS VELOCITY	MPM	1568.	1575.	1577.	1568.	1572.	1557.
DS	STACK DIAMETER	CM	647.70	647.70	647.70	647.70	647.70	647.70
AS	STACK AREA	SQ CM	329506.7	329506.7	329506.7	329506.7	329506.7	329506.7
QS	STACK FLOW RT(DRY STD)	DNCMPM	29805.	29387.	29134.	29961.	29682.	30760.
QA	STACK FLOW RT(ACTUAL)	ACMPM	51653.	51914.	51954.	51653.	51803.	51293.
DN	PROBE TIP DIAMETER	CM	0.472	0.472	0.472	0.518	0.518	0.518
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	95.6
MF	PARTICULATE (FRONT)	MG	57.80	21.00	35.10	76.80	90.30	76.60
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	G/DNCM	0.0154	0.0111	0.0188	0.0171	0.0395	0.0340
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	G/ACM	0.0089	0.0063	0.0105	0.0099	0.0226	0.0203
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	KG/HR	27.596	19.544	32.763	30.654	70.316	62.703
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0.000

MOORE BUSINESS FORMS INC.

SULFURIC ACID

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFURIC ACID
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	IN HG	29.95	29.95	29.95	29.95	29.90	29.65
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.104	1.260	1.287	0.231	2.240	2.153
VM	VOL DRY GAS(METER CON)	DCF	49.860	50.930	51.220	22.120	72.360	68.140
TM	AVG GAS METER TEMP	DEG F	81.3	72.7	70.2	70.9	56.2	64.7
VMSTD	VOL DRY GAS (STD COND)	DSCF	48.85	50.70	51.23	22.04	74.39	68.32
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	SCF	5.120	4.785	5.831	1.870	7.955	8.563
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.396	1.461	1.493	1.201	1.343	1.389
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	372.	373.	376.	374.	379.	380.
PM	STACK PRESSURE(STATIC)	IN H2O	0.95	0.95	0.95	1.50	1.50	1.50
PS	STACK PRESSURE (ABS)	IN HG	30.02	30.02	30.02	30.06	30.01	29.76
VS	AVG STACK GAS VELOCITY	FPM	4377.	4502.	4552.	4036.	4379.	4496.
DS	STACK DIAMETER	INCHES	202.00	202.00	202.00	202.00	202.00	202.00
AS	STACK AREA	SQ IN	32047.4	32047.4	32047.4	32047.4	32047.4	32047.4
QS	STACK FLOW RT(DRY STD)	DSCFM	563391.	584300.	578798.	528684.	557547.	557838.
QA	STACK FLOW RT(ACTUAL)	ACFM	974186.	1001952.	1013108.	898247.	974515.	1000643.
DN	PROBE TIP DIAMETER	INCHES	0.204	0.204	0.204	0.138	0.240	0.240
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	2.70	3.17	3.19	2.28	3.25	1.77
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	GR/DSCF	0.0009	0.0010	0.0010	0.0016	0.0007	0.0004
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0005	0.0006	0.0005	0.0009	0.0004	0.0002
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	LB/HR	4.110	4.822	4.757	7.219	3.215	1.907
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFURIC ACID
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	CM HG	76.07	76.07	76.07	76.07	75.95	75.31
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.803	3.200	3.268	0.587	5.690	5.469
VM	VOL DRY GAS(METER CON)	DCM	1.413	1.442	1.451	0.626	2.049	1.930
TM	AVG GAS METER TEMP	DEG C	27.4	22.6	21.2	21.6	13.4	10.2
VMSTD	VOL DRY GAS (STD COND)	DNCM	1.38	1.44	1.45	0.62	2.11	1.93
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	NCM	0.145	0.136	0.165	0.053	0.225	0.242
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	CM H2O	3.545	3.711	3.792	3.052	3.411	3.529
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG C	189.	190.	191.	190.	193.	193.
PM	STACK PRESSURE(STATIC)	CM H2O	2.42	2.42	2.42	3.81	3.81	3.81
PS	STACK PRESSURE (ABS)	CM HG	76.25	76.25	76.25	76.35	76.23	75.59
VS	AVG STACK GAS VELOCITY	MPM	133.	1372.	1388.	1230.	1335.	1370.
DS	STACK DIAMETER	CM	513.08	513.08	513.08	513.08	513.08	513.08
AS	STACK AREA	SQ CM	206769.5	206769.5	206769.5	206769.5	206769.5	206769.5
QS	STACK FLOW RT(DRY STD)	DNCMPM	15955.	16547.	16392.	14972.	15790.	15798.
QA	STACK FLOW RT(ACTUAL)	ACMPM	27589.	28375.	28691.	25438.	27598.	28338.
DN	PROBE TIP DIAMETER	CM	0.518	0.518	0.518	0.351	0.610	0.610
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	2.70	3.17	3.19	2.28	3.25	1.77
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	G/DNCM	0.0019	0.0022	0.0022	0.0036	0.0015	0.0009
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	G/ACM	0.0011	0.0013	0.0012	0.0021	0.0009	0.0005
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	KG/HR	1.864	2.187	2.158	3.274	1.458	0.865
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFURIC ACID
EPA 9D PROGRAM CALCULATION

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-OL
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	120.0
PB	BAROMETRIC PRESSURE	IN HG	29.69	29.88	29.48	29.69	29.88	29.48
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.156	1.149	1.147	1.584	1.584	1.572
VM	VOL DRY GAS(METER CON)	DCF	136.310	67.953	68.079	164.300	82.158	82.189
TM	AVG GAS METER TEMP	DEG F	82.8	78.4	78.4	84.7	79.0	80.5
VMSTD	VOL DRY GAS (STD COND)	DSCF	131.96	66.75	65.98	158.68	80.58	79.43
VW	TOTAL H2O COLLECTED	ML	301.1	190.3	181.5	342.6	205.6	94.9
VWG	VOL H2O VAPOR(STD CON)	SCF	14.182	8.963	8.549	16.136	9.684	4.470
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5.33
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.947
CO2	PERCENT CO2		12.4	11.3	11.0	12.4	11.3	11.0
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	29.5
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.829	1.833	1.819	1.832	1.833	1.819
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	359.	361.	361.	359.	361.	361.
PM	STACK PRESSURE(STATIC)	IN H2O	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80
PS	STACK PRESSURE (ABS)	IN HG	29.56	29.75	29.35	29.56	29.75	29.35
VS	AVG STACK GAS VELOCITY	FPM	5143.	5169.	5173.	5143.	5158.	5107.
DS	STACK DIAMETER	INCHES	255.00	255.00	255.00	255.00	255.00	255.00
AS	STACK AREA	SQ IN	51070.5	51070.5	51070.5	51070.5	51070.5	51070.5
QS	STACK FLOW RT(DRY STD)	DSCFM	1052424.	1037691.	1028746.	1057948.	1048088.	1086149.
QA	STACK FLOW RT(ACTUAL)	ACFM	1823912.	1833114.	1834524.	1823914.	1829216.	1811208.
DN	PROBE TIP DIAMETER	INCHES	0.186	0.186	0.186	0.204	0.204	0.204
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	95.6
MF	PARTICULATE (FRONT)	MG	4.28	2.20	2.89	8.67	7.99	4.26
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	GR/DSCF	0.0005	0.0005	0.0007	0.0008	0.0015	0.0008
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0003	0.0003	0.0004	0.0005	0.0009	0.0005
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	LB/HR	4.505	4.514	5.947	7.629	13.716	7.688
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFURIC ACID
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-OL
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	120.0
PB	BAROMETRIC PRESSURE	CM HG	75.41	75.90	74.88	75.41	75.90	74.88
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.936	2.919	2.914	4.024	4.024	3.993
VM	VOL DRY GAS(METER CON)	DCM	3.860	1.924	1.928	4.653	2.327	2.328
TM	AVG GAS METER TEMP	DEG C	28.2	25.8	25.8	29.3	26.6	26.9
VMSTD	VOL DRY GAS (STD COND)	DNCM	3.74	1.89	1.87	4.49	2.28	2.25
VW	TOTAL H2O COLLECTED	ML	301.1	190.3	181.5	342.6	205.6	94.9
VWG	VOL H2O VAPOR(STD CON)	NCM	0.402	0.254	0.242	0.457	0.274	0.127
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5.33
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.947
CO2	PERCENT CO2		12'4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	29.5
DELP	AVG STACK VELOCITY HEAD	CM H2O	4.645	4.657	4.620	4.654	4.657	4.620
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG C	182.	183.	183.	182.	183.	183.
PM	STACK PRESSURE(STATIC)	CM H2O	-4.57	-4.57	-4.57	-4.57	-4.57	-4.57
PS	STACK PRESSURE (ABS)	CM HG	75.08	75.56	74.54	75.08	75.56	74.54
VS	AVG STACK GAS VELOCITY	MPM	1568.	1575.	1577.	1568.	1572.	1557.
DS	STACK DIAMETER	CM	647.70	647.70	647.70	647.70	647.70	647.70
AS	STACK AREA	SQ CM	329506.7	329506.7	329506.7	329506.7	329506.7	329506.7
QS	STACK FLOW RT(DRY STD)	DNCMPM	29805.	29387.	29134.	29961.	29682.	30760.
QA	STACK FLOW RT(ACTUAL)	ACMPM	51653.	51914.	51954.	51653.	51803.	51293.
DN	PROBE TIP DIAMETER	CM	0.472	0.472	0.472	0.518	0.518	0.518
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	95.6
MF	PARTICULATE (FRONT)	MG	4.28	2.20	2.89	8.67	7.99	4.26
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	G/DNCM	0.0011	0.0012	0.0015	0.0019	0.0035	0.0019
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	G/ACM	0.0007	0.0007	0.0009	0.0011	0.0020	0.0011
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	KG/HR	2.043	2.047	2.698	3.461	6.222	3.487
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0.000

SULFATE

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFATE
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	IN HG	29.95	29.95	29.95	29.95	29.90	29.65
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.104	1.260	1.287	0.231	2.240	2.153
VM	VOL DRY GAS(METER CON)	DCF	49.890	50.930	51.220	22.120	72.360	68.140
TM	AVG GAS METER TEMP	DEG F	81.3	72.7	70.2	70.9	56.2	64.7
VMSTD	VOL DRY GAS (STD COND)	DSCF	48.85	50.70	51.23	22.04	74.39	68.32
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	SCF	5.120	4.785	5.831	1.870	7.955	8.563
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.396	1.461	1.493	1.201	1.343	1.389
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	372.	373.	376.	374.	379.	380.
PM	STACK PRESSURE(STATIC)	IN H2O	0.95	0.95	0.95	1.50	1.50	1.50
PS	STACK PRESSURE (ABS)	IN HG	30.02	30.02	30.02	30.06	30.01	29.76
VS	AVG STACK GAS VELOCITY	FPM	4377.	4502.	4552.	4036.	4379.	4496.
DS	STACK DIAMETER	INCHES	202.00	202.00	202.00	202.00	202.00	202.00
AS	STACK AREA	SQ IN	32047.4	32047.4	32047.4	32047.4	32047.4	32047.4
QS	STACK FLOW RT(DRY STD)	DSCFM	563391.	584300.	578798.	528684.	557547.	557838.
QA	STACK FLOW RT(ACTUAL)	ACFM	974186.	1001952.	1013108.	898247.	974515.	1000643.
DN	PROBE TIP DIAMETER	INCHES	0.204	0.204	0.204	0.138	0.240	0.240
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	92.80	151.00	142.00	79.70	189.00	141.00
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	GR/DSCF	0.0293	0.0459	0.0427	0.0557	0.0391	0.0318
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0169	0.0267	0.0243	0.0327	0.0223	0.0177
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	LB/HR	141.248	229.681	211.745	252.339	186.959	151.945
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFATE
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-IN	2-IN	3-IN	1-IS	2-IS	3-IS
TT	DURATION OF RUN	MINUTES	90.0	90.0	90.0	87.5	90.0	90.0
PB	BAROMETRIC PRESSURE	CM HG	76.07	76.07	76.07	76.07	75.95	75.31
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.803	3.200	3.268	0.587	5.690	5.469
VM	VOL DRY GAS(METER CON)	DCM	1.413	1.442	1.451	0.626	2.049	1.930
TM	AVG GAS METER TEMP	DEG C	27.4	22.6	21.2	21.6	13.4	18.2
VMSTD	VOL DRY GAS (STD COND)	DNCM	1.38	1.44	1.45	0.62	2.11	1.93
VW	TOTAL H2O COLLECTED	ML	108.7	101.6	123.8	39.7	168.9	181.8
VWG	VOL H2O VAPOR(STD CON)	NCM	0.145	0.136	0.165	0.053	0.225	0.242
PCNTM	PERCNT MOISTURE BY VOL		9.49	8.62	10.22	7.82	9.66	11.14
MD	MOLE FRACTION DRY GAS		0.905	0.914	0.898	0.922	0.903	0.889
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	29.0	28.9	29.2	28.9	28.8
DELP	AVG STACK VELOCITY HEAD	CM H2O	3.545	3.711	3.792	3.052	3.411	3.529
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG C	189.	190.	191.	190.	193.	193.
PM	STACK PRESSURE(STATIC)	CM H2O	2.42	2.42	2.42	3.81	3.81	3.81
PS	STACK PRESSURE (ABS)	CM HG	76.25	76.25	76.25	76.35	76.23	75.59
VS	AVG STACK GAS VELOCITY	MPM	1334.	1372.	1388.	1230.	1335.	1370.
DS	STACK DIAMETER	CM	513.08	513.08	513.08	513.08	513.08	513.08
AS	STACK AREA	SQ CM	206769.5	206769.5	206769.5	206769.5	206769.5	206769.5
QS	STACK FLOW RT(DRY STD)	DNCMPM	15955.	16547.	16392.	14972.	15790.	15798.
QA	STACK FLOW RT(ACTUAL)	ACMPM	27589.	28375.	28691.	25438.	27598.	28338.
DN	PROBE TIP DIAMETER	CM	0.518	0.518	0.518	0.351	0.610	0.610
PCTI	PERCENT ISOKINETIC		94.8	94.9	96.8	102.5	105.4	96.8
MF	PARTICULATE (FRONT)	MG	92.80	151.00	142.00	79.70	189.00	141.00
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	G/DNCM	0.0670	0.1050	0.0977	0.1275	0.0896	0.0727
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	G/ACM	0.0386	0.0610	0.0556	0.0748	0.0511	0.0404
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	KG/HR	64.070	104.183	96.047	114.461	84.805	68.922
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFATE
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (68 DEG F)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-OL
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	120.0
PB	BAROMETRIC PRESSURE	IN HG	29.69	29.88	29.48	29.69	29.88	29.48
DELH	AVG ORIFICE PRESS DROP	IN H2O	1.156	1.149	1.147	1.584	1.584	1.572
VM	VOL DRY GAS(METER CON)	DCF	136.310	67.953	68.079	164.300	82.158	82.169
TM	AVG GAS METER TEMP	DEG F	82.8	78.4	78.4	84.7	79.8	80.5
VMSTD	VOL DRY GAS (STD COND)	DSCF	131.96	66.75	65.98	158.68	80.58	79.43
VW	TOTAL H2O COLLECTED	ML	301.1	190.3	181.5	342.6	205.6	94.9
VWG	VOL H2O VAPOR(STD CON)	SCF	14.182	8.963	8.549	16.136	9.684	4.470
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5.33
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.947
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	29.5
DELP	AVG STACK VELOCITY HEAD	IN H2O	1.829	1.833	1.819	1.832	1.833	1.819
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG F	359.	361.	361.	359.	361.	361.
PM	STACK PRESSURE(STATIC)	IN H2O	-1.80	-1.80	-1.80	-1.80	-1.80	-1.80
PS	STACK PRESSURE (ABS)	IN HG	29.56	29.75	29.35	29.56	29.75	29.35
VS	AVG STACK GAS VELOCITY	FPM	5143.	5169.	5173.	5143.	5158.	5107.
DS	STACK DIAMETER	INCHES	255.00	255.00	255.00	255.00	255.00	255.00
AS	STACK AREA	SQ IN	51070.5	51070.5	51070.5	51070.5	51070.5	51070.5
QS	STACK FLOW RT(DRY STD)	DSCFM	1052424.	1037691.	1028746.	1057948.	1048088.	1086149.
QA	STACK FLOW RT(ACTUAL)	ACFM	1823912.	1833114.	1834524.	1823914.	1829216.	1811208.
DN	PROBE TIP DIAMETER	INCHES	0.186	0.186	0.186	0.204	0.204	0.204
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	95.6
MF	PARTICULATE (FRONT)	MG	10.80	8.84	18.00	19.60	22.30	37.40
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	GR/DSCF	0.0013	0.0020	0.0042	0.0019	0.0043	0.0073
CAO	PARTICULATE (TOTAL)	GR/DSCF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	GR/ACF	0.0007	0.0012	0.0023	0.0011	0.0024	0.0043
CAU	PARTICULATE (TOTAL)	GR/ACF	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	LB/HR	11.367	18.137	37.040	17.247	38.282	67.493
CAX	PARTICULATE (TOTAL)	LB/HR	0.000	0.000	0.000	0.000	0.000	0.000

29 OCTOBER 1981

BOSTON EDISON MYSTIC
SULFATE
EPA 90 PROGRAM CALCULATION

ABBR	DESCRIPTION (20 DEG C)	UNITS	1-OH	2-OH	3-OH	1-OL	2-OL	3-OL
TT	DURATION OF RUN	MINUTES	240.0	120.0	120.0	240.0	120.0	120.0
PB	BAROMETRIC PRESSURE	CM HG	75.41	75.90	74.88	75.41	75.90	74.88
DELH	AVG ORIFICE PRESS DROP	CM H2O	2.936	2.919	2.914	4.024	4.024	3.993
VM	VOL DRY GAS(METER CON)	DCM	3.860	1.924	1.928	4.653	2.327	2.328
TM	AVG GAS METER TEMP	DEG C	28.2	25.8	25.8	29.3	26.6	26.9
VMSTD	VOL DRY GAS (STD COND)	DNCM	3.74	1.89	1.87	4.49	2.28	2.25
VW	TOTAL H2O COLLECTED	ML	301.1	190.3	181.5	342.6	205.6	94.9
VWG	VOL H2O VAPOR(STD CON)	NCM	0.402	0.254	0.242	0.457	0.274	0.127
PCNTM	PERCNT MOISTURE BY VOL		9.70	11.84	11.47	9.23	10.73	5.33
MD	MOLE FRACTION DRY GAS		0.903	0.882	0.885	0.908	0.893	0.947
CO2	PERCENT CO2		12.4	11.3	11.8	12.4	11.3	11.8
O2	PERCENT O2		5.0	6.1	5.5	5.0	6.1	5.5
N2	PERCENT N2		82.6	82.6	82.6	82.6	82.6	82.6
MWD	MOL WT OF DRY GAS		30.2	30.1	30.1	30.2	30.1	30.1
MW	MOL WT OF STACK GAS		29.0	28.6	28.7	29.1	28.8	29.5
DELP	AVG STACK VELOCITY HEAD	CM H2O	4.645	4.657	4.620	4.654	4.657	4.620
CP	PITOT COEFFICIENT		0.760	0.760	0.760	0.760	0.760	0.760
TS	STACK TEMPERATURE	DEG C	182.	183.	183.	182.	183.	183.
PM	STACK PRESSURE(STATIC)	CM H2O	-4.57	-4.57	-4.57	-4.57	-4.57	-4.57
PS	STACK PRESSURE (ABS)	CM HG	75.08	75.56	74.54	75.08	75.56	74.54
VS	AVG STACK GAS VELOCITY	MPM	1568.	1575.	1577.	1568.	1572.	1557.
DS	STACK DIAMETER	CM	647.70	647.70	647.70	647.70	647.70	647.70
AS	STACK AREA	SQ CM	329506.7	329506.7	329506.7	329506.7	329506.7	329506.7
QS	STACK FLOW RT(DRY STD)	DNCMPM	29805.	29387.	29134.	29961.	29682.	30760.
QA	STACK FLOW RT(ACTUAL)	ACMPM	51653.	51914.	51954.	51653.	51803.	51298.
DN	PROBE TIP DIAMETER	CM	0.472	0.472	0.472	0.518	0.518	0.518
PCTI	PERCENT ISOKINETIC		98.6	101.1	100.8	98.0	100.5	95.6
MF	PARTICULATE (FRONT)	MG	10.80	8.84	18.00	19.60	22.30	37.40
MT	PARTICULATE (TOTAL)	MG	0.00	0.00	0.00	0.00	0.00	0.00
CAN	PARTICULATE (FRONT)	G/DNCM	0.0029	0.0047	0.0096	0.0044	0.0098	0.0166
CAO	PARTICULATE (TOTAL)	G/DNCM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAT	PARTICULATE (FRONT)	G/ACM	0.0017	0.0026	0.0054	0.0025	0.0056	0.0099
CAU	PARTICULATE (TOTAL)	G/ACM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CAW	PARTICULATE (FRONT)	KG/HR	5.156	8.227	16.801	7.823	17.365	30.615
CAX	PARTICULATE (TOTAL)	KG/HR	0.000	0.000	0.000	0.000	0.000	0.000

APPENDIX C

ANALYTICAL METHODS FOR SULFURIC ACID, SULFATE, AND PARTICULATE DETERMINATIONS

ANALYTICAL METHODS FOR SULFURIC ACID AND SULFATE DETERMINATIONS

EXTRACTION PROCEDURE

Place the filters in 75-mL test tubes and add 50 mL of 100% isopropanol. Add 50 mL of isopropanol directly to the 250 mL beaker containing the dried residue from the evaporation of the sampling train front half rinses. Allow the solutions to sit at least 12 hours. Sonify for 30 minutes. Filter each extract through a glass fiber filter, using a vacuum filter apparatus. Wash the filters with isopropanol while filtering. Transfer the filtrates to 100 mL volumetric flasks and dilute to volume with isopropanol. Repeat the extraction two more times with isopropanol on each sample and again dilute the extracts to volume.

Extract the samples 3 times with deionized-distilled in place of the isopropanol using the above procedure including the 12 hour soaking period.

Analyze the isopropanol extracts for sulfuric acid and the water extracts for sulfate by barium-thorin titration.

Transfer the particulate samples to closed containers and refrigerate under dry nitrogen. Bottle the untitrated extracts and save in a refrigerator.

SULFURIC ACID ANALYSIS

Pipet 25 mL (or a suitable aliquot) of the diluted isopropanol extract into an Erlenmeyer flask and add 3-5 drops of the barium-thorin indicator. Titrate the sample with a standardized solution of barium perchlorate until the color of the solution changes from organe to pink. Calculate the mg of sulfuric acid dehydrate in the sample using the following equation:

$$\text{mg } H_2SO_4 \bullet 2H_2O = \frac{67nV_tV_s}{V_a}$$

where n = normality of $Ba(ClO_4)_2$ titrant ($\sim$0.01N)

v_t = volume of titrant

v_s = volume of filtrate

v_a = volume of filtrate titrated.

The $Ba(ClO_4)_2$ was standardized against 0.02N H_2SO_4 purchased from Fisher Scientific Company.

SULFATE ANALYSIS

Pass the deionized-distilled water extract through a Rexyn-101 ion exchange column. Pipet 25 mL or a suitable aliquot of the diluted deionized-distilled water extract into a flask. Add 80 mL isopropanol to bring the concentration to at least 80%. Add 3-5 drops barium-thorin indicator, and titrate the sample to the endpoint as indicated by the color change from orange to pink. Calculate the mg of sulfate in the sample using the following equation:

$$\text{mg of } SO_4 = \frac{48n\ V_+ V_s}{V_a}$$

where n = normality of $Ba(ClO_4)_2$ titrant ($\sim$0.01N)

V_+ = volume of titrant

V_s = volume of filtrate

V_a = volume of filtrate (extract) titrated

PROCEDURES FOR PREPARATION OF SULFURIC ACID QUALITY ASSURANCE SAMPLES

A. Equipment

1. Six (6) sheets of filter paper (Reeve Angel 934 AH, 11 cm diameter glass micro fibre filters).

2. Six (6) beakers (nitric acid prewashed).

3. Three (3) 175-mL screw cap test tubes (nitric acid pre-washed).

4. Three (3) glass petri dishes (nitric acid pre-washed).

B. Procedure

1. place one sheet of filter paper in each of 3 petri dishes.

2. Roll 3 sheets of filter paper into tubes and insert into each of 3 test tubes.

3a. Label the petri dishes QC5F, QC6F, QC7F.
b. Label the test tubes QC8F, QC9F, QC10F.
c. Label the beakers QC5B, QC6B, QC7B, QC8B, QC9B, QC10B.

4. Pipet sulfuric acid onto the filter paper and into the beakers according to the following chart:

Sample No.	Sulfuric acid 0.02N	Sulfuric acid 1.0 N
QC5F	4.0 mL	
QC6F		0.75 mL
QC7F		0.50 mL
QC8F	4.0 mL	
QC9F		0.75 mL
QC10F		0.50 mL
QC5B	10.0	
QC6B		0.50
QC7B	4.0	
QC8B	10.0	
QC9B		0.50
QC10B	4.0	

5a. QC5F, QC6F and QC7F are baked at 160°C for 3 hours, extracted, then analyzed for sulfuric acid in the same manner as the field samples.

b. QC5B, QC6B, and QC7B are evaporated in the same manner as the acetone probe washes, baked at 160°C for 3 hours, extracted, then analyzed for sulfuric acid in the same manner as the field samples.

c. QC8F, QC9F, QC10F, QC8B, QC9B, QC10B are extracted, then analyzed for sulfuric acid in the same manner as the field samples. (Do <u>not</u> bake at 160°C).

6. <u>Calculations</u>

Mg $H_2SO_4 \bullet 2H_2O$ = Normality x mL x 67

where 67 is the equivalent weight of $H_2SO_4 \bullet 2H_2O$.

The theoretical values based on the above calculation are as follows:

QC5F	= 5.36 mg	QC5B	= 13.4 mg
QC6F	= 50.2 mg	QC6B	= 33.5 mg
QC7F	= 33.5 mg	QC7B	= 5.36 mg
QC8F	= 5.36 mg	QC8B	= 13.4 mg
QC9F	= 50.2 mg	QC9B	= 33.5 mg
QC10F	= 33.5 mg	QC10B	= 5.36 mg

Particulate Analysis

The attached page (Figure C-1) shows the particulate analytical scheme used in the Boston Edison project per discussion with EPA, Gary McAlister on 10/14/81. Appendix E-2 has a breakdown of which samples were subject to the respective bakings and their resultant weights. All samples were subject to the 1st bake; about 80% required the 2nd bake; only 1 sample required the 3rd bake; 20% required the 4th bake; and no sample required the 5th bake.

Note that after each baking all samples were weighed to a constant weight (i.e., a less than 4 mg weight loss between consecutive weighings).

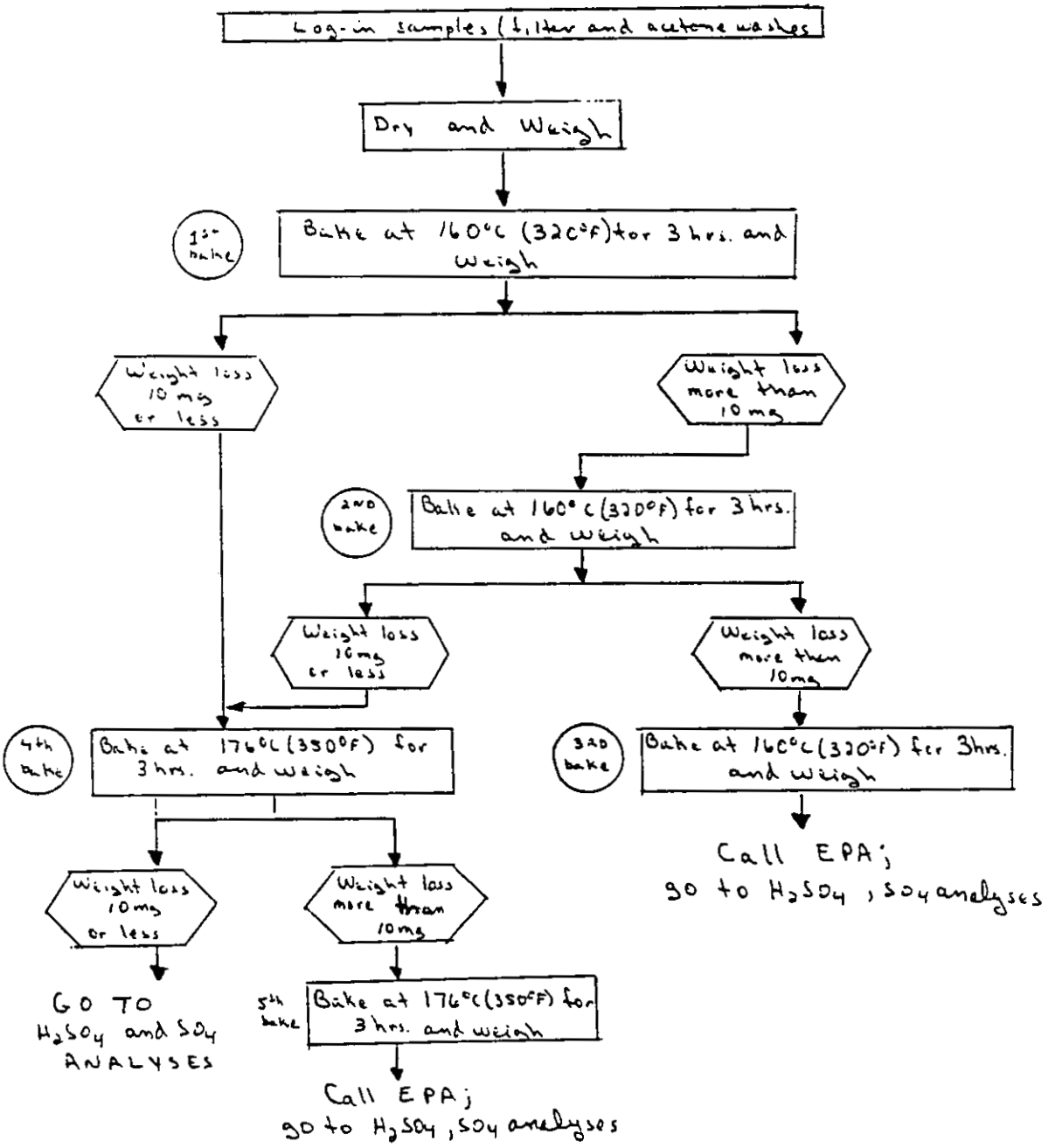


Figure C-1. Particulate analytical scheme (filters and acetone washes) (recommended by EPA on 10/14/81 discussion).

APPENDIX D

ANALYTICAL DATA

D-1 Results of Stack Sample Analysis D-2
D-2 Total Particulate Mass Data. D-4
D-3 Sulfuric Acid Mass Data. D-14
D-4 Sulfate Mass Data. D-16
D-5 QC Report for Boston Edison Company Plant. D-18
D-6 Chain of Custody Records D-31

SECTION D-1

RESULTS OF STACK SAMPLE ANALYSIS

Boston Edison 101.1223

Results of Stack Sampling

Run No.		Wt. after dessication, mg	Wt. after baking, mg	mg $H_2SO_4 \cdot H_2O$	mg SO_4
1	OH	203.3	57.8	4.3	10.8
	OL	388.1	76.8	8.7	19.6
	IN	449.2	404.5	≤ 2.7	92.8
	IS	381.0	343.9	2.3	79.7
2	OH	113.6	21.0	2.2	8.8
	OL	287.9	90.3	8.0	22.3
	IN	600.6	552.3	≤ 3.2	151.
	IS	640.5	572.6	≤ 3.3	189.
3	OH	107.5	35.1	2.9	18.0
	OL	202.1	76.6	4.3	37.4
	IN	639.5	582.3	≤ 3.2	142.
	IS	571.8	539.9	≤ 1.8	141.

OH = outlet-high temp. (Method 5B)
OL = outlet-low temp. (Method 5)
IN = inlet north (Method 5)
IS = inlet south (Method 5)

SECTION D-2

TOTAL PARTICULATE MASS DATA

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston-Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065; 4066-4071 2000120-24; 1999628-31 1998792-95	

Title: Particulate

Method: Federal Register Method 5

Filters were desiccated to constant weight. It was not reasonable to strive for a constant weight to within 0.5 mg, as defined in the procedure. This was primarily due to the hygroscopic nature of the samples. A guide line of 10 mg was used as a definition of constant weight. The actual constant weight for the filters was ≤ 3.6 mg, with the average ± 1.2 mg.

The acetone rinses were evaporated at a temperature between ambient and the boiling point of the solvent, which is an option stated in the procedure. Constant weight for the beakers with the evaporated residues was ≤ 1.9 mg. The average for all of the weighings was ± 0.6 mg.

The data from the particulate determinations are presented in Column A of Table E-1.

ANALYST: L. Stamper / M. Arnold
A. Ford / [illegible]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038, 4065-4071, 2000120-24, 1999625-31, 1998792-95	

Title: Particulates
Method: Federal Register Method 5B

After the Method 5 weighings were complete the samples were baked at 160°C for 3 hours, again desiccated to constant weight. This procedure was repeated until the sample gave data indicating sample loss of 10 mg or less.[a] Each time the sample was again desiccated to constant weight.

Constant weight for the filters was ≤ 2.3 mg with the average for all weighings in this step being ± 0.6 mg.

Constant weight for the beakers (acetone rinses) was ≤ 1.3 mg, with the average being ± 0.6 mg.

The particulate data after the 160°C baking procedure is presented in Columns B & D of Table E-1. Also given are the overall weight losses due to this baking step.

[a] Between 1 and 3 bakes were required for each sample to achieve a constant weight (less than 10 mg wt. loss).

D-6

ANALYST: L. Stamper / M. Arnold
A. Ford / [illegible]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000120-24; 1999628-31 1998792-95	

Title: Particulates

Method: Baking Procedure at 176°C.

Following the 160°C baking procedure carried out on each of the samples, they were baked at 176°C for 3 hours and then desiccated to constant weight. This procedure was repeated until the weight change from the 160°C baking procedure through the 176°C procedure was ≤ 10 mg.[a] Samples were again weighed to constant weight.

Constant weight for the filters was ≤ 1.3 mg with the average for all weighings in this step being ± 0.4 mg.

Constant weight for the acetone rinses was ≤ 1.0 mg, with the average at ± 0.3 mg.

The particulate data after the 176°C baking procedure is presented in Column C of Table E-1. Also given are the weight changes from the 160°C bake through the 176°C procedure, and finally the weight change from the initial drying through both baking procedures.

a All samples required only 1 bake at 176°C to achieve constant weight.

D-7

L. Stamper / M. Arnold

ANALYST: A. Ford / [illegible]

Boston-Edison
101.1223
1-81-10-06-01

Particulates (mg)
Table E-1.

		Initial (A)			Post 160°C. (B)			Δ	Post 176°C. (C)			Δ	Δ
		Filter	Acetone Rinse	Total	Filter	Acetone Rinse	Total	A-B	Filter	Acetone Rinse	Total	B-C	A-C
S	1-IN	116.0	333.2	449.2	104.0	300.5	404.5	44.7	103.2	296.5	399.7	4.8	49.5
S	1-IS	50.0	331.0	381.0	41.8	302.1	343.9	37.1	43.1	298.2	341.3	2.6	39.7
SB	1-OH	13.8	189.5	203.3	12.3	45.5	57.8	145.5	12.5	41.0	53.5	4.3	149.8
S	1-OL	95.9	292.2	388.1	12.0	64.8	76.8	311.3	11.6	64.8	76.4	0.4	311.7
S	2-IN	113.2	487.4	600.6	102.0	450.3	552.3	48.3	100.6	446.4	547.0	5.3	53.6
S	2-IS	248.8	391.7	640.5	215.1	357.5	572.6	67.9	214.1	349.1	563.2	9.4	77.3
SB	2-OH	6.2	107.4	113.6	4.9	16.1	21.0	92.6	5.3	12.7	18.0	3.0	95.6
S	2-OL	125.8	162.1	287.9	25.5	64.8	90.3	197.6	25.2	62.5	87.7	2.6	200.2
S	3-IN	147.9	491.6	639.5	130.0	452.3	582.3	57.2	130.1	449.9	580.0	2.3	59.5
S	3-IS	262.5	309.3	571.8	252.0	287.9	539.9	31.9	249.2	283.0	532.2	7.7	39.6
SB	3-OH	7.8	99.4	107.2	6.6	28.5	35.1	72.1	6.9	26.2	33.1	2.0	74.1
S	3-OL	73.7	128.4	202.1	8.6	68.0	76.6	125.5	8.3	65.4	73.7	2.9	128.4
	BLANK	2.3	4.3	6.6	(-0.3)	(-2.2)	(-2.5)	9.1	(-2.0)	(-2.3)	(-4.3)	1.8	10.9
	Maximum Value Constant Weight	≤ 3.6	≤ 1.9		≤ 2.3	≤ 1.3			≤ 1.3	≤ 1.0			
	Avg. for all $\bar{x}$ weighings.	± 1.2	± 0.6		± 0.6	± 0.6			± 0.4	± 0.3			

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4C65-71 2000120-24; 1999628-31 ~~1998792-95~~	

Title: Particulates

Method:

Table E-2 presents the particulate data from the perspective of the particulates on the filters and in the Dreaches from the residue of the acetone washes and the effect of the various baking procedures on these data.

The sample 1-OL acetone rinse was the only sample that required a third 160°C baking procedure to provide a sample loss of ≤ 10 mg. All of the samples gave ≤ 10 mg weight loss between their last 160°C bake and the 176°C baking procedure.

L. Stamper / M. Arnold

ANALYST: A. Ford / [illegible]

Boston/Edison 101.1223 1-81-10-06-01 6/20

Particulates Table E-2.

A Sample #/Type		A Initial Weight	A Range[a] (mg)	B Post 160-I	B Range[a] (mg)	(A-B) Difference (mg)	C Post 160-II	C Range[a] (mg)	(B-C) Diff. (mg)	D Post 160-III	D Range[a] (mg)	(C-D) Diff. (mg)	E Post 176°	E Range[a] (mg)	a.(C-E) b.(D-E) Diff (mg)
1-IN	F	116.0	±0.0	102.8	±0.15	13.2	104.0	±0.60	+1.20				103.2	±0.10	0.8
1-IN	W	333.2	±0.0	302.1	±0.05	31.1	300.5	±0.35	1.60				296.5	±0.20	4.0
							404.5								
1-IS	F	50.0	±0.3	41.8	±0.15	8.20							43.1	±0.20	+1.3
1-IS	W	331.0	±0.15	302.7	±0.15	28.3	302.1	±0.30	0.60				298.8	±0.10	3.9
1-OH	F	13.8	±0.05	12.3	±0.0	1.50							12.5	±0.0	+0.20
1-OH	W	189.5	±0.75	53.1	±0.20	136.4	45.5	±0.25	7.60				41.0	±0.50	4.5
1-OL	F	95.9	±0.70	11.9	±0.05	84.0	12.0	±0.0	+0.10				11.6	±0.0	0.4
1-OL	W	292.8	±0.40	94.2	±0.40	198.0	65.1	±0.45	29.1	64.8	±0.50	0.3			
2-IN	F	113.2	±0.50	98.4	±0.25	14.8	102	±1.15	+3.60				100.6	±0.65	1.4
2-IN	W	487.4	±0.50	453.3	±0.05	34.1	450.3	±0.45	3.00				446.4	±0.05	3.9
2-IS	F	248.8	±0.50	214.7	±0.55	34.1	215.1	±0.80	+0.40				214.1	±0.20	-1.0
2-IS	W	371.7	±0.55	362.8	±0.55	28.9	357.5	±0.30	5.30				349.1	±0.10	8.4
2-OH	F	6.2	±0.15	4.9	±0.05	1.30							5.3	±0.05	+0.4
2-OH	W	107.4	±0.10	21.9	±0.20	85.5	16.1	±0.35	5.80				12.7	±0.25	3.4
2-OL	F	125.8	±1.70	25.5	±0.15	100.3	25.5	±0.0	0.00				25.2	±0.10	0.3
2-OL	W	162.1	±0.05	72.8	±0.15	89.3	64.8	±0.35	8.00				62.5	±0.15	5.3
3-IN	F	147.9	±1.1	127.7	±0.35	20.2	130.0	±0.55	+2.30				130.1	±0.45	+0.1
3-IN	W	491.6	±0.10	456.1	±0.05	35.5	452.3	±0.65	3.80				449.9	±0.16	2.4
3-IS	F	262.5	±1.0	251.9	±0.20	10.6	252.0	±0.65	+0.10				249.2	±0.65	2.8
3-IS	W	309.3	±0.0	291.7	±0.40	17.6	287.9	±0.50	3.80				283.0	±0.10	4.9
3-OH	F	7.8	±0.15	6.6	±0.0	1.2							6.9	±0.05	+0.3
3-OH	W	99.4	±0.25	32.6	±0.15	66.8	28.5	±0.50	4.10				26.2	±0.0	2.3
3-OL	F	73.7	±1.80	8.5	±0.20	65.2	8.6	±0.05	+0.10				8.3	±0.10	0.3
3-OL	W	128.4	±0.20	71.8	±0.10	56.6	68.0	±0.65	3.80				65.4	±0.15	2.6
Blank	F	2.3	±0.1	-0.3	±0.15								-2.0	±0.05	+2.3
Blank	W	4.3	±0.25	-2.1	±0.35		-2.2	±0.05	0.10				-2.3	±0.20	0.1

a F = filter
b W = acetone wash

1st 160°C bake — 2nd 160°C bake — 3rd 160°C bake — only 176°C bake

Discussion of Effects of Baking Samples

D.A. Day 10/2/81

Section 2 of this report summarizes the effects of baking the total samples (filters plus acetone washes) at 160°C and 176°C. Results show that between 62% and 81% of the total sample for Methods 5 and 5B at the outlet was lost due to the first baking at 160°C. These results do not agree with the expected results after baking, which are ~0% weight loss in Method 5B due to sampling at 160°C (320°F) and baking at 160°C.

This disagreement between expected and actual weight loss can be explained by reviewing Tables E-1 and E-2 (in this Appendix (E)) and the field data in Appendix A. Tables E-1 and E-2 ~~in this Appendix~~ give a detailed breakdown of individual filters and acetone washes after each baking. The method 5B (OH) filters lost only 1, 21, and 15% of their weight, while the acetone washes lost 72, 80, and 67% of their weight after the first 160°C baking. Thus, the acetone wash accounted for most of the weight

loss for the Method 5B samples. The cause for this large weight loss in acetone washes is that the probe was not at 160°C (320°F) as the filters but at an average of ~121°C (250°F) as shown below:

Average Temperatures for 5B Sampling at Boston Edison

	Run 1, °F (range)	Run 2, °F (range)	Run 3, °F (range)
Stack temp.	~359	361	361
* Probe. temp.	254 (169-392)	253 (187-367)	254 (196-324)
Flexline temp.	318	325	327
* Filter oven temp.	317 (270-340)	324 (304-333)	325 (303-346)

Taken from Appendix A

Thus, as shown in the attached Figure E-1, the sampled air ~~was~~ cooled in the probe and was reheated in the flex line and filter oven. While cooling in the probe sulfuric acid, ~~and~~ sulfates, and other materials condensed and deposited on the probe. These deposits were then removed by the acetone wash and the analyses revealed the unexpected high particulate value.

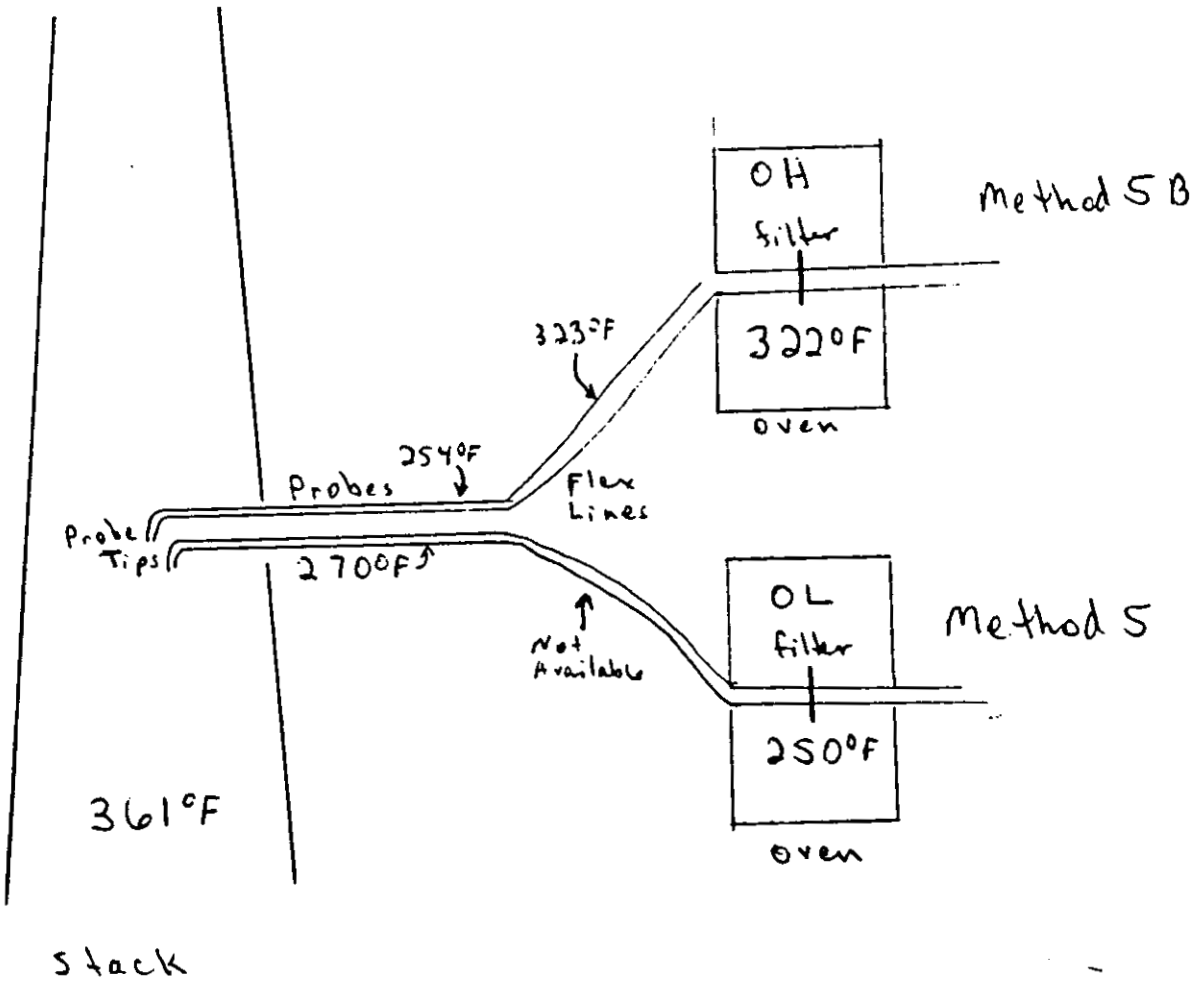


Figure E-1. Sampling train (dual-probe) and average temperatures for Boston Sampling job (Sept. 28 - Oct. 2, 1981)

SECTION D-3

SULFURIC ACID MASS DATA

Sulfuric Acid Mass Data

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES, MONSANTO RESEARCH CORPORATION, Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-71, 2000120-24; 1999628-31, 1998792-95	

Title: Sulfuric Acid

Method: Federal Register Method 6 - Barium Perchlorate Titration

I-1 : First isopropyl alcohol extraction
I-2 : Second " " "
I-3 : Third " " "

All titrations were performed in duplicate and the values reported were based on the average of those two determinations.

Units : mg $H_2SO_4 \cdot H_2O$

Sample	I-1 filter	I-1 acetone	I-2 filter	I-2 acetone	I-3 filter	I-3 acetone	total filter	total acetone	Sample Total
1-IN	<.05	.95	<.05	.66	<.13	.86	≤.23	2.47	≤2.70
1-IS	1.05	.11	.51	.21	.29	.11	1.85	.43	2.28
1-OH	1.58	1.54	.27	.51	.27	.11	2.12	2.16	4.28
1-OL	1.16	5.30	.27	1.46	.16	.32	1.59	7.08	8.67
2-IN	<.05	.93	<.05	1.29	<.05	.80	≤.15	3.02	≤3.17
2-IS	<.05	1.29	<.05	.79	.05	1.02	≤.15	3.10	≤3.25
2-OH	.18	.77	.27	.66	.05	.27	.50	1.70	2.20
2-OL	1.05	4.90	.05	1.19	.27	.53	1.37	6.62	7.99
3-IN	<.05	1.33	<.05	.64	.33	.79	≤.43	2.76	≤3.19
3-IS	<.05	.74	<.05	.48	<.13	.32	≤.23	1.54	≤1.77
3-OH	.67	.87	.46	.51	.27	.11	1.40	1.49	2.89
3-OL	.67	1.80	.18	.74	.47	.40	1.32	2.94	4.26
Blank[a]	<.13	.26	.19	.05	.27	.19	≤.59	.50	≤1.09

a The blank consisted of a blank filter and a beaker which had been used to evaporate an amount of acetone equal in volume to the average volume of the acetone rinse.

L. Stamper / C. Fritsch / T. Woosley / A. Ford

ANALYST: M. Arnold / DEA

SECTION D-4

SULFATE MASS DATA

Sulfate Mass Data

8/20

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston-Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000126-24; 1999628-31 1998792-95	

Title: Sulfate

Method: Federal Register Method 6: Barium Perchlorate Titration

W-1 : First water extraction
W-2 : Second " "
W-3 : Third " "

All titrations were performed in duplicate and the values reported were based on the average of these two determinations.

Units: mg SO_4

Sample	W-1 Filter	W-1 Acetone	W-2 Filter	W-2 Acetone	W-3 Filter	W-3 Acetone	Total Filter	Total Acetone	Sample Total
1-IN	43.4	31.9	6.88	8.25	1.15	1.19	51.4	41.30	92.80
1-IS	19.9	35.2	2.68	18.0	0.75	3.17	23.30	56.40	79.70
1-OH	2.29	6.64	.63	.92	.17	.19	3.09	7.75	10.80
1-OL	3.99	11.2	.67	2.85	.27	.57	4.93	14.6	19.6
2-IN	39.8	92.6	6.15	9.94	.95	1.53	46.9	104.	151.
2-IS	85.9	75.0	14.6	9.60	2.29	1.61	103.0	86.2	189.
2-OH	2.37	3.45	.57	2.09	.19	.17	3.13	5.71	8.84
2-OL	11.4	1.99	2.49	4.59	.85	.96	14.7	7.54	22.3
3-IN	39.2	83.0	7.84	9.14	1.34	1.34	48.4	93.5	142.
3-IS	82.2	37.7	12.8	4.84	2.46	1.23	97.5	43.8	141.
3-OH	3.25	10.3	2.19	1.61	.27	.38	5.71	12.3	18.0
3-OL	4.69	26.9	.76	3.74	.29	1.01	5.74	31.6	37.4
Blank[a]	.76	.25	.32	.27	.11	.19	1.19	0.71	1.90

a - The blank consisted of a blank filter and a beaker which had been used to evaporate an amount of acetone equal in volume to the average volume of the acetone rinses.

L. Stamper / C. Fritsch / T. Woodley / A. Ford

ANALYST: M. Arnold / [illegible]

SECTION D-5

QC REPORT FOR BOSTON EDISON COMPANY PLANT

QC/QA Report

9/20

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000120-24; 1999628-31 1998792-95	

Title: Sulfuric Acid QA/QC Filters

Method: Barium Perchlorate Titration of isopropyl alcohol extracts.

Units: mg $H_2SO_4 \cdot 2H_2O$

Sample	Observed Value	True Value	Recovery
I. QC Samples baked according to procedures employed in samples).			
QC5F	≤ 0.83	5.36	15.5 %
QC6F	≤ 0.58	50.2	1.2 %
QC7F	≤ 0.43	33.5	1.3 %
II. QC Samples used as prepared with no baking procedures employed.			
QC8F	4.74	5.36	88.4 %
QC9F	53.5	50.2	106.6 %
QC10F	30.8	33.5	92.1 %

ANALYST: H. Arnold / A. Ford / C. Fritsch / L. Stamper / T. Woosley / [illegible]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2090/20-24; 1999628-31 1998792-95	

Title: Sulfuric Acid QA/QC Beakers (Acetone Rinses)

Method: Barium Perchlorate Titration of isopropyl alcohol extractions.

Units: mg $H_2SO_4 \cdot 2H_2O$

I.

QC Samples baked according to procedures employed with samples

Sample	Observed Value	True Value	Recovery
QC 5 B	0.58	13.4	4.3 %
QC 6 B	1.54	33.5	4.6 %
QC 7 B	0.56	5.36	10.4 %

II.

QC Samples used as prepared with no baking procedures employed.

QC 8 B	12.67	13.4	94.6 %
QC 9 B	25.81	33.5	77.0 %
QC 10 B	5.52	5.36	103.0 %

ANALYST: M. Arnold / A. Ford / C. Fritsch / L. Stamper / T. Woodley / [illegible]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101,1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000120-24; 1999628-31 1998792-95	

Title: Sulfate QA/QC - Beakers
Method: Barium Perchlorate Titration of water extracts.

Units: mg SO_4

I QC sample baked according to procedures employed with field samples.

Sample	Observed Value	True Value	Recovery
Baked QC Beaker	3.28	3.2	102. %

II QC sample used as prepared with no baking procedures employed.

QC Beaker	3.37	3.2	105. %

Prior to analysis for sulfate these samples had been extracted three times with isopropyl alcohol in the same manner that the field samples were treated.

ANALYST: M. Arnold / A. Ford / C. Fritsch / L. Stamper / T. Woosley / [illegible]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038, 4065-4071, 2000/20-24, 1999628-31, 1998792-95	

Title: Sulfate QA/QC - Filters
Method: Barium Perchlorate Titration of water extracts.

Units: mg SO_4

I. QC samples baked according to procedures employed with samples.

Sample	Observed Value	True Value	Recovery
BLANK	1.82	-0-	—
Baked QC-A	4.01	3.2	125.%
Baked QC-B	4.59	3.2	143 %

II. QC Samples used as prepared with no baking procedures employed.

BLANK	2.85	-0-	—
QC-A	3.44	3.2	108.%
QC-B	3.43	3.2	107.%

Prior to analysis for sulfate these samples had been extracted three times with isopropyl alcohol in the same manner that the field samples were treated.

ANALYST: M. Arnold / A. Ford / C. Fritsch / L. Stamper / T. Wooley / [illegible]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO. D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071; 2000120-24; 1999628-31; 1998792-95	

Title: EPA Method 6 Round Robin SO_x Vials
Method: Barium Perchlorate Titration

These samples were analyzed to maintain a continuous monitor of the titrations

Units: mg/dscm

Sample	Observed Value	True Value	Recovery
0281/5137	2277.	2287.8	99.5%
	2284.8		99.9%
	2300.		100.5%
	2300.		100.5%
	2300.		100.5%
	2260.4		98.8%
0680/3240	1140.	1143.91	99.7%
	1136.		99.3%
	1140.		99.7%
0680/2107	570.4	571.55	99.7%
	571.2		99.9%
	567.5		99.2%
	570.2		99.7%
	571.56		100.0%
	577.27		100.9%
	577.27		100.9%
0680/1000	233.7	228.78	102.2%
"	228.	228.78	99.7%

ANALYST: M. Arnold / A. Ford / C. Fritsch / L. Stamper / T. Woodley / [illegible]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO Dr. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071; 2000120-24; 1999628-31; 1998792-95	

Title: Accuracy of H_2SO_4 Analysis

Method:

Sulfuric acid quality control samples were prepared under the supervision of the QA/QC Coordinator for the Analytical Support Unit. These samples were analyzed at the same time and in the same manner as the field samples except for these QC samples that were not subjected to the baking procedures. The results were:

Units: mg $H_2SO_4 \cdot 2H_2O$

Sample	Theory	IPA-1	IPA-2	IPA-3	total	Recovery %
Filters						
QC-5F	5.36	.51	<.05	.27	≤.83	15.5
QC-6F	50.2	.26	<.05	.27	≤.58	1.2
QC-7F	33.5	.27	<.05	.11	≤.43	1.3
* QC-8F	5.36	3.94	.53	.27	4.74	88.4
* QC-9F	50.2	49.8	3.42	.27	53.54	106.6
* QC-10F	33.5	28.68	2.06	.11	30.85	92.1
Beakers						
QC-5B	13.4	.21	.26	.11	.58	4.3
QC-6B	33.5	1.01	.26	.27	1.54	4.6
QC-7B	5.36	.40	.11	.05	.56	10.4
* QC-8B	13.4	12.35	.11	.21	12.67	94.6
* QC-9B	33.5	25.46	.08	.27	25.81	77.0
* QC-10B	5.36	5.30	.11	.11	5.52	103.0

* Samples were not baked

The filters and beakers that were baked, as were the field samples, extracted, then titrated gave very low results. This gives good

ANALYST: D-24

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038, 4065-4071, 2000120-24, 1999628-31, 1998792-95	

Title:

Method:

Correlation to earlier work done on the Peoria project.

The standards prepared on filters, but not baked, gave a range of recovery from 88.4 to 106.6% with a mean of 95.7% and a standard deviation of 09.6.

The standards prepared in beakers, but not baked, demonstrated a range of recovery from 77.0 to 103% with a mean of 91.5% and a standard deviation of 13.3.

Accuracy of Sulfate Analysis

Sulfate quality control samples were prepared under the supervision of the QA/QC Coordinator for the Analytical Support Unit. These samples were analyzed at the same time and in the same manner as the field samples, including the prior extraction with isopropyl alcohol. The only exception to this were those samples that were not subjected to the baking procedures.

The results were as follows:

ANALYST: [signature]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000/26-24; 199628-31 1998792-45	

Title:

Method:

units: mg SO_4

Sample	Theory	W-1	W-2	W-3	Total	Recovery %
Filters						
Bkgd Blank	0	1.29	.34	.19	1.82	—
Baked A	3.2	3.06	.76	.19	4.01	125.
Baked B	3.2	3.82	.62	.15	4.59	143.
* Blank	0	.67	.19	.17	2.85	—
* A	3.2	2.87	.38	.19	3.44	108.
* B	3.2	2.74	.34	.35	3.43	107.
Beakers						
Baked Beak	3.2	2.70	.44	.14	3.28	102.
* Beaker	3.2	2.65	.47	.25	3.37	105.

* Samples were NOT baked.

The average % Recovery for the filters was 120.8% with a standard deviation of 17. The average recovery for the beakers was 103.5% with a standard deviation of 2.1.

Titration Accuracy —

EPA Method 6 Barium Rabin SO_4 vials were analyzed periodically during the titration of the field samples. The average recovery was 100.0% and the standard deviation was 0.8.

ANALYST: [signature]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000120-24; 1999628-31 1998792-95	

Title:
Method: Blanks – In addition to the QA/QC samples two types of blanks were carried through the entire procedure (desiccation, 960°C baking, 176°C baking, extraction and titration).

1) Lab filter blank

2) Acetone lab blank

Results were:

Sample	mg $H_2SO_4 \cdot 2H_2O$	mg SO_4
filter	≤ .59	1.19
acetone	.50	.71

The least amount of sulfuric acid observed was 1.77 mg $H_2SO_4 \cdot 2H_2O$. Using this figure the maximum % of each blank is calculated as:

filter 33%
acetone 28%

Based on a low of 8.84 mg SO_4 found in a sample the maximum % of each blank was:

filter 13%
acetone 8%.

ANALYST: [signature]

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101,1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000120-24; 1999628-31 1998792-95	

Title: Analysis of Field Sample Extraction Data

Method: (Table E-3)

Following is a tabulation of the amount of sulfuric acid and sulfates obtained from the field sample filters and acetone rinses and the relation of the amounts of material found in the third extraction to the amount in the first extraction, and of the amount in the third extraction to the total amount of material. The average of each of the percentages is indicated as well as the standard deviation.

Also shown is the amounts of sulfuric acid and sulfate extracted in the first extract for both the filters and the beakers related to the total amount extracted.

In the case of sulfuric acid the average recovery of the total in the first extract was 44.8% for the filters and 51.5% for the beakers, while the recovery in the third extract averaged 31.8% in the filters and 18.6% in the beakers. These lower than expected relationships are probably due to the low level recovery of sulfuric acid after the samples have been subjected to the required baking procedures.

In the sulfate analyses, the average for first extract recovery was 79.2% for

ANALYST: Bll

Table E-3 - Boston/Edison 101.1223 1-81-10-06-01

19/20

FILTERS

Sample	IPA-1	IPA-2	IPA-3	Total	IPA-3/IPA-1 X100	IPA-3/Total X100	W-1	W-2	W-3	Total	W-3/W-1 X100	W-3/Total X100	H_2SO_4/H_2O IPA-1/Total X100	SO_4 W-1/Total X100
1-IN	<.05	<.05	<.13	≤.23	—	56.5	43.4	6.88	1.15	51.4	2.6	2.2	21.7	84.4
1-IS	1.05	.51	.29	1.95	27.6	15.7	19.9	2.68	.75	23.3	3.8	3.2	56.8	85.4
1-OH	1.58	.27	.27	2.12	17.1	12.7	2.29	.63	.17	3.09	7.4	5.5	74.5	74.1
1-OL	1.16	.27	.16	1.59	13.8	10.1	3.49	.67	.27	4.93	6.8	5.5	73.0	80.9
2-IN	<.05	<.05	<.05	≤.15	—	33.3	39.8	6.15	.95	46.9	2.4	2.0	33.3	84.9
2-IS	<.05	<.05	.05	≤.15	—	33.3	85.9	14.6	2.29	103.	2.7	2.2	33.3	83.4
2-OH	.18	.27	.05	.50	27.8	10.0	2.37	.57	.19	3.13	8.0	6.1	36.0	75.7
2-OL	1.05	.05	.27	1.37	25.7	19.7	11.4	2.49	.85	14.7	7.5	5.8	76.6	77.6
3-IN	<.05	<.05	.33	≤.43	—	76.7	39.2	7.84	1.34	48.4	3.4	2.8	11.6	81.0
3-IS	<.05	<.05	<.13	≤.23	—	56.5	82.2	12.8	2.46	97.5	3.0	2.5	21.7	84.3
3-OH	.67	.46	.27	1.40	40.3	19.3	3.25	2.19	.27	5.71	8.3	4.7	47.9	56.9
3-OL	.67	.18	.47	1.32	70.2	35.6	4.69	.76	.29	5.74	6.2	5.0	50.8	81.7
Average					31.8	31.6					5.2	4.0	44.8	79.2
Std Dev.					19.	22.					2.4	1.6	22.1	7.9

BEAKERS

Sample	IPA-1	IPA-2	IPA-3	Total	IPA-3/IPA-1 X100	IPA-3/Total X100	W-1	W-2	W-3	Total	W-3/W-1 X100	W-3/Total X100	H_2SO_4/H_2O IPA-1/Total X100	SO_4 W-1/Total X100
1-IN	.95	.66	.86	2.47	90.5	34.8	31.9	8.25	1.19	41.3	3.7	2.9	38.5	77.2
1-IS	.11	.21	.11	.43	100.	25.6	35.2	18.0	3.17	56.4	9.0	5.6	25.6	62.4
1-OH	1.54	.51	.11	2.16	7.1	5.1	6.64	.92	.19	7.75	2.9	2.4	71.3	85.7
1-OL	5.30	1.46	.32	7.08	6.0	4.5	11.2	2.85	.57	14.6	5.1	3.9	74.9	76.7
2-IN	.93	1.29	.80	3.02	86.0	26.5	92.6	9.94	1.53	104.	1.6	1.5	30.8	89.0
2-IS	1.29	.79	1.02	3.10	79.1	32.9	75.0	9.60	1.61	86.2	2.2	1.9	41.6	87.0
2-OH	.77	.66	.27	1.70	35.1	15.9	3.45	2.09	.17	5.71	4.9	3.0	45.3	60.4
2-OL	4.90	1.19	.53	6.62	10.8	8.0	1.99	4.59	.96	7.54	48.2	12.7	74.0	26.4
3-IN	1.33	.64	.79	2.76	59.4	28.6	83.0	9.14	1.34	93.5	1.6	1.4	48.2	88.8
3-IS	.74	.48	.32	1.54	43.2	20.8	37.7	4.84	1.23	43.8	3.3	2.8	48.0	86.1
3-OH	.87	.51	.11	1.49	12.6	7.4	10.3	1.61	.38	12.3	3.7	3.1	58.4	83.7
3-OL	1.80	.74	.40	2.94	22.2	13.6	26.9	3.74	1.01	31.6	3.8	3.2	61.2	85.1
Average					46.0	18.6					7.5	3.7	57.5	75.7
Std. Dev.					35.6	11.0					13.0	3.0	16.6	18.3

ANALYSIS REPORT	DATE 10-26-81	cc:Files
TO D. Day / Boston Edison	RECORD NUMBER 1-81-10-06-01	
FROM ANALYTICAL SERVICES MONSANTO RESEARCH CORPORATION Dayton, Ohio	PROJECT NUMBER 101.1223	
	NOTEBOOK REFERENCE 1834038; 4065-4071 2000120-24; 1999628-31 1998292-95	

Title:

Method:

the filters and 75.7% for the beakers. In the third extraction sequence the average recovery was 84.0% for the filters and 83.7% for the beakers. This represents good agreement with expected extraction behavior.

It should be noted that the end point in the barium perchlorate titration procedure is fairly difficult to visualize. In previous work high recovery of standards was noted and may have been attributable to this end point difficulty. In the analysis methodology for sulfuric acid determinations sample aliquots are diluted with isopropyl alcohol prior to titration. However, field samples treated accordingly gave extreme difficulty in observing the end point. The substitution of 80% isopropyl alcohol/water enhanced the end point observation and did not provide any interference to the analysis. Several acid standards were titrated utilizing the addition of 20% water to the titration matrix to ensure good observance of true values prior to modification of the method.

M. Arnold / A. Ford / C. Fritsch
L. Stamper / T. Woosley

ANALYST: [signature]

SECTION D-6

CHAIN OF CUSTODY RECORDS

CHAIN OF CUSTODY RECORD

MRC JOB NUMBER 101.1229

CONTRACT NUMBER 68-02-3547

PLANT NAME OR CODE Boston Edison

CUSTOMER REPRESENTATIVE D. Holtzschuh-EPA

MRC CONTRACT MANAGER G. Ball

MRC TEAM LEADER ✓ D. Day

(Specific information on samples is available on attached "Sample Identification Log")

Signatures		Date	Time	Remarks
Team Leader Verification of Collected Samples: Jim Schalman		9/3/81		
Relinquished by: J.J.	Received by: LDJ	10/2/81		
Relinquished by: LDJ	Received by: DRD	10/5/81		
Logged-in-by: Alan Ford				
Received for Analysis by: Al Ford				
Method of Shipment: Truck - driven by MRC personnel		Number of Containers: 4 bottles & 4 filters		

Special Instructions (Sample preservation, security, delivery to, etc.)

bottles tape sealed and boxed
4 bottles include #1 - OH
1 - OL
1 - IN North
1 - IN South
(bottles contain acetone wash)
4 filters from run #1 - OH
1 - OL
1 - IN North
1 - IN South

CHAIN OF CUSTODY RECORD

MRC JOB NUMBER 101 1229

CONTRACT NUMBER 68-02-3547

PLANT NAME OR CODE Boston Edison

CUSTOMER REPRESENTATIVE D. Holzschuh-EPA

MRC CONTRACT MANAGER G. Ball

MRC TEAM LEADER Tim Thalman

(Specific information on samples is available on attached "Sample Identification Log")

Signatures		Date	Time	Remarks
Team Leader Verification of Collected Samples: Jim Thalman		10/1/81		
Relinquished by: JJ.	Received by: JBJ	10/2/81		
Relinquished by: JBJ	Received by: DRD	10/5/81		
Logged-in-by: Alan Ford				
Received for Analysis by: Al Ford				
Method of Shipment: truck-driven by MRC personnel		Number of Containers:		4 bottles & 4 filters

Special Instructions (Sample preservation, security, delivery to, etc.)

Bottles tape sealed and boxed
4 bottles include #2 - OH
2 - OL
2 - IN North
2 - IN South
(bottles contain acetone wash)
4 filters from run #2 - OH
2 - OL
2 - IN North
2 - IN South

1 copy to Team Leader or Representative

CHAIN OF CUSTODY RECORD

MRC JOB NUMBER 101.1229

CONTRACT NUMBER 68-02-3547

PLANT NAME OR CODE Boston Edison

CUSTOMER REPRESENTATIVE D. Holmschuh-EPA

MRC CONTRACT MANAGER G. Ball

MRC TEAM LEADER Tim Thalman

(Specific information on samples is available on attached "Sample Identification Log")

Signatures		Date	Time	Remarks
Team Leader Verification of Collected Samples: Jim Thalman		10/2/81		
Relinquished by: J.J.	Received by: JDD	10/2/81		
Relinquished by: JDD	Received by: DRD	10/5/81		
Logged-in-by: Alan Ford				
Received for Analysis by: Al Ford				
Method of Shipment: Truck-driven by MRC personnel		Number of Containers: 4 bottles & 4 filters		

Special Instructions (Sample preservation, security, delivery to, etc.)

Bottles tape sealed and boxed
4 bottles include # 3 - OH
3 - OL
3 - IN North
3 - IN South

(bottles contain acetone wash)
4 filters from run # 3 - OH
3 - OL
3 - IN North
3 - IN South

APPENDIX E

PROJECT PARTICIPANTS

APPENDIX E

PROJECT PARTICIPANTS

Environmental Protection Agency

Dennis Holzschuh	Task Manager, Emissions Measurement Branch
Gary McAlister	Chemist, Emissions Measurement Branch

Monsanto Research Corporation

George Ball	Contract Manager, Contract Program Manager
Duane Day	Research Engineer, Contract Task Leader, Principal report writer, Sampling team member
Tom Hughes	Field Sampling Supervisor, Sampling manpower assignment, Sampling team member
Tim Thalman	Team Leader
Darrel Harris	Sampling Team Members, Console Operator
Sam Cheng	Sampling Team Member, Probe pusher
Lauvon Stokes	Sampling Team Member, Probe pusher
Audrey Buchanan	Data Processing Operator, keypunch and computer operator
Elaine Santana	Research Chemist I, Quality Assurance Control Supervisor, report reviewer
Don Sharp	Analytical Support Manager, Sample analysis coordinator, Reporter of analysis results and QC report
Mike Arnold	Analytical personnel, extraction, titrated samples
Len Stamper	Analytical personnel, titrated samples
Charlotte Fritsch	Analytical personnel, titrated samples
Al Ford	Analytical personnel, log-in
Teri Woosley	Analytical personnel, titrated samples

Pollution Control Science, Inc.

Frank Meadows	Sampling Team Member, Console operator
Craig Jones	Sampling Team Member, Console operator
Vasu Kulkarni	Sampling Team Member, Smoke reader

Systec, Inc.

Debbie Barrett	Sampling Team Member, Console operator

Radian Corporation

Steve Piccott	ESP operations, boiler and monitor

Boston Edison Company

Peter Gravallese	Administrative and plant contact
Jim Creed	Plant contact

Environmental Protection Agency - State of Massachusetts

Brad Stewart	Local state agency contact

United States
Environmental Protection
Agency

Office of Air Noise and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park NC 27711

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