FINAL REPORT

on

STACK EMISSION SAMPLING AT WISCONSIN STEEL COMPANY COKE OVEN PLANT, CHICAGO, ILLINOIS

to

ENVIRONMENTAL PROTECTION AGENCY

(Contract No. 68-02-1409, Task 50)

by

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SECTION 1

INTRODUCTION

Emissions from the coke manufacturing industry are reported to contribute significant amounts of particulate and carcinogenic compounds into the atmosphere[1,2]. Wet electrostatic precipitators (WESP) are being used as a control device for such emissions. In an effort to determine the efficiency of WESP units relative to the process emissions from the coke oven doors, the United States Environmental Protection Agency contracted with Battelle-Columbus Laboratories and Clayton Environmental Consultants to measure the emissions from coke oven door leaks at the inlet and outlet of the WESP units of Wisconsin Steel coke oven plant, Chicago, Illinois.

Battelle-Columbus Laboratory personnel were responsible for sampling and analyzing the WESP inlet and outlet gas streams to determine the concentrations of about 20 polycyclic organic matter (POM) compounds in these streams. POM samples were collected using a Method 5 sampling train modified to include a Tenax-adsorbent column between the filter and the first impinger. Gas chromatography-mass spectrometry (GC-MS) analyses were conducted at the Battelle-Columbus Laboratories. Also, stack emission gases from the inlet and outlet were collected in Tedlar bags at a relatively slow rate over the 8-hour sampling period. Evacuated-flask samples were collected from the gas samples in the Tedlar bags, and the gases were analyzed for concentrations of benzene and ethyne (acetylene) by gas chromatography.

Clayton Environmental Consultants personnel were responsible for the measurement of particulate concentrations in the WESP inlet and outlet gas streams, for determination of the CO_2, O_2, and CO concentrations in the gases collected in the Tedlar bags, for visible emissions observations, and for the collection of WESP water samples from the inlet and outlet water supply. In addition, Clayton included an XAD-2 adsorbent column in their sampling train to collect organic vapors. Battelle determined the benzene-soluble organic catch in the XAD-2 columns and analyzed the water samples for POM compounds.

The following sections of this report cover the summary of results, process description and operation, location of sampling points, and sampling and analytical procedures. Field and laboratory data and calculations are presented in various appendices as noted.

Results of the work performed by Clayton and Battelle analyses of Clayton samples are reported in a separate report prepared by Clayton.

SECTION 2

SUMMARY AND DISCUSSION OF RESULTS

The inlet and outlet gas sampling data and results are summarized and presented in Tables 1 and 2 respectively. Raw field and laboratory data are presented in Appendix A. Complete sampling results, including additional support data and sample calculations, are presented in Appendix B.

POLYCYCLIC ORGANIC MATTER (POM) IN GAS STREAM

Tables 3 and 4 present results for emissions of selected POM species at the wet ESP inlet and outlet in terms of concentrations and emission rates, respectively. Table 5 is a tabulation of the actual POM content of the individual samples. For each run, the probe wash residue and filter catch were combined for one analysis; the Tenax adsorbent catch was analysed separately. Hence, in Tables 3, 4, and 5, two values are presented for each sample; one represents the probe wash and filter, the other represents the adsorbent column. Pre-clean up and blank values are also presented. (The outlet pre-clean up results for the probe-wash-plus-filter are abnormally high with no explanation at this time.) For the most part, the data show relativity high values at the precipitator inlet when compared to the outlet, as would be expected.

Table 4 presents results on the effectiveness of the wet ESP for controlling emissions of individual POM species. The wet ESP was reasonably effective (over 90 percent) in reducing POM emissions of all species except naphthalene.

Table 6 summarizes the effectiveness of the wet ESP for controlling total POM emissions from the coke oven. In Table 6, the sum of the POM emissions in the inlet and outlet streams are computed, and the control device efficiency is calcualted. For three runs, the control device efficiency was moderately high, 80.7 to 92.4 percent. The low efficiency for Run 4 of 17.2 percent (attributed to a high naphthalene value for the outlet adsorbent column sample), reduced the average efficiency to 69.0 percent. Neglecting naphthalene, WESP efficiencies for the four runs are 93.5, 95.5, 98.9 and 94.5; an average of 95.6

TOTAL FLUORESCENCE RESULTS

Table 7 presents results of total fluorescence for the air emission samples. Also shown in Table 7 are the total POM values obtained by summing values for all POM species reported in Table 5, and the ratio of total fluorescence to the sum of POM values by GC-MS. Reviewing these results shows that the total fluorescence values were much higher than the summation of the POM values; ranging from a value 8 times as high as the GC-MS value to a value over 8000 times the GC-MS value. It appears that there were large quantities of fluorescent compounds present in these samples beyond the specific POM compounds examined by GC-MS technique. It is known that most complex organics (non-POM compounds as well as POMs) fluoresce when excited over a broad range of wavelengths. Apparently the bands of excitation and emission wavelengths used for these measurements were not sufficiently selective for the POM compounds of interest. A possible improvement in the total fluorescence precedure might be to excite the sample over a broad range of wavelenths, as was done here, but to develop a mask, or screen, for the emission measurement that will selectively pass fluorescence in the wavelengths of harmful POM's, but not pass fluorescence in other wavelengths.

ANALYSIS OF SAMPLES

Grab (flask) samples were taken from the integrated gas (bag) samples, which were collected during the particulate runs. The flask samples were analyzed for C_2H_2 and C_6H_6. Table 8 is a tabulation of these data. The accuracy of the reported values is estimated to be $\pm$ 20 percent.

Inlet and outlet data indicate little difference with C_2H_2 concentrations ranging from 5 to 15 ppm, by volume, and C_6H_6 concentrations ranging from 1 to 5 ppm by volume.

WET ELECTROSTATIC PRECIPITATOR WATER SAMPLES

Water samples were collected from the inlet and outlet of the ESP unit and analyzed for POM constituents. Table 9 is a tabulation of the results of the analysis. Unfortunately, the volume of the water samples was not measured before extraction, either by Clayton at the sampling site, or by Battelle preceding extraction. Interviewing the Battelle staff that provided the sample containers and transported the filled containers back to the laboratory for analyses revealed that the samples were transported in 1-liter bottles, and the bottles were 60 to 90 percent full. Assuming that the bottles were 75 percent full, POM concentrations were calculated; these values are reported in Table 10.

If the inlet and outlet water flow rates were known, it would be desirable to compare values for the POM removed from the gas stream with the POM increase for the water stream.

TABLE 1. INLET GAS SAMPLING RESULTS

(Metric Units)

INLET RESULTS, WISCONSIN STEEL CO.

RUN NO.	1	2	3	4	AVERAGE
TEST DATE	5/10	5/11	5/12	5/13	
VOLUME OF GAS SAMPLED, NCM	10.43	9.34	9.44	9.24	9.61
PERCENT MOISTURE BY VOLUME	1.0	1.0	1.0	1.0	1.0
AVERAGE STACK TEMPERATURE, C	23	32	35	34	31
STACK VOLUMETRIC FLOW RATE, NCMM	5110	5058	5102	5010	5073
STACK VOLUMETRIC FLOW RATE, CMM	5305	5411	5518	5425	5415
PERCENT ISOKINETIC	104.3	101.9	102.2	102.0	102.6

(English Units)

INLET RESULTS, WISCONSIN STEEL CO.

RUN NO.	1	2	3	4	AVERAGE
TEST DATE	5/10	5/11	5/12	5/13	
VOLUME OF GAS SAMPLED, DSCF	369.8	331.2	334.6	327.7	340.8
PERCENT MOISTURE BY VOLUME	1.0	1.0	1.0	1.0	1.0
AVERAGE STACK TEMPERATURE, F	74	90	96	94	89
STACK VOLUMETRIC FLOW RATE, DSCFM	181144	179686	180892	177622	179836
STACK VOLUMETRIC FLOW RATE, ACFM	188063	191839	195637	192331	191968
PERCENT ISOKINETIC	104.3	101.9	102.2	102.0	102.6

TABLE 2. OUTLET GAS SAMPLING RESULTS

(Metric Units)

OUTLET RESULTS, WISCONSIN STEEL CO.

RUN NO.	1	2	3	4	AVERAGE
TEST DATE	5/10	5/11	5/12	5/13	
VOLUME OF GAS SAMPLED, NCM	8.35	8.65	8.77	8.89	8.67
PERCENT MOISTURE BY VOLUME	1.7	1.6	2.0	2.4	1.9
AVERAGE STACK TEMPERATURE, C	16	22	26	25	22
STACK VOLUMETRIC FLOW RATE, NCMM	5366	5359	5318	5277	5330
STACK VOLUMETRIC FLOW RATE, CMM	5455	5552	5582	5564	5543
PERCENT ISOKINETIC	88.9	99.8	101.9	104.1	98.7

(English Units

OUTLET RESULTS, WISCONSIN STEEL CO.

RUN NO.	1	2	3	4	AVERAGE
TEST DATE	5/10	5/11	5/12	5/13	
VOLUME OF GAS SAMPLED, DSCF	295.9	306.7	310.7	315.2	307.1
PERCENT MOISTURE BY VOLUME	1.7	1.6	2.0	2.4	1.9
AVERAGE STACK TEMPERATURE, F	62	73	79	77	73
STACK VOLUMETRIC FLOW RATE, DSCFM	190226	189998	188526	187092	188961
STACK VOLUMETRIC FLOW RATE, ACFM	193379	196820	197881	197963	196511
PERCENT ISOKINETIC	88.9	99.8	101.9	104.1	98.7

TABLE 3. POM CONCENTRATIONS IN INLET AND OUTLET GAS STREAMS

	RUN 1				RUN 2			
	INLET		OUTLET		INLET		OUTLET	
	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column
Naphthalene	2.24	49.2	2.68	35.8	600.	2450.	0.416	1090.
Fluoranthrene	560.	17.1	7.54	116.	613.	419.	8.67	81.2
Pyrene	377.	10.6	4.31	50.3	393.	291.	5.20	35.0
Benz(c)phenanthrene	51.8	-	0.108	0.539	30.3	17.0	0.590	0.925
Chrysene	535.	1.64	0.503	5.16	297.	93.3	6.96	3.25
Benz(a)anthracene	535.	2.97	1.68	6.47	286.	81.5	3.58	3.01
Dimethylbenz(a)anthracene	<0.05	0.345	<0.06	0.06	9.53	<0.05	<0.06	<0.06
Benz fluoranthrenes	497.	0.585	1.86	3.25	469.	1.19	2.60	1.63
Benz(a)pyrene	150.	0.221	1.34	-	129.	0.343	-	0.486
Benz(e)pyrene	246.	-	0.383	1.77	227.	0.064	2.29	-
Cholanthrene	<0.05	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06
Indeno(1,2,3-cd)pyrene	135.	<0.05	2.04	<0.06	143.	0.107	1.85	<0.06
Dibenz anthracenes	108.	<0.05	1.92	<0.06	158.	<0.05	1.85	<0.06
Dibenz acridine	<0.05	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06
Dibenz carbazole	<0.05	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06
Dibenz pyrene	137.	<0.05	1.80	<0.06	131.	<0.05	1.85	<0.06
3-Methyl cholanthrene	<0.05	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06

TABLE 3. POM CONCENTRATIONS IN INLET AND OUTLET GAS STREAMS (continued)

	RUN 3				RUN 4			
	INLET		OUTLET		INLET		OUTLET	
	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column
Naphthalene	525.	883.	-	1120.	576.	9.45	-	2210.
Fluoranthrene	3120.	310.	6.84	38.7	587.	1.73	9.79	49.3
Pyrene	798.	180.	3.76	21.2	357.	0.974	2.81	32.4
Benz(c)phenanthrene	38.1	25.2	0.034	0.205	29.6	18.8	2.09	0.675
Chrysene	322.	40.5	0.593	4.46	263.	73.0	0.584	5.52
Benz(a)anthracene	284.	27.9	0.570	4.33	223.	52.5	0.787	5.29
Dimethylbenz(a)anthracene	3.81	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06
Benz fluoranthrenes	755.	3.93	0.969	1.49	291.	0.877	1.97	2.04
Benz(a)pyrene	195.	0.286	0.741	0.422	89.0	0.758	3.37	0.922
Benz(e)pyrene	625.	0.011	0.148	0.011	146.	-	0.315	0.067
Cholanthrene	<0.05	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06
Indeno(1,2,3-cd)pyrene	242.	<0.05	1.48	<0.06	84.1	<0.05	1.91	0.911
Dibenz anthracenes	272.	<0.05	<0.06	<0.06	84.6	<0.05	2.02	<0.06
Dibenz acridine	-	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06
Dibenz carbazole	-	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06
Dibenz pyrene	217.	<0.05	1.25	<0.06	82.1	<0.05	1.69	<0.06
3-Methyl cholanthrene	-	<0.05	<0.06	<0.06	<0.05	<0.05	<0.06	<0.06

TABLE 3. POM CONCENTRATIONS IN INLET AND OUTLET GAS STREAMS (continued)

	AVERAGES					
	INLET			OUTLET		
	Probe Wash plus Filter	Adsorbent Column	Total	Probe Wash plus Filter	Adsorbent Column	Total
Naphthalene	426.	848.	1270.	0.77	1110.	1110.
Fluoranthrene	1220.	187.	1410.	8.21	71.3	79.5
Pyrene	481.	121.	602.	4.02	34.8	38.8
Benz(c)phenanthrene	37.5	15.3	52.8	0.710	0.586	1.30
Chrysene	354.	52.1	406.	2.16	4.60	6.76
Benz(a)anthracene	332.	41.2	373.	1.65	4.78	6.43
Dimethylbenz(a)anthracene	3.34/3.36	0.086/0.124	3.43/3.48	<0.06	<0.06	<0.12
Benz fluoranthrenes	503.	1.65	505.	1.85	2.10	3.95
Benz(a)pyrene	141.	0.402	141.	1.36	0.458	1.82
Benz(e)pyrene	311.	0.019	311.	0.784	0.462	1.25
Cholanthrene	<0.05	<0.05	<0.10	<0.06	<0.06	<0.12
Indeno(1,2,3-cd)pyrene	151.	0.027/0.063	151.	1.82	0.228/0.273	2.05/2.09
Dibenz anthracenes	156.	<0.05	156.	1.45/1.46	<0.06	1.45/1.52
Dibenz acridine	<0.05	<0.05	<0.10	<0.06	<0.06	<0.12
Dibenz carbazole	<0.05	<0.05	<0.10	<0.06	<0.06	<0.12
Dibenz pyrene	142.	<0.05	142.	1.65	<0.06	1.65/1.71
3-Methyl cholanthrene	<0.05	<0.05	<0.10	<0.06	<0.06	<0.12

Footnotes to TABLE 3.

1. Units are nanograms/normal cubic meter.

2. Solvent and adsorbent column blanks were subtracted from POM mass values before concentrations were calculated. Blank values reported as "less than" values were treated as zero values for these calculations.

3. All calculated values were rounded off to 3 significant figures to avoid implying excessive accuracy.

TABLE 4. POM EMISSION RATES

	RUN 1				RUN 2			
	INLET		OUTLET		INLET		OUTLET	
	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column
Naphthalene	0.687	15.1	0.863	11.5	183	744	0.134	350
Fluoranthrene	171	5.24	2.43	37.4	186	127	2.79	26.1
Pyrene	116	3.25	1.39	16.2	120	88.5	1.67	11.3
Benz(c)phenanthrene	15.9	--	0.034	0.173	9.22	5.17	0.190	0.297
Chrysene	164	0.503	0.164	1.66	90.3	28.4	2.24	1.04
Benz(a)anthracene	164	0.910	0.541	2.06	87.0	24.8	1.15	0.965
Dimethylbenz(a)anthracene	<0.02	0.106	<0.02	<0.02	2.89	<0.02	<0.02	<0.02
Benz fluoranthrenes	152	0.179	0.599	1.04	142	0.362	0.836	0.524
Benz(a)pyrene	45.9	0.067	0.432	--	39.2	0.104	--	0.156
Benz(e)pyrene	75.4	--	0.123	0.570	69.0	0.020	0.736	--
Cholanthrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Indeno(1,2,3-cd)pyrene	41.4	<0.02	0.657	<0.02	43.5	0.033	0.595	<0.02
Dibenz anthracenes	33.1	<0.02	0.618	<0.02	48.0	<0.02	0.595	<0.02
Dibenz acridine	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenz carbazole	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenz pyrene	42.0	<0.02	0.579	<0.02	39.8	<0.02	0.595	<0.02
3-Methyl cholanthrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
TOTAL	1021.39	25.36	8.43	70.60	1059.91	1018.39	11.53	390.38

TABLE 4. POM EMISSION RATES (Continued)

	RUN 3				RUN 4			
	INLET		OUTLET		INLET		OUTLET	
	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column	Probe Wash plus Filter	Adsorbent Column
Naphthalene	161	270	--	357	173	2.84	--	699
Fluoranthrene	952	95.2	2.18	12.4	176	0.520	3.10	15.6
Pyrene	244	55.1	1.20	6.76	107	0.293	0.889	10.3
Benz(c)phenanthrene	11.7	7.71	0.010	0.066	8.89	5.65	0.662	0.216
Chrysene	98.9	12.4	0.190	1.42	79.1	22.0	0.185	1.75
Benz(a)anthracene	86.9	8.54	0.182	1.38	67.0	15.8	0.249	1.67
Dimethylbenz(a)anthracene	1.17	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benz fluoranthrenes	231	1.20	0.310	0.475	87.5	0.263	0.624	0.645
Benz(a)pyrene	59.7	0.088	0.236	0.134	26.8	0.228	1.07	0.292
Benz(e)pyrene	191	0.004	0.048	0.004	43.9	--	0.100	0.021
Cholanthrene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Indeno(1,2,3-cd)pyrene	74.1	<0.02	0.473	<0.02	25.3	<0.02	0.605	0.288
Dibenz anthracenes	83.3	<0.02	<0.02	<0.02	25.4	<0.02	0.640	<0.02
Dibenz acridine	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenz carbazole	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Dibenz pyrene	66.4	<0.02	0.399	<0.02	24.7	<0.02	0.535	<0.02
3-Methyl cholanthrene	--	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
	2261.17	450.24	5.23	379.64	844.59	47.59	8.66	729.78

TABLE 4. POM EMISSION RATES (Continued)

	AVERAGES						
	INLET			OUTLET			
	Probe Wash Plus Filter	Adsorbent Column	Total	Probe Wash Plus Filter	Adsorbent Column	Total	Control Device Efficiency, percent ($\frac{\text{Inlet-Outlet}}{\text{Inlet}}$ x 100)
Naphthalene	129	258	387	0.997	354	355	8.3
Fluoranthrene	371	57	428	2.63	22.9	25.5	94.0
Pyrene	147	36.8	184	1.29	11.1	12.4	93.3
Benz(c)phenanthrene	11.4	4.63	17.1	0.224	0.188	0.412	97.6
Chrysene	108	15.8	124	0.695	1.47	2.17	98.3
Benz(a)anthracene	101	12.5	114	0.531	1.52	2.05	98.2
Dimethylbenz(a)anthracene	1.02/1.03	.028/.043	1.05/1.07	<0.02	<0.02	<0.04	96.2/100
Benz fluoranthrenes	153	0.501	154	0.592	0.671	1.26	99.2
Benz(a)pyrene	42.9	0.122	43.0	0.435	0.146	0.581	98.6
Benz(e)pyrene	94.8	0.006	94.8	0.252	0.149	0.399	99.6
Cholanthrene	<0.02	<0.02	<0.04	<0.02	<0.02	<0.04	—
Indeno(1,2,3-cd)pyrene	46.1	0.008/0.023	46.1	0.583	0.072/0.087	0.655/0.670	98.6
Dibenz anthracenes	47.5	<0.02	47.5	0.463/0.468	<0.02	<0.48/0.49	99.0
Dibenz acridine	<0.02	<0.02	<0.04	<0.02	<0.02	<0.04	—
Dibenz carbazole	<0.02	<0.02	<0.04	<0.02	<0.02	<0.04	—
Dibenz pyrene	43.2	<0.02	43.2	0.527	<0.02	0.53/0.55	98.8
3-Methyl cholanthrene	<0.02	<0.02	<0.04	<0.02	<0.02	<0.04	—

Footnotes to TABLE 4.

1. Units are milligrams/hour (corrected for blanks).

2. All above values for specific POM's were rounded off to 3 significant figures or 3 decimal places to avoid implying excessive accuracy.

TABLE 5. COKE OVEN EFFLUENT ANALYSIS RESULTS BY GAS CHROMATIC-MASS SPECTROPHOTOMETRY

	Pre-Clean-Up				Run 1				Run 2			
	INLET		OUTLET		INLET		OUTLET		INLET		OUTLET	
	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column
Sample Number ⟶	301-302	303	304-305	306	307-308	309	310-311	312	318-319	320	321-322	323
Naphthalene	5.0	24	6474	6.1	24	525	23	311	5607	22857	4.2	9435
Fluoranthene	3.3	4.5	9492	1.4	5844	178	63	972	5727	3921	75	702
Pyrene	1.5	<0.5	5487	0.4	3927	111	36	420	3666	2721	45	303
Benz(c)phenanthrene	<0.5	<0.5	183	<0.5	543	2.4	3.3	7.5	285	162	7.5	11
Chrysene	<0.5	<0.5	7237	<0.5	5583	20	9	46	2775	874	65	31
Benz(a)anthracene	<0.5	<0.5	5240	<0.5	5583	31	14	54	2667	761	31	26
Dimethylbenz(a)Anthracene	<0.5	<0.5	<0.5	<0.5	<0.5	3.6	<0.5	<0.5	89	<0.5	<0.5	<0.5
Benz fluoranthenes	<0.5	<0.5	42	<0.5	5193	13	23	34	4389	18	30	21
Benz(a)pyrene	<0.5	<0.5	14	<0.5	1574	9.1	18.2	1.3	1216	10	2	11
Benx(e)pyrene	<0.5	<0.5	3	<0.5	2569	0	3.4	15.2	2117	1	20	0
Cholanthrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-cd)pyrene	<0.5	<0.5	<0.5	<0.5	1404	<0.5	17	<0.5	1335	1	16	<0.5
Dibenz anthracene	<0.5	<0.5	<0.5	<0.5	1122	<0.5	16	<0.5	1474	<0.5	16	<0.5
Dibenz acridine	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz carbazole	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz pyrene	<0.5	<0.5	<0.5	<0.5	1430	<0.5	15	<0.5	1227	<0.5	16	<0.5
3-Methyl cholanthrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TOTAL POM	9.2	16.8	34,149.5	1.8	34,773.5	861.9	218.4	1,834.8	32,551.5	31,294.3	310.2	10,508.7

Note: 1. All data are nanograms
2. "Less than" values indicate some of the compound was detected but it was below the reported value and could not be quantified more accurately.

TABLE 5. COKE OVEN EFFLUENT ANALYSIS RESULTS BY GAS CHROMATIC-MASS SPECTROPHOTOMETRY (Continued)

	Run 3				Run 4					
	INLET		OUTLET		INLET		OUTLET			
	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column	Probe wash plus filter	Adsorbent Column	Blank Solvent	Blank Adsorbent
Sample Number ⟶	329-330	331	332-333	334	340-341	342	343-344	345	351-352-353	355
Naphthalene	4955	8346	0.5	9831	5319	99	0.5	19677	0.6	11.7
Fluoranthene	29454	2928	60	339	5427	16	87	438	<0.5	<0.5
Pyrene	7536	1698	33	186	3301	9	25	288	<0.5	<0.5
Benz(c)phenanthrene	362	241	2.7	4.8	276	177	21	9.0	2.4	3.0
Chrysene	3049	385	10	42	2435	679	10	52	4.8	2.9
Benz(a)anthracene	2685	263	5	38	2062	485	7	47	0	0
Dimethylbenz(a)Anthracene	36	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benz fluoranthenes	7134	44	16	20	2700	15	25	25	7.5	6.9
Benz(a)pyrene	1844	9.5	13.5	10.5	829	14	22	15	7.0	6.8
Benz(e)pyrene	5902	<0.5	1.5	<0.5	1346	0	3	1	0.2	0.4
Cholanthrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-cd)pyrene	2286	<0.5	13	<0.5	777	<0.5	17	8.1	<0.5	<0.5
Dibenz anthracene	2565	<0.5	<0.5	<0.5	782	<0.5	18	< 0.5	<0.5	<0.5
Dibenz acridine		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz carbazole		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	< 0.5	< 0.5
Dibenz pyrene	2046	<0.5	11	< 0.5	759	< 0.5	15	< 0.5	< 0.5	< 0.5
3-Methyl cholanthrene		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
TOTAL POM	69,851.5	13,883.5	143.8	10,440.1	25,990.5	1,462.3	228.1	20,528.4	-	-

TABLE 6. WESP EFFECTIVENESS FOR CONTROLLING POM EMISSIONS AT WISCONSIN STEEL COKE OVEN

Run	Inlet[a] Sample	Inlet[a] Total POM Emissions, mg/hr	Outlet[a] Sample	Outlet[a] Total POM Emissions, mg/hr	$\frac{\text{Inlet-Outlet}}{\text{Inlet}}$ x100
Run 1	307-308	1,021.39	310-311	8.43	
	309	25.36	312	70.60	
		1,046.75		79.03	92.4
Run 2	318-319	1,059.91	321-322	11.53	
	320	1,018.30	323	390.38	
		2,078.30		401.91	80.7
Run 3	329-330	2,261.17	332-333	5.23	
	331	450.24	334	379.64	
		2,711.41		384.87	85.8
Run 4	340-341	844.59	343-344	8.66	
	342	47.59	345	729.78	
		892.18		738.44	17.2
Average					69.0

(a) Inlet and outlet values equal mean value obtained by summation of GC-MS values minus blanks for individual runs.

TABLE 7. TOTAL FLUORESCENCE RESULTS, POM SAMPLES, WISCONSIN STEEL - COKE OVEN

Run	Sampling Position	Sample(a)		Total Fluorescence,µg	Summation of GC-MS POM values,ng	Ratio of Total Fluorescence to Summation POM
Pre-Clean-up	Inlet	Filterable	301-2	85	9.8-15.8	6,641.
Pre Clean-up	Inlet	Adsorbent	303	27	28.5-35.0	850.
Pre-Clean-up	Outlet	Filterable	304-5	11,205	34,181.8-34,185.8	328.
Pre-Clean-up	Outlet	Adsorbent	306	90	7.9-13.9	8,257.
Run 1	Inlet	Filterable	307-8	35,100	68,977.8-68,980.3	509.
Run 1	Inlet	Adsorbent	309	69	893.1-896.6	77.
Run 1	Outlet	Filterable	310-11	92	1,134.0-1,136.5	81.
Run 1	Outlet	Adsorbent	312	765	1,861.- 1,865.	411.
Run 2	Inlet	Filterable	318-9	31,500	34,435.- 34,437.	915.
Run 2	Inlet	Adsorbent	320	4,356	31,326.- 31,329.5	139.
Run 2	Outlet	Filterable	321-2	171	327.7-330.2	520.
Run 2	Outlet	Adsorbent	323	89	10,540.-10,544.	8.
Run 3	Inlet	Filterable	329-3	16,650	69,874.-69,874.5	238.
Run 3	Inlet	Adsorbent	331	14,400	13,915.-13,919.	1,035.
Run 3	Outlet	Filterable	332-3	117	165.7-169.2	699.
Run 3	Outlet	Adsorbent	334	652	10,471.8-10,475.8	62.

TABLE 7. TOTAL FLUORESCENCE RESULTS, POM SAMPLES, WISCONSIN STEEL - COKE OVEN (Continued)

Run	Sampling Position	Sample(a)		Total Fluorescence, μg	Summation of GC-MS POM values, ng	Ratio of Total Fluorescence to Summation POM
Run 4	Inlet	Filterable	340-1	20,250	26,013.-26,015.5	778.
Run 4	Inlet	Adsorbent	342	3,150	1,494.-1,498.	2,106.
Run 4	Outlet	Filterable	343-4	256	250.-253.	1,018.
Run 4	Outlet	Adsorbent	345	900	20,560.1-20,563.6	44.
Blank		Solvents	351-3	45	20.1-27.5	1,891.
Blank		Adsorbent	355	52	31.7-36.7	1,520.
Run 3	Inlet	XAD-2 Column		6,750	Not applicable	
Run 3	Outlet	XAD-2 Column		440	"	
Run 4	Inlet	XAD-2 Column		675	"	
Run 4	Outlet	XAD-2 Column		755	"	
Blank		XAD-2 Column		52	"	

(a) Filterable = Probe and glassware washes plus filter

Adsorbent = Adsorbent column (Tenax) extract

XAD-2 Column = Extract from adsorbent column incorporated into particulate sampling train to collect vapors for BSO determination.

TABLE 8. ANALYSIS OF GASEOUS EMISSIONS FROM WISCONSIN STEEL COKE OVEN PLANT

Run	Location	Sampling Period	EPA Sample Number	Volume concentration, ppm		Emission Rates, kg/hr	
				C_2H_2	C_6H_6	C_2H_2	C_6H_6
1	Inlet	5/10/77, 1200-1930	S77-002-316	10	3	3.30	2.97
1	Outlet	5/10/77, 1200-1930	S77-002-317	10	3	3.47	3.12
2	Inlet	5/11/77, 1030-1900	S77-112-327	5	2	1.64	1.96
2	Outlet	5/11/77, 1030-1900	S77-002-328	9	2	3.12	2.08
3	Inlet	5/12/77, 0930-1830	S77-002-338	10	4	3.30	3.96
3	Outlet	5/12/77, 0930-1830	S77-002-339	15	1	5.16	1.03
Blank, filtered air						<0.05	<0.05

TABLE 9. QUANTITY OF POM COMPOUNDS FOUND IN WISCONSIN STEEL COKE OVEN WESP WATER SAMPLES[(a)]

CONSTITUENT	RUN 1		RUN 2		RUN 3		RUN 4	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
	Sample No.313	Sample No.314	Sample No.324	Sample No.325	Sample No.335	Sample No.336	Sample No.346	Sample No.347
Naphthalene	2.4	4.5	<0.5	<0.5	<0.5	1.5	<0.5	0.6
Flyoranthene	2.1	3.3	<0.5	5.1	<0.5	<0.5	<0.5	<0.5
Pyrene	<0.5	0.9	<0.5	2.7	<0.5	<0.5	<0.5	<0.5
Benz(c)phenanthrene	<0.5	6.1	1.8	2.4	1.8	3.7	3.3	3.3
Chrysene	5.1	7.3	2.7	3.4	3.9	2.3	3.6	3.2
Benz(a)anthracene	0	<0.5	0	4.7	0	0.7	2.7	0.1
Dimethylbenz(a)anthracene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benz fluoranthene	8.4	14	7.5	9.9	7.8	7.5	9.9	7.2
Benz(a)pyrene	7.5	11	6.4	10	7.5	6.5	8.0	7.5
Benz(e)pyrene	0	2	0.8	1	0	0.7	1.0	0
Cholanthrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-cd)pyrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz anthracenes	<0.5	13	<0.5	12	9.6	<0.5	<0.5	<0.5
Dibenz acridine	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz carbazole	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz pyrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
3-Methyl cholanthrene	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5

NOTES: (a) All data are nanograms; <0.5 ng indicates presence of the compound was detected, but at level below 0.5 ng.

TABLE 10. POM CONCENTRATIONS IN WISCONSIN STEEL COKE OVEN WESP WATER SAMPLES[a]

CONSTITUENT	RUN 1 Inlet Sample No.313	RUN 1 Outlet Sample No.314	RUN 2 Inlet Sample No.324	RUN 2 Outlet Sample No.325	RUN 3 Inlet Sample No.335	RUN 3 Outlet Sample No.336	RUN 4 Inlet Sample No.346	RUN 4 Outlet Sample No.347	Average[b] Inlet	Average[b] Outlet	POM Pickup in WESP[c] (Outlet -Inlet)
Naphthalene	3.2	6.0	<0.7	<0.7	<0.7	2.0	<0.7	0.8	0.8-1.3	2.2-2.4	1.3
Flyoranthene	2.8	4.4	<0.7	6.8	<0.7	<0.7	<0.7	<0.7	0.7-1.2	2.8-3.2	2.1
Pyrene	<0.7	1.2	<0.7	3.6	<0.7	<0.7	<0.7	<0.7	0 -0.7	1.2-1.6	1.1
Benz(c)phenanthrene	<0.7	8.1	2.4	3.2	2.4	4.9	4.4	4.4	2.3-2.5	5.2	2.8
Chrysene	6.8	9.7	3.6	4.5	5.2	3.1	4.8	4.3	5.1	5.4	0.3
Benz(a)anthracene	0	0.7	0	6.3	0	0.9	3.6	0.1	0.9	2.0	1.1
Dimethylbenz(a)anthracene	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-
Benz fluoranthene	11.2	18.7	10.0	13.2	10.4	10.0	13.2	9.6	11.2	12.9	1.7
Benz(a)pyrene	10.0	14.7	8.5	13.3	10.0	8.7	10.7	10.0	9.8	11.7	1.9
Benz(e)pyrene	0	2.7	1.1	1.3	0	0.9	1.3	0	0.6	1.2	0.6
Cholanthrene	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-
Indeno(1,2,3-cd)pyrene	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-
Dibenz anthracenes	<0.7	17.3	<0.7	16.	12.8	<0.7	<0.7	<0.7	3.2-3.7	8.3-8.7	5.1
Dibenz acridine	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-
Dibenz carbazole	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-
Dibenz pyrene	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-
3-Methyl cholanthrene	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	-

NOTES: (a) All data are micrograms/meter^3; <0.7 mg/m^3 indicates presence of the compound was detected, but at level below 0.7mg/m^3. Sample volumes were not measured but consisted of 60 to 90 percent full 1-liter containers; a sample value of 0.750 ℓ was assumed for all samples.

(b) Where reported values are given as "less than"; averages were calculated using values of 0.0 and 0.7.

(c) Where averages are reported as a range, the midpoint of the range was used to calculate pickup of POM by water.

SECTION 3

PROCESS DESCRIPTION AND PROCESS OPERATION

(To be inserted by EPA)

SECTION 4

LOCATION OF SAMPLING POINTS

Sample port and point locations were determined as outlined in the EPA Federal Register, December 23, 1971, Method 1.

INLET SAMPLING

Precipitator inlet stack gases were sampled from an 80 inch by 80 inch horizontal duct as shown in Figure 1; the probe was inserted into the duct vertically from above. The stack geometry, as indicated in Figure 1, was such that 48 sample points were required for representative sampling. Sample ports were located 2.8 duct diameters downstream and 2.0 duct diameters upstream from flow disturbances.

OUTLET SAMPLING

Outlet stack sampling was from an 80-foot high, 8-foot diameter, vertical stack. The stack geometry, as presented in Figure 2, shows the sample port location relative to the nearest upstream and downstream flow disturbance. Straight, unobstructed distances upstream and downstream of the sampling position were 5.5 and 2.0 stack diameters, respectively. Accordingly, 24 sample points, as presented in Table 1, were required.

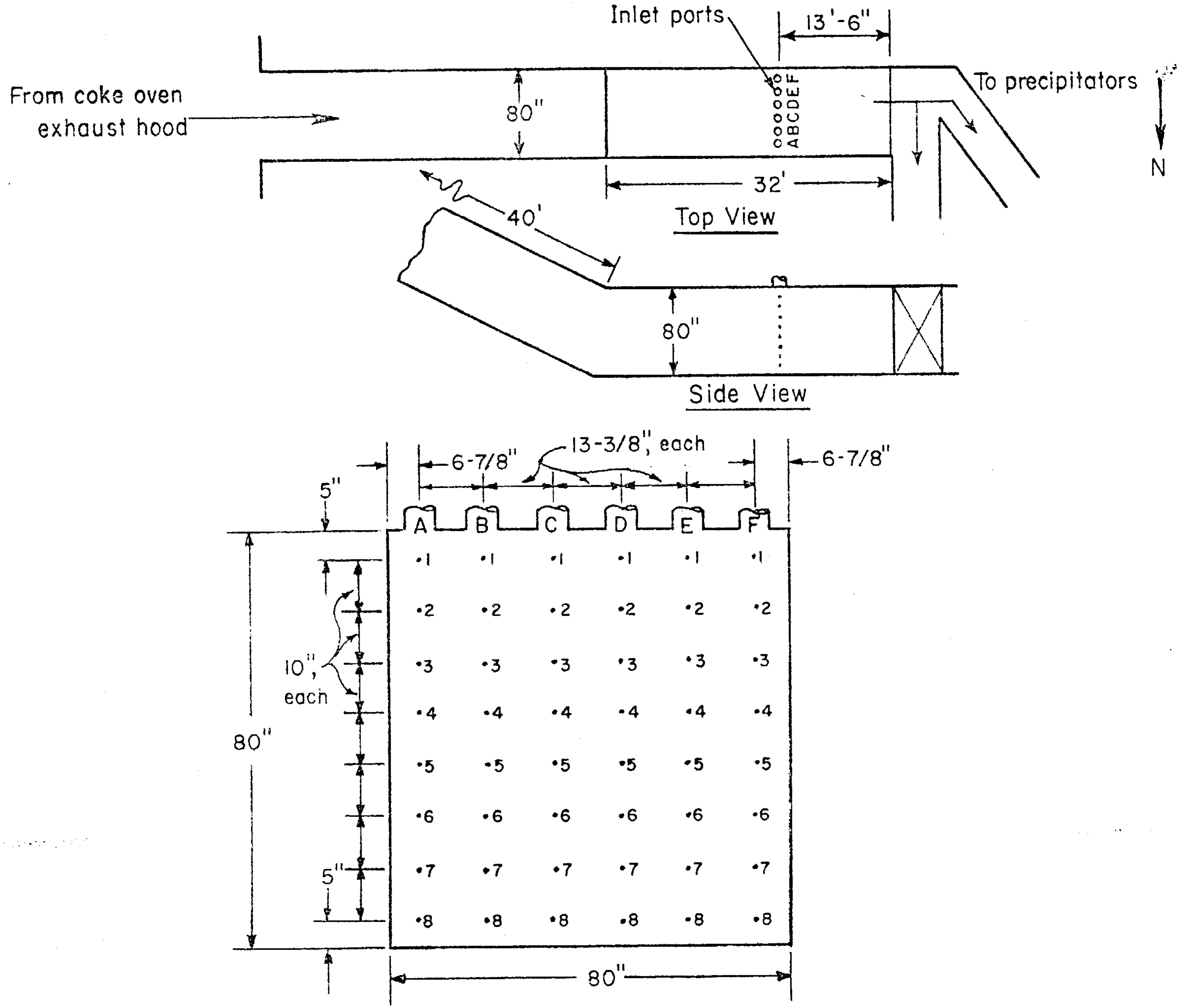
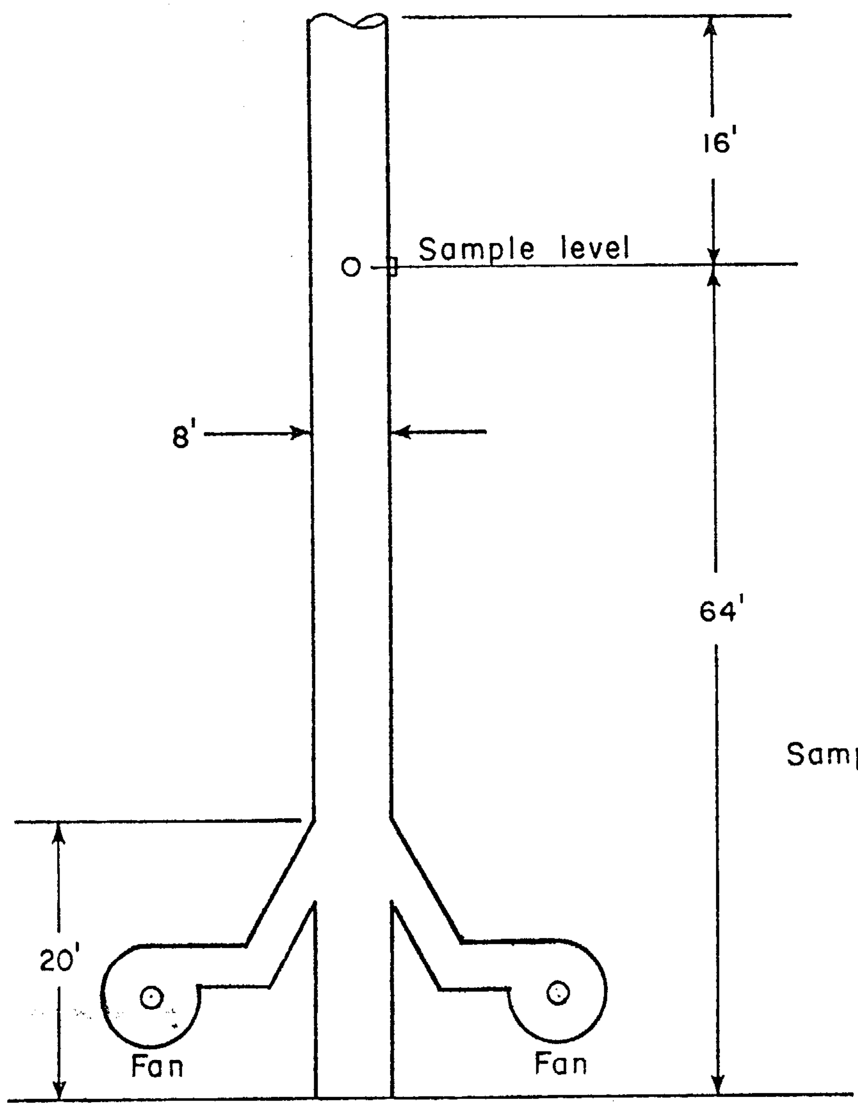
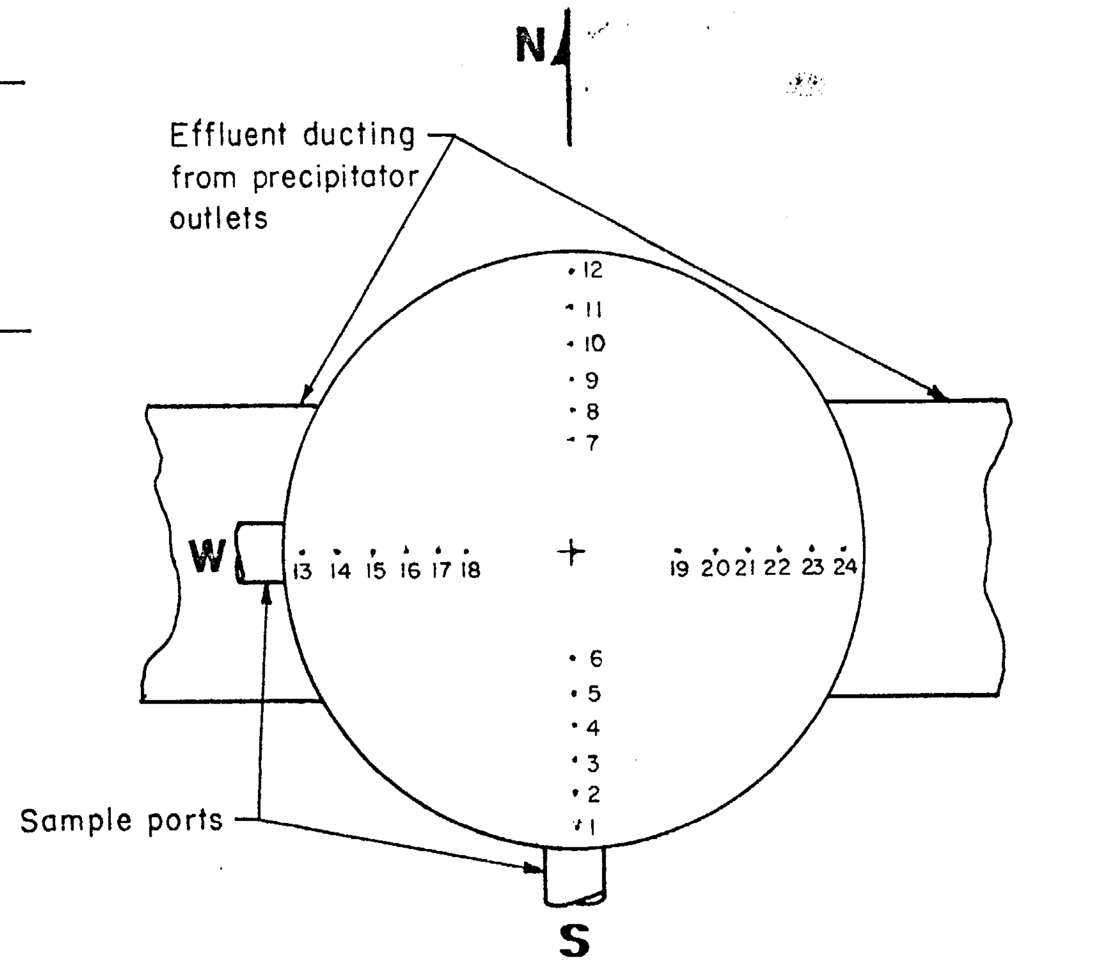


Figure 1. Inlet Stack Geometry Configuration





Distance of Sampling Point From Wall

Point	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
Distance, inches	2	6.4	11.3	17	24	34.1	61.9	72.0	79.0	84.7	89.6	94.0
% of Diam	2.1	6.7	11.8	17.7	25.0	35.5	64.5	75.0	82.3	88.2	93.3	97.9

Figure 2. Outlet Stack Geometry Configuration

SECTION 5

SAMPLING AND ANALYTICAL PROCEDURES

POM SAMPLING AND ANALYSIS

POM Sampling Procedures

An established methodology to sample organic and POM compounds is not yet available as an EPA method. The state of the art, to date, is to incorporate a special organic adsorbent material (which is enclosed in a temperature-controlled column) with the conventional particulate sampling train. To accomplish this, EPA Method 5 sampling train was modified to include the adsorbent column for the sampling of organic compounds from the inlet and outlet of a wet electrostatic precipitator at Wisconsin Steel Company coke oven plant (see Figure 3). Details of the operation of the column are described in Appendix G.

Figure 4 shows the Wisconsin Steel Company coke oven control device, including hood, wet electrostatic precipitator, and exhaust stack. The inlet sampling location is part of an 80-inch by 80-inch horizontal duct connecting the coke oven hood to the WESP unit. The traverse of this duct was conducted by sampling vertically from above. The filter and adsorbent column were attached directly to the end of the sample probe to avoid any line loss of organic material. Collection efficiency of the column is temperature dependent; therefore, the gas temperature entering the column was monitored and the oven temperature was adjusted to maintain an optimum collection efficiency gas temperature of 125 F ± 5 F. An umbilical line comprised of a flexible polyethylene hose with the associated thermocouple and electric lines was attached from the sample probe outlet to the standard Method 5 impinger box which in turn was connected to the meter box (Figure 3). Since the inlet probe had to be repositioned in the vertical plane for traversing, this sampling configuration kept the probe weight at a minimum.

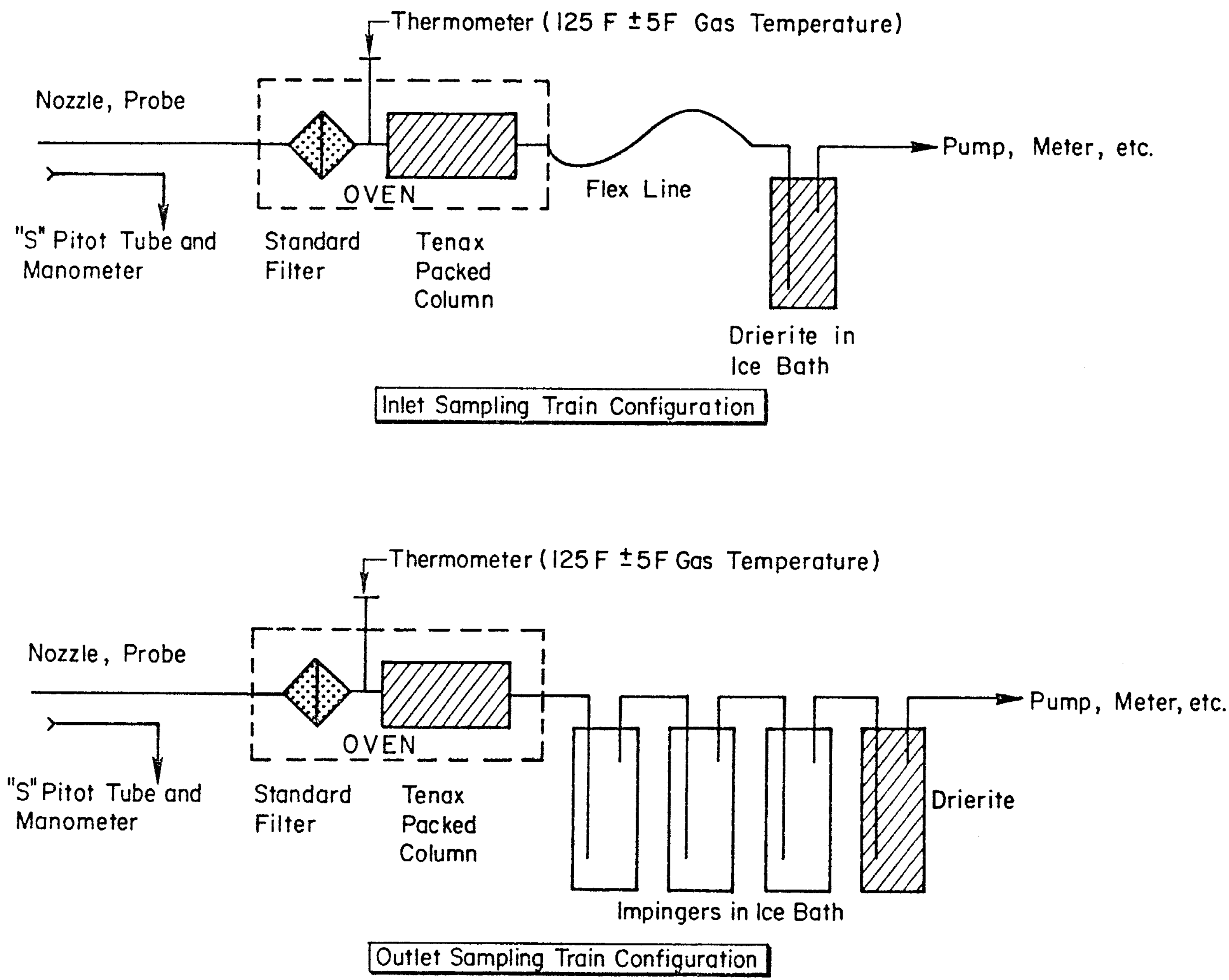


FIGURE 3. POM SAMPLING TRAINS

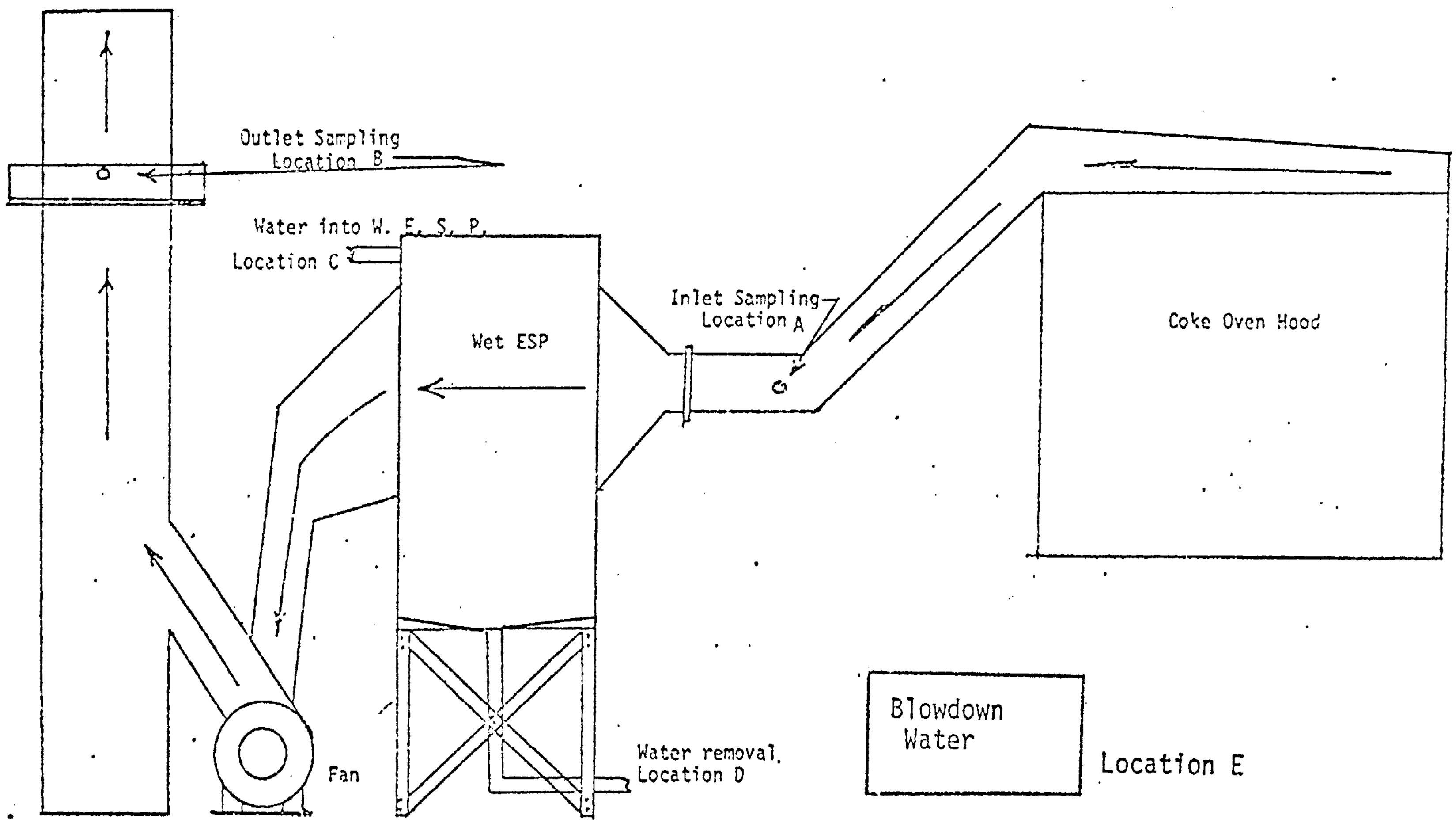


Figure 4. Schematic of Wisconsin Steel Byproduct Coke Plant with Wet Electrostatic Precipitator

Since coke oven door leakage was of primary concern, coke pushing was minimized during the sampling period. To avoid any particulate collection by impaction when pushing occurred, the inlet sample probe assembly was turned 180 degrees so that the sample nozzle was pointing away from the gas flow.

The precipitator outlet gases were sampled simultaneously with the inlet in order to determine precipitator efficiency. The standard train used at the outlet was identical to the train used at the inlet and consisted of a Method 5 train modified by incorporating a POM adsorbent column just after the filter (Figure 3). The gas temperature going into the POM column was monitored, as in the inlet sampling train, and the oven temperature adjusted to maintain 125 ± 5 F gas temperature. The outlet stack geometry at the sampling location was a vertical stack so the sample probe was connected directly to the impinger box, eliminating the necessity for an umbilical cord between the probe outlet and impinger box.

Sampling time for both inlet and outlet was selected to be 8 hours due to the expected low concentrations of organic material in the gas streams.

POM Sample Cleanup Procedures

Because of the light sensitive nature of polycyclic organic matter, it is necessary to keep all samples in the dark during sampling and after cleanup. Figure 5 is the sample handling procedure which was followed during cleanup. To establish background data from solvents and sample train constituents, a pre-cleanup of all glass components was made.

After the sample was collected, the sample trains were removed from the stack and taken to an on-site mobile laboratory. Each Pyrex probe and all glassware up to the front half of the filter holder was rinsed with methylene chloride and acetone and the rinses stored in amber bottles. The filter was placed in a petri dish and placed in a dark container.
The back half of the filter holder and all glassware up to the POM column was rinsed with methylene chloride and acetone and placed in the amber bottles containing the front half rinse. The POM column ends were capped and the body wrapped in a light-tight container. This procedure was followed for each run -- the contents of the amber bottles and the filter catch were then taken to Battelle labs to be analyzed for organic matter.

Blank Methylene Chloride Blank Acetone Blank Filter	POM Analysis		
Blank Adsorbent Column →	POM Analysis		
Pre-cleanup Methylene Chloride Wash Pre-cleanup Acetone Wash Pre-cleanup Filter	POM Analysis		
Pre-cleanup Adsorbent Column →	POM Analysis		
Methylene Chloride Wash, probe & front-half glassware Methylene Chloride Wash, back-half glassware	Amber bottle, store in dark	Weigh to determine volume	POM Analysis
Acetone Wash, probe & front-half glassware Acetone Wash, back-half glassware	Amber bottle, store in dark	Weigh to determine volume	
Filter →	Store in dark		
Adsorbent Column →	Cap ends, store in dark	→	POM Analysis

FIGURE 5. POM CLEANUP SCHEMATIC

POM Analysis

The POM analysis was conducted using standard Battelle POM analysis procedures. These procedures are described in Appendix G, pages G-6 to G-9. Basically, the analysis procedure includes extracting the filter and adsorbent column with methylene chloride and pentane, respectively. Then the three solvent solutions (probe wash, filter extract, and adsorbent column extract) are analyzed separately or in various combinations by gas chromatography-mass spectroscopy (GC-MS) techniques. For this task, the methylene chloride and acetone rinses of the probe and glassware were combined with the filter to determine a single "filterable" POM value; the adsorbent column was analyzed separately.

Water samples were extracted with methylene chloride and the extracts were processed in the same manner as air emission extracts, as described above and in Appendix G, pages G-8 to G-9.

TOTAL FLUORESCENCE

Pretest discussions between EPA staff and Battelle staff had suggested that total fluorescence might provide a useful measure of total POM content of emission samples. Total fluorescence would be a more descriminating measure of carcinogenic organics than the frequently used benzene-soluble organic (BSO), and is a less costly analytical procedure than GC-MS. Thus, Battelle was requested to determine total fluorescence for the POM emission samples and the samples from the XAD-2 Columns used for BSO vapors.

Total fluorescence was determined for each sample on a Turner spectrofluorimeter, using a 3500 Å excitation and 4100 Å emission wavelengths. The emission slit was 25 Å and the excitation slit was 100 Å. Results are reported in Table 6.

MOLECULAR WEIGHT OF STACK GAS

During the 8 hours of sampling for organic material, an integrated gas sample was collected in a Tedlar bag. The sampling rate was adjusted so that the bag would be essentially full at the end of the 8-hour test period. Orsat analysis for concentrations of CO_2, O_2 and CO was completed at the end of each run. These data were then used to calculate the stack gas molecular weight. The collection schedule for the integrated gas samples is presented in Appendix D.

GASEOUS HYDROCARBONS SAMPLING AND ANALYSIS

To provide a gas sample for gaseous hydrocarbons analyses (benzene and acetylene), at the end of each run a gas sample was collected in an evacuated flask by removing an aliquot from the integrated bag sample which had been collected for Orsat analysis. Both the inlet and outlet gases were sampled in the same manner.

The evacuated-flask samples were analyzed for benzene and acetylene using a gas chromatograph with a flame ionization detector. The instrument used was a Aerograph, Model 20 C; the column was a 10mm (0.25 inch) x 0.48m (10 feet) stainless steel column containing Poropak Q; the carrier gas was helium, flowing at 48 ml/min; and the detector was a thermal conductivity detector operating at a 275 milliamp current. Instrument temperatures were column, 30 C for acetylene and 200 C for benzene; detector, 93 C; and injector, 145 C.

The compounds were calibrated against standard mixtures of acetylene in nitrogen and benzene in nitrogen.

SECTION 6

REFERENCES

1. "Exposure to Coke Oven Emissions, Occupation Safety and Health Standard", Federal Register, Vol. 41, No. 206, October 22, 1976, p46742 - 46790.

2. "Particulate Polycyclic Organic Matter", National Acadamy of Sciences, 1972, p28.

APPENDIX A

FIELD AND LABORATORY DATA RELATED TO POLYCYCLIC ORGANIC MATTER (POM) SAMPLING

Nomograph Data Sheets
Field Data Sheets
Field Cleanup Data Sheets
Sample Identification

NOMOGRAPH DATA SHEETS

Nomograph data sheets for inlet runs are not available.

NOMOGRAPH DATA

PLANT Wisconsin Steel

DATE 5/11/77

SAMPLING LOCATION outlet

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.82
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	75°
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	62°
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	1.40
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	
C FACTOR		1.08
CALCULATED NOZZLE DIAMETER, in.		1.82
ACTUAL NOZZLE DIAMETER, in.		0.175
REFERENCE Δp, in. H_2O		1.65 ~~3.2~~

EPA (Dur) 234
4/72

NOMOGRAPH DATA

PLANT Wisconsin Steel

DATE 5/12/77

SAMPLING LOCATION outlet

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.82
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	105
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	73
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	1.45
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	
C FACTOR		1.10
CALCULATED NOZZLE DIAMETER, in.		~~[illegible]~~ .181
ACTUAL NOZZLE DIAMETER, in.		.175
REFERENCE Δp, in. H_2O		1.68

EPA (Dur) 234
4/72

NOMOGRAPH DATA

PLANT Wisconsin Steel

DATE 5/13/77

SAMPLING LOCATION outlet

CALIBRATED PRESSURE DIFFERENTIAL ACROSS ORIFICE, in. H_2O	$\Delta H_@$	1.82
AVERAGE METER TEMPERATURE (AMBIENT + 20 °F), °F	$T_{m_{avg.}}$	105
PERCENT MOISTURE IN GAS STREAM BY VOLUME	B_{wo}	2
BAROMETRIC PRESSURE AT METER, in. Hg	P_m	29.
STATIC PRESSURE IN STACK, in. Hg ($P_m \pm 0.073$ x STACK GAUGE PRESSURE in in. H_2O)	P_s	
RATIO OF STATIC PRESSURE TO METER PRESSURE	P_s/P_m	1
AVERAGE STACK TEMPERATURE, °F	$T_{s_{avg.}}$	75
AVERAGE VELOCITY HEAD, in. H_2O	$\Delta p_{avg.}$	1.40
MAXIMUM VELOCITY HEAD, in. H_2O	$\Delta p_{max.}$	
C FACTOR		
CALCULATED NOZZLE DIAMETER, in.		.182
ACTUAL NOZZLE DIAMETER, in.		.175
REFERENCE Δp, in. H_2O		1.65

EPA (Dur) 234
4/72

FIELD DATA SHEETS

G 2872-5014

FIELD DATA

PLANT Wisconsin Steel Works
DATE 5/10/77
SAMPLING LOCATION W ESP Inlet
SAMPLE TYPE POM
RUN NUMBER 1-A
OPERATOR Ed...f J Faught
AMBIENT TEMPERATURE 50
BAROMETRIC PRESSURE 29.59
STATIC PRESSURE, (P_s) ~~-3.0~~ -2.5
FILTER NUMBER (s) # 93
POM # 309

Page 1

PROBE LENGTH AND TYPE 9' Pyrex
NOZZLE I.D. 1.82
ASSUMED MOISTURE, % 5
SAMPLE BOX NUMBER
METER BOX NUMBER 12
METER $\Delta H_@$ 1.82
C FACTOR 1.08
PROBE HEATER SETTING 125
HEATER BOX SETTING 125
REFERENCE Δp 1.4

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY ~~10~~ 5 MINUTES

TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp °F
	0	10:00	328.900										
A 1	5			1.5	1.95	1.95	67	66	53	15	130	47	120
1	10		336.7	1.5	1.95	1.95	67	66	53	17	130	47	121
A 2	15			1.7	2.25	2.25	66	66	54	17	141	49	119
2	20		344.0	1.7	2.25	2.25	67	68	55	17	141	49	119
A 3	25		351.3	1.45	1.9	1.9	68	73	56	15	125	51	117
3	30		351.3	1.45	1.9	1.9	67	73	57	15	125	51	118
A 4	35			1.5	1.95	1.95	67	74	57	15	127	51	118
4	40		359.1	1.5	1.95	1.95	68	75	59	15	129	53	120
A 5	45		361.8	1.65	2.15	2.15	69	76	60	16	130	52	125
5	50		367.0	1.65	2.15	2.15	69	76	60	16	130	52	125
A 6	55		370.7	1.25	1.7	1.7	68	76	60	14	130	54	127
6	60		374.4	1.25	1.7	1.7	68	76	61	14	128	54	124
A 7	65		378.0	1.35	1.8	1.8	68	76	62	14	122	55	124
7	70		381.7	1.35	1.8	1.8	69	77	62	14	122	55	124
A 8	75		385.5	1.4	1.82	1.82	69	78	63	14	121	56	124
8	80		389.2	1.4	1.82	1.82	69	78	63	14	120	56	124
B 1	85	11:35 / 11:58	392.6 / 392.8	1.1	1.5	1.5	69	71	63	11	125	56	129
1	90		396.2	1.1	1.5	1.5	71	63	61	11	121	54	125
B 2	95		399.6	1.4	1.82	1.82	70	63	60	14	126	53	122
2	100		403.2	1.4	1.82	1.82	71	66	61	14	129	55	126
B 3	105		407.2	1.7	2.25	2.25	71	68	60	17	130	55	127
3	110		411.4	1.7	2.25	2.25	72	70	61	17	132	55	122
B 4	115		415.4	1.6	2.1	2.1	72	72	60	17	129	55	124

installed thermocouple on POM outlet leak check

Gas sample started 12:05 P

COMMENTS:

TRAVERSE POINT NUMBER	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 PUM GAS	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp. F
4	120		419.5	1.6	2.1	2.1	71	72	60	17	127	56	127
B 5	125		423.6	1.7	2.25	2.25	71	73	61	17	123	57	128
5	130		427.8	1.7	2.25	2.25	71	74	61	17	121	56	128
B 6	135		431.9	1.7	2.25	2.25	71	74	61	17	120	56	124
6	140		436.1	1.7	2.25	2.25	71	74	61	17	120	56	124
B 7	145		439.9	1.3	1.7	1.7	70	73	62	14	121	56	127
7	150		443.5	1.3	1.7	1.7	71	72	62	14	122	56	124
B 8	155		447.4	1.5	2.05	2.05	69	72	62	15	124	57	122
8	160	1313 1315	451.4	1.5	2.05	2.05	73	73	62	15	126	57	125
C 1	165		455.6	1.7	2.25	2.25	74	71	62	17	125	56	129
1	170		459.7	1.7	2.25	2.25	74	72	62	17	127	56	127
C 2	175		464.0	1.8	2.4	2.4	72	72	62	19	128	56	127
2	180		468.3	1.8	2.4	2.4	72	72	61	19	129	55	124
C 3	185		472.5	1.7	2.25	2.25	70	74	62	18	129	56	121
3	190		476.7	1.7	2.25	2.25	73	74	62	18	128	56	125
C 4	195		480.9	1.7	2.25	2.25	70	74	62	18	128	57	123
4	200		485.2	1.7	2.25	2.25	71	75	63	18	126	58	123
C 5	205		489.4	1.7	2.25	2.25	72	75	63	18	124	58	123
5	210		493.6	1.7	2.25	2.25	73	74	62	18	121	56	122
C 6	215		497.8	1.75	2.3	2.3	71	73	63	18	120	57	124
6	220		502.0	1.75	2.3	2.3	72	75	63	18	120	58	129
C 7	225		505.8	1.3	1.7	1.7	72	75	63	14	123	58	127
7	230		509.5	1.3	1.7	1.7	72	73	63	14	123	57	127
C 8	235		513.6	1.3	1.7	1.7	72	72	63	14	124	58	127
8	240	1435	516.7	1.3	1.7	1.7	73	72	63	14	124	56	127
D 1	245	1440	520.3	1.2	1.6	1.6	77	64	62	13	121	56	124
1	250		523.9	1.2	1.6	1.6	75	65	61	13	124	55	122
D 2	255		527.8	1.6	2.1	2.1	76	66	61	17	128	55	120
2	260		531.8	1.6	2.1	2.1	74	68	60	17	129	56	121
D 3	265		536.0	1.75	2.3	2.3	73	70	61	18	132	57	125
3	270		540.2	1.7	2.25	2.25	73	72	61	18	133	57	127
D 4	275		544.4	1.7	2.25	2.25	73	73	62	18	132	57	127
4	280		548.6	1.7	2.25	2.25	73	74	62	18	130	57	126
D 5	285		552.6	1.5	2.0	2.0	76	75	63	16	128	58	128
5	290		556.5	1.5	2.0	2.0	74	74	63	16	127	57	130
D [illegible]	[illegible]		[illegible]	1.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	121

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Revised page 2

FIELD DATA

G 2P72-5014

Bar 16[15] 29.50" Hg

PLANT Wisconsin Steel Works
DATE 5/10/77
SAMPLING LOCATION WESP Inlet
SAMPLE TYPE POM
RUN NUMBER 1
OPERATOR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

Page 2

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY ~~10~~ 5 MINUTES

	TRAVERSE POINT NUMBER	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 Temp. °F
Pushing →	D 7	305	1542/1547	567.7	1.4	1.82	1.82	80	70	63	14	123	58	129
Pushing →	7	310	1552/1557	571.3	1.4	1.82	1.82	80	69	63	14	126	57	130
Pushing →	D 8	315	1609/1614	574.8	1.4	1.82	1.82	88	67	63	14	123	57	122
	8	320	1618/1625	578.5	1.4	1.82	1.82	83	64	61	14	118	54	132
	E 1	325		581.7	1.0	1.35	1.35	86	74	60	11	117	53	124
Pushing →	1	330	1628/1633	584.9	1.0	1.35	1.35	82	68	60	11	121	52	123
	E 2	335		588.5	1.4	1.82	1.82	80	64	60	15	131	55	132
Pushing MAX 129 F →	2	340	1640/1643	592.2	1.4	1.82	1.82	80	64	60	15	137	56	129
Pushing 165 →	E 3	345	1651/1654	596.1	1.6	2.1	2.1	86	64	60	16	128	56	125
Pushing 149 →	3	350	1704/1709	600.0	1.6	2.1	2.1	86	66	60	16	118	55	128
Pushing 161 →	E 4	355	1712/17[illegible]	603.7	1.6	2.1	2.1	89	64	60	16	119	55	127
	4	360		607.4	1.6	2.1	2.1	83	62	59	16	132	54	129
Pushing 161 →	E 5	365	1731/1734	611.9	1.8	2.4	2.4	86	65	59	19	132	54	127
	5	370		616.0	1.8	2.4	2.4	85	66	60	19	122	55	123
Pushing 232 →	E 6	375	1745/1754	619.9	1.6	2.1	2.1	83	69	60	17	120	55	121
	6	380		623.8	1.6	2.1	2.1	86	66	60	17	121	56	126
	E 7	385		627.5	1.3	1.75	1.75	80	69	60	15	126	56	128
	7	390		631.1	1.3	1.75	1.75	78	70	60	15	128	56	129
	E 8	395		634.8	1.4	1.82	1.82	78	72	60	15	131	56	127
	8	400	1808/1812	638.5	1.4	1.82	1.82	75	72	60	15	129	55	122
	F 1	405		642.4	1.5	2.0	2.0	76	67	60	16	121	55	124
	1	410		646.3	1.5	2.0	2.0	76	69	60	.16	119	55	121
	F 2	415		650.3	1.7	2.3	2.3	75	72	60	19	123	54	132

COMMENTS:

TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp F
2	420		654.5	1.7	2.3	2.3	75	74	61	19	130	54	124
F 3	425		658.4	1.5	2.0	2.0	73	73	60	18	134	52	124
3	430		662.4	1.5	2.0	2.0	71	73	60	18	133	52	124
F 4	435		666.2	1.4	1.82	1.82	70	73	60	16	129	52	123
4	440		670.1	1.4	1.82	1.82	70	72	60	16	127	52	128
F 5	445		674.0	1.6	2.1	2.1	70	72	60	17	121	50	124
5	450		678.1	1.6	2.1	2.1	71	72	60	17	120	49	129
F 6	455		681.9	1.3	1.75	1.75	69	72	60	15	122	48	124
6	460	19 18 / 19 23	685.4	1.3	1.75	1.75	69	71	60	15	124	47	124
F 7	465	19 23 / 19 33	688.9	1.2	1.6	1.6	79	63	60	13	124	48	126
7	470	19 42 / 19 45	692.2	1.2	1.6	1.6	80	63	60	13	125	47	130
F 8	475	54 / 44	696.0	1.5	2.0	2.0	79	62	59	17	124	46	121
8	480	19 49 / 20 02	699.8	1.5	2.0	2.0	78	64	59	17	124	47	128
	480		370.7	1.5		1.98	74	66					

Pushing 126 →
Pushing 160 →
Pushing 140 →
Pushing 145 °F →

Bar 29.49

avg 59.5

A-10

FIELD DATA

PLANT Wisconsin Steel Works
DATE 5/11/77
SAMPLING LOCATION W/ESP Inlet
SAMPLE TYPE POM
RUN NUMBER 2-A Page 1
OPERATOR Faught. Schulz
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.58
STATIC PRESSURE, (P_s) -2.5" H2O
FILTER NUMBER (s) #95
Tenax column #202

PROBE LENGTH AND TYPE 9' pyrex
NOZZLE I.D. 0.175
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER
METER BOX NUMBER #12
METER $\Delta H_@$ 1.82
C FACTOR 1.06
PROBE HEATER SETTING 125
HEATER BOX SETTING 125
REFERENCE Δp 1.7

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp. F
	0 / 10:02 hr	700.500										
D 1	5	703.6	1.2	1.35	1.35	84	70	61	12	129	63	124
1	10	706.8	1.2	1.35	1.35	85	73	62	12	132	63	120
D 2	15	710.3	1.6	1.75	1.75	83	78	63	16	132	66	124
2	20	713.9	1.6	1.75	1.75	83	79	63	16	131	66	125
D 3	25	717.6	1.75	1.95	1.95	84	83	66	17	131	66	125
3	30	721.5	1.75	1.95	1.95	86	85	66	17	132	68	125
D 4	35	725.3	1.7	1.82	1.82	86	87	68	16	133	68	123
4	40	729.0	1.7	1.82	1.82	87	88	69	16	129	69	122
D 5	45	732.5	1.5	1.65	1.65	86	89	69	15	126	69	124
5	50	736.1	1.5	1.65	1.65	87	89	71	15	121	71	127
D 6	55	739.5	1.3	1.45	1.45	85	89	72	13	119	72	127
6	60	742.8	1.3	1.45	1.45	86	89	72	13	119	72	128
D 7	65	746.1	1.3	1.45	1.45	86	89	73	13	123	72	128
7	70	749.5	1.3	1.45	1.45	86	90	74	13	127	73	128
D 8	75	753.0	1.4	1.6	1.6	85	90	75	14	129	72	127
8	80 / 11:20	756.5	1.4	1.6	1.6	86	90	75	14	130	73	125
E 1	85	759.2	0.95	1.05	1.05	90	90	77	10	127	72	127
1	90	762.0	0.95	1.05	1.05	87	89	77	10	127	74	127
E 2	95	765.4	1.4	1.6	1.6	88	89	78	14	124	75	128
2	100	768.9	1.4	1.6	1.6	90	91	78	14	123	77	128
E 3	105	772.6	1.7	1.82	1.82	87	92	78	15	122	75	128
3	110	776.4	1.7	1.82	1.82	85	91	78	.15	122	75	125
E 4	115	780.0	1.6	1.75	1.75	85	90	78	15	125	75	123

COMMENTS:

TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp. F
4	120		783.7	1.6	1.75	1.75	83	88	77	15	127	72	124
E 5	125		787.6	1.8	2.0	2.0	86	89	78	17	128	76	127
5	130		791.5	1.8	2.0	2.0	86	90	78	17	128	78	127
E 6	135		795.5	1.7	1.82	1.82	86	91	78	16	127	78	124
6	140		799.1	1.7	1.82	1.82	84	91	78	16	124	76	126
E 7	145		802.8	1.4	1.6	1.6	83	89	77	15	120	72	127
7	150		806.3	1.4	1.6	1.6	83	85	77	15	120	72	127
E 8	155		809.8	1.5	1.65	1.65	83	84	77	15	124	73	125
8	160	12 44 / 12 49	813.4	1.5	1.65	1.65	86	86	78	15	127	76	125
F 1	165	51	817.0	1.6	1.75	1.75	88	84	78	15	125	76	127
1	170		820.7	1.6	1.75	1.75	89	86	78	15	125	78	125
F 2	175		824.7	2.0	2.2	2.2	90	90	79	19	124	79	127
2	180		828.9	1.9	2.1	2.1	89	91	79	19	124	79	127
F 3	185		832.7	1.7	1.8	1.8	89	92	79	16	123	79	128
3	190		836.4	1.7	1.8	1.8	89	92	79	16	122	79	124
F 4	195		840.1	1.5	1.65	1.65	89	92	80	15	123	80	127
4	200		843.6	1.5	1.65	1.65	90	92	80	15	127	81	128
F 5	205		847.3	1.6	1.75	1.75	89	92	80	16	131	80	127
5	210		851.0	1.6	1.75	1.75	90	92	80	16	135	81	134
F 6	215		854.4	1.3	1.45	1.45	89	91	80	14	136	79	124
6	220		857.8	1.3	1.45	1.45	89	90	80	14	134	79	124
F 7	225		861.	1.4	1.6	1.6	87	90	80	15	132	78	124
7	230		865.0	1.4	1.6	1.6	86	89	80	15	128	78	123
F 8	235		868.6	1.4	1.6	1.6	86	89	80	15	124	78	127
8	240	14 06 / 14 1?	872.2	1.4	1.6	1.6	87	89	80	15	122	78	124
A 1	245		875.8	1.5	1.65	1.65	90	87	80	15	125	80	134
1	250		879.3	1.5	1.65	1.65	89	88	80	15	129	79	122
A 2	255		883.1	1.65	1.8	1.8	87	88	79	16	132	78	122
2	260		886.8	1.65	1.8	1.8	89	89	80	16	132	78	127
A 3	265		890.7	1.8	2.0	2.0	88	90	80	18	129	78	124
3	270		894.7	1.8	2.0	2.0	88	90	80	18	128	78	121
A 4	275		898.4	1.5	1.65	1.65	85	87	79	15	124	72	128
4	280		901.9	1.5	1.65	1.65	87	88	79	15	123	76	124
A 5	285		905.7	1.75	1.9	1.9	86	89	79	17	126	78	124
5	290		909.5	1.75	1.9	1.9	85	89	79	17	128	75	124
A 6	295		[illegible]	1.3	1.45	1.45	86	[illegible]	79	14	136	77	125

finned

FIELD DATA

G2872-5014

PLANT Wisconsin Steel Works
DATE 2/11/77
SAMPLING LOCATION WESP Inlet
SAMPLE TYPE POM
RUN NUMBER 2
OPERATOR Shuly & Faught
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

Page 2

PROBE LENGTH AND TYPE 9' pyrex
NOZZLE I.D. 0.175
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

	TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp F
Bar 29.55 →	A 7	305		919.7	1.35	1.5	1.5	86	89	80	14	127	78	125
	7	310		923.2	1.35	1.5	1.5	86	89	80	14	126	79	127
	A 8	315		926.7	1.4	1.55	1.55	87	90	80	14	123	79	129
	8	320	1533/1534	930.1	1.4	1.55	1.55	87	90	80	14	121	79	129
Max °F	B 1	328		933.1	1.0	1.15	1.15	90	89	80	11	126	78	127
Pushing 149 →	1	330	1541/1542	936.1	1.0	1.15	1.15	91	88	80	11	129	78	127
Pushing 182 →	B 2	335	1551/1553	939.5	1.4	1.55	1.55	98	86	80	14	129	77	125
	2	~~400~~ 340		942.9	1.4	1.55	1.55	99	84	80	14	126	78	132
	B 3	345		946.9	1.9	2.15	2.15	96	87	80	20	125	77	121
Pushing 156 →	3	350	1610/1613	950.5	1.9	2.15	2.15	96	89	80	20	118	78	141
	B 4	355		954.2	1.6	1.75	1.75	99	90	81	16	122	78	121
Pushing 148 →	4	360	1628/1638	957.9	1.6	1.75	1.75	95	90	80	16	123	78	127
	B 5	365		961.5	1.6	1.75	1.75	97	86	80	16	128	77	121
Pushing 163 →	5	370	1642/1647	965.3	1.6	1.75	1.75	98	89	80	16	128	77	122
	B 6	375		969.0	1.6	1.75	1.75	99	86	80	16	123	76	123
Pushing 175 →	6	380	1655/1700	972.7	1.7	1.82	1.82	98	85	80	16	123	77	130
	B 7	385		976.1	1.35	1.5	1.5	102	87	80	14	127	78	126
Pushing 158 →	7	390	1710/1715	979.5	1.35	1.5	1.5	99	83	79	14	129	75	127
	B 8	395		983.1	1.5	1.7	1.7	98	84	79	15	128	74	118
143	8	400	1725/1730/1735	986.7	1.5	1.7	1.7	96	84	79	15	126	75	120
Pushing	C 1	405		990.3	1.6	1.75	1.75	99	79	79	15	125	75	130
Pushing	1	410		994.0	1.6	1.75	1.75	99	79	78	.16	128	72	121
	C 2	415		997.9	1.8	2.0	2.0	98	80	78	19	129	72	120

COMMENTS:

TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	
2	420	1001.7	1.8	2.0	2.0	99	83	78	19	130	72	127
C 3	425	1005.5	1.7	1.82	1.82	98	86	78	18	130	73	120
3	430	1009.3	1.7	1.82	1.82	98	89	79	18	129	74	127
C 4	435	1013.1	1.7	1.82	1.82	97	91	79	18	129	74	126
4	~~408~~ 440	1016.9	1.7	1.82	1.82	97	92	79	18	128	75	126
C 5	~~405~~ 445	1020.7	1.6	1.8	1.8	96	94	80	17	126	75	130
5	~~410~~ 450	1024.4	1.6	1.8	1.8	95	94	80	17	126	75	118
C 6	~~415~~ 455	1027.9	1.4	1.55	1.55	94	94	80	15	127	75	124
6	~~420~~ 460	1031.4	1.4	1.55	1.55	94	94	81	15	126	75	123
C 7	~~425~~ 465	1034.7	1.3	1.45	1.45	95	94	81	14	124	75	122
7	~~430~~ 470	1038.1	1.3	1.45	1.45	94	94	81	14	124	75	125
C 8	~~43~~ 475	1041.4	1.30	1.45	1.45	93	92	81	14	124	73	126
8	480	1044.8	1.30	1.45	1.45	92	91	80	14	126	72	128
	480	344.3	1.3		1.68	90	86					

Bar 29.52

avg 29.55

FIELD DATA

G2872-5014

PLANT Wisconsin Steel Works
DATE 5/12/77
SAMPLING LOCATION WESP Inlet
SAMPLE TYPE POM
RUN NUMBER Run 3
OPERATOR Schulz & Faught
AMBIENT TEMPERATURE 59
BAROMETRIC PRESSURE 29.63
STATIC PRESSURE, (P_s) -2.5 in H_2O
FILTER NUMBER (s) #97
Tenax #218

Page 1

PROBE LENGTH AND TYPE 9' pyrex
NOZZLE I.D. 0.175
ASSUMED MOISTURE, % 5
SAMPLE BOX NUMBER
METER BOX NUMBER 12
METER $\Delta H_@$ 1.82
C FACTOR 1.12
PROBE HEATER SETTING 125
HEATER BOX SETTING 125
REFERENCE Δp 1.7

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp F
	0	921	45.100										
D 1	5		48.2	1.1	1.25	1.25	86	72	66	9	129	68	128
1	10		51.3	1.1	1.25	1.25	89	75	66	9	129	68	125
D 2	15		54.6	1.6	1.75	1.75	87	78	67	12	128	68	124
2	20		58.3	1.6	1.75	1.75	87	83	68	12	126	69	124
D 3	25		62.0	1.7	1.82	1.82	89	85	69	12	124	69	125
3	30		65.7	1.7	1.82	1.82	90	87	69	12	124	69	124
D 4	35		69.4	1.6	1.75	1.75	87	89	71	12	127	69	123
4	40		73.1	1.6	1.75	1.75	89	91	72	12	128	69	125
D 5	45		76.7	1.55	1.7	1.7	88	93	73	12	127	70	125
5	50		80.4	1.55	1.7	1.7	89	93	74	12	126	70	125
D 6	55		83.9	1.35	1.5	1.5	89	93	75	11	124	71	124
6	60		87.3	1.35	1.5	1.5	88	92	76	11	123	72	125
D 7	65		90.8	1.4	1.55	1.55	89	92	77	11	126	73	125
7	70		94.2	1.4	1.55	1.55	88	91	78	11	127	74	124
D 8	75		97.7	1.4	1.55	1.55	91	91	78	11	127	73	125
8	80	1041 / 1043	101.1	1.4	1.55	1.55	90	91	79	11	127	74	126
E 1	85		104.1	0.95	1.1	1.1	91	90	79	8	125	75	125
1	90		107.0	0.95	1.1	1.1	91	90	79	8	124	76	124
E 2	95		110.4	1.5	1.65	1.65	91	90	80	11	126	78	126
2	100		114.0	1.5	1.65	1.65	90	91	80	11	127	78	124
E 3	105		117.8	1.7	1.82	1.82	91	93	80	12	127	78	124
3	110		112.6	1.7	1.82	1.82	91	94	80	12	127	79	123
E 4	115		125.4	1.65	1.8	1.8	91	94	81	12	125	79	125

COMMENTS:

TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp. F
4	120	128.4	1.65	1.8	1.8	91	94	81	12	124	79	127
E 5	125	133.1	1.8	2.0	2.0	91	95	82	13	124	80	127
5	130	137.0	1.8	2.0	2.0	91	96	83	13	124	80	125
E 6	135	140.8	1.7	1.82	1.82	90	96	83	12	124	81	125
6	140	144.6	1.7	1.82	1.82	94	96	83	12	124	79	125
E 7	145	148.3	1.6	1.75	1.75	92	95	83	12	124	80	126
7	150	152.0	1.6	1.75	1.75	91	95	84	12	125	80	125
E 8	155	155.4	1.5	1.65	1.65	93	95	84	11	124	82	125
8	160 / 1203 1205	159.1	1.5	1.65	1.65	92	95	84	11	124	83	126
F 1	165	162.9	1.6	1.75	1.75	94	94	84	12	124	83	127
1	170	166.6	1.6	1.75	1.75	92	94	84	12	123	83	123
F 2	175	170.6	1.9	2.1	2.1	94	95	85	14	124	83	123
2	180	174.6	1.9	2.1	2.1	94	96	85	14	125	84	124
F 3	185	178.4	1.7	1.82	1.82	93	96	85	12	127	85	126
3	190	182.2	1.7	1.82	1.82	94	96	85	12	127	83	124
F 4	195	185.8	1.5	1.65	1.65	93	96	86	11	126	85	124
4	200	189.4	1.5	1.65	1.65	94	96	86	11	125	85	125
F 5	205	193.2	1.7	1.82	1.82	94	96	86	12	124	86	127
5	210	197.0	1.7	1.82	1.82	94	96	86	12	124	84	127
F 6	215	200.5	1.4	1.55	1.55	94	95	86	11	124	86	127
6	220	204.0	1.4	1.55	1.55	95	95	87	11	124	86	127
F 7	225	207.5	1.4	1.55	1.55	95	95	87	11	124	85	127
7	230	211.0	1.4	1.55	1.55	96	95	87	11	124	86	127
F 8	235	214.6	1.5	1.65	1.65	95	96	87	11	124	85	127
8	240 / 1325 1335	218.2	1.5	1.65	1.65	95	96	87	11	124	86	127
A 1	245	221.9	1.6	1.75	1.75	94	90	87	12	123	86	129
1	250	225.6	1.6	1.75	1.75	96	~~86~~ 91	86	12	124	86	127
A 2	255	229.4	1.75	1.9	1.9	96	94	87	13	125	87	125
2	260	233.3	1.75	1.9	1.9	95	95	87	13	126	87	125
A 3	265	237.3	1.9	2.1	2.1	95	96	87	14	126	87	125
3	270	241.4	1.9	2.1	2.1	96	97	87	14	127	87	124
A 4	275	245.1	1.6	1.75	1.75	93	97	87	12	126	88	124
4	280	248.8	1.6	1.75	1.75	95	96	87	12	125	89	124
A 5	285	252.7	1.8	2.0	2.0	96	98	88	13	126	88	127
5	290	256.7	1.8	2.0	2.0	96	99	88	13	126	86	127
A 6	[illegible]	[illegible].2	1.3	1.45	1.45	98	97	[illegible]	11	126	86	127

continued

Continued

FIELD DATA

G2872-5014

PLANT *Wisconsin Steel Works*
DATE *5/12/77*
SAMPLING LOCATION *WESP Inlet*
SAMPLE TYPE *POM*
RUN NUMBER *3* *Page 2*
OPERATOR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY *5* MINUTES

	TRAVERSE POINT NUMBER	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 *POM Gas*	~~IMPINGER~~ TEMPERATURE, °F *Ambient*	*Probe Temp F*
Bar 29.55 →	A 7	305		267.1	1.4	1.55	1.55	96	96	89	11	126	86	128
	7	310		270.5	1.4	1.55	1.55	95	96	89	11	127	86	127
	A 8	315		274.1	1.5	1.65	1.65	95	96	89	11	126	87	126
	8	320	14 53 / 14 55	277.7	1.5	1.65	1.65	95	96	89	11	126	88	125
	B 1	325		280.9	1.1	1.25	1.25	98	95	89	9	125	89	127
	1	330		284.0	1.1	1.25	1.25	97	94	89	9	125	89	127
	B 2	335		287.4	1.4	1.55	1.55	96	94	89	11	126	89	125
	2	340		290.9	1.4	1.55	1.55	99	95	89	11	127	88	125
	B 3	345		294.9	2.0	2.2	2.2	99	96	89	15	127	86	124
	3	350		299.1	2.0	2.2	2.2	99	99	89	15	126	86	123
	B 4	355		303.1	1.75	1.9	1.9	99	99	89	13	124	86	123
	4	360		307.0	1.75	1.9	1.9	96	99	89	13	124	86	126
Max Temp	B 5	365		310.8	1.7	1.82	1.82	98	99	89	13	124	87	127
Pushing 184F →	5	370	15 43 / 15 48	314.6	1.7	1.85	1.85	103	99	89	13	124	86	128
	B 6	375		318.4	1.7	1.85	1.85	109	94	89	13	122	85	142
Pushing 210 →	6	380	15 58 / 16 00	322.2	1.7	1.85	1.85	109	92	89	13	123	86	138
Pushing 209 →	B 7	385	16 08 / 16 13	325.7	1.35	1.5	1.5	108	94	89	11	122	84	126
	7	390		329.1	1.35	1.5	1.5	107	91	89	11	121	83	143
	B 8	395	16 28	332.6	1.5	1.65	1.65	106	92	89	11	127	84	127
Pushing 191 →	8	400	16 33 / 16 35 / 16 37	336.2	1.5	1.65	1.65	103	92	88	11	128	84	127
	C 1	405		339.7	1.4	1.55	1.55	109	91	88	11	129	83	127
	1	410		343.2	1.4	1.55	1.55	106	93	89	11	128	83	122
	C 2	415		347.1	1.4	2.1	2.1	105	94	88	14	124	83	123

COMMENTS:

	TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp F
	2	420		351.2	1.9	2.1	2.1	104	96	88	14	123	84	124
Pushing 196	C 3	425	1703 / 1708	355.1	1.8	2.0	2.0	105	98	89	14	123	83	127
	3	430	1719	359.1	1.8	2.0	2.0	107	94	89	14	129	83	122
	C 4	435	1724	363.0	1.8	2.0	2.0	110	95	89	14	130	83	128
Pushing 159	4	440		366.9	1.8	2.0	2.0	108	94	88	14	129	82	128
	C 5	445	1736	370.7	1.7	1.85	1.85	109	95	89	13	124	83	124
Pushing 185	5	450	1744	374.6	1.7	1.85	1.85	106	96	89	13	127	83	129
	C 6	455	1752	378.1	1.4	1.55	1.55	108	94	89	11	124	83	128
Pushing 265	6	460	1757	381.5	1.4	1.55	1.55	104	94	89	11	126	83	129
	C 7	465		385.0	1.4	1.55	1.55	109	92	89	11	129	85	133
	7	470		388.5	1.4	1.55	1.55	106	94	89	11	128	85	127
Pushing 224	C 8	475	1813 / 1818	391.9	1.3	1.45	1.45	107	95	89	11	124	83	128
	8	480		395.2	1.3	1.45	1.45	112	93	89	11	124	83	136
Bar 29.48		480		350.10	1.56		1.71	96	89					

G2872-5014

FIELD DATA

PLANT Wisconsin Steel Works
DATE 5/13 & 14-77
SAMPLING LOCATION WESP Inlet
SAMPLE TYPE POM
RUN NUMBER 4-A Page 1
OPERATOR Schub Faught
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE 29.35
STATIC PRESSURE, (P_s) -2.6" H_2O
FILTER NUMBER (s) #99
Tenax #204

PROBE LENGTH AND TYPE 9' pyrex
NOZZLE I.D. 0.175
ASSUMED MOISTURE, % 8
SAMPLE BOX NUMBER
METER BOX NUMBER 12
METER $\Delta H_@$ 1.82
C FACTOR 1.12
PROBE HEATER SETTING 125
HEATER BOX SETTING 125
REFERENCE Δp 1.7

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

Max Temp	TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp F
		0	20:16	395.400										
	D 1	5		395.8	1.1	1.25	1.25	114	89	90	10	122	81	126
Pushing 179	1	10	20:26 / 20:31	401.7	1.1	1.25	1.25	91	89	90	10	122	81	125
	D 2	15		405.2	1.6	1.75	1.75	116	90	89	12	126	80	127
	2	20		408.9	1.6	1.75	1.75	113	91	89	12	126	80	127
Pushing 147	D 3	25	20:47 / 20:52	412.6	1.7	1.85	1.85	109	94	89	-13	127	80	127
	3	30		416.4	1.7	1.85	1.85	89	92	89	-13	124	80	127
Pushing 126	D 4	35	21:01 / 21:06	420.1	1.6	1.75	1.75	90	95	89	13	125	80	128
	4	40		423.8	1.6	1.75	1.75	94	93	89	13	126	79	130
	D 5	45		427.4	1.5	1.65	1.65	99	95	89	12	124	79	128
	5	50		431.0	1.5	1.65	1.65	95	96	89	12	123	79	127
	D 6	55		435.0	1.3	1.45	1.45	92	96	89	11	126	79	124
	6	60		437.7	1.3	1.45	1.45	91	96	89	11	126	78	125
Pushing 165	D 7	65	21:34 / 21:39	441.1	1.3	1.45	1.45	93	96	89	11	124	78	124
	7	70		444.4	1.3	1.45	1.45	100	93	89	11	123	78	126
	D 8	75		447.9	1.4	1.55	1.55	99	94	89	12	124	77	124
	8	80	21:57 / 21:54	451.3	1.4	1.55	1.55	90	94	89	12	125	77	121
	E 1	85		454.1	0.9	1.0	1.0	100	93	89	8	125	76	123
	1	90		456.9	0.9	1.0	1.0	90	93	89	8	124	76	121
	E 2	95		460.3	1.4	1.55	1.56	82	92	88	12	125	75	121
	2	100		463.8	1.4	1.55	1.56	87	94	88	12	126	75	122
	E 3	105		467.5	1.6	1.75	1.75	89	94	88	14	126	75	122
	3	110		471.3	1.7	1.85	1.85	89	93	88	.14	124	75	122
	E 4	115		475.0	1.6	1.75	1.75	89	95	88	14	124	75	122

COMMENTS:

Remarks	TRAVERSE POINT NUMBER		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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp F
		4	120		478.7	1.6	1.75	1.75	88	96	88	14	124	75	124
	E	5	125		482.6	1.8	2.0	2.0	88	96	88	15	125	74	126
		5	130		486.6	1.8	2.0	2.0	89	96	88	15	125	74	124
	E	6	135		490.4	1.7	1.85	1.85	88	96	88	14	125	74	123
		6	140		494.2	1.7	1.85	1.85	88	96	88	14	124	73	123
	E	7	145		497.7	1.4	1.55	1.55	88	96	88	12	124	73	123
No touch Rise Couple start		7	150		501.2	1.4	1.55	1.55	88	96	88	12	123	73	124
	E	8	155		504.8	1.5	1.65	1.65	88	96	88	13	126	73	124
Pushing 80		8	160	23 18 / 23 22 23 25 23 32	508.3	1.5	1.65	1.65	88	95	88	13	127	73	124
Pushing —	F	1	165		512.0	1.5	1.65	1.65	88	87	86	13	121	72	122
		1	170		515.5	1.5	1.65	1.65	88	88	86	13	124	72	121
Pushing 128	F	2	175	23 46 / 23 51	519.5	1.9	2.1	2.1	98	89	85	16	127	71	120
		2	180		523.5	1.9	2.1	2.1	104	86	85	16	124	71	—
Pushing 172	F	3	185	24 00 / 24 05	527.3	1.7	1.85	1.85	102	86	84	14	122	71	123
		3	190		531.0	1.7	1.85	1.85	102	88	84	14	129	71	124
Pushing 219	F	4	195	24 20 / 24 25	534.6	1.5	1.65	1.65	100	89	84	13	132	71	117
		4	200		538.2	1.5	1.65	1.65	102	88	83	13	127	71	125
Pushing 186	F	5	205	24 32 / 24 37	541.9	1.6	1.75	1.75	106	89	83	13	124	70	121
		5	210		545.6	1.7	1.85	1.85	102	86	83	14	130	70	130
	F	6	215		549.1	1.4	1.55	1.55	105	88	83	13	131	69	120
Pushing 172		6	220	24 53 / 24 58	552.6	1.4	1.55	1.55	103	88	83	13	128	69	126
	F	7	225		555.9	1.3	1.45	1.45	99	86	82	12	122	69	127
		7	230		559.4	1.35	1.5	1.5	98	87	82	12	123	69	121
Pushing 144	F	8	235	1 15 / 1 18	562.9	1.4	1.55	1.55	96	89	82	12	124	69	125
		8	240	1 26 / 1 31	566.2	1.4	1.55	1.55	102	86	81	12	122	69	121
	A	1	245		569.7	1.4	1.55	1.55	97	82	80	12	122	68	124
Pushing 168		1	250	1 47 / 1 52	573.2	1.4	1.55	1.55	96	83	80	12	122	68	123
	A	2	255		576.8	1.6	1.75	1.75	96	81	80	13	123	68	124
		2	260		580.6	1.6	1.75	1.75	97	83	79	13	124	67	124
	A	3	265		584.3	1.8	2.0	2.0	95	86	79	16	126	67	122
		3	270		588.2	1.8	2.0	2.0	95	87	79	16	126	67	121
	A	4	275		592.1	1.65	1.8	1.8	91	89	79	15	125	67	121
		4	280		595.6	1.5	1.65	1.65	91	88	79	13	125	67	123
	A	5	285		599.4	1.7	1.85	1.85	90	88	79	14	124	67	124
		5	290		603.2	1.7	1.85	1.85	89	89	79	14	124	67	124
	A	6	295		606.[illegible]	1.7	1.85	1.85	89	89	[illegible]	[illegible]	124	67	123

G2872-5014

FIELD DATA

PLANT Wisconsin Steel Works
DATE 5/13 & 14/77
SAMPLING LOCATION W ESP Inlet
SAMPLE TYPE POM
RUN NUMBER 4 Page 2
OPERATOR Schroll Faught
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

PROBE LENGTH AND TYPE 9' Pyrex
NOZZLE I.D. 0.175
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

	TRAVERSE POINT NUMBER	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 POM Gas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp F
	A 7	305		613.4	1.35	1.5	1.5	88	87	79	12	126	66	123
	7	310		616.8	1.35	1.5	1.5	87	87	79	12	130	66	124
	A 8	315		620.3	1.4	1.55	1.55	86	87	79	13	131	66	123
	8	320	3:02 / 3:09	623.7	1.4	1.55	1.55	87	87	79	13	129	66	123
	B 1	325		626.7	1.0	1.15	1.15	86	84	79	10	125	66	125
	1	330		629.7	1.0	1.15	1.15	87	83	79	10	124	65	124
Pushing 187	B 2	335	3:17 / 3:22	633.1	1.4	1.55	1.55	87	83	78	13	124	65	124
Pushing 165	2	340	3:26 / 3:31	636.5	1.4	1.55	1.55	100	81	78	13	123	65	128
	B 3	345		640.3	1.8	2.0	2.0	102	81	78	16	124	65	123
	3	350		644.2	1.8	2.0	2.0	99	83	78	16	126	65	124
Pushing 156	B 4	355	3:46 / 3:51	647.9	1.6	1.75	1.75	94	80	78	14	123	65	128
Pushing 159	4	360	4:00 / 4:05	651.5	1.6	1.75	1.75	92	82	78	14	124	65	124
	B 5	365		655.2	1.7	1.85	1.85	95	80	77	15	125	64	131
	5	370		659.0	1.7	1.85	1.85	96	82	77	15	124	64	122
	B 6	375		662.7	1.7	1.85	1.85	91	83	77	15	124	64	125
Pushing 165	6	380	4:22 / 4:27	666.5	1.7	1.85	1.85	90	85	77	15	124	64	124
	B 7	385		669.9	1.4	1.55	1.55	97	82	77	13	124	63	126
Pushing 156	7	390	4:36 / 4:40	673.3	1.4	1.55	1.55	96	83	77	13	125	63	126
	B 8	395	4:51 / 4:56	676.8	1.45	1.6	1.6	91	80	76	13	124	63	126
Pushing 163	8	400	4:58 / 5:02 / 5:04	680.3	1.45	1.6	1.6	95	79	76	13	124	63	126
	C 1	405		683.7	1.35	1.5	1.5	102	79	~~8~~ 76	13	124	63	126
Pushing 155	1	410	5:12 / 5:17	687.1	1.35	1.5	1.5	100	80	75	.13	127	63	126
	C 2	415		690.7	1.75	1.9	1.9	97	79	75	15	123	63	124

COMMENTS:

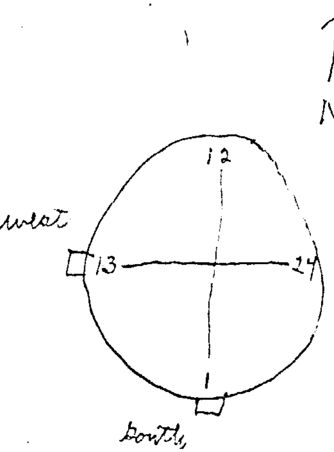
TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in Hg	~~SAMPLE BOX~~ TEMPERATURE, °F POMGas	~~IMPINGER~~ TEMPERATURE, °F Ambient	Probe Temp. F
2	420		694.5	1.75	1.9	1.9	96	81	75	15	124	63	121
C 3	425		698.2	1.7	1.85	1.85	93	83	75	13	127	63	122
3	430		701.9	1.6	1.75	1.75	91	84	75	15	127	63	124
C 4	435		705.6	1.7	1.85	1.85	89	85	75	15	126	62	125
4	440		709.3	1.7	1.85	1.85	89	85	75	15	124	62	127
C 5	445	5:50	713.1	1.75	1.9	1.9	86	86	75	16	124	62	124
5	450	~~555~~	717.0	1.75	1.9	1.9	86	84	75	16	124	62	126
C 6	455		720.4	1.4	1.55	1.55	87	82	75	13	124	62	120
6	460		723.8	1.4	1.55	1.55	87	82	75	13	125	62	121
C 7	465		727.1	1.3	1.45	1.45	85	83	75	12	125	62	121
7	470		730.4	1.3	1.45	1.45	85	83	75	12	124	62	120
C 8	475		733.7	1.3	1.45	1.45	84	83	75	12	126	62	121
8	480	634	737.1	1.3	1.45	1.45	83	83	75	12	126	62	124
	480		341.70	1.51		1.67	93	84					

Deposits on outside of Probe was not as heavy as in runs 1, 2 & 3.

...shing 176

...ar .935

... 29.35



FIELD DATA

PLANT Wisconsin Steel, Chicago Ill.
DATE 5/10/77
SAMPLING LOCATION outlet stack
SAMPLE TYPE POM
RUN NUMBER 1-B
OPERATOR Leonard
AMBIENT TEMPERATURE 55
BAROMETRIC PRESSURE 29.52
STATIC PRESSURE, (P_s)
FILTER NUMBER (s) #94 0.50100g
POM 312-1
312-2

Page 1 of 2

PROBE LENGTH AND TYPE 8' glass + 1 ft. S.S.
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 5
METER BOX NUMBER 2
METER $\Delta H_@$ 1.82
C FACTOR 1.08
PROBE HEATER SETTING 125° F
HEATER BOX SETTING 125°F
REFERENCE Δp 1.40

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

probe	TRAVERSE POINT NUMBER	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 / of PACK COLUMN	IMPINGER TEMPERATURE, °F
				805.408									
	12	0	10:01	~~807~~	~~0.91~~ 1.10	~~1.20~~ 1.40	~~1.20~~ 1.40	62	69	63	19"	127	
118	12	5	10:06	807.	1.05	1.38	1.38	61	70	63	19"	122	
127	11	10	10:11	811.5	1.30	1.70	1.50	61	72	63	21"	125	
	11	15	10:16	814.8	1.30	1.70	1.50	60	71	63	22"	124	42
121	10	20	10:21	818.1	1.30	1.70	1.50	60	70	63	22"	122	42
124	10	25	10:26	821.4	1.30	1.70	1.50	60	71	63	22"	122	43
124	9	30	10:31	824.8	1.30	1.70	1.50	60	72	64	22"	121	43
124	9	35	10:36	828.1	1.30	1.70	1.50	60	73	66	22"	127	44
125	8	40	10:41	831.4	1.30	1.70	1.45	60	74	66	22"	131	
		42	10:43	off replace	glassware	to measure	temp out of				pack	column	
		42	10:44	on									
126	8	45	10:47	834.7	1.30	1.70	1.40	61	75	68	22"	132	
125	7	50	10:52	838.0	1.30	1.70	1.40	62	75	68	22"	105°F (dial therm)	
125	7	55	10:57	841.3	1.30	1.70	1.40	62	77	70	22"	110°	58
124	6	60	11:02	844.5	1.35	1.75	1.40	62	77	70	22"	110°	56
133	6	65	11:07	847.6	1.35	1.75	1.35	62	78	71	22"	115°/149° T.C.	58
119	5	70	11:12	850.9	1.40	1.82	1.36	63	79	72	22"	120°/152	60
125	5	75	11:17	854.1	1.40	1.82	1.35	63	79	73	22"	120°/153°	
128	4	80	11:22	857.3	1.45	1.90	1.35	63	79	73	22"	120°/153°	58
129	4	85	11:27	860.4	1.45	1.90	1.35	63	79	74	22"	120°/154°	
128	3	90	11:32	863.6	1.45	1.90	1.35	62	79	75	22"	120°/154	
128	3	95	11:37	866.9	1.45	1.90	1.35	61	79	75	22"	120°/154	
129	2	100	11:42	870.2	1.35	1.75	1.35	61	80	75	22"	120°/155	

COMMENTS:

Probe	TRAVERSE POINT NUMBER	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
128	2	105	11:47	873.3	1.30	1.70	1.35	61	79	75	22	120°/153	
128	1	110	11:52	876.7	1.05	1.38	1.35	61	79	75	22	/154	
127	1	115	11:57	879.8	1.05	1.38	1.35	61	79	75	22	/153	
		120	12:02	883.109 off	change pack,	column.							
134	1	120	12:09	883.109	0.95	1.24	1.24	61	78	75	15	/127	
129	1	125	12:14	886.2	0.92	1.20	1.20	61	77	75	18	96 /133	60
129	2	130	12:19	890.6	1.30	1.70	1.50	61	79	76	22	102 /143	
128	2	135	12:24	892.9	1.30	1.70	1.50	61	79	76	22	112 /161	
129	3	140	12:29	895.9	1.50	1.95	1.30	61	80	77	22	120 /169	
131	3	145	12:34	899.4	1.45	1.90	1.30	61	80	77	22	/171	
132	4	150	12:39	902.4	1.50	1.95	1.30	61	80	77	22	130/171	60
132	4	155	12:44	905.5	1.50	1.95	1.30	61	81	77	22	125/159	
131	5	160	12:49	908.7	1.45	1.90	1.30	61	81	78	22	124/149	60
129	5	165	12:54	912.0	1.40	1.82	1.30	61	81	78	22	120/149	
128	6	170	12:59	915.3	1.35	1.75	1.35	61	81	78	22	120/150	
127	6	175	13:04	918.5	1.35	1.75	1.35	61	82	78	22	118/153	
121	7	180	13:09	921.8	1.25	1.60	1.35	61	82	78	22	120/154	
118	7	185	13:14	925.0	1.25	1.60	1.35	61	82	78	22	122/158	
118	8	190	13:19	928.2	1.25	1.60	1.35	61	82	78	22	124/159	54
121	8	195	13:24	931.4	1.30	1.70	1.35	60	81	78	22	124/158	
123	9	200	13:29	934.6	1.30	1.70	1.35	60	81	78	22	124/156	54
124	9	205	13:34	937.8	1.30	1.70	1.35	60	80	78	22	124/156	54
123	10	210	13:39	941.1	1.30	1.70	1.35	60	80	78	22	124/155	54
124	10	215	13:44	944.3	1.30	1.70	1.30	60	80	78	22	125/159	54
124	11	220	13:49	947.5	1.25	1.60	1.30	61	81	78	22	125/159	58
124	11	225	13:54	950.7	1.30	1.70	1.30	61	82	79	22	125/153	58
124	12	230	13:59	953.9	1.05	1.38	1.30	61	82	78	22	125/152	58
124	12	235	14:04	957.2	1.05	1.38	1.30	60	82	78	22	124/151	57
		240	14:09	960.771 off		change	ports						
125	24	240	14:32	960.771 on	1.05	1.38	1.35	60	78	76	22	102/144	
116	24	245	14:37	964.2	1.05	1.38	1.30	60	77	76	22	116/165	
129	23	250	14:42	967.6	1.20	1.55	1.25	60	78	76	22	118/171	
120	23	255	14:47	970.9	1.20	1.55	1.25	59	79	76	22	124/175	54
118	22	260	14:52	974.2	1.25	1.60	1.30	59	79	76	22	125/171	56
128	22	265	14:57	977.5	1.25	1.60	1.30	60	80	77	22	124/156	54
121	21	270	15:02	980.2	1.30	1.70	1.30	60	80	78	22	120/153	54

2 of 2 sheets

FIELD DATA

PLANT Wisconsin Steel
DATE 5/10/77
SAMPLING LOCATION outlet
SAMPLE TYPE POM
RUN NUMBER 1-B
OPERATOR Leonard, Badhe
AMBIENT TEMPERATURE 55
BAROMETRIC PRESSURE 29.57
STATIC PRESSURE, (P_s)
FILTER NUMBER (s) ~~#9~~
POM # 213-1
212-2

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PROBE LENGTH AND TYPE
NOZZLE I.D. 0.182
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 2
METER BOX NUMBER 5
METER $\Delta H_@$ 1.82
C FACTOR 1.08
PROBE HEATER SETTING 125°F
HEATER BOX SETTING 125° at POM outlet
REFERENCE Δp 1.40

SCHEMATIC OF TRAVERSE POINT LAYOUT

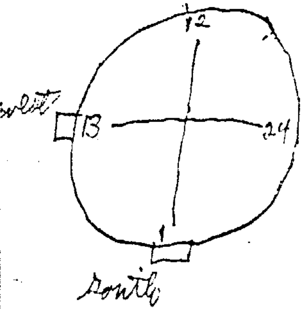
READ AND RECORD ALL DATA EVERY ______ MINUTES

Probe	TRAVERSE POINT NUMBER	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
122	20	280	15:12	986.4	1.30	1.70	1.30	60	81	78	22	118/171	
122	20	285	15:17	989.5	1.30	1.70	1.25	60	82	78	22	120/171	54
123	19	290	15:22	992.7	1.25	1.60	1.20	59	82	78	22	122/177	54
122	19	295	15:27	995.8	1.30	1.70	1.20	59	82	77	22	124/171	54
122	18	300	15:32	998.9	1.30	1.70	1.20	59	83	79	22	125/173	54
129	18	305	15:37	1001.9	1.30	1.70	1.20	60	83	79	22	125/169	52
	17	310	15:42	1005.012 off	push	coke.	(start back up	at point 17)				/"	
152	17	310	15:48	1005.012	1.40	1.82	1.30	67	83	80	22	/148	
	17	314	15:53	1007.623 off	push	coke							
	17	314	15:57	1007.623 on									
143	17	315	15:58	1008.3	1.40	1.82	1.30	65	82	79	22	108/164	52
133	16	320	16:03	1011.5	1.45	1.90	1.20	66	81	79	22	118/181	
		322	16:05	1012.654 off	push	coke							
		322	16:09	1012.654 on	~~1.45~~	~~1.90~~	~~1.20~~						
132	16	325	16:12	1014.5	1.45	1.90	1.20	68	81	79	22	110/191	
127	15	330	16:17	1017.5	1.45	1.90	1.20	66	81	79	22	120/195	
127	15	335	16:22	1020.6	1.50	1.92	1.20	64	82	80	22	128/197	
	14	340	16:27	1023.507 off	(start back	up on	point 14)						
137		340	16:32	1023.507 on	1.50	1.92	1.20	63	82	79	22	118/170	
134	14	345	16:37	1026.6	1.50	1.92	1.20	63	80	79	22	122/170	
		348	16:40	1028.550 off									
138		348	16:45	1028.550 on	1.50	1.92	1.20	64	82	77	22	/171	
137	13	350	16:47	1029.9	1.10	1.40	1.20	66	81	77	22	120/182	

COMMENTS: 354 16:51 1032.384 off

$\sqrt{1.3\,(460+61)} = 26.02$ approx

probe	TRAVERSE POINT NUMBER	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
		354	16:55	1032.384 on									
	13	355	16:56	1033.0	1.10	1.40	1.20	66	82	79	22	120/181	
132	13	360	17:01	1036.1	1.10	1.40	1.20	69	81	79	22	122/183	
		361	17:02	1036.765 off									
136		361	17:07	1036.765 on	~~1.10~~	~~1.40~~	~~1.20~~	~~66~~	~~83~~	~~80~~	22	112/177	
132	13	365	17:11	1039.2	1.10	1.40	1.20	69	81	79	22	/181	
	14	370	17:16	1042.327 off		(start ~~back~~ out			point 14)				
133		370	17:21	1042.327 on	1.50	1.92	1.20	66	82	79	22	120/179	
130	14	375	17:26	1045.5	1.50	1.92	1.20	68	80	79	22	/178	
		379	17:30	1047.809 off									
		379	17:35	1047.809 ON									
	15	380	17:36	—	1.50	1.92	1.10	68	81	80	22½	120/178	
133	15	385	17:41										
		388	17:44	1053.863 off									
		388	17:49	1053.863 on									
135	16	390	17:50	1054.6	1.50	1.92	1.15	69	82	80	22.5	/177	
133	16	395	17:55	1057.4	1.50	1.92	1.15	68	82	80	22.5	124/180	
131	17	400	18:00	1060.4	1.50	1.92	1.15	65	82	80	22.5	/186	
130	17	405	18:05	1063.1	1.50	1.92	1.15	64	83	80	22.5	135/177	
130	18	410	18:10	1066.1	1.45	1.90	1.15	63	83	80	22.5	128/163	54
129	18	415	18:15	1069.1	1.40	1.82	1.25	64	83	80	22.5	122/148	52
128	19	420	18:20	1072.3	1.30	1.70	1.30	63	83	80	22.0	124/146	53
118	19	425	18:25	1075.3	1.30	1.70	1.30	63	83	80	22.0	122/154	54
123	20	430	18:30	1078.3	1.30	1.70	1.25	63	83	80	22.0	120/163	
124	20	435	18:35	1081.4	1.30	1.70	1.25	62	83	80	22.0	118/164	53
125	21	440	18:40	1084.5	1.30	1.70	1.20	62	82	80	22.0	121/168	53
124	21	445	18:45	1087.6	1.30	1.70	1.20	61	82	80	22.0	122/172	54
124	22	450	18:50	1090.6	1.25	1.60	1.20	61	82	80	22.0	120/176	54
124	22	455	18:55	1093.7	1.25	1.60	1.20	61	82	80	22.5	126/175	54
125	23	460	19:00	1096.7	1.20	1.55	1.20	60	81	79	22.5	129/178	54
124	23	465	19:05	1099.8	1.20	1.55	1.20	60	81	79	22.5	130/176	54
125	24	470	19:10	1102.9	0.95	1.25	1.20	60	81	79	22.5	126/167	54
125	24	475	19:15	1106.0	0.95	1.25	1.20	61	81	79	22.5	126/169	54
		477	19:17	1107.134 off									
130		477	19:22	1107.134 on	0.95	1.25	1.25	66	80	79	22.0	/151	
		480	19:25	1109.318									



FIELD DATA

PLANT Wisconsin Steel Ill.
DATE 5/11/77
SAMPLING LOCATION outlet
SAMPLE TYPE POM
RUN NUMBER 2
OPERATOR Leonard, Radha
AMBIENT TEMPERATURE 55°
BAROMETRIC PRESSURE 29.57
STATIC PRESSURE, (P_s)
FILTER NUMBER (s) 496 0.50353g
POM - 203

Page 1 of 2

PROBE LENGTH AND TYPE 8' glass + 1' S.S.
NOZZLE I.D. 0.175
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER 5
METER BOX NUMBER 2
METER $\Delta H_@$ 1.82
C FACTOR 1.08
PROBE HEATER SETTING ~~180°~~ 125°
HEATER BOX SETTING 180° at start, 120° at POM outlet
REFERENCE Δp 1.65

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

probe	TRAVERSE POINT NUMBER	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 DIAL THERMO / box T.C.	IMPINGER TEMPERATURE, °F
				112.672									
	12	0	10:01		1.0	1.10	1.10	69	82	78	13.0	98/168	50
136	12	5	10:06	115.5	1.0	1.10	1.10	69	86	78	13.0	112/184	50
131	11	10	10:11	118.4	1.20	1.35	1.35	69	94	79	15.0	134/193	56
129	11	15	10:16	121.4	1.25	1.40	1.40	69	99	80	16.0	/195	
129	10	20	10:21	124.5	1.30	1.45	1.45	69	103	81	17.5	140/187	60
130	10	25	10:26	127.9	1.30	1.45	1.45	70	105	83	17.5	138/179	63
130	9	30	10:31	131.3	1.30	1.45	1.45	71	107	85	17.0	136/170	62
131	9	35	10:36	134.7	1.30	1.45	1.45	72	108	87	16.0	134/161	61
128	8	40	10:41	138.1	1.30	1.45	1.45	72	110	89	15.5	130/155	
128	8	45	10:46	141.5	1.30	1.45	1.45	72	112	90	15.25	124/165	60
128	7	50	10:51	144.9	1.30	1.45	1.45	73	113	91	15.25	125/165	59
128	7	55	10:56	148.2	1.30	1.45	1.45	72	113	92	15.25	128/170	60
127	6	60	11:01	151.6	1.35	1.50	1.50	72	113	94	15.5	128/164	60
139	6	65	11:06	155.2	1.35	1.50	1.50	72	115	94	15.75	128/158	60
138	5	70	11:11	158.4	1.45	1.60	1.60	73	116	95	16.5	130/153	60
137	5	75	11:16	161.9	1.45	1.60	1.60	73	116	96	16.5	126/149	
138	4	80	11:21	165.5	1.45	1.60	1.60	72	117	96	16.5	124/145	59
133	4	85	11:26	169.0	1.45	1.60	1.60	72	117	97	16.5	124/145	
137	3	90	11:31	172.7	1.45	1.60	1.60	72	117	98	16.0	124/147	58
128	3	95	11:36	176.3	1.45	1.60	1.60	72	118	99	16.0	123/148	
124	2	100	11:41	179.9	1.40	1.55	1.55	73	118	97	15.75	122/145	58
126	2	105	11:46	183.4	1.40	1.55	1.55	72	118	99	15.75	122/143	
129	1	110	11:51	187.0	1.00	1.10	1.10	72	118	100	12.0	122/141	58

COMMENTS:

probe	TRAVERSE POINT NUMBER	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
129	1	115	11:56	190.5	1.00	1.10	1.10	72	117	100	11.5	/139	
127	1	120	12:01	193.2	1.00	1.10	1.10	72	117	101	11.5	120/142	
118	1	125	12:06	196.5	1.00	1.10	1.10	72	117	101	11.5	119/144	
125	2	130	12:11	199.2	1.40	1.55	1.55	72	117	101	15.0	118/149	
129	2	135	12:16	202.6	1.40	1.55	1.55	72	118	102	15.25	/151	
131	3	140	12:21	206.0	1.45	1.60	1.60	72	120	102	16.0	122/156	58
133	3	145	12:26	209.4	1.45	1.60	1.60	72	121	102	16.0	/158	
130	4	150	12:31	213.1	1.45	1.60	1.60	72	120	102	16.25	128/159	58
125	4	155	12:36	216.7	1.45	1.60	1.60	72	120	103	16.5	/158	
122	5	160	12:41	220.4	1.45	1.60	1.60	72	121	103	16.5	124/149	58
119	5	165	12:46	224.2	1.40	1.55	1.55	71	120	103	15.5	122/141	
130	6	170	12:51	227.6	1.40	1.55	1.55	71	120	103	16.25	112/134	
125	6	175	12:56	231.4	1.40	1.55	1.55	72	120	103	15.25	/146	
125	7	180	13:01	234.8	1.25	1.40	1.40	72	120	104	14.25	116/160	59
115	7	185	13:06	238.2	1.30	1.45	1.45	72	120	104	14.75	/167	
122	8	190	13:11	241.6	1.35	1.50	1.50	72	119	103	15.25	124/172	60
121	8	195	13:16	245.1	1.25	1.40	1.40	72	119	104	15	130/164	60
121	9	200	13:21	248.5	1.30	1.45	1.45	72	120	104	15	128/157	60
121	9	205	13:26	252.0	1.30	1.45	1.45	72	120	104	15	/150	
123	10	210	13:31	255.5	1.30	1.45	1.45	72	120	105	15	122/145	60
124	10	215	13:36	259.0	1.35	1.50	1.50	72	121	105	15	/149	
124	11	220	13:41	262.5	1.30	1.45	1.45	72	121	105	14.75	118/151	60
124	11	225	13:46	266.0	1.30	1.45	1.45	72	121	105	14.75	/151	
123	12	230	13:51	269.5	1.05	1.18	1.18	72	121	105	12.5	/153	
124	12	235	13:56	272.8	1.05	1.18	1.18	71	120	105	12.5	115/153	
	off	240	14:01	276.011 off-change ports (leak checked)									
158	24	240	14:15	276.987 on	1.05	1.18	1.18	71	105	102	11.5	/181	
137	24	245	14:20	279.9	1.05	1.18	1.18	72	106	102	12.0	120/182	60
128	23	250	14:25	283.0	1.20	1.35	1.35	71	109	101	14.0	/183	
126	23	255	14:30	286.1	1.20	1.35	1.35	71	112	100	14.75	130/174	60
		258	14:33	288.040 off-change drierite impinger									
		258	14:35	288.040 on									
128	22	260	14:37	289.2	1.25	1.40	1.40	72	111	100	14.0	122/164	61
126	22	265	14:42	292.6	1.25	1.40	1.40	72	114	100	14.0	/158	
125	21	270	14:47	295.9	1.25	1.40	1.40	72	116	100	14.0	116/150	60
12[illegible]	21	275	14:52	299.4	1.25	1.40	1.40	72	117	100	14.0	116/163	66

#2 of 2 sheets

FIELD DATA

PLANT: Wisconsin Steel
DATE: 5/11/77
SAMPLING LOCATION: OUTLET ESP
SAMPLE TYPE: POM
RUN NUMBER: 2
OPERATOR: LEONARD, RADHA
AMBIENT TEMPERATURE:
BAROMETRIC PRESSURE:
STATIC PRESSURE, (P_s):
FILTER NUMBER (s): same
POM same

PROBE LENGTH AND TYPE: 8' Pyrex
NOZZLE I.D.: 0.175
ASSUMED MOISTURE, %:
SAMPLE BOX NUMBER: 5
METER BOX NUMBER: 2
METER $\Delta H_@$: 1.82
C FACTOR: 1.08
PROBE HEATER SETTING:
HEATER BOX SETTING:
REFERENCE Δp: 1.65

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY ____ MINUTES

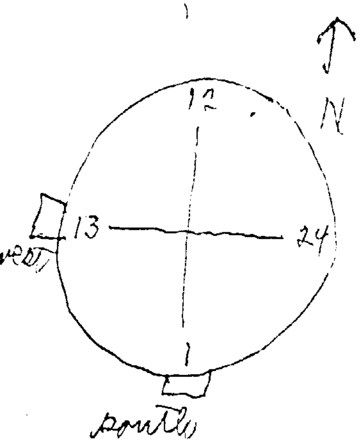
probe	TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	OUTLET ($T_{m\ out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
124	20	285	15:02	306.2	1.30	1.45	1.45	72	118	102	14	/162	
124	19	290	15:07	309.6	1.30	1.45	1.45	72	118	102	14.25	122/161	62
124	19	295	15:12	313.0	1.30	1.45	1.45	72	118	102	14.25	120/159	61
124	18	300	15:17	316.5	1.35	1.50	1.50	72	118	102	14.5	122/157	60
130	18	305	15:22	319.9	1.35	1.50	1.50	72	119	103	14.5	/154	
132	17	310	15:27	323.0	1.45	1.60	1.60	72	120	103	15.0	120/152	60
122	17	315	15:32	327.0	1.45	1.60	1.60	72	121	104	15.0	/149	
116	16	320	15:37	331.2	1.50	1.65	1.65	72	121	104	15.0	112/146	
	16	322	15:39	332.090 off	push	coke							
		322	15:44	332.090 on	~~1.50~~	~~1.65~~	~~1.65~~				16.0		
126	16	325	15:47	334.2	1.50	1.65	1.65	76	113	103	16.5	/142	
		328	15:50	336.436 off	push	coke							
		328	15:54	336.436 on									
128	15	330	15:56	337.8	1.60	1.80	1.80	77	110	102	23	120/188	60
124	15	335	16:01	341.6	1.60	1.80	1.70	75	107	102	23	/191	60
123	14	340	16:06	345.2	1.55	1.70	1.70	73	106	102	23	/183	
		341	16:07	346.102 off	push	coke							
		341	16:12	346.102 on									
128	14	345	16:16	349.1	1.55	1.70	1.70	76	102	100	23	/169	
126	13	350	16:21	353.0	1.20	1.35	1.35	75	101	99	15	128/160	60
125	13	355	16:26	356.5	1.15	1.30	1.30	77	101	99	14	/151	
		359	16:30	359.153 off	push	coke							
		359	16:36	359.153 on									

COMMENTS:

probe	TRAVERSE POINT NUMBER	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
131	-13	360	16:37	359.8		1.15	1.30	1.30	75	99	98	13	/139	
		362	16:39	361.049	off	push	coke							
		362	16:44	361.049	on									
128	13	365	16:47	363.0		1.15	1.30	1.30	78	99	97	13.5	102/146	58
125	14	370	16:52	366.3		1.50	1.65	1.65	78	99	97	18.0	/169	
		371	16:53	366.902	off	push	coke		78	99	97			
		371	16:57	366.902	on									
124	14	375	17:01	369.7		1.50	1.65	1.65	77	98	96	20.0	124/185	58
121	15	380	17:06	373.3		1.55	1.70	1.70	76	99	96	22.0	/173	
		381	17:07	374.106	off	push	coke							
		381	17:12	374.106	on	~~1.55~~	~~1.70~~	~~1.70~~				22.0		
133	15	385	17:16	377.1		1.55	1.70	1.70	78	99	96	21	126/164	60
130	16	390	17:21	380.9		1.55	1.70	1.70	77	99	96	20.5	/172	
		391	17:22	381.637	off	push	coke							
		391	17:27	381.637	on	~~1.50~~	~~1.65~~	~~1.65~~				19.0	122/167	58
133	16	395	17:31	384.6		1.50	1.65	1.65	79	99	97	19.0	123/167	
125	17	400	17:36	388.2		1.45	1.60	1.60	79	100	96	18.5	127/167	60
		403	17:39	390.418	off	push	coke							
		403	17:44	390.418	on									
125	17	405	17:46	391.9		1.45	1.60	1.60	78	100	96	17.5	116/153	58
127	18	410	17:51	395.4		1.40	1.55	1.55	79	100	96	17.0	120/149	60
127	18	415	17:56	398.9		1.40	1.55	1.55	79	100	97	16.5	120/150	60
124	19	420	18:01	402.5		1.30	1.45	1.45	78	102	97	15.5	117/151	61
123	19	425	18:06	406.0		1.25	1.40	1.40	78	102	97	15.0	118/154	62
120	20	430	18:11	409.3		1.30	1.45	1.45	78	102	97	15.5	122/157	62
126	20	435	18:16	412.7		1.30	1.45	1.45	78	102	97	16.0	122/159	62
121	21	440	18:21	416.2		1.30	1.45	1.45	78	102	97	16.0	126/160	60
124	21	445	18:26	419.6		1.30	1.45	1.45	78	102	97	16.0	/160	
125	22	450	18:31	422.9		1.30	1.45	1.45	77	102	98	16.0	124/158	60
125	22	455	18:36	426.3		1.30	1.45	1.45	77	102	98	16.0	126/153	58
126	23	460	18:41	429.7		1.15	1.30	1.30	77	102	98	14.0	125/149	58
126	23	465	18:46	433.2		1.15	1.30	1.30	77	102	98	14.0	124/145	58
126	24	470	18:51	436.2		1.00	1.10	1.10	77	102	97	12.5	120/145	59
125	24	475	18:56	439.2		1.00	1.10	1.10	76	102	97	12.0	118/145	60
		480	19:01	442.227	off									
						1.71		1.46	73	104				

$\sqrt{1.31(460+73)} = 26.42$

#1 of 3 sheets



FIELD DATA

PLANT Wisconsin Steel
DATE 5/12/77
SAMPLING LOCATION outlet
SAMPLE TYPE POM
RUN NUMBER 3-B
OPERATOR Leonard, Rodha
AMBIENT TEMPERATURE 65°
BAROMETRIC PRESSURE 29.62
STATIC PRESSURE, (P_s)
FILTER NUMBER (s) #98
POM # 205

PROBE LENGTH AND TYPE
NOZZLE I.D. 0.175
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 5
METER BOX NUMBER C
METER $\Delta H_@$ 1.82
C FACTOR 1.10
PROBE HEATER SETTING 125°F
HEATER BOX SETTING
REFERENCE Δp 1.68

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

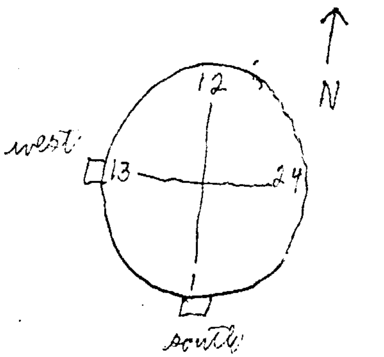
	TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
				443.063									
135	12	0	9:17	4'	1.10	1.20	1.20	73	87	82	14.0	/180	
127	12	5	9:22	445.8	1.10	1.20	1.20	73	89	83	14.5	122/188	58
129	11	10	9:27	448.8	1.30	1.40	1.40	73	94	83	19.5	/184	60
	11	15	9:32	452.050 off	Clayton had to change nozzle								
		15	9:37	452.050 on									
128	10	20	9:42	455.3	1.35	1.50	1.50	75	91	86	19.0	124/125	62
126	10	25	9:47	458.8	1.35	1.50	1.50	76	93	86	18.5	/169	
125	9	30	9:52	462.4	1.35	1.50	1.50	75	94	87	18.0	/162	66
124	9	35	9:57	465.9	1.35	1.50	1.50	75	94	88	17.5	128/156	65
124	8	40	10:02	469.4	1.35	1.50	1.50	75	95	89	17.0	122/149	66
124	8	45	10:07	472.8	1.35	1.50	1.50	75	96	89	16.5	120/148	60
124	7	50	10:12	476.3	1.35	1.50	1.50	75	96	90	16	119/148	61
124	7	55	10:17	479.8	1.30	1.40	1.40	75	97	90	15.5	120/150	64
124	6	60	10:22	483.3	1.35	1.50	1.50	75	98	91	16	123/152	64
133	6	65	10:27	486.7	1.35	1.50	1.50	75	99	91	16	120/149	64
121	5	70	10:32	490.1	1.40	1.55	1.55	75	99	93	16	122/149	62
	5	75	10:37	493.671 off	Clayton had to clean grease from their system.								
	5	75	10:51	493.671 on									
133	4	80	10:56	497.1	1.45	1.60	1.60	76	99	95	19.0	128/188	
127	4	85	11:01	500.5	1.45	1.60	1.60	75	100	95	20.0	/182	
124	3	90	11:06	504.0	1.45	1.60	1.60	76	102	96	20.0	134/176	
124	3	95	11:11	507.7	1.45	1.60	1.60	76	104	96	19.0	/170	
126	2	100	11:16	511.4	1.40	1.55	1.55	77	105	98	17.5	/161	

COMMENTS:

	TRAVERSE POINT NUMBER	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
127	2	105	11:21	515.0		1.35	1.50	1.50	77	106	99	16.5	128/156	
122	1	110	11:26	518.6		1.05	1.15	1.15	78	107	97	12.5	118/149	60
121	1	115	11:31	521.8		1.05	1.15	1.15	77	107	101	12.0	/144	
118	1	120	11:36	525.0		1.05	1.15	1.15	77	109	102	12.0	112/139	
124	1	125	11:41	528.0		1.05	1.15	1.15	78	109	102	12.0	/141	
128	2	130	11:46	531.1		1.35	1.50	1.50	77	110	103	15.0	118/162	60
129	2	135	11:51	534.6		1.35	1.50	1.50	77	110	104	17.0	/183	60
125	3	140	11:56	538.0		1.50	1.65	1.65	77	112	105	21.0	127/181	
123	3	145	12:01	541.6		1.50	1.65	1.65	77	113	105	21.0	/177	
	4	150	12:06	545.386	off	change drierite								
	4	150	12:08	545.386	on									
		151	12:09	546.150	off	lost power								
		151	12:11	546.150	on									
		153	12:13	546.878	off	lost power								
		153	12:14	546.878	on									
127	4	155	12:16	548.6		1.45	1.60	1.60	78	110	106	18.5	126/158	62
123	5	160	12:21	552.3		1.40	1.55	1.55	78	112	106	17.0	123/153	68
124	5	165	12:26	555.8		1.40	1.55	1.55	78	112	106	17.0	120/150	68
126	6	170	12:31	559.4		1.35	1.50	1.50	78	113	107	16.0	120/149	68
121	6	175	12:36	563.0		1.35	1.50	1.50	78	113	107	16.0	118/148	68
117	7	180	12:41	566.5		1.30	1.40	1.40	78	113	107	15.0	118/147	68
104	7	185	12:46	570.0		1.25	1.40	1.40	78	113	107	15.0	118/146	68
111	8	190	12:51	573.4		1.30	1.40	1.40	78	113	107	15.0	118/146	68
115	8	195	12:56	576.8		1.30	1.40	1.40	78	114	108	15.0	120/148	68
118	9	200	13:01	580.2		1.30	1.40	1.40	78	114	108	15.0	122/149	68
120	9	205	13:06	583.6		1.30	1.40	1.40	78	114	109	15.0	122/150	68
121	10	210	13:11	587.0		1.35	1.50	1.50	78	114	109	16.0	123/150	68
121	10	215	13:16	590.5		1.35	1.50	1.50	78	115	109	16.0	124/151	68
122	11	220	13:21	594.0		1.35	1.50	1.50	78	115	109	16.0	122/148	68
121	11	225	13:26	597.6		1.35	1.50	1.50	79	115	110	16.0	122/146	68
121	12	230	13:31	601.1		1.05	1.15	1.15	78	115	110	13.0	120/145	68
123	12	235	13:36	604.3		1.05	1.15	1.15	79	114	110	13.0	120/143	66
		240	13:41	607.489	off	change parts + drierite								
132	24	240	13:56	607.489		1.05	1.15	1.15	78	110	108	12.5	/172	
128	24	245	14:01	610.4		1.05	1.15	1.15	78	110	107	13.5	124/183	60
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	1.20	1.20	78	110	107	17.5	/188	

#2 of 3 sheets

FIELD DATA



PLANT Wisconsin Steel, Chicago
DATE 5/12/77
SAMPLING LOCATION outlet
SAMPLE TYPE POM
RUN NUMBER 3-B
OPERATOR Leonard, Maddox
AMBIENT TEMPERATURE 75°
BAROMETRIC PRESSURE 29.62
STATIC PRESSURE, (P_s) S
FILTER NUMBER (s) Same Same

PROBE LENGTH AND TYPE 8' glass + 1' S.S.
NOZZLE I.D. 0.175
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 5
METER BOX NUMBER 2
METER $\Delta H_@$ 1.82
C FACTOR 1.10
PROBE HEATER SETTING 125
HEATER BOX SETTING 180° to start then 120°F at POM outlet
REFERENCE Δp 1.68

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

probe	TRAVERSE POINT NUMBER	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
123	22	260	14:16	620.1	1.25	1.40	1.40	78	111	108	18.0	/177	
124	22	265	14:21	623.4	1.25	1.40	1.40	78	112	108	18.0	132/171	64
124	21	270	14:26	626.8	1.30	1.40	1.40	79	113	108	18.0	130/164	62
124	21	275	14:31	630.3	1.30	1.40	1.40	79	113	109	17.5	/159	-
123	20	280	14:36	633.9	1.30	1.40	1.40	78	114	109	17.5	120/153	62
123	20	285	14:41	637.4	1.30	1.40	1.40	79	115	109	17.0	120/150	62
123	19	290	14:46	640.9	1.30	1.40	1.40	77	116	110	17.0	122/153	64
122	19	295	14:51	644.4	1.30	1.40	1.40	79	116	110	17.0	122/154	66
122	18	300	14:56	647.9	1.30	1.40	1.40	79	116	110	17.0	125/154	62
135	18	305	15:01	651.4	1.30	1.40	1.40	79	116	110	17.0	128/154	62
130	17	310	15:06	655.0	1.45	1.60	1.60	78	116	110	18.0	126/153	60
121	17	315	15:11	658.5	1.45	1.60	1.60	78	117	111	18.0	124/148	62
124	16	320	15:16	662.2	1.50	1.65	1.65	79	117	111	18.5	122/145	62
124	16	325	15:21	665.9	1.55	1.70	1.70	79	117	111	18.5	118/145	63
127	15	330	15:26	669.7	1.55	1.70	1.70	79	117	112	18.5	118/143	60
117	15	335	15:31	673.5	1.55	1.70	1.70	79	117	112	18.5	118/142	64
120	14	340	15:36	677.2	1.50	1.65	1.65	79	117	112	18.5	118/142	64
		344	15:40	680.234 off	push	coke	-						
		344	15:45	680.234 on									
125	14	345	15:46	680.9	1.50	1.65	1.65	82	115	111	18.5	117/158	66
125	13	350	15:51	684.616 off	push	coke		83	114	111		115/173	70
127	13	350	15:56	684.616 on	1.10	1.20	1.20	81	113	110	15.5	/195	
124	13	355	16:01	687.7	1.10	1.20	1.20	81	113	110	18.5	/193	

COMMENTS:

probe	TRAVERSE POINT NUMBER	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
		358	16:04	689.595	off	push	coke							
126		358	16:09	689.595	on	~~1.10~~	~~1.20~~	~~1.20~~	~~82~~	~~112~~	~~110~~	17.0	/195	
124	13	360	16:11	690.9		1.15	1.30	1.30	81	112	110	18.0	138/183	
121	13	365	16:16	694.2		1.15	1.30	1.30	81	111	109	18.0	/179	
120	14	370	16:21	697.6		1.45	1.60	1.60	80	111	109	19.0	132/172	
		374	16:25	700.474	off	push	coke							
		374	16:30	700.474	on									
122	14	375	16:31	701.2		1.45	1.60	1.60	81	111	109	19.0	125/156	
128	15	380	16:36	704.9		1.50	1.65	1.65	83	111	108	19.0	122/150	64
124	15	385	16:41	708.7		1.55	1.70	1.70	81	112	108	19.0	122/145	
123	16	390	16:46	712.3		1.50	1.65	1.65	80	113	108	18.0	120/142	64
122	16	395	16:51	716.2		1.55	1.70	1.70	80	113	108	18.0	116/141	64
122	17	400	16:56	719.8		1.45	1.60	1.60	80	113	109	17.5	116/150	64
		403	16:59	722.053	off	push	coke							
		403	17:04	722.053	on									
127	17	405	17:06	723.5		1.45	1.60	1.60	80	112	108	19.0	122/159	62
123	18	410	17:11	727.0		1.35	1.50	1.50	81	111	108	18.5	132/159	62
		414	17:15	729.957	off	push	coke							
		414	17:20	729.957	on									
128	18	415	17:21	730.7		1.35	1.50	1.50	81	110	107	18.0	124/153	62
123	19	420	17:26	734.2		1.25	1.40	1.40	82	110	107	16.0	122/149	64
109	19	425	17:31	737.7		1.30	1.40	1.40	81	110	107	16.0	/146	
		426	17:32	738.407	off	push	coke							
		426	17:38	738.407	on									
142	20	430	17:42	741.1		1.30	1.40	1.40	84	109	107	16.5	120/156	64
119	20	435	17:47	744.5		1.25	1.40	1.40	82	110	107	16.5	124/153	64
		437	17:49	745.852	off	push	coke							
		437	17:55	745.852	on									
120	21	440	17:58	747.9		1.25	1.40	1.40	85	110	107	16.5	120/148	60
117	21	445	18:03	751.4		1.25	1.40	1.40	83	110	107	16.5	120/145	60
123	22	450	18:08	754.8		1.25	1.40	1.40	81	110	107	16.5	118/145	60
		452	18:10	756.264	off	push	coke							
		452	18:14	756.264	on									
132	22	455	18:17	758.3		1.25	1.40	1.40	87	110	107	16.0	/142	
129	23	460	18:22	761.8		1.20	1.30	1.30	84	110	107	15.0	126/143	62
[illegible]	23	465	18:27	765.1		1.20	1.30	1.30	83	111	107	15.0	118/144	61

#3 of 3 sheets

FIELD DATA

PLANT Wisconsin Steel
DATE 5/12/77
SAMPLING LOCATION Outlet
SAMPLE TYPE PCM
RUN NUMBER 3
OPERATOR Leonard, Radke
AMBIENT TEMPERATURE 75°
BAROMETRIC PRESSURE 29.62
STATIC PRESSURE, (P_s)
FILTER NUMBER (s) Same
Same

PROBE LENGTH AND TYPE 8' glass, 1' S.S.
NOZZLE I.D. 0.175
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 5
METER BOX NUMBER 2
METER $\Delta H_@$ 1.82
C FACTOR 1.10
PROBE HEATER SETTING 125°
HEATER BOX SETTING
REFERENCE Δp 1.65

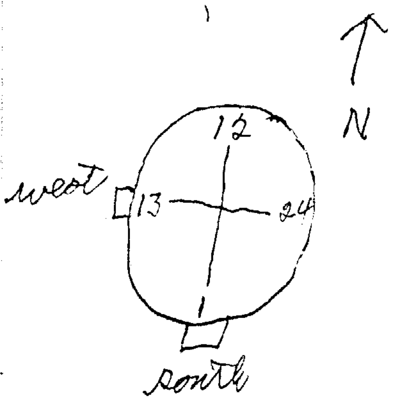
SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

Probe	TRAVERSE POINT NUMBER	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
124	24	475	18:37	771.7	1.05	1.15	1.15	81	113	107	14.0	116/144	62
		480	18:42	775.021 off									
		480		331.96	1.31		1.45	79	101				

$\sqrt{1.31\ (460+79)} = 26.57$

COMMENTS:



FIELD DATA

Page 1 of 3

PLANT Wisconsin Steel
DATE 5/13/77
SAMPLING LOCATION outlet
SAMPLE TYPE POM
RUN NUMBER 4-B
OPERATOR [illegible]
AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE [illegible]
STATIC PRESSURE, (P_s)
FILTER NUMBER (s) #100
POM # 206

PROBE LENGTH AND TYPE
NOZZLE I.D. .175
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 5
METER BOX NUMBER 2
METER $\Delta H_@$ 1.52
C FACTOR 1.10
PROBE HEATER SETTING 125°
HEATER BOX SETTING
REFERENCE Δp 1.65

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

probe	TRAVERSE POINT NUMBER	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
				775.127									
123	12	0	20:17		1.10	1.25	1.25	83	100	100	13.5	104/164	52
117	12	5	20:22	778.2	1.05	1.20	1.20	83	99	97	14.0	110/160	52
		8	20:25	780.133 off	push	coke							
		8	20:30	780.133 on									
147	11	10	20:32	781.4	1.20	1.35	1.35	82	102	97	16.0	112/154	53
127	11	15	20:37	784.6	1.30	1.50	1.50	83	106	99	18.0	118/159	54
119	10	20	20:42	788.1	1.25	1.40	1.40	82	105	99	17.5	122/160	57
		24	20:46	790.856 off	push	coke							
		24	20:51	790.856 on									
132	10	25	20:52	791.5	1.26	1.40	1.40	82	104	99	17.0	116/148	58
129	9	30	20:57	794.9	1.30	1.50	1.50	83	103	99	18.0	110/145	58
		34	21:01	797.652 off	push	coke							
		34	21:05	797.652 on									
129	9	35	21:06	798.3	1.30	1.50	1.50	83	103	99	18.0	112/145	58
127	8	40	21:11	801.8	1.30	1.50	1.60	83	102	99	18.0	118/145	60
124	8	45	21:16	805.3	1.30	1.50	1.50	82	103	99	18.0	118/146	62
124	7	50	21:21	808.7	1.30	1.50	1.50	81	103	99	18.0	118/146	64
124	7	55	21:26	812.3	1.25	1.40	1.40	80	104	99	17.5	120/147	63
125	6	60	21:31	815.6	1.30	1.30	1.40	79	104	99	17.5	120/148	60
		63	21:34	817.704 off	push	coke							
		63	21:39	817.704 on									
140	6	65	21:41	819.0	1.30	1.40	1.40	79	102	99	17.0	120/145	60
131	5	70	21:46	822.4	1.40	1.60	1.60	79	102	99	19.5	120/144	60

COMMENTS:

pirdie	TRAVERSE POINT NUMBER	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
127	5	75	21:51	826.0	1.40	1.60	1.60	79	102	99	19.5	120/143	62
125	4	80	21:56	829.6	1.45	1.65	1.65	78	103	99	20.5	118/142	62
124	4	85	22:01	833.3	1.45	1.65	1.65	78	103	99	20.0	118/141	62
124	3	90	22:06	836.9	1.45	1.65	1.65	77	103	99	20.0	120/140	60
125	3	95	22:11	840.6	1.45	1.65	1.65	77	103	99	20.0	118/142	60
127	2	100	22:16	844.3	1.40	1.60	1.60	76	102	98	19.0	118/145	60
124	2	105	22:21	848.0	1.40	1.60	1.60	75	102	98	19.0	116/145	60
124	1	110	22:26	851.5	0.95	1.10	1.10	75	102	98	13.0	118/147	60
124	1	115	22:31	854.7	0.95	1.10	1.10	75	102	97	13.0	118/148	60
124	1	120	22:36	857.7	0.95	1.10	1.10	75	101	97	13.0	116/149	60
124	1	125	22:41	860.6	0.95	1.10	1.10	74	101	96	13.0	116/149	60
125	2	130	22:46	863.5	1.30	1.50	1.50	74	100	96	18.0	118/150	60
125	2	135	22:51	867.0	1.35	1.55	1.55	74	101	96	18.5	120/150	60
124	3	140	22:56	870.5	1.45	1.65	1.65	74	101	96	20.0	120/151	60
126	3	145	23:01	874.1	1.45	1.65	1.65	74	101	96	20.0	120/152	60
125	4	150	23:06	877.8	1.45	1.65	1.65	74	101	96	20.0	120/153	60
124	4	155	23:11	881.5	1.45	1.65	1.65	74	101	96	20.0	120/151	60
122	5	160	23:16	885.1	1.45	1.65	1.65	73	101	96	20.0	120/149	60
		161	23:17	885.922 off	push	coke							
		161	23:21	885.922 on									
125	5	165	23:25	888.863 off push coke	1.45	1.65	1.65	78	99	95	20.0	116/147	58
		165	23:29	888.863 on									
124	6	170	23:34	892.5	1.30	1.50	1.50	79	96	95	18.0	112/145	56
122	6	175	23:39	896.0	1.35	1.55	1.55	77	96	94	18.5	112/145	56
		179	23:43	898.898 off	push	coke							
		179	23:48	898.898 on	1.35	1.55	1.55						
137	7	180	23:49	899.6	1.25	1.40	1.40	76	95	93	17.0	110/148	54
120	7	185	23:54	903.0	1.30	1.50	1.50	78	95	93	18.0	110/149	54
		188	23:57	905.130 off	push	coke							
midnight		188	00:02	905.130 on									
130	8	190	00:04	906.5	1.30	1.50	1.50	78	94	92	18.0	112/156	60
122	8	195	00:09	910.0	1.25	1.40	1.40	78	94	92	18.0	118/158	60
120	9	200	00:14	913.4	1.30	1.50	1.50	78	95	92	19.0	120/158	56
		202	00:16	914.793 off	push	coke							
		203	00:21	914.793 on	1.30	1.50	1.50						
132	9	205	00:24	916.8	1.30	1.50	1.50	80	94	92	19.0	/149	

FIELD DATA

Page 2 of 3

PLANT Wisconsin Steel, Chicago
DATE 5/13/77
SAMPLING LOCATION outlet
SAMPLE TYPE POM
RUN NUMBER 4
OPERATOR Leonard, Radke
AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.35
STATIC PRESSURE, (P_s)
FILTER NUMBER (s) Same Same

PROBE LENGTH AND TYPE 8' glass + 1' S.S. ext
NOZZLE I.D. 0.175
ASSUMED MOISTURE, % 2
SAMPLE BOX NUMBER 5
METER BOX NUMBER 2
METER $\Delta H_@$ 1.82
C FACTOR 1.12
PROBE HEATER SETTING 125°
HEATER BOX SETTING
REFERENCE Δp 1.65

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 5 MINUTES

	TRAVERSE POINT NUMBER	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
		213	00:32	922.490 off	push	coke							
		213	00:36	922.490 on									
127	10	215	00:38	923.9	1.30	1.50	1.50	78	94	91	19.0	117/150	54
121	11	220	00:43	927.5	1.30	1.50	1.50	79	94	91	19.0	116/151	56
	11	225	00:48	930.928 off	push	coke							
		225	00:54	930.928 on									
124	12	230	00:59	934.4	1.05	1.20	1.20	78	93	91	15.0	115/152	54
123	12	235	01:04	937.6	1.05	1.20	1.20	78	94	91	15.0	115/153	54
		240	01:09	940.774 off	change	ports	+ push coke.						
134	24	240	01:23	940.774 on	1.05	1.20	1.20	78	92	90	14.5	/153	
129	24	245	01:28	943.8	1.05	1.20	1.20	78	91	90	14.5	115/154	62
120	23	250	01:33	946.9	1.25	1.40	1.40	77	91	90	17.5	115/154	62
126	23	255	01:38	950.2	1.25	1.40	1.40	77	92	90	17.5	/154	
		259	01:42	952.908 off	push	coke							
		259	01:47	952.908 on									
130	22	260	01:48	953.6	1.25	1.40	1.40	77	92	90	17.5	110/153	60
126	22	265	01:53	956.9	1.25	1.40	1.40	79	92	90	17.5	112/153	60
123	21	270	01:58	960.3	1.25	1.40	1.40	77	92	89	17.5	116/153	62
122	21	275	02:03	963.7	1.30	1.50	1.50	76	93	90	19.0	116/153	60
125	20	280	02:08	967.0	1.30	1.50	1.50	75	94	90	19.0	116/153	62
125	20	285	02:13	970.5	1.30	1.50	1.50	75	94	90	19.0	116/153	62
125	19	290	02:18	973.9	1.30	1.50	1.50	75	94	90	19.0	116/153	64
125	19	295	02:23	977.4	1.30	1.50	1.50	75	95	90	19.0	116/153	62

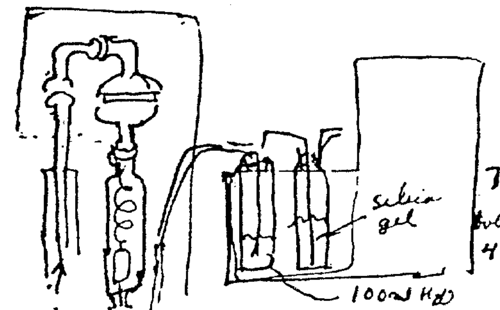
COMMENTS:

$\sqrt{1.31(460+77)} = 26.52$

probe	TRAVERSE POINT NUMBER	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
124	18	300	02:28	980.8	1.35	1.55	1.55	74	95	90	20.0	116/153	60
134	18	305	02:33	984.4	1.35	1.55	1.55	74	95	90	20.0	118/153	60
131	17	310	02:38	987.9	1.45	1.65	1.65	74	95	90	22.0	119/153	62
120	17	315	02:43	991.5	1.45	1.65	1.65	73	95	90	22.0	120/151	62
124	16	320	02:48	995.1	1.55	1.75	1.75	74	95	90	23.0	120/149	62
127	16	325	02:53	998.8	1.55	1.75	1.75	73	95	90	23.0	118/148	61
121	15	330	02:58	1002.6	1.55	1.75	1.75	73	95	90	23.0	120/146	61
121	15	335	03:03	1006.3	1.55	1.75	1.75	73	95	90	23.0	120/145	61
126	14	340	03:08	1010.2	1.50	1.70	1.70	73	95	90	23.0	120/143	61
		344	03:12	1013.248 off	push coke								
		344	03:17	1013.248 on									
129	14	345	03:18	1013.9	1.50	1.70	1.70	75	93	90	22.5	/144	
		349	03:22	1016.775 off	push coke								
		349	03:27	1016.775 on									
124	13	350	03:28	1017.5	1.10	1.25	1.25	78	91	90	14.0	/146	
120	13	355	03:33	1020.9	1.10	1.25	1.25	79	91	89	14.0	/148	
117	13	360	03:38	1024.3	1.10	1.25	1.25	78	91	89	14.0	120/147	
	~~13~~	~~365~~	~~03:38~~	~~1025.803~~ ~~off~~	~~push coke~~								
		368	03:41	1025.803 off	push coke								
		368	03:46	1025.803 on	~~1.10~~	~~1.25~~	1.25						
119	13	365	03:48	1027.0	1.10	1.25	1.25	75	91	89	14.0	120/148	
122	14	370	03:53	1030.2	1.50	1.70	1.70	76	91	89	22.0	120/148	
		373	03:56	1032.366 off	push coke								
		373	04:00	1032.366 on									
132	14	375	04:02	1033.9	1.50	1.70	1.70	76	91	88	22.0	114/148	
122	15	380	04:07	1037.6	1.55	1.75	1.75	78	91	88	22.5	117/148	
121	15	385	04:12	1041.4	1.55	1.75	1.75	76	88	91	22.5	/149	
	16	390	04:17	1045.061 off	push coke								
		390	04:22	1045.061 on	1.55	1.75	1.75	77			23.0		
138	16	395	04:27	1048.8	1.55	1.75	1.75	79	90	88	23.0	/151	
129	17	400	04:32	1052.511 off	push coke			78	91	88		/153	
		400	04:36	1052.511 on	1.50	1.70	1.70	77			23.0		
120	17	405	04:41	1056.2	1.50	1.70	1.70	75	90	87	23.0	112/155	60
133	18	410	04:46	1059.9	1.35	1.65	1.55	77	90	87	20.0	118/156	
		411	04:47	1060.667 off	push coke								
[illegible]		411	04:51	1060.667 on	~~1.35~~	1.65	1.55	79	89	86	20.0	/156	

FIELD CLEANUP DATA SHEETS

ANALYTICAL DATA



PLANT: Wisconsin Steel Works, Chicago, Illinois, G 2872-5014

DATE: MAY 9 1977

SAMPLING LOCATION: INLET

SAMPLE TYPE: POM - TENAX

RUN NUMBER: CLEAN-UP WSW - POM - A - CL-UP

SAMPLE BOX NUMBER: A

CLEAN-UP MAN: Baylor

COMMENTS:

EPA No. - 577-002 -

301 — Methylene Chloride Rinse of Probe nozzle - front of filter.

302 - QUARTZ-TISSUE FILTER # 91 -

303 - POM - COLUMN - TENAX -

LABORATORY RESULTS

FRONT HALF

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

FILTER NUMBER ______ ______

CONTAINER ______ ______ mg

91 tare 0.49943 g ______

net ______ ______

POM # 303

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ m

ETHER-CHLOROFORM EXTRACTION ______ m

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ m

BACK HALF SUBTOTAL ______ m

TOTAL WEIGHT ______ m

filled but did not collect

Rinse volumes ______ ml ______ ml ______ ml ______ ml ______ ml ______

MOISTURE

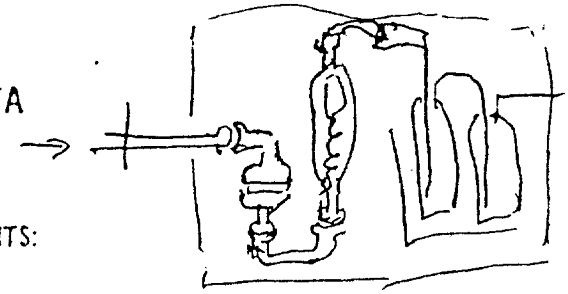
IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	ml	/ ml	ml	ml	ml	
INITIAL VOLUME	100 ml	/				
NET VOLUME	ml	ml	ml	ml	ml	ml

SILICA GEL			
FINAL WEIGHT	475. g	g	g
INITIAL WEIGHT	475 g	g	g
NET WEIGHT	g	g	g

TOTAL MOISTURE ______

EPA (Dur) 231
4/72

ANALYTICAL DATA



PLANT: Wisconsin Steel Works, Chicago, Illinois, G 2?7 -5?14

DATE: MAY 9 1977

SAMPLING LOCATION: STACK – OUTLET

SAMPLE TYPE: POM –

RUN NUMBER: WSW – POM – B – CU

SAMPLE BOX NUMBER: 2

CLEAN-UP MAN: Boyton

COMMENTS:

EPA #
577-002 –

304 – M.C. Rinse of probe, etc.

305 – Quartz filter # 92

306 – POM column – TENAX.

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER — CONTAINER ______ ______ mg

FILTER NUMBER ______ ______ — CONTAINER ______ ______ mg

\# 92 tare 0.49991 g ______

net ______ ______

POM # 304

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER — CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

~~Did~~ FILLED EA. IMPINGER BUT DID NOT COLLECT SINCE THIS PART OF THE TRAIN WILL NOT BE ANALYSED FOR POM.

Rinse volumes ______ ml ______ ml ______ ml ______ ml ______ ml ______

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	ml	ml	ml	ml	ml	
INITIAL VOLUME	100 ml					
NET VOLUME	ml	ml	ml	ml	ml	ml

SILICA GEL			
FINAL WEIGHT	g	g	g
INITIAL WEIGHT	425 g	g	g
NET WEIGHT	g	g	g

TOTAL MOISTURE ______

EPA (Dur) 231
4/72

ANALYTICAL DATA

BAROMETRIC PRESSURE = ~~29~~.51 "Hg at 1300.
29.48" Hg at 1500

PLANT Wisconsin Steel Works
Chicago, Illinois
G 2272-5014

COMMENTS:

DATE MAY 10 1977 - TUESDAY

SAMPLING LOCATION INLET TO ESP.

SAMPLE TYPE POM - TENNAX -

RUN NUMBER WSIV-A-POM-1

SAMPLE BOX NUMBER

CLEAN-UP MAN Baytos

EPA No
577-002
Tare
548.0g - 308.0g =
-307- Methylene Chloride rinse of Probe - cle
-308- Tissue quality filter # 93
-309 - POM- COLUMN - #
-309A - 1st IMPINGER CATCH

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

FILTER NUMBER ______ ______

CONTAINER ______ ______ mg

93 tare 0.50245 g ______

net ______ ______

POM # 309

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

Rinse volumes did not use ______ ml ______ ml ______ ml ______ ml ______ ml ______

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	ml	ml	ml	ml	ml	
H_2O - INITIAL VOLUME	~~100~~ ml					
NET VOLUME	ml	ml	ml	ml	ml	ml

SILICA GEL			
FINAL WEIGHT	g	g	g
INITIAL WEIGHT	475.0 g	g	g
NET WEIGHT	g	g	g

TOTAL MOISTURE ______

EPA (Dur) 231
4/72

ANALYTICAL DATA

PLANT: Wisconsin Steel Works, Chicago, Illinois, G 2872, 5014

DATE: MAY 1 0 1977 TUESDAY

SAMPLING LOCATION: OUTLET FROM ESP.

SAMPLE TYPE: POM - TENAX

RUN NUMBER: WSW - B - POM - 1

SAMPLE BOX NUMBER: ________

CLEAN-UP MAN: Baytor

COMMENTS:

EPA No. Tare.
577-002- 5800,- 312.5g.
-310 - Methylene Chloride rinse of probe, etc.
-311 - Tissue Quartz filter - #94
-312 - POM - COLUMN - (2 column.
-312A - 1st IMPINGER CATCH

FRONT HALF

upon opening, the filter split; the filter was tightened under vacuum - noted moist at end, after... put vacuum on filter holder to remove ... piece, some ... the filter split

			LABORATORY RESULTS
ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER		CONTAINER ____	____ mg
FILTER NUMBER	____ ____	CONTAINER ____	____ mg
# 94	tare 0.50100 g ____		
	net ____ ____		

POM # 312 -1
312 - 2

FRONT HALF SUBTOTAL ________ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER	CONTAINER ____	____ mg
	ETHER-CHLOROFORM EXTRACTION	____ mg
ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER	CONTAINER ____	____ mg
	BACK HALF SUBTOTAL	____ mg
	TOTAL WEIGHT	____ mg

Rinse volumes ____ ml ____ ml ____ ml ____ ml ____ ml ____

MOISTURE

IMPINGERS	1	2 (cloudy)	3	4	5	6
FINAL VOLUME	58.0 ml	ml	ml	ml	ml	
INITIAL VOLUME	100.0 ml					
NET VOLUME	-42.0 ml	ml	ml	ml	ml	ml

SILICA GEL		- completely saturated	
FINAL WEIGHT	525.9 g	521 g	g
INITIAL WEIGHT	475 g	475 g	g
NET WEIGHT	50.9 g	g	g

TOTAL MOISTURE ________

A-45

EPA (Dur) 231
4/72

ANALYTICAL DATA

Wisconsin Ste l Works
Chicago, Illinois
G 2872-5014

PLANT
MAY 11 1977 - WEDNESDAY
DATE
of coke ovens
SAMPLING LOCATION INLET to net ESP.
SAMPLE TYPE POM - Tenax
RUN NUMBER WSW - A - POM - T - 2
SAMPLE BOX NUMBER 1
CLEAN-UP MAN Baytos

BP = 29.58 - at 10:07 AM

COMMENTS:

EPA - Sample #
577 - 002 - (471.0 - 258.9) =
- 318 - methylene Chloride rinse of Probe, nozzle + connecting glassware
- 319 - Quartz tissue filter # 95
- 320 - POM column - Tenax

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

CONTAINER ______ ______ mg

FILTER NUMBER ______ ______
95 tare 0.50188 g ______
net ______ ______

Tenax
POM # (202) EPA #-577-002-320

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg
ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

(not used)

TOTAL WEIGHT ______ mg

Rinse volumes ______ ml ______ ml ______ ml ______ ml ______ ml ______

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	ml	ml	ml	ml	ml	
INITIAL VOLUME	— ml					
NET VOLUME	ml	ml	ml	ml	ml	ml

SILICA GEL			
FINAL WEIGHT	g	g	g
INITIAL WEIGHT	— g	g	g
NET WEIGHT	g	g	g

TOTAL MOISTURE ______

EPA (Dur) 231
4/72

ANALYTICAL DATA

Wisconsin Steel Works
Chicago, Illinois

PLANT G 2872-5014

DATE MAY 11 1977 - wednesday -

SAMPLING LOCATION OUTLET From wet ESP

SAMPLE TYPE POM - Tennax absorbent

RUN NUMBER WSW - B - POM - T - 2

SAMPLE BOX NUMBER 2

CLEAN-UP MAN Bayto

COMMENTS:

EPA - No. -
577-002- (572.0 - 300.5g) -
321 - methylene chloride rinse of Probe & thermom
322 - Quartz fiber filter #96
323 - POM column - Tenax

LABORATORY RESULTS

FRONT HALF

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER	CONTAINER	mg
FILTER NUMBER	CONTAINER	mg
# 96 tare 0.50350 g		
net		
POM # 20 3	FRONT HALF SUBTOTAL	mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER	CONTAINER	mg
	ETHER-CHLOROFORM EXTRACTION	mg
ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER	CONTAINER	mg
	BACK HALF SUBTOTAL	mg
	TOTAL WEIGHT	mg

Rinse volumes ml ml ml ml ml

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	114 ml	ml	ml	ml	ml	
INITIAL VOLUME	100 ml					
NET VOLUME	14 ml	ml	ml	ml	ml	ml

Changed at port change time / saturated

SILICA GEL				
FINAL WEIGHT	522.0 g	521 g	g	46
INITIAL WEIGHT	475 g	475 g	g	47
NET WEIGHT	47 g	46 g	g	14
				107

TOTAL MOISTURE 107

A-47

EPA (Dur) 231
4/72

ANALYTICAL DATA

PLANT Wisconsin Steel Works, Chicago, Illinois, G 2872-5014

BP - 29.63" Hg

DATE MAY 1 2 1977 THURSDAY

COMMENTS:

SAMPLING LOCATION INLET TO wet ESP

SAMPLE TYPE POM - collection on TENAX

RUN NUMBER WSW-A-POM-T-3

SAMPLE BOX NUMBER -

CLEAN-UP MAN Bayton

EPA #
377-002-
(553.0 - 303.5g)
329 - methylene Chloride Rinse of Probe + Glassware
330 - Quartz Tissue filter # 97
331 - POM collecting column - Tenax 218

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER ______ ______ ml

FILTER NUMBER ______ ______

CONTAINER ______ ______ ml

97 tare 0.50769 g ______

net ______ ______

POM # 218

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

Rinse volumes ______ ml ______ ml ______ ml ______ ml ______ ml ______

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	ml	ml	ml	ml	ml	
INITIAL VOLUME	ml					
NET VOLUME	ml	ml	ml	ml	ml	ml

SILICA GEL			
FINAL WEIGHT	g	g	g
INITIAL WEIGHT	g	g	g
NET WEIGHT	g	g	g

TOTAL MOISTURE ______

EPA (Dur) 231
4/72

ANALYTICAL DATA

Wisconsin Steel Works
Chicago, Illinois

PLANT G 2872-5014

DATE MAY 12 1977 THURSDAY

SAMPLING LOCATION outlet from wet ESP

SAMPLE TYPE POM- collected on Tenax column

RUN NUMBER WSW - B - POM-T-3

SAMPLE BOX NUMBER

CLEAN-UP MAN Boyts

COMMENTS:

EPA#
577-002-

(618.5 - 316.0g .) =

332- methylene Chloride Rinse of Probe &

333 Quartz tissue filter # 98

334 - POM Column # 205

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

CONTAINER ______ ______ mg

FILTER NUMBER ______ ______

98 tare 0.50438 g ______

net ______ ______

POM # ~~219~~ 205 — back seal gave way during initial leak check - this column is a total loss. actually no break - spring found.

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

Rinse volumes ____ ml ____ ml ____ ml ____ ml ____ ml ____

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	116 ml	ml	ml	ml	ml	
INITIAL VOLUME	100 ml					
NET VOLUME	16 ml	ml	ml	ml	ml	ml

~95% spent changed after 105 minutes · ~90% spent · ~95% spent

SILICA GEL				
FINAL WEIGHT	511 g	497.5 g	610.3 g	16
INITIAL WEIGHT	475 g	475 g	550 g	36
NET WEIGHT	36 g	22.5 g	60.3 g	22.5
				60.3
				134.8

TOTAL MOISTURE 134.8

EPA (Dur) 231
4/72

ANALYTICAL DATA

PLANT Wisconsin Steel Works Chicago, Illinois G 2872-5014

DATE MAY 1 3 1977 — FRIDAY

SAMPLING LOCATION INLET TO wet ESP

SAMPLE TYPE POM - (organics) on TENAX

RUN NUMBER WSW - A - POM-T-4

SAMPLE BOX NUMBER

CLEAN-UP MAN Baytos

COMMENTS:

EPA # 577-002-340 — Methylene Chloride rinse of Probe nozzle, glass

341 - Quartz tissue filter # 99

342 - POM collecting column, Tenax absorbent

FRONT HALF

LABORATORY RESULTS

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

FILTER NUMBER ______ ______

99 tare 0.49154 g ______

net ______ ______

CONTAINER ______ ______ mg

note: on this run the probe app wash appeared to be clean, similar to other, however, the nozzle appeared to have the most of catch.

POM # 204

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

Rinse volumes (none used) ______ ml ______ ml ______ ml ______ ml ______ ml ______

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	ml	ml	ml	ml	ml	
INITIAL VOLUME	ml					
NET VOLUME	ml	ml	ml	ml	ml	ml

SILICA GEL			
FINAL WEIGHT	g	g	g
INITIAL WEIGHT	g	g	g
NET WEIGHT	g	g	g

TOTAL MOISTURE ______

EPA (Dur) 231
4/72

ANALYTICAL DATA

Wisconsin Steel Works
Chicago, Illinois

PLANT G 2872-5014

DATE MAY 13 1977 - FRIDAY.

SAMPLING LOCATION OUTLET FROM ESP

SAMPLE TYPE POM- collected on TENAX.

RUN NUMBER WSN- B- POM-T-4

SAMPLE BOX NUMBER

CLEAN-UP MAN Baylor

COMMENTS:

GPA #
577-002- (526.4 - 312.5) =
343 — Methylene Chloride rinse of probe + cavity glass
344 — Quartz tissue filter # 100
345- POM collecting column # 206

LABORATORY RESULTS

FRONT HALF

ACETONE WASH OF NOZZLE, PROBE, CYCLONE (BYPASS), FLASK, FRONT HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

FILTER NUMBER ______ ______

CONTAINER ______ ______ mg

100 tare 0.48946 g

net ______ ______

POM # 206
SM # 577-002-345

FRONT HALF SUBTOTAL ______ mg

BACK HALF

IMPINGER CONTENTS AND WATER WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

ETHER-CHLOROFORM EXTRACTION ______ mg

ACETONE WASH OF IMPINGERS, CONNECTORS, AND BACK HALF OF FILTER HOLDER

CONTAINER ______ ______ mg

BACK HALF SUBTOTAL ______ mg

TOTAL WEIGHT ______ mg

Rinse volumes ______ ml ______ ml ______ ml ______ ml ______ ml ______

MOISTURE

IMPINGERS	1	2	3	4	5	6
FINAL VOLUME	144 ml	ml	ml	ml	ml	
INITIAL VOLUME	100 ml					
NET VOLUME	44 ml	ml	ml	ml	ml	ml

~95g. Solvent

SILICA GEL			
FINAL WEIGHT	609.6 g	607.0 g	g
INITIAL WEIGHT	550.0 g	550 g	g
NET WEIGHT	59.6 g	57.0 g	g

TOTAL MOISTURE 160.6

EPA (Dur) 231
4/72

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant Wisconsin Steel Works
Location Chicago, Illinois
Industry G 2872-5014
Project No.

Battelle Record Book No 33284
Collected & Recorded By BAYTOS
Page ___ of ___.

EPA No. S77-002	Date	Run Number	Sample Description	Remarks
		WSW-A-POM-CU		
	MAY 9 1977 -		MONDAY —	
-301			METHYLENE CHLORIDE RINSE OF	PROBE, + GLASS CONNECTORS
-302			QUARTZ TISSUE FILTER # 91	
-303			POM - COLUMN - TENNAX	
		WSW-B-POM-CU		
304			METHYLENE CHLORINE RINSE OF	PROBE + GLASS CONNECTORS
305			QUARTZ TISSUE FILTER # 92	
306			POM - COLUMN - TENAX	

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant Wisconsin Steel Works
Location ~~Chicago, Illinois~~ ~~G 2872-5014~~
Industry COKE OVEN
Project No.

Battelle Record Book No 33284
Collected & Recorded By Baylor
Page ___ of ___.

EPA No. S77-002-	Date	Run Number	Sample Description	Remarks
		WSW-A-POM-T-1 (INLET TO ESP)		
	MAY 10 1977		TUESDAY	
307			METHYLENE CHLORIDE RINSE OF PROBE & CONNECTING GLASS WARE	
308			QUARTZ TISSUE FILTER # 93	
309			POM- COLUMN - TENAX —	
		WSW-B- POM-T-1 (OUTLET TO ESP)		
310			M.C. RINSE OF PROBE AND CONNECTING GLASS WARE	
311			QUART TISSUE FILTER # 94	
312			POM - COLUMN - TENAX - used	2 columns.
	wet	ESP - WATER SAMPLES (COMPOSITE)		
313			INLET	
314			OUTLET - FROM BOTH EAST & WEST ESP.	
315			'BLOW DOWN' WATER (SEWER)	
			3L - EVACUATED FLASK SAMPLES.	STACK GAS COLLECTED IN BAG OVER 1
				collection rate ~ 100cc/min
-316			INLET TO W ESP START 12N	to 730 PM
317			OUTLET FROM WESP ″	″
307A			Acetone Rinse of Probe + connecting glassware, after MC rinse	
310A			— ditto —	
312W			#1 impinger catch, Sampling point B	

KEY TO RUN

WSW - A POM-T - 1

WISCONSIN STEEL WORKS | SAMPLE LOCATION | MATERIAL SOUGHT | TENAX ON | RUN #

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant Wisconsin Steel Works Chicago, Illinois
Location G 2872-5014
Industry COKE OVENS
Project No.

Battelle Record Book No 33284
Collected & Recorded By [illegible]
Page ____ of ____.

EPA No. S77-002	Date	Run Number	Sample Description	Remarks
		WSN·A - POM-T-2 (INLET TO WET ESP)		
	MAY 11 1977		- WEDNESDAY	
318			METHYLENE CHLORIDE RINSE OF PROBE - AND CONNECTING GLASSWARE	
319			QUARTZ TISSUE FILTER # 95	
320			POM · COLUMN - TENAX	
		WSW·B - POM-T- 2 (OUTLET FROM wet ESP)		
321			METHYLENE CHLORIDE RINSE OF PROBE & CONNECTING GLASSWARE	
322			QUARTZ TISSUE FILTER # 96	
323			POM - COLUMN - TENNAX	
		wet ESP - WATER SAMPLES (COMPOSITE)		
324			INLET - (PROCESS WATER)	
325			OUTLET (FROM EAST & WEST ESP.)	
326			BLOWDOWN WATER (SEWER)	
		3L	EVACUATED FLASK SAMPLES	
327			INLET TO wet ESP	
328			OUTLET FROM wet ESP -	
318A			ACETONE RINSE OF PROBE AND CONNECTING GLASS WARE (after MC)	
321A			— ditto —	
323W			Impinger catch, Sampling port B -	

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant Wisconsin Steel Works
Location Chicago, Illinois
Industry G 2272-5C14
Project No.

Battelle Record Book No 33284
Collected & Recorded By Boyton
Page ___ of ___.

EPA No. S77-002	Date	Run Number	Sample Description	Remarks
		WSW-A-POM-T-3		
	MAY 12 1977		– THURSDAY	
329			METHYLENE CHLORIDE RINSE OF PROBE AND CONNECTING GLASSWARE	
330			QUARTZ TISSUE FILTER No 97	
331			POM COLUMN, TENNAX # 218	
		WSW-B-POM T-		
332			METHYLENE CHLORIDE RINSE OF PROBE AND CONNECTING GLASSWARE	
333			QUARTZ TISSUE FILTER No. 98	
334			POM COLUMN - TENNAX # 205	
		wet ESP	WATER SAMPLES	(COMPOSITE)
335			INLET TO ESP	
336			OUTLET FROM ESP	
337			"BLOWDOWN" WATER SEWER	
		3 L	EVACUATED FLASKS SAMPLES	(COMPOSITED)
338			INLET TO wet ESP	
339			OUTLET FROM wet ESP	
329A			ACETONE RINSE, AFTER M.C. RINSE, OF INLET PROBE, & CONNECTING GLASSWARE	
332A			– ditto — , of OUTLET – ditto —	
334W			impinger catch of outlet train	

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant Wisconsin Steel Works
Location Chicago, Illinois
Industry G 2872-5014
Project No.

Battelle Record Book No 33284
Collected & Recorded By [illegible]
Page ___ of ___.

EPA No. S77-002	Date	Run Number	Sample Description	Remarks
		WSW-A-POM-T-4		
	MAY 13 1977		- FRIDAY	
340			METHYLENE CHLORIDE RINSE OF PROBE AND CONNECTING GLASSWARE	
341			QUARTZ TISSUE FILTER № 99	
342			POM COLUMN - TENNAX # 204	
		WSW B-POM-T-4		
343			METHYLENE CHLORIDE RINSE OF PROBE AND CONNECTING GLASSWARE	
344			QUARTZ TISSUE FILTER № 100	
345			POM COLUMN - TENNAX # 206	
		wet ESP -	WATER SAMPLES	(COMPOSITE)
346			INLET - (PROCESS WATER)	
347			OUTLET - FROM EAST AND WEST ESP	
348			BLOWDOWN WATER (SEWER)	
			3L EVACUATED FLASK	(COMPOSITE)
~~349~~			~~INLET TO ESP~~	* not required for this run
~~350~~			~~OUTLET FROM ESP~~	not required for this run
340A		INLET	Acetone Rinse, after MC rinse, of INLET probe, and connecting glassware	
343A		OUTLET	— ditto — OUTLET — " —	
345W		OUTLET	Impinger catch, at OUTLET TRAIN	

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant Wisconsin Steel Works
Location Chicago, Illinois
Industry G 2872-5014
Project No.

Battelle Record Book No 33 284
Collected & Recorded By Bayter
Page ___ of ___.

EPA No. S77-002	Date	Run Number	Sample Description	Remarks
			BLANKS	
351			QUARTZ TISSUE FILTER, 3 ea	~~101~~, ~~102~~, ~~and 103~~ 88, 89, 90
352			METHYLENE CHLORIDE, 200 ml,	BURDICK AND JACKSON "DISTILLED IN GLASS" LOT ~~#~~ 9452
353			ACETONE, 200 ml, BURDICK AND JACKSON	DISTILLED IN GLASS LOT # 9771
354			DEMINERALIZED, DBL., DIST. WATER	PREPARED BY OSU LABS. CAT. NO. 97805
355			POM ABSORBING COLUMN, FILLED WITH TENAX	
			SAMPLES RECIEVED FROM CLAYTON ENVIRONMENTAL	
		3	~~outlet~~	
	5/1/77	#3 1	Inlet POM - XAD-2 column - after filter + before 1st impinger	
		2	Outlet Dual - XAD 2 columns - after ~~filter + before 1st impinger~~ 3 rd ~~before 4th impinger~~	
		3	wash of elbow	
		4	Water wash.	
	5/13/77	4	Dual Columns, with connecting glass ware, outlet after impingers, between 3 + 4th impinger XAD-2 single column, at Inlet, between 3rd and 4th impinger XAD-2	

SAMPLE IDENTIFICATION

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant International Harvester Wisconsin Stell Works
Location Chicago, Illinois 60617
Industry coke ovens
Project No. G 2872-5014

Battelle Record Book No 33284
Collected & Recorded By Baytos
Page 1 of 7.

EPA No. S77-002-	Date	Run Number	Sample Description	Remarks
			PRE-SAMPLING CLEAN-UP	
		WSW-A-POM.t-CU	(inlet to wet ESP)	
	MAY 9 1977		MONDAY	
301			Methylene chloride rinse of probe and connecting glassware	
302			Quartz tissue filter # 91	
303			POM absorbing column # 221	
		WSW-B-POM.t-CU	(stack)	
304			Methylene chloride rinse of probe and connecting glassware	
305			Quartz tissue filter # 92	
306			POM absorbing column # 226	

IDENTIFICATION LOG OF SAMPLES COLLECTED

International Harvester

Plant Wisconsin Steel Works

Location Chicago, Illinois 60617

Industry coke oven

Project No. G 2872-5014

Battelle Record Book No 33284

Collected & Recorded By Baytos

Page 2 of 7.

EPA No. S77-002-	Date	Run Number	Sample Description	Remarks
			POM SPECIES COLLECTED BY MODIFIED METHOD FIVE	
	MAY 10 1977		TUESDAY (collected by Battelle)	
		WSW-A-POM.t-1	(inlet side to wet ESP)	
307			Methylene chloride rinse of probe and connecting glassware	
307A			Acetone rinse of probe, etc. after MC rinse	
308			Quartz tissue filter # 93	
309			POM absorbing column, # 200	filled with Tenax
		WSW-B-POM.t-1	(stack)	
310			Methylene chloride rinse of probe and connecting glassware	
310A			Acetone rinse of probe, etc., after MC rinse	
311			Quartz tissue filter # 94	
312			POM absorbing column, # 199 201	filled with Tenax (used 2 col.
312W			Water from first impinger only	
			WATER SAMPLES COLLECTED FROM WET ESP, COMPOSITED	
313			Inlet	
314			Outlet, from both east and west ESP's	
315			Blowdown (at sewer discharge)	
			THREE LITER EVACUATED FLASK SAMPLES	(gases composited in Tedlar bag during sampling period: sampling rate: 100cc/mi
316			Inlet	start 12 noon stop. 7:30pm
317			Outlet	

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant International Harvester Wisconsin Steel Works
Location Chicago, Illinois 60617
Industry coke oven
Project No. G 2872-5014

Battelle Record Book No 33284
Collected & Recorded By Baytos
Page 3 of 7.

EPA No. S77-002-	Date	Run Number	Sample Description	Remarks
			POM SPECIES COLLECTED BY MODIFIED METHOD FIVE	
	MAY 11 1977		WEDNESDAY (collected by Battelle)	
		WSW-A-POM.t- 2	(inlet side to wet ESP)	
318			Methylene chloride rinse of probe and connecting glassware	
318A			Acetone rinse of probe,etc. after MC rinse	
319			Quartz tissue filter # 95	
320			POM absorbing column, # 202	filled with Tenax
		WSW-B-POM.t- 2	(stack)	
321			Methylene chloride rinse of probe and connecting glassware	
321A			Acetone rinse of probe, etc., after MC rinse	
322			Quartz tissue filter # 96	
323			POM absorbing column, # 203	filled with Tenax
323W			Water from first impinger only	
			WATER SAMPLES COLLECTED FROM WET ESP, COMPOSITED	
324			Inlet	
325			Outlet, from both east and west ESP's	
326			Blowdown (at sewer discharge)	
				(gases composited in Tedlar bag during sampling period: sampling rate: 100cc/mi
			THREE LITER EVACUATED FLASK SAMPLES	
327			Inlet	start 1030 stop. 1900
328			Outlet	

IDENTIFICATION LOG OF SAMPLES COLLECTED

International Harvester
Plant Wisconsin Steel Works
Location Chicago, Illinois 60617
Industry coke oven
Project No. G 2872-5014

Battelle Record Book No 33284
Collected & Recorded By Baytos
Page 4 **of** 7.

EPA No. S77-002-	Date	Run Number	Sample Description	Remarks
			POM SPECIES COLLECTED BY MODIFIED METHOD FIVE	
	MAY 12 1977		THURSDAY (collected by Battelle)	
		WSW-A-POM.t- 3	(inlet side to wet ESP)	
329			Methylene chloride rinse of probe and connecting glassware	
329A			Acetone rinse of probe, etc. after MC rinse	
330			Quartz tissue filter # 97	
331			POM absorbing column, # 218	filled with Tenax
		WSW-B-POM.t- 3	(stack)	
332			Methylene chloride rinse of probe and connecting glassware	
332A			Acetone rinse of probe, etc., after MC rinse	
333			Quartz tissue filter # 98	
334			POM absorbing column, # 205	filled with Tenax
334W			Water from first impinger only	
			WATER SAMPLES COLLECTED FROM WET ESP, COMPOSITED	
335			Inlet	
336			Outlet, from both east and west ESP's	
337			Blowdown (at sewer discharge)	
			THREE LITER EVACUATED FLASK SAMPLES	(gases composited in Tedlar bag during sampling period: sampling rate: 100cc/m
338			Inlet	start 0930 stop. 1830
339			Outlet	(sampling stopped during pushing operation)

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant International Harvester Wisconsin Steel Works
Location Chicago, Illinois 60617
Industry coke oven
Project No. G 2872-5014

Battelle Record Book No 33284
Collected & Recorded By Baytos
Page 5 of 7.

EPA No. S77-002-	Date	Run Number	Sample Description	Remarks
			POM SPECIES COLLECTED BY MODIFIED METHOD FIVE	
	MAY 13 1977		FRIDAY (collected by Battelle)	
		WSW-A-POM.t-4	(inlet side to wet ESP)	
340			Methylene chloride rinse of probe and connecting glassware	
340A			Acetone rinse of probe, etc. after MC rinse	
341			Quartz tissue filter #99	
342			POM absorbing column, #204	filled with Tenax
		WSW-B-POM.t-4	(stack)	
343			Methylene chloride rinse of probe and connecting glassware	
343A			Acetone rinse of probe, etc., after MC rinse	
344			Quartz tissue filter # 100	
345			POM absorbing column, # 206	filled with Tenax
345W			Water from first impinger only	
			WATER SAMPLES COLLECTED FROM WET ESP, COMPOSITED	
346			Inlet	
347			Outlet, from both east and west ESP's	
348			Blowdown (at sewer discharge)	
				(gases composited in Tedlar bag during sampling period: sampling rate: 100cc/[illegible]
			THREE LITER EVACUATED FLASK SAMPLES	
~~349~~			~~Inlet~~ not required for this run	~~start~~ stop.
~~350~~			~~Outlet~~	

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant International Harvester Wisconsin Steel Works
Location Chicago, Illinois 60617
Industry coke ovens
Project No. G2872-5014

Battelle Record Book No 33284
Collected & Recorded By Baytos
Page 6 of 7 .

EPA No.	Date	Run Number	Sample Description	Remarks
			BLANKS	
351			Quartz tissue filters, 3 ea. #'s 88, 89, & 90	2500 QAST, Pallflex Products Corp. Putnam, Conn. 06260
352			Methylene chloride, 200 ml distilled in glass	Burdick & Jackson Lot # 9452
353			Acetone 200 ml distilled in glass	Burdick & Jackson Lot # 9771
354			Demineralized dbl. distilled water 200 ml	Prepared by Ohio State Univ. Labs, Cat. # 97805
355			POM absorbing column, filled Tenax, BCL # 220	filled at Battelle

IDENTIFICATION LOG OF SAMPLES COLLECTED

Plant Wisconsin Steel Works
Location Chicago, Illinois
Industry G 2872-5014
Project No.

Battelle Record Book No 33284
Collected & Recorded By Clayton
Page 7 of 7.

EPA No. S77-002-	Date	Run Number	Sample Description	Remarks
			POM SPECIES ABSORBED ON XAD-2	
			(collected by Clayton)	
		WSW-3		
	MAY 1 2 1977		Inlet	
356			Single column, after filter and before 1st impinger	
			Outlet	
357			Dual columns, after filter and before first impinger	
358			H_2O flush of base of XAD-2 tube	
359			H_2O blank	
		WSW-4		
	MAY 1 3 1977			
			Inlet	
360			Single column, between 3d and 4th impingers	
			Outlet	
361			Dual columns, between 3d and 4th impingers	
362			XAD-2 column, blank	

TABLE 3. ANALYSIS SCHEDULE OF WISCONSIN STEEL COKE OVEN SAMPLES

(Aliquot) Analyses (POM)(a)	(TPF)(b)	(BN-N)(c)	Sample Number	Sample Information	(Aliquot) Sample for EPA	Sample for Future (TPF)
				(Inlet Preclean-up)		
			S77-002-301	Methylene chloride		
1	1	--	S77-002-302	#91 filter	1	1
1	1	--	S77-002-303	#221 tenax column	1	1
				(Outlet Preclean-up)		
			S77-002-304	Methylene chloride		
1	1	--	S77-002-305	#92 filter	1	1
1	1	--	S77-002-306	#226 tenax column	1	1
				(Run 1 Inlet)		
			S77-002-307	Methylene chloride		
			S77-002-307A	Acetone		
1	1	--	S77-002-308	#93 filter	1	1
1	1		S77-002-309	#200 tenax column	1	1
				(Run 1 Outlet)		
			S77-002-310	Methylene chloride		
			S77-002-310A	Acetone		
1	1	--	S77-002-311	#94 filter	1	1
1	1		S77-002-312	#199 #201 tenax column	1	1
				(Run 2 Inlet)		
			S77-002-318	Methylene chloride		
			S77-002-318A	Acetone		
1		--	S77-002-319	#95 filter	1	1
		-	S77-002-320	#202 tenax column	1	1
				Run 2 Outlet		
			S77-002-321	Methylene chloride		
			S77-002-321A	Acetone		
1	1	--	S77-002-322	#96 filter	1	1
1	1	--	S77-002-323	#203 tenax column	1	1
				(Run 3 Inlet)		
			S77-002-329	Methylene chloride		
			S77-002-329A	Acetone		
1	1	1	S77-002-330	#97 filter	1	1
1	1	1	S77-002-331	#218 tenax column	1	1
				(Run 3 Outlet)		
			S77-002-332	Methylene chloride		
			S77-002-332A	Acetone		
1	1	1	S77-002-333	#98 filter	1	1
1	1	1	S77-002-334	#205 tenax column	1	1
				(Run 4 Inlet)		
			S77-002-340	Methylene chloride		
			S77-002-340A	Acetone		
1	1	--	S77-002-341	#99 filter	1	1
1	1	--	S77-002-342	#204 tenax column	1	1
				(Run 4 Outlet)		
			S77-002-343	Methylene chloride		
			S77-002-343A	Acetone		
1	1	--	S77-002-344	#100 filter	1	1
1	1	--	S77-002-345	#206 tenax column	1	1

(Aliquot) Analyses (POM)(a)	(TPF)(b)	(BN-N)(c)	Sample Number	Sample Information	Sample for EPA	Sample for Future TPF
				Water Samples		
1	--	--	S77-002-313	Run 1 WESP Inlet	1	1
1	--	--	S77-002-314	Run 1 WESP Outlet	1	1
1	--	--	S77-002-324	Run 2 WESP Inlet	1	1
1	--	--	S77-002-325	Run 2 WESP Outlet	1	1
1	--	--	S77-002-335	Run 3 WESP Inlet	1	1
1	--	--	S77-002-336	Run 3 WESP Outlet	1	1
1	--	--	S77-002-346	Run 4 WESP Inlet	1	1
1	--	--	S77-002-347	Run 4 WESP Outlet	1	1
				Blanks		
			S77-002-351	#101 filter (quartz)		
1	1	--	S77-002-352	Methylene chloride	1	1
			S77-002-353	Acetone		
1	1	--	S77-002-355	#220 tenax column	1	1

(Aliquot) Analyses (BSO)(d)	(TPF)(b)	Sample Number	Sample Information	Sample for EPA	Sample for Future TPF
1	1	S77-002-356	#215 XAD-2 column, Run 3 Inlet	1	1
		S77-002-357	#216 #217 Dual XAD-2 columns, Run 3 Outlet		
1	1			1	1
		S77-002-358	H_2O flush of column, Run 3 Outlet		
1	1	S77-002-359	H_2O blank of H_2O flush	1	1
1	1	S77-002-360	#207 XAD-2 column, Run 4 Inlet	1	1
1	1	S77-002-361	#208 #210 Dual XAD-2 columns, Run 4 Outlet	1	1
1	1	S77-002-362	#212 XAD-2 column blank	1	1

(a) POM Compounds -- Analyse for all listed in (Attachment A).

(b) TPF -- Total PoM Fluorescence.

(c) BN-N = Benz naphthylamine and naphthalene.

(d) BSO = Benzene soluable organics.

APPENDIX B

COMPLETE SAMPLING RESULTS WITH SAMPLE CALCULATIONS

INLET RESULTS, WISCONSIN STEEL CO.

			1	2	3	4
	RUN NO.		1	2	3	4
	TEST DATE		5/10	5/11	5/12	5/13
	SAMPLING TIME, 24 HOUR CLOCK	FROM	1000	1002	0921	2016
		TO	1959	4500	1823	0634
DN	SAMPLING NOZZLE DIAMETER, IN.		0.182	0.175	0.175	0.175
TT	NET TIME OF TEST, MIN.		480	480	480	480
PB	BAROMETRIC PRESSURE, IN. HG ABSOLUTE		29.50	29.55	29.52	29.35
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O		1.98	1.58	1.71	1.57
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, DCF		370.7	344.3	350.1	341.7
TM	AVG. GAS METER TEMPERATURE, F		66	86	89	84
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, DSCF		369.8	331.2	334.6	327.7
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML		77.0	73.0	73.0	71.0
VWGAS	VOLUME OF H2O VAPOR COLLECTED,SCF		3.6	3.5	3.5	3.4
%M	PERCENT MOISTURE IN STACK GAS BY VOLUME		0.98	1.03	1.02	1.02
MD	MOLECULAR FRACTION OF DRY GAS		0.99	0.99	0.99	0.99
% CO2	VOLUME PERCENT DRY		.0	.0	.0	.0
% O2	VOLUME PERCENT DRY		20.8	20.8	20.8	20.8
% CO	VOLUME PERCENT DRY		.0	.0	.0	.0
% N2	VOLUME PERCENT DRY		79.2	79.2	79.2	79.2
% EA	PERCENT EXCESS AIR		-	-	-	-
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS		28.8	28.8	28.8	28.8
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS		28.7	28.7	28.7	28.7
CP	PITOT TUBE COEFFICIENT		0.85	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE		74	90	96	94
NP	NET SAMPLING POINTS		48	48	48	48
PST	STATIC PRESSURE OF STACK GAS, IN. HG.		-0.18	-0.18	-0.18	-0.18
PS	STACK GAS PRESSURE, IN. HG ABS.		29.32	29.37	29.34	29.17
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM		4232	4317	4403	4328
AS	STACK AREA, SQ. IN.		6400	6400	6400	6400
QS	DRY STACK GAS VOLUMETRIC FLOW RATE AT STANDARD CONDITIONS,DSCFM		181144	179686	180892	177622
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM		188063	191839	195637	192331
% I	PERCENT ISOKINETIC		104.3	101.9	102.2	102.0

OUTLET RESULTS, WISCONSIN STEEL CO.

		1	2	3	4
	RUN NO.	1	2	3	4
	TEST DATE	5/10	5/11	5/12	5/13
	SAMPLING TIME, 24 HOUR CLOCK FROM	1001	1001	0917	2017
	TO	1925	1901	1842	0609
DN	SAMPLING NOZZLE DIAMETER, IN.	0.182	0.175	0.175	0.175
TT	NET TIME OF TEST, MIN.	480	480	480	480
PB	BAROMETRIC PRESSURE, IN. HG ABSOLUTE	29.50	29.55	29.56	29.35
PM	AVG. ORIFICE PRESSURE DROP, IN. H2O	1.29	1.46	1.45	1.45
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS, DCF	303.9	329.6	332.0	332.5
TM	AVG. GAS METER TEMPERATURE, F	78	104	101	90
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS, DSCF	295.9	306.7	310.7	315.2
VW	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL, ML	110.0	107.3	134.8	160.6
VWGAS	VOLUME OF H2O VAPOR COLLECTED, SCF	5.2	5.1	6.4	7.6
%M	PERCENT MOISTURE IN STACK GAS BY VOLUME	1.73	1.63	2.01	2.36
MD	MOLECULAR FRACTION OF DRY GAS	0.98	0.98	0.98	0.98
% CO2	VOLUME PERCENT DRY	.0	.0	.0	.0
% O2	VOLUME PERCENT DRY	20.8	20.8	20.8	20.8
% CO	VOLUME PERCENT DRY	.0	.0	.0	.0
% N2	VOLUME PERCENT DRY	79.2	79.2	79.2	79.2
% EA	PERCENT EXCESS AIR	—	—	—	—
MWD	MOLECULAR WEIGHT OF STACK GAS, DRY BASIS	28.8	28.8	28.8	28.8
MW	MOLECULAR WEIGHT OF STACK GAS, WET BASIS	28.6	28.7	28.6	28.6
CP	PITOT TUBE COEFFICIENT	0.85	0.85	0.85	0.85
TS	AVG. STACK TEMPERATURE	62	73	79	77
NP	NET SAMPLING POINTS	48	48	48	48
PST	STATIC PRESSURE OF STACK GAS, IN. HG.	.00	.00	.00	.00
PS	STACK GAS PRESSURE, IN. HG ABS.	29.50	29.55	29.56	29.35
VS	STACK GAS VELOCITY AT STACK CONDITIONS, FPM	3890	3960	3981	3983
AS	STACK AREA, SQ. IN.	7159.00	7159.00	7159.00	7159.00
QS	DRY STACK GAS VOLUMETRIC FLOW RATE AT STANDARD CONDITIONS, DSCFM	190226	189998	188526	187092
QA	STACK GAS VOLUMETRIC FLOW RATE AT STACK CONDITIONS, ACFM	193379	196820	197881	197963
% I	PERCENT ISOKINETIC	88.9	99.8	101.9	104.1

Sample Particulate Calculations
Outlet Run No. 1

1. Volume of dry gas sampled at standard conditions[a], dscf

$$V_{m_{std}} = \frac{17.7 \times V_m (P_b + \frac{P_m}{13.6})}{(T_m + 460)} = \frac{17.7 \times 303.9\ (29.50 + \frac{1.29}{13.6})}{(78 + 460)} = 295.9 \text{ dscf}$$

2. Volume of water vapor at standard conditions, scf

$$V_{w_{gas}} = 0.0474 \times V_w = 0.0474 \times 110.0 = 5.2 \text{ scf}$$

3. Moisture in stack gas, percent

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \frac{100 \times 5.2}{295.9 + 5.2} = 1.73$$

4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100} = \frac{100 - 1.73}{100} = 0.98$$

5. Molecular weight of dry stack gas

$$MW_d = (\%CO_2 \times \frac{44}{100}) + (\%O_2 \times \frac{32}{100}) + [(\%CO + \%N_2) \times \frac{28}{100}] =$$

$$(0.0 \times \frac{44}{100}) + (20.8 \times \frac{32}{100}) + 79.2 \times \frac{28}{100}) = 28.8$$

6. Molecular weight of wet stack gas

$$MW = MW_d \times M_d + 18(1 - M_d) = 28.8 \times 0.98 + 18(1 - 0.98) = 28.6$$

(a) Standard conditions at 70 F, 29.92 in. Hg.

7. Stack gas velocity at stack conditions[b], fpm

$$V_s = 4{,}360 \sqrt{\Delta P_s \times (T_s + 460)} \quad \left[\frac{1}{P_s \times MW}\right]^{1/2} =$$

$$4{,}360 \times 25.941 \left[\frac{1}{29.50 \times 28.6}\right]^{1/2} = 3890 \text{ fpm}$$

8. Stack gas volumetric flow rate at standard conditions, dscfm

$$Q_s = \frac{0.123 \times V_s \times A_s \times M_d \times P_s}{T_s + 460} = \frac{0.123 \times 3890 \times 7159 \times 0.98 \times 29.50}{62 + 460}$$

$$= 190226 \text{ dscfm}$$

9. Stack gas volumetric flow rate at stack conditions, acfm

$$Q_a = \frac{0.05645 \times Q_s(T_s + 460)}{P_s \times M_d} = \frac{0.05645 \times 190226 \ (62 + 460)}{29.50 \times 0.98} = 193379 \text{ acfm}$$

10. Percent isokinetic

$$\%I = \frac{1{,}032 \ (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2} = \frac{1{,}032 \ (62 + 460) \times 295.9}{3890 \times 480 \times 29.50 \times 0.98 \times (0.182)^2}$$

$$= 88.9$$

APPENDIX C

WET ESP WATER SAMPLE LOG

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Wet Electrostatic Precipitator Samples

Run Number WSW-1- Date MAY 10 1977

Composite of inlet water to WESP - 1 qt Amber bottle
C
S-77-002-313 POM Analyses (Peter Jones)

Composite of outlet water to WESP - 1 qt Amber bottle
D
S77-002-314 POM Analyses (Peter Jones)

Blowdown water - 1 qt Amber bottle (store)
E
S77-002-315

Wisconsin Steel Works
Chicago, Illinois
G 2872- 5014

Wet Electrostatic Precipitator Samples

Run Number WSW - 2 Date MAY 11 1977

Composite of inlet water to WESP - 1 qt Amber bottle ———

S77-002 - 324

POM Analyses
(Peter Jones)

Composite of outlet water to WESP - 1 qt Amber bottle ———

S77-002 - 325

POM Analyses
(Peter Jones)

Blowdown water - 1 qt Amber bottle (store) ———

S77-002 - 326

collected

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Wet Electrostatic Precipitator Samples

Run Number WSW-3 Date MAY 12 1977 THURSDAY

Composite of inlet water to WESP - 1 qt Amber bottle ———

S77-002-335 POM Analyses
(Peter Jones)

Composite of outlet water to WESP - 1 qt Amber bottle ———

S77-002-336 POM Analyses
(Peter Jones)

Blowdown water - 1 qt Amber bottle (store) ———

S77-002-337

note: This water was composited only over the time period where no pushing of coke was done, In the two previous, samples were collected and composited while pushing operations occurred - 9 pushes occurred during this collection period

Collect from ~~10 AM~~ 0930 AM to ~~7 PM~~ 4:00 PM

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Wet Electrostatic Precipitator Samples

Run Number WSW-4 Date MAY 1 3 1977

Composite of inlet water to WESP - 1 qt Amber bottle ———

S-77-002-346 POM Analyses
(Peter Jones)

Composite of outlet water to WESP - 1 qt Amber bottle ———

S77-002-347 POM Analyses
(Peter Jones)

Blowdown water - 1 qt Amber bottle (store) ———

S77-002-348

Water samples composited throughout run —
22 pulses occurred during run

APPENDIX D

INTEGRATED GAS COLLECTION LOG

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Run # WSW- 2

Integrated Bag Gas Sample

Sampling Location INLET TO ESP

Bag Number INLET

Evacuated Flask Number S77-002-~~326~~ 327

Date MAY [illegible]

Sample Start Time 10:30 AM

Sample Stop Time 7 PM

Total Time Samples

Evacuated Flask - Keep in Dark

Bob Iden GC/MS

Benzene
Ethyne Acetylene

~~Peter Jones~~

~~Homologous series by single IR scan~~

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Integrated Bag Gas Sample

Run# WSW-2

Sampling Location OUTLET

Bag Number OUTLET

Evacuated Flask Number S77-002-327

Date MAY 11 1977

Sample Start Time 10:30 AM

Sample Stop Time 1900

Total Time Samples

Evacuated Flask - Keep in Dark

Benzene
Ethyne Acetylene

Bob Iden GC/MS

Peter Jones

~~Homologous series by single IR scan~~

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Integrated Bag Gas Sample

Run # WSW-3

Sampling Location inlet to ESP

Bag Number INLET

Evacuated Flask Number 577-002-338

Date MAY 12 1977 - Thursday -

Sample Start Time 0930

Sample Stop Time 18 30

Total Time Samples ____________

Evacuated Flask - Keep in Dark

Bob Iden GC/MS

Benzene
Ethyne Acetylene

Peter Jones

~~Homologous series by single IR scan~~

Gases were composited over the time period where pushing was not happening - the pumps were ~~disconnected~~ turned off for the pushing period.
The two previous runs, the gases were collected over the entire stack sampling period -.
Yesterday's run 2 had 9 pushes when
Run 1, had 16 pushes -

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Integrated Bag Gas Sample

Run# WSW-3

Sampling Location OUTLET FROM ESP

Bag Number OUTLET

Evacuated Flask Number S77-002-339

Date MAY 12 1977

Sample Start Time 0930

Sample Stop Time 1830

Total Time Samples

Evacuated Flask - Keep in Dark

Bob Iden GC/MS

Benzene
Ethyne Acetylene

Peter Jones

~~Homologous series by single IR scan~~

APPENDIX E

DAILY ACTIVITY LOG

DATE MAY 9 1977 MONDAY -

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

0830 - Arrive at plant - (4 people - Schultz, Eaytn, [illegible] [illegible] - met with [illegible], [illegible] group -
Sign in at [illegible] office. Gate 6A, then at [illegible]
Timekeeper office - Car passes issued.
Wisconsin Steel's Environmental man is [illegible] HAUSKNECHT -
Ext. [illegible] at plant and Home phone # 331-0873.

0900 - at site and [illegible] with area - Set-up block + tackle and move equipment to stack. Construct 2 protective shelters and begin assembling equipment -

1130 - The last 2 [illegible] people arrive - Webb + Fernandez -

12-7PM. Checked equipment on stack + set-up truck laboratory - Require additional current to operate stack equipment - [illegible] solder [illegible] electronic [illegible]

7-8PM - Did Pre-Sampling Clean up - (see analytical data sheets)

DATE MAY 1 0 1977 — TUESDAY —

Wisconsin Steel Works
Chicago, Illinois
G 2872—5014

Run # WSW-1

0730 — Arrive at plant — Sampling trains hoisted to roof top [illegible]

to 1000 — leak check, preweighed, and performed all essential tasks

prior to sampling.

10:00 — Sampling of Gas Stream started — both inlet to Wet ESP

and outlet from Wet ESP. — Run # WSW-B-POM-1 / WSW-A-POM-1

[illegible]

[illegible] conditions —

[illegible]

~1930 — End of stack sampling Run #'s WSW-A, and WSW B-1

— Collected evacuated bottle samples at both inlet as well as

outlet. These gas samples were composited over the stack

sampling period — 12 N to 1930.

"Cleaned up" both inlet and outlet sampling systems.

Water samples from wet ESP composited —

2130 — Closed shop —

DATE MAY 11 1977 – WEDNESDAY –

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Run # WSW-2.

0730 – Arrive at plant – [illegible] stack, set up [illegible]

[illegible] stack –

1000 – Start Run 2 series –

STACK – [illegible]

GAS BAG [illegible] 1000/[illegible]

[illegible] TO [illegible] 600 [illegible]

[illegible]

7:00 PM Run # 2 series completed –

Samples recovered, [illegible] [illegible] –

8:30 PM – Close shop

DATE MAY 12 1977 —THURSDAY

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

Run WSW-3

0730 - Arrive at coke ovens, begin assembling sampling train as well as all the [illegible] devices.

0915 - [illegible] WSW-3 starts - [illegible] column on the outlet [illegible]; there was no [illegible] spring to [illegible] Tenax [illegible] in the [illegible] glass [illegible]. [illegible] (the [illegible] Tenax pulled over into the 1st impinger) The [illegible] replaced; [illegible] to prepare 3-4 more Tenax columns - for delivery to [illegible] the field tomorrow -

~1842 - Run WSW-3 completed, Samples recovered, [illegible] and stored -

[illegible] delivery to [illegible], the XAD-2 column [illegible] [illegible] parallel [illegible]

2000 - [illegible] stop -

DATE MAY 1 3 1977 - FRIDAY EVE.

Wisconsin Steel Works
Chicago, Illinois
G 2872-5014

MAY 1 3 1977 - Run # WSW-4 — FINAL

1830 - Arrive at plant for preparation for 4th Run. This purpose is collecting gas samples in the eve. is to compare daytime emissions when we're pushing of coke & heavier [illegible] overall that in the night when coke is pushed. System checked out and began Run 4

2017 (started at 2017)

Comp. Water samples collected by Clayton as in the previous runs —

MAY 1 4 1977

0130 Switched ports with Clayton — continue sampling —

22 pushes occurred during run —

0638 - Sampling period completed, take all equipment off stack; Recovered emission catch from probe nozzle filter for POM analysis, [illegible]

Clayton received 3 POM columns, intact —

and the corresponding ESP catch for delivery to [illegible] for POM analysis —

No composite gas bag samples taken; not required —

Packed equipment in truck in preparation for departure.

0830 - Signed out at plant — mission completed

[illegible]

[illegible]

Columns.

APPENDIX F

GASEOUS EMISSION LABORATORY RESULTS

TABLE F-1. FLASK SAMPLE IDENTIFICATION OF WISCONCIN STEEL COKE OVEN SAMPLES

Flasks	Number	Sample Information
1	S77-002-316	Inlet Run 1, May 10, 1977
2	S77-002-317	Outlet Run 1, May 10, 1977
3	S77-002-~~326~~327	Inlet Run 2, May 11, 1977
4	S77-002-~~327~~328	Outlet Run 2, May 11, 1977
5	S77-002-338	Inlet Run 3, May 12, 1977
6	S77-002-339	Outlet Run 3, May 12, 1977
7	(The seventh flask, an unused flask, should be exposed to clean filtered air and analyzed as a blank.)	

BATTELLE MEMORIAL INSTITUTE
COLUMBUS LABORATORIES
ANALYTICAL REPORT CARD

PROJECT [illegible]

DATE SUBMITTED [illegible]

SUBMITTED BY [illegible] EXT. [illegible] ROOM NO. 6230 D

SECTION NO. 569

CARD NO. P 7274

TYPE OF ANALYSIS: CHEM ☐ OES ☐ XRF ☐ XRD ☐ EMP ☐ SSMS ☐ GMS ☑ P. CHEM ☐ OM ☐ EM ☐ AA ☐ SIMS ☐

APPROX. COMPOSITION

REMARKS Wisconsin Steel Chicago Ill

SAMPLE NO. (DO NOT FILL IN)	DESCRIPTION OF SAMPLE	DETERMINATIONS DESIRED (REPORT AS Vol ppm)										
		C_2H_2	C_2H_6									
S46413	[illegible]	10	4									
	[illegible]											
S46414	[illegible]	15	1									
	[illegible]											

ANALYST [illegible]

DATE REPORTED [illegible] -77

WHITE -- REPORT COPY
YELLOW -- SUBDIVISION COPY
BUFF -- DIVISION COPY

SYMBOLS ON REVERSE SIDE

REMARKS

QUALITATIVE ☐ SEMI-QUANT ☐ QUANT ☑

BATTELLE MEMORIAL INSTITUTE
COLUMBUS LABORATORIES
ANALYTICAL REPORT CARD

PROJECT [illegible]

DATE SUBMITTED [illegible]

SUBMITTED BY [illegible] EXT. [illegible] ROOM NO. 6230 D

SECTION NO. 569

CARD NO. P 7273

TYPE OF ANALYSIS: CHEM ☐ OES ☐ XRF ☐ XRD ☐ EMP ☐ SSMS ☐ GMS ☑ P. CHEM ☐ OM ☐ EM ☐ AA ☐ SIMS ☐

APPROX. COMPOSITION

REMARKS Wisconsin Steel Chicago Ill

SAMPLE NO. (DO NOT FILL IN)	DESCRIPTION OF SAMPLE	DETERMINATIONS DESIRED (REPORT AS Vol ppm)										
		C_2H_2	C_2H_6									
S46409	[illegible]	10	3									
	[illegible]											
S46410	[illegible]	10	3									
	[illegible]											
S46411	[illegible]	5	2									
	[illegible]											
S46412	[illegible]	9	2									
	[illegible]											

ANALYST [illegible]

DATE REPORTED [illegible]-77

WHITE -- REPORT COPY
YELLOW -- SUBDIVISION COPY
BUFF -- DIVISION COPY

SYMBOLS ON REVERSE SIDE

REMARKS

QUALITATIVE ☐ SEMI-QUANT ☐ QUANT ☑

APPENDIX G

POM SAMPLING AND ANALYSIS USING THE SPECIAL POM SAMPLING TRAIN

APPENDIX G

POM SAMPLING AND ANALYSIS USING THE SPECIAL POM SAMPLING TRAIN

Background

Several years ago, the need for sampling and analysis of polycyclic organic material (POM) arose on several programs at Battelle. At that time the best available technology for sampling for POM appeared to be some version of the EPA Method 5 particulate sampling train. Use of the Method 5 sampling train produced inconsistent POM emission data and led Battelle staff to question the suitability of using this train for POM sampling. As a result, Battelle developed a POM sampling train that retains many of the features and components of the Method 5 train, but which incorporates an additional element that serves to collect the majority of the POM in the gas sample.

Sampling for POM with the POM Sampling Train should be a straightforward procedure for those already familiar and skilled with the operation of a Method 5 train for particulate collection. The POM sampling procedure utilizes the existing Method 5 train, but also includes a chromatographic adsorbent device (referred to as the adsorbent sampler). This additional component, and its auxiliary equipment, increases the time required for setup, and requires some additional precautionary measures over those associated with particulate sampling alone, but the additional effort and skill required to obtain a meaningful POM sample is not appreciable and the reliability of the POM data obtained is significantly increased.

Sampling System

The POM Sampling Train, as shown in Figure G-1, consists of a Method 5 train with an adsorbent sampler located between the filter and the impingers. Immediately after leaving the hot filter, the gas sample passes into the cooling coil (120 x 0.8 cm) of the adsorbent sampler, and then passes through a Pyrex frit and into a cylindrical column of Tenax adsorbent (7 x 3-cm diameter). The cooling coil and Tenax adsorbent are maintained above the water dewpoint by means of a thermostated circulating water bath. Thus, the incoming gases are cooled to maintain adsorbent efficiency, yet the adsorbent is maintained at a temperature which precludes condensation of water vapor present in all combustion effluents. The gases leaving the sampler are drawn through impingers and a Drierite trap, dry gas meter, and leakless vacuum pump (as in Method 5 sampling).

With the system, POM emissions can be determined from the analysis of the probe wash, filter catch, and adsorbent sampler catch. The impingers are only used to cool and dry the stack gases before they enter the dry-gas meter. Laboratory tests, reported later, have shown that the probe, filter, and adsorbent sampler retain all the POM, and that the POM can be recovered during analysis.

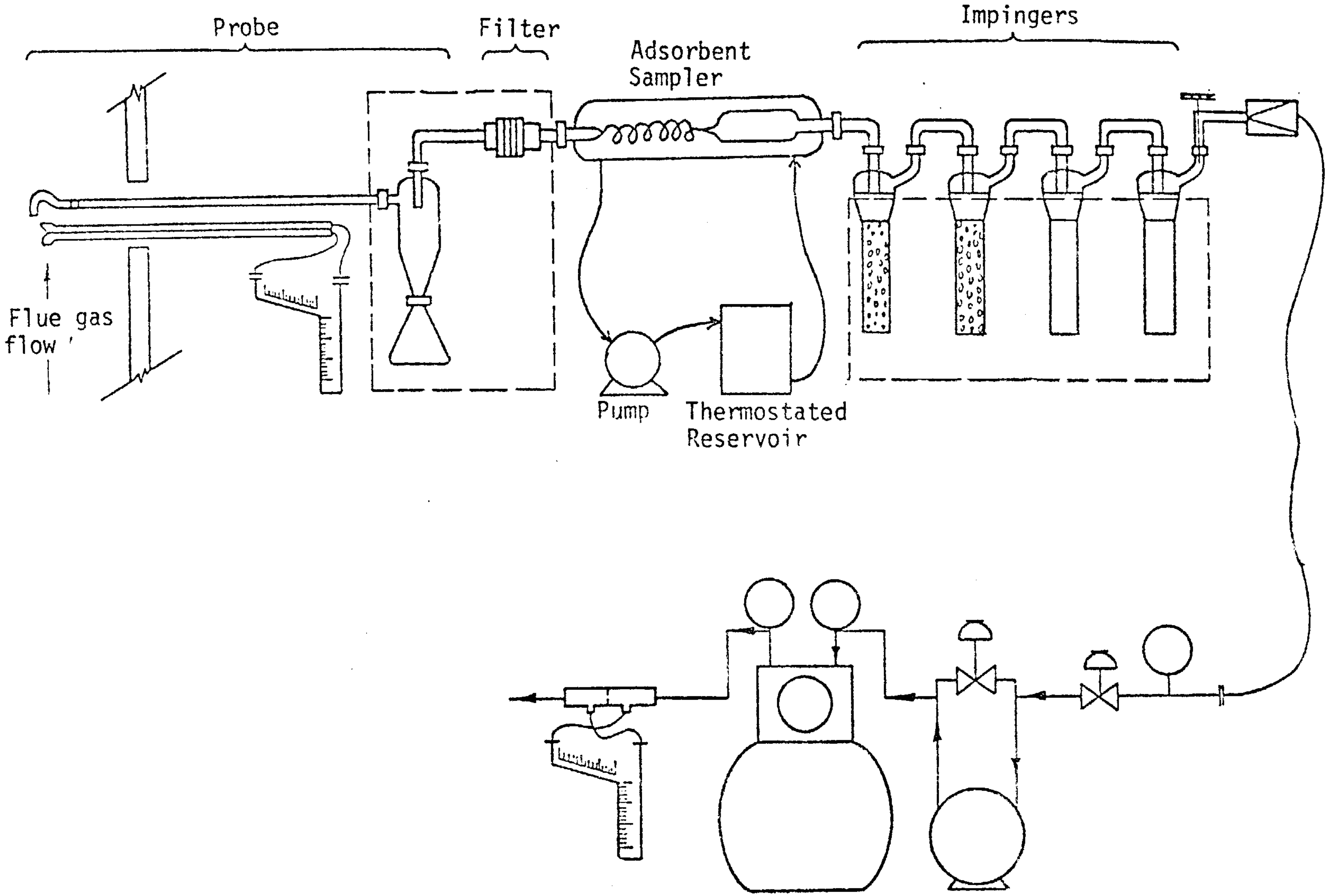


FIGURE G-1. BATTELLE POM SAMPLING TRAIN

Details of POM Absorber

A schematic representation of the adsorbent sampler is shown in Figure G-2. The heat exchanger section consists of 120 cm (4 feet) of 8-mm Pyrex tubing wound in approximately eight coils. The adsorbent is retained by an extra coarse Pyrex frit and a spring loaded glass wool plug, as shown; Tenax (35/60 mesh) is routinely used in the adsorbent trap of the adsorbent sampler. The dimensions of the adsorbent section are 15-mm radius and 70-mm length. The 28/12 Pyrex joint on the inlet to the sampler is compatible with the fittings commonly used in commercial EPA Method 5 sampling trains; the 15-mm Solv-Seal joint at the sampler outlet provides an efficient vacuum seal during sampling. (A 28/12 Pyrex joint could be used at the sampler outlet.) A vacuum hose coupling between the front sampler outlet and the impinger inlet is sufficient.

Adsorbent Sampler Temperature

The collection efficiency of the adsorbent sampler is dependent on the temperature of the adsorbent material. The optimum temperature of the adsorbent should be as low as possible without condensing large quantities of water vapor (present in most stack gases) and plugging the adsorbent device. Generally, this temperature is 20 to 25 F (10 to 15 C) above the dewpoint of the stack gases. For sampling gases that would consist primarily of vented air or products of combustion of fossil fuels it has been found that 125 F to 130 F (52 to 55 C) is a satisfactory adsorbent temperature. Of course, the adsorbent temperature is to be maintained at the predetermined temperature throughout the run to insure a continuous high POM collection efficiency.

Auxiliary Equipment

To maintain the adsorber at a temperature above the dewpoint, a thermostated controlled water bath is used. A 10-ℓ/min pump circulates water to the absorbent sampler from a 4-ℓ reservoir. An acquastat is used to control a 450-watt heating element to maintain the water temperature. For stack gas temperatures up to at least 550 F (300 C) and sampling rates of 0.6 scfm (0.017 Nm^3/min) to 0.75 scfm (0.021 Nm^3/min), the heat loss from the water circulating loop to the ambient surroundings generally is greater than the heat gain from the stack gases to the water, so it usually is necessary to supply auxiliary heat to the water loop. Although unlikely, depending upon the conditions under which a sample is collected (at high stack temperatures and/or high ambient temperature), it may be necessary to cool the circulating water to maintain the desired temperature. A simple calculation of the heat transfer between the gas sample and the circulating water will determine whether or not cooling is needed. If cooling is needed, an additional cooling coil could be inserted between the adsorbent sampler and the reservoir.

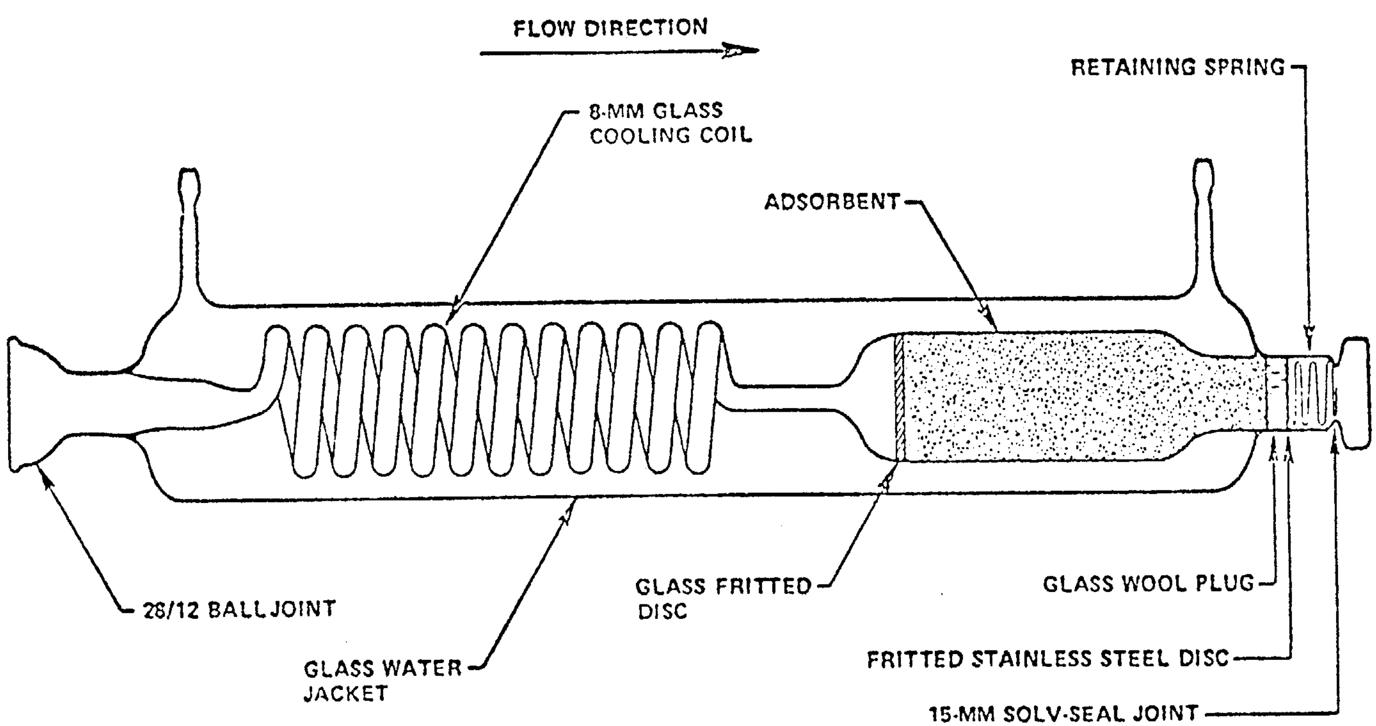


FIGURE G-2. ADSORBENT SAMPLING SYSTEM

Sampling

Sampling with the POM Sampling Train is conducted in essentially the same manner as sampling with the EPA Method 5 sampling train. The one difference between operation of these two sampling trains is that, in using the Battelle POM Sampling Train, it is desired to maintain the probe and filter temperature at 350 F (versus the 250 F when using the EPA sampling train). Maintaining the probe and filter at 350 F prevents condensation and/or adsorption of SO_3 and POM on these components (followed by destructive reaction of SO_3 with POM). Instead of being caught by the probe and filter, the POM passes through these components and is retained in the absorbent sampler.

When sampling for POM, the stack gases are sampled isokinetically as described in Method 5. (Isokinetic sampling is desired because some of the POM may be physically associated with particulate in the gas stream.) The pressure drop associated with the flow of stack gases through the adsorbent device may interfere with maintaining an isokinetic sampling rate throughout the run, therefore it is usually a good idea to reduce the calculated nozzle size in order to reduce the flow rate and, thus, the pressure differential across the sampler.

Sample Recovery in the Field and Sample Preservation

Polycyclic organic materials are readily photooxidized in the presence of ultraviolet light (and possible visible light). Thus, the sampling train should be protected from sunlight and all other ultraviolet sources, both during and after sample collection. Also, some organic compounds which are collected by the adsorbent sample may have an appreciable vapor pressure, and care must be exercised to minimize losses of such materials. To prevent loss of POM by photooxidation, a heavy dark cloth is placed over the exposed sampling train glassware during sampling. Immediately after sample collection is completed, the adsorbent sampler is sealed with ball-joint and Solv-Seal stoppers and the filter and adsorbent sampler are stored in a cool light-free container for transport to the analytical lab.

The probe and glassware up to the filter (including the filter holder) are washed with acetone followed by methylene chloride*; these solvents are 'Distilled-in-Glass' quality or better. The solution and particulate matter from the probe rinse are stored in a dark (amber) glass bottle prior to analysis and kept cool.

*To minimize evaporative sample loss during solvent extraction, solvents with very low boiling points are used.

Sample Extraction and Recovery

Sample recovery from the POM Sampling Train for POM analysis involves extraction of three separate portions of the total sampling train:

(1) Probe and glassware up to the filter
(2) Filter
(3) The adsorbent sampler.

Initial recovery of Item (1) is done in the field (i.e., the probe is washed as described above), while Items (2) and (3) are most conveniently extracted in the laboratory.

Sample Recovery from the Probe Wash

The probe wash (a solvent and particulate mixture) is agitated for 1 hour in an ultrasonic bath before filtering off the solvent with a Whatman No. 40 filter.

Sample Recovery from the Filter

Organic material is extracted from the filter by means of Soxhlet extraction with methylene chloride ('Distilled-in-Glass'), or by ultrasonic agitation with methylene chloride followed by filtration using a Whatman No. 40 filter. While both methods have been found to be equally satisfactory, ultrasonic extraction is somewhat faster.

Sample Recovery from the Adsorbent Sampler

Great care must be taken not to expose the adsorbent sampler to polar solvents such as methylene chloride or acetone, since the Tenax adsorbent is readily soluble in these solvents. Our experience has shown that is it preferable to extract the adsorbent sampler with a low boiling point hydrocarbon such as pentane ('Distilled-in-Glass').

To extract the adsorbent sampler, the two stoppers are first removed, and the extraction apparatus assembled, as shown in Figure G-3, under yellow safe-lights. A double surface water cooled condenser is preferred, the distilling flask is of 250-ml capacity. The adsorbent sampler is extracted with 'Distilled-in-Glass' pentane. An initial volume of 180 ml is usually necessary since there is an appreciable solvent holdup during extraction. The samplers are extracted with the continuous extraction apparatus for 24 hours, and it is normal to experience a small loss of pentane during this period. The extraction apparatus is then disassembled and the pentane extract stoppered and stored in darkness.

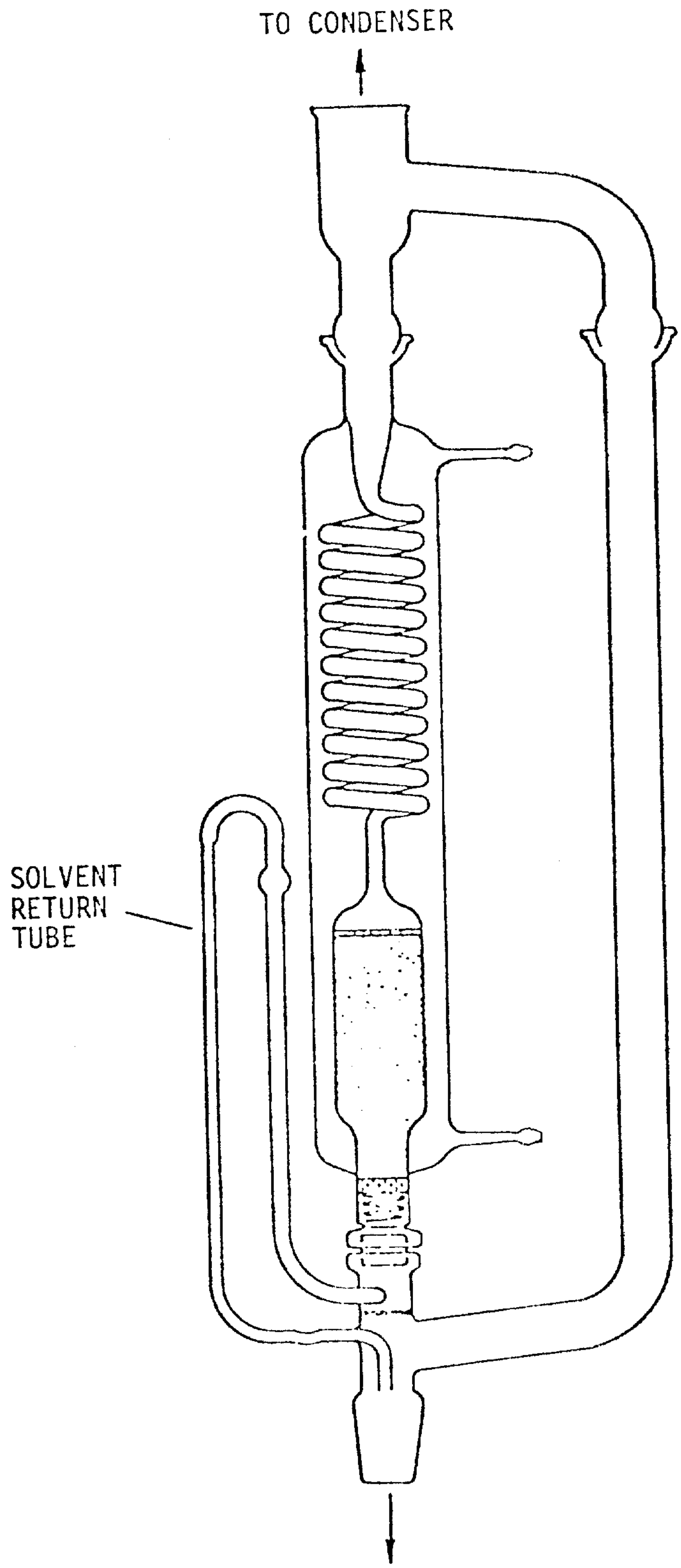


FIGURE G-3. CONTINUOUS EXTRACTION ASSEMBLY FOR ADSORBENT SAMPLER

Thus, three extracts are obtained from the adsorbent sampler-Method 5 sampling train:

(1) Acetone and methylene chloride probe extract
(2) Methylene chloride filter extract
(3) Pentane adsorbent sampler extract.

These extracts are sealed and kept in darkness while awaiting analysis.

Reactivation of Adsorbent Sampler

Following extraction, air is drawn through the sampler with an aspirator to remove most of the remaining pentane solvent. The sampler is then dismounted by withdrawing the stainless steel spring with a hooked spatula, removing the stainless steel perforated disk, discarding the glass wool plug, and emptying the almost dry Tenax into a clean glass container. The adsorbent sampler body is cleaned by blowing with compressed air to remove any trace materials and then rinsed with the following solvents in the order given:

(1) Methylene chloride
(2) Chromic acid
(3) Water
(4) Acetone
(5) Methylene chloride
(6) Pentane.

The sampler is then sealed with clean stoppers prior to refilling with activated Tenax.

Used pentane extracted Tenax may be reactivated and thoroughly cleaned by placing it in an oven at 200 C under nitrogen flow in a glass tube for 24 hours. New Tenax may be similarly prepared by first Soxhlet extracting with pentane for 24 hours and then heating under nitrogen. It is generally desirable to maintain a small supply of activated Tenax, and to reactivate the adsorbent from six or more samplers at one time.

An adsorbent sampler is prepared by filling the adsorbent section with activated Tenax to within 3/4 inch of the top of the sampler while agitating the sampler with an electrical vibrator. A clean glass wool plug is then inserted into the neck, followed by a perforated stainless steel disk and the stainless steel retaining spring. The sampler is then sealed with the appropriate 28/12 ball-joint and 15-mm Solv-Seal stoppers and is ready to use.

Analysis of Extracts

The three extracts from the probe, filter, and absorbent samples, may be analyzed separately for POM compounds, or they may be combined and a single POM analysis performed on the total sample.

Internal standards are added to the combined extracts from each sampling train prior to volume reduction by rotary evaporation and Kuderna-Danish evaporation. The extract is subjected to a Rosen-type liquid chromatography separation[1] in order to isolate the POM fraction before carrying out gas chromatographic-mass spectrometric (GC-MS) analysis. Gas chromatographic separation is achieved using a 14-foot x 2-mm, 2½ percent, Dexil 300 column programmed from 170 C to 350 C at 4 C min^{-1}. Separation of the benzpyrene isomers is routinely accomplished using a one foot 1% N,N'-Bix (p-methoxy-benzylidene)-α,α'-bi-p-toluidine column isothermal at 130 C. Mass spectrometric analysis is carried out with a Finnigan 1015 quadrupole mass spectrometer with a chemical ionization source; methane is routinely used as the carrier and reagent gas. Data acquisition is accomplished with a System Industries 150 data acquisition system, and quantification of the POM compounds present is accomplished using a Digital PDP8 computer.

This mass spectrometric-computer quantification procedure makes use of specific absolute ion currents. The bases for the quantification procedure is to initially obtain the computer reconstructed gas chromatogram and mass spectrum in the normal fashion; this reconstructed gas chromatogram is then displayed on the CRT terminal and an overlay for the protonated molecular ion of the POM of interest is superimposed. This overlay represents the ion current corresponding to that specific POM molecular weight plus 1 mass unit. If there is an area in the reconstructed gas chromatogram where the overlay indicates that this mass number is prevalent, the mass spectrum of this peak is displayed on the CRT unit, and the presence of the POM may be confirmed. If the POM is found to be present at a correct relative retention time to the internal standards, the computer then sums the ion current due to all important ions in the POM's mass spectrum which represents the area of the peak of interest. Quantification of each POM is achieved by ratioing its ion current to that of an internal standard of known concentration. The relative ionization efficiencies of the internal standards and many POM species were previously determined, and the appropriate factor is used in quantification.

This quantification technique overcomes the problems associated with interfering or overlapping peaks and poor base-line separations since these interfering species usually have different molecular weights. Isomeric compounds such as pyrene and fluoranthrene which have the same molecular weight can be quantified easily since they are very adequately separated by gas chromatography and their order of elution is known.

In order to obtain optimum sensitivity during the gas chromatographic-mass spectrometric analyses, the ionization voltage must ge adjusted at various stages during the analysis. This adjustment necessitated the incorproation of three internal standards so that an internal standard would elute between each ionization adjustment. The internal standards chosen were 9-methylanthracene, 9-phenylanthracene, and 9,10-diphenylanthracene. It was fortuitous that 9,10-diphenylanthracene elutes almost coincident with the benz(a)pyrene/benz(e)pyrene isomers, giving a very accurate marker when searching for these important compounds. The relative retention times of other POM species to one or more of the internal standards are generally sufficiently well known to permit specific compound identification when the mass spectra are displayed.

This ion integration technique has proven to be far superior to GC for the analysis and quantification of POM due to its very high selectivity; it also offers a very significant advantage in speed of data handling.

Laboratory Validation Studies

Preliminary experiments were carried out in order to determine the most suitable solvent for extraction of the adsorbent sampler. Extraction was attempted with methylene chloride, acetone, methyl alcohol, p-dioxane, pentane, cyclohexane, benzene, and toluene; only saturated hydrocarbons proved entirely suitable, on account of partial Tenax solubility in more polar solvents. Pentane was found to be the most suitable solvent, its high volatility minimized sample loss during extraction. The relatively low extraction efficiency of pentane is overcome by means of continuous solvent extraction for a period of over 24 hours, as described above.

Laboratory validation studies were performed on the adsorbent sampler component of the POM Sampling Train. These validation studies involved setting up an adsorbent sampler, to collect air drawn through a 500 F (260 C) tube furnace. A precisely measured quantity of polynuclear compounds in a few microliters of methylene chloride solution was then injected into the inlet of the adsorbent sampler, and heated air was passed through the system for at least an hour. Following solvent extraction of the sampler, a suitable internal standard was added, and analysis for the spiked polynuclear compound was made by GC-MS analysis.

Initial validation experiments involved sampling and recovery of measured quantities of anthracene; during this work the temperature of the sampler was allowed to rise to approximately 200 F (93 C), but quantitative anthracene recovery was always obtained.

Subsequent validation experiments were carried out with the sampler at 130 F (55 C) using pyrene, chrysene, perylene, benz(ghi)perylene, and coronene; these compounds are representative of commonly encountered POM species. Ten thousand ng of each of these compounds was separately sampled over a 2-hour time period; following pentane extraction and addition of internal standard, each POM compound was quantified by GC-MS using specific absolute ion current integration. The results of several representative laboratory validation experiments are given in Table G-1.

TABLE G-1. RECOVERY OF POM FROM ADSORBENT SAMPLER
Integration by GC-MS

POM	Spiked (ng)	Sample #1 Average % Recovery	Sample #2 Average % Recovery	Sample #3 Average % Recovery
Pyrene	10,000	91 ± 3	98 ± 4	104 ± 4
Chrysene	10,000	90 ± 5	92 ± 5	106 ± 5
Perylene	10,000	91 ± 4	105 ± 5	102 ± 6
Benz(ghi)perylene	10,000	101 ± 10	106 ± 10	103 ± 7
Coronene	10,000	80 ± 7	92 ± 8	100 ± 14

References

(1) Moore, G. G., Thomas, R. S., and Monkman, J. L., *J. Chromatog.*, **26,** 456 (1967).

(2) Neher, M. B., Jones, P. W., and Perry, P. J., "Validation of the Battelle Adsorbent Sampler", Draft Final Report from Battelle-Columbus to Electric-Power Research Institute, 1977.