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Volume 1

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EMISSION TEST REPORT
SLOAN CONSTRUCTION COMPANY
ASPHALT CONCRETE PLANT
COCOA, FLORIDA

Final Report 84-ASP-8
Volume I

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EPA Contract No. 68-02-3850
Work Assignment 09
ESED Project No. 83-05

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PREFACE

The work reported herein was performed by personnel from Radian Corporation, Midwest Research Institute (MRI), and the U.S. Environmental Protection Agency (EPA).

Radian's Project Director, Michael Fuchs, directed the field sampling and analytical effort. Larry Rohlack was responsible for summarizing the test and analytical data presented in this report. Sample analysis was performed by Radian Corporation in Austin, Texas. The test work was performed under EPA Contract No. 68-02-3850, Work Assignment No. 9.

MRI Project Monitor, Jack Butler, was responsible for monitoring process operations during the emissions testing program, and for reporting those data to EPA. Radian was responsible for incorporating the process data into report form (Section 3.0). The assistance of Sloan Construction Company personnel contributed substantially to the success of this emission test program. Sloan Construction Company personnel included Mr. Paul Haigler, Vice President, Mr. Kelly Sherrill, Plant Manager, Mr. Harry Thomas, Plant Superintendent, and Mr. Randy Watkins, Plant Foreman.

Mr. Michael Clowers, Office of Air Quality Planning and Standards, Industrial Studies Branch, EPA, served as Project Lead Engineer and was responsible for coordinating the process operations monitoring.

Mr. Clyde E. Riley, Office of the Air Quality Planning and Standards, Emission Measurements Branch, EPA, served as Task Manager and was responsible for overall test program coordination.

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SECTION 1

1.0 INTRODUCTION

Section 111 of the Clean Air Act of 1970 charges the Administrator of the U. S. Environmental Protection Agency (EPA) with the responsibility for establishing Federal standards of performance for new stationary sources which may significantly contribute to air pollution. When promulgated, these new source performance standards (NSPS's) are to reflect the degree of emission limitation achievable through application of the best demonstrated emission control technology. Emission data, obtained from selected industrial sources, are used in the development and/or review of NSPS regulations. Information is presently being collected and analyzed for a review of the NSPS for the asphalt concrete industry.

1.1 BACKGROUND

An NSPS for asphalt concrete plants was promulgated March 8, 1974 and established a particulate matter limit of 0.04 grains per dry standard cubic foot and a visible emission limit of 20 percent opacity. Following a review of the asphalt concrete industry in 1979, no revisions to the standard were proposed; however, a second review of the NSPS was initiated in November of 1982. As part of the review, particulate matter and opacity limits are being evaluated for plants processing recycled asphalt pavement (RAP). The review of the NSPS was requested by the National Asphalt Pavement Association (NAPA). The request was made from the concern that possible higher emissions (particulate matter and visible emissions) were generated during asphalt concrete production with RAP. Increased hydrocarbon emissions during RAP processing are considered to result in greater plume opacity due to the generation of a "blue haze" created by condensed hydrocarbons.

EPA's Office of Air Quality Planning and Standards selected the Sloan Construction Company (Sloan) asphalt concrete plant in Cocoa, Florida as an emission test program site. Selection was based upon (1) processing of RAP, (2) prior results obtained during NSPS compliance testing, and (3) suitability for testing.

1.2 OBJECTIVES

The purpose of the test program was to obtain and evaluate emission data (particulate matter, hydrocarbons, and visible emissions) from an asphalt concrete plant processing RAP. The plant was tested during recycle operation.

1.3 BRIEF PROCESS DESCRIPTION

Figure 1-1 presents a schematic of the Sloan asphalt concrete process. Recycle operation is the term used to denote process operation when feeding both virgin aggregate, i.e., unused aggregate material, and RAP to the rotary drum simultaneously. The advantages of recycle operation include use of less virgin aggregate, usually in areas with a limited supply of virgin aggregate, and the use of less asphalt cement due to the inclusion of asphalt material in the RAP.

The virgin aggregate is loaded into the natural gas-fired rotary drum mixer via a belt conveyor. The quantity and mix of virgin aggregate is fed from two bins and controlled by a computer located in the control room. RAP is fed into the center portion of the rotary drum mixer via a belt conveyor. The RAP feed rate is dependent upon the production rate and the percentage of RAP desired, relative to the virgin aggregate feed rate. Liquid asphalt is injected into the drum about three-fourths of the distance of the drum from the burner end. The asphalt concrete falls from the drum onto a conveyor and is transported to a temporary storage silo for truck load-out.

Gaseous emissions from the rotary drum enter a knockout box which reduces the gas velocity to allow reduction of entrained particulate matter by settling.

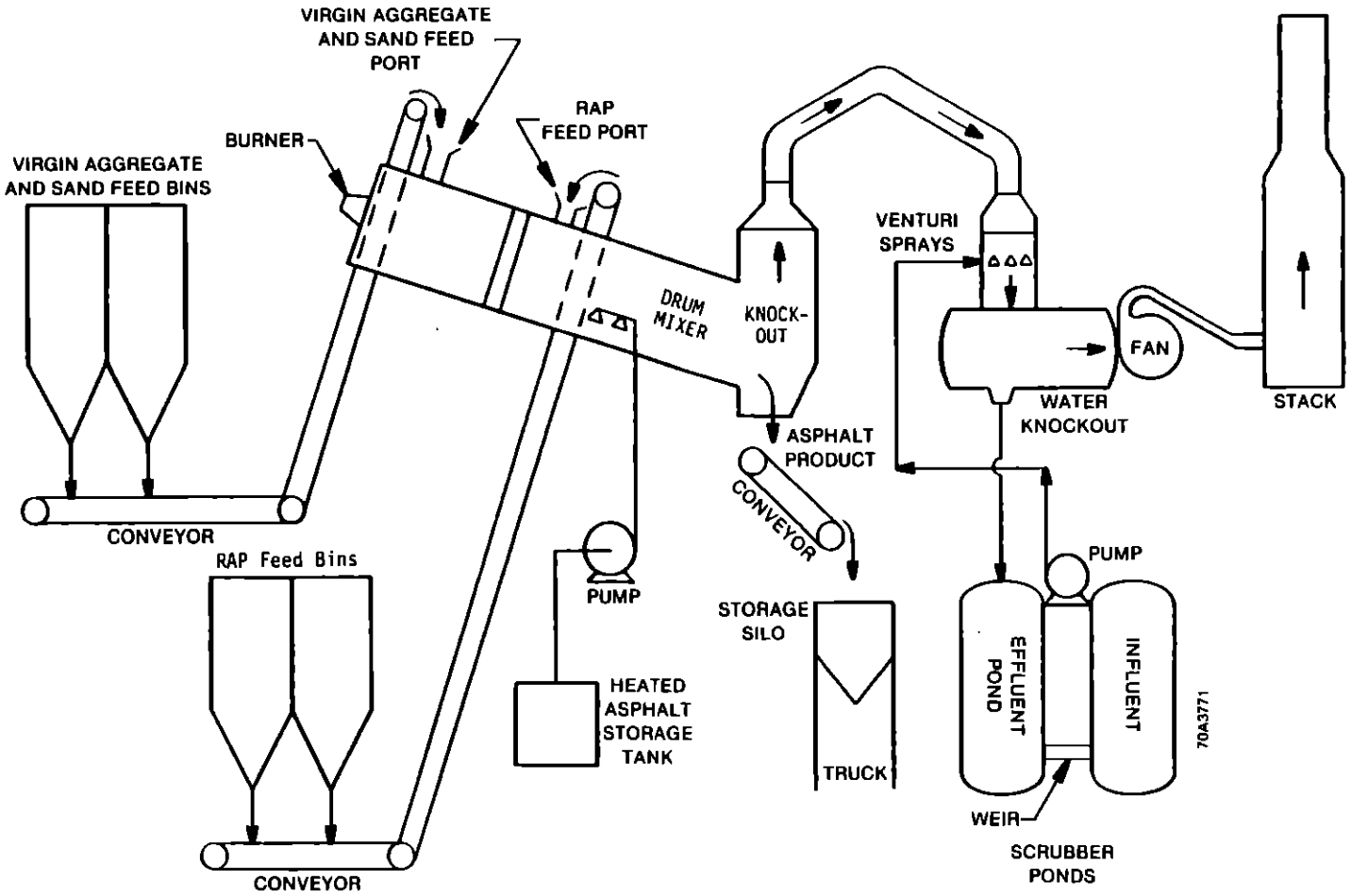

Figure 1-1. Schematic of the Sloan Asphalt Concrete Process

From the knockout box, the emissions are ducted to a wet venturi scrubber. Water is sprayed at the venturi throat to control emissions. Additional water is flushed through a collection box below the venturi. Scrubber water is contained in two earthen ponds. One pond is approximately 18 feet by 60 feet, and the other pond is approximately 24 feet by 60 feet. Both ponds have an effective depth of approximately 5 feet. Scrubber effluent flows into the end of one pond while scrubber supply water is pumped from the end of the other pond. The ponds are interconnected by means of an eight-inch diameter PVC pipe which serves as a weir to reduce the suspended particulate matter in the scrubber water supply pond.

1.4 EMISSIONS MEASUREMENT PROGRAM

The emissions measurement program was conducted at the Sloan Construction Company asphalt concrete plant in Cocoa, Florida, May 7-11, 1984. The emission tests were designed to characterize and quantify uncontrolled (venturi scrubber inlet) and controlled (venturi scrubber outlet) emissions during recycle operation.

Radian personnel were responsible for sampling and analyzing process emissions. Midwest Research Institute (MRI) was responsible for coordinating the test program with plant officials and for assuring that operating conditions for process and control equipment were suitable for the test program. MRI was also responsible for monitoring and recording all necessary process and control equipment operating parameters.

1.4.1 Particulate Mass Loading

Total particulate loading measurements were performed simultaneously at the scrubber inlet (uncontrolled) and outlet (controlled) using a modified version of EPA Method 5E. A total of four particulate mass runs were conducted during recycle operation.

1.4.2 Total Organic Carbon Loading

Total organic carbon (TOC) samples were collected at the scrubber inlet and outlet simultaneously during the EPA Method 5E determinations described in Section 1.4.1. Each sample consisted of organic matter collected on the glassware downstream of the filter holder and in the two impingers containing 0.1N NaOH. TOC impinger samples (0.1N NaOH impinger and rinse solution) were analyzed to determine the total organic carbon content. Four test runs were conducted during recycle operation.

1.4.3 Gas Stream Analysis

The CO_2 and O_2 concentrations of the inlet and outlet flue gases were determined using individual Fyrite® O_2/CO_2 units according to EPA Method 3.

1.4.4 Particle Size Distribution

Two particle size distribution (PSD) test runs were performed for uncontrolled emissions during recycle operation.

1.4.5 Polynuclear Aromatic Hydrocarbons

One inlet sample and one outlet sample were collected during recycle operation for polynuclear aromatic hydrocarbons (PAH).

1.4.6 Visible Emissions

Visible emissions were measured by a certified reader during testing periods when a clear, blue sky was available. The blue sky background was necessary to determine the opacity of the plume.

1.4.7 Scrubber and Process Sample Analysis

The two process waters sampled were scrubber water to the venturi and scrubber water from the venturi. Multiple grab samples of process waters were collected during each particulate/TOC and PAH run. Samples collected during each test run were composited and analyzed for total dissolved solids, total suspended solids, and total organic carbon. Selected samples were analyzed for polynuclear aromatic hydrocarbons. The temperature and pH of water entering and exiting the scrubber were measured at the respective sampling locations coincident with the recycle process sampling.

Grab samples of the three process solids streams virgin aggregate, RAP, and asphalt cement were obtained during the test program. Virgin aggregate and RAP were analyzed for moisture content. Samples of asphalt cement and RAP were analyzed to determine the smoke point temperature. The flash point of the asphalt cement was also determined.

1.4.8 Scrubber Operation and Process Production Monitoring

The total flow of scrubber water to the venturi scrubber and the scrubber pressure drop were monitored and recorded during each test run. Flow rate and pressure drop data were recorded during each emission test run.

MRI monitored and recorded the process operations data presented in this report.

1.5 DESCRIPTION OF REPORT SECTIONS

The remaining sections of this report present the Summary and Discussion of Results (Section 2), Process Description and Operation (Section 3), Location of Sampling Points (Section 4), Sampling and Analytical Methodology (Section 5), and Quality Assurance Procedures (Section 6). Detailed descriptions of methods and procedures, field and laboratory data, and calculations are presented in the various appendices, as indicated in the Table of Contents.

SECTION 2

2.0 SUMMARY AND DISCUSSION OF RESULTS

This section includes a presentation and discussion of the results of emission and process characterization tests conducted at the Sloan asphalt concrete plant in Cocoa, Florida. Uncontrolled and controlled gaseous emission streams were tested. Process characterization included testing of scrubber waters and feed materials. Testing was conducted during recycle operation.

Table 2-1 (English units) and Table 2-2 (metric units) include a summary of particulate and total organic carbon (TOC) emission test results conducted at the Sloan asphalt concrete plant. Particulate mass and TOC test results are presented and discussed in Sections 2.1 and 2.2, respectively. Section 2.3 presents polynuclear aromatic hydrocarbon results. Particle size distribution data and visible emission results are presented in Sections 2.4 and 2.5 Sections 2.6 and 2.7 present scrubber characterization results and process sampling results.

Difficulties encountered in either sample collection or process control during testing are discussed as applicable to data interpretation. The test results are also discussed and comparisons made, when applicable, to help explain variabilities or discrepancies within the test results.

Field data may be found in Appendices A and C. Additional analytical data may be found in Appendix E.

2.1 PARTICULATE EMISSION RESULTS

A modified version of EPA Method 5E was used to collect particulate mass samples during recycle operation. A total of four uncontrolled and

TABLE 2-1. SUMMARY OF PARTICULATE AND TOTAL ORGANIC CARBON EMISSIONS (ENGLISH UNITS)

Run Number	Run 1		Run 2		Run 3		Run 4		Average[c]	
Date	0508		0510		0510		0510		--	
Type Emissions	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled
Scrubber Pressure Drop (in. H_2O)	15	18	17	17	19	20	20	20	19	19
Scrubber Water Flow Rate (GPM)	377	376	360	360	366	365	362	361	363	362
Process Mix Type	S-1		S-1		S-1		S-1		--	
Production Rate (tons/hr)	207	209	190	190	192	195	205	204	196	196
Average Opacity (percent) Mean, Range	8.4 (5.4-11.9)		13.6 (9.6-17.5)		12.5 (7.3-16.9)		9.8 (6.7-12.9)		12.0 (6.7-17.5)	
Particulate and Total Organic Carbon (TOC) Results										
Front Half Catch - Particulate (probe, cyclone, and filter)										
mass - mg	8470	416	5640	356	5990	393	4910	298	5510	349
gr/dscf	8.09	0.115	5.54	0.130	6.15	0.143	5.28	0.113	5.66	0.129
lbs/hr	1310	15.9[a]	861	19.9	949	21.4	748	16.1	853	19.1
lbs/ton production	6.33	0.076[a]	4.53	0.105	4.94	0.110	3.65	0.079	4.37	0.097
Collection eff. (%)[b]	98.8		97.7		97.7		97.8		97.7	
Back Half Catch - TOC (impinger solutions and rinses)										
mg - mass	365	83	52	69	53	68	48	50	51	62
gr/dscf	0.349	0.023	0.051	0.025	0.054	0.025	0.050	0.019	0.052	0.023
lbs/hr	56.4	3.47	7.92	3.86	8.40	3.70	7.12	2.78	7.81	3.45
lbs/ton production	0.272	0.017	0.042	0.020	0.044	0.019	0.035	0.014	0.041	0.018
Collection eff. (%)[b]	93.8		51.3		56.0		61.8		56.2	
Total Catch										
mass - mg	8830	499	5690	425	6040	461	4960	348	5560	411
gr/dscf	8.44	0.138	5.59	0.155	6.21	0.167	5.33	0.132	5.71	0.153
lbs/hr	1370	19.4	867	23.8	957	25.1	753	18.9	859	22.6
lbs/ton production	6.60	0.093	4.56	0.125	4.99	0.129	3.67	0.093	4.41	0.115
Collection Eff. (%)[b]	98.5		97.3		97.4		97.4		97.4	

[a] Results determined from average of concentration and area ratio methods
[b] Collection efficiency percent determined using lbs/hr values
[c] Average values determined from Runs 2, 3, and 4 only

TABLE 2-2. SUMMARY OF PARTICULATE AND TOTAL ORGANIC CARBON EMISSIONS (METRIC UNITS)

Run Number	Run 1		Run 2		Run 3		Run 4		Average[c]	
Date	0508		0510		0510		0510		--	
Type Emissions	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled	Uncontrolled	Controlled
Scrubber Pressure Drop (cm H_2O)	38.1	45.7	43.2	43.2	48.3	50.8	50.8	50.8	48.3	48.3
Scrubber Water Flow Rate (lps)	23.8	23.7	22.7	22.7	23.1	23.0	22.8	22.8	22.9	22.8
Process Mix Type	S-1		S-1		S-1		S-1		S-1	
Production Rate (Kg/s)	51.2	52.7	47.9	47.9	48.4	49.1	51.7	51.4	49.4	49.4
Average Opacity (percent) Mean, Range	8.4 (5.4-11.9)		13.6 (9.6-17.5)		12.5 (7.3-16.9)		9.8 (6.7-12.9)		12.0 (6.7-17.5)	
Particulate and Total Organic Carbon (TOC) Results										
Front Half Catch - Particulate (probe, cyclone, and filter)										
mass - mg	8470	416	5640	356	5990	393	4910	298	5510	349
mg/dscm	18,500	263	12,700	298	14,100	327	12,100	259	13,000	295
g/s	165	2.00[a]	109	2.51	120	2.70	94.3	2.03	108	2.41
g/kg production	12.7	0.038[a]	2.26	0.052	2.47	0.055	1.82	0.040	2.18	0.049
Collection eff. (%)[b]	98.8		97.7		97.7		97.8		97.7	
Back Half Catch - TOC (impinger solutions and rinses)										
mg - mass	365	83	52	69	53	68	48	50	51	62
mg/dscm	799	52.6	117	57.2	124	57.2	119	43.5	120	52.6
g/s	7.11	0.438	0.999	0.487	1.06	0.467	0.918	0.351	0.992	0.435
g/kg production	0.136	0.009	0.021	0.010	0.022	0.010	0.018	0.007	0.020	0.009
Collection eff. (%)[b]	93.8		51.3		56.0		61.8		56.2	
Total Catch										
mass - mg	8830	499	5690	425	6040	461	4960	348	5560	411
mg/dscm	19,300	316	12,800	355	14,200	384	12,200	302	13,100	348
g/s	173	2.44	109	3.00	121	3.17	95.0	2.38	108	2.84
g/kg production	3.30	0.047	2.28	0.062	2.50	0.065	1.84	0.047	2.21	0.058
Collection eff. (%)[b]	98.5		97.3		97.4		97.4		97.4	

[a] Results determined from average of concentration and area ratio methods (Table 2-5)
[b] Collection efficiency percent determined using g/s values
[c] Average values based on Runs 2, 3, and 4 only

controlled particulate emission tests were conducted at the Sloan asphalt concrete plant. Results of the Sloan uncontrolled and controlled particulate emission tests are presented in Tables 2-3 and 2-4, respectively. Particulate emission results, identified in the data tables as the "front-half catch," are presented and discussed in this section.

2.1.1 Uncontrolled Particulate Emission Results

Uncontrolled particulate loadings (refer to Table 2-3) were 8.09, 5.54, 6.15, and 5.28 grains per dry standard cubic feet (gr/DSCF) for Runs 1, 2, 3, and 4, respectively. The average uncontrolled particulate mass loading for Runs 2, 3, and 4 was 5.66 gr/DSCF. Run 1 uncontrolled mass loading data was not included in the average because the Run 1 controlled particulate loading test was collected under anisokinetic conditions (83%).

2.1.2 Controlled Particulate Emission Results

Controlled particulate loadings (refer to Table 2-4) were 0.115, 0.130, 0.143, and 0.113 gr/DSCF for Runs 1, 2, 3, and 4, respectively. The average controlled particulate mass loading for Runs 2, 3, and 4 was 0.129 gr/DSCF, which is above the present NSPS standard of 0.04 gr/DSCF. Run 1 controlled mass loading data was not included in the average because the test was conducted under anisokinetic conditions (83%).

2.1.3 Discussion of Particulate Emission Test Results

Three topics are discussed in this section. They include:

- difficulties encountered in collecting particulate mass samples,
- anisokinetic effect on particulate mass emission calculations, and
- venturi scrubber particulate emissions removal efficiency.

TABLE 2-3. SUMMARY OF UNCONTROLLED PARTICULATE AND TOTAL ORGANIC CARBON EMISSIONS

Run Number	Run 1	Run 2	Run 3	Run 4	Average[b]
Date	0508	0510	0510	0510	--
Volume Gas Sampled (DSCF)	16.1	15.7	15.0	14.4	15.0
Stack Gas Flow Rate (DSCFM)	18,900	18,100	18,000	16,500	17,500
Stack Temperature (°F)	287	304	291	293	296
Percent Moisture by Volume	30.3	29.0	30.4	32.2	30.5
Percent Isokinetic	99.7	101.2	97.5	101.5	100.0
Production Rate (tons/hr)	207	190	192	205	196
Particulate and Total Organic Carbon (TOC) Results					
Front Half Catch - Particulate (probe, cyclone, and filter)					
mass - mg	8470	5640	5990	4910	5510
gr/dscf	8.09	5.54	6.15	5.28	5.66
lbs/hr	1310	861	949	748	853
lbs/ton production	6.33	4.53	4.94	3.65	4.37
Back Half Catch - TOC (impinger, solutions and rinses)					
impinger number	1 2&3	1 2&3	1 2&3	1 2&3	1 2&3
mass - mg	353 12	39 13	32 21	36 11	36 15
gr/dscf	0.349	0.051	0.054	0.050	0.052
lbs/hr	56.4	7.92	8.40	7.12	7.81
lbs/ton production	0.272	0.042	0.044	0.035	0.041
Percent TOC catch[a]	96.7 3.3	75.0 25.0	60.4 39.6	76.6 23.4	70.6 29.4

[a]Percent of total impinger catch.
[b]Average values calculated from Runs 2, 3, and 4 only.

TABLE 2-4. SUMMARY OF CONTROLLED PARTICULATE AND TOTAL ORGANIC CARBON EMISSIONS

Run Number	Run 1		Run 2		Run 3		Run 4		Average[b]	
Date	0508		0510		0510		0510		--	
Volume Gas Sampled (DSCF)	55.7		42.2		42.5		39.6		41.4	
Stack Gas Flow Rate (DSCFM)	17,600		17,800		17,500		16,700		17,300	
Stack Temperature (°F)	159		154		160		161		158	
Percent Moisture by Volume	29.5		24.8		30.2		30.4		28.5	
Percent Isokinetic	82.6		102.1		104.7		102.3		103.0	
Production Rate (tons/hr)	209		190		195		204		196	
Particulate and Total Organic Carbon (TOC) Results										
Front Half Catch - Particulate (probe, cyclone, and filter)										
mass (mg)	416		356		393		298		349	
gr/dscf	0.115		0.130		0.143		0.113		0.129	
lbs/hr	15.9[a]		19.9		21.4		16.1		19.1	
lbs/ton	0.076[a]		0.105		0.110		0.079		0.097	
Back Half Catch - TOC										
impinger number	1&2	3&4	1&2	3&4	1&2	3&4	1&2	3&4	1&2	3&4
mass (mg)	71	12	59	10	57	10	44	6	53	8.7
gr/dscf	0.023		0.025		0.025		0.019		0.023	
lbs/hr	3.47		3.86		3.70		2.78		3.45	
lbs/ton	0.017		0.020		0.019		0.014		0.018	
Percent TOC catch[c]	85.5	14.5	85.5	14.5	85.1	14.9	88.0	12.0	85.9	14.1

[a]Average Emission Rate determined from concentration and Area Ratio Methods (Table 2-5)
[b]Average values determined from Runs 2, 3, and 4 only
[c]Percent of total impinger catch

2.1.3.1 Particulate Mass Sampling Difficulties--

Problems encountered during particulate mass sampling were limited to the controlled emissions sampling location. The sampling problems included:

- development of high sampling system pressure drop during sample acquisition, and
- source sampling equipment malfunctions.

During the first half of controlled particulate emissions test Run 1, the sampling system pressure drop increased from 3 inches of mercury (Hg) to 22 inches of Hg due to the build up of particulate matter on the filter. At this point the run was stopped because the isokinetic sampling rate could not be maintained. The filter was replaced and sampling resumed. During the second half of controlled particulate emissions test Run 1, the sampling system pressure drop again increased from 3 inches Hg to 22 inches Hg. The run was terminated one minute early because isokinetic sample gas flow could not be maintained. To alleviate this problem, the sampling time was reduced from 5 minutes per point to 3 minutes per point for the remaining controlled runs.

During controlled particulate emissions test Run 2, the temperature controller used to control the temperature of the gas sample exiting the filter holder, malfunctioned. To alleviate this problem a variac was used to control the gas temperature exiting the filter holder at 250 $\pm$ 10°F.

2.1.3.2 Discussion of Anisokinetic Test Results--

Controlled particulate emissions Run 1 was collected at subisokinetic conditions (83%). In order to allow a review of possible effects introduced by anisokinetic sampling into the normal mass emission rate calculations, two methods were used to calculate mass emission rates for controlled particulate mass emission Run 1. The method normally used to calculate particulate mass emission rates is the concentration method. This method involves multiplying the particulate loading (sample mass divided by gas sample volume) by the volumetric gas flow rate. The second particulate mass

emission rate calculation method is the area-ratio method. Based on the area-ratio method, the sample mass is divided by the sampling time and then multiplied by the ratio of the stack area to nozzle area to obtain the particulate mass emission rate.

The difference between the emission rates calculated by these two methods is an estimate of the maximum bias in the measured emission rate due to anisokinetic sampling. Table 2-5 includes particulate emission rates calculated using the concentration method and the area-ratio method. The average particulate emission rate listed in Table 2-5 was used as the true value for the particulate emission run that was outside of the isokinetic sampling limit of 100 $\pm$ 10%.

2.1.3.3 Discussion of Venturi Scrubber Particulate Emissions Removal Efficiency--

The venturi scrubber particulate emissions removal efficiency ranged from 97.7 to 98.8 percent during Runs 1 through 4. The average venturi scrubber particulate emissions removal efficiency was 97.7 percent for Runs 2, 3, and 4.

2.2 TOTAL ORGANIC CARBON RESULTS

Uncontrolled and controlled total organic carbon (TOC) mass samples were collected simultaneously with particulate mass samples using the modified EPA Method 5E sampling train. The TOC content of the 0.1 N NaOH impinger and rinse solutions were analyzed directly using an instrumental technique. Results of the Sloan uncontrolled and controlled particulate emission tests are presented in Tables 2-3 and 2-4 respectively. TOC results, identified in the data tables as the "back-half catch," are presented and discussed in this section.

TABLE 2-5. COMPARISON OF PARTICULATE EMISSION RATES CALCULATED BY CONCENTRATION METHOD VS. AREA RATIO METHOD

Date	Time	Run Description	Percent Isokinetic	Particulate Mass Emission Rate (lbs/hr)		
				Concentration Method	Area-Ratio Method	Average
5-08-84	1426-1739	Controlled Part. Run 1	82.6	17.4	14.4	15.9

2.2.1 Uncontrolled TOC Emission Results

Uncontrolled TOC loadings (refer to Table 2-3) were 0.349, 0.051, 0.054, and 0.052 gr/DSCF for Runs 1, 2, 3, and 4 respectively. The average uncontrolled TOC loading was 0.052 gr/DSCF for Runs 2, 3, and 4. Run 1 uncontrolled TOC mass loading was not included in the average because the Run 1 controlled TOC loading test was collected under anisokinetic conditions (83%).

2.2.2 Controlled TOC Emission Results

Controlled TOC loadings (refer to Table 2-4) were 0.023, 0.025, 0.025, and 0.019 gr/DSCF for Runs 1, 2, 3, and 4 respectively. The average controlled TOC loading was 0.023 gr/DSCF for Runs 2, 3, and 4. Run 1 TOC data was not included in the average because the sample was collected under anisokinetic conditions.

2.2.3 Discussion of TOC Emission Results

The uncontrolled Run 1 TOC loading (0.349 gr/DSCF) was approximately 7 times greater than the average TOC loading (0.052 gr/DSCF) for Runs 2, 3, and 4. Reanalysis of the sample verified the higher TOC results. Uncontrolled Run 1 is believed to be an outlier due to possible contamination.

One of the objectives of this program was to determine the removal efficiency of the 0.1 N NaOH impingers. Based on data from Runs 2, 3, and 4, the average percentage of TOC collected in the first NaOH impinger sample relative to the total mass of TOC collected in the impinger train was 68.0 for the uncontrolled emissions tests and 83.4 for the controlled emission tests.

The venturi scrubber TOC removal efficiency was 93.9, 51.3, 56.0, and 61.8 percent for Runs 1, 2, 3, and 4, respectively. The average TOC removal efficiency across the venturi was 56.2 percent for Runs 2, 3, and 4.

2.3 POLYNUCLEAR AROMATIC HYDROCARBONS EMISSION TEST RESULTS

Polynuclear aromatic hydrocarbons (PAH) samples were collected in the uncontrolled and controlled air emissions, during this program, using an adaptation of EPA Method 5E. The technique, described in Section 5, includes the use of the Method 5E "front-half" (filter) for particulate collection and the "back-half" (XAD-2 resin) for adsorption of organic compounds. One set of uncontrolled and controlled PAH samples was collected during recycle operation.

During the preparation of the PAH emission samples for analysis, the extraction device malfunctioned and the solvent evaporated to dryness. As a result, the PAH emission samples were destroyed and no analysis could be performed. For this reason no gas phase PAH emission results are presented.

2.4 PARTICLE SIZE DISTRIBUTION RESULTS

An Andersen High Capacity Stack Sampler (AHCSS) was used during this program to determine the particle size distribution (PSD) of uncontrolled emissions. The AHCSS sizes particles aerodynamically and is designed to determine the PSD of gas streams with high grain loadings. The AHCSS collection stages allow for the collection of a greater mass of particulate matter as opposed to conventional impaction type PSD samplers. This in turn allows for the collection of sample over a longer and more representative period.

A total of three PSD runs were performed at Sloan. Of the three PSD runs, only two were valid because of a leak that developed in the impinger train during sampling. The results of the two uncontrolled PSD runs are presented graphically in Figure 2-1 and tabularly in Table 2-6. Based on the PSD data, the mass mean diameter for both PSD runs is greater than 15 μm.

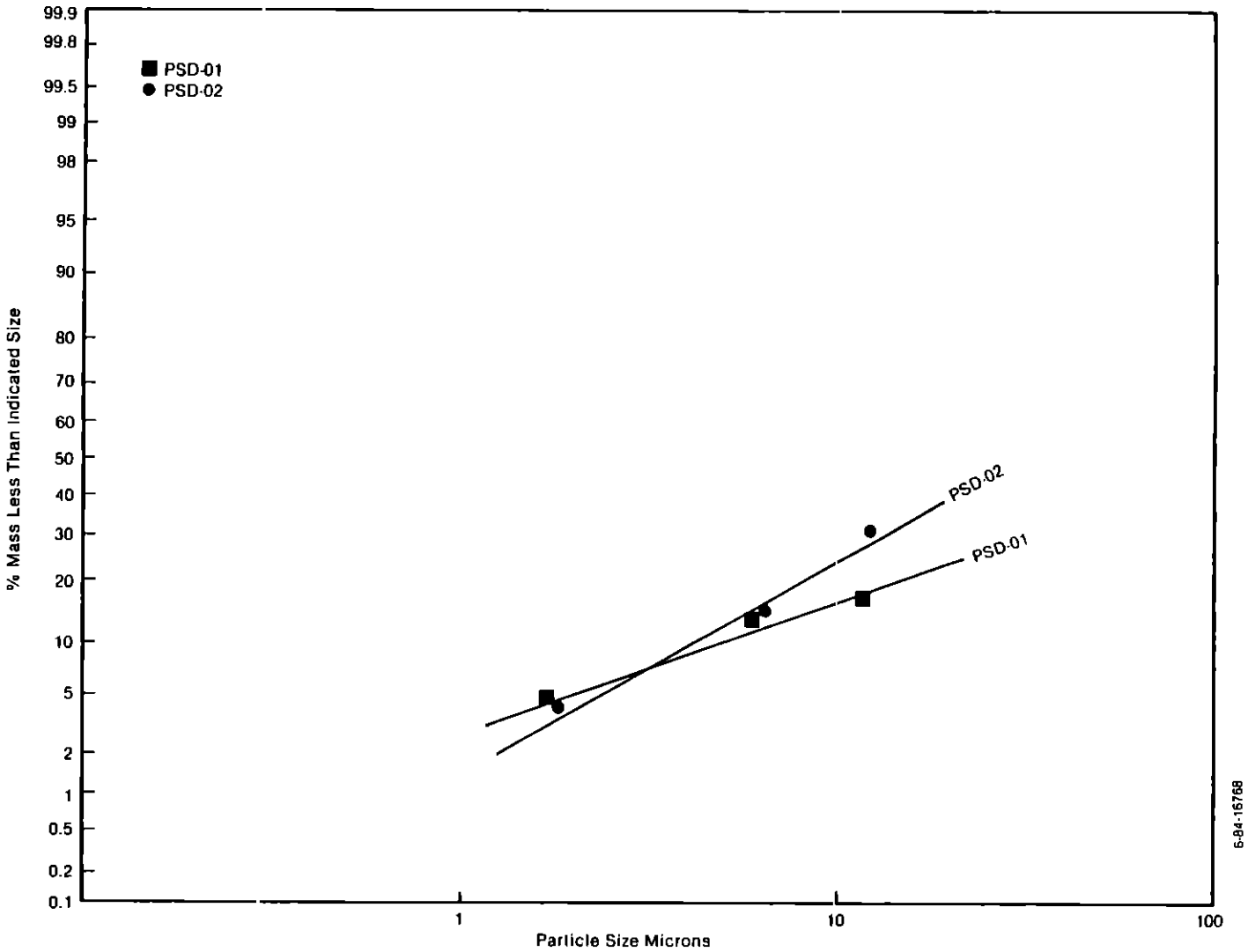

Figure 2-1. Particle Size Distribution Curves of Uncontrolled Emissions Collected during Recycle Operation.

TABLE 2-6. SUMMARY OF UNCONTROLLED PARTICLE SIZE DISTRIBUTION TESTS

Date	Time	Run No.	Flow Rate (ACFM)	Stage	Mass Collected	% in Size Range	Cumulative % Less than Size Range	Size Range (μm)	DP_{50} (μm)	Percent Isokinetic
5-10-84	1411-1545	PSD-01	0.584	1	4.6491	83.7	16.2	>11.8	11.8	96.2
				2	0.1629	2.9	13.3	6.0-11.8	6.0	
				cyclone	0.4727	8.5	4.8	1.7-6.0	1.7	
				filter	0.2676	4.8	--	<1.7	--	
5-11-84	1230-1400	PSD-02	0.549	1	5.6909	69.5	30.6	>12.1	12.1	96.0
				2	1.2100	14.8	15.8	6.4-12.1	6.4	
				cyclone	0.9406	11.5	4.3	1.8-6.4	1.8	
				filter	0.3505	4.3	--	<1.8	--	

2.5 VISIBLE EMISSIONS RESULTS

Visible emissions were measured by a certified reader during testing periods when a clear, blue sky was available. Visible emissions were not measured during test periods when overcast conditions existed. The blue sky background was required for detection of emissions caused by condensed hydrocarbons in the plume. Opacity readings are presented in Table 2-7. Visible emission results obtained during the four particulate/TOC loading runs are graphically presented in Figure 2-2, 2-3, 2-4, and 2-5.

The average opacity measurement was 8.4, 13.6, 12.5, and 9.8 during Runs 1, 2, 3, and 4 respectively. The maximum six-minute opacity measurement was 11.9, 17.5, 16.9, and 12.9 percent for Runs 1, 2, 3, and 4 respectively. The average opacity measurement during Runs 2, 3, and 4 was 12.0 percent.

2.6 SCRUBBER WATER MONITORING AND GRAB SAMPLE ANALYSIS RESULTS

This section presents results of scrubber water pH and temperature measurements and analytical results performed on scrubber water samples.

2.6.1 Scrubber Water pH and Temperature Results

Periodically during each sampling run, the pH and temperature of the venturi scrubber water influent and effluent were measured. Results of pH and temperature measurements during recycle operation are presented in Table 2-8. The average pH measurements for the venturi scrubber water influent were 6.16, 6.14, 6.12, 6.10, and 6.14 for particulate/TOC Runs 1, 2, 3, 4 and PAH Run 1, respectively. The average venturi scrubber water effluent pH readings corresponding to the above sampling runs were 5.80, 5.76, 5.74, 5.77, and 5.74, respectively.

The average venturi scrubber water influent temperatures were 137°F, 118°F, 138°F, 140°F, and 143°F for particulate/TOC Runs 1, 2, 3, 4 and PAH Run 1, respectively. The average corresponding scrubber water effluent

TABLE 2-7. OPACITY READINGS ON THE VENTURI SCRUBBER OUTLET

Date	Run Description	Time	Average Opacity for 6 Minutes	Date	Run Description	Time	Average Opacity for 6 Minutes
5-08-84	Part./TOC-1	1425-1430	10.2	5-10-84	Part./TOC-2	0800-0805	10,6
		1431-1436	8.5			0806-0811	12.3
		1437-1442	7.1				
		1443-1448	8.5			0818-0823	9.6
		1449-1454	10.6			0824-0829	12.7
		1455-1500	7.7			0830-0835	12.9
		1501-1506	8.8				
		1507-1512	6.2			0914-0919	10.6
		1513-1518	8.1			0920-0925	13.1
						0926-0931	12.3
		1555-1600	6.7			0932-0937	17.5
		1601-1606	7.3			0938-0943	14.4
		1607-1612	8.1				
						0946-0951	15.6
		1640-1645	5.4			0952-0957	17.5
		1646-1651	7.5			0958-1003	16.2
		1652-1657	5.4			1004-1009	11.8
		1658-1703	11.9			1010-1015	14.8
		1704-1709	9.2			1016-1021	16.2
		1710-1715	11.0			1022-1027	11.5
		1716-1721	11.4				
		1722-1727	11.2			Average	13.6
		1728-1733	8.1				
		1734-1739	7.9				
		1740-1745	6.9				
		Average	8.4				
5-10-84	Part./TOC-3	1139-1144	10.0	5-10-84	Part./TOC-4	1540-1545	7.7
		1145-1150	12.7			1546-1551	6.7
		1151-1156	12.5			1552-1557	7.7
		1157-1202	11.2			1558-1603	8.3
		1203-1208	12.7			1604-1609	10.6
		1209-1214	7.3			1610-1615	12.9
		1323-1328	13.3			1623-1628	11.0
		1329-1334	15.0			1629-1634	7.5
		1335-1340	16.9			1635-1640	10.2
		1341-1346	7.3			1641-1646	10.6
		1347-1352	13.1			1647-1652	11.4
		1353-1358	13.3			1653-1659	12.9
		1359-1404	14.1				
		1405-1410	15.2			Average	9.8
		Average	12.5				

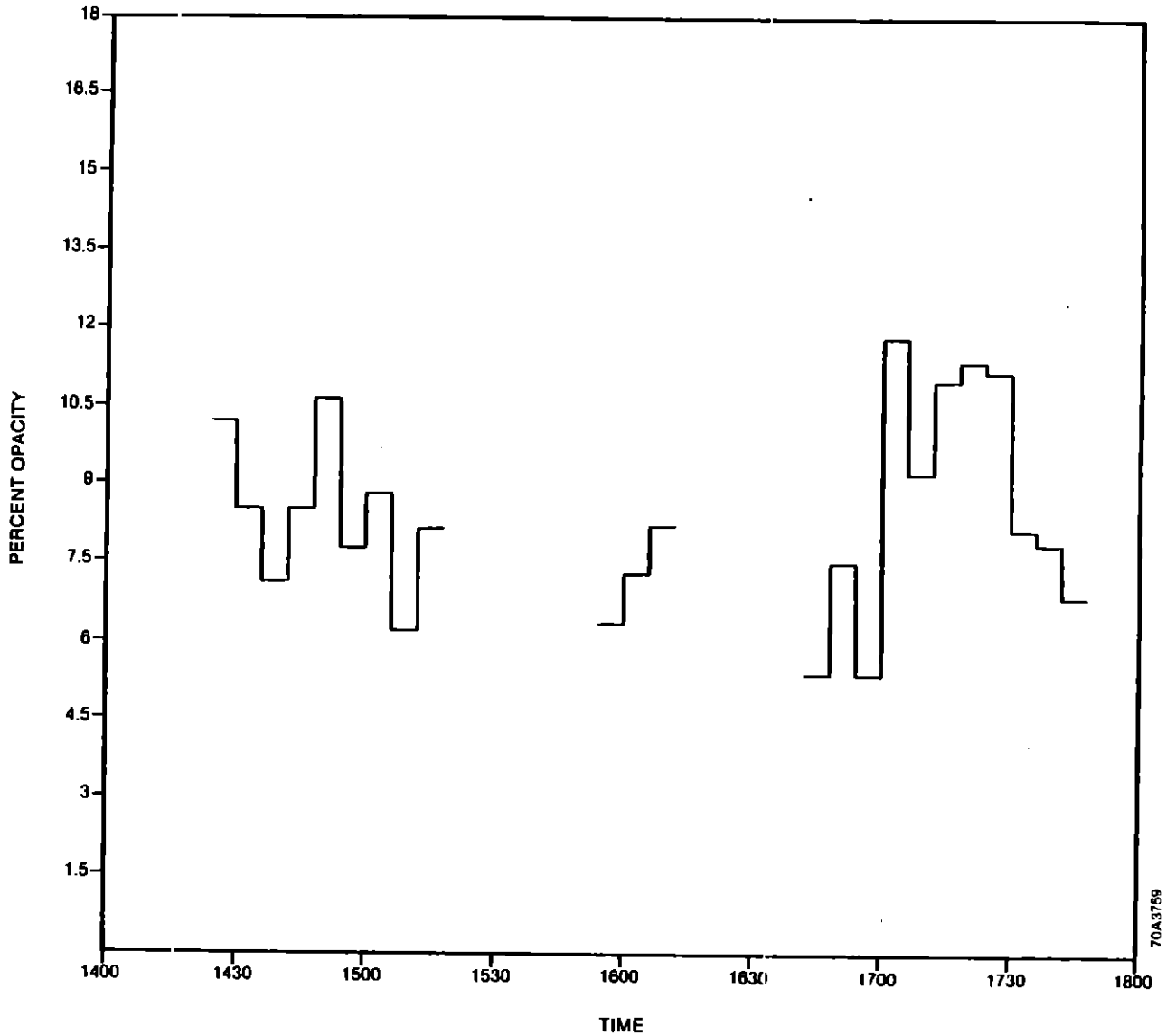

Figure 2-2. Six-Minute Averages of the Visible Emissions from the Venturi Scrubber Stack during Particulate/TOC Run 1 at the Sloan Construction Company Asphalt Concrete Plant, Cocoa, Florida on May 8, 1984.

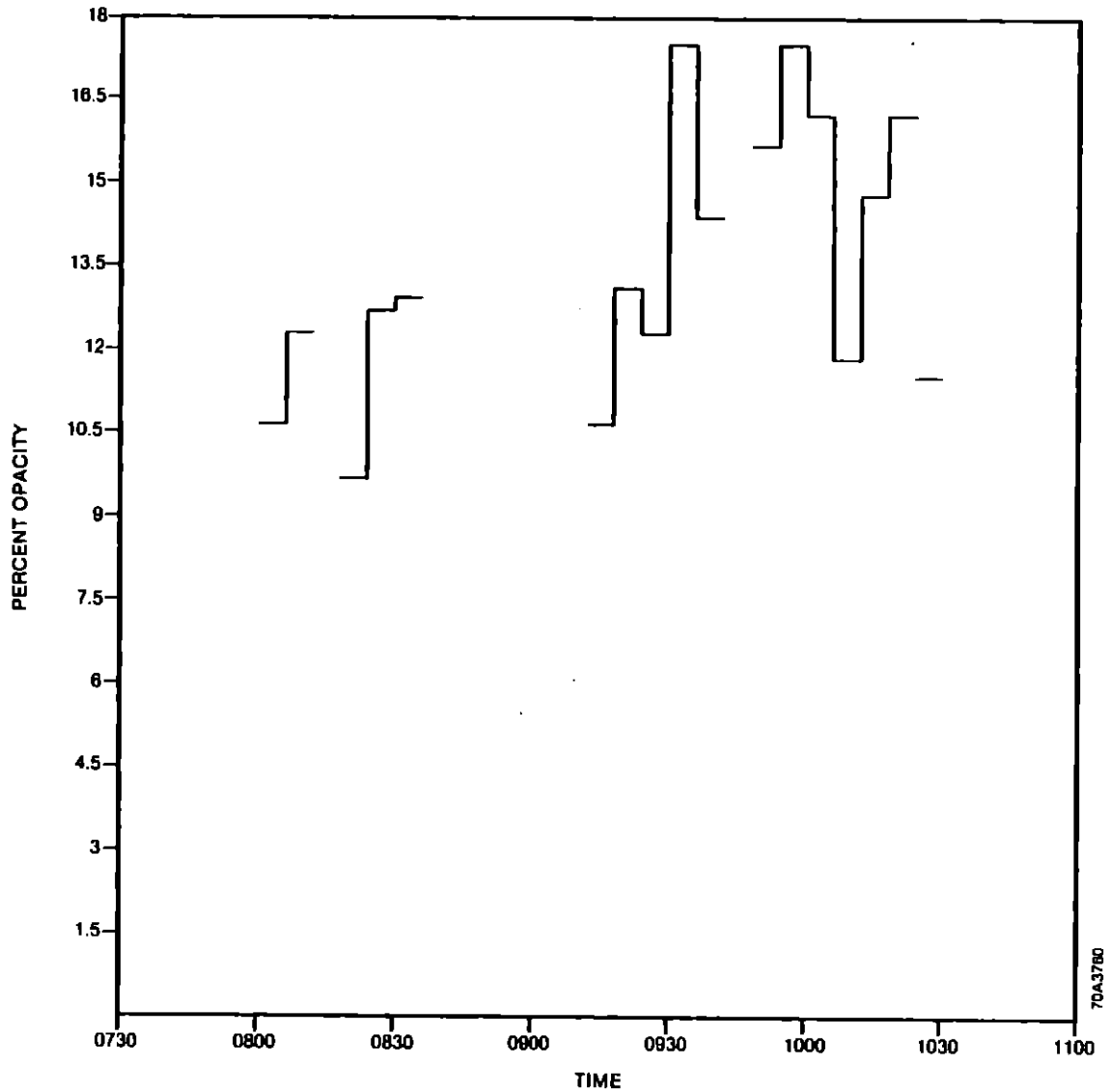

Figure 2-3. Six-Minute Averages of the Visible Emissions from the Venturi Scrubber Stack during Particulate/TOC Run 2 of the Sloan Construction Company Asphalt Concrete Plant, Cocoa, Florida on May 10, 1984.

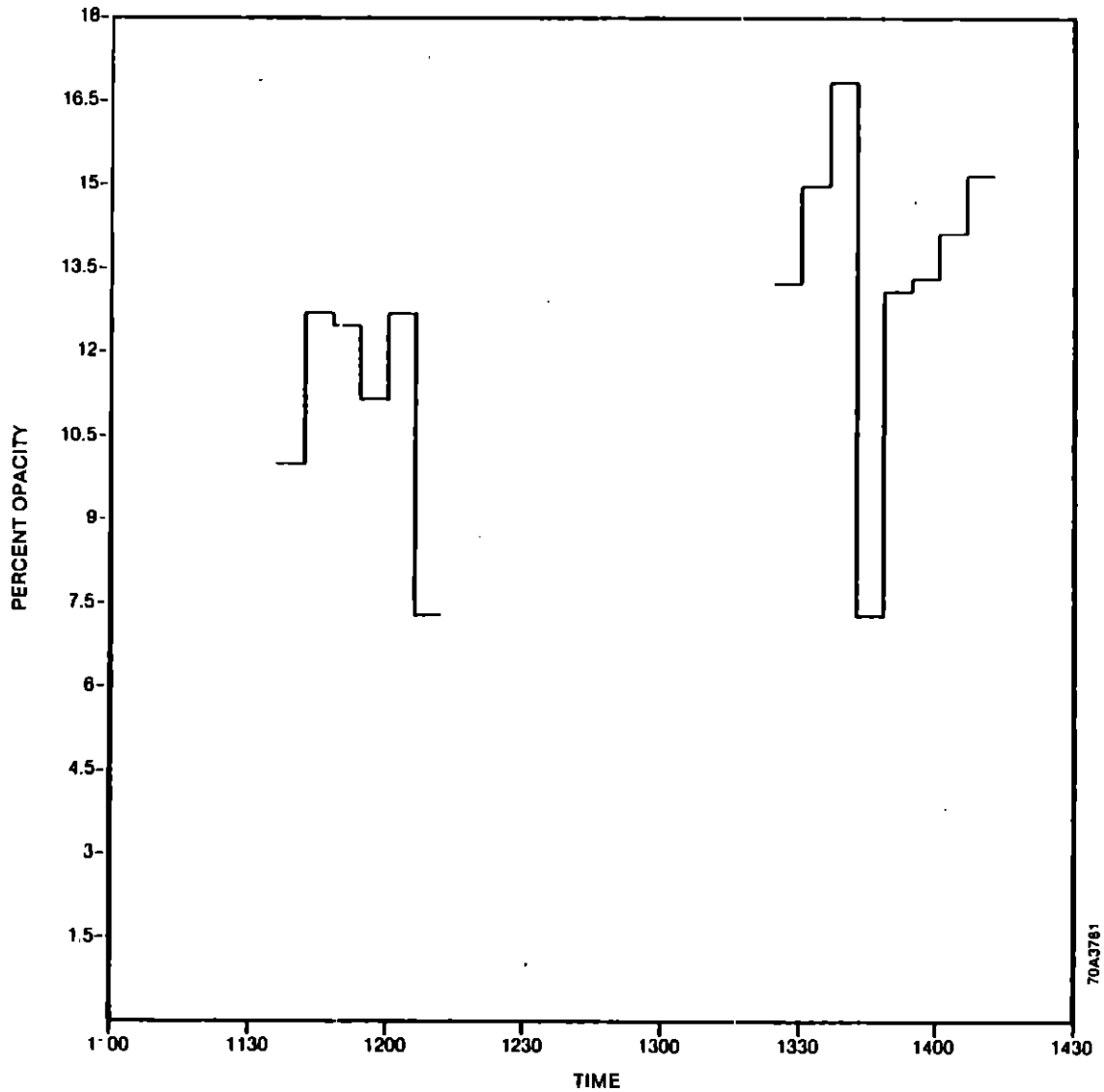

Figure 2-4. Six-Minute Averages of the Visible Emission from the Venturi Scrubber Stack during Particulate/TOC Run 3 at the Sloan Construction Company Asphalt Concrete Plant, Cocoa, Florida on May 10, 1984.

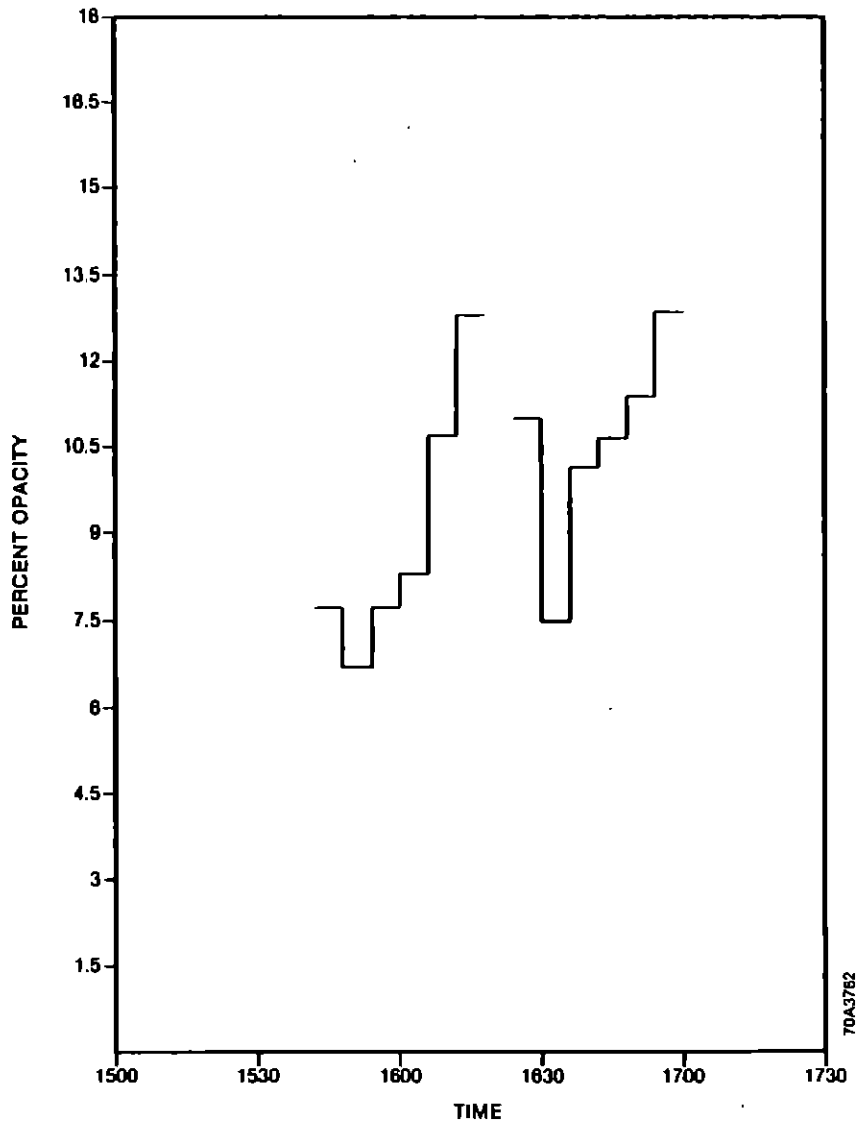

Figure 2-5. Six-Minute Averages of the Visible Emissions from the Venturi Scrubber Stack during Particulate/TOC Run 4 at the Sloan Construction Company Asphalt Concrete Plant, Cocoa, Florida on May 10, 1984

temperatures were 156°F, 150°F, 157°F, 156°F, and 158°F, respectively. Also included in Table 2-8 are pond temperature data collected by MRI personnel.

2.6.2 Scrubber Water Analytical Results

During each sampling run, at least two venturi scrubber water influent and effluent samples were collected. The grab samples during each run were composited and then filtered to determine total suspended solids. An aliquot of the filtrate was then analyzed for dissolved solids. The remaining filtrate was analyzed for TOC and polynuclear aromatic hydrocarbons and major organics.

Table 2-9 presents the scrubber water analytical results. Total suspended solids (TSS) concentrations for the venturi scrubber water influent samples were 57.3, 18.0, 33.5, 48.8, and 110 mg/l for particulate/TOC Runs 1, 2, 3, 4, and PAH Run 1, respectively. The corresponding total dissolved solids (TDS) concentrations were 14,700; 12,100; 13,000; 13,800; and 14,200 mg/l. TSS concentrations for the venturi scrubber water effluent samples were 1970, 864, 774, 960, and 1040 mg/l for particulate/TOC Runs 1, 2, 3, 4 and PAH Run 1, respectively. The corresponding TDS concentrations were 15,000; 12,300; 13,400; 14,200; and 14,100 mg/l.

Polynuclear aromatic hydrocarbons were not detected in the scrubber water samples collected during PAH Run 1. The major organic species quantified in the scrubber water samples are included in Table 2-9.

2.7 PROCESS SAMPLING RESULTS

During each test period, samples of virgin aggregate and recycled asphalt pavement were collected and analyzed for percent moisture. Care was taken to obtain a representative sample. To accomplish this a large sample (approximately 10 pounds) was collected and coned-and-quartered to yield 500-700 grams for analysis. Table 2-10 presents moisture values of the virgin aggregate and RAP samples. The percent moisture by weight values

TABLE 2-8. SUMMARY OF SCRUBBER WATER pH AND TEMPERATURE MEASUREMENTS

Date	Run Number	Time	Water to Venturi pH	Water to Venturi Temperature (°F)	Venturi Exit Water pH	Venturi Exit Water Temperature (°F)	Pond Water[a] Temperature Inlet	Pond Water[a] Temperature Outlet
5-08-84	Part./TOC-1	1440-1445	6.28	134	5.87	154	136	154
		1555-1559	6.11	136	5.77	157	136	154
		1650-1655	6.10	140	5.75	156	139	154
		Average	6.16	137	5.80	156	137	154
5-10-84	Part./TOC-2	0820-0825	6.25	111	5.75	147	---	---
		0945-0950	6.02	126	5.77	152	126	152
		Average	6.14	118	5.76	150	126	152
5-10-84	Part./TOC-3	1144-1148	6.09	143	5.75	158	143	158
		1332-1336	6.16	132	5.73	156	134	156
		Average	6.12	138	5.74	157	138	157
5-10-84	Part./TOC-4	1540-1545	6.09	140	5.74	156	140	156
		1644-1647	6.12	140	5.80	156	140	155
		Average	6.10	140	5.77	156	140	156
5-11-84	PAH Run 1	1112-1116	6.28	142	5.86	157	144	157
		1230-1232	6.00	144	5.61	158	144	158
		Average	6.14	143	5.74	158	144	158

[a]Data recorded by MRI personnel.

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TABLE 2-9. SUMMARY OF SCRUBBER WATER ANALYTICAL RESULTS

Sample Type	Part Run 1 0508		Part Run 2 0510		Part Run 3 0510		Part Run 4 0510		PAH Run 1 0510		Average	
	Water to Venturi	Venturi Exit Water	Water to Venturi	Venturi Exit Water	Water to Venturi	Venturi Exit Water	Water to Venturi	Venturi Exit Water	Water to Venturi	Venturi Exit Water	Water to Venturi	Venturi Exit Water
pH	6.16	5.80	6.14	5.76	6.12	5.74	6.10	5.77	6.14	5.74	6.14	5.76
Temperature °F	137	156	118	150	138	157	140	156	143	158	135	155
Total Organic Carbon Results												
mg/l (as C)	1120	1110	830	920	930	960	990	950	—	—	970	980
Total Solids Results												
Suspended Solids												
mg/l	57.3	1970	18.0	864	33.5	774	48.8	960	110	1040	53.5	1120
Dissolved Solids												
mg/l	14,700	15,000	12,100	12,300	13,000	13,400	13,800	14,200	14,200	14,100	13,600	13,800
Polynuclear Aromatic Hydrocarbon Results												
Active Carcinogenic[b] Series (µg/l)												
Benz(a)anthracene									ND	ND		
Chrysene									ND	ND		
Benzo(o)fluoranthene									ND	ND		
Benzo(j)fluoranthene									ND	ND		
Benzo(e)pyrene									ND	ND		
Benzo(a)pyrene									ND	ND		
Indeno(1,2,3-c,d) pyrene									ND	ND		
Non-active Carcinogenic Series (µg/l)												
Phenanthrene									ND	ND		
Anthracene									ND	ND		
Fluoranthene									ND	ND		
Pyrene									ND	ND		
Benzo(k)fluoranthene									ND	ND		
Perylene									ND	ND		
Benzo(g,h,i)perylene									ND	ND		
Major Organic Species (µg/l)												
Phenol									670	870		
Cresol									97	200		
Methoxy phenol									60	54		
C_2-Phenol									46	69		
Unknown[a]									75	46		
Unknown									60	ND		
C_4-Benzene									120	190		
C_3-Phenol									106	170		
Hydroxymethoxy-phenyl ethanone									100	200		
Unknown									70	57		
Unknown									ND	56		

[a]Unknown compounds quantified by relative response factor.
[b]Furoma. David. et al.

TABLE 2-10. SUMMARY OF PROCESS SAMPLE MEASUREMENTS

		Virgin Aggregate			Recycled Asphalt Pavement		
Run Number	Date	Time	Sample Wt.(g)	Moisture by Weight (%)	Time	Sample Wt.(g)	Moisture by Weight (%)
Part./TOC-1	0508	1515	466	4.14	1615	462	2.64
Part./TOC-2	0510	0920	454	5.91	0930	452	1.64
Part./TOC-3	0510	1200	461	6.44	1325	458	1.88
Part./TOC-4	0510	1600	564	5.73	1615	885	1.80
PAH/Run 1	0511	1140	799	5.93	1150	600	2.42
Average	--	--	549	5.63	--	571	2.08

were 4.14, 5.91, 6.44, 5.73, and 5.93 for the virgin aggregate and 2.64, 1.64, 1.88, 1.80, and 2.42 for the RAP collected during particulate/TOC Runs 1, 2, 3, 4, and PAH Run 1, respectively.

Samples of RAP were also collected during each test period for smoke point determination. Each RAP sample was analyzed by the Oklahoma Testing Laboratory and by Radian. The RAP smoke point test results are recorded in Table 2-11. RAP smoke point test results obtained by the Oklahoma Testing Laboratory ranged from 330°F to 350°F with an average of 341°F. RAP smoke point test results obtained by Radian ranged from 360°F to 373°F with an average of 368°F.

A sample of the asphalt cement (AC) used by the plant was collected for smoke point and flash point analysis. The AC smoke point and flash point analysis was performed by the Oklahoma Testing Laboratory and the results are included in Table 2-11.

TABLE 2-11. SUMMARY OF RECYCLE ASPHALT PAVEMENT (RAP) SMOKE POINT RESULTS AND ASPHALT CEMENT (AC) SMOKE POINT AND FLASH POINT RESULTS

Collection Date	Time	Sample Type	Oklahoma Testing Smoke Point °F	Radian Smoke Point °F	Flash[a] Point °F
5-08-84	1615	RAP	350	360	--
5-10-84	0930	RAP	340	370	--
5-10-84	1325	RAP	340	373	--
5-10-84	1615	RAP	330	370	--
5-11-84	1130	RAP	345	367	--
5-10-84	0830	AC	360	--	580

[a]Flash Point Analysis performed by Oklahoma Testing Laboratory.

SECTION 3

3.0 PROCESS DESCRIPTION AND OPERATION

This section provides a brief description of the asphalt concrete plant operated by the Sloan Construction Company in Cocoa, Florida. The procedures used to monitor the operation of the asphalt concrete plant and the process parameters recorded during recycle emissions testing are also presented in this section.

3.1 PROCESS DESCRIPTION

A description of the Sloan asphalt concrete plant (including the emissions control system) is presented in this section.

3.1.1 Process Equipment Description

Sloan Construction Company operates an ASTEC drum-mix asphalt concrete plant on Clear Lake Road off State Highway 528 (Beeline Expressway) near Cocoa, Florida (refer to Figure 1-1). The plant was installed in 1981. Table 3-1 presents a summary of technical data on the Sloan asphalt concrete plant.

The ASTEC drum at Sloan is 42 feet long and 7 feet in diameter. The Sloan plant utilizes four cold feed bins: two for RAP, one for virgin aggregate, and one for sand. The virgin aggregate and sand enter the burner end of the rotating drum. The RAP enters the rotating drum through a collar around the center of the drum. Fuel for the burner is No. 5 fuel oil.

TABLE 3-1. TECHNICAL DATA ON THE ASPHALT CONCRETE PLANT OPERATED BY THE SLOAN CONSTRUCTION COMPANY, COCOA, FLORIDA

Type plant	Drum-mix
Manufacturer	ASTEC
Percent RAP on current project	51
Estimated completion date for current project	May 31, 1984
Year installed	1981
Design capacity, tph (% moisture)	293 (4) 252 (5) 221 (6) 196 (7) 176 (8)
Dryer fuel	No. 5 fuel oil[a]
Firing rate, gal/ton	1.5-2.5[b]
Burner manufacturer	Hauck
Drum size,	
Length, ft	42
Diameter, ft	7
Recycle entrance point	Mid drum
AC injection point (ft upstream from discharge end of drum)	11-17
Asphalt type	Chevron HMA-175
Smoke point, °F[c]	>400
Blue haze observed?[d]	Yes

[a]Heat content of No. 5 fuel oil was reported by Mr. Sherrill to be 44,000 Btu/gal.

[b]Dependent on moisture content and production rate.

[c]Estimated by Mr. Sherrill.

[d]During testing.

Asphalt cement is injected into the drum at a point approximately 4 to 10 feet downstream from the RAP collar. The liquid asphalt is stored in a heated storage container maintained at about 230°F. The final product exiting the drum is transported by conveyor to a temporary holding silo where the product is loaded onto trucks for transportation.

3.1.2 Emission Control System Description

Figure 3-1 illustrates the emission control system (venturi scrubber) used by Sloan. Process emissions from the drum-mixer exit the discharge end of the drum and enter a knockout box to remove some of the larger particles by reducing the air velocity. From here the emissions are ducted up from the top face of the knockout box through an approximately 3-foot diameter, inverted U- or V-shape duct and back down to the venturi scrubber. This duct consists of three elbows separated by two approximately 6-foot long, straight duct sections.

Specifications for the wet venturi scrubber are listed in Table 3-2. Scrubber water is injected through a nozzle spray bar located just prior to the venturi throat. The venturi pressure drop is variable from 15 to 21 inches of water column. Upon exiting the scrubber, the process gases enter a horizontal water knockout drum and then pass through the induced draft (I.D.) fan. Water sprays are located in the fan housing to help prevent the buildup of material on the fan blades. The process gases exit the fan into a tangential-entry, 10-foot diameter knockout box, pass through straightening vanes, and out a 4-foot diameter steel stack.

Scrubber water is contained in two adjacent earthen ponds that are interconnected by means of an 8-inch diameter PVC pipe. One pond is 18 feet by 60 feet and the other is 24 feet by 60 feet. Scrubber effluent flows into the end of one pond while scrubber supply water is pumped from the other pond. The dike dividing the two ponds serves as a weir to reduce the suspended particulate matter in the scrubber supply pond. Pond make-up water is supplied from the water table which is about 1 foot below the ground surface in this

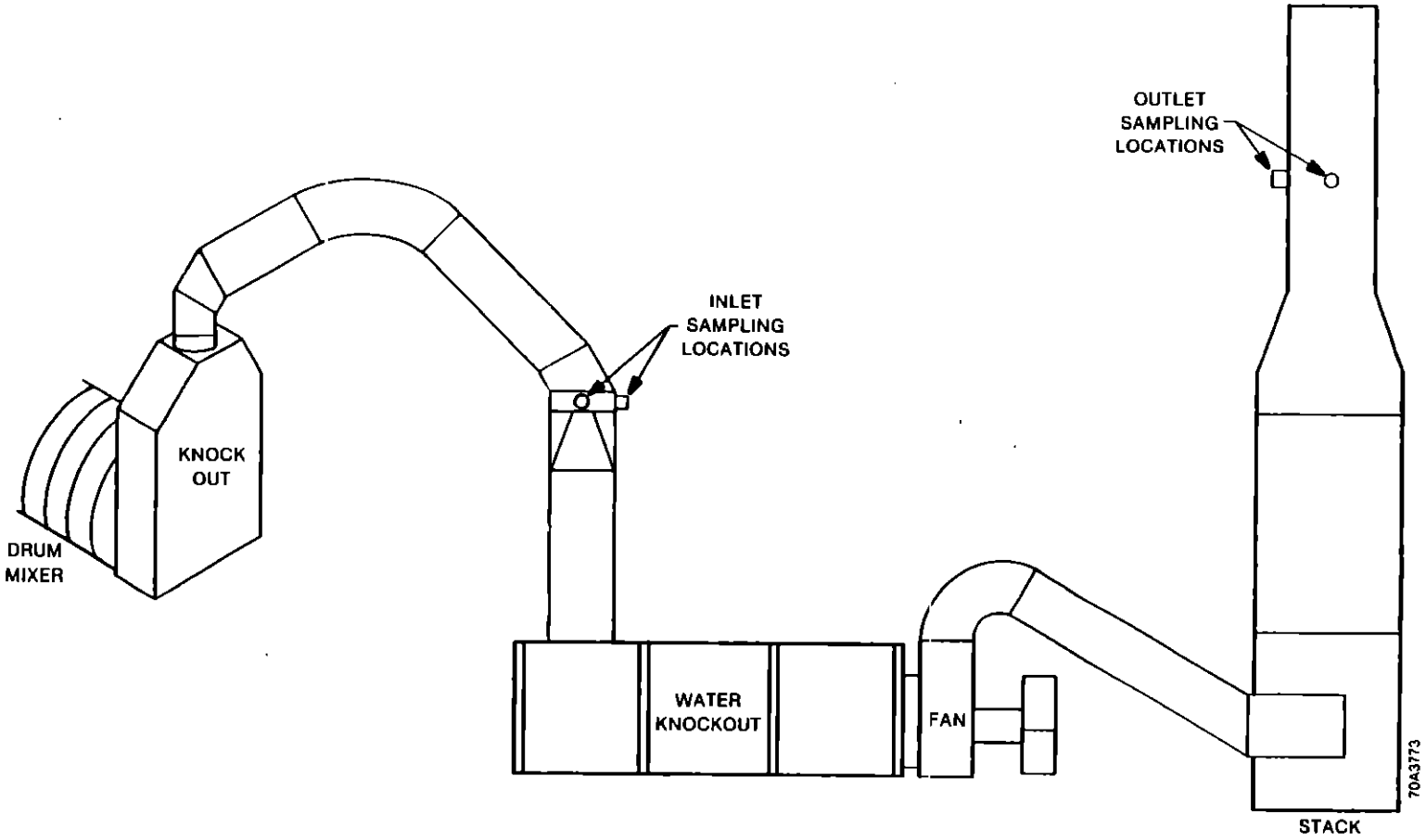


Figure 3-1. Schematic of Emission Control System Used at the Sloan Asphalt Concrete Plant, Cocoa, Florida.

TABLE 3-2. TECHNICAL DATA ON THE WET VENTURI SCRUBBER AT THE SLOAN PLANT, COCOA, FLORIDA

Type scrubber	Venturi
Manufacturer	ASTEC
Date installed	1981
Design air flow, acfm	43,000
Water circulation rate, gpm	300-400
Makeup water source	Water table
Scrubber water discharge temp, °F[a]	140-160
Scrubber pond temp at surface, °F[a]	100-145
Scrubber outlet	4-ft diameter circular steel stack with sampling ports
Scrubber inlet	3-ft diameter circular steel duct
Blue haze observed?[a]	Yes

[a]During test period.

area. Plant personnel believed the ponds to be about 10 feet deep. Crude measurements made at the time of testing indicated the ponds were approximately 5 feet deep.

Sloan personnel do not normally treat the pond water in any manner, so it was not treated during this test. (Scrubber pond water can be treated with a floculant to remove suspended solids or with lime to control the pond water pH.)

3.2 PROCESS OPERATION

Operation of the Sloan plant is typical of other drum-mix plants. During testing, the plant operated about 11 hours per day and was resurfacing a section of Interstate 95. Limestone aggregate and local sand were used at the Sloan plant during testing. The RAP was obtained from the section of I-95 being resurfaced. The asphalt cement used during the test period was Chevron HMA-175 which was stored and used at about 230°F. Chevron HMA is a basic asphalt to which light Arabian crude is added and is available in a number of viscosities. The viscosity of Chevron HMA actually used is dependent upon the viscosity of the RAP being utilized.

The rate of asphalt concrete production is dependent upon the temperature of the product and the moisture content of the raw feed material. The maximum rated capacity of the Sloan plant is 293 tons per hour with a feed moisture content of 1-2 percent.

3.3 PROCESS MONITORING DURING THE EMISSION TEST PROGRAM

Operation of the drum-mix asphalt plant was monitored by MRI personnel during emission test periods. The sampling crew from Radian set up equipment and prepared for testing on Monday, May 7, 1984. The plant was not operating on this date. Testing began on May 8, 1984; however, the controlled emissions results during the first day's test were not acceptable because the sampling was

performed at less than 90 percent of the prescribed isokinetic sampling rate. Rain prevented the plant from operating on May 9, 1984, so no tests were performed. The majority of the testing was done of May 10 and 11, 1984. Tables 3-3, 3-4, and 3-5 contain a summary of the process data collected during the test periods on May 8, 10, and 11, respectively.

Two barometers were available at the plant during the testing; one supplied by EPA/EMB, and the other by the Radian sampling crew. These barometric readings differed consistently by 0.28 in. Hg. Averaged values are presented in Tables 3-3, 3-4, and 3-5. Charts recording the mix temperature during plant operation and testing on May 10 and 11, 1984, are shown in Figure 3-2. The final product temperature during testing was about 290°F. The product mix sieve analyses results for May 8, 10, and 11 are shown in Table 3-6.

As noted in Tables 3-3, 3-4, and 3-5, problems encountered with plant operation included shortages of sand and aggregate in the hoppers, clogging of the RAP feed, power failures, truck shortages, and a broken ram to operate a bin door. It should be noted that shortages of sand and/or aggregate in the dryer drum resulted in a sudden increase in mix temperature and the emission of dense clouds of light tan smoke.

3.4 EMISSION CONTROL SYSTEM MONITORING

MRI personnel monitored the operation of the venturi scrubber emission control system during the test periods. Emission control system parameters that were monitored during testing included:

- venturi scrubber pressure drop,
- venturi inlet gas temperature,
- total scrubber water flow to the scrubber system, and
- the scrubbet water inlet and outlet temperature.

A summary of the venturi scrubber operating data collected during the test program is presented in Tables 3-3, 3-4, and 3-5.

TABLE 3-3. SUMMARY OF PROCESS AND CONTROL DEVICE OPERATING DATA COLLECTED DURING EMISSION TESTING AT THE SLOAN ASPHALT CONCRETE PLANT, COCOA, FLORIDA - MAY 8, 1984

Time Hr:Min	Mix Production Rate, (tph)	Virgin Feed Rate, (tph)	RAP Feed Rate, (tph)	Asphalt Feed Rate, (tph)	Mix Temp., (°F)	Burner Setting, (%)	Fuel Consumption Rate, (gpm)	Venturi Scrubber ΔP (in. H_2O)	Venturi Inlet Gas Temp., (°F)	Scrubber Water Flow Rate, (gpm)	Scrubber Water Temp., (°F) In	Scrubber Water Temp., (°F) Out	Blue Haze Present	Ambient Air Temp., (°F) Wet	Ambient Air Temp., (°F) Dry	Ambient Air Relative Humidity (%)	Barometer Pressure (in. Hg)	Wind Speed (mph)	Wind Dir.	Comments
10:35	184	88	92	4.0	210	50	5.5	18	280	370	108	144	Yes	75	86	60	30.16	1	N	
10:40	184	90	90	4.0	212	50	5.5	19	300	370				75	86	60	30.15	1	N	
10:54	190	93	93	4.1	213	50	5.5	19	280	370			No							
11:15	189	90	95	4.1	218	45	5.0	17	280	370	120	143	No							
11:30	188	91	93	4.1	219	45	4.8	15	273	370	124	145	Yes	74	85	59	30.15	1	N	Blue haze is slight
11:45	190	90	95	4.5	214	44	4.8	19	274	370	127	145	Yes	74	86	57	30.13	1	N	Power failure 1:30-1:50 p.m.
1:15	213	100	107	5.7	294	80	5.8	21	280	370	134	152	Yes							
2:23	204	96	103	5.1	285	60	5.4	17	275	375	135	154	Yes							
2:30	206	98	103	5.2	296	52	5.4	16	277	375	135	154	Yes	79	89	64	30.07	3	W	
2:45	211	100	105	5.5	280	62	5.4	17	280	375	136	154	Yes							
3:00	209	97	107	5.3	275	56	5.2	15	278	370	136	154	Yes							
3:15	214	99	110	5.4	291	64	5.5	21	275	370	137	154	Yes	77	85	69	30.04	4	W	
3:50	205	95	105	5.2	294	80	5.8	10	275	380	136	154	Yes							Water in manometer line
4:00	205	98	102	5.2	277	75	5.7	15	275	380	136	157	Yes	77	85	69	30.03	3	W	
4:15	213	99	109	5.5	296	75	5.8	15	275	380	137	155	Yes							
4:30	210	100	105	5.3	289	70	5.8	21	280	370	139	155	Yes							
4:45	203	98	100	5.1	287	56	5.2	21	275	380	139	154	Yes							
5:00	210	97	108	5.2	293	62	5.5	21	275	380	139	114	Yes	77	86	66	30.02	4	W	
5:15	214	99	110	5.4	233	62	5.5	21	275	380	140	155	Yes							
5:30	209	97	107	5.2	293	62	5.4	20	285	380	140	155	Yes							
5:42	214	99	110	5.1	298	55	5.2	21	278	380	141	153	Yes	75	83	68	30.01	10	W	

Notes:

1. Moisture content of aggregate = 4 percent; moisture content of RAP = 2.5 percent.
2. Water flow rate is average of readings from Sloan's meter and Radian's meter. (Sloan's meter read 20 gpm lower than Radian's)
3. Barometric pressure is average of readings from two barometers which differed by about 0.28 in Hg.

TABLE 3-4. SUMMARY OF PROCESS AND CONTROL DEVICE OPERATING DATA COLLECTED DURING EMISSION TESTING AT THE SLOAN ASPHALT CONCRETE PLANT, COCOA, FLORIDA - MAY 10, 1984

Time Hr:Min	Mix Production Rate, (tph)	Virgin Feed Rate, (tph)	RAP Feed Rate, (tph)	Asphalt Feed Rate, (tph)	Mix Temp., (°F)	Burner Setting, (%)	Fuel Consumption Rate, (gpm)	Venturi Scrubber ΔP (in. H_2O)	Venturi Inlet Gas Temp., (°F)	Scrubber Water Flow Rate, (gpm)	Scrubber Water Temp., (°F) In	Scrubber Water Temp., (°F) Out	Blue Haze Present	Ambient Air Temp. (°F) Wet	Ambient Air Temp. (°F) Dry	Ambient Air Relative Humidity (%)	Barometer Pressure (in. Hg)	Wind Speed (mph)	Wind Dir.	Comments
8:00	175	82	89	4.4	292	62	5.3	17	290	360	107	142	Yes	60	62	88	30.14	1	SE	
8:15	191	88	98	4.8	288	62	5.3	17	285	360	112	144	Yes	60	65	74	30.14	1	SE	
8:30	195	90	100	5.0	288	62	5.3	17	285	360	---	---	Yes							Plant down 8:33-9:05 due to truck shortage. Blue haze is slight.
9:15	186	86	96	4.8	281	62	5.3	17	280	360	119	148	Yes	64	70		30.14	1	SE	
9:30	190	87	98	4.6	291	64	5.3	17	280	360	121	148	Yes							
9:45	175	81	90	4.4	287	64	5.3	17	280	360	126	152	Yes							Blue haze is slight.
10:00	183	86	92	4.7	303	58	5.3	17	285	360	130	151	Yes	63	73	57	30.16	1	SSW	
10:15	184	85	94	4.7	298	60	5.3	17	283	360	129	151	Yes							
10:25	217	100	113	5.2	287	70	5.3	16	280	360	133	155	Yes	62	73	53	30.18	1	S	
11:15	213	97	111	5.6	283	100	5.5	21	278	370	139	159	Yes	62	75	47	30.19	3	SE	
11:30	201	93	103	5.1	299	92	5.5	22	284	360	141	158	Yes							
11:45	207	95	107	5.2	282	75	5.5	22	280	360	143	158	Yes							
12:00	197	91	101	5.1	294	68	5.5	21	283	360	140	155	Yes							
12:15	215	99	111	5.4	267	100	5.6	22	270	360	143	163	Yes	62	75	47	30.17	2	SE	Plant down due to broken ram from 12:16-1:19
1:20	189	87	97	5.0	278	72	5.3	17	280	370	136	156	Yes	64	77	48	30.17	1	S	
1:30	181	84	92	4.6	299	64	5.3	17	285	370	134	156	Yes	64	77	48	30.17	1	S	
1:45	184	86	93	4.7	292	64	5.3	17	284	370	133	155	Yes							
2:00	190	87	98	4.7	298	80	5.4	16	286	370	135	156	Yes							
2:15	193	90	98	5.0	295	72	5.3	21	290	370	137	154	Yes							
2:30	183	84	94	4.6	293	54	5.0	21	286	360	137	152	Yes	64	77	48	30.15	2	S	Plant down 2:45-2:55
3:00	197	91	101	5.0	288	55	5.2	21	285	360	138	153	Yes							
3:15	195	89	101	5.0	292	58	5.2	19	280	360	139	155	Yes							
3:30	198	91	102	5.0	294	63	5.2	21	275	360	138	155	Yes	63	76	48	30.15	1	S	
3:45	206	95	106	5.2	284	58	5.2	21	273	360	140	156	Yes							
4:00	204	94	105	5.1	287	60	5.2	20	273	360	140	155	Yes							

TABLE 3-4 (continued)

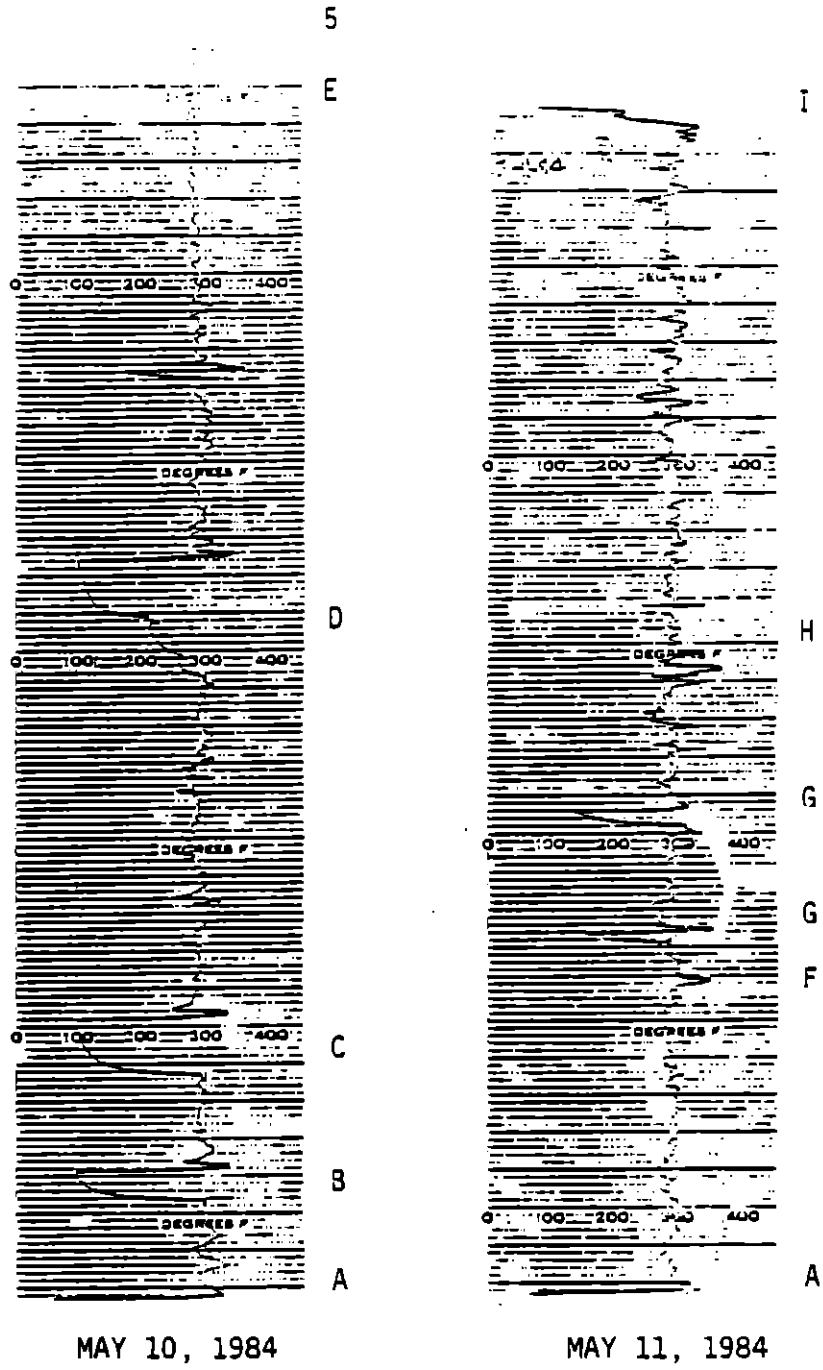
Time Hr:Min	Mix Production Rate, (tph)	Virgin Feed Rate, (tph)	RAP Feed Rate, (tph)	Asphalt Feed Rate, (tph)	Mix Temp., (°F)	Burner Setting, (%)	Fuel Consumption Rate, (gpm)	Venturi Scrubber ΔP (in. H_2O)	Venturi Inlet Gas Temp., (°F)	Scrubber Water Flow Rate, (gpm)	Scrubber Water Temp., (°F) In	Scrubber Water Temp., (°F) Out	Blue Haze Present	Ambient Air Temp. (°F) Wet	Ambient Air Temp. (°F) Dry	Ambient Air Relative Humidity (%)	Barometer Pressure (in. Hg)	Wind Speed (mph)	Wind Dir.	Comments
4:15	202	93	104	5.1	281	60	5.2	20	275	360	141	145	Yes							
4:30	213	99	108	5.7	278	66	5.2	20	283	360	139	155	Yes	64	76	52	30.15	1	S	
4:45	204	94	105	5.2	284	67	5.2	20	283	370	140	155	Yes							
5:00	201	93	103	5.2	282	67	5.2	20	285	360	140	156	Yes	64	76	52	30.15	1	S	

Notes:
1. Moisture content of aggregate = 4.5 percent; moisture content of RAP = 2.5 percent.
2. Water flow rate is reading from Sloan's meter plus 10 gpm to correct to readings in Table 4. (Radian's meter would not operate.)
3. Barometric pressure is average of readings from two barometers which differed by about 0.28 in Hg.

TABLE 3-5. SUMMARY OF PROCESS AND CONTROL DEVICE OPERATING DATA COLLECTED DURING EMISSION TESTING AT THE SLOAN ASPHALT CONCRETE PLANT, COCOA, FLORIDA - MAY 11, 1984

Time Hr:Min	Mix Production Rate, (tph)	Virgin Feed Rate, (tph)	RAP Feed Rate, (tph)	Asphalt Feed Rate, (tph)	Mix Temp., (°F)	Burner Setting, (%)	Fuel Consumption Rate, (gpm)	Venturi Scrubber ΔP (in. H_2O)	Venturi Inlet Gas Temp., (°F)	Scrubber Water Flow Rate, (gpm)	Scrubber Water Temp., (°F) In	Scrubber Water Temp., (°F) Out	Blue Haze Present	Ambient Air Temp., (°F) Wet	Ambient Air Temp., (°F) Dry	Ambient Air Relative Humidity (%)	Barometer Pressure (in. Hg)	Wind Speed (mph)	Wind Dir.	Comments
8:15	198	90	103	5.1	296	90	5.5	16	290	340	129	154	No							
8:30	196	92	100	4.4	292	90	5.5	16	290	340	133	154	Yes	65	73	65	30.18	2	S	Blue haze developed between 8:15 and 9:15.
8:45	199	94	110	5.3	285	92	5.5	17	285	350	136	157	Yes							
9:00	207	95	107	5.2	288	94	5.5	15	280	350	139	156	Yes							
9:15	211	98	108	5.1	280	95	5.5	14	280	340	140	152	Yes							
9:30	131	62	66	3.2	337	94	5.5	16	305	340	140	152	Yes	67	76	62	30.20	2	S	Ran out of sand 9:28-9:32 RAP feed clogged--plant down 9:51-9:55
10:00	201	92	104	5.2	274	100	5.5	14	280	340	141	156	Yes							
10:15	195	90	100	4.9	295	98	5.7	14	282	340	142	158	Yes							
10:30	201	93	103	5.0	287	98	5.6	14	285	340	142	158	Yes	65	77	59	30.22	2	S	
10:45	199	92	102	5.0	308	70	5.3	16	290	340	144	153	Yes							
11:00	165	78	83	4.1	313	72	5.3	17	280	340	144	148	Yes							
11:15	200	93	102	4.9	275	66	5.3	15	275	340	144	157	Yes							
11:30	210	98	107	5.2	294	75	5.3	15	280	340	142	158	Yes	67	79	53	30.23	2	SE	
11:45	216	100	111	5.3	285	73	5.3	15	282	340	143	156	Yes							Ran low on sand 11:45
12:00	206	95	106	5.1	284	100	5.8	13	272	340	144	161	Yes							Ran low on Sand 12:11
12:15	---	---	---	---	370	100	5.8	19	370	340	144	154	Yes							Ran out of aggregate--plant down 12:15-12:30
12:30	195	90	100	5.0	288	75	5.3	16	290	340	144	158	Yes	67	79	53	30.23	4	S	
12:45	193	89	99	5.0	275	66	5.3	16	280	340	144	158	Yes							
1:00	203	94	104	5.4	289	72	5.3	14	282	340	145	157	Yes							
1:15	206	95	106	5.3	279	100	5.8	16	280	340	146	160	Yes	66	80	47	30.24	4	S	
1:30	220	101	114	5.4	295	85	5.5		283	340	---	---	Yes							
1:45	196	90	101	5.4	306	76	5.3		285	340	---	---	Yes							
2:00	215	100	110	5.4	293	75	5.3		283	340	---	---	Yes							

Notes:
1. Moisture content of aggregate = 4.5 percent; moisture content of RAP = 2.5 percent.
2. Water flow rate is reading from Sloan's meter plus 10 gpm to correct to readings in Table 4. (Radian's meter would not operate.)
3. Barometric pressure is average of readings from two barometers which differed by about 0.28 in Hg.



KEY

A = PLANT STARTUP--6:30 A.M.
B = WATER PUMP CLOGGED
C = TRUCK SHORTAGE
D = BROKEN RAM
E = PLANT SHUTDOWN--6:00 P.M.
F = RAN OUT OF SAND
G = FEED CLOGGED
H = RAN OUT OF SAND AND AGGREGATE
I = PLANT SHUTDOWN--5:00 P.M.

Figure 3-2. Record of mix temperature.

TABLE 3-6. PRODUCT MIX SIEVE ANALYSIS RESULTS[1]

	May 8, 1984	May 10, 1984	May 11, 1984
Mix type	S-1	S-1	S-1
Asphalt cement	HMA-175	HMA-175	HMA-175
Percent asphalt in mix	2.7	5.42	6.3
Aggregate sieve/ screen analysis (percent passing)			
3/4 in.	100	100	100
1/2 in.	96	99	99
3/8 in.	85	83	87
No. 4	63	59	64
No. 10	48	45	47
No. 40	37	35	37
No. 80	15	14	13
No. 200	3.9	6.1	5.4

[1] Sieve Analysis Conducted by Florida DOT Personnel.

In addition to the scrubber water flow meter already at the plant, the Radian Corporation (Radian) sampling crew installed a Signet Scientific paddle wheel Flosensor®, flow meter. The Flosensor® meter read 20 gpm higher than the existing meter. An average of these two readings was recorded during operation and testing on May 8, 1984. On May 10 and 11, 1984, the Flosensor® meter was not operable. On these dates, the existing meter was used and the flow rate recorded was the value from the meter plus 10 gpm to yield values comparable to those recorded on May 8, 1984.

SECTION 4

4.0 SAMPLING LOCATIONS

A schematic diagram of the asphalt concrete process is presented in Figure 4-1. The general location of each sampling point and the parameters measured at each sampling location are also presented in Figure 4-1. Section 4 contains a brief description of each of the sampling locations used at Sloan during the emissions testing program.

4.1 VENTURI SCRUBBER INLET SAMPLING LOCATIONS

Uncontrolled emissions samples were collected in the duct work between the drum mixer and the wet venturi scrubber. A side view of the duct work immediately upstream and downstream of the uncontrolled emissions sampling location is illustrated in Figure 4-2. Flue gas exiting the rotating drum enters the knockout duct that carries the flue gas upward about 5 to 6 feet where it then enters a circular duct that connects the outlet of the knockout box to the venturi inlet. The circular duct is approximately 3 feet in diameter and is shaped like an inverted U or V. This duct consists of three elbows separated by two approximately 6 feet long, straight duct sections. Uncontrolled emissions samples were collected in the circular duct immediately above the venturi scrubber.

Two ports were used to measure the gas flow rate and collect uncontrolled emissions samples. A 3-inch port was located on the north side of the inlet duct and a 4-inch port was located on the east side of the inlet duct. The two sampling ports were located less than 12 inches from the nearest upstream and downstream flow disturbance. Figure 4-3 includes a description of the 16 sampling points used to characterize the inlet duct.

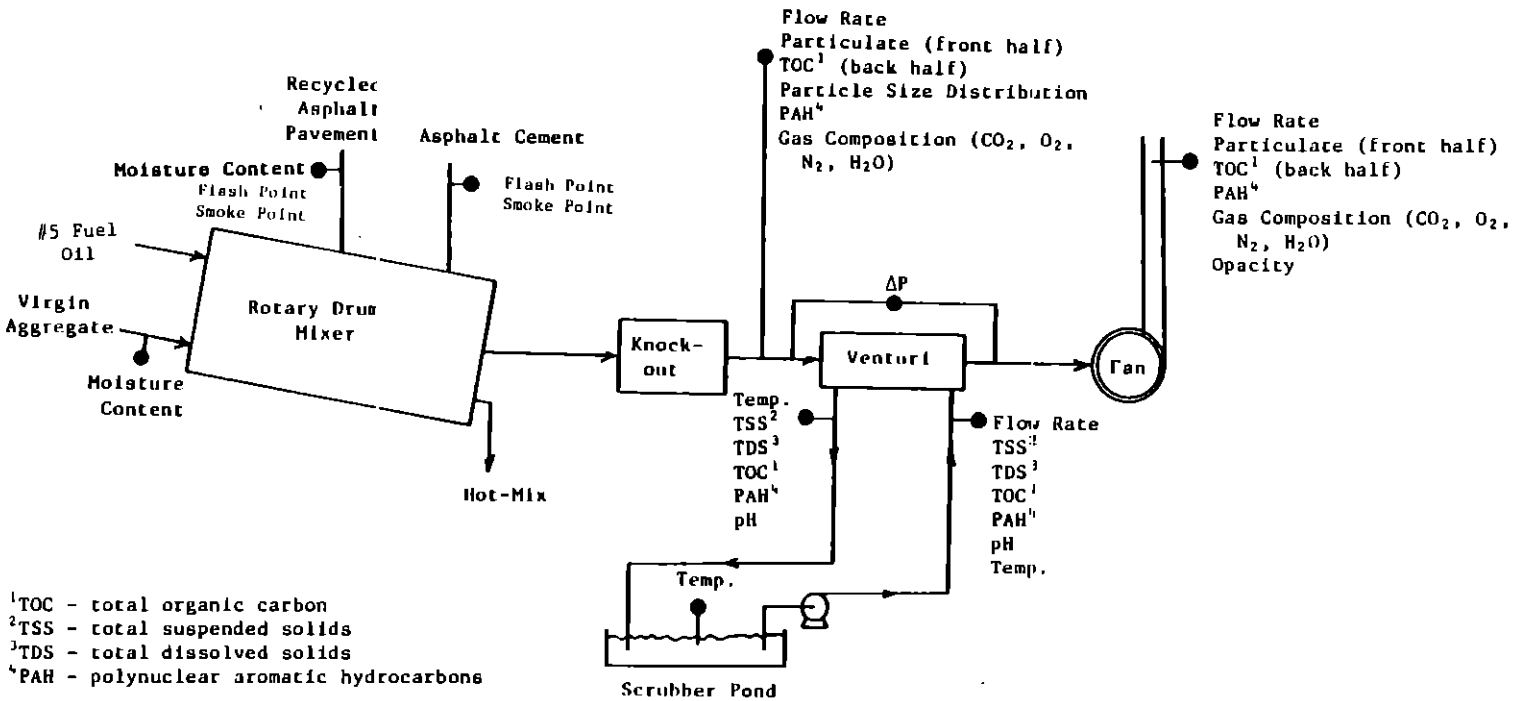


Figure 4-1. Schematic of the Sloan Asphalt Concrete Process Including General Sampling Point Locations and Test Parameters.

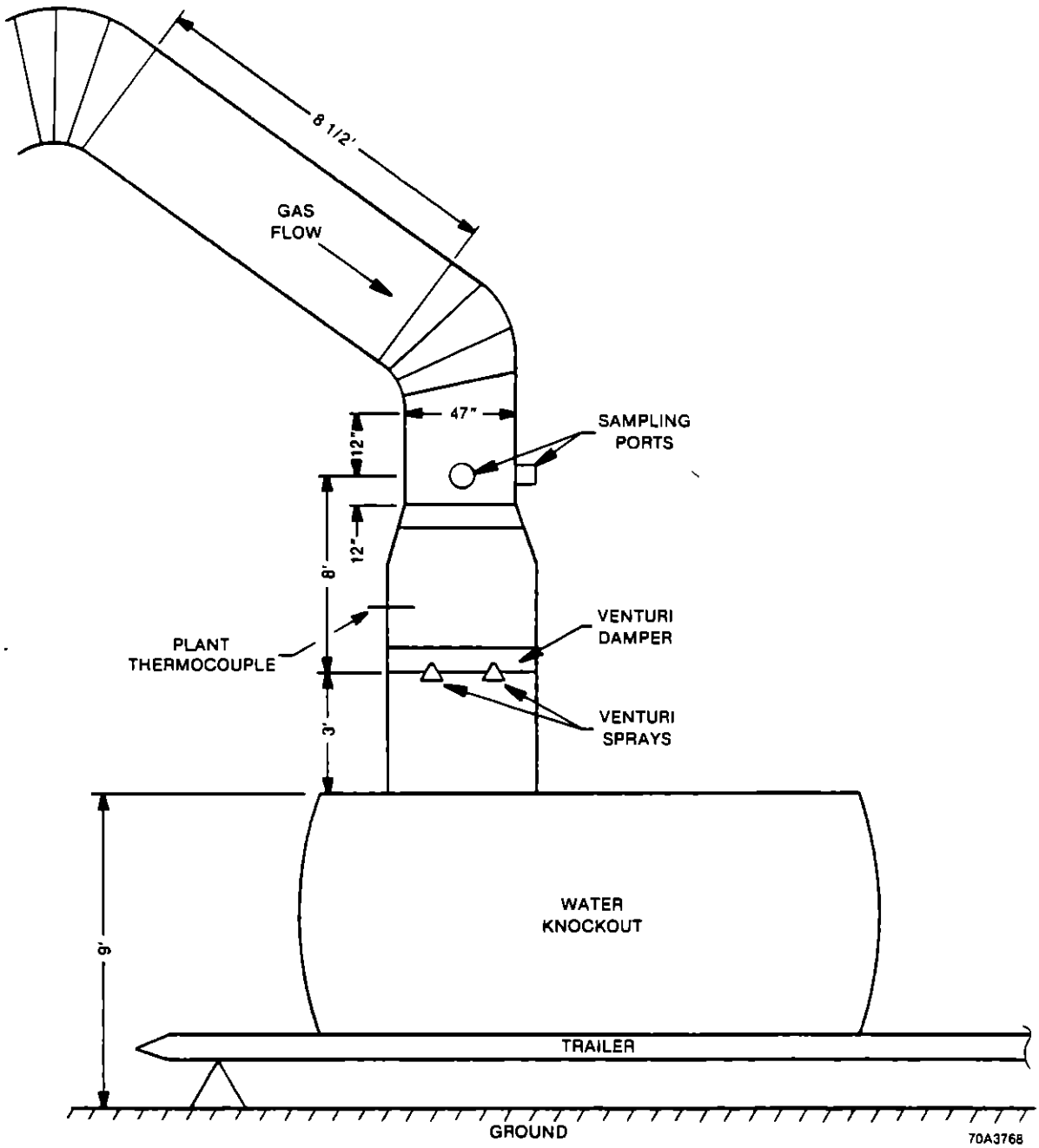
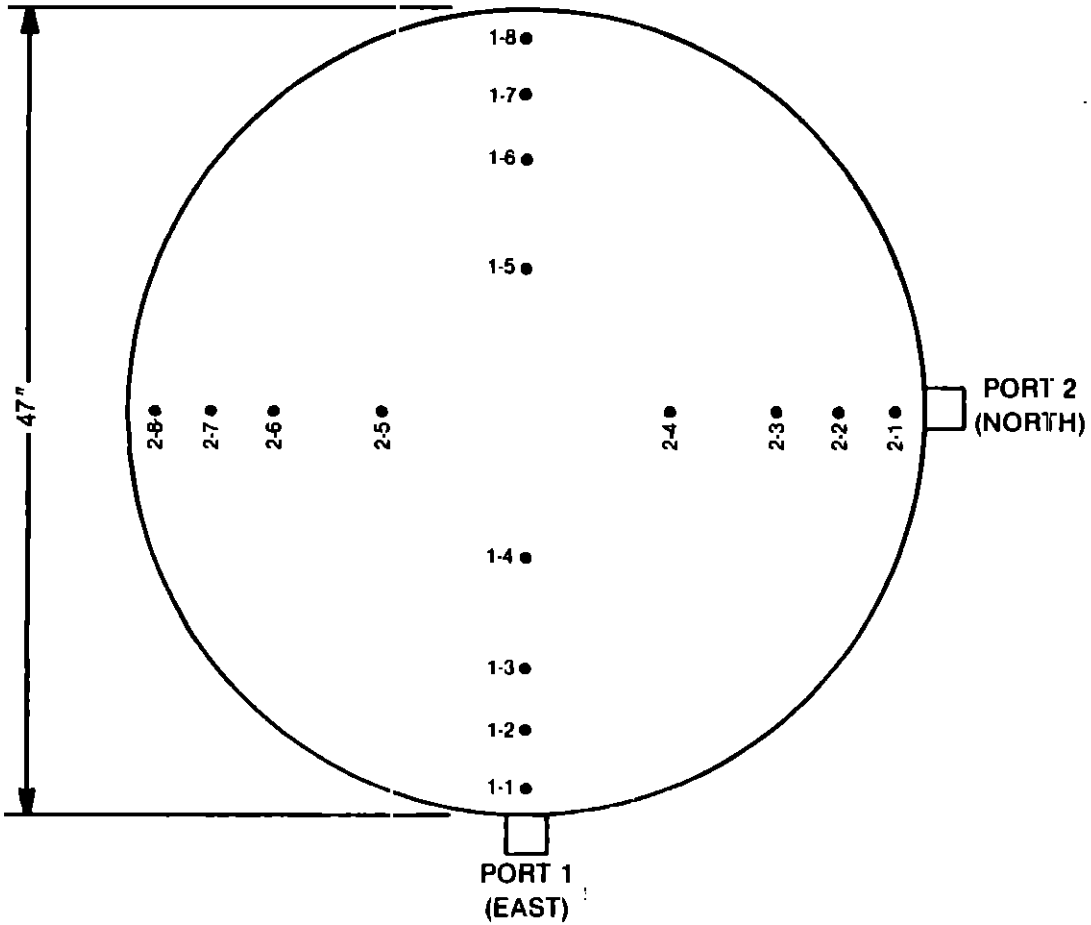


Figure 4-2. Side View of Duct Work Upstream and Downstream of the Sloan Uncontrolled Emissions Sampling Location.



TRAVERSE POINT LOCATION	
TRAVERSE POINT NUMBER	TRAVERSE POINT LOCATION FROM OUTSIDE OF DUCT (INCHES)
1	1.5
2	4.9
3	9.1
4	15.2
5	31.8
6	37.9
7	42.1
8	45.5

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Figure 4-3. Sloan Uncontrolled Emissions Sampling Traverse Point Locations.

Particle size distribution (PSD) samples were collected through the 4-inch port mounted on the east side of the inlet duct. PSD samples were collected at a point 15.2 inches from the east wall. Figure 4-4 includes a description of the sampling point used to collect PSD samples of the uncontrolled emissions. The gas velocity at this point approximated the average gas velocity.

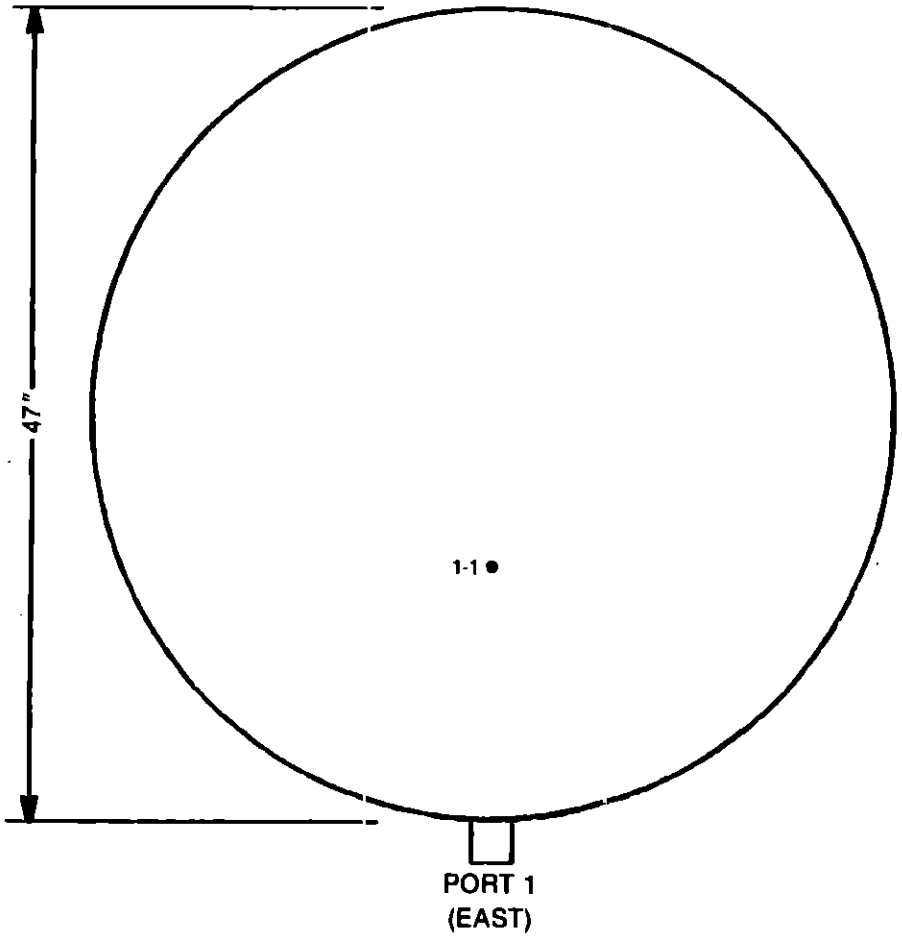
4.2 VENTURI SCRUBBER OUTLET SAMPLING LOCATIONS

Controlled emissions samples were collected at the outlet of the venturi scrubber from two sets of sampling ports on a circular stack. A side view of the duct work immediately upstream and downstream of the controlled emissions sampling location is illustrated in Figure 4-5. Flue gas exiting the venturi scrubber entered a horizontal water knockout drum and then passed through an induced draft (I.D.) fan. Gases exiting the fan then enter a vertical water knockout drum at the base of the 4-foot diameter steel stack.

Two 3-inch ports were used to measure the gas flow rate and collect samples of the controlled emissions. One of the 3-inch ports was positioned on the northeast side of the duct and the second port was positioned on the southeast side. Both ports are located approximately 10 feet from the nearest upstream disturbance and 4 feet from the nearest downstream disturbance. Figure 4-6 illustrates the position of the two ports and the locations of the twenty-four sampling points used to collect controlled emissions samples.

4.3 VISIBLE EMISSIONS OBSERVATION LOCATIONS

Visible emissions observations were made of the plume exiting the stack. A total of six locations were used to make the opacity observations during this program. Figure 4-7 presents the layout of the Sloan asphalt plant and the approximate location of the observer with respect to the stack at each position during visible emissions measurements.



POINT LOCATION	
POINT NUMBER	POINT LOCATION FROM OUTSIDE OF DUCT (INCHES)
1	15.2

70A3765

Figure 4-4. Sloan Uncontrolled Emissions PSD Sampling Point Location.

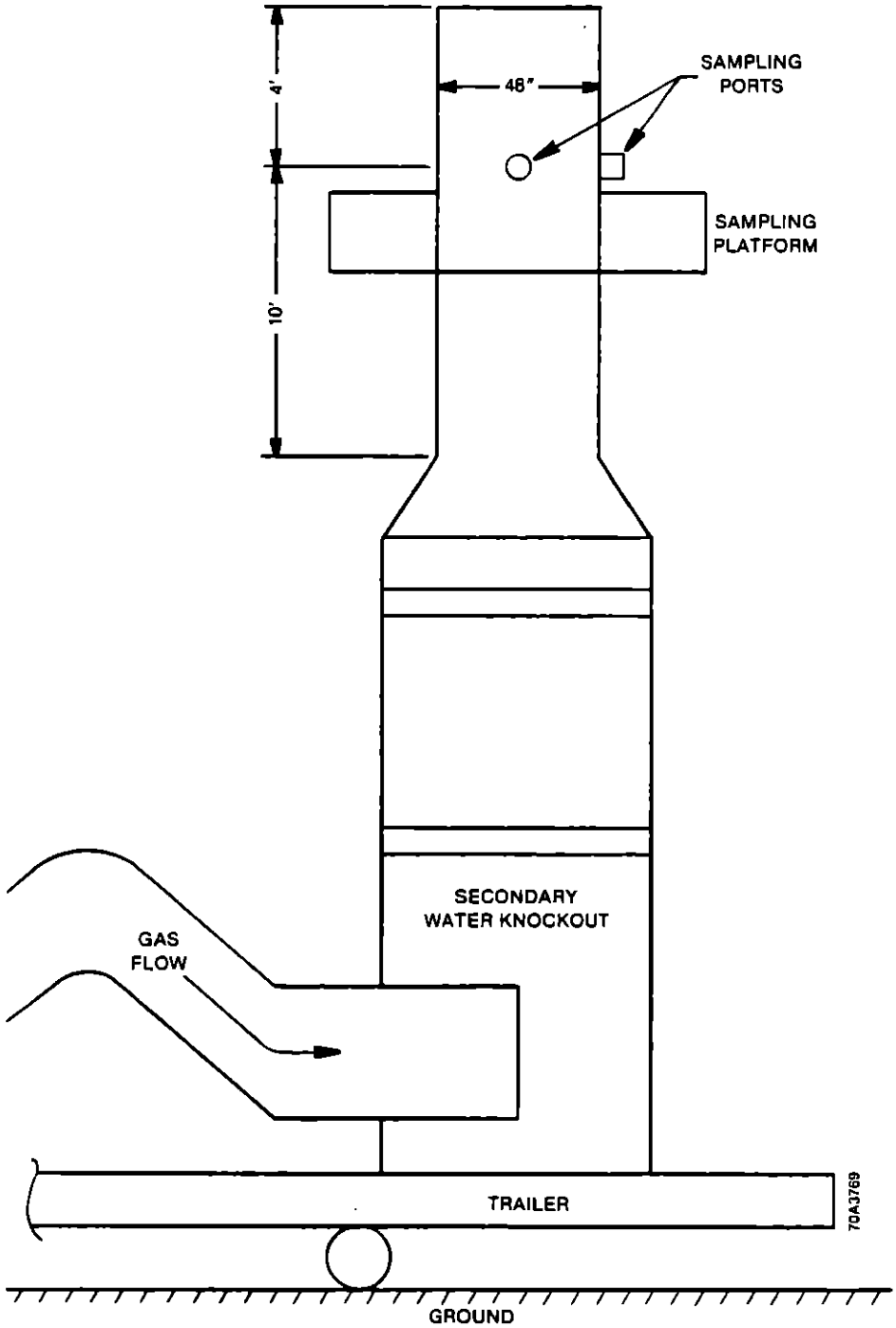
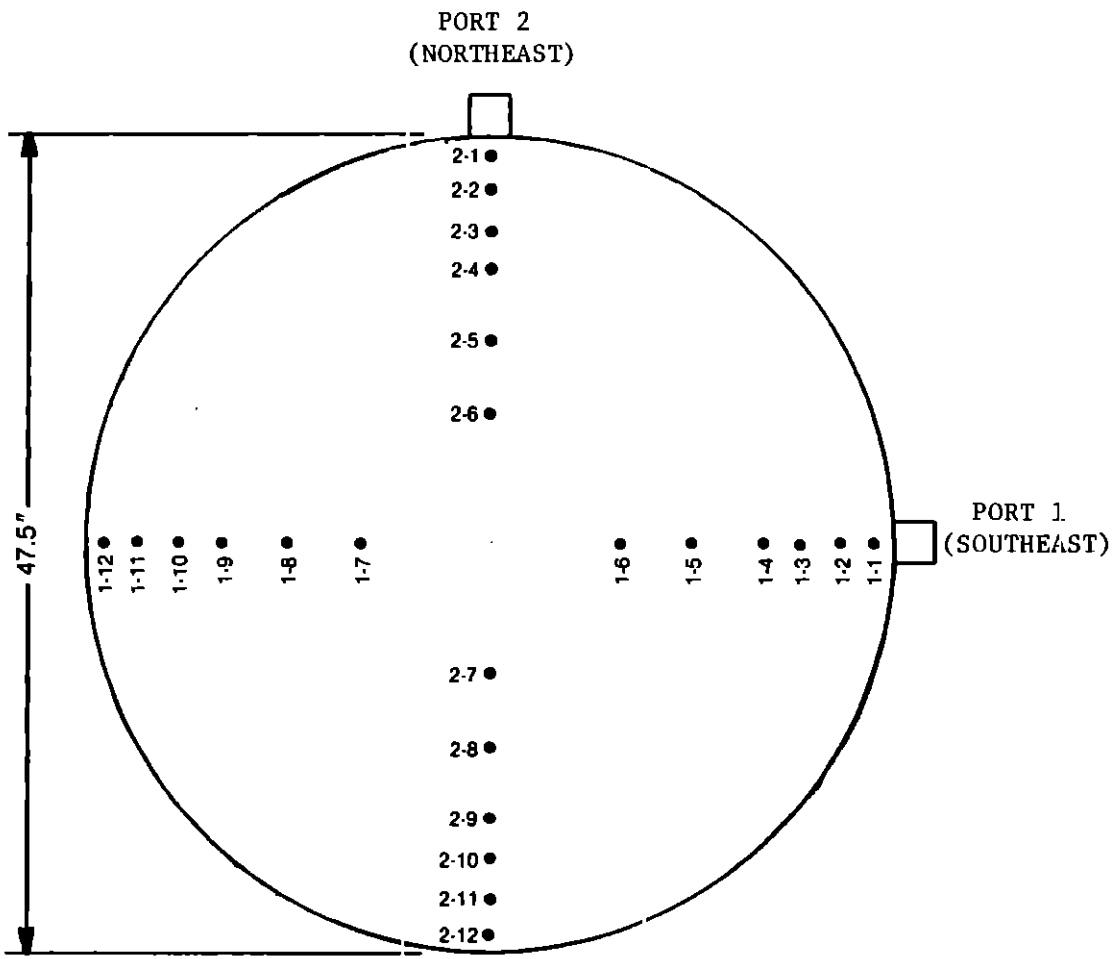


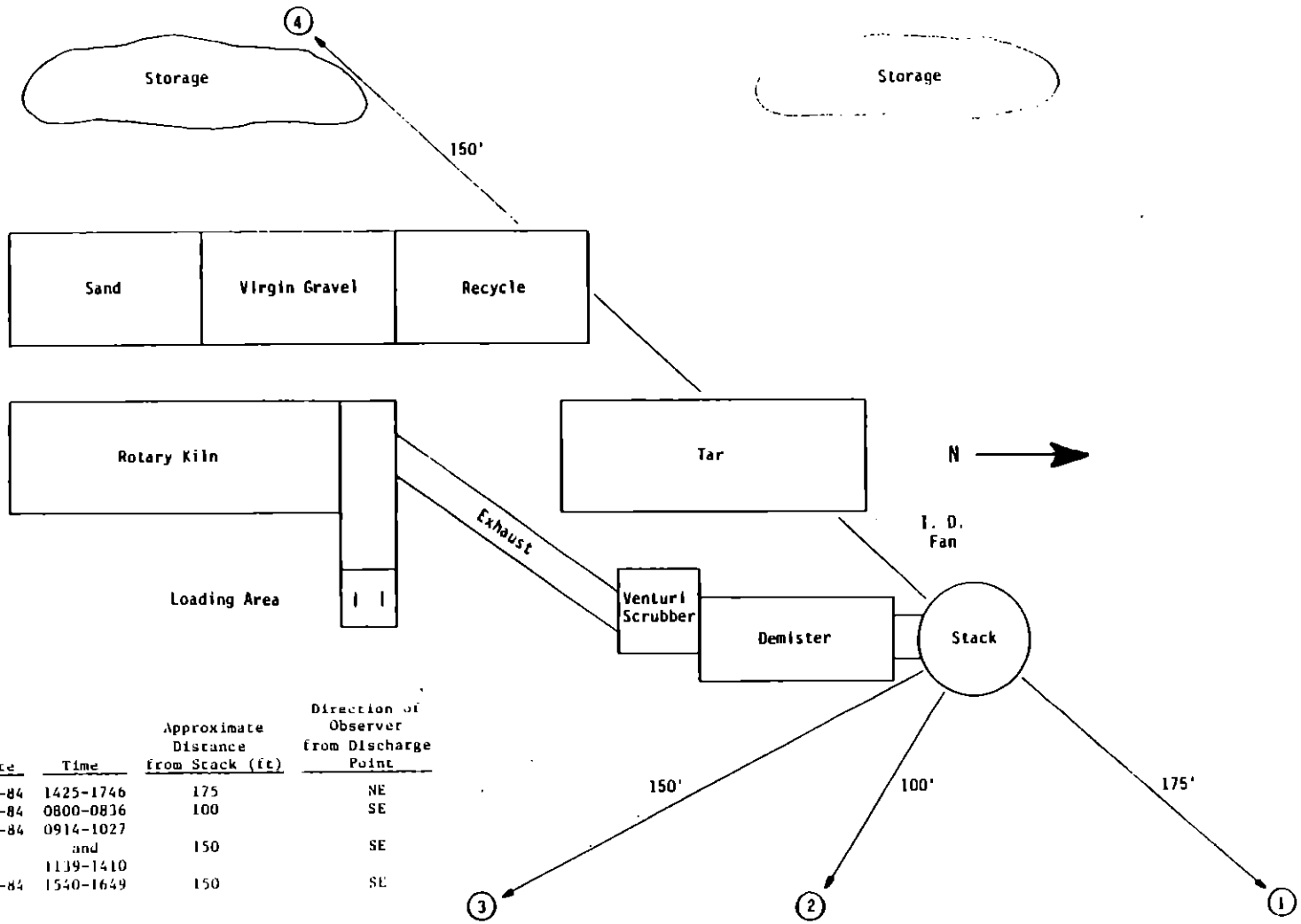
Figure 4-5. Side View of Duct Work Upstream and Downstream of the Sloan Controlled Emissions Sampling Location.



TRAVERSE POINT LOCATION	
TRAVERSE POINT NUMBER	TRAVERSE POINT LOCATION FROM OUTSIDE OF DUCT (INCHES)
1	1.0
2	3.2
3	5.6
4	8.4
5	11.9
6	16.9
7	30.6
8	35.6
9	39.1
10	41.9
11	44.3
12	46.5

70A3783

Figure 4-6. Sloan Controlled Emissions Sampling Traverse Point Locations.



Position No.	Date	Time	Approximate Distance from Stack (ft)	Direction of Observer from Discharge Point
1	5-08-84	1425-1746	175	NE
2	5-10-84	0800-0836	100	SE
3	5-10-84	0914-1027 and 1139-1410	150	SE
4	5-10-84	1540-1649	150	SE

Figure 4-7. Locations of visible emissions observations at the Sloan Construction Company asphalt concrete plant, Cocoa, Florida.

4.4 VENTURI SCRUBBER WATER SAMPLING LOCATIONS

Samples of water supplied to the venturi scrubber and samples of venturi scrubber effluent water were collected during emissions testing. Samples of pond water being supplied to the venturi scrubber spray nozzles were collected from a valve installed on the discharge side of the scrubber feed pump. A general layout of the two scrubber water ponds and the influent and effluent sample collection points is presented in Figure 4-8. The scrubber pump intake line floats in the pond and access to the intake is by means of a floating platform.

Venturi scrubber water drains into a collection box below the venturi mist eliminator and in the base of the stack. The scrubber water then drains back to the settling pond by means of an 8-inch diameter plastic pipe. Samples of the scrubber effluent water were collected in a sample container as the effluent water exited the pipe.

4.5 VENTURI SCRUBBER PROCESS MONITORING LOCATIONS

The venturi scrubber pressure drop and venturi scrubber water flow rates were monitored during the emissions test program.

4.5.1 Venturi Scrubber Pressure Drop Monitoring

Previously installed pressure taps were located upstream and downstream of the venturi scrubber. An attempt was made to use these sample taps to measure the venturi pressure drop. The sample tap downstream of the venturi was plugged with solids and could not be cleared. As a result, MRI personnel used a water manometer installed by Sloan for process control to monitor the venturi pressure drop.

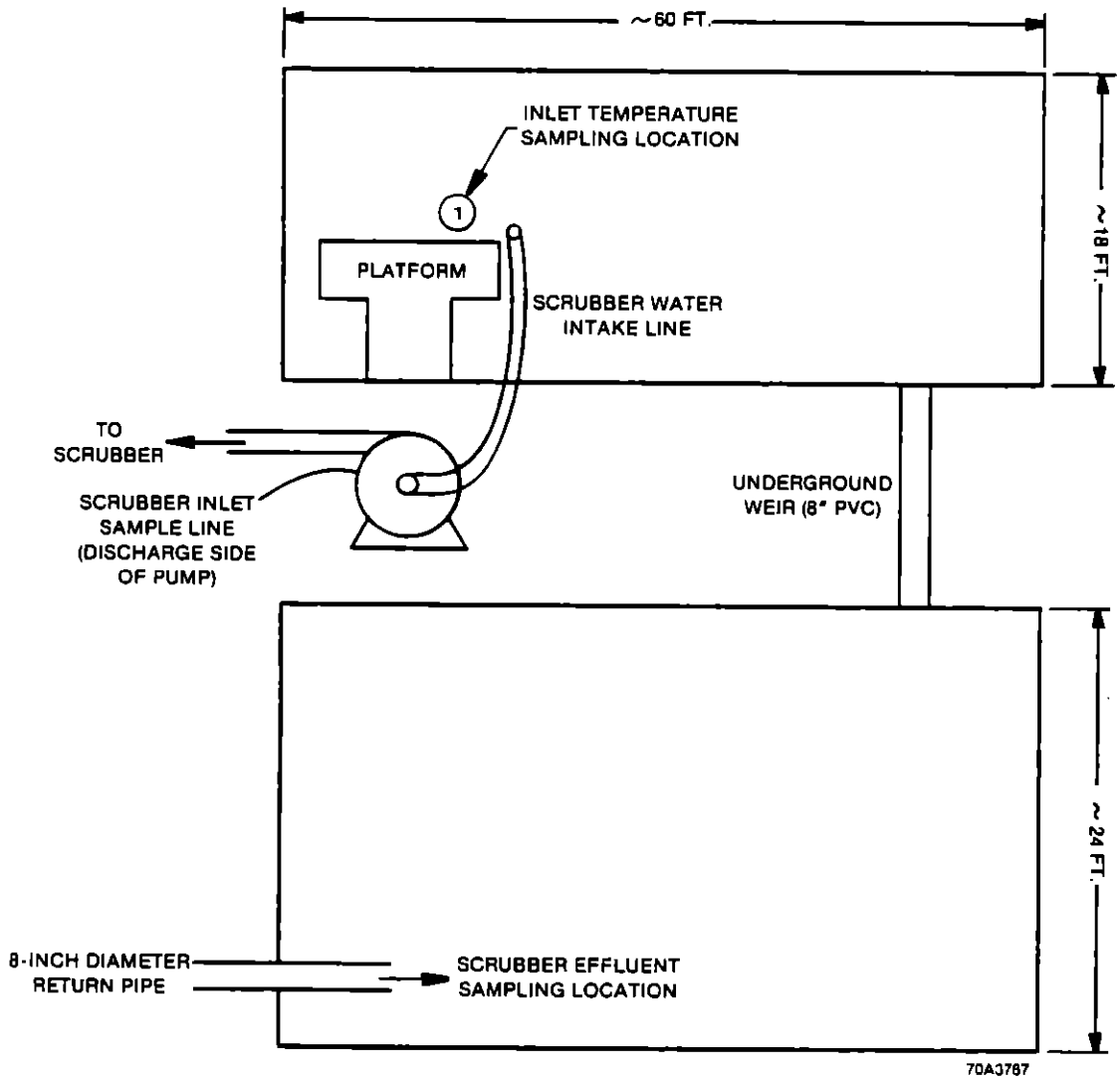


Figure 4-8. Layout of Sloan Effluent and Influent Scrubber Ponds Including Sample Collection Locations.

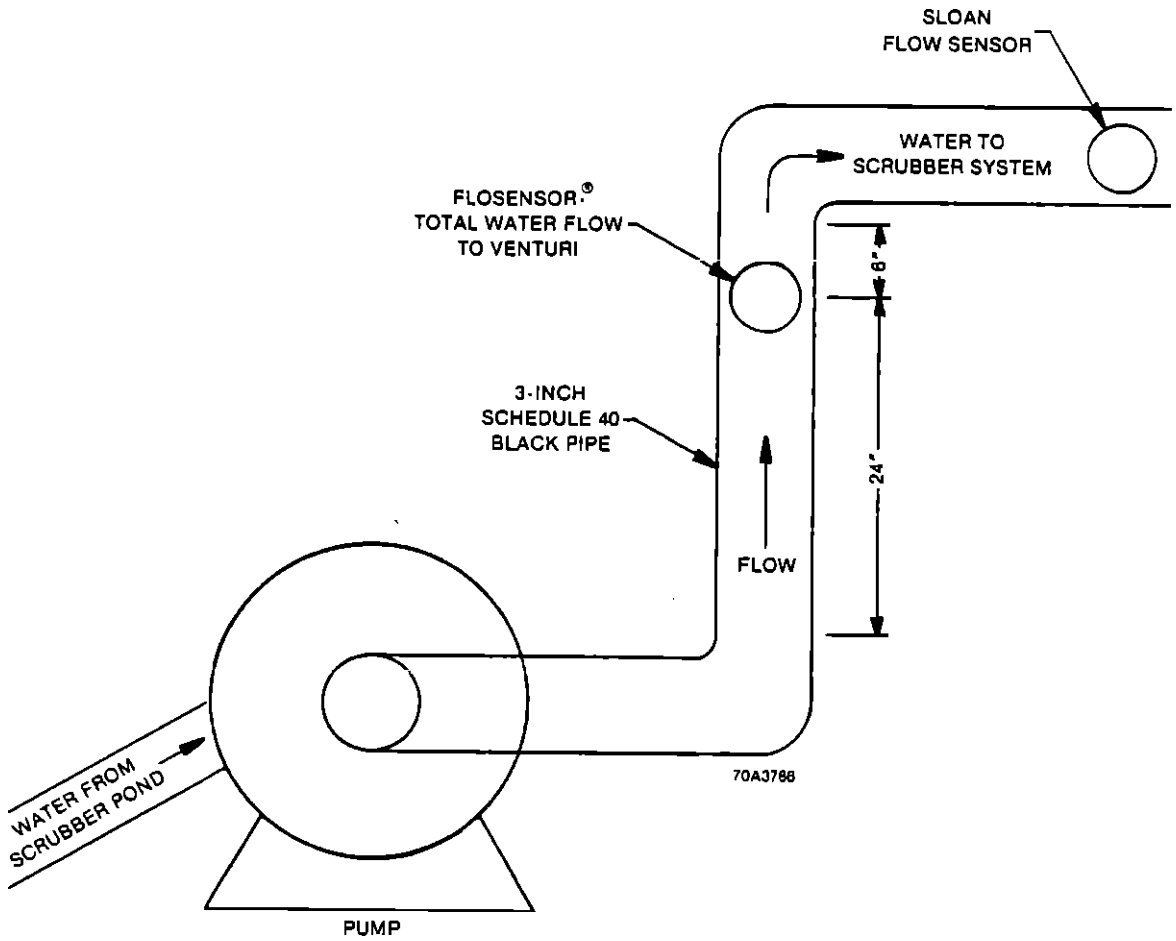


Figure 4-9. Location of Flosensor® Used to Monitor the Total Water Flow to the Sloan Venturi.

4.5.2 Venturi Scrubber Water Flow Rate Monitoring

The total flow rate of water to the venturi was monitored using a Signet Scientific paddle-wheel Flosensor® and a flow sensor provided by the Sloan Company. Figure 4-9 depicts the location of the two flow sensors in the scrubber system. The Flosensor® was mounted in a vertical section of pipe while Sloan's flow sensor was mounted in a horizontal section of pipe. During the first day of testing both readings were taken and an average flowrate reported. On 5-10-84 the Signal Scientific Flosensor® malfunctioned and all subsequent data was taken from Sloan's flow sensor exclusively. A ten-gallon per minute correction factor was applied to all of the Sloan flow sensor readings to yield values comparable with those recorded on 5-8-84. All data was recorded by MRI personnel.

4.6 ASPHALT CONCRETE PROCESS SAMPLING LOCATIONS

During emissions testing, samples of the virgin aggregate and recycled asphalt pavement were collected from the conveyor belts that transport the raw materials to the drum mixer from the storage bins.

Samples of the liquid asphalt cement were obtained from a vendor truck that transported the asphalt cement to the plant.

SECTION 5

5.0 SAMPLING AND ANALYSIS

This section contains general descriptions of sampling equipment, sample collection techniques, and sample recovery techniques used during the emissions testing program at the Sloan asphalt concrete plant. Also included are analytical preparation techniques and analytical methodology used to analyze the samples collected during sampling. Additional information is provided in Appendix J.

5.1 SAMPLING PROCEDURES

This section provides a description of the sampling procedures that were used to collect samples of the flue gases, scrubber waters, and process solids for analysis.

5.1.1 Source Sampling Procedures

Included in Table 5-1 is a list of the various parameters that were measured at the inlet and outlet of the venturi scrubber and the sampling methodology that was used during source sampling. Each of the sampling methods listed in Table 5-1 are described in this section. Whenever possible, EPA referenced source sampling methods were used. The EPA reference methods were taken from the Environmental Reporter, Volume I - Federal Regulations, Section 121, "Air," Appendix A. If an EPA reference method did not exist, a detailed description of the methodology is provided.

5.1.1.1 Gas Phase Composition--

Following are discussions of the methods which were used to measure gas phase composition.

TABLE 5-1. SUMMARY OF SOURCE SAMPLING PARAMETERS AND METHODOLOGY

Parameter Measured	Test Location	Methodology	Sample Frequency[1]	
			Uncontrolled	Controlled
Number and location of sampling points, gas velocity and volumetric gas flow	Inlet/outlet	EPA Methods 1 & 2	6	6
Gas phase composition/ dew point	Inlet/outlet	Wet bulb/dry bulb	16	6
Gas phase composition and molecular weight	Inlet/outlet	EPA Method 3	8	6
Gas phase composition moisture content	Inlet/outlet	EPA Method 4	6	5
Particulate loading	Inlet/outlet	Modified EPA Method 5E	4	3
TOC	Inlet/outlet	Modified EPA Method 5E with 0.1N NaOH impinger solutions	4	4
Polynuclear aromatic hydrocarbons	Inlet/outlet	Modified EPA Method 5E with XAD-2 resin canister	1	1
Particle size distribution	Inlet	Andersen High Capacity Stack Sampler	2	

[1]Number of valid sampling runs performed

Molecular Weight Determination--The dry molecular weight of the gas stream was determined using the grab sampling technique described in EPA Method 3. The dry molecular weight of the gas was calculated based upon the O_2, CO_2, and N_2 concentration. CO_2 and O_2 concentrations were determined using individual Fyrite® units. N_2 was determined by difference.

A stainless steel probe and hand-held squeeze pump were used to collect the gas sample directly in the Fyrite® analyzer. A specific volume of gas is collected in the Fyrite®. During analysis, the gas sample is passed through an absorbing solution designed to selectively remove either CO_2 or O_2. The decrease in the gas volume in the Fyrite® container is proportional to the dry concentration of the absorbed species. The balance of the gas mixture was assumed to be N_2. If more than six passes were required to obtain a constant (0.3% difference, absolute) reading for either O_2 or CO_2, the appropriate absorbing solution was replaced.

5.1.1.2 Volumetric Gas Flow Rate Determinations--

Total gas flow rates at the scrubber inlet and outlet were determined using procedures described in EPA Method 2. The volumetric gas flow rate was determined by measuring the cross sectional area of the inlet duct and the stack and the average velocity of the gas stream. The cross-sectional areas of the inlet duct and the stack were determined by direct measurement.

The number of sampling points required at each sampling location to statistically measure the average gas velocity in the stack was determined using the procedures outlined in EPA Method 1. The number of sampling points and their distance from the duct wall is a function of the proximity of the sampling location to its nearest upstream and downstream flow disturbances.

The inlet and outlet sampling locations (refer to Section 4) did not meet EPA Method 1 criteria, but represented the best possible location available for collecting uncontrolled and controlled emission samples. The number of inlet sampling points were limited to 16 because of the high particulate loading, resulting in a limited sample collection time. A total of 24 sampling points were used at the outlet stack sampling location.

Moisture Determination--The moisture content of the inlet and outlet gas streams was determined using a modified version of the methodology described in EPA Method 4. This method requires that a known volume of particle free gas be pulled through a chilled impinger train. The quantity of condensed water is determined gravimetrically and then related to the volume of gas sampled to determine the moisture content.

The moisture content of the two gas streams was determined simultaneously during each EPA Method 5E test and each particle size distribution determination. The absolute filter in the EPA Method 5E and particle sizing trains removed the particulate matter from the gas stream, allowing condensed water to collect in the impinger train.

The moisture content of the gas stream is required to calculate the molecular weight of the gas (wet) and the isokinetic gas sampling rate.

Relative Humidity--A wet bulb/dry bulb apparatus was used in conjunction with a psychrometric chart to determine the relative humidity of the scrubber gas streams. The wet bulb/dry bulb apparatus consists of two thermocouples strapped together. The front end of the first thermocouple extended out about three inches further than the second thermocouple. A cloth sock was placed tightly over the front two inches of the first thermocouple (wet bulb). Prior to sampling, the cloth sock was saturated with water. The thermocouples were then inserted into the center of the duct and the temperature of the wet bulb thermocouple monitored. After the temperature of the wet bulb thermocouple stabilized (reached equilibrium), the temperature of the dry thermocouple was measured. The wet bulb and dry bulb temperatures were used with a psychrometric chart to determine the relative humidity and moisture content of the gas stream. A high temperature psychrometric chart (dry bulb temperature ~500°F) was used during this program because of the high temperature (~300°F) of the uncontrolled emissions gas stream. The moisture content of uncontrolled emissions was determined twice during each Method 5E run due to the rapidly varying moisture content of the stream

The gas stream velocity was calculated from the average pitot differential pressure measurements (ΔP), the average flue gas temperature, wet molecular weight, and absolute pressure. ΔP and temperature profile data were measured at each of the sampling points using an S-type pitot tube and type-K thermocouple. A Magnehelic® gauge was used to measure the ΔP across the S-type pitot.

Barometric pressure readings were obtained daily by reading two barometers on-site and taking the average. The static pressure was measured by inserting a stainless steel probe into the duct. A Magnehelic® gauge attached to the probe was used to measure the static pressure within the duct.

5.1.1.3 Particulate Loading Determination--

A modified version of the sampling procedure specified in EPA Reference Method 5E was used to determine the uncontrolled and controlled particulate emissions. Modifications to EPA Reference Method 5E included:

- eliminating the probe and nozzle water rinse prior to the acetone probe and nozzle rinse,
- installing a variable transformer to control the probe temperature to 250°F ± 25°F, and
- installing a time proportioning temperature controller to maintain the temperature of the gas stream at the filter to 250°F ± 10°F (controlled accuracy ± 1% of full scale of 400°F).

Figure 5-1 illustrates the EPA Method 5E sampling train. A sample of particulate-laden flue gas was collected isokinetically through a stainless steel gooseneck nozzle. A glass-lined heat traced probe transported the flue gas from the duct to the heated filter. (The filter holder and associated glassware are contained in an insulated, heated enclosure.) The probe temperature was closely monitored and controlled at 250°F ± 25°F. Particulate matter was removed from the gas stream by means of a glass fiber filter housed in a glass holder. The temperature of the sampled gas was monitored and controlled at the filter using a time proportioning temperature controller to a temperature of 250°F ± 10°F.

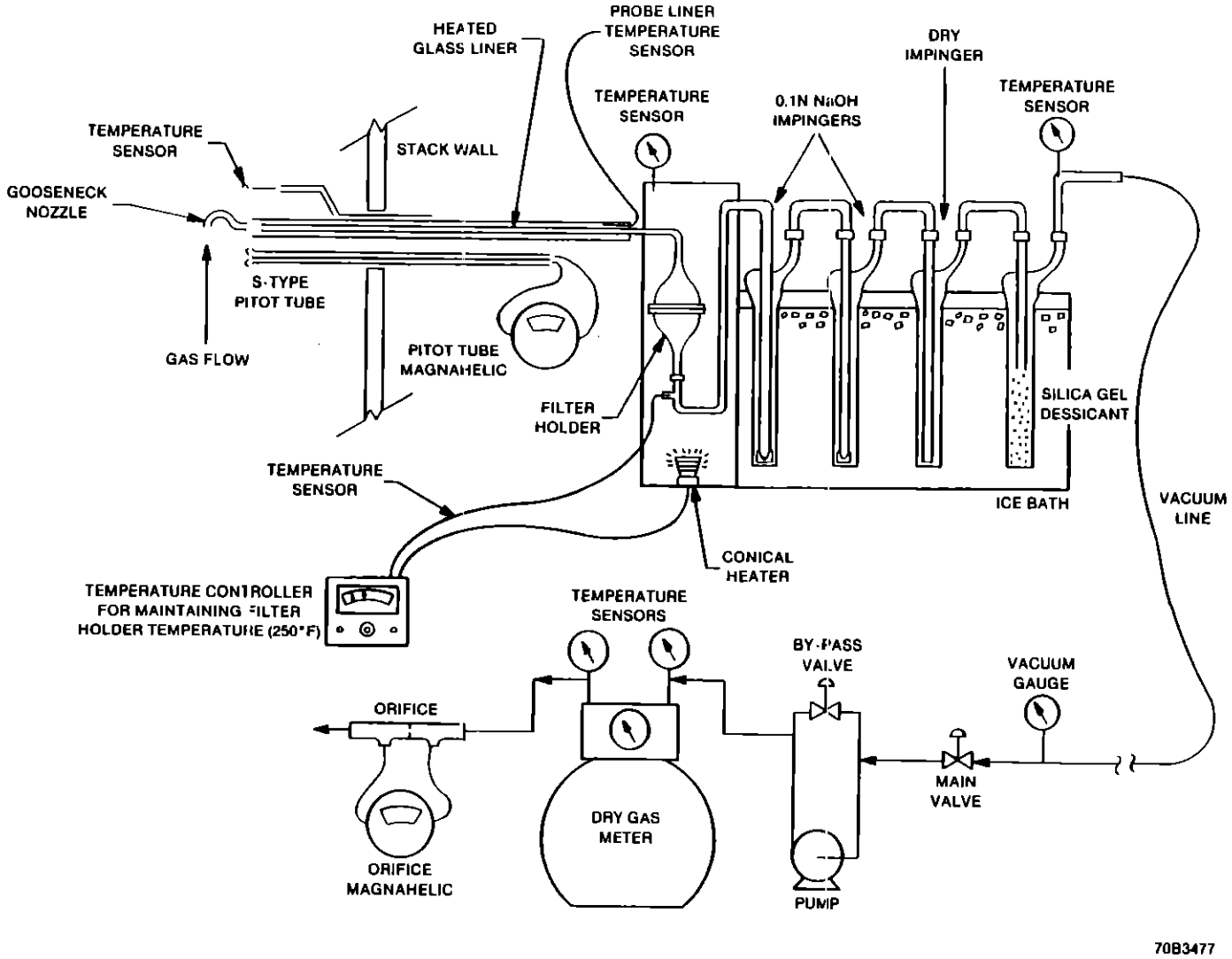


Figure 5-1. Modified EPA Method 5E Sampling Train Designed to Collect Particulate and Total Organic Carbon Samples at the Venturi Scrubber Inlet.

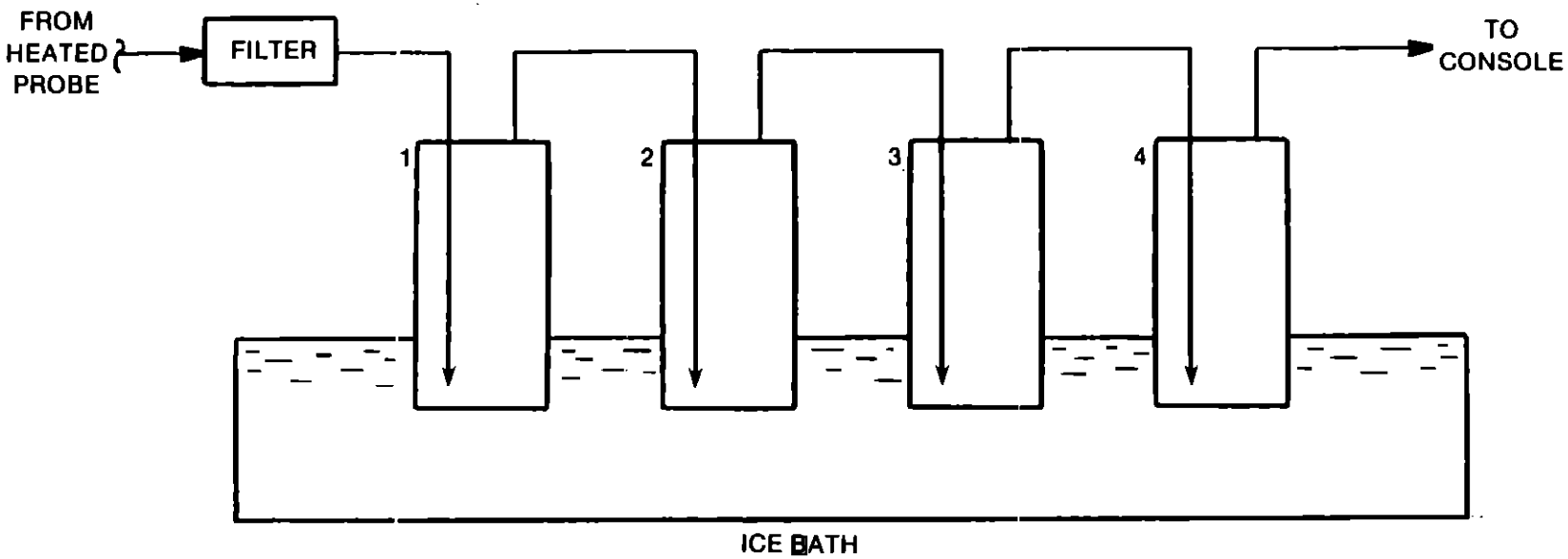
The filtered gas stream then entered a series of impingers immersed in an ice bath. The configuration and contents of the impingers depended on whether the impinger train was used at the uncontrolled or controlled sampling location. Figure 5-2 and Figure 5-3 illustrate the configuration and contents of the uncontrolled and controlled impinger trains, respectively.

The uncontrolled impinger train consisted of four impingers. The first, third, and fourth impingers were of the modified Greenburg-Smith design and the second impinger was of the Greenburg-Smith design. Impingers 1 and 2 contained approximately 200 ml of 0.1 N NaOH for TOC absorption. The third impinger was dry and the fourth impinger contained about 200 grams of indicating type silica gel for final moisture removal.

The controlled impinger train consisted of five impingers. The configuration and contents of the controlled impinger train is similar to the uncontrolled impinger train except that an initial dry modified Greenburg-Smith impinger was placed in front of the other four impingers for collection of water condensate. The additional impinger was necessitated by the high moisture content of the stream and gas sample volumes.

During sampling, the flue gas velocity was monitored by an S-type pitot tube attached to a Magnehelic® gauge. The isokinetic sampling rate was maintained through a system of valves and a leakless pump. The sampling rate was monitored using a calibrated orifice with a Magnehelic® gauge and the total sample volume was measured using a calibrated dry gas meter. The gas stream temperature was monitored using a type-K thermocouple and a pyrometer.

When sampling was complete, the filter was removed and placed in the original petri dish. A water rinse of the nozzle, probe liner, and front half of the filter holder was not performed because TOC analysis of the front half catch was not required during this program. The nozzle, probe liner, and front half of the filter holder were rinsed and brushed three times using acetone. The acetone rinses were stored in a 500 ml glass bottles with teflon lid insert.

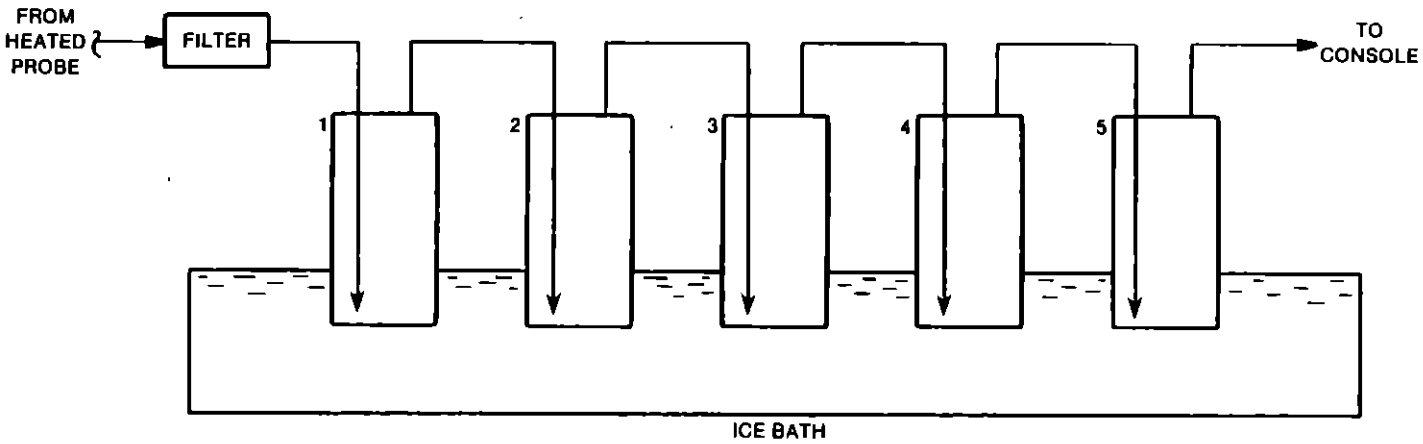


TOC SAMPLING TRAIN-RUNS 1, 2, 3, AND 4

IMPINGER NO.	1	2	3	4
TYPE	MOD-GREENBURG-SMITH	GREENBURG-SMITH	MOD-GREENBURG-SMITH	MOD-GREENBURG-SMITH
CONTENTS	NaOH	NaOH	DRY	SILICA GEL
CONCENTRATION (N)	0.1	0.1	——	——
VOLUME (ml)	200	200	——	——

70A3772

Figure 5-2. EPA Reference Method 5E Impinger Train Configuration and Contents Used During Uncontrolled Emissions Source Testing at the Sloan Construction Co., Cocoa, Florida.



TOC SAMPLING TRAIN-RUNS 1, 2, 3, AND 4

IMPINGER NO.	1	2	3	4	5
TYPE	MOD-GREENBURG-SMITH	MOD-GREENBURG-SMITH	GREENBURG-SMITH	MOD-GREENBURG-SMITH	MOD-GREENBURG-SMITH
CONTENTS	DRY	NaOH	NaOH	DRY	SILICA GEL
CONCENTRATION (N)	——	0.1	0.1	——	——
VOLUME	——	200	200	——	——

70A3770

Figure 5-3. EPA Reference Method 5E Impinger Train Configuration and Contents Used During Controlled Emissions Source Testing at the Sloan Construction Co., Cocoa, Florida.

All impingers were weighed before and after sampling using a top loader balance. The impinger weight gain data were used to calculate the moisture content of the flue gas. After weighing, the contents of the NaOH impingers were quantitatively transferred to individual 500 ml glass bottles with Teflon lid inserts. All of the glassware from the filter holder exit to the exit of the first NaOH impinger was rinsed with two aliquots of 0.1N NaOH. This rinse solution was added to the first NaOH impinger sample container. The glassware from the second NaOH impinger to the silica gel impinger was also rinsed with two aliquots of 0.1N NaOH. This rinse solution was added to the second NaOH impinger sample container. The NaOH impinger samples were analyzed individually to determine the collection efficiency of the impinger trains.

The filters, impinger solutions, and acetone rinses were carefully packaged for shipment back to Radian for weighing and analysis.

5.1.1.4 Polynuclear Aromatic Hydrocarbons Sample Collection--

Figure 5-4 illustrates the sampling train that was used to collect samples of the gas stream for PAH analysis. The PAH sample collection procedure is similar to the particulate loading procedure described in Section 5.1.1.3. The major differences between the two systems include impinger configuration, contents, and sample recovery procedures.

The PAH impinger train consisted of a dry impinger for cooling down the gas before entering the glass canister containing XAD-2 resin for PAH adsorption. The temperature of the gas entering the resin canister was monitored using a thermocouple. Following the XAD-2 resin canister was a second dry impinger for collection of any condensate occurring downstream of the XAD-2 resin. The third impinger contained silica gel for final moisture removal. The filter glassware, the two dry impingers, and the XAD-2 resin canister were wrapped with aluminum foil to reduce sample exposure to ultraviolet radiation, which is refuted to cause photodegradation of the PAH's.

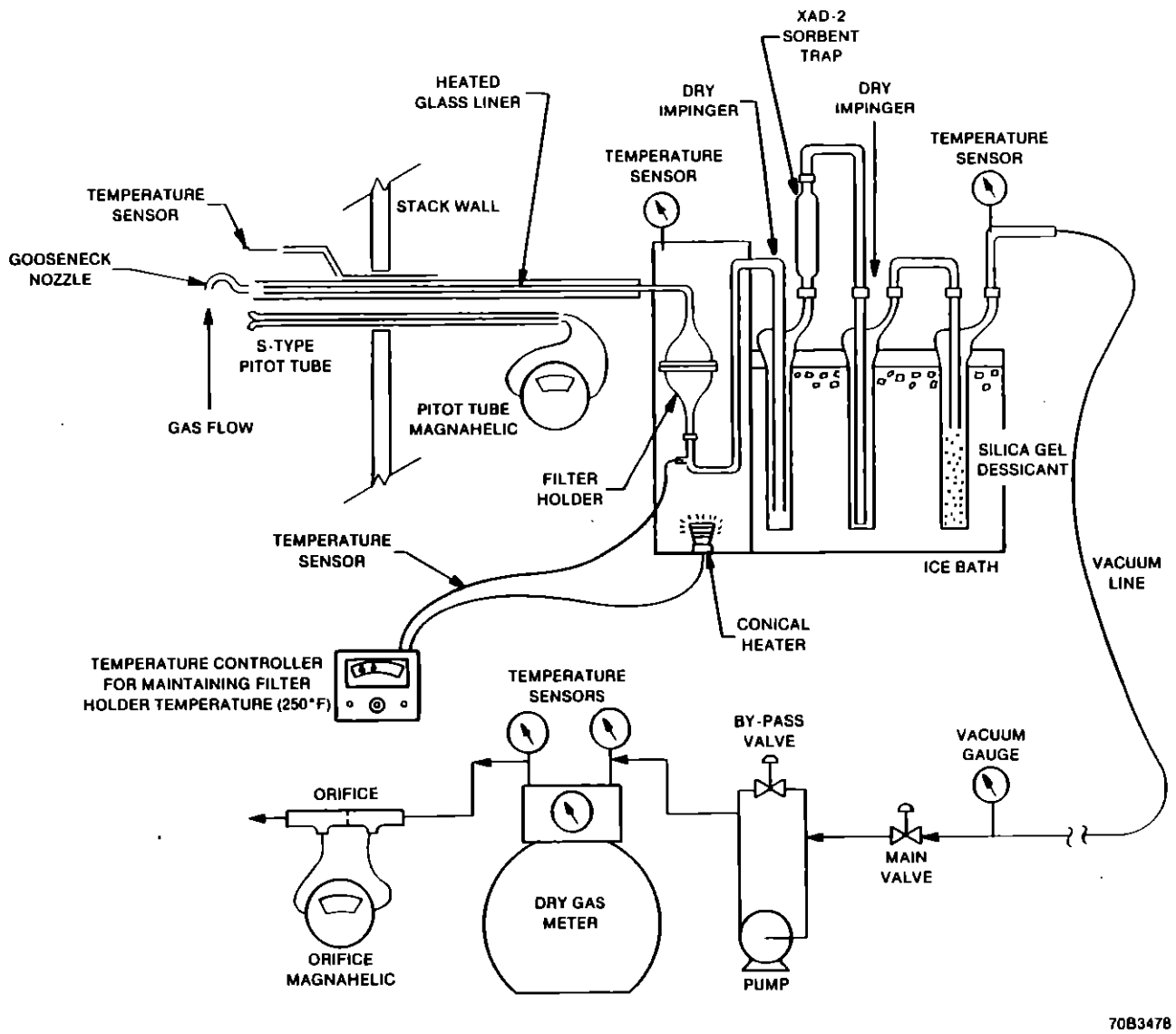


Figure 5-4. Sampling Train Designed to Collect Polynuclear Aromatic Hydrocarbon Samples at the Sloan Venturi Scrubber Inlet and Outlet.

Upon completion of sampling, the sampling train was returned to the mobile laboratory for sample recovery. Incandescent lights were used in the mobile laboratory during sample recovery to minimize sample exposure to ultraviolet radiation. The nozzle and glass probe liner were brushed and rinsed with methylene chloride. All interconnecting glassware in the hot box and impinger train (except the silica gel impinger) were also rinsed with methylene chloride. The methylene chloride rinses were stored in amber glass bottles with Teflon lid inserts. The filter was transferred to a glass petri dish and wrapped with aluminum foil to protect it from direct light during storage and shipment. The XAD-2 resin was transferred from the canister to a glass jar and wrapped with aluminum foil for storage. Methylene chloride was used to rinse the resin into the jar. A lid with a Teflon insert was used to seal the jar.

5.1.1.5 Particle Size Distribution Determination--

During this project the particle size distribution at the inlet of the scrubber was determined using the sampling train illustrated in Figure 5-5. Because of the high particulate loading encountered at the scrubber inlet, an Andersen High Capacity Stack Sampler (AHCSS) was used to determine the inlet particle size distribution. The AHCSS sampling train is designed to classify particles present in the gas stream with respect to their aerodynamic size.

A cut-away view of the AHCSS is illustrated in Figure 5-6. The AHCSS contains two impaction chambers followed by a cyclone and a backup absolute thimble. Particles were automatically fractionated into four size ranges and the results were then plotted to represent the size distribution (see Figure 2-3).

A right angle probe was used at the scrubber inlet to allow the AHCSS to be pointed into the gas stream. A straight-neck sampling nozzle was attached to the AHCSS to minimize the impaction of larger particles that would occur in a gooseneck nozzle.

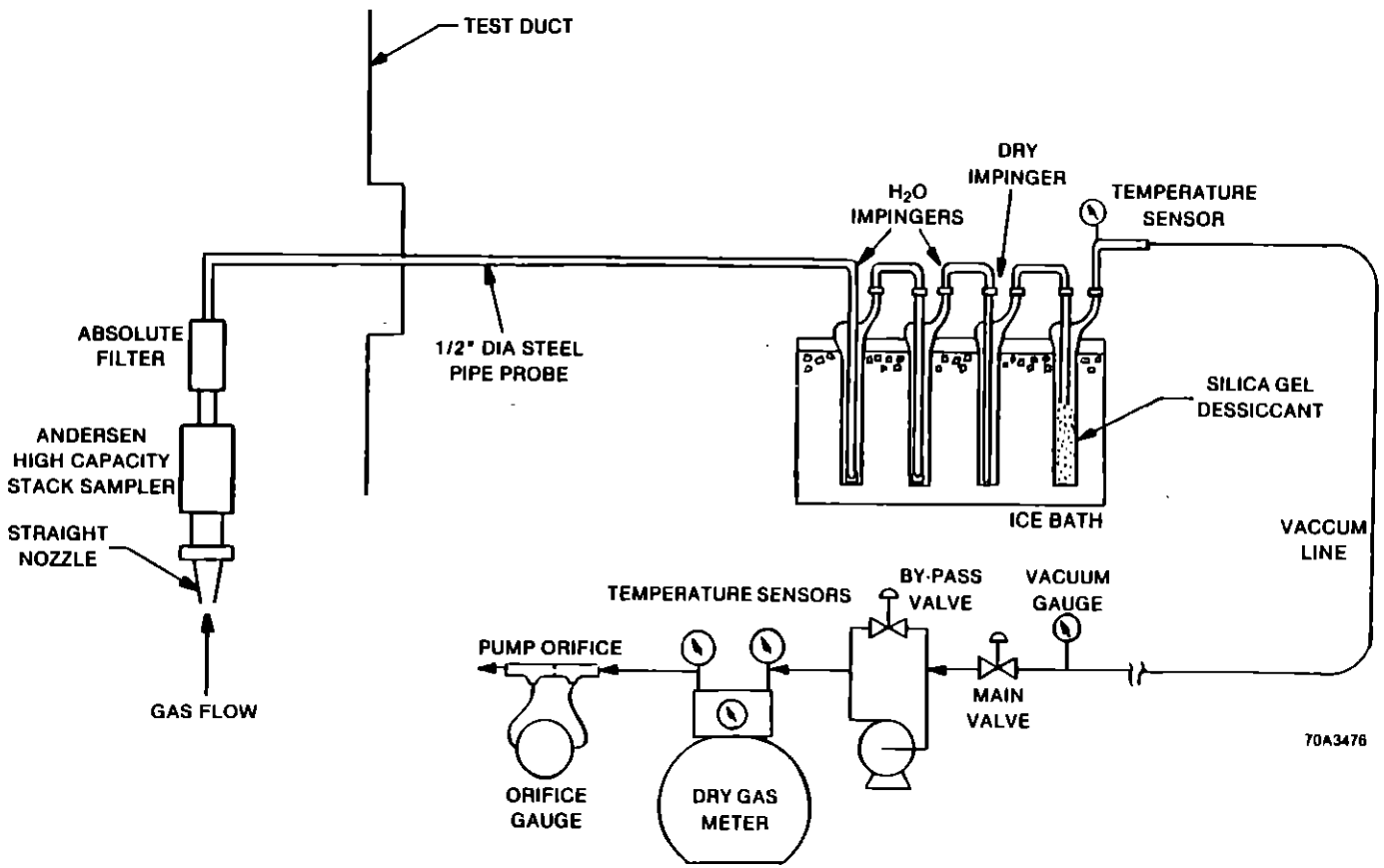


Figure 5-5. In-Stack Andersen High Capacity Stack Sampler Sampling Train Used to Determine the Particle Size Distribution at the Sloan Venturi Scrubber Inlet.

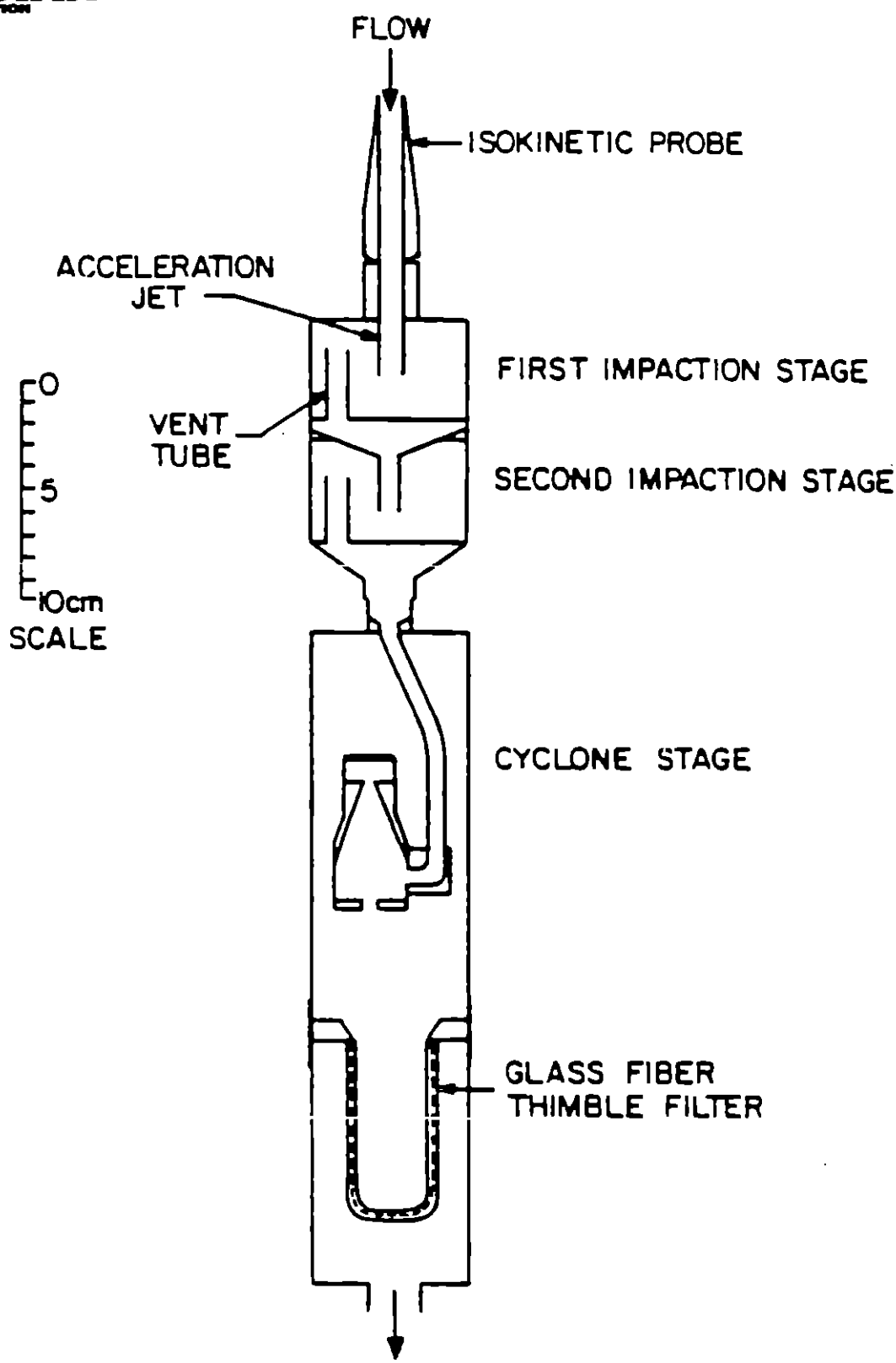


Figure 5-6. Schematic of the Andersen Model HCSS High Grain-Loading Impactor

Impactor sampling at the inlet was performed at a point of average velocity in the gas stream. The isokinetic flow rate through the nozzle was precalculated based on velocity data obtained during earlier sampling (Method 5E). Operation of the AHCSS requires that the flow rate through the impactor be kept constant. This requirement eliminates the possibility of adjusting the flow rate if variations in gas velocity occurred.

Prior to sampling at the inlet, the AHCSS was allowed to preheat in the duct for at least 45 minutes to allow ample time for the unit to reach the flue gas temperature. After sampling, the AHCSS was carefully unloaded and the solids and filter desiccated and weighed. The individual weight gains of the stages and filters were used along with the impactor operating conditions to calculate the particle size distribution of the scrubber inlet. The impingers were weighed before and after sampling to determine the moisture content of the gas stream.

5.1.1.6 Visible Determination of Opacity--

The visible opacity of the outlet stack plume was determined by visual observation using the procedure described in EPA Method 9. When meteorological conditions permitted, observations were performed during stack gas sampling runs for particulate and TOC loading and polynuclear aromatic hydrocarbons. Visible opacity readings were performed when a clear blue sky background existed. The clear blue sky background was required for detection of emissions caused by condensed hydrocarbons in the plume.

5.1.2 Process Water Sampling

Scrubber water influent and effluent samples were collected during the field testing program. Scrubber water was contained in two ponds located near the venturi scrubber. Water supplied to the scrubber was pumped from the end of one pond through a floating intake line. Water from the scrubber flows by gravity to the second pond. The two ponds are interconnected by an eight-inch diameter pipe that served as a weir to facilitate settling of solids.

Following are descriptions of sampling methods for the scrubber water streams.

Scrubber Water Sample Collection--Samples of the process water pumped to the venturi scrubber were collected at a valve installed on the discharge side of the pump. The venturi scrubber return water samples were collected at the discharge end of the plastic pipe as the water gravity fed to the settling pond. Samples were collected in a beaker and then stored in 500 ml amber glass bottles with Teflon liners. An attempt was made to collect at least two samples during each particulate and TOC loading run and the polynuclear aromatic hydrocarbons run.

Scrubber Water Flow Rate--The total flow rate of water to the venturi was monitored using a Signet Scientific paddle-wheel Flosensor® and a flow sensor provided by the Sloan Company. During the first day of testing both readings were taken and an average flowrate reported. On 5-10-84 the Signal Scientific Flosensor® malfunctioned and all subsequent data was taken from Sloan's flow sensor exclusively. A ten-gallon per minute correction factor was applied to all of the Sloan flow sensor readings to yield values comparable to those recorded on 5-8-84. All data was recorded by MRI personnel.

Scrubber Water Temperature and pH--At the times of collection of venturi scrubber water samples, the temperature and pH of the stream were measured. Temperature was measured by direct insertion of a thermocouple into the water stream at the collection point. pH measurements were performed using an Orion digital hand-held pH meter. The pH meter was standardized with pH 7 and pH 10 buffers just prior to each set of measurements. The pH of the venturi influent and effluent waters was measured by collecting a sample in a beaker and then measuring the pH at the collection location.

MRI measured the temperature of the pond water at the location of the scrubber water intake pump and at the scrubber water return location. These measurements were taken using a thermocouple.

5.1.3 Process Solids Sampling

Three process solids streams were sampled:

- virgin aggregate,
- recycled asphalt pavement, and
- asphalt cement.

The sampling and analytical requirements for virgin aggregate and recycled asphalt pavement were the same. The two streams are belt-conveyed individually from storage hoppers to the drum mixer. Samples were collected from the belt conveyors in a large collection tray. The samples were coned and quartered to obtain a representative sample and taken directly to the mobile laboratory for moisture analysis. At least one sample was collected and analyzed for moisture during each particulate/TOC loading run, and polynuclear aromatic hydrocarbons run. Additional samples of the recycled asphalt pavement were collected for shipment to Austin for smoke point analysis.

A sample of asphalt cement was collected during the testing program in a one-gallon metal can. The asphalt cement sample was shipped to Austin for smoke point and flash point analysis.

5.1.4 Process Parameters

MRI was responsible for monitoring the venturi pressure drop across the venturi scrubber. MRI was also responsible for monitoring the total flow to the venturi scrubber.

5.2 ANALYTICAL METHODOLOGY

The previous section described sampling procedures. This section describes the analytical procedures and identifies where samples for analysis were retrieved from the various sample streams.

The majority of analyses for this project were performed at Radian's Austin laboratories. Samples for analysis resulted from the following:

- particulate/TOC sampling train for controlled and uncontrolled air emissions;
- polynuclear aromatic hydrocarbons sampling train for controlled and uncontrolled air emissions;
- scrubber water to and from the venturi; and
- virgin aggregate, recycled asphalt pavement, and asphalt cement.

Figures 5-7 through 5-9 present analytical schemes for the two sampling trains and scrubber waters. These figures indicate where samples were retrieved from the various systems and the analyses performed. The following analyses were performed:

- particulate mass,
- total organic carbon,
- polynuclear aromatic hydrocarbons,
- total solids (suspended and dissolved),
- pH and temperature,
- moisture,
- smoke point, and
- flash point.

Particulate Mass Analysis--The EPA Method 5E particulate mass sample consisted of the filter and the acetone front-half rinse. Filter analysis consisted of dessicating the filter for 24 hours and then weighing at 24-hour intervals to a constant weight.

The acetone rinse volumes were gravimetrically determined. The rinse samples were transferred to individual clean, dry, tared 250 ml beakers

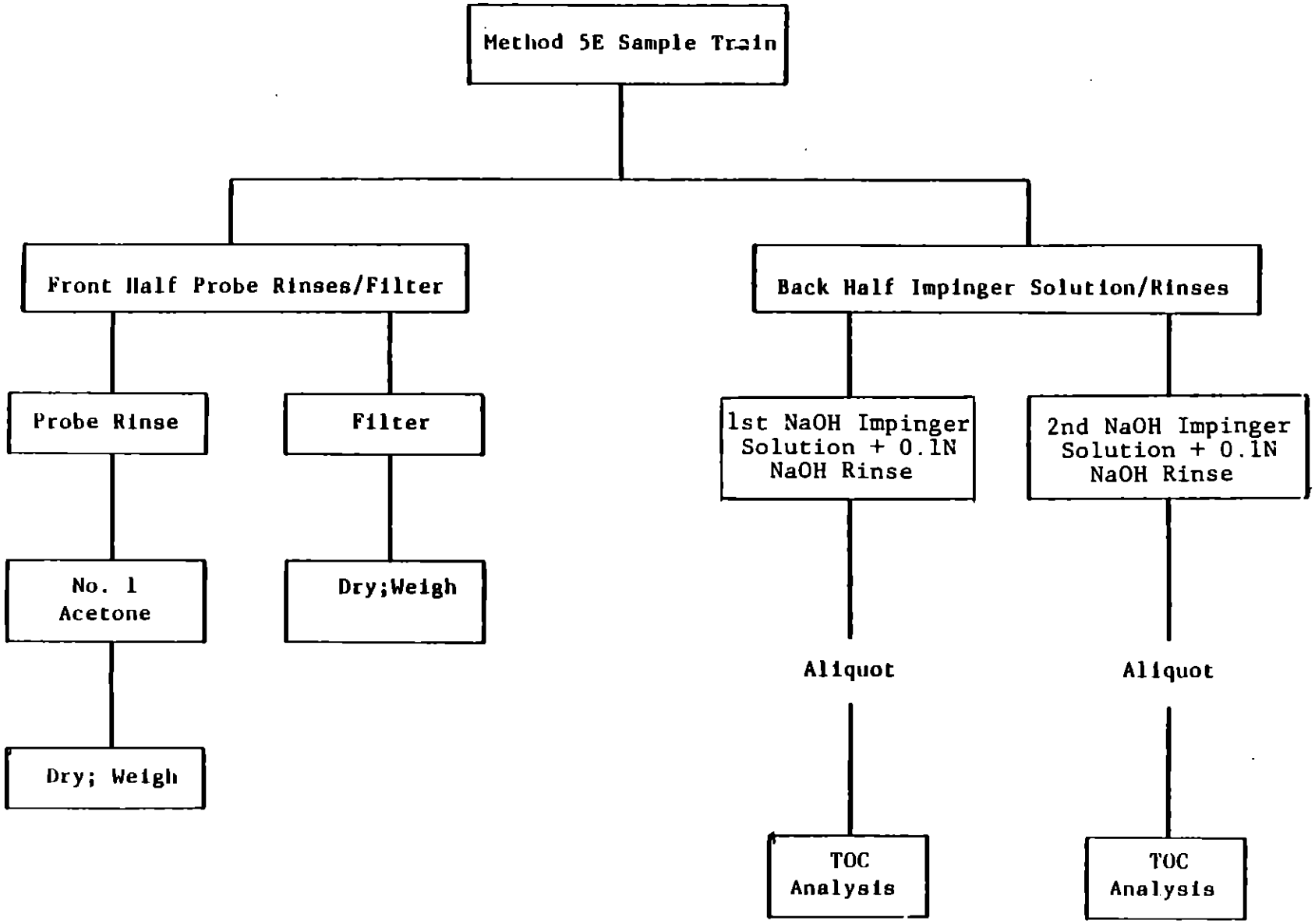


Figure 5-7. Particulate and TOC Sample Recovery Analytical Matrix.

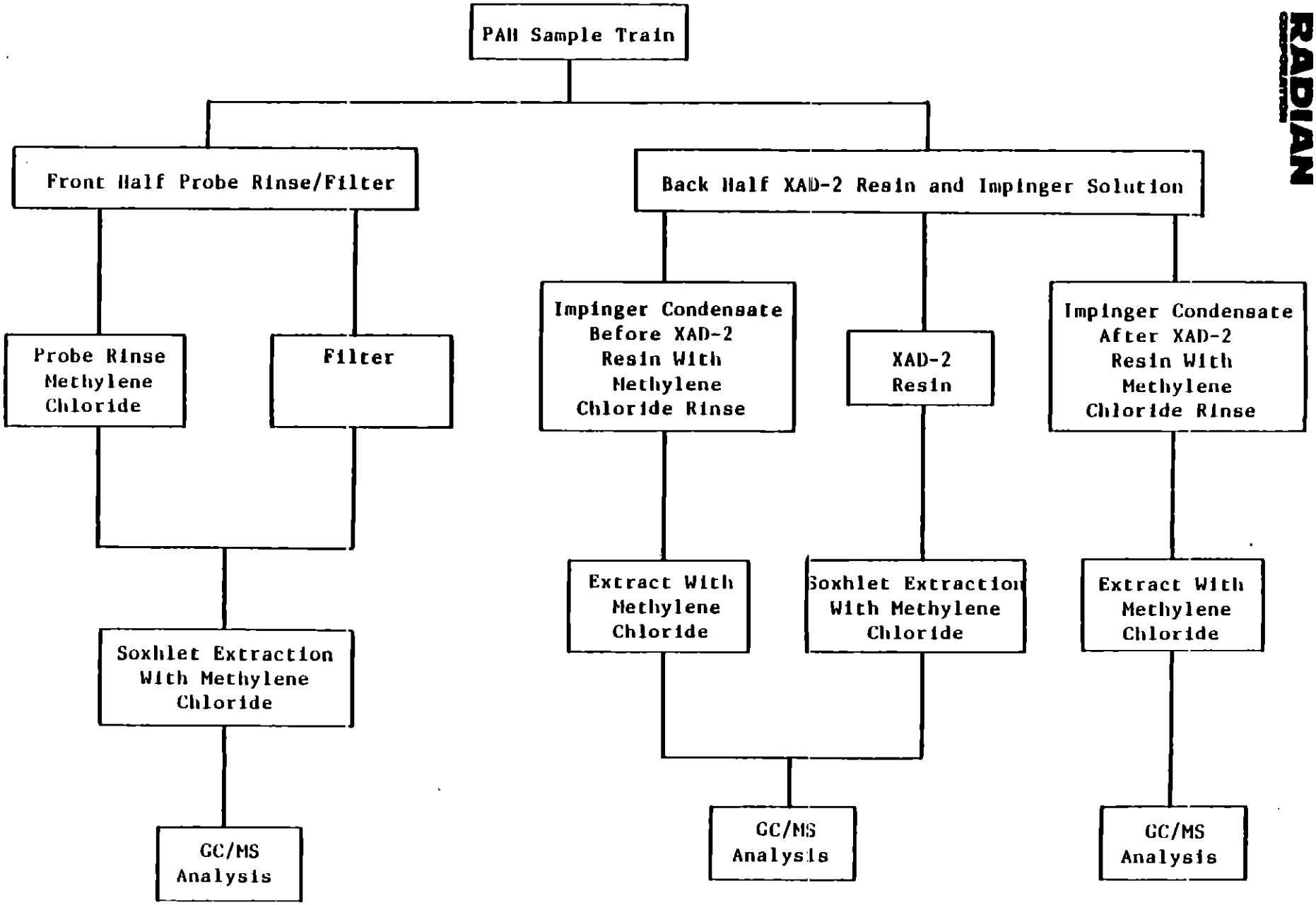


Figure 5-8. Polynuclear Aromatic Hydrocarbons Sample Recovery Analytical Matrix.

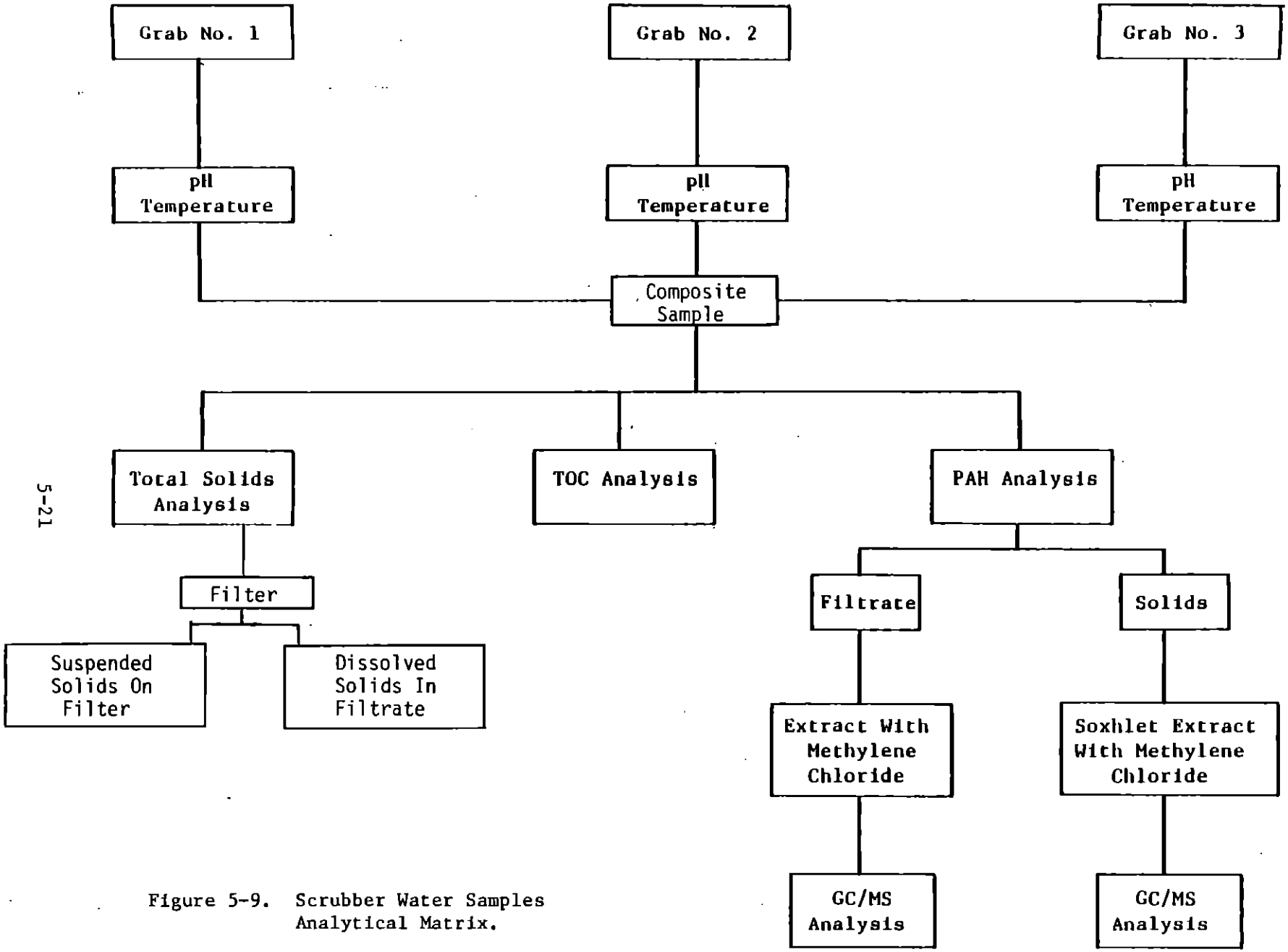


Figure 5-9. Scrubber Water Samples Analytical Matrix.

for evaporation. The samples were evaporated to dryness at room temperature and pressure. When the samples were dry they were dessicated for 24 hours and weighed at 24-hour intervals to a constant weight.

Total Organic Carbon (TOC) Analysis--The TOC content of the EPA Method 5E sodium hydroxide impinger solutions and scrubber water filtrate samples was determined instrumentally using the procedure specified in EPA Method 5E. A Beckman Model 915 B Total Carbon Analyzer was used to determine the total carbon content and total inorganic carbon content of the sample. The concentration of carbon present in the sample was determined by comparing the sample results with the results of standards prepared using potassium hydrogen phthalate. The total organic carbon content was determined by subtracting the total inorganic carbon content from the total carbon content.

Polynuclear Aromatic Hydrocarbon (PAH) Analysis--The original scope of work called for the PAH analysis of samples retrieved from the PAH sampling train and scrubber water samples. During the extraction of the PAH blank samples and the gas phase PAH samples for GC/MS analysis, the extraction apparatus malfunctioned causing the complete evaporation of the solvents and subjecting the samples to excessive temperatures. For this reason, no gas phase PAH sample analyses were performed.

Scrubber water samples were prepared for PAH analysis by extraction in a continuous water extractor for twenty-four hours in methylene chloride.

The effluent scrubber water solid samples were prepared for analysis by first spiking the solid samples with isotopically labeled benzo(a)pyrene-d_{12} to serve as a sample recovery check. The solids were then extracted for 24 hours in methylene chloride using a soxhlet extractor.

Extracts were concentrated by means of a Kuderna-Danish evaporation apparatus.

The sample concentrates were analyzed by GC-MS with operation in the selected ion monitoring mode (SIM). Individual PAH compounds were separated by employing a fused silica capillary column. The chromatographic conditions and other instrumental parameters are summarized in Table 5-2. Mass spectral data were stored on a magnetic disc for interpretation and reference.

Identification of individual PAH compounds was based primarily on two criteria: chromatographic retention time and mass spectral characteristics. The appearance of key fragment ions of the compounds at a precise retention time is indicative of the presence of the compound. In general, PAH compounds are relatively stable in the ion source of a mass spectrometer. The major (base peak) fragment corresponds to the molecular weight of the compound (M^+), other fragments are generally found at M^+-2 and $M^+/2$ (corresponding to a double charged ion). The relative intensities of these fragment ions are also examined in order to confirm the identification. Table 5-3 lists the individual PAH compounds measured. The internal standard, phenanthrene-d_{10}, served as a marker to verify retention time to within $\pm$ 0.1 minute.

Once an individual PAH compound was identified, the selected ion area of the chromatographic peak corresponding to the base peak fragment was obtained. This area was compared to the corresponding area of the internal standard. The concentration of the compound was then calculated using a known response based on a calibration standard.

Total Solids--Total solids in the scrubber waters were determined by the analysis of total suspended solids (TSS) and total dissolved solids (TDS) on-site. During each test run, multiple samples of the influent and effluent venturi scrubber waters were collected. The samples were collectively filtered to determine a composite TSS concentration by measuring the residue collected on the filter and relating the mass to the water volume determined gravimetrically. The TDS concentration in the resulting composite sample was determined by pipetting a 50 milliliter aliquot of the sample into a tared

TABLE 5-2. GC-MS CONDITIONS

Operating Parameter	Experimental Conditon
Instrument	Hewlett Packard 5985A
Ionization voltage	70eV
Scan rate	1 scan/second
Scan range	40 → 450 amu
Column	SE54 fused silica capillary
H_2 flow rate	30 cm/sec
Initial temp	25°
Initial hold	2.0 min
Program rate	8°/min
Final temp	300°C
Final hold	20 min
Injector temp	25°C
Injection	Cool on-column
Sample size	1 μL

TABLE 5-3. POLYCYCLIC AROMATIC HYDROCARBONS DETERMINED BY GC-MS

Phenanthrenes (178)	Benzopyrenes (252)
Phenanthrene	Benzo(a)pyrene
Anthracenes	Benzo(e)pyrene
	Perylene
Pyrenes (202	Benzo(b)fluoranthrene
	Benzo(j)fluoranthrene
Pyrene	Benzo(k)fluoranthene
Fluoranthene	
	Benzoperylenes (276)
Chrysenes (278)	
	Benzo(g,h,i)perylene
Chrysene	Indeno(1,2,3-c,d)pyrene
Benz(a)anthracene	
Triphenylene	

Note: The molecular weight of each group is shown in parentheses.

100 milliliter beaker and evaporating to dryness at 105°C, desiccating the sample, and weighing. The concentration of TDS is the mass of residue remaining related to the volume of the aliquot.

pH and Temperature--Samples of the influent and effluent venturi scrubber waters were collected during each particulate/TOC loading and PAH runs. pH measurements were performed at the sampling locations during sample collection with a hand-held pH meter.

Scrubber water temperatures were monitored at the sampling location using a thermocouple and portable read-out.

Moisture--During each particulate/TOC loading and polynuclear aromatic hydrocarbon run, at least one sample of the virgin aggregate and recycled asphalt pavement were collected for moisture analysis. The samples were collected in a large tray, coned-and-quartered to obtain a representative sample and taken directly to the on-site mobile laboratory for moisture analysis. In the mobile lab, approximately 500 grams of the material was weighed into an aluminum pan and dried overnight at 105°C. The sample was then weighed to within ± 0.1 gram.

Smoke Point Determination of Recycled Asphalt Payment--The smoke point of RAP samples collected during the test program was determined using a test procedure developed by the Oklahoma Testing Laboratory. Based on this method a sample of RAP is first dried to a constant weight in an oven set at 140°F. 500 grams of the dried sample is then placed in a stainless steel bowl and heated at a rate of 25 to 30°F per minute while stirring the RAP with a stainless steel spatula. When the sample temperature is approximately 250°F the heating rate is decreased so that the sample temperature rise is 5° to 10°F per minute until the smoke point is reached. The smoke point is recorded as the temperature at which the RAP starts to smoke.

Smoke Point and Flash Point Determination of Asphalt Cement--The smoke point and flash point of the asphalt cement used during testing was determined by the ASTM D92-Cleveland Open Cup procedure.[1] Based on this method, the test cup is filled to a specified level with the asphalt sample. The temperature of the sample is increased rapidly at first and then at a slow constant rate as the smoke point is approached. As soon as smoke is detected, the temperature of the sample is noted. To determine the flash point, the temperature is increased and at specified intervals a small test flame is passed across the cup. The lowest temperature at which application of the test flame causes the vapors above the surface of the liquid to ignite is taken as the flash point.

5.3 DATA REDUCTION

This section provides a discussion of the data reduction procedures used to process the raw data generated during this sampling program. EPA referenced data reduction procedures were used whenever possible. When an EPA referenced data reduction procedure was not available, a detailed description of the data reduction procedure is provided. Further information is given in Appendix B.

5.3.1 Gas Stream Sampling Data Reduction

Data reduction procedures and equations used for gas stream sampling data reduction were taken from applicable parts of 40 CFR 60, Appendix A. Raw field data were reduced to engineering units using Radian's Source Sampling Data Reduction Computer Program. Copies of the data reduction printouts are presented in Appendix A. As a verification check of the computer reduction, several runs were hand calculated using the equations outlined in Appendix B.

[1] Annual Book of ASTM Standards, "Standard Test Method for Flash and Fire Points by Cleveland Open Cup," Part 23, Petroleum Products and Lubricants(I), D92-72, pages 27-32.

Particulate Mass Emission Rate Data Reduction

In order to allow a review of possible effects introduced by anisokinetic sampling into the normal mass emission rate calculations, two methods were used to calculate mass emission rates for the particulate mass emission runs. The method normally used to calculate particulate mass emission rates is the concentration method. This method involves multiplying the particulate loading (sample mass divided by gas sample volume) by the volumetric gas flow rate. The second particulate mass emission rate calculation method is the area-ratio method. Based on the area-ratio method, the sample mass is divided by the sampling time and then multiplied by the ratio of the stack area to nozzle area to obtain the particulate mass flow rate.

Equation:

$$(m/t) \times (A_s/A_n) = MER$$

where: m = mass of particulate matter collected during sampling (pounds)

t = elapsed sampling time (hours)

A_s = area of stack (square feet)

A_n = area of nozzle (square feet)

MER = mass emission rate (pounds per hour)

The difference between the emission rates calculated by these two methods is an estimate of the maximum bias in the measured emission rate due to anisokinetic sampling.

Total Organic Carbon (TOC) Emissions Data Reduction

Equation:

$$TOC_{(g)} = \frac{(TOC_{(L)} \times V_I) - (TOC_{(B)} \times V_I)}{DGV}$$

Nomenclature:

$TOC_{(g)}$ = Total organic carbon in gas phase, mg/dscm

$TOC_{(L)}$ = Total organic carbon in impinger catch, mg/l

$TOC_{(B)}$ = Total organic carbon in the impinger blank, mg/l

V_I = Total volume of impinger catch, l

DGV = Volume of gas sampled, standard conditions dry standard cubic meters, dscm

Particle Size Distribution Data Reduction (AHCSS)

The procedure for calculating the particle size distribution of the particulate caught by the AHCSS was taken directly from the operating manual for the AHCSS.

Add up the weight gains for the four stages to obtain the total particulate collected.

Divide the amount collected in an individual stage by the total amount collected to determine the percentage of the total collected in each stage.

Starting with stage 4 (backup filter) compute the cumulative percent less than the staged size range. The cumulative percent less than stage 3 (the cyclone) is equal to the percent caught in stage 4. The cumulative percent less than stage 2 is the sum of the percent caught on stage 3 and the percent caught on stage 4. The cumulative percent less than stage 1 is the sum of the percents caught on stages 4, 3, and 2.

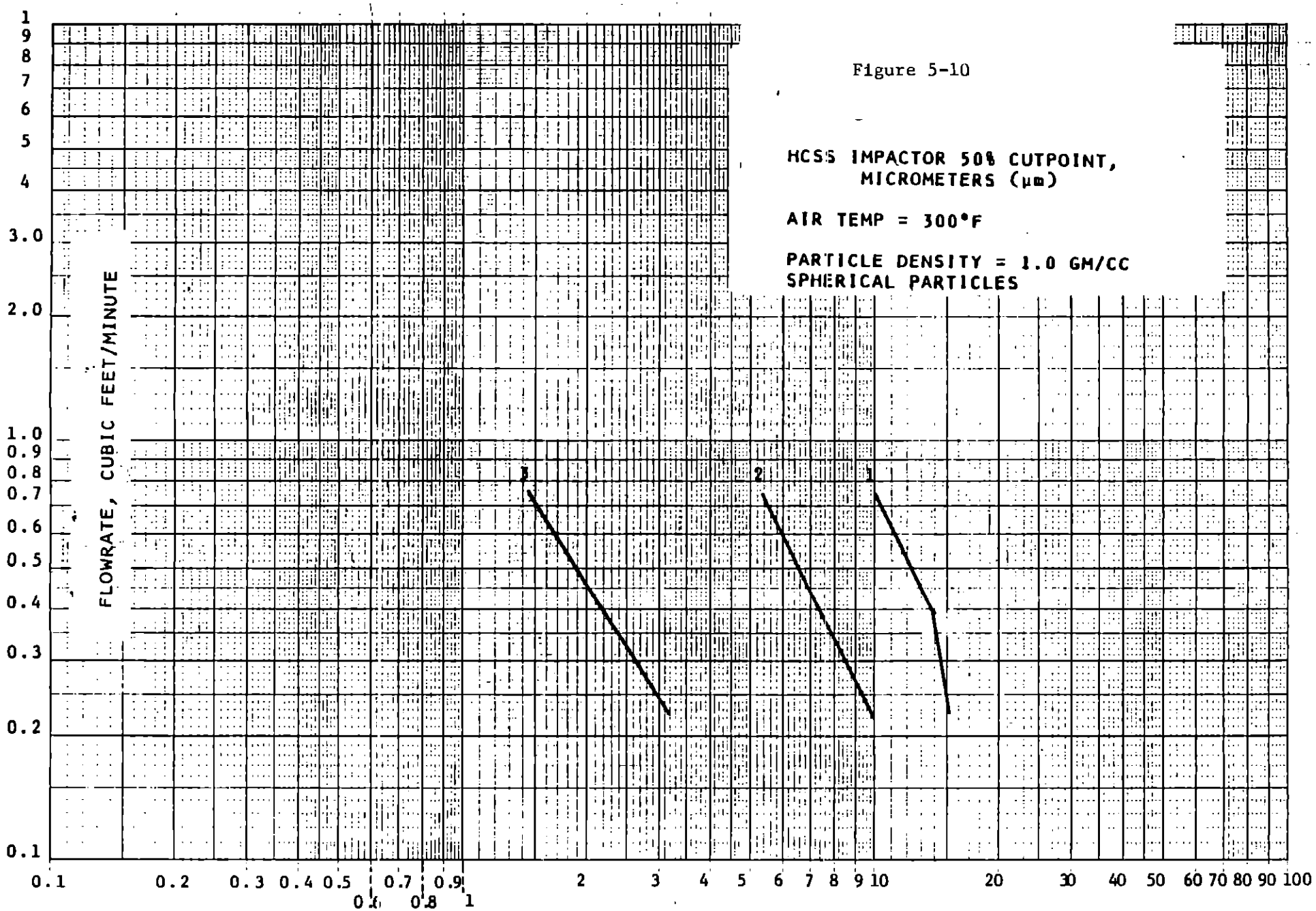
Particle density is considered to be 1.0 gm/cm^3 and the particles are considered to be spherical. Particle sizes are reported as equivalent aerodynamic diameters.

Using Figure 5-10 with gas flow rate at stack conditions and stack temperature, determine the d_{50} (50% Effective Cut Off Diameter) for each stage.

Plot the results on log probability graph paper with the particle diameter (d_{50}) as the ordinate and the cumulative percent less than the stated size range by weight as the abscissa.

Visible Determination of Opacity

The procedure used to calculate the opacity of the outlet stack plume was taken directly from the procedure specified in EPA Reference Method 9. Based on this method, opacity is determined as the average of 24 consecutive observations recorded at 15 second intervals (six minute average).



Gas flow rate at stack conditions and stack temperature.

5.3.2 Process Sampling Data Reduction

PAH in Scrubber Water Data Reduction

Equation:

$$PAH_{(W)} = \frac{P_{(T)}}{0.4}$$

Nomenclature:

$PAH_{(W)}$ = Concentration of PAH in the scrubber water, μg/liter

$P_{(T)}$ = Total concentration of PAH specie, μg

0.4 = Volume of scrubber water extracted, liter

PAH in Scrubber Solids Data Reduction

Equation:

$$PAH_{(S)} = \frac{P_{(T)}}{S}$$

Nomenclature:

$PAH_{(S)}$ = Concentration of PAH specie in scrubber solids, μg/gram

$P_{(T)}$ = Total concentration of PAH specie, μg

S = Weight of scrubber solids extracted, g

Weight Percent Solids Data Reduction

Equation:

$$S_{(WT)} = \frac{F_{(F)} - F_{(T)}}{W_{(T)}} \times 100$$

Nomenclature:

$S_{(WT)}$ = Weight % solids

$F_{(F)}$ = Final filter weight, g

$F_{(T)}$ = Filter tare weight, g

$W_{(T)}$ = Weight of scrubber water filtered, g

100 = conversion from fraction to percent

Total Dissolved Solids Data Reduction

Equation:

$$TDS = \frac{W_{(F)} - W_{(T)}}{0.05}$$

Nomenclature:

TDS = Total dissolved solids, mg/l

$W_{(F)}$ = Weight of beaker and residue after evaporation, mg

$W_{(T)}$ = Beaker tare weight, mg

0.05 = Volume of solution evaporated, liter

SECTION 6

6.0 QUALITY ASSURANCE

Quality assurance/quality control guidelines outline pertinent steps during the production of analytical and emission data to ensure the acceptability and reliability of the data generated. The measures outlined in this section were followed to ensure the production of quality data from the sampling and analytical efforts. Additional information is presented in Appendix I of Volume 2.

6.1 STANDARD QUALITY ASSURANCE PROCEDURES

QA/QC procedures are followed during sampling and analysis to ensure that the data generated are of acceptable quality. These quality control and quality assurance procedures are used during EPA reference method sampling and/or routine analysis. Additional QA/QC procedures may be called for on a site-specific basis. This section describes QA/QC procedures applicable to the methods used, as well as specific procedures used during this test program.

6.1.1 Sampling Equipment Preparation

The checkout and calibration of source sampling equipment is vital to maintaining data quality. Referenced calibration procedures were strictly adhered to when available, and all results were documented and retained. If a referenced calibration technique for a particular piece of apparatus is not available, then a state-of-the-art technique was documented and followed. Table 6-1 summarizes the parameters of interest and the types of sampling equipment that were used to measure each parameter. The techniques used to calibrate the equipment are as follows:

TABLE 6-1 SUMMARY OF CALIBRATED EQUIPMENT USED IN PERFORMING SOURCE SAMPLING

Parameter		Calibrated Equipment Used in Measuring Parameters					
		Type-S Pitot Tube	Differential Pressure Gauge	Temperature Measuring Device	Gas Metering System	Fyrite	Isokinetic Nozzles
Volumetric Gas Flow Rate	EPA-1, EPA-2	*	*	*			
Gas Phase Composition							
Moisture	EPA-4		*	*	*		
Molecular Weight	EPA-3					*	
Particulate Mass & TOC	Modified EPA-5E	*	*	*	*	*	*
Polynuclear Aromatic Hydrocarbons	Modified EPA-5	*	*	*	*	*	*
Particle Size Distribution		*	*	*	*	*	*

RADIAN CORPORATION

- Prior to sampling, all equipment was cleaned and checked to ensure operability.

- Equipment requiring pretest calibration (Table 6-1) was calibrated in accordance with "Quality Assurance Handbook for Air Pollution Measurements Systems, Volume III, Stationary Source Specific Methods," (EPA 600 4-77-027b).

- Equipment calibration forms were reviewed for completeness to ensure acceptability of the equipment required for each specific application.

- The AHCSS was cleaned and visually inspected.

- Each component of the various sampling systems was carefully packaged for shipment.

- Upon arrival on site--the equipment was unloaded, inspected for possible damage, assembled for use, and checked for operability.

6.1.2 Collection of Samples

The most important aspect of sample collection is obtaining a valid sample. This section focuses on measures taken to obtain valid samples. Those measures were:

- Pretest and posttest leak checks of the sampling trains were made.

- Field blanks were collected for the particulate, TOC, and PAH sampling trains prior to sample collection.

- The sampling systems were visually inspected prior to sampling to ensure proper assembly and operability.

- The S-type pitot tubes were leak checked before and after sampling and inspected for damage.

- The Magnehelic® gauges were leveled and zeroed prior to sampling.

- Temperature measurement systems were visually checked for damage and operability by measuring the ambient temperature prior to each sampling run.

- The nozzles were visually inspected for damage before and after each sampling run.

- The AHCSS was preheated to prevent condensation of water in the particle sizing device.

- Data requirements were reviewed prior to each sampling run.

- Ice was maintained in the icebaths during all sampling runs.

- Number and location of sampling points were checked prior to each sampling run.

- Sampling ports were sealed to help prevent possible air inleakage.

The molecular weight of the flue gas was determined using EPA Reference Method 3 (4). Quality control for Method 3 focused on the following:

- The sampling train was purged prior to sample collection.

- The Fyrite® analyzer fluid level was zeroed prior to use.

- The Fyrite® analyzer was thoroughly purged with sample prior to analysis.

- Analyses were repeated until the analysis agreed within 0.5% absolute.

- The Fyrite® absorbing solutions were changed when more than six passes were required to obtain a stable reading of any component.

The moisture determinations were made simultaneous with the modified EPA Reference Method 5E. Quality control procedures for Method 4 focused on the following:

- Before and after sampling each impinger was carefully weighed to the nearest 0.02 g. Care was taken to see the impingers were dry and the stopcock grease was removed from the ball joints prior to each weighing.

The particulate loading determinations were performed using a modified EPA Reference Method 5E. Quality control procedures for this method focused on the following:

- Prior to particulate sampling, preliminary velocity, temperature, and moisture determinations were made. This aided in calculating isokinetic flow rates.

- Prior to sampling, particulate filters were baked, desiccated and weighed. They were then placed in clean petri dishes until used.

- Particulate filters were handled with tweezers.

The visible opacity of controlled emissions were observed using EPA Reference Method 9. Quality control procedures for this method focused on the following:

- The visible emissions observer was certified within six months of the test program.
- The location of the observer was independently verified.
- A clear, blue sky was required to ensure valid visible emission observations.

6.1.3 Sample Recovery

To ensure data integrity careful sample recovery techniques must be adhered to. This section outlines quality control procedures followed to ensure data integrity. These include:

- Particulate filters were handled out of drafts and transferred with treezers.
- Sample trains were disassembled and the samples recovered in clean areas to prevent contamination.
- The nozzle was capped prior to and following sampling.
- The samples were transferred to appropriate storage containers and clearly labeled. Liquid levels were noted.
- Field blanks were included for each method. These consisted of (i.e. unused) sampling trains which were assembled, disassembled, recovered, and analyzed in the same manner as actual sampling trains and samples.

- Samples were carefully labeled, logged into the field logbook and assigned a unique identification code immediately after collection.

- The impingers were rinsed three times with aliquots of fresh impinger solution.

6.1.4 Preparation of Samples for Analysis

Prior to analysis, each sample must be properly prepared. This section outlines quality control procedures used to ensure proper sample preparation. Included are:

- Each sample identification code was crosschecked for accuracy against the sample logbook.

- The analytical requirements of each sample were reviewed.

- The sample containers were checked for leakage or damage and any anomalies were noted.

6.1.5 Sample Analysis

The exact quality assurance/quality control procedures followed during the analysis task were dependent on the specific analysis being performed. One or more of the following steps were taken:

- Duplicate analyses were performed on 5-15% of the samples.

- Internal QC samples were analyzed to verify instrument or procedural variance.

- Blind QC samples prepared by EPA were submitted to the Analytical lab along with the field generated samples.

- Blanks were analyzed to correct for background and/or matrix interferences.

- The samples were spiked with known additions of the species of interest.

6.1.6 Data Reduction

Several steps were taken to verify the correctness of the data reduction. Steps routinely used include:

- Alternate procedures were used to reduce the data. An example is, reducing source sampling data by using Radian's Source Sampling Data Reduction Program and comparing selected results against hand calculations.

- A certain percentage (approximately 10%) of the results were recalculated from raw data by someone unassociated with the original data reduction.

- The data was carefully checked for unexplained variance and internal consistency, i.e. are the results consistent with expected and/or other results.

6.1.7 Data Documentation and Verification

Several measures were taken to verify the completeness and accuracy of the data generated. These include:

- All sampling data was recorded on preformated data sheets.

- Analytical results and calculations were recorded in bound laboratory notebooks.

- Data tables were made and reviewed for completeness and accuracy.

- All data that appeared to be outside expected ranges were carefully scrutinized for process upsets and reanalyzed as necessary.

- Data generated were compared to process operation and system upsets.

6.2 TEST PROGRAM SPECIFIC QUALITY CONTROL/QUALITY ASSURANCE PROCEDURES

Each sampling site presents its own individual problems and peculiarities. Because of this any QA/QC program must be custom tailored to each specific site. This section presents the procedures that were specific to the Sloan asphalt concrete sampling program.

6.2.1 Sampling Equipment Preparation

This section outlines equipment modifications that were used during this program to ensure the sample data produced were valid. These measures are in addition to the standard equipment calibration and checkout procedures outlined in Section 6.1.1. These include:

- Variacs were used to control the probe heater temperature.

- Inline thermocouples were installed to monitor the gas stream temperature as it exited the filter holder.

- A time-proportioning temperature controller was used to control the hot box temperature to within $\pm 10°F$.

Hydrocarbons in the gas stream condense as a function of temperature. As the temperature decreases more hydrocarbons condense as particulate. For this program it was important to have very strict control of the collection temperature since the collection temperature "defined" the particulate. If temperature fluctuations were encountered an increase or decrease in the amount of particulate collected could be observed depending on temperature.

An inline thermocouple positioned directly after the filter holder, coupled to a time proportioning temperature controller, was used to control the hot box so the gas temperature would remain at 250°F ± 10°F. The vast majority of the time temperature was controlled at 250°F ± 5°F. A variac was used to control the probe heat temperature. The constant voltage output kept a more constant temperature and avoided the temperature fluctuations encountered with standard oven heaters.

6.2.2 Sample Collection

The sampling program presented some special problems in sample collection. This section outlines special QC steps that were taken to aid in reliable and representative sample collection. These are in addition to such measures as visual inspection of sampling trains and equipment, leak checks, and other measures outlined in Section 6.1.2.

6.2.2.1 Sampling Preparation--

Certain non-equipment items such as the filters and glassware required special preparation. This section outlines that preparation. The measures include:

- Particulate filters were baked at 500°F prior to use. They were then desiccated, weighed, and placed in clean petri dishes,

- Particulate filters used during polynuclear aromatic hydrocarbon sampling were methylene chloride extracted and then baked at 500°F prior to being stored in glass petri dishes.

All glassware used during sampling was cleaned as follows:

- The glassware was first washed thoroughly with laboratory soap and water.

- The glassware was kiln-fired at 500°C for 18 hours.

- After the glassware cooled, it was rinsed with methylene chloride and all the ball joints were capped with aluminum foil.

6.2.2.2 Preliminary Measurements--

This section outlines QC checks and measurements performed prior to sampling to assist in the calculation of anisokinetic sampling rate. These include:

- A check for cyclonic or turbulent flow was performed prior to sampling at the uncontrolled emissions sampling location.

- Preliminary velocity, temperature, and moisture determinations were performed to aid in conducting isokinetic sampling.

- Wet bulb/dry bulb moisture determinations were performed prior to and during individual sampling runs.

It was discovered early into the sampling program that the moisture content of the scrubber inlet could vary drastically from run to run. For this reason moisture determinations were performed prior to and during each uncontrolled sampling run to calculate accurate isokinetic sampling rates prior to each sampling run.

6.2.2.3 Sampling Procedures--

This section outlines measures taken to ensure that valid and representative samples were collected. The measures include:

- Approximately 10 pound aggregate samples were collected. The samples were coned and quartered to produce the 600 gram sample used to determine the moisture content.

- Two to four scrubber water samples were taken during each sampling run. The samples were composited and all subsequent analyses were performed on the composite sample.

- All glassware, except the silica gel impinger was wrapped with aluminum foil during the polynuclear aromatic hydrocarbon sampling runs to help prevent photodegradation of the organic species.

6.2.3 Sample Recovery

This section outlines special QA/QC measures taken during sample recovery. These measures are in addition to particulate filter handling, performance of field blanks, labeling and logging in of samples and other steps outlined in Section 6.1.3. Measures taken to further ensure the integrity of the samples during recovery include:

- Incandescent lighting was used during recovery of the polynuclear aromatic hydrocarbons sampling trains. This was to

reduce the chance of photodegradation of the organic species by ultraviolet light.

- Polynuclear aromatic hydrocarbons samples were stored in amber glass bottles with Teflon lid inserts to prevent photodegradation and/or contamination of the sample during storage and transport.

- Particulate filters used during the polynuclear aromatic hydrocarbons sampling runs were stored after use in glass petri dishes. The petri dishes were wrapped in aluminum foil to prevent possible photodegradation of the sample.

6.2.4 Preparation of Samples for Analysis

Quality control procedures incorporated during the preparation of the samples for analysis are outlined in this section. These were in addition to visually checking the samples for damage and ensuring proper labeling and other procedures outlined in Section 6.1.4. These measures include:

- Sample matrix sheets were developed as an aid in analytical preparation and as a flow diagram for the actual analysis.

- Particulate filters and impactor substrates were desiccated for at least 24 hours prior to their first weighing.

- The particulate filters were weighed at 24-hour intervals to a constant weight.

6.2.5 Sample Analysis

This section outlines additional QC procedures employed during the program to evaluate the quality of the analytical data. These procedures are in addition to such measures as duplicate analysis, blank analysis, internal QC samples, and other measures outlined in Section 6.1.5. Included are:

- Total organic carbon audit samples were submitted to the analytical laboratory prior to the submission of the field samples.
- Field blanks (Section 6.1.3) were evaluated to determine species background and possible contamination problems.
- Two laboratories performed smoke point determinations on RAP samples to help evaluate data variability.

The results of the total organic carbon audit samples are presented in Table 6-2.

The results of the field blanks are presented in Table 6-3. The clean-up results were used to correct the analytical results for background.

TABLE 6-2. SUMMARY OF TOTAL ORGANIC CARBON AUDIT SAMPLE MEASUREMENTS

EPA PREPARED SAMPLE RESULTS		(A)	(R)	
Sample No.	Date of Analysis	Actual Values (mg/l)	Radian Analysis Values (mg/l)	Percent Error R-A/A x 100
33790	5-17-84	4.1	9.3	127
33791	thru	61.2	53.7	-12.3
33792	5-29-84	4.1	3.58	-12.7
33793		61.2	51.8	-15.4

RADIAN PREPARED SAMPLES RESULTS		(A)	(R)	
Sample No.	Date of Analysis	Actual Values (mg/l)	Radian Analysis Values (mg/l)	Percent Error R-A/A x 100
Set 1 submitted 5-17-84				
Radian #1		40	38.7	-3.2
Radian #2		200	192	-4.0
Radian #3		200	200	0
Radian #4		1000	1000	0
Set 2 submitted 6-21-84				
Radian #1		1316	1340	1.8
Radian #2		329	325	-1.5
Radian #3		132	133	0.8
Set 3 submitted 7-5-84				
Radian #1		1316	1385	5.2
Radian #2		329	322	-2.1
Radian #2		132	133	0.8
Radian #4		1005	1004	-0.1
Radian #5		158	153	-3.2
Radian #6		80.4	70	-12.9

TABLE 6-3. SUMMARY OF CLEANUP RESULTS

Particulate and Total Organic Carbon Sample Blanks	Train 1 Uncontrolled	Train 2 Controlled	Average
Front half probe rinses (mg)	7.3	5.5	6.4
Filter blanks (mg)	0.6	0.3	0.4
Total organic carbon (mg)			
1st impinger	<1	<1	<1
2nd & 3rd impinger	2	2	2

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Planning and Standards
Research Triangle Park NC 27711

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Prepared for:

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APPENDIX A

COMPUTER PRINTOUT OF TEST RESULTS

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APPENDIX A.1

PARTICULATE MASS (MODIFIED EPA METHOD 5E)

INCLUDES

A.1.1 Uncontrolled Particulate Emission Data

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION INLET
SAMPLE IDENT. TOC-0508-RUN1
DATE 5/ 8/84 (MMDDYY) TIME START 14:24 (HHMM) TIME FINISH 16: 8 (HHMM)
DIAMETER 3.940FT.
PTCF .84 DGMCF .995
TEST DURATION 32. MIN.
NOZZLE DIA. .244 INCHES
% CO .0 % N2 80.9
BAR PRESS. 30.27 "HG
% CO2 6.2 % H2 .0
STATIC PRESS. -3.1 "H2O .0
% O2 12.9 % CH4 .0
INITIAL LEAK RATE .004 CFM
CONDENSED WATER 148.2 GMS
FINAL LEAK RATE .002 CFM
FILTER WT. GAIN .49690 GMS
OPERATOR INITIALSEPA/CSG
PROBE WASH WT. GAIN 7.97270 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H2O	DH IN. H2O	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
1-1	1424.	568.324	.35	.40	270.	97.	97.	265.	64.	2.0
1-2	1426.	569.010	.50	.50	283.	96.	96.	257.	64.	2.0
1-3	1428.	569.830	.68	.80	288.	96.	96.	255.	64.	3.0
1-4	1430.	570.830	.65	.74	287.	96.	96.	260.	64.	3.0
1-5	1432.	571.830	.58	.85	286.	97.	96.	258.	64.	3.0
1-6	1434.	572.930	.63	1.00	293.	98.	96.	255.	64.	3.0
1-7	1436.	574.020	.65	1.05	294.	99.	97.	255.	64.	3.0
1-8	1438.	575.140	.60	1.00	294.	99.	97.	255.	64.	3.0
STOP	1440.	576.268								
2-8	1552.	576.302	.50	.85	288.	94.	94.	257.	61.	3.0
2-7	1554.	577.390	.43	.70	285.	94.	93.	250.	61.	3.0
2-6	1556.	578.430	.55	.95	286.	95.	94.	250.	61.	3.5
2-5	1558.	579.550	.50	.85	284.	95.	94.	250.	61.	3.5
2-4	1600.	580.780	.75	1.30	288.	96.	94.	253.	61.	4.0
2-3	1602.	581.900	.65	1.08	293.	96.	94.	250.	61.	4.0
2-2	1604.	583.090	.60	1.00	287.	97.	95.	253.	61.	4.8
2-1	1606.	584.200	.35	.58	284.	97.	95.	253.	61.	3.2
STOP	1608.	585.135								

REMARKS FYRITE CO2-6.5,6.6

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0508-RUN1

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: INLET
DATE: 5/ 8/84 TIME START: 14:24 TIME FINISH: 16: 8

REMARKS: FYRITE CO2-6.5,6.6

AVERAGE FLUE GAS TEMPERATURE	286.9	(F)	141.6	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.04	"HG	76.31	CMHG
FLUE GAS STATIC PRESSURE	-3.10	"H2O	-7.874	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	26.02	LB/LB-MOLE	26.0182	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	30.31	%	30.31	%
AVERAGE FLUE GAS VELOCITY	52.2748	FPS	15.9534	M/S
AVERAGE FLUE GAS FLOWRATE	38242.	ACFM	1083.	M3/MIN
	18914.	DSCFM	536.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	16.1494	DSCF	.4574	M3
TEST DURATION	32.	MIN	32.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	254.8	(F)	123.7	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	62.5	(F)	16.9	(C)
MAXIMUM LINE VACUUM	4.8	"HG	12.19	CMHG
FINAL LEAK RATE	.002	CFM	.0001	M3/MIN
PERCENT ISOKINETIC	99.7	%	99.7	%
PARTICULATE MASS CONCENTRATION	.809-001	GR/DSCF	.185+002	GMS/M3
	.116-002	LBS/DSCF		
PARTICULATE MASS RATE	.131+004	LBS/HR	.595+003	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0508-RUN1

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
1-1	41.04	270.00
1-2	49.49	283.00
1-3	57.91	288.00
1-4	56.58	287.00
1-5	53.41	286.00
1-6	55.93	293.00
1-7	56.85	294.00
1-8	54.62	294.00
STOP		
2-8	49.66	288.00
2-7	45.96	285.00
2-6	52.01	286.00
2-5	49.52	284.00
2-4	60.82	288.00
2-3	56.81	293.00
2-2	54.36	287.00
2-1	41.44	284.00
STOP		

CORPORATION

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION INLET
SAMPLE IDENT. TOC-0510-RUN2
DATE 5/10/84 (MMDDYY) TIME START 8:15 (HHMM) TIME FINISH 9:29 (HHMM)
DIAMETER 3.940FT.
PTCF .84 DGMCF .995
NOZZLE DIA. .244 INCHES
BAR PRESS. 30.27 "HG
STATIC PRESS. -2.2 "H20 .0
INITIAL LEAK RATE .002 CFM
FINAL LEAK RATE .004 CFM
OPERATOR INITIALSEPA/CSG

TEST DURATION 32. MIN.

% CO	.0	% N2	79.1
% CO2	5.6	% H2	.0
% O2	15.3	% CH4	.0

CONDENSED WATER 135.0 GMS
FILTER WT. GAIN .44850 GMS
PROBE WASH WT. GAIN 5.18820 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H20	DH IN. H20	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
1-8	815.	587.440	.55	.88	289.	74.	73.	245.	53.	2.5
1-7	817.	588.480	.63	1.00	296.	76.	73.	256.	53.	2.5
1-6	819.	589.560	.60	.96	295.	76.	74.	255.	53.	2.5
1-5	821.	590.620	.53	.84	297.	77.	74.	251.	53.	2.5
1-4	823.	591.630	.60	.96	298.	77.	75.	250.	53.	2.5
1-3	825.	592.690	.65	1.04	289.	78.	75.	253.	53.	3.0
1-2	827.	593.800	.50	.80	284.	79.	76.	252.	53.	2.8
1-1	829.	594.800	.40	.64	276.	80.	77.	250.	53.	2.8
STOP	831.	595.715								
2-8	912.	595.750	.45	.72	272.	90.	89.	247.	50.	2.8
2-7	914.	596.710	.43	.70	277.	90.	89.	250.	53.	2.8
2-6	916.	597.660	.45	.72	280.	90.	89.	251.	53.	2.8
2-5	918.	598.570	.50	.80	283.	90.	89.	250.	53.	3.0
2-4	920.	599.540	.65	1.04	290.	91.	89.	249.	53.	3.0
2-3	922.	600.640	.65	1.04	293.	91.	89.	250.	53.	3.0
2-2	924.	601.770	.50	.80	262.	92.	90.	250.	53.	3.0
2-1	926.	602.750	.25	.40	272.	92.	90.	249.	53.	2.0
STOP	928.	603.496								

REMARKS FYRITE CO2-L.0,5.0,5.5,6.0 O2-15.5,15.1

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510-RUN2

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: INLET
DATE: 5/10/84 TIME START: 8:15 TIME FINISH: 9:28

REMARKS: FYRITE CO2-L.0,5.0,5.5,6.0 O2-15.5,15.1

AVERAGE FLUE GAS TEMPERATURE	303.7	(F)	150.9	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.11	"HG	76.47	CMHG
FLUE GAS STATIC PRESSURE	-2.20	"H2O	-5.588	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	26.18	LB/LB-MOLE	26.1766	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	28.95	%	28.95	%
AVERAGE FLUE GAS VELOCITY	50.1417	FPS	15.2832	M/S
AVERAGE FLUE GAS FLOWRATE	36682.	ACFM	1039.	M3/MIN
	18129.	DSCFM	513.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	15.7057	DSCF	.4448	M3
TEST DURATION	32.	MIN	32.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	250.5	(F)	121.4	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	53.4	(F)	11.9	(C)
MAXIMUM LINE VACUUM	3.0	"HG	7.62	CMHG
FINAL LEAK RATE	.004	CFM	.0001	M3/MIN
PERCENT ISOKINETIC	101.2	%	101.2	%
PARTICULATE MASS CONCENTRATION	.554+001	GR/DSCF	.127+002	GMS/M3
	.791-003	LBS/DSCF		
PARTICULATE MASS RATE	.861+003	LBS/HR	.391+003	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510-RUN2

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
1-8	51.90	289.00
1-7	55.81	296.00
1-6	54.43	295.00
1-5	51.22	297.00
1-4	54.53	298.00
1-3	56.42	289.00
1-2	49.32	284.00
1-1	43.88	276.00
STOP		
2-8	46.41	272.00
2-7	45.52	277.00
2-6	46.66	280.00
2-5	49.29	283.00
2-4	56.46	290.00
2-3	56.57	293.00
2-2	49.25	282.00
2-1	34.59	272.00
STOP		

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION INLET — SAMPLE IDENT. TOC-0510-RUN3
DATE 5/10/84 (MMDDYY) — TIME START 11:40 (HHMM) — TIME FINISH 13:41 (HHMM)
DIAMETER 3.940FT.
PTCF .84 — DGMCF .095 — TEST DURATION 32. MIN.
NOZZLE DIA. .244 INCHES — % CO .0 — % N2 79.7
BAR PRESS. 30.31 "HG — % CO2 4.5 — % H2 .0
STATIC PRESS. -2.5 "H2O .0 — % O2 15.8 — % CH4 .0
INITIAL LEAK RATE .018 CFM — CONDENSED WATER 138.3 GMS
FINAL LEAK RATE .016 CFM — FILTER WT. GAIN .60920 GMS
OPERATOR INITIALSEPA/CSG — PROBE WASH WT. GAIN 5.37670 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H2O	DH IN. H2O	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
1-8	1140.	604.674	.55	.88	288.	87.	88.	243.	59.	2.7
1-7	1142.	605.720	.60	.96	294.	88.	88.	239.	55.	3.0
1-6	1144.	606.790	.55	.88	290.	88.	87.	253.	53.	3.0
1-5	1146.	607.850	.55	.88	291.	88.	87.	257.	53.	3.0
1-4	1148.	608.880	.57	.90	290.	88.	87.	250.	53.	3.0
1-3	1150.	609.930	.57	.90	294.	88.	87.	248.	53.	3.0
1-2	1152.	610.970	.50	.80	288.	89.	88.	250.	53.	3.0
1-1	1154.	611.960	.38	.60	284.	89.	87.	250.	53.	2.8
STOP	1156.	612.842								
2-8	1325.	612.902	.50	.75	288.	86.	86.	248.	55.	3.0
2-7	1327.	613.840	.40	.55	292.	86.	86.	248.	53.	2.6
2-6	1329.	614.680	.40	.55	293.	86.	86.	252.	53.	2.6
2-5	1331.	615.490	.45	.60	300.	87.	86.	250.	53.	2.8
2-4	1333.	616.340	.65	1.00	296.	88.	86.	250.	53.	3.5
2-3	1335.	617.390	.70	1.05	293.	88.	86.	250.	53.	3.8
2-2	1337.	618.510	.45	.60	286.	88.	87.	251.	53.	2.9
2-1	1339.	619.370	.30	.45	284.	88.	87.	252.	53.	2.5
STOP	1341.	620.076								

REMARKS FYRITE CO2=5.5,4.5,4.5 MW(DRY)=29.35

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510-RUN3

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: INLET
DATE: 5/10/84 TIME START: 11:40 TIME FINISH: 13:41

REMARKS: FYRITE CO2=5.5,4.5,4.5 MW(DRY)=29.35

AVERAGE FLUE GAS TEMPERATURE	290.7	(F)	143.7	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.13	"HG	76.52	CMHG
FLUE GAS STATIC PRESSURE	-2.50	"H20	-6.350	CMH20
FLUE GAS MOLECULAR WEIGHT (WET)	25.90	LB/LB-MOLE	25.9023	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	30.39	%	30.39	%
AVERAGE FLUE GAS VELOCITY	49.8984	FPS	15.2090	M/S
AVERAGE FLUE GAS FLOWRATE	36504.	ACFM	1034.	M3/MIN
	17993.	DSCFM	510.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	15.0169	DSCF	.4253	M3
TEST DURATION	32.	MIN	32.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	249.4	(F)	120.8	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	53.6	(F)	12.0	(C)
MAXIMUM LINE VACUUM	3.8	"HG	9.65	CMHG
FINAL LEAK RATE	.016	CFM	.0005	M3/MIN
PERCENT ISOKINETIC	97.5	%	97.5	%
PARTICULATE MASS CONCENTRATION	.615+001	GR/DSCF	.141+002	GMS/M3
	.879-003	LBS/DSCF		
PARTICULATE MASS RATE	.949+003	LBS/HR	.430+003	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510-RUN3

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
1-8	52.12	288.00
1-7	54.66	294.00
1-6	52.19	290.00
1-5	52.23	291.00
1-4	53.13	290.00
1-3	53.28	294.00
1-2	49.70	288.00
1-1	43.21	284.00
STOP		
2-8	49.70	288.00
2-7	44.57	292.00
2-6	44.60	293.00
2-5	47.53	300.00
2-4	56.97	296.00
2-3	59.00	293.00
2-2	47.09	286.00
2-1	38.39	284.00
STOP		

CORPORATION

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION INLET#04
DATE 5/10/84 (MMDDYY) TIME START 16:14 (HHMM)

SAMPLE IDENT. TOC-0510 - RUN 4
TIME FINISH 16:56 (HHMM)

DIAMETER 3.940FT.
PTCF .84 DGMCF .995
NOZZLE DIA. .244 INCHES
BAR PRESS. 30.31 "HG
STATIC PRESS. -2.3 "H20 .0
INITIAL LEAK RATE .004 CFM
FINAL LEAK RATE .005 CFM
OPERATOR INITIAL SEPA/CSG

TEST DURATION 32. MIN.

% CO	.0	% N2	80.0
% CO2	5.5	% H2	.0
% O2	14.5	% CH4	.0

CONDENSED WATER 143.9 GMS
FILTER WT. GAIN .73400 GMS
PROBE WASH WT. GAIN 4.18050 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H20	DH IN. H20	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
2-8	1614.	644.073	.38	.60	268.	95.	94.	245.	61.	2.5
2-7	1616.	644.830	.38	.60	268.	95.	94.	248.	61.	2.5
2-6	1618.	645.710	.38	.60	270.	94.	94.	250.	61.	2.5
2-5	1620.	646.580	.40	.62	272.	94.	94.	250.	61.	2.5
2-4	1622.	647.470	.53	.84	284.	94.	94.	248.	56.	3.0
2-3	1624.	648.460	.63	1.00	282.	94.	94.	247.	56.	3.2
2-2	1626.	649.540	.50	.80	272.	95.	94.	246.	56.	3.0
2-1	1628.	650.530	.20	.30	270.	95.	94.	245.	56.	2.5
STOP	1630.	651.179								
1-8	1640.	651.212	.50	.80	276.	95.	95.	250.	59.	3.2
1-7	1642.	652.190	.56	.90	284.	96.	95.	248.	57.	3.5
1-6	1644.	653.240	.55	.85	283.	97.	96.	250.	57.	3.5
1-5	1646.	654.260	.50	.80	282.	98.	96.	250.	57.	3.5
1-4	1648.	655.250	.48	.76	281.	98.	96.	245.	57.	3.5
1-3	1650.	656.240	.50	.80	279.	98.	96.	244.	57.	3.8
1-2	1652.	657.190	.48	.76	278.	99.	96.	243.	56.	3.8
1-1	1654.	658.160	.40	.65	269.	99.	96.	245.	56.	3.5
STOP	1656.	659.073								

REMARKS PYRITE CO2-5.5.5.5

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510 - RUN 4

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: INLET#04
DATE: 5/16/84 TIME START: 16:14 TIME FINISH: 16:56

REMARKS: PYRITE CO2-5.5.5.5

AVERAGE FLUE GAS TEMPERATURE	293.4	(F)	145.2	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.14	"HG	76.56	CMHG
FLUE GAS STATIC PRESSURE	-2.30	"H2O	-5.842	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	25.77	LB/LB-MOLE	25.7686	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	32.21	%	32.21	%
AVERAGE FLUE GAS VELOCITY	47.1931	FPS	14.3845	M/S
AVERAGE FLUE GAS FLOWRATE	34524.	ACFM	978.	M3/MIN
	16521.	DSCFM	468.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	14.3548	DSCF	.4065	M3
TEST DURATION	32.	MIN	32.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	247.3	(F)	119.6	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	57.8	(F)	14.3	(C)
MAXIMUM LINE VACUUM	3.8	"HG	9.65	CMHG
FINAL LEAK RATE	.005	CFM	.0001	M3/MIN
PERCENT ISOKINETIC	101.5	%	101.5	%
PARTICULATE MASS CONCENTRATION	.528+001	GR/DSCF	.121+002	GMS/M3
	.755-003	LBS/DSCF		
PARTICULATE MASS RATE	.748+003	LBS/HR	.339+003	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510 - RUN 4

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
2-8	42.84	268.00
2-7	42.84	268.00
2-6	42.90	270.00
2-5	44.08	272.00
2-4	51.15	284.00
2-3	55.69	282.00
2-2	49.28	272.00
2-1	31.12	270.00
STOP		
1-8	49.41	276.00
1-7	53.51	284.00
1-6	52.07	283.00
1-5	49.62	282.00
1-4	48.58	281.00
1-3	49.51	279.00
1-2	48.48	278.00
1-1	43.99	269.00
STOP		

APPENDIX A.1

PARTICULATE MASS (MODIFIED EPA METHOD 5E)

INCLUDES

A.1.2 Controlled Particulate Emission Data

CORPORATION

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION OUTLET — SAMPLE IDENT. TOC-050A-RUN1
DATE 5/ 8/84 (MMDDYY) — TIME START 14:26 (HHMM) — TIME FINISH 17:39 (HHMM)
DIAMETER 3.960FT.
PTCF .84 — DGMCF .959 — TEST DURATION 119. MIN.
NOZZLE DIA. .269 INCHES — % CO .0 — % H2 81.1
BAR PRESS. 30.29 "HG — % CO2 5.3 — % H2 .0
STATIC PRESS. -.2 "H20 .0 — % O2 13.6 — % CH4 .0
INITIAL LEAK RATE .010 CFM — CONDENSED WATER 491.8 GMS
FINAL LEAK RATE .016 CFM — FILTER WT. GAIN .27380 GMS
OPERATOR INITIALS LAR — PROBE WASH WT. GAIN .14240 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H2O	DH IN. H2O	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
S12	1426.	934.800	.46	1.10	157.	97.	96.	256.	250.	3.0
S11	1431.	938.000	.54	1.20	156.	101.	94.	254.	245.	3.2
S10	1436.	941.000	.46	1.10	156.	103.	95.	255.	240.	3.5
S9	1441.	944.000	.38	.77	159.	104.	96.	256.	240.	3.5
S8	1446.	946.600	.30	.70	157.	104.	96.	258.	245.	3.0
S7	1451.	949.000	.22	.45	158.	104.	98.	256.	245.	3.0
S6	1456.	951.400	.28	.70	159.	106.	98.	256.	240.	3.0
S5	1501.	953.600	.46	1.10	159.	110.	99.	260.	240.	3.0
S4	1506.	956.800	.46	1.00	157.	111.	99.	256.	245.	3.0
S3	1511.	959.600	.46	1.00	157.	111.	100.	256.	245.	3.8
S2	1516.	963.000	.42	.90	157.	111.	101.	256.	245.	3.8
STOP	1520.	964.540								
S2	1558.	964.540	.46	1.00	163.	103.	101.	259.	250.	4.5
S1	1559.	965.300	.28	.70	158.	103.	101.	259.	250.	15.0
STOP	1604.	967.000								
F12	1640.	968.000	.14	.32	159.	99.	98.	259.	250.	2.0
F11	1645.	969.600	.15	.33	159.	99.	99.	256.	245.	2.0
F10	1650.	971.100	.14	.32	160.	99.	98.	257.	245.	2.0
E9	1655.	972.800	.18	.30	160.	101.	98.	253.	245.	2.0
E8	1700.	974.300	.16	.32	159.	102.	98.	254.	245.	2.0
E7	1705.	975.900	.18	.36	159.	102.	99.	260.	240.	2.0

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

E6	1710.	977.500	.46	1.10	159.	102.	100.	260.	245.	3.5
E5	1715.	980.300	.72	1.50	163.	112.	101.	254.	245.	5.0
E4	1720.	983.900	.86	1.70	160.	112.	101.	263.	240.	5.5
E3	1725.	987.700	.74	1.60	160.	113.	101.	256.	240.	5.5
E2	1730.	991.300	.62	1.30	160.	112.	102.	253.	240.	5.5
E1	1735.	994.500	.55	1.10	160.	110.	102.	253.	245.	5.5
STOP	1739.	996.500								

REMARKS SYSTEM VACUUM BUILT UP DURING LAST POINT (E1) STOPPED 1 MINUTE EARLY 22" HG

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0500-RUN1

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: OUTLET
DATE: 5/ 8/84 TIME START: 14:26 TIME FINISH: 17:39

REMARKS: SYSTEM VACUUM BUILT UP DURING LAST POINT (E1) STOPPED 1 MINUTE EARLY 22" HG

AVERAGE FLUE GAS TEMPERATURE	158.8	(F)	70.5	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.28	"HG	76.90	CMHG
FLUE GAS STATIC PRESSURE	-.20	"H2O	-.508	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	26.02	LB/LB-MOLE	26.0249	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	29.51	%	29.51	%
AVERAGE FLUE GAS VELOCITY	39.1182	FPS	11.9232	M/S
AVERAGE FLUE GAS FLOWRATE	28909.	ACFM	819.	M3/MIN
	17592.	DSCFM	498.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	55.6917	DSCF	1.5772	M3
TEST DURATION	119.	MIN	119.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	256.6	(F)	124.8	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	244.2	(F)	117.9	(C)
MAXIMUM LINE VACUUM	15.0	"HG	38.10	CMHG
FINAL LEAK RATE	.016	CFM	.0005	M3/MIN
PERCENT ISOKINETIC	82.6	%	82.6	%
PARTICULATE MASS CONCENTRATION	.115+000	GR/DSCF	.264+000	GMS/M3
	.165-004	LBS/DSCF		
PARTICULATE MASS RATE	.174+002	LBS/HR	.789+001	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0508-RUN1

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
S12	43.08	157.00
S11	46.64	156.00
S10	43.05	156.00
S9	39.22	159.00
S8	34.79	157.00
S7	29.82	158.00
S6	33.67	159.00
S5	43.15	159.00
S4	43.08	157.00
S3	43.08	157.00
S2	41.17	157.00
STOP		
S2	43.29	163.00
S1	33.64	158.00
STOP		
E12	23.81	159.00
E11	24.64	159.00
E10	23.83	160.00
E9	27.02	160.00
E8	25.45	159.00
E7	26.99	159.00
E6	43.15	159.00
E5	54.16	163.00
E4	59.05	160.00
E3	54.78	160.00
E2	50.14	160.00
E1	47.23	160.00
STOP		

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION OUTLET 02 SAMPLE IDENT. TOC-0510- RUN 2
DATE 5/10/84 (MMDDYY) TIME START 8:17 (HHMM) TIME FINISH 10:21 (HHMM)
DIAMETER 3.960FT.
PTCF .84 DGMCF .959 TEST DURATION 72. MIN.
NOZZLE DIA. .269 INCHES % CO .0 % N2 79.5
BAR PRESS. 30.27 "HG % CO2 5.5 % H2 .0
STATIC PRESS. -.1 "H20 .0 % O2 15.0 % CH4 .0
INITIAL LEAK RATE .010 CFM CONDENSED WATER 292.9 GMS
FINAL LEAK RATE .010 CFM FILTER WT. GAIN .26750 GMS
OPERATOR INITIALS LAR PROBE WASH WT. GAIN .08880 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H2O	DH IN. H2O	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
S12	817.	7.100	.40	1.05	150.	73.	74.	260.	248.	3.5
S11	820.	9.000	.48	1.50	150.	86.	73.	258.	260.	4.5
S10	823.	10.900	.42	1.10	151.	87.	74.	258.	260.	4.5
S09	826.	12.900	.32	.94	153.	88.	74.	260.	250.	4.5
S08	829.	14.900	.28	.82	151.	88.	76.	260.	254.	3.0
STOP	832.	16.960								
S07	911.	16.960	.20	.65	154.	89.	84.	260.	260.	2.5
S06	914.	18.400	.28	.91	155.	91.	84.	252.	260.	2.9
S05	917.	20.060	.35	1.13	154.	94.	85.	250.	260.	3.5
S04	920.	22.000	.40	1.35	155.	95.	85.	245.	256.	3.5
S03	923.	23.900	.44	1.50	155.	97.	85.	247.	250.	4.0
S02	926.	25.950	.42	1.40	153.	97.	85.	252.	250.	4.0
S01	929.	28.060	.40	1.35	151.	97.	85.	254.	245.	4.0
STOP	932.	30.080								
E1	945.	30.300	.66	2.40	153.	97.	86.	260.	254.	6.0
E2	948.	32.900	.66	2.40	152.	100.	89.	245.	254.	6.0
E3	951.	35.400	.64	2.10	156.	101.	89.	245.	240.	6.0
E4	954.	37.900	.74	2.40	155.	101.	89.	245.	240.	6.0
E05	957.	40.700	.70	2.30	154.	102.	89.	245.	260.	6.0
E06	1000.	43.200	.40	1.35	154.	100.	89.	245.	260.	4.5
E07	1003.	45.300	.16	.52	157.	97.	90.	254.	260.	3.0

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

F08	1006.	46.700	.14	.48	154.	96.	90.	249.	260.	2.8
F09	1009.	47.850	.12	.39	157.	95.	90.	240.	248.	2.8
F10	1012.	49.000	.12	.39	156.	95.	90.	250.	250.	2.8
F11	1015.	50.100	.12	.39	155.	94.	90.	260.	240.	2.8
F12	1018.	51.200	.12	.39	156.	94.	90.	260.	247.	2.8
STOP	1021.	52.270								

REMARKS HOT BOX CONTROLLER WENT OUT-USING VARIAC FOR TEMPERATURE CONTROLLER

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510- RUN 2

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: OUTLET 02
DATE: 5/10/84 TIME START: 8:17 TIME FINISH: 10:21

REMARKS: HOT BOX CONTROLLER WENT OUT-USING VARIAC FOR TEMPERATURE CONTROLLER

AVERAGE FLUE GAS TEMPERATURE	153.8	(F)	67.7	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.26	"HG	76.87	CMHG
FLUE GAS STATIC PRESSURE	-.10	"H2O	-.254	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	26.64	LB/LB-MOLE	26.6380	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	24.76	%	24.76	%
AVERAGE FLUE GAS VELOCITY	36.8622	FPS	11.2356	M/S
AVERAGE FLUE GAS FLOWRATE	27241.	ACFM	771.	M3/MIN
	17833.	DSCFM	505.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	42.1974	DSCF	1.1950	M3
TEST DURATION	72.	MIN	72.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	252.3	(F)	122.3	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	252.8	(F)	122.6	(C)
MAXIMUM LINE VACUUM	6.0	"HG	15.24	CMHG
FINAL LEAK RATE	.010	CFM	.0003	M3/MIN
PERCENT ISOKINETIC	102.1	%	102.1	%
PARTICULATE MASS CONCENTRATION	.130+000	GR/DSCF	.298+000	GMS/M3
	.186-004	LBS/DSCF		
PARTICULATE MASS RATE	.199+002	LBS/HR	.904+001	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 "HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE TREEN: TGC-0510-RUN 2

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
S12	39.49	150.00
S11	43.26	150.00
S10	40.50	151.00
S09	35.41	153.00
S08	33.07	151.00
STOP		
S07	26.02	154.00
S06	33.18	155.00
S05	37.06	154.00
S04	39.65	155.00
S03	41.59	155.00
S02	40.57	153.00
S01	39.53	151.00
STOP		
E1	50.85	153.00
E2	50.81	152.00
E3	50.20	156.00
E4	53.94	155.00
E05	52.42	154.00
E06	39.62	154.00
E07	25.12	157.00
E08	23.44	154.00
E09	21.76	157.00
E10	21.74	156.00
E11	21.72	155.00
E12	21.74	156.00
STOP		

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION OUTLET #04 SAMPLE IDENT. TOC-0510- RUN 3
DATE 5/10/84 (MMDDYY) TIME START 11:37 (HHMM) TIME FINISH 14: 4 (HHMM)
DIAMETER 3.960FT.

PTCF	.84	DGMCF	.959	TEST DURATION	72. MIN.		
NOZZLE DIA.	.269 INCHES			% CO	.0	% N2	79.5
BAR PRESS.	30.31 "HG			% CO2	5.5	% H2	.0
STATIC PRESS.	-.1 "H20	.0		% O2	15.0	% CH4	.0
INITIAL LEAK RATE	.010 CFM			CONDENSED WATER	387.7 GMS		
FINAL LEAK RATE	.011 CFM			FILTER WT. GAIN	.28410 GMS		
OPERATOR INITIALS	LAR			PROBE WASH WT. GAIN	.10870 GMS		

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H20	DH IN. H20	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
S12	1137.	52.900	.52	1.50	160.	86.	85.	245.	250.	3.5
S11	1140.	54.900	.48	1.40	161.	92.	85.	255.	240.	3.5
S10	1143.	57.000	.46	1.37	161.	93.	85.	260.	260.	3.5
S09	1146.	59.100	.38	1.15	160.	94.	86.	258.	240.	3.0
S08	1149.	61.060	.30	.89	160.	94.	86.	254.	249.	3.0
S07	1152.	62.900	.30	.89	160.	95.	86.	250.	250.	3.0
S06	1155.	64.500	.22	.65	160.	95.	87.	260.	249.	2.5
S05	1158.	65.900	.38	1.15	160.	94.	86.	255.	260.	3.5
S04	1201.	67.800	.44	1.30	160.	95.	86.	249.	258.	3.5
S03	1204.	69.800	.48	1.40	160.	95.	86.	257.	245.	4.0
S02	1207.	71.800	.48	1.40	161.	99.	87.	260.	240.	4.0
S01	1210.	73.850	.48	1.40	164.	100.	89.	255.	249.	4.0
STOP	1213.	76.010								
E1	1328.	76.220	.62	1.88	158.	85.	84.	260.	260.	4.0
E2	1331.	78.570	.68	2.10	157.	90.	84.	240.	259.	4.5
E3	1334.	80.700	.84	2.60	159.	94.	84.	240.	240.	5.5
E4	1337.	83.800	.74	2.20	159.	94.	84.	250.	260.	5.0
E5	1340.	86.400	.70	2.10	159.	95.	85.	260.	240.	5.0
E6	1343.	89.000	.50	1.45	159.	96.	86.	260.	260.	4.5
E7	1346.	91.300	.15	.45	161.	94.	85.	258.	251.	3.0
E8	1349.	92.550	.16	.50	161.	94.	85.	255.	260.	3.0

SOURCE SAMPLING FIELD DATA
TOPUT VERIFICATION

E9	1352.	93.800	.16	.50	162.	94.	84.	249.	260.	3.0
F10	1355.	94.950	.14	.42	159.	92.	85.	254.	260.	2.5
F11	1358.	96.100	.13	.40	160.	92.	85.	255.	260.	2.5
F12	1401.	97.200	.12	.36	159.	91.	86.	256.	251.	2.5
STOP	1404.	98.310								

REMARKS . VARTAC USED TO CONTROL PROBE TEMP.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510- RUN 3

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: OUTLET #04
DATE: 5/10/84 TIME START: 11:37 TIME FINISH: 14: 4

REMARKS: VARIAC USED TO CONTROL PROBE TEMP.

AVERAGE FLUE GAS TEMPERATURE	160.0	(F)	71.1	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.30	"HG	76.97	CMHG
FLUE GAS STATIC PRESSURE	-.10	"H2O	-.254	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	26.01	LB/LB-MOLE	26.0136	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	30.19	%	30.19	%
AVERAGE FLUE GAS VELOCITY	39.3412	FPS	11.9912	M/S
AVERAGE FLUE GAS FLOWRATE	29073.	ACFM	823.	M3/MIN
	17503.	DSCFM	496.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	42.4842	DSCF	1.2032	M3
TEST DURATION	72.	MIN	72.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	254.3	(F)	123.5	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	252.1	(F)	122.3	(C)
MAXIMUM LINE VACUUM	5.5	"HG	13.97	CMHG
FINAL LEAK RATE	.011	CFM	.0003	M3/MIN
PERCENT ISOKINETIC	104.7	%	104.7	%
PARTICULATE MASS CONCENTRATION	.143+000	GR/DSCF	.326+000	GMS/M3
	.204-004	LBS/DSCF		
PARTICULATE MASS RATE	.214+002	LBS/HR	.971+001	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510- RUN 3

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
S12	45.91	160.00
S11	44.14	161.00
S10	43.21	161.00
S09	39.24	160.00
S08	34.87	160.00
S07	34.87	160.00
S06	29.86	160.00
S05	39.24	160.00
S04	42.23	160.00
S03	44.11	160.00
S02	44.14	161.00
S01	44.25	164.00
STOP		
E1	50.05	158.00
E2	52.37	157.00
E3	58.30	159.00
E4	54.72	159.00
E5	53.22	159.00
E6	44.98	159.00
E7	24.68	161.00
E8	25.49	161.00
E9	25.51	162.00
E10	23.80	159.00
E11	22.95	160.00
E12	22.04	159.00
STOP		

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION
SAMPLING LOCATION STACK SAMPLE IDENT. TOC-0510- RUN 4
DATE 5/10/84 (MMDDYY) TIME START 15:37 (HHMM) TIME FINISH 16:57 (HHMM)
DIAMETER 3.960FT.
PTCF .84 DGMCF .959 TEST DURATION 72. MIN.
NOZZLE DIA. .269 INCHES % CO .0 % N2 79.0
BAR PRESS. 30.31 "HG % CO2 6.2 % H2 .0
STATIC PRESS. -.1 "H20 .0 % O2 14.8 % CH4 .0
INITIAL LEAK RATE .010 CFM CONDENSED WATER 365.0 GMS
FINAL LEAK RATE .016 CFM FILTER WT. GAIN .14300 GMS
OPERATOR INITIALS LAR PROBE WASH WT. GAIN .14640 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H2O	DH IN. H2O	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
S12	1537.	99.600	.54	1.50	159.	85.	83.	255.	240.	4.0
S11	1540.	101.800	.50	1.50	160.	87.	82.	257.	240.	4.0
S10	1543.	103.900	.37	1.10	161.	90.	82.	260.	240.	3.5
S09	1546.	105.800	.32	.95	160.	90.	82.	257.	249.	3.5
S08	1549.	107.600	.25	.74	160.	91.	83.	245.	243.	3.5
S07	1552.	109.100	.18	.54	160.	91.	83.	240.	249.	3.5
S06	1555.	110.500	.22	.65	160.	91.	83.	245.	248.	3.0
S05	1558.	111.900	.34	1.00	161.	92.	84.	260.	248.	3.0
S04	1601.	113.600	.38	1.10	161.	96.	86.	260.	246.	3.0
S03	1604.	115.600	.42	1.25	161.	97.	86.	255.	260.	3.5
S02	1607.	117.500	.42	1.25	159.	97.	86.	252.	261.	4.0
S01	1610.	119.600	.42	1.20	160.	97.	87.	253.	245.	4.0
STOP	1613.	121.380								
F1	1621.	121.600	.64	1.90	161.	96.	88.	240.	247.	5.0
F2	1624.	123.900	.78	2.30	161.	98.	88.	252.	251.	5.5
F3	1627.	126.350	.72	2.10	159.	99.	88.	260.	244.	6.0
F4	1630.	128.900	.78	2.30	162.	99.	89.	257.	255.	7.0
F5	1633.	131.500	.70	2.00	162.	101.	89.	256.	246.	6.5
F6	1636.	134.000	.50	1.50	161.	100.	89.	260.	240.	5.5
F7	1639.	136.100	.14	.41	161.	99.	90.	260.	245.	3.5
F8	1642.	137.400	.14	.41	161.	93.	90.	248.	245.	3.5

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

F9	1645.	138.400	.12	.36	160.	93.	90.	250.	252.	2.5
F10	1648.	139.360	.12	.36	163.	92.	89.	256.	260.	3.0
F11	1651.	140.200	.12	.36	163.	92.	89.	258.	257.	3.0
F12	1654.	141.100	.10	.30	163.	92.	88.	260.	260.	7.0
STOP	1657.	142.040								

REMARKS VARIAC USED TO CONTROL PROBE TEMPERATURE
SYSTEM VACUUM AT END OF RUN=12"HG

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510- RUN 4

PLANT NAME: SLOAN CONSTRUCTION
SAMPLING LOCATION: STACK
DATE: 5/10/84 TIME START: 15:37 TIME FINISH: 16:57

REMARKS: VARIAC USED TO CONTROL PROBE TEMPERATURE
SYSTEM VACUUM AT END OF RUN=12"HG

AVERAGE FLUE GAS TEMPERATURE	160.8	(F)	71.5	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.30	"HG	76.97	CMHG
FLUE GAS STATIC PRESSURE	-.10	"H20	-.254	CMH20
FLUE GAS MOLECULAR WEIGHT (WET)	26.06	LB/LB-MOLE	26.0629	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	30.40	%	30.40	%
AVERAGE FLUE GAS VELOCITY	37.6938	FPS	11.4891	M/S
AVERAGE FLUE GAS FLOWRATE	27856.	ACFM	789.	M3/MIN
	16700.	DSCFM	473.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	39.6166	DSCF	1.1219	M3
TEST DURATION	72.	MIN	72.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	254.0	(F)	123.3	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	248.8	(F)	120.4	(C)
MAXIMUM LINE VACUUM	7.0	"HG	17.78	CMHG
FINAL LEAK RATE	.016	CFM	.0005	M3/MIN
PERCENT ISOKINETIC	102.3	%	102.3	%
PARTICULATE MASS CONCENTRATION	.113+000	GR/DSCF	.258+000	GMS/M3
	.161-004	LBS/DSCF		
PARTICULATE MASS RATE	.161+002	LBS/HR	.732+001	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: TOC-0510- RUN 4

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
S12	46.70	159.00
S11	44.97	160.00
S10	38.72	161.00
S09	35.98	160.00
S08	31.80	160.00
S07	26.98	160.00
S06	29.83	160.00
S05	37.12	161.00
S04	39.24	161.00
S03	41.25	161.00
S02	41.19	159.00
S01	41.22	160.00
STOP		
E1	50.92	161.00
E2	56.22	161.00
E3	53.93	159.00
E4	56.26	162.00
E5	53.30	162.00
E6	45.01	161.00
E7	23.82	161.00
E8	23.82	161.00
E9	22.03	160.00
E10	22.09	163.00
E11	22.09	163.00
E12	20.16	163.00
STOP		

APPENDIX A.2

UNCONTROLLED PARTICLE SIZE DISTRIBUTION EMISSION DATA

SUMMARY OF UNCONTROLLED PARTICLE SIZE DISTRIBUTION
SAMPLING DATA COLLECTED AT THE SLOAN CONSTRUCTION ASPHALT PLANT

Run Number	PSD-1	PSD-2
Date	5-10	5-11
Total Mass Collected (grams)	5.5523	8.1920
Total Meter Volume (dry cubic feet)	22.625	24.516
Barometric Pressure (inches Hg)	30.31	30.30
Orifice Pressure Drop (ΔH, inches H_2O)	.24	.25
Meter Temperature (°F)	92	97
Dry Gas Fraction	.697	.699
Stack Temperature (°F)	296	291
Static Pressure (inches H_2O)	-2.5	-2.5
Sample Time (minutes)	85	90
Molecular Weight Wet (grams/gram-mole)	25.91	25.70
Percent Isokinetic	96.2	96.0
Particle Density (gram/cc)	1.0	1.0
Stage 1 (grams collected)	4.6491	5.6909
Stage 2 (grams collected)	0.1629	1.2100
Cyclone (grams collected)	0.4727	.9406
Filter (grams collected)	0.2676	.3505
Volume of Gas Sampled (DSCF)	21.822	23.426
Particulate Concentration (gr/DSCF)	3.92	5.40
Volumetric Flow Rate (ACFM)	19,600	19,800

APPENDIX A.3

POLYNUCLEAR AROMATIC HYDROCARBONS

INCLUDES

A.3.1 Uncontrolled Polynuclear Aromatic Hydrocarbon Emission Data

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION INLET SAMPLE IDENT. PAH-0511-01
DATE 5/11/84 (MMDDYY) TIME START 11: 8 (HHMM) TIME FINISH 12: 7 (HHMM)
DIAMETER 3.940FT.
PTCF .84 DGMCF .995 TEST DURATION 49. MIN.
NOZZLE DIA. .244 INCHES % CO .0 % N2 80.0
BAR PRESS. 30.30 "HG % CO2 5.0 % H2 .0
STATIC PRESS. -2.4 "H20 .0 % O2 15.0 % CH4 .0
INITIAL LEAK RATE .004 CFM CONDENSED WATER 223.7 GMS
FINAL LEAK RATE .020 CFM FILTER WT. GAIN .00000 GMS
OPERATOR INITIALSFPA/CSG PROBE WASH WT. GAIN .00000 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H20	DH IN. H20	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
1-8	1108.	681.805	.55	.84	289.	98.	97.	243.	72.	11.5
1-7	1111.	683.310	.00	.00	0.	0.	0.	0.	0.	.0
STOP	1114.	684.719								
1-7	1115.	684.719	.65	1.00	293.	97.	96.	251.	73.	12.2
1-6	1116.	684.990	.65	1.00	289.	97.	96.	252.	63.	12.2
1-5	1119.	686.570	.55	.84	298.	96.	96.	250.	63.	11.8
1-4	1122.	688.100	.55	.84	291.	96.	96.	250.	62.	13.0
1-3	1125.	689.590	.60	.90	290.	95.	95.	250.	62.	15.0
1-2	1128.	691.100	.50	.75	280.	95.	95.	250.	62.	14.0
1-1	1131.	692.610	.40	.60	275.	95.	95.	250.	62.	11.5
STOP	1134.	693.950								
2-8	1143.	694.032	.50	.75	264.	96.	95.	251.	53.	13.0
2-7	1146.	695.280	.50	.75	265.	96.	96.	250.	53.	14.3
2-6	1149.	696.720	.55	.80	275.	96.	96.	250.	53.	16.5
2-5	1152.	698.220	.50	.75	285.	96.	96.	250.	53.	15.8
2-4	1155.	699.720	.70	1.06	287.	96.	96.	250.	53.	19.0
2-3	1158.	701.400	.50	.75	287.	95.	94.	248.	53.	15.8
2-1	1201.	702.850	.50	.75	284.	95.	94.	248.	53.	16.0
2-1	1204.	704.350	.20	.30	274.	95.	94.	249.	53.	8.0
STOP	1207.	705.353								

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: PAH-0511-01

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: INLET
DATE: 5/11/84 TIME START: 11: 8 TIME FINISH: 12: 7

AVERAGE FLUE GAS TEMPERATURE	266.2	(F)	130.1	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.12	"HG	76.51	CMHG
FLUE GAS STATIC PRESSURE	-2.40	"H2O	-6.096	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	25.79	LB/LB-MOLE	25.7858	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	31.70	%	31.70	%
AVERAGE FLUE GAS VELOCITY	47.5596	FPS	14.4962	M/S
AVERAGE FLUE GAS FLOWRATE	34793.	ACFM	985.	M3/MIN
	17391.	DSCFM	493.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	22.8424	DSCF	.6469	M3
TEST DURATION	49.	MIN	49.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	234.8	(F)	112.7	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	55.5	(F)	13.0	(C)
MAXIMUM LINE VACUUM	19.0	"HG	48.26	CMHG
FINAL LEAK RATE	.020	CFM	.0006	M3/MIN
PERCENT ISOKINETIC	100.2	%	100.2	%
PARTICULATE MASS CONCENTRATION	.000	GR/DSCF	.000	GMS/M3
	.000	LBS/DSCF		
PARTICULATE MASS RATE	.000	LBS/HR	.000	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: PAH-0511-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
1-8	52.28	289.00
1-7	.00	.00
STOP		
1-7	56.99	295.00
1-6	56.83	289.00
1-5	52.59	298.00
1-4	52.35	291.00
1-3	54.64	290.00
1-2	49.55	280.00
1-1	44.17	275.00
STOP		
2-8	49.01	264.00
2-7	49.04	265.00
2-6	51.79	275.00
2-5	49.71	285.00
2-4	58.90	287.00
2-3	49.78	287.00
2-1	49.68	284.00
2-1	31.21	274.00
STOP		

APPENDIX A.3

POLYNUCLEAR AROMATIC HYDROCARBONS

INCLUDES

A.3.2 Controlled Polynuclear Aromatic Hydrocarbon Emission Data

CORPORATION

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

PLANT NAME SLOAN CONSTRUCTION CO.
SAMPLING LOCATION OUTLET#01 SAMPLE IDENT. PAH-0511-01
DATE 5/11/84 (MMDDYY) TIME START 10:26 (HHMM) TIME FINISH 13:14 (HHMM)
DIAMETER 3.960FT.
PTCF .84 DGMCF .959 TEST DURATION 97. MIN.
NOZZLE DIA. .183 INCHES % CO .0 % N2 80.0
BAR PRESS. 30.30 "HG % CO2 7.5 % H2 .0
STATIC PRESS. .2 "H2O .0 % O2 12.5 % CH4 .0
INITIAL LEAK RATE .020 CFM CONDENSED WATER 264.3 GMS
FINAL LEAK RATE .013 CFM FILTER WT. GAIN .00000 GMS
OPERATOR INITIALS LAR PROBE WASH WT. GAIN .00000 GMS

PT.	CLOCK TIME	DRY GAS METER READING	DP IN. H2O	DH IN. H2O	STACK TEMP. (F)	DRY GAS METER TEMPERATURE INLET (F)	DRY GAS METER TEMPERATURE OUTLET (F)	HOT BOX TEMP. (F)	LAST IMPINGER TEMP. (F)	L. VAC. IN. HG GAUGE
S12	1026.	144.600	.68	2.00	161.	85.	84.	248.	260.	22.0
STOP	1030.	147.390								
S11	1108.	147.600	.58	.37	161.	91.	89.	240.	258.	7.5
S10	1112.	148.950	.50	.32	162.	92.	89.	260.	258.	7.5
S09	1116.	150.300	.38	.24	0.	0.	0.	260.	254.	.0
STOP	1117.	151.740								
S09	1137.	151.840	.42	.25	162.	94.	92.	247.	246.	6.0
S08	1141.	152.940	.34	.22	162.	94.	93.	258.	260.	6.0
S07	1145.	153.800	.25	.16	168.	93.	91.	245.	260.	5.0
S06	1149.	154.970	.34	.18	168.	93.	91.	240.	259.	5.0
S05	1153.	155.830	.40	.22	165.	94.	91.	260.	257.	5.5
S04	1157.	156.970	.38	.21	165.	94.	91.	245.	252.	6.0
S03	1201.	158.200	.48	.27	164.	94.	91.	253.	251.	7.0
S02	1205.	159.200	.42	.27	162.	94.	91.	259.	248.	7.0
S01	1209.	160.460	.33	.21	163.	96.	92.	257.	249.	7.5
STOP	1213.	161.410								
E1	1226.	161.520	.88	.56	160.	96.	93.	244.	255.	14.5
E2	1230.	163.200	.60	.38	159.	98.	94.	252.	260.	7.5
E3	1234.	164.600	.80	.51	163.	99.	94.	257.	260.	9.0
E4	1238.	166.300	.86	.55	162.	99.	95.	258.	260.	9.5
E5	1242.	167.970	.80	.51	162.	100.	96.	257.	259.	9.0

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

E6	1206.	169.530	.52	.33	162.	101.	96.	256.	260.	8.0
E7	1250.	170.900	.20	.14	159.	96.	97.	254.	261.	6.0
E8	1254.	171.820	.16	.11	160.	96.	95.	252.	260.	5.0
E9	1258.	172.500	.16	.11	160.	95.	94.	252.	260.	5.0
E10	1302.	173.230	.16	.11	160.	97.	96.	248.	257.	5.0
E11	1306.	173.990	.15	.10	159.	97.	96.	248.	254.	5.0
E12	1310.	174.700	.15	.10	159.	97.	96.	248.	253.	5.0
STOP	1314.	175.310								

REMARKS 20"HG VACUUM,VARIAC USED TO CONTROL PROBE TEMP

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: PAH-0511-01

PLANT NAME: SLOAN CONSTRUCTION CO.
SAMPLING LOCATION: OUTLET#01
DATE: 5/11/84 TIME START: 10:26 TIME FINISH: 13:14

REMARKS: 20"HG VACUUM,VARIAC USED TO CONTROL PROBE TEMP

AVERAGE FLUE GAS TEMPERATURE	155.5	(F)	68.6	(C)
FLUE GAS PRESSURE (ABSOLUTE)	30.31	"HG	77.00	CMHG
FLUE GAS STATIC PRESSURE	.20	"H2O	.508	CMH2O
FLUE GAS MOLECULAR WEIGHT (WET)	26.12	LB/LB-MOLE	26.1151	GM/GM-MOLE
FLUE GAS PERCENT MOISTURE	30.64	%	30.64	%
AVERAGE FLUE GAS VELOCITY	40.4039	FPS	12.3151	M/S
AVERAGE FLUE GAS FLOWRATE	29859.	ACFM	846.	M3/MIN
	17998.	DSCFM	510.	M3/MIN
VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS)	28.3590	DSCF	.8031	M3
TEST DURATION	97.	MIN	97.	MIN
TEMPERATURE AT WHICH PARTICULATE COLLECTED	251.9	(F)	122.2	(C)
AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER	256.4	(F)	124.7	(C)
MAXIMUM LINE VACUUM	22.0	"HG	55.88	CMHG
FINAL LEAK RATE	.013	CFM	.0004	M3/MIN
PERCENT ISOKINETIC	109.0	%	109.0	%
PARTICULATE MASS CONCENTRATION	.000	GR/DSCF	.000	GMS/M3
	.000	LBS/DSCF		
PARTICULATE MASS RATE	.000	LBS/HR	.000	KG/HR

STANDARD CONDITIONS DEFINED AS 68 (F) & 29.92 >HG.

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: PAH-0511-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

PT.	VELOCITY (FPS)	TEMPERATURE (F)
S12	52.43	161.00
STOP		
S11	48.42	161.00
S10	44.99	162.00
S09	33.73	.00
STOP		
S09	41.24	162.00
S08	37.10	162.00
S07	31.97	168.00
S06	37.28	168.00
S05	40.34	165.00
S04	39.32	165.00
S03	44.15	164.00
S02	41.24	162.00
S01	36.58	163.00
STOP		
E1	59.59	160.00
E2	49.17	159.00
E3	56.96	163.00
E4	59.01	162.00
E5	56.91	162.00
E6	45.88	162.00
E7	28.39	159.00
E8	25.41	160.00
E9	25.41	160.00
E10	25.41	160.00
E11	24.58	159.00
E12	24.58	159.00
STOP		

APPENDIX B

DATA REDUCTION EQUATIONS AND NOMENCLATURE

INCLUDES

B.1 EPA Reference Methods 2, 3, 4, and 5E
- B.1.1 EPA Reference Method 2 - Determination of Stack Gas Velocity and Volumetric Flow Rate
- B.1.2 EPA Reference Method 3 - Determination of Flue Gas Molecular Weight - Wet Basis
- B.1.3 EPA Reference Method 4 - Determination of Moisture Content in Stack Gases
- B.1.4 Modified EPA Reference Method 5E
  - B.1.4.1 Determination of Particulate Emission Concentration
  - B.1.4.2 Determination of Percent Isokinetic during Sampling
  - B.1.4.3 Determination of Mass Emission Rate - Concentration Method
  - B.1.4.4 Determination of Mass Emission Rate - Area Ratio Method

B.2 Determination of Moisture Content in Stack Gases - Wet Bulb/Dry Bulb Method

B.3 Determination of Total Organic Carbon (TOC) Emissions

B.4 Particle Size Distribution - Andersen High Capacity Stack Sampler (AHCSS)

B.5 Determination of Polynuclear Aromatic Hydrocarbons (PAH) Concentrations
- B.5.1 Concentration of PAH in Scrubber Water
- B.5.2 Concentration of PAH in Scrubber Water Solids

B.6 Total Solids Determination
- B.6.1 Determination of Weight Percent Solids (Suspended Solids)
- B.6.2 Determination of Dissolved Solids

APPENDIX B.1

EPA REFERENCE METHODS 2, 3, 4, AND 5E

INCLUDES

B.1.1 EPA Reference Method 2 - Determination of Stack Gas Velocity and Volumetric Flow Rate
B.1.2 EPA Reference Method 3 - Determination of Flue Gas Molecular Weight - Wet Basis
B.1.3 EPA Reference Method 4 - Determination of Moisture Content in Stack Gases
B.1.4 Modified EPA Reference Method 5E
B.1.4.1 Determination of Particulate Emission Concentration
B.1.4.2 Determination of Percent Isokinetic during Sampling
B.1.4.3 Determination of Mass Emission Rate - Concentration Method
B.1.4.4 Determination of Mass Emission Rate - Area Ratio Method

B.1.1 EPA Reference Method 2 - Determination of Stack Gas Velocity

Equation:

$$V_s = 85.48\ Cp \sqrt{\frac{T_s}{P_s \times M_w}} \quad \sqrt{\Delta P_{ave}}$$

Nomenclature:

85.48 = Pitot tube constant $\frac{ft}{sec} \left[\frac{(lb/Lbmole)(in\ Hg)}{(°R)(in\ H_2O)}\right]^{1/2}$

V_s = Velocity of the stack flue gas, actual feet per second

ΔP = Differential pressure measured by type S pitot, inches of water

T_s = Average stack temperature, °R

P_s = Absolute stack pressure, inches of mercury

M_w = Gas molecular weight (lb/lb-mole)

C_p = Type S pitot correction factor

Volumetric Flow Rate Dry Standard Conditions

Equation:

$$Q_{sd} = 60\ (1-B_w)(V_s)(A) \quad \left[\frac{T_{std}}{T_{s(ave)}}\right]\left[\frac{P_s}{P_{std}}\right]$$

Nomenclature:

Q_{sd} = DSCFM, dry standard cubic feet per minute

B_w = Moisture fraction

V_s = Velocity of the flue gas, feet per second

A = Cross-sectional area of the duct, ft^2

T_{std} = Standard temperature, 528°R

T_s = Stack temperature average, °R

P_{std} = Standard pressure, 29.92 inches Hg

P_s = Absolute stack pressure, inches Hg

B.1.2 EPA Reference Method 3 - Determination of Flue Gas Molecular Weight - Wet Basis

Equation:

$$M_w = [(.44)(\%CO_2 \text{ dry}) + (.32)(\% O_2 \text{ dry}) + (.28)(\% N_2 \text{ dry})] \times (1-B_w) + (18)(B_w)$$

Nomenclature:

M_w = Molecular weight of gas on wet basis, lb/lb-mole

B_w = Moisture fraction from EPA reference method 4

44 = Molecular weight of CO_2

32 = Molecular weight of O_2

28 = Molecular weight of N_2

B.1.3 EPA Reference Method 4 - Determination of Moisture Content in Stack Gases

Equation:

$$B_w = \frac{(MWC)(1.339)}{[(MWC)(1.339)] \left[\frac{(DGV)(Pm)}{Tm}(499.9)\right]}$$

Nomenclature:

B_w = Moisture fraction

MWC = Impinger wt gain, gms

DGV = Dry gas volume, ft^3

P_m = Pressure at meter, in. Hg

T_m = Temperature at meter, °R

1.339 = Conversion of grams of H_2O to liters of H_2O vapor at standard conditions, $\frac{\text{liters } H_2O \text{ vapor}}{\text{gram } H_2O}$

499.9 = Conversion of liters to cubic feet at standard conditions, $\frac{\text{liters } °R}{ft^3 \text{ in Hg}}$

B.1.4 Modified EPA Reference Method 5E

B.1.4.1 - Determination of Particulate Emission Concentrations

Equation:

$$C_{SE} = (.001 g/mg)\left(\frac{M_N}{V_{MSTD}}\right)(15.43) \text{ or}$$

$$C_{SM} = \left(\frac{M_N}{V_{MSTD}}\right)(.0283)$$

Nomenclature:

C_{SE} = Concentration of particulate matter in flue gas, corrected to dry standard conditions and reported in English units, grains/DSCF

C_{SM} = Concentration of particulate matter in flue gas, corrected to dry standard conditions and reported in metric units, grams/DSCM

M_N = Mass of particulate matter collected, milligrams

$V_{M(STD)}$ = Dry gas volume corrected to standard conditions, DSCF

15.43 = Conversion of grams to grains

0.0283 = Conversion of DSCF to DSCM

B.1.4.2 - Determination of Percent Isokinetic During Sampling

Equation:

$$\% I = \frac{V_N}{V_S} \times 100$$

$$\text{where: } V_N = \frac{V_M}{T} \times \frac{1}{A_N} \times \frac{1}{1-B_W} \times \frac{T_S}{T_M} \times \frac{P_M}{P_S} \times \frac{1}{60}$$

Nomenclature:

% I = Percent isokinetic

V_S = Average flue gas velocity (feet per second) in duct during sampling - See Equation B.1.1

V_N = Average sample gas velocity (feet per second) at the nozzle during sampling

V_M = Sample dry gas volume at meter, ft^3

B.1.4.2 cont'd

T = Elapsed sampling time, min.

A_N = Cross-sectional area of nozzle, ft^2

B_W = Moisture fraction

T_S = Flue gas temperature at stack, °R

T_M = Average gas temperature at meter, °R

P_M = Absolute pressure at the meter, inches Hg

P_S = Absolute pressure at the stack, inches Hg

B.1.4.3 Determination of Mass Emission Rate - Concentration Method

Equation:

$$(M/V) \times Q = MFR \text{ (pounds per hour)}$$

Nomenclature:

M - Amount of particulate sampled (pounds)

V - Volume of gas sampled (dry standard cubic feet)

Q = Volumetric flowrate (dry standard cubic feet per hour)

B.1.4.4 - Determination of Mass Emission Rate Using the Area Ratio Method

Equation:

$$(m/t) \times (As/An) = MFR \text{ (pounds per hour)}$$

Nomenclature:

m = Amount of particulate sampled (pounds)

t = Time sampled (hours)

As = Area of stack (square feet)

An = area of nozzle (square feet)

APPENDIX B.2

DETERMINATION OF MOISTURE CONTENT
IN STACK GASES - WET BULB/DRY BULB METHOD

B.2 Determination of Moisture Content in Stack Gases - Wet Bulb/Dry Bulb Method

During the Sloan test program preliminary stack gas moisture values were determined using the wet bulb/dry bulb technique and a psychometric chart. The high temperature psychometric chart used to determine the moisture content for the inlet is illustrated in Figure B-1. Outlet moisture content was determined using the low temperature psychometric chart illustrated in Figure B-2.

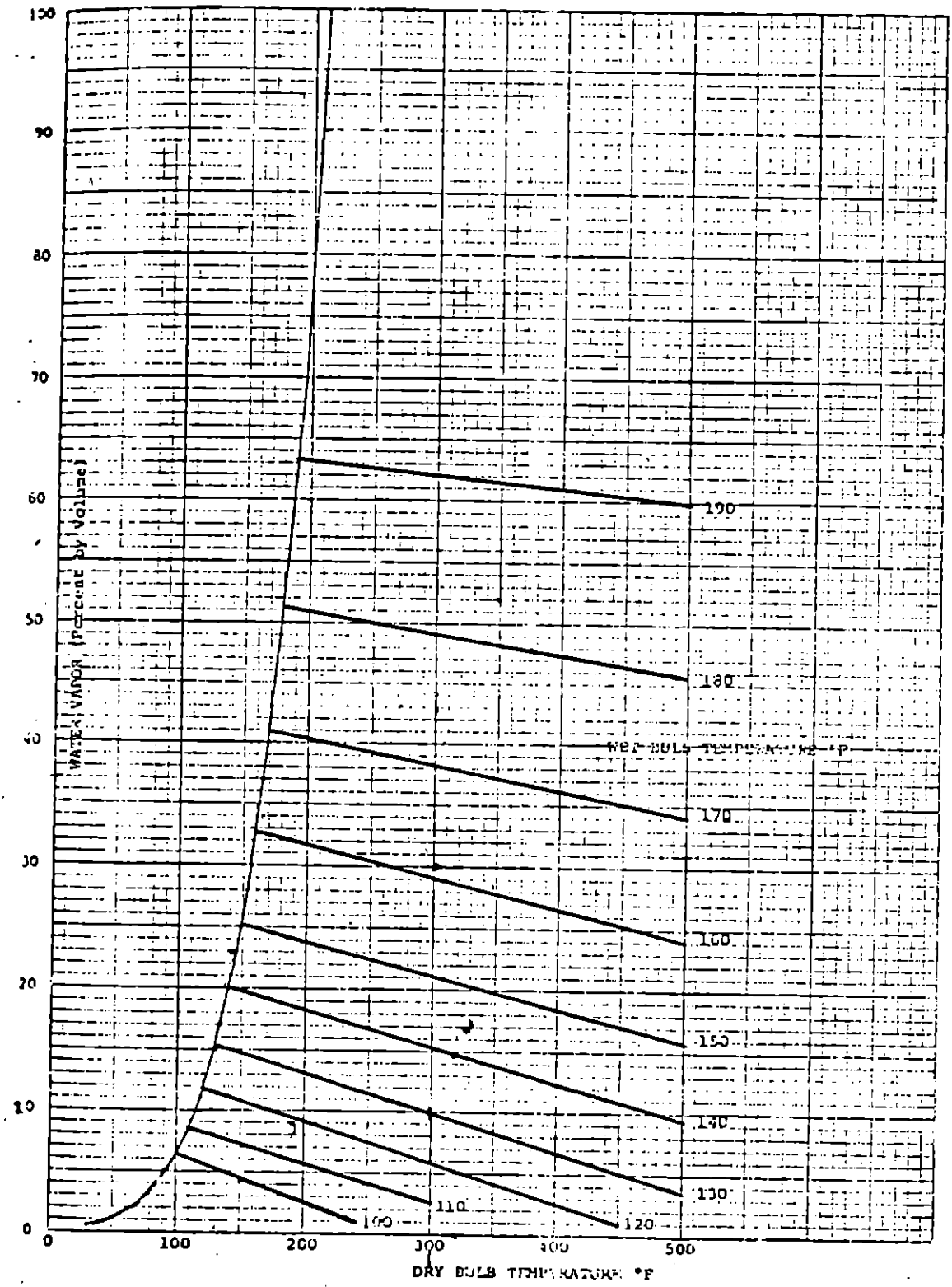
100
90
80
70
60
50
40
30
20
10
0
WATER VAPOR (Percent by Volume)
0
100
200
300
400
500
DRY BULB TEMPERATURE °F
190
180
170
160
150
140
130
120
110
100

Figure B-1

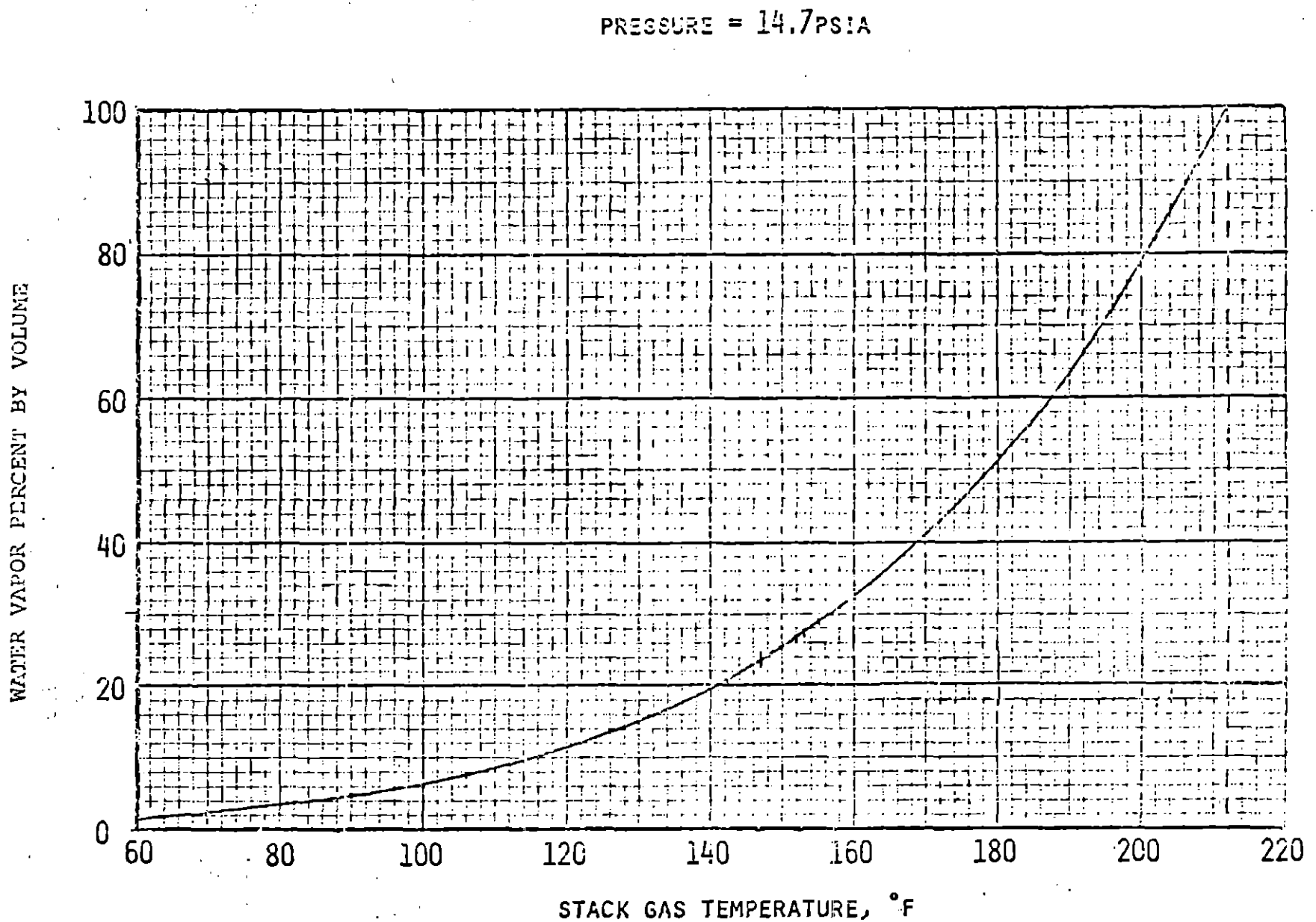

Figure B-2

Percent Water Vapor in Air at Saturation

APPENDIX B.3

DETERMINATION OF TOTAL ORGANIC CARBON (TOC) AIR EMISSIONS

B.3 Determination of Total Organic Carbon (TOC) Air Emissions

Equation:

$$TOC(g) = \frac{(TOC_{(L_1)} \times V_1) + (TOC_{(L_2)} \times V_2) - [TOC_{(B)} \times (V_1 + V_2)]}{DGV}$$

Nomenclature:

$TOC(g)$ = Total organic carbon in gas phase, milligrams per dry standard cubic meter (mg/DSCM)

$TOC_{(L_1)}$ = Total organic carbon concentration in first NaOH impinger and impinger rinse, mg/l

V_1 = Volume of first NaOH impinger and impinger rinse, l

$TOC_{(L_2)}$ = Total organic carbon concentration in second NaOH impinger and impinger rinse, mg/l

V_2 = Volume of second NaOH impinger and impinger rinse, l

$TOC_{(B)}$ = Total organic carbon concentration in blank, mg/l

DGV = Volume of gas sampled, dry standard cubic meters, DSCM

APPENDIX B.4

PARTICLE SIZE DISTRIBUTION - ANDERSEN HIGH CAPACITY STACK SAMPLER (AHCSS)

B.4 Particle Size Distribution - Andersen High Capacity Stack Sampler (AHCSS)

The procedure for calculating the particle size distribution of the particulate caught by the AHCSS was taken directly from the operating manual for the AHCSS.

Add up the weight gains for the four stages to obtain the total particulate collected.

Divide the amount collected in an individual stage by the total amount collected to determine the percentage of the total collected in each stage.

Starting with stage 4 (backup filter) compute the cumulative percent less than the staged size range. The cumulative percent less than stage 3 (the cyclone) is equal to the percent caught in stage 4. The cumulative percent less than stage 2 is the sum of the percent caught on stage 3 and the percent caught on stage 4. The cumulative percent less than stage 1 is the sum of the percents caught on stages 4, 3, and 2.

Particle densities should be considered as 1.0 gm/cm^3 and the particles should be considered as spherical so that the particle sized can be reported as equivalent aerodynamic diameters.

Using Figure B-1 with gas flow rate at stack conditions and stack temperature, determine the d_{50} (50% Effective Cut Off Diameter) for each stage.

Plot the results on log probability graph paper with the particle diameter (d_{50}) as the ordinate and the cumulative percent less than the stated size range by weight as the abscissa.

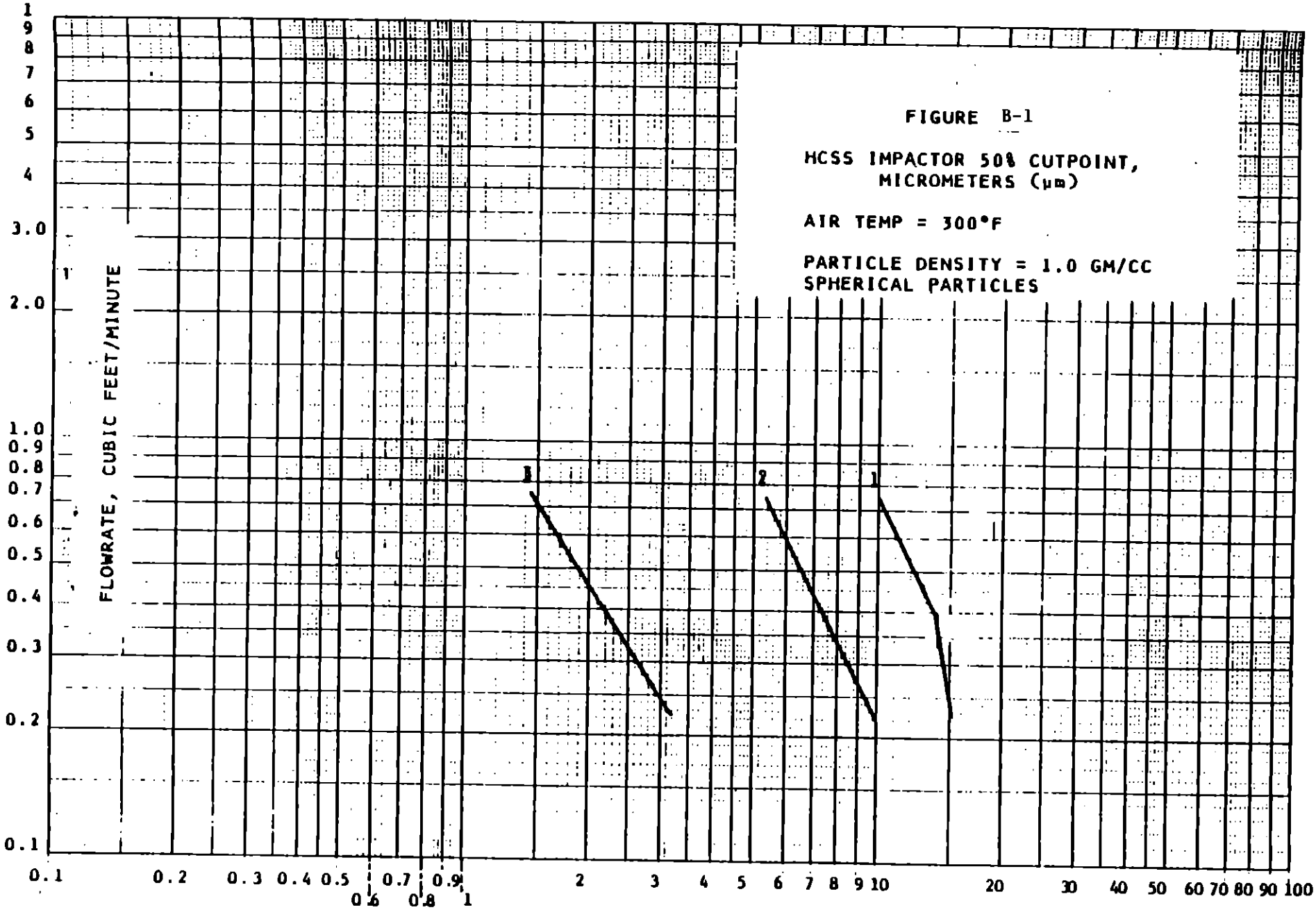
FIGURE B-1
HCSS IMPACTOR 50% CUTPOINT, MICROMETERS (μm)
AIR TEMP = 300°F
PARTICLE DENSITY = 1.0 GM/CC
SPHERICAL PARTICLES
FLOWRATE, CUBIC FEET/MINUTE
1
2
3
1 9 8 7 6 5 4 3.0 2.0 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 2 3 4 5 6 7 8 9 10 20 30 40 50 60 70 80 90 100

APPENDIX B.5

DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBON (PAH) CONCENTRATIONS

INCLUDES

B.5.1 Concentration of PAH in Scrubber Water
B.5.2 Concentration of PAH in Scrubber Water Solids

B.5 Determination of Polynuclear Aromatic Hydrocarbon (PAH) Concentrations

B.5.1 Concentration of PAH in Scrubber Water

Equation:

$$PAH_{(W)} = \frac{P_{(T)}}{V_s}$$

Nomenclature:

$PAH_{(W)}$ = Concentration of PAH in the scrubber water, μg/liter

$P_{(T)}$ = Total concentration of PAH specie, μg

V = Volume of scrubber water extracted, liter

B.5.2 Concentration of PAH in Scrubber Water Solids

Equation:

$$PAH_{(S)} = \frac{P_{(T)}}{S}$$

Nomenclature:

$PAH_{(S)}$ = Concentration of PAH specie in scrubber solids, μg/gram

$P_{(T)}$ = Total concentration of PAH specie, μg

S = Weight of scrubber solids extracted, g

APPENDIX B.6

TOTAL SOLIDS DETERMINATION

INCLUDES

B.6.1 Determination of Weight Percent Solids (Suspended Solids)
B.6.2 Determination of Total Dissolved Solids

B.6 Total Solids Determination

B.6.1 Determination of Weight Percent Solids (Suspended Solids)

Equation

$$S_{(WT)} = \frac{F_{(F)} - F_{(T)}}{W_{(T)}} \times 100$$

Nomenclature:

$S_{(WT)}$ = Weight % solids

$F_{(F)}$ = Final filter weight, g

$F_{(T)}$ = Filter tare weight, g

$W_{(T)}$ = Weight of scrubber water filtered, g

100 = conversion from fraction to percent

B.6.2 Determination of Total Dissolved Solids

Equation:

$$TDS = \frac{W_{(F)} - W_{(T)}}{0.05}$$

Nomenclature:

TDS = Total dissolved solids, mg/l

$W_{(F)}$ = Weight of beaker and residue after evaporation, mg

$W_{(T)}$ = Beaker tare weight, mg

0.05 = Volume of solution evaporated, liter

B.7 Determination of Moisture Content in the Virgin Aggregate and Recycle Asphalt Pavement (RAP) Samples

Equation

$$M_s = (C-B)-(A-B)/(C-B) \times 100$$

Nomenclature

M_s = moisture content of solids, %

A = final weight of solids plus pan after drying, grams

B = tare weight of pan, grams

C = initial weight of solids plus pan before drying, grams

APPENDIX C

FIELD SAMPLING DATA SHEETS

INCLUDES

C.1 EPA Reference Methods 2, 3, 4, and 5E
- C.1.1 Uncontrolled Emissions - EPA Reference Methods 2, 3, 4, and 5E Data Sheets
- C.1.2 Controlled Emissions - EPA Reference Methods 2, 3, 4, and 5E Data Sheets

C.2 Uncontrolled Emissions - Particle Size Distribution Data Sheets

C.3 Polynuclear Aromatic Hydrocarbon (PAH) Data Sheets
- C.3.1 Uncontrolled Emissions - PAH Data Sheets
- C.3.2 Controlled Emissions - PAH Data Sheets

C.4 Preliminary Calculation Data Summary Report
- C.4.1 Uncontrolled Emissions - Preliminary Calculations
- C.4.2 Controlled Emissions - Preliminary Calculations

APPENDIX C.1

EPA REFERENCE METHODS 2, 3, 4, AND 5E

INCLUDES

C.1.1 Uncontrolled Emissions - EPA Reference Methods 2, 3, 4, and 5E Data Sheets

VELOCITY PROFILE FIELD DATA

Plant Name> Sloan Const. Co.

Sampling Location> Inlet Sample Ident.>

Date 050884 (MMDDYY) Time Start 1055 (HHMM) Time Finish 1115 (HHMM)

Duct Dimensions — x — ft. or Diameter 3.94 ft.

PTCF .84 % H_2O

Bar Press. 30.29 "Hg % CO 0 % N_2

Static Press. - 2.5 "H_2O % CO_2 % H_2 0

Operator Initials EPA /CSG % O_2 % CH_4 0

	Pt.	Stack Temp. °F #1	#2	Ave.	Velocity Pressure "H_2O #1	#2	Ave.	Other ( ) #1	#2	Ave.
004	1-1		287	287	.35	.32	.34			
005	1-2		297	297	.53	.50	.52			
006	1-3		301	301	.60	.60	.60			
007	1-4		302	302	.45	.53	.49			
008	1-5	284	300	292	.57	.53	.55			
009	1-6	290	298	294	.65	.70	.68			
010	1-7	294	297	296	.65	.70	.68			
011	1-8	296	296	296	.60	.63	.62			
012				(296)						
013	2-1	291		291	.25	.25	.25			
014	2-2	293		293	.50	.40	.45			
015	2-3	297		297	.52	.50	.51			
016	2-4	296		296	.65	.63	.64			
017	2-5	295		295	.50	.47	.48			
018	2-6	296		296	.42	.40	.41			
019	2-7	296		296	.40	.45	.42			
020	2-8	296		296	.42	.45	.44			
021				(295)						

Weather 50% Recycle, 16.7 ΔP (venturi) 193 tons/hr

Remarks Port 1 = 4" Duct, Port 2 = 3" Duct
Black = Port 1 Red = Port 2

WET	DRY
162	300

moisture = 31%

Stack (T_s) = 295 - 755

$\sqrt{\Delta P}$ (AVE) = .705

ΔP (AVE) = .4976

RADIAN

ORSAT DATA SHEET

Location Inlet

Date 05/08/87

Time 1435

Operator EPA

Comments

Sorbing Reagents: _____ (CO_2) _____ (O_2) _____ (CO)

Replicate Number	Original Volume Reading 1	(CO_2) Reading 2 (ml)	(CO_2) Volume (2-1) (ml)	(O_2) Reading 3 (ml)	(O_2) Volume (3-2) (ml)	(CO) Reading 4 (ml)	(CO) Volume (4-3) (ml)
1	0	6.2	6.2	19.2	13.0		
2	0	6.2	6.2	18.9	12.7		

Averaged Results: % CO_2 6.2 % O_2 12.85

% CO _____ % N_2 80.95

Dry Molecular Weight, MW (dry) =

$$= 0.44 \frac{2.728}{(\% CO_2)} + 0.32 \frac{4.112}{(\% O_2)} + 0.28 \frac{22.666}{(\% CO + \% N_2)}$$

= _____ + _____ + _____

= 29.51 g/mole

Figure 5-3. Orsat field data sheet.

RADIAN

ORSAT DATA SHEET

Location INLET Comments

Date 5/8/84

Time 1200

Operator

Sorbing Reagents; (CO_2) (O_2) (CO)

Replicate Number	Original Volume Reading 1	(CO_2) Reading 2 (ml)	(CO_2) Volume (2-1) (ml)	(O_2) Reading 3 (ml)	(O_2) Volume (3-2) (ml)	(CO) Reading 4 (ml)	(CO) Volume (4-3) (ml)
1	0.0	4.2	4.2	18.7	14.5		
2	0.8	5.9	5.1	19.6	13.7		
3	0.9	6.0	5.1	19.6	13.6		

Averaged Results; % CO_2 5.10 % O_2 13.65

% CO % N_2

Dry Molecular Weight, MW (dry) =

$$= 0.44 \frac{2.244}{(\% CO_2)} + 0.32 \frac{4.368}{(\% O_2)} + 0.28 \frac{22.75}{(\% CO + \% N_2)}$$

= + +

= 29.36 g/mole

Figure 5-3. Orsat field data sheet.

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Inlet Sample Ident.> TOC-0508-Run1

A02 (1-3) Date 050884 (MMDDYY) Time Start 1424 (HHMM) Time Finish 1608 (HHMM)

Duct Dimensions — x — ft. or Diameter 3.94 ft.

PTCF .84 DGMCF .9954 Test Duration 32 min.

A03 (1-3) Nozzle Dia. .244 inches % CO 0 % N_2 80.95

Bar Press. 30.27 "Hg % CO_2 6.8 % H_2 0

Static Press. -3.5 "H_2O % O_2 12.85 % CH_4 0

A04 (1-3) Initial leak rate .004 cfm Condensed Water 148.2 gms

Final leak rate .002 cfm Filter wt. gain 0.4969 gms

Operator initials EPA/CSG Probe wash wt. gain [illegible] gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	L. Vac. in. Hg Gauge
A05	1-1	1424	568.324	.35	.40	270	97	97	265	64	2
	1-2	1426	569.01	.50	.50	283	96	96	257	64	2
	1-3	1428	569.53	.68	.80	288	96	96	255	64	3
8	1-4	1430	570.83	.65	.74	287	96	96	260	64	3
A09	1-5	1432	571.83	.58	.85	286	97	96	258	64	3
A10	1-6	1434	572.93	.63	1.00	293	98	96	255	64	3
A11	1-7	1436	574.02	.65	1.05	294	99	97	255	64	3
A12	1-8	1438	575.14	.60	1.00	294	99	97	255	64	3
A13	stop	1440	576.268								
A14	2-8	1552	576.302	.58	.85	285	94	94	257	61	3
A15	2-7	1554	577.39	.43	.70	285	94	93	250	61	3
A16	2-6	1556	578.43	.55	.95	286	95	94	250	61	3.5
A17	2-5	1558	579.55	.50	.85	284	95	94	250	61	3.5
A18	2-4	1600	580.78	.75	1.30	288	96	94	253	61	4.0
A19	2-3	1602	581.90	.65	1.08	293	96	94	250	61	4.0
A20	2-2	1604	583.09	.60	1.00	287	97	95	253	61	3.8
A21	2-1	1606	584.10	.35	.58	284	97	95	253	61	3.2
A22	STOP	1608	585.135								
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console D-548 Filter 004 Initial Wt. .5275 gms

Sample Analysis

Weather WET 161 } 30% 164 } 32%
DRY 313 } 308 }

A23 Remarks Fyrite CO_2 - 6.5, 6.5
O_2 - 14.5, 14.0

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	0.1N NaOH	150 ml	Mod	Final	748.4
				Initial	615.2 g
				Wt. Gain	133.2
2	0.1N NaOH	150 ml	S.G.	Final	602.4
				Initial	592.7 g
				Wt. Gain	9.7
3	Dry	—	Mod.	Final	437.1
				Inital	437.1 g
				Wt. Gain	0
4	Silica Gel	200 ml	Mod.	Final	612.9
				Initial	607.6 g
				Wt. Gain	5.3
5				Final	
				Initial	
				Wt. Gain	
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC) (grams) 148.2 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 16.651 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 556 °R

Total imp. wt. gain, MWC 148.2 grams H_2O

Pressure at meter, PM 30.27 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ \frac{(501.7)}{4999}\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = 30.2\%$$

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Inlet Sample Ident. TOC-0510-Run 2

A02 (1-3) Date 5/19/84 (MMDDYY) Time Start 0815 (HHMM) Time Finish 0928 (HHMM)

Duct Dimensions — x — ft. or Diameter 3.94 ft.

PTCF .84 DGMCF .9954 Test Duration 32 min.

A03 (1-3) Nozzle Dia. .244 inches % CO 0 % N_2 79.1

Bar Press. 30.27 "Hg % CO_2 5.6 % H_2 0

Static Press. -2.2 "H_2O % O_2 15.3 % CH_4 0

A04 (1-3) Initial leak rate .002 cfm Condensed Water 135.0 gms

Final leak rate .004 cfm Filter wt. gain .4485 gms

Operator initials EPA/CSG Probe wash wt. gain gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	L. Vac. In. Hg Gauge
A05	1-8	0815	587.448	.55	.88	289	74	73	245	53	2.5
	1-7	0817	588.48	.63	1.00	296	76	73	256	53	2.5
	1-6	0819	589.56	.60	.96	295	76	74	255	53	2.5
8	1-5	0821	590.62	.53	.84	297	77	74	251	53	2.5
A09	1-4	0823	591.63	.60	.96	298	77	75	250	53	2.5
A10	1-3	0825	592.69	.65	1.04	289	78	75	253	53	3.0
A11	1-2	0827	593.80	.50	.80	284	79	76	252	53	2.8
A12	1-1	0829	594.80	.40	.64	276	80	77	250	53	2.8
A13	STOP	0831	595.715								
A14	2-8	0912	595.750	.45	.72	292	90	89	247	60	2.8
A15	2-7	0914	596.71	.43	.70	277	90	89	250	53	2.8
A16	2-6	0916	597.66	.45	.72	280	90	89	251	53	2.8
A17	2-5	0918	598.57	.50	.80	283	90	89	250	53	3.0
A18	2-4	0920	599.54	.65	1.04	290	91	89	249	53	3.0
A19	2-3	0922	600.64	.65	1.04	293	91	89	250	53	3.0
A20	2-2	0924	601.77	.50	.80	282	92	90	250	53	3.0
A21	2-1	0926	602.75	.25	.40	272	92	90	249	53	2.0
A22	STOP	0928	603.496								
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console D-548 Filter 006 Initial Wt. .5263 gms

Sample Analysis Nozzle NZ-118 Pitot Leak check - OK @ 1" H2O midRun leak check .004CFM

Weather wet 163 } 31% 162

Dry 316 } 292

A23 Remarks Fyrite CO_2 - 6.0, 5.0, 5.5, 6.0 } mw 29.51

O_2 - 15.5, 15.1

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	0.1N NaOH	150 ml	Mod.	Final	743.0
				Initial	619.8
				Wt. Gain	123.2 g
2	0.1N NaOH	150 ml	S.G.	Final	609.7
				Initial	602.4
				Wt. Gain	7.3 g
3	Dry	—	Mod.	Final	437.4
				Inital	436.4
				Wt. Gain	1.0 g
4	Silica Gel	200 ml.	Mod.	Final	616.2
				Initial	612.7
				Wt. Gain	3.5 g
5				Final	
				Initial	
				Wt. Gain	
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC)(grams) 135.0 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Inlet Sample Ident.> TOC-0510-Run 3

A02 (1-3) Date 5/10/84 (MMDDYY) Time Start 1140 (HHMM) Time Finish 1341 (HHMM)

Duct Dimensions — x — ft. or Diameter 3.94 ft.

PTCF 0.84 DGMCF .9954 Test Duration 32 min.

A03 (1-3) Nozzle Dia. .244 inches % CO 0 % N_2 79.7

Bar Press. 30.31 "Hg % CO_2 4.5 % H_2 0

Static Press. -2.5 "H_2O % O_2 15.8 % CH_4 0

A04 (1-3) Initial leak rate .018 cfm Condensed Water 138.3 gms

Final leak rate .016 cfm Filter wt. gain 0.6092 gms

Operator initials EPA/CSC Probe wash wt. gain 5.2767 gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	L. Vac. in. Hg Gauge
A05	1-8	1140	604.674	.55	.88	288	87	88	243	59	2.7
	1-7	1142	605.72	.60	.96	294	88	88	239	55	3.0
	1-6	1144	606.79	.55	.88	290	88	87	253	53	3.0
B	1-5	1146	607.85	.55	.88	291	88	87	257	53	3.0
A09	1-4	1148	608.88	.57	.90	290	88	87	250	53	3.0
A10	1-3	1150	609.93	.57	.90	294	88	87	248	53	3.0
A11	1-2	1152	610.97	.50	.80	288	89	88	250	53	3.0
A12	1-1	1154	611.96	.38	.60	284	89	87	250	53	2.8
A13	STOP	1156	612.842								
A14	2-8	1325	612.902	.50	.75	288	86	86	248	55	3.0
A15	2-7	1327	613.84	.40	.55	292	86	86	248	53	2.6
A16	2-6	1329	614.68	.40	.55	293	86	86	252	53	2.6
A17	2-5	1331	615.49	.45	.60	300	88	86	250	53	2.8
A18	2-4	1333	616.34	.65	1.00	296	88	86	250	53	3.5
A19	2-3	1335	617.39	.70	1.05	293	88	86	250	53	3.8
A20	2-2	1337	618.51	.45	.60	286	88	87	251	53	2.9
A21	2-1	1339	619.37	.30	.45	284	88	87	252	53	2.5
A22	STOP	1341	620.076								
		(4:4)	(11:4)	(16:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console D-545 Filter M08 Initial Wt. .5048 gms

Sample Analysis Midpoint leak check .010

Weather wet -16.3 } 31% 168 } 37% 165 } 34% 165 } 34%

Dry 305 } 282 } 305 } 298 }

A23 Remarks Fyrite CO_2 = 5.5 4.5, 4.5 MW(dry) = 29.35

O_2 = 15.0, 15.5 16.0 16.0

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)
1	0.1N NaOH	150 ml.	Mod.	Final 698.7 Initial 578.1 g. Wt. Gain 120.6
2	0.1N NaOH	150 ml	S.G.	Final 592.9 Initial 579.9 g. Wt. Gain 13.0
3	Dry	—	Mod.	Final 411.2 Inital 410.5 g Wt. Gain .7
4	Silica Gel	200 ml	Mod.	Final 597.6 Initial ~~556.7~~ g. 593.6 Wt. Gain 4.0
5				Final Initial Wt. Gain
6				Final Initial Wt. Gain
7				Final Initial Wt. Gain

Total Impingers Weight Gain (MWC)(grams) 138.3 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{\text{ft}^3\ \text{in. Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sheen Construction Co.

Sampling Location> Inlet #04 Sample Ident.> TOC-0510

A02 (1-3) Date 5/10/84 (MMDDYY) Time Start 1614 (HHMM) Time Finish 1656 (HHMM)

Duct Dimensions — x — ft. or Diameter 3.94 ft.

PTCF 0.84 DGMCF .9954 Test Duration 32 min.

A03 (1-3) Nozzle Dia. .244 inches % CO 0 % N_2 80.0

Bar Press. 30.31 "Hg % CO_2 5.5 % H_2 0

Static Press. -2.3 "H_2O % O_2 14.7 % CH_4 0

A04 (1-3) Initial leak rate .004 cfm Condensed Water 143.9 gms

Final leak rate .005 cfm Filter wt. gain 0.7340 gms

Operator initials EPA/CSG Probe wash wt. gain 4.1205 gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	L. Vac. in. Hg Gauge
A05	2-8	1614	644.073	.38	.60	268	95	94	245	61	2.5
	2-7	1616	644.83	.38	.60	268	95	94	248	61	2.5
	2-6	1618	645.71	.38	.60	270	94	94	250	61	2.5
8	2-5	1620	646.58	.40	.62	272	94	94	250	61	2.5
A09	2-4	1622	647.47	.53	.89	284	94	94	248	56	3.0
A10	2-3	1624	648.46	.63	1.00	282	94	94	247	56	3.2
A11	2-2	1626	649.54	.50	.80	272	95	94	248	56	3.0
A12	2-1	1628	650.53	.20	.30	270	95	94	245	56	2.5
A13	STOP	1630	651.179								
A14	1-8	1640	651.212	.50	.80	276	95	95	250	59	3.2
A15	1-7	1642	652.19	.58	.90	284	96	95	248	57	3.5
A16	1-6	1644	653.24	.55	.85	283	97	96	250	57	3.5
A17	1-5	1646	654.26	.50	.80	282	98	96	250	57	3.5
A18	1-4	1648	655.25	.48	.76	281	98	96	245	57	3.5
A19	1-3	1650	656.24	.50	.80	279	98	96	244	57	3.8
A20	1-2	1652	657.19	.48	.76	278	99	96	243	56	3.8
A21	1-1	1654	658.16	.40	.65	269	99	96	245	56	3.5
A22	STOP	1656	659.073								
	(4:2)	(11:4)	(18:7) 14.967	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console D-545 Filter 010 Initial Wt. .5055 gms

Sample Analysis midrun leak check .002 Mw(dry) = 29.46

Weather wet 164 } 33% 164 } 33%
dry 289 } 283 }

A23 Remarks Fyrite CO_2 - 5.5, 5.5
O_2 14.5, 15.0 14.5

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	0.1N NaOH	150 ml.	Mod.	Final	762.4
				Initial	632.5
				Wt. Gain	129.9
2	0.1N NaOH	150 ml	S.G.	Final	598.6
				Initial	588.1
				Wt. Gain	10.5
3	Dry	—	Mod	Final	436.6
				Inital	436.1
				Wt. Gain	.5
4	Silica Gel	200 ml	Mod.	Final	619.2
				Initial	616.2
				Wt. Gain	3.0
5				Final	
				Initial	
				Wt. Gain	
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC)(grams) 143.9 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{\text{ft}^3\ \text{in. Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)\ (1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

APPENDIX C.1

EPA REFERENCE METHODS 2, 3, 4, AND 5E

INCLUDES

C.1.2 Controlled Emissions - EPA Reference Methods 2, 3, 4, and 5E Data Sheets

VELOCITY PROFILE FIELD DATA

Plant Name> Sloan - Cocoa Beach

Sampling Location> Stack Sample Ident.>

Date 050884 (MMDDYY) Time Start 1055 (HHMM) Time Finish 1122 (HHMM)

Duct Dimensions ____ x ____ ft. or Diameter 47.5 inches ft.

PTCF 0.84 % H_2O ____

Bar Press. 30.29 "Hg % CO ____ % N_2 ____

Static Press. +0.2 "H_2O % CO_2 ____ % H_2 ____

Operator Initials LAR % O_2 ____ % CH_4 ____

Pt.	Stack Temp. °F #1	#2	Avg.	Velocity Pressure "H_2O #1	#2	Avg.	Other ( ) #1	#2	Avg.
S12	147	147		.46	.49	.48			
S11	148	147		.53	.51	.52			
S10	147	147		.43	.42	.42			
S9	146	146		.35	.33	.34			
S8									
S7	146	146		.20	.22	.21			
S6	148	147		.23	.24	.24			
S5									
S4	148	148		.42	.41	.42			
S3	148	149		.43	.41	.42			
S2	147	148		.41	.43	.42			
S1	147	147		.33	.35	.34			
E12	149	149		.12	.12	.12			
E11	149	149		.14	.12	.13			
E10	149	149		.13	.12	.12			
E9	149	149		.14	.16	.15			
E8									
E7	149	149		.15	.14	.14			

Weather ____

Remarks Preliminary Velocity Profile –
193 Tons/hr 50% Recycle 16.7" ΔP scrubber
Wet Bulb Temp. = 147°F ~24% H_2O
Dry Bulb Temp = 147°F

VELOCITY PROFILE FIELD DATA

Plant Name> Sloan - Cocoa Beach

Sampling Location> Stack Sample Ident.>

Date 050884 (MMDDYY) Time Start 1055 (HHMM) Time Finish 1122 (HHMM)

Duct Dimensions ____ x ____ ft. or Diameter ____ ft.

PTCF 0.84 % H_2O ____

Bar Press. 30.29 "Hg % CO ____ % N_2 ____

Static Press. ____ "H_2O % CO_2 ____ % H_2 ____

Operator Initials LAR % O_2 ____ % CH_4 ____

	Pt.	Stack Temp. °F #1	#2	Ave.	Velocity Pressure "H_2O #1	#2	Ave.	Other ( ) #1	#2	Ave.
004	E6	149	149		.42	.44	.43			
005	E5									
006	E4	148	148		.70	.78	.74			
007	E3	148	148		.72	.74	.73			
008	E2	147	146		.70	.72	.71			
009	E1	133	133		.44	.42	.43			
010										
011										
012										
013										
014										
015										
016										
017										
018										
019										
020										
021										

Weather ____

Remarks Preliminary Velocity Profiles - 0.35

Pg 1

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co

Sampling Location> OUTLET Sample Ident.> TOC-050F-Run 1

A02 (1-3) Date 050987 (MMDDYY) (4:6) Time Start 1426 (11:4) (HHMM) Time Finish 1739 (18:4) (HHMM)

Duct Dimensions — (25:5) x — (32:5) ft. or Diameter 3.96 (39:5) ft.

PTCF 0.84 (46:5) DGMCF 0.9587 (53:5) Test Duration 119 (60:5) min.

A03 (1-3) Nozzle Dia. .269 (6:6) inches % CO 0 % N_2 81.15 (18:5)

Bar Press. 30.79 (25:5) "Hg % CO_2 5.25 % H_2 0 (29:5)

Static Press. -.2 (46:5) "H_2O (53) % O_2 13.6 (60:5) % CH_4 0 (67:5)

A04 (1-3) Initial leak rate .01 (4:5) cfm Condensed Water 491.8 (11:6) gms

Final leak rate .016 (18:5) cfm Filter wt. gain 0.2738 (25:7) gms

Operator initials LAR (32:7) Probe wash wt. gain 0.1424 (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~last impinger~~ Temp. °F	L. Vac. in. Hg Gauge
A05	S12	1426	934.80	.46	1.1	157	97	96	256	250	3.0
	S11	1431	938.	.54	1.2	156	101	94	254	245	3.2
	S10	1436	941.0	.46	1.1	156	103	95	255	240	3.5
8	S9	1441	944.0	.38	0.77	159	104	96	256	240	3.5
A09	S8	1446	946.6	.30	0.70	157	104	96	258	245	3.0
A10	S7	1451	949.0	.22	0.45	158	104	98	256	245	3.0
A11	S6	1456	951.4	.28	0.7	159	106	98	256	240	3.0
A12	S5	1501	953.6	.46	1.1	159	110	99	260	240	3.0
A13	S4	1506	956.8	.46	1.0	157	111	99	256	245	3.0
A14	S3	1511	959.6	.46	1.0	157	111	100	256	245	3.8
A15	S2	1516	963.0	.42	0.9	157	111	101	256	245	3.8
A16	STOP	1520	964.54	Plant Down			—	—	—	—	—
A17	S2	1559	964.54	.46	1.0	163	103	101	259	250	4.5
A18	S1	1559	965.3	.28	0.7	158	103	101	259	250	15.
A19	STOP	1604	967.0	—	—	—	—	—	—	—	—
A20	E12	1640	968.0	.14	0.32	159	99	98	259	250	2.0
A21	E11	1645	969.6	.15	0.33	159	99	99	256	245	2.0
A22	E10	1650	971.1	.14	0.32	160	99	98	257	245	2.0
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console R31-520 Filter 003 Initial Wt. .5211 gms

Sample Analysis 005

Weather Fyrite CO_2 5.0 5.5

O_2 13.5 13.7

A23 Remarks $K = 0.0423 \sqrt{\Delta P\ T_s}$ $\left(\frac{M^3}{ST}\right)$

S1 - System vacuum developed. Stopped Run at 22" Hg

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> TOC-0508

A02 (1-3) Date _____ (4:6) (MMDDYY) Time Start _____ (11:4) (HHMM) Time Finish _____ (18:4) (HHMM)

Duct Dimensions _____ (25:5) x _____ (32:5) ft. or Diameter _____ (39:5) ft.

PTCF _____ (46:5) DGMCF _____ (53:5) Test Duration _____ (60:5) min.

A03 (1-3) Nozzle Dia. _____ (4:4) inches % CO _____ (11:5) % N_2 _____ (18:5)

Bar Press. _____ (25:5) "Hg % CO_2 _____ (32:5) % H_2 _____ (39:5)

Static Press. _____ (46:5) "H_2O _____ (53) % O_2 _____ (60:5) % CH_4 _____ (67:5)

A04 (1-3) Initial leak rate _____ (4:5) cfm Condensed Water _____ (11:6) gms

Final leak rate _____ (18:5A) cfm Filter wt. gain _____ (25:7) gms

Operator initials _____ (32:7) Probe wash wt. gain _____ (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~Last Impinger~~ Temp. °F	L. Vac. In. Hg Gauge
A05	E9	1655	972.8	.18	.38	160	101	98	253	245	2.0
	E8	1700	974.3	.16	.32	159	102	98	254	245	2.0
	E7	1705	975.9	.18	.36	159	102	99	260	240	2.0
8	E6	1710	977.5	.46	1.1	159	102	100	260	245	3.5
A09	E5	1715	980.3	.72	1.5	163	112	101	254	245	5.0
A10	E4	1720	983.9	.86	1.7	160	112	101	263	240	5.5
A11	E3	1725	987.7	.74	1.6	160	113	101	256	240	5.5
A12	E2	1730	991.3	.62	1.3	160	112	102	253	240	5.5
A13	E1	1735	994.5	.55	1.1	160	110	102	253	245	5.5
A14	STOP	1739	996.5	—	—	—					
A15											
A16											
A17											
A18											
A19											
A20											
A21											
A22											
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console R31-520 Filter 003+005 Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks System Vacuum Built up during last Point (E1). Stopped 1 minute early 22" Hg

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	DRY	—	MOD	Final	721.2 g
				Initial	441.0
				Wt. Gain	280.2
2	0.1N NaOH	150	MOD	Final	745.2 g
				Initial	586.3
				Wt. Gain	158.9
3	0.1N NaOH	150	SG	Final	623.4 g
				Inital	607.9
				Wt. Gain	15.5
4	DRY	—	MOD	Final	451.8 g
				Initial	449.1
				Wt. Gain	2.7
5	SILICAGEL	—	MOD	Final	635.4 g
				Initial	600.9
				Wt. Gain	34.5
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC)(grams) 491.8 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{\text{ft}^3\ \text{in. Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)\ (1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

1/2

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Outlet 02 Sample Ident.> TOC-050-2

A02 (1-3) Date 5/10/84 (MMDDYY) Time Start 0917 (HHMM) Time Finish 1021 (HHMM)

Duct Dimensions ____ x ____ ft. or Diameter 3.96 ft.

PTCF 0.94 DGMCF 0.9587 Test Duration 72 min.

A03 (1-3) Nozzle Dia. .269 inches % CO 0 % N_2 79.5

Bar Press. 30.27 "Hg % CO_2 5.5 % H_2 0

Static Press. -.1 "H_2O % O_2 15.0 % CH_4 0

A04 (1-3) Initial leak rate .01 cfm Condensed Water 312.9 gms

Final leak rate .01 cfm Filter wt. gain 0.2675 gms

Operator initials LAR Probe wash wt. gain 0.0888 gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~Last Impinger~~ Temp. °F	L. Vac. in. Hg Gauge
A05	S12	0817	007.10	0.40	1.05	150	73	74	260	248	3.5
	S11	0820	9.0	0.48	1.50	150	86	73	258	260	4.5
	S10	0823	10.9	0.42	1.10	151	87	74	258	260	4.5
8	S09	0826	12.9	0.32	0.94	153	88	74	260	250	4.5
A09	S08	0829	14.9	0.28	0.82	151	88	76	260	254	3.0
A10	STOP	0832	16.96	Plant Down	—	—	—	—	—	—	—
A11	S07	0911	16.96	0.20	0.65	154	89	84	260	260	2.5
A12	S06	0914	18.4	0.28	0.91	155	91	84	252	260	2.9
A13	S05	0917	20.06	0.35	1.13	154	94	85	250	260	3.5
A14	S04	0920	22.0	0.40	1.35	155	95	85	245	256	3.5
A15	S03	0923	23.9	0.44	1.5	155	97	85	247	250	4.0
A16	S02	0926	25.95	0.42	1.4	153	97	85	252	250	4.0
A17	S01	0929	28.06	0.40	1.35	151	97	85	254	245	4.0
A18	STOP	0932	30.08	—	—	—	—	—	—	—	—
A19	E1	0945	30.30	0.66	2.4	153	97	88	260	254	6.0
A20	E2	0948	32.9	0.66	2.4	152	100	89	245	254	6.0
A21	E3	0951	35.4	0.64	2.1	156	101	89	245	240	6.0
A22	E4	0954	37.9	0.74	2.4	155	101	89	245	240	6.0
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console F31-520 Filter 007 Initial Wt. .4998 gms

Sample Analysis

Weather

A23 Remarks

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> TOC-0510-2

A02 (1-3) Date _____ (4:6) (MMDDYY) Time Start _____ (11:4) (HHMM) Time Finish _____ (18:4) (HHMM)

Duct Dimensions _____ (25:5) x _____ (32:5) ft. or Diameter _____ (39:5) ft.

PTCF _____ (46:5) DGMCF _____ (53:5) Test Duration _____ (60:5) min.

A03 (1-3) Nozzle Dia. _____ (4:6) inches % CO _____ (11:5) % N_2 _____ (18:5)

Bar Press. _____ (25:5) "Hg % CO_2 _____ (32:5) % H_2 _____ (39:5)

Static Press. _____ (46:5) "H_2O _____ (53) % O_2 _____ (60:5) % CH_4 _____ (67:5)

A04 (1-3) Initial leak rate _____ (4:5) cfm Condensed Water _____ (11:6) gms

Final leak rate _____ (18:4) cfm Filter wt. gain _____ (25:7) gms

Operator initials _____ (32:7) Probe wash wt. gain _____ (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~test~~ Impinger Temp. °F	L. Vac. in. Hg Gauge
A05	E05	0957	40.7	0.70	2.3	154	102	89	245	260	6.0
	E06	1000	43.2	0.40	1.35	154	100	89	245	260	4.5
	E07	1003	45.3	0.16	0.52	157	97	90	254	260	3.0
8	E08	1006	46.7	0.14	0.48	154	96	90	249	260	2.8
A09	E09	1009	47.85	0.12	0.39	157	95	90	240	248	2.8
A10	E10	1012	49.0	0.12	0.39	156	95	90	250	250	2.8
A11	E11	1015	50.1	0.12	0.39	155	94	90	260	240	2.8
A12	E12	1018	51.2	0.12	0.39	156	94	90	260	247	2.8
A13	STOP	1021	52.27	—	—	—	—	—	—	—	—
A14											
A15											
A16											
A17											
A18											
A19											
A20											
A21											
A22											
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console _____ Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks Hot box controller went out - using variac for temperature controller

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	DRY	—	MOD	Final	677.2
				Initial	435.8
				Wt. Gain	241.4
2	1N NaOH	150	MOD	Final	648.3
				Initial	602.5
				Wt. Gain	45.8
3	1N NaOH	150	GS	Final	617.3
				Inital	613.8
				Wt. Gain	3.5
4	DRY	—	MOD	Final	442.5
				Initial	441.8
				Wt. Gain	.7
5	SILICA GEL	—	MOD	Final	664.7
				Initial	643.2
				Wt. Gain	21.5
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC)(grams) 312.9 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{ft^3\ \text{in. Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Outlet #04 Sample Ident.> Toc-0510-03

A02 (1-3) Date 5/10/84 (4:6) (MMDDYY) Time Start 1137 (11:4) (HHMM) Time Finish 1404 (18:4) (HHMM)

Duct Dimensions ____ (25:5) x ____ (32:5) ft. or Diameter 3.96 (39:5) ft.

PTCF 0.84 (46:5) DGMCF .9587 (53:5) Test Duration 72 (60:5) min.

A03 (1-3) Nozzle Dia. 0.269 (4:6) inches % CO 0 (11:5) % N_2 79.5 (18:5)

Bar Press. 30.31 (25:5) "Hg % CO_2 5.5 (32:5) % H_2 0 (39:5)

Static Press. -.1 (46:5) "H_2O ____ (53) % O_2 15.0 (60:5) % CH_4 0 (67:5)

A04 (1-3) Initial leak rate .01 (4:5) cfm Condensed Water 387.7 (11:6) gms

Final leak rate .011 (18:6) cfm Filter wt. gain 0.2841 (25:7) gms

Operator initials LAR (32:7) Probe wash wt. gain 2.1087 (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~Last Impinger~~ Temp. °F	L. Vac. in. Hg Gauge
A05	S12	1137	52.90	.52	1.5	160	86	85	245	250	3.5
	S11	1140	54.9	.48	1.4	161	92	85	255	240	3.5
	S10	1143	57.0	.46	1.37	161	93	85	260	260	3.5
8	S09	1146	59.1	.38	1.15	160	94	86	258	240	3.0
A09	S08	1149	61.06	.30	0.89	160	94	86	254	249	3.0
A10	S07	1152	62.90	.30	0.89	160	95	86	258	250	3.0
A11	S06	1155	64.50	.22	0.65	160	95	87	260	249	2.5
A12	S05	1158	65.90	.38	1.15	160	94	86	255	260	3.5
A13	S04	1201	67.8	.44	1.3	160	95	86	249	258	3.5
A14	S03	1204	69.8	.48	1.4	160	95	86	257	245	4.0
A15	S02	1207	71.8	.48	1.4	161	99	87	260	240	4.0
A16	S01	1210	73.85	.48	1.4	164	100	89	255	249	4.0
A17	STOP	1213	76.01	—	—	—	—	—	—	—	—
A18	E1	1328	76.22	.62	1.88	158	85	84	260	260	4.0
A19	E2	1331	78.57	.68	2.1	157	90	84	240	259	4.5
A20	E3	1334	80.7	.84	2.6	159	94	84	240	240	5.5
A21	E4	1337	83.8	.74	2.2	159	94	84	250	260	5.0
A22	E5	1340	86.4	.70	2.1	159	95	85	260	240	5.0
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console R31-520 Filter 009 Initial Wt. 5115 gms

Sample Analysis

Weather Fyrite CO_2 5.5, 5.5, 5.4

O_2 15.0 14.8 15.0

A23 Remarks Varine used to control Hot box temp.

2/2

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> TOC-0510-03

A02 (1-3) Date _____ (MMDDYY) Time Start _____ (HHMM) Time Finish _____ (HHMM)

Duct Dimensions _____ x _____ ft. or Diameter _____ ft.

PTCF _____ DGMCF _____ Test Duration _____ min.

A03 (1-3) Nozzle Dia. _____ inches % CO _____ % N_2 _____

Bar Press. _____ "Hg % CO_2 _____ % H_2 _____

Static Press. _____ "H_2O ____ % O_2 _____ % CH_4 _____

A04 (1-3) Initial leak rate _____ cfm Condensed Water _____ gms

Final leak rate _____ cfm Filter wt. gain _____ gms

Operator initials _____ Probe wash wt. gain _____ gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~test impinger~~ Temp. °F	L. Vac. In. Hg Gauge
A05	E6	1343	89.0	0.50	1.45	159	96	96	260	260	4.5
	E7	1346	91.3	0.15	.45	161	94	85	258	251	3.0
	E8	1349	92.55	0.16	.50	161	94	85	255	260	3.0
8	E9	1352	93.8	0.16	.50	162	94	94	249	260	3.0
A09	E10	1355	94.95	0.14	.42	159	92	85	254	260	2.5
A10	E11	1358	96.1	0.13	.40	160	92	85	255	260	2.5
A11	E12	1401	97.2	0.12	.36	159	91	86	256	251	2.5
A12	STOP	1404	98.31	–	–	–	–	–	–	–	–
A13											
A14											
A15											
A16											
A17											
A18											
A19											
A20											
A21											
A22											
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console _____ Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks _____

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	Dry	—	Mod	Final	723.0
				Initial	411.3
				Wt. Gain	311.7
2	0.1N NaOH	150 ml.	Mod.	Final	613.0
				Initial	557.3
				Wt. Gain	55.7
3	0.1N NaOH	150 ml	S.G	Final	611.4
				Inital	607.2
				Wt. Gain	4.2
4	Dry	—	Mod.	Final	440.4
				Initial	438.8
				Wt. Gain	1.6
5	Silica Gel	200 ml	Mod	Final	668.5
				Initial	654.0
				Wt. Gain	14.5
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC) (grams) 387.7 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

1/1

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction

Sampling Location> Stack Sample Ident.> TOC-0510-04

A02 (1-3) Date 05084 (MMDDYY) (4:6) Time Start 1537 (HHMM) (11:4) Time Finish 1657 (HHMM) (18:4)

Duct Dimensions ____ (25:5) x ____ (32:5) ft. or Diameter 3.96 (39:5) ft.

PTCF 0.84 (46:5) DGMCF .9587 (53:5) Test Duration 72 (60:5) min.

A03 (1-3) Nozzle Dia. .269 (4:6) inches % CO 0 (11:5) % N_2 79.0 (18:5)

Bar Press. 30.31 (25:5) "Hg % CO_2 6.2 (32:5) % H_2 0 (39:5)

Static Press. -.1 (46:5) "H_2O ____ (53) % O_2 14.8 (60:5) % CH_4 0 (67:5)

A04 (1-3) Initial leak rate .01 (4:5) cfm Condensed Water 365.0 (11:6) gms

Final leak rate .016 (18:5) cfm Filter wt. gain .1430 (29:7) gms

Operator initials LHR (32:7) Probe wash wt. gain .1464 (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~Last Impinger~~ Temp. °F	L. Vac. in. Hg Gauge
A05	S12	1537	99.60	.54	1.5	159	85	83	255	240	4.0
	S11	1540	101.8	.50	1.5	160	87	82	257	240	4.0
	S10	1543	103.9	.37	1.1	161	90	82	260	240	3.5
8	S09	1546	105.8	.32	0.95	160	90	82	257	249	3.5
A09	S08	1549	107.6	.25	0.74	160	91	83	245	243	3.5
A10	S07	1552	109.1	.18	0.54	160	91	83	240	249	3.5
A11	S06	1555	110.5	.22	0.65	160	91	83	245	248	3.0
A12	S05	1558	111.9	.34	1.0	161	92	84	260	248	3.0
A13	S04	1601	113.6	.38	1.1	161	96	86	260	246	3.0
A14	S03	1604	115.6	.42	1.25	161	97	86	255	260	3.5
A15	S02	1607	117.5	.42	1.25	159	97	86	252	261	4.0
A16	S01	1610	119.6	.42	1.20	160	97	87	253	245	4.0
A17	STOP	1613	121.38	—	—	—	—	—	—	—	—
A18	E1	1621	121.60	.64	1.90	161	96	88	240	247	5.0
A19	E2	1624	123.9	.78	2.3	161	98	88	252	251	5.5
A20	E3	1627	126.35	.72	2.1	159	99	88	260	244	6.0
A21	E4	1630	128.90	.78	2.3	162	99	89	257	255	7.0
A22	E5	1633	131.5	.70	2.0	162	101	89	256	246	6.5
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console R31-520 Filter 011 Initial Wt. .5067 gms

Sample Analysis ____

Weather Fyile CO_2 = 6.0, 6.5, 6.0

O_2 = 14.5, 15.0, 15.0

'3 Remarks Variac Used to control hot box temperature

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> TOC-0510-04

A02 (1-3) Date _____ (MMDDYY) Time Start _____ (HHMM) Time Finish _____ (HHMM)

Duct Dimensions _____ x _____ ft. or Diameter _____ ft.

PTCF _____ DGMCF _____ Test Duration _____ min.

A03 (1-3) Nozzle Dia. _____ inches % CO _____ % N_2 _____

Bar Press. _____ "Hg % CO_2 _____ % H_2 _____

Static Press. _____ "H_2O _____ % O_2 _____ % CH_4 _____

A04 (1-3) Initial leak rate _____ cfm Condensed Water _____ gms

Final leak rate _____ cfm Filter wt. gain _____ gms

Operator initials _____ Probe wash wt. gain _____ gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	L. Vac. in. Hg Gauge
A05	E6	1636	134.0	0.50	1.5	161	100	89	260	240	5.5
	E7	1639	136.1	0.14	0.41	161	99	90	260	245	3.5
	E8	1642	137.4	0.14	0.41	161	93	90	248	245	3.5
8	E9	1645	138.4	0.12	0.36	160	93	90	250	252	2.5
A09	E10	1648	139.36	0.12	0.36	169	92	89	256	260	3.0
A10	E11	1651	140.2	0.12	0.36	163	92	89	258	257	3.0
A11	E12	1654	141.1	0.10	0.30	163	92	88	260	260	7.0
A12	STOP	1657	142.04	—	—	—	—	—	—	—	—
A13											
A14											
A15											
A16											
A17											
A18											
A19											
A20											
A21											
A22											
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console R31-520 Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks System Vacuum at end of run = 12" Hg
Final leak check at 18" Hg

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	Dry	—	Mod	Final	672.6
				Initial	435.2
				Wt. Gain	237.4
2	0.1N NaOH	150 ml	Mod	Final	696.9
				Initial	615.9
				Wt. Gain	81.0
3	0.1N NaOH	150 ml	S.G.	Final	632.9
				Inital	621.7
				Wt. Gain	11.2
4	Dry	—	Mod	Final	446.8
				Initial	441.1
				Wt. Gain	5.7
5	Silica Gel	300 ml	Mod.	Final	702.3
				Initial	673.6
				Wt. Gain	28.7
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC)(grams) 365.0 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

APPENDIX C.2

UNCONTROLLED EMISSIONS - PARTICLE SIZE DISTRIBUTION
DATA SHEETS

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Inlet Sample Ident.> PSD-01

A02 (1-3) Date 5/10/84 (MMDDYY) Time Start 1411 (HHMM) Time Finish 1545 (HHMM)

Duct Dimensions — x — ft. or Diameter 3.94 ft.

PTCF .846 DGMCF .9954 Test Duration 85 min.

A03 (1-3) Nozzle Dia. .175 inches % CO 0 % N_2 79.7

Bar Press. 30.31 "Hg 30.13 % CO_2 4.5 % H_2 0

Static Press. -2.5 "H_2O % O_2 15.8 % CH_4 0

A04 (1-3) Initial leak rate .004 cfm Condensed Water 34% H_2O gms

Final leak rate NA cfm Filter wt. gain gms

Operator initials EPA/CSG Probe wash wt. gain gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Probe Temp. Nozzle-Base Temp. °F	Last Impinger Temp. °F	L. Vac. in. Hg Gauge
A05	4	1411	621.263	.60	.24	296	90	90	140	62	1
	4	1425	624.86	.60	.24	296	90	90	144	58	1
	4	1440	628.82	.60	.24	296	92	92	168	58	1
A08	STOP	1443	629.809								
A09	4	1452	629.809	.60	.24	296	94	93	145	53	1
A10	4	1502	632.52	.60	.24	296	94	94	129	56	1
A11	4	1517	636.64	.60	.24	296	94	94	168	56	1
A12	4	1532	640.80	.60	.24	296	94	94	169	59	2
A13	STOP	1545	643.888								
A14											
A15			22.625			296		92			
A16											
A17											
A18											
A19											
A20											
A21											
A22											
	(4:2)	(11:4)	(18:7)	(25:4)	(32:4)	(39:4)	(46:4)	(53:4)	(60:4)	(67:4)	(74:4)

Console D-548 Filter 020 Initial Wt. gms

Sample Analysis Impactor sampling - Point 4

Weather wet 165 ≲ 34%

Dry 300

A23 Remarks Suspect thermocouple in probe Not close enough to end of impactor

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	0.1N NaOH	~~Dry~~	~~100 ml~~	K.G.	Final 578.6 Initial 548.3 Wt. Gain 30.3
2	~~0.1N NaOH~~ Dry	~~100 ml~~	Mod		Final 453.1 Initial 452.1 Wt. Gain 1.0
3	Silica Gel	200 ml	Mod.		Final 591.9 Inital 587.4 Wt. Gain 4.5
4					Final Initial Wt. Gain
5					Final Initial Wt. Gain
6					Final Initial Wt. Gain
7					Final Initial Wt. Gain

Total Impingers Weight Gain (MWC)(grams) 35.8 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

IMPACTOR FIELD DATA

801 (1-3) Plant Name> Sloan Const Co

Sampling Location> Inlet Sample Ident.> PSD-02

Type of Impactor> Anderson HCSS Impactor Substrate>

802 (1-3) Date 051184 (MMDDYY) Time Start 1230 (HHMM) Time Finish 1400 (HHMM)

Duct Dimensions — x — ft. or Diameter 3.94 ft.

PTCF .84 DGMCF .9954 Test Duration 90 min.

803 (1-3) Bar Press. 29.30 "Hg Static Press. -2.5 "H_2O

Nozzle Dia. .175 inches Condensed Water gms

Intake leak rate .004 cfm Operator initials EPA/CSG

	Pt.	Clock Time	Dry Gas Meter Reading ft^3	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Probe ~~Hot-Box~~ Temp. °F	Last Impinger Temp. °F	L. Vac. in. Hg Gauge
804	4	1230	705.546	.60	.25	291	97	97	156	62	1
805	4	1245	709.72	.60	.25	291	95	95	166	58	1
806	4	1300	713.79	.60	.25	291	97	97	169	57	1
807	4	1315	717.80	.60	.25	291	98	98	166	57	2
808	4	1330	721.83	.60	.25	291	98	98	160	57	2.5
809	4	1345	725.95	.60	.25	291	98	98	159	57	2.5
810	STOP	1400	729.062								
811									97		
812											
813											
814											
815											
816											
817											
818											
819											
820											
821											
	(4:2)	(11:4)	(18:7)	(25:6)	(32:6)	(39:6)	(46:6)	(53:6)	(60:6)	(67:6)	(74:3)

29.4

* Dry air purge when sampling wet streams

Console

Weather

Remarks Wet 161 } 30% 163 } 32%
Dry 296 } 303 }

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

Impinger No.	Solution Used	Amount of Solution (ml)	Imp. Tip Configuration	Weight (grams)
1	0.1N NaOH	100 ml		Final 790.7 Initial 582.2 g Wt. gain 208.5
2	Dry	—		Final 455.7 Initial 454.4 g Wt. gain 1.3
3	Silica Gel	200 ml.		Final 599.1 Initial 594.8 g Wt. gain 4.3
4				Final Initial Wt. gain
5				Final Initial Wt. gain
6				Final Initial Wt. gain
7				Final Initial Wt. gain

~~TOTAL WEIGHT GAIN OF IMPINGERS~~ (grams) 214.1

Samples for Further Analysis:

Sample No.	Description	Species	Results (total mg.)

Remarks

APPENDIX C.3

POLYNUCLEAR AROMATIC HYDROCARBON (PAH) DATA SHEETS

INCLUDES

C.3.1 Uncontrolled Emissions - PAH Data Sheets

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Inlet Sample Ident.> PAH-0511-01

A02 (1-3) Date 05 11 84 (MMDDYY) (4:6) Time Start 1108 (HHMM) (11:4) Time Finish 1207 (HHMM) (18:4)

Duct Dimensions ____ (25:5) x ____ (32:5) ft. or Diameter 3.94 (39:5) ft.

PTCF 0.84 (46:5) DGMCF .9954 (53:5) Test Duration 49 (60:5) min.

A03 (1-3) Nozzle Dia. .244 (4:6) inches % CO 0 (11:5) % N_2 80.0 (18:5)

Bar Press. 30.30 (25:5) "Hg % CO_2 5.0 (32:5) % H_2 0 (39:5)

Static Press. -2.4 (46:5) "H_2O ____ (53) % O_2 15.0 (60:5) % CH_4 0 (67:5)

A04 (1-3) Initial leak rate .004 (4:5) cfm Condensed Water 223.7 (11:6) gms

Final leak rate .02 (18:5) cfm Filter wt. gain ____ (25:7) gms

Operator initials EPA/CSG (32:7) Probe wash wt. gain ____ (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft^3	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	i. Vac. In. Hg Gauge
A05	1-8	1108	681.805	.55	.84	289	98	97	243	72	11.5
	1-7	1111	683.31								
	STOP	1114	684.719				0				
8	1-7	1115	684.719	.65	1.00	293	97	96	251	73	12.2
A09	1-6	1116	684.99	.65	1.00	289	97	96	252	63	12.2
A10	1-5	1119	686.57	.55	.84	298	96	96	250	63	11.8
A11	1-4	1122	688.10	.55	.84	291	96	96	250	62	13.0
A12	1-3	1125	689.59	.60	.90	290	95	95	250	62	15.0
A13	1-2	1128	691.10	.50	.75	280	95	95	250	62	14.0
A14	1-1	1131	692.61	.40	.60	275	95	95	250	62	11.5
A15	STOP	1134	693.950								
A16	2-8	1143	694.032	.50	.75	264	96	95	251	53	13.0
A17	2-7	1146	695.28	.50	.75	265	96	96	250	53	14.3
A18	2-6	1149	696.72	.55	.80	275	96	96	250	53	16.5
A19	2-5	1152	698.22	.50	.75	285	96	96	250	53	15.8
A20	2-4	1155	699.72	.70	1.06	287	96	96	250	53	19.0
A21	2-3	1158	701.40	.50	.75	287	95	94	248	53	15.8
A22	2-1	1201	702.85	.50	.75	284	95	94	248	53	16.0
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console D-548 Filter 029 Initial Wt. .5252 gms

Sample Analysis ____

Weather Wet 165 } 33% 166 } 55% 167 } Fyrite CO_2 5.0 5.0

Dry 305 } 280 } 296 } O_2 15.0 15.0

A23 Remarks ____

2/2

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> PAH-0511-01

A02 (1-3) Date _____ (MMDDYY) (4:6) Time Start _____ (HHMM) (11:4) Time Finish _____ (HHMM) (18:4)

Duct Dimensions _____ (25:5) x _____ (32:5) ft. or Diameter _____ (39:5) ft.

PTCF _____ (46:5) DGMCF _____ (53:5) Test Duration _____ (60:5) min.

A03 (1-3) Nozzle Dia. _____ (4:6) inches % CO _____ (11:5) % N_2 _____ (18:5)

Bar Press. _____ (25:5) "Hg % CO_2 _____ (32:5) % H_2 _____ (39:5)

Static Press. _____ (46:5) "H_2O _____ (53) % O_2 _____ (60:5) % CH_4 _____ (67:5)

A04 (1-3) Initial leak rate _____ (4:5) cfm Condensed Water _____ (11:6) gms

Final leak rate _____ (18:5) cfm Filter wt. gain _____ (25:7) gms

Operator initials _____ (32:7) Probe wash wt. gain _____ (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	L. Vac. In. Hg Gauge
A05	2-1	1204	704.35	.20	.30	274	95	94	249	53	8.0
	STOP	1207	705.353								
A09											
A10											
A11											
A12											
A13											
A14											
A15											
A16											
A17											
A18											
A19											
A20											
A21											
A22											
	(6:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console _____ Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks _____

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	Dry	—	S.G	Final	618.8
				Initial	437.7
				Wt. Gain	181.1
2	Dry	—	S.G	Final	472.7
				Initial	451.5
				Wt. Gain	21.2
3	Silica Gel	200	Mod	Final	618.9
				Inital	597.5
				Wt. Gain	21.4
4				Final	
				Initial	
				Wt. Gain	
5				Final	
				Initial	
				Wt. Gain	
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC)(grams) 223.7 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.339)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (\bar{P}M)}{(TM)}\ (501.7)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

APPENDIX C.3

POLYNUCLEAR AROMATIC HYDROCARBON (PAH) DATA SHEETS

INCLUDES

C.3.2 Controlled Emissions - PAH Data Sheets

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Sloan Construction Co.

Sampling Location> Outlet #01 Sample Ident.> PAH-0511-01

A02 (1-3) Date 5/11/84 (MMDDYY) Time Start 1026 (HHMM) Time Finish 1314 (HHMM)

Duct Dimensions ____ x ____ ft. or Diameter 3.96 ft.

PTCF 0.84 DGMCF .9587 Test Duration 97 min.

A03 (1-3) Nozzle Dia. .183 inches % CO 0 % N_2 80.0

Bar Press. 30.30 "Hg % CO_2 7.5 % H_2 0

Static Press. +.2 "H_2O % O_2 12.5 % CH_4 0

A04 (1-3) *Initial leak rate .020 cfm Condensed Water 264.3 gms

Final leak rate .013 cfm Filter wt. gain ____ gms

Operator initials LAR Probe wash wt. gain ____ gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Probe ~~test impinger~~ Temp. °F	L. Vac. in. Hg Gauge
A05	S12	1026	144.60	.68	2.0	161	85	84	248	260	22
	STOP	1030	147.39	Changed nozzles					—	—	—
	S11	1108	147.60	.58	.37	161	91	89	240	258	7.5
8	S10	1112	148.95	.50	.32	162	92	89	260	258	7.5
A09	S09	1116	150.3	.38	.24	—	—	—	260	254	—
A10	STOP	1117	Glass Crossover Probe almost immediately at S09								
A11 **	STOP	1117	151.74	—	—	—	—	—	—	—	—
A12	S09	1137	151.84	.42	.25	162	94	92	247	246	6.0
A13	S08	1141	152.94	.34	.22	162	94	93	258	260	6.0
A14	S07	1145	153.8	.25	.16	168	93	91	245	260	5.0
A15	S06	1149	154.97	.34	.18	168	93	91	240	259	5.0
A16	S05	1153	155.83	.40	.22	165	94	91	260	257	5.5
A17	S04	1157	156.97	.38	.21	165	94	91	245	252	6.0
A18	S03	1201	158.2	.48	.27	164	94	91	253	251	7.0
A19	S02	1205	159.2	.42	.27	162	94	91	259	248	7.0
A20	S01	1209	160.4	.33	.21	163	96	92	257	249	7.5
A21	STOP	1213	161.41	—	—	—	—	—	—	—	—
A22	E1	1226	161.52	.88	.56	160	96	93	244	255	14.5

Console R31-520 Filter 028 Initial Wt. .5220 gms

Sample Analysis ____

Weather Fyrite CO_2 7.5, 8.0, 7.0

O_2 12.5, 12.0, 13.0

A23 Remarks * 20" Hg Vacuum, Valve Used to Control Probe Temp

** Leak check = 0.016

2/2

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> PAH-05-11-01

A02 (1-3) Date _____ (4:8) (MMDDYY) Time Start _____ (11:4) (HHMM) Time Finish _____ (18:4) (HHMM)

Duct Dimensions _____ (25:5) x _____ (32:5) ft. or Diameter _____ (39:5) ft.

PTCF _____ (46:5) DGMCF _____ (53:5) Test Duration _____ (60:5) min.

A03 (1-3) Nozzle Dia. _____ (4:6) inches % CO _____ (11:5) % N_2 _____ (18:5)

Bar Press. _____ (25:5) "Hg % CO_2 _____ (32:5) % H_2 _____ (39:5)

Static Press. _____ (46:5) "H_2O _____ (53) % O_2 _____ (60:5) % CH_4 _____ (67:5)

A04 (1-3) Initial leak rate _____ (4:5) cfm Condensed Water _____ (11:6) gms

Final leak rate _____ (19:5) cfm Filter wt. gain _____ (25:7) gms

Operator initials _____ (32:2) Probe wash wt. gain _____ (39:7) gms

	Pt.	Clock Time	Dry Gas Meter Reading ft³	ΔP in. H_2O	ΔH in. H_2O	Stack Temp. °F	Dry Gas Meter Temperature Inlet °F	Dry Gas Meter Temperature Outlet °F	Hot Box Temp. °F	Last Impinger Temp. °F	L. Vac. in. Hg Gauge
A05	E2	1230	163.2	.60	.38	159	98	94	252	260	7.5
	E3	1234	164.6	.80	.51	163	99	94	257	260	9.0
	E4	1238	166.3	.86	.55	162	99	95	258	260	9.5
B	E5	1242	167.97	.90	.51	162	100	96	257	259	9.0
A09	E6	1246	169.53	.52	.33	162	101	96	256	260	8.0
A10	E7	1250	170.9	.20	.14	159	96	97	254	261	6.0
A11	E8	1254	171.82	.16	.11	160	96	95	252	260	5.0
A12	E9	1258	172.50	.16	.11	160	95	94	252	260	5.0
A13	E10	1302	173.23	.16	.11	160	97	96	248	257	5.0
A14	E11	1306	173.99	.15	.10	159	97	96	248	254	5.0
A15	E12	1310	174.7	.15	.10	159	97	96	248	253	5.0
A16	STOP	1314	175.31	—	—	—	—	—	—	—	—
A17											
A18											
A19											
A20											
A21											
A22											
	(4:2)	(11:4)	(18:7)	(25:5)	(32:5)	(39:5)	(46:5)	(53:5)	(60:5)	(67:5)	(74:5)

Console _____ Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks _____

MOISTURE AND IMPINGER CATCH DATA SHEET

Impinger Number	Solution	Solution (mL)	Configuration	Weight (g)	
1	Dry	—	S.G.	Final	~~686.0~~ 625.9
				Initial	462.6
				Wt. Gain	223.3
2	Dry	—	SG	Final	465.1
				Initial	451.3
				Wt. Gain	13.8
3	Silica Gel	200 mL	Mod.	Final	656.2
				Inital	629.0
				Wt. Gain	27.2
4				Final	
				Initial	
				Wt. Gain	
5				Final	
				Initial	
				Wt. Gain	
6				Final	
				Initial	
				Wt. Gain	
7				Final	
				Initial	
				Wt. Gain	

Total Impingers Weight Gain (MWC) (grams) 264.3 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = _____ ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = _____ °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.339)\ \frac{liters}{gm\ H_2O}}{\left[(MWC)\ (1.339)\ \frac{liters}{gm\ H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (501.7)\ \frac{liters\ °R}{ft^3\ in.Hg}\right]}$$

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{\quad}}$$

APPENDIX C.4

PRELIMINARY CALCULATION DATA SUMMARY REPORTS

INCLUDES

C.4.1 Uncontrolled Emissions - Preliminary Calculations Data Summary Reports

RADIAN
CORPORATION

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Eric P Anderson

Position Scientist

Plant Name Sloan Const. Co

Date of Testing 5/08/87

Run No. TOC-0508

Sampling Location Inlet

Total Test Time (min.) 32

Sample Gas Volume (SCFD) 16.22

Percent Moisture 30.2 %

"Dry" Molecular Weight 29.51

Gas Flow (DSCFM) ~~8300~~ 19,100

Percent Isokinetic 100.2

Average Visible Emission

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN
CORPORATION

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name _____

Position Venturi Inlet

Plant Name Sloan Construction

Date of Testing 5/10

Run No. Part/TOC Run 2

Sampling ~~Location~~ Times 0815-0831 0912-0928

Total Test Time (min.) 32

Sample Gas Volume (SCFD) 15.849

Percent Moisture 28.7

"Dry" Molecular Weight 26.2

Gas Flow (DSCFM) 18,600

Percent Isokinetic 98.6

Average Visible Emission _____

$$V_{scf} = 16.013 \times \frac{528}{541} \times \frac{30.27}{29.92} \times 1.0024 = 15.849$$

$$\% H_2O = \frac{135.0 \times .0472 \times 100}{15.849 + (135.0 \times .0472)} = 28.7$$

$$Avg\ V_s = 85.48(.84)\left(\frac{\sqrt{\Delta P \times T_s}}{\sqrt{MW \times P_s}}\right) \frac{19.6085}{\sqrt{26.2 \times 30.11}} = 50.1$$

$$V_{Nozzle} = \frac{15.849}{32(60)} \left(\frac{1}{.0003247}\right)\left(\frac{1}{1-.287}\right)\left(\frac{746}{528}\right)\left(\frac{29.92}{30.11}\right) = 49.4$$

$$\% Iso = \frac{49.4}{50.1} \times 100 = 98.6\ \%$$

CO_2	5.6		1.7
O_2	15.3		2.49
N_2	79.1		15.79
H_2O		28.7	5.17
			26.2

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$$50.1\ ft/min \times 60 \times \frac{528}{746} \times \frac{30.11}{29.92} \times .713 \times 12.19\ ft^2 = 18,600\ DSCFM$$

Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Co.

Position

Plant Name

Date of Testing 5/10/84

Run No. Part/TOC Run 3

Sampling Location Venturi Inlet

Total Test Time (min.) 32 1140-1156 1325-1341

Sample Gas Volume (SCFD) 15.038

Percent Moisture 30.3

"Dry" Molecular Weight 29.4

Gas Flow (DSCFM) 18,000

Percent Isokinetic 98.0

Average Visible Emission

$$V_{SCF} = 15.342 \times \frac{528}{547} \times \frac{30.31}{29.92} \times 1.0024 = 15.038$$

$$\% H_2O = \frac{138.3 \times .0472 \times 100}{15.038 + (138.3 \times .0472)} = 30.3\%$$

$$Avg\ V_s = 85.48(.84)\frac{19.4166}{\sqrt{25.9 \times 30.13}} = 49.9$$

CO_2	4.5	1.30
O_2	15.8	3.52
N_2	79.7	15.55
H_2O	30.3	5.45
		25.9

$$V_{Nozzle} = \frac{15.038}{32(60)}\left(\frac{1}{.0003247}\right)\left(\frac{1}{1-.303}\right)\left(\frac{751}{528}\right)\left(\frac{29.92}{30.13}\right) = 48.9$$

$$\%ISO = \frac{48.9}{49.9} \times 100 = 98.0\%$$

$$49.9\ ft/sec \times 60 \times \frac{528}{751} \times \frac{30.13}{29.92} \times (1-.303) \times 12.19\ ft^2 = 18,000\ DSCFM$$

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN
CORPORATION

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Co.

Position

Plant Name

Date of Testing 5/10/84

Run No. Part/Toc Run 4

Sampling Location Venturi Inlet

Total Test Time (min.) 32 1614-1630 1640-1656

Sample Gas Volume (SCFD) 14.459

Percent Moisture 32.0

"Dry" Molecular Weight 29.5

Gas Flow (DSCFM) 17,100

Percent Isokinetic 99.4

Average Visible Emission

$$V_{scf} = 14.967 \times \frac{528}{555} \times \frac{30.31}{29.92} \times 1.0024 = 14.459$$

$$\% H_2O = \frac{143.9 \times .0472 \times 100}{14.459 + (143.9 \times .0472} = 32.0$$

$$Avg\ V_s = 85.48(.84)\frac{18.3210}{\sqrt{25.4 \times 30.14}} = 47.5$$

CO_2	5.5
O_2	14.5
N_2	80.0
H_2O	32.0
	25.4

$$V_{Nozzle} = \frac{14.459}{32(60)}\left(\frac{1}{.0003247}\right)\left(\frac{736}{528}\right)\left(\frac{29.92}{30.14}\right)\left(\frac{1}{1-.32}\right) = 47.2$$

$$\% ISO = \frac{47.2}{47.5} \times 100 = 99.4\%$$

$$47.5\ ft/sec \times 60 \times \frac{528}{736} \times \frac{30.14}{29.92} \times (1-.32) \times 12.19 = 17,100$$

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN
CORPORATION

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Co.

Position

Plant Name

Date of Testing 5/10/84

Run No. PSD Run 1

Sampling Location Venturi Inlet

Total Test Time (min.) 85 1411-1443 1452-1545

Sample Gas Volume (SCFD) 21.976

Percent Moisture 30.3 (Part/Toc Run 2)

"Dry" Molecular Weight 29.4

Gas Flow (DSCFM)

Percent Isokinetic 96.2

Average Visible Emission

$$V_{SCF} = 22.625 \times \frac{528}{552} \times \frac{30.31}{29.92} \times 1.0024 = 21.976$$

CO_2	4.5
O_2	15.8
N_2	79.7
H_2O	30.3
	25.9

$$V_s = 85.48(.84)\sqrt{\frac{.60 \times 756}{25.9 \times 30.13}} = 54.7$$

$$\% H_2O = \frac{35.8 \times .0472 \times 100}{16.046 + (35.8 \times .0472)} = 9.5 \text{ VOID}$$

$$V_{Nozzle} = \frac{21.976}{85(60)}\left(\frac{1}{.0001670}\right)\left(\frac{756}{528}\right)\left(\frac{29.92}{30.13}\right)\left(\frac{1}{1-.303}\right) = 52.6$$

$$\% ISO = \frac{52.6}{54.7} \times 100 = 96.2\%$$

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Co.

Location

Plant Name

Date of Testing 5/11/84

Run No. PED 2

Sampling Location Venturi Inlet

Total Test Time (min.) 90 1230-1400

Sample Gas Volume (SCFD) 23.478

Percent Moisture 30.1

"Dry" Molecular Weight

Gas Flow (DSCFM)

Percent Isokinetic 96.0

Average Visible Emission

$$V_{scf} = 24.516 \times \frac{528}{557} \times \frac{30.30}{29.92} \times 1.0024 = 23.478$$

$$\%H_2O = \frac{214.1 \times .0472 \times 100}{23.478 + (214.1 \times .0472)} = 30.1$$

$$Avg\ V_s = 85.48(.84)\frac{\sqrt{.60 \times 751}}{\sqrt{25.7 \times 30.12}} = 54.8$$

$$V_{Nozzle} = \frac{23.478}{10(60)}\left(\frac{1}{.0001670}\right)\left(\frac{751}{528}\right)\left(\frac{29.92}{30.12}\right)\left(\frac{1}{1-.301}\right) = 52.6$$

$$\%Iso = \frac{52.6}{54.8} \times 100 = 96.0\%$$

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Co.

Position

Plant Name

Date of Testing 5/11/84

Run No. PAH

Sampling Location Venturi Inlet

Total Test Time (min.) 48 1108-1134 1143-1207

Sample Gas Volume (SCFD) 22.338

Pollutant Moisture 32.1

"Dry" Molecular Weight 29.4

Gas Flow (DSCFM) 18,400

Percent Isokinetic 94.8

Average Visible Emission

$$V_{SCF} = 23.466 \times \frac{528}{556} \times \frac{30.30}{29.92} \times 1.0024 = 22.338$$

$$\% H_2O = \frac{223.7 \times .0472 \times 100}{22.338 + (223.7 \times .0472)} = 32.1$$

$$Avg\ V_s = 85.48(.84)\frac{20.1174}{\sqrt{25.7 \times 30.12}} = 51.9$$

$$V_{Nozzle} = \frac{22.338}{48(60)}\left(\frac{1}{.0003247}\right)\left(\frac{743}{528}\right)\left(\frac{29.92}{30.12}\right)\left(\frac{1}{1-.321}\right) = 49.2$$

$$\% ISO = \frac{49.2}{51.9} \times 100 = 94.8$$

$$51.9\ ft/sec \times 60 \times \frac{528}{743} \times \frac{30.12}{29.92} \times (1-.321) \times 12.19\ ft^2 = 18,400\ DSCFM$$

CO_2	5
O_2	15
N_2	80
H_2O	32.1
	25.7

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

APPENDIX C.4

PRELIMINARY CALCULATION DATA SUMMARY REPORTS

INCLUDES

C.4.2 Controlled Emissions - Preliminary Calculations Data Summary Reports

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Larry A. Rolland

Position Stack Stack Scientist

Plant Name Sloan Construction

Date of Testing 050884

Run No. TOC - 0508

Sampling Location Stack

Total Test Time (min.) 119

Sample Gas Volume (SCFD) 0.95

Percent Moisture 29.8

"Dry" Molecular Weight 30.4

Gas Flow (DSCFM) 16,800

Percent Isokinetic 81.5

Average Visible Emission

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN
CORPORATION

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name

Position

Plant Name Sloan Construction Co.

Date of Testing 5/10/84

Run No. Part/TOC Run 2

Sampling Location Venturi Outlet

Total Test Time (min.) 72 0817-0832 0911-0932 0945-1021

Sample Gas Volume (SCFD) 41.55

Percent Moisture 25.0

"Dry" Molecular Weight 29.5

Gas Flow (DSCFM) 17,800

Percent Isokinetic 101.4

Average Visible Emission

$$V_{scf} = 44.95 \times \frac{528}{549} \times \frac{30.27}{29.92} \times 0.9500 = 41.55$$

$$\% H_2O = \frac{292.9 \times .0472 \times 100}{41.55 + (292.9 \times .0472)} = 25.0$$

$$Avg\ V_s = 55.48(.84)\frac{14.5798}{\sqrt{26.6 \times 30.26}} = 36.9$$

$$V_{Nozzle} = \frac{41.55}{72(60)}\left(\frac{1}{.0003947}\right)\left(\frac{1}{1-.25}\right)\left(\frac{614}{528}\right)\left(\frac{29.92}{30.26}\right) = 37.4$$

$$\% Iso = \frac{37.4}{36.9} \times 100 = 101.4\%$$

$$36.9\ ft/sec \times 60 \times \frac{528}{614} \times \frac{30.26}{29.92} \times .75 \times 12.32\ ft^2 = 17{,}800\ DSCFM$$

CO_2	5.5	1.82
O_2	15.0	3.60
N_2	79.5	16.70
H_2O	25.0	9.50
		24.6

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN
CORPORATION

RADIAN
CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Co.

Position

Plant Name

Date of Testing 5/10/84

Run No. Part/TOC Run 3

Sampling Location Venturi Outlet

Total Test Time (min.) 72 1137-1213 1328-1404

Sample Gas Volume (SCFD) 41.84

Percent Moisture 30.4

"Dry" Molecular Weight 29.5

Gas Flow (DSCFM) 17,100

Percent Isokinetic 106.0

Average Visible Emission

$$V_{SCF} = 45.20 \times \frac{528}{549} \times \frac{30.31}{29.92} \times 0.95 = 41.84$$

$$\% H_2O = \frac{387.7 \times .0472 \times 100}{41.84 + (387.7 \times .0472)} = 30.4$$

$$Avg\ V_s = 85.48(.84)\frac{15.0723}{\sqrt{26.0 \times 30.30}} = 38.6$$

CO_2	5.5	1.68
O_2	15.0	3.34
N_2	79.5	15.49
H_2O	30.4	5.47
		26.0

$$V_{Nozzle} = \frac{41.84}{72(60)}\left(\frac{1}{.0003947}\right)\left(\frac{1}{1-.304}\right)\left(\frac{620}{528}\right)\left(\frac{29.92}{30.30}\right) = 40.9$$

$$\% Iso = \frac{40.9}{38.6} \times 100 = 106.0\%$$

$$38.6\ ft/sec \times 60 \times \frac{528}{620} \times \frac{30.30}{29.92} \times (1-.304) \times 12.32\ ft^2 = 17,100\ DSCFM$$

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN CORPORATION

RADIAN CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY REPORT

Name Sloan Construction Co.

Position

Plant Name

Date of Testing 5/10/84

Run No. Part/Toc Run 4

Sampling Location Venturi Outlet

Total Test Time (min.) 72 1537-1613 1621-1657

Sample Gas Volume (SCFD) 39.01

Percent Moisture 30.6

"Dry" Molecular Weight 29.6

Gas Flow (DSCFM) 16,700

Percent Isokinetic 101.3

Average Visible Emission

$$V_{scf} = 42.22 \times \frac{528}{550} \times \frac{30.31}{29.92} \times 0.95 = 39.01$$

$$\% H_2O = \frac{365.0 \times .0472 \times 100}{39.01 + (365.0 \times .0472)} = 30.6$$

$$Avg\ V_s = 85.48(.84)\frac{14.757}{\sqrt{26.0 \times 30.30}} = 37.8$$

$$V_{Nozzle} = \frac{39.01}{72(60)}\left(\frac{1}{.0003947}\right)\left(\frac{621}{528}\right)\left(\frac{29.92}{30.30}\right)\left(\frac{1}{1-.306}\right) = 38.3$$

$$\% ISO = \frac{38.3}{37.8} \times 100 = 101.3\ \%$$

$$37.8\ ft/sec \times 60 \times \frac{528}{621} \times \frac{30.30}{29.92} \times (1-.306) \times 12.32\ ft^2 = 16,700\ DSCFM$$

CO_2 6.2
O_2 14.8
N_2 79.0
H_2O 30.6
26.0

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

RADIAN CORPORATION

PRELIMINARY CALCULATION DATA SUMMARY SHEET

Name Sloan Construction Co.

Location

Plant Name

Date of Testing 5/11/84

Run No. PAH

Sampling Location Venturi Outlet

Total Test Time (min.) 97 1026-1030 1108-1117 1137-1213 1226-1314

Sample Gas Volume (SCFD) 27.77

Percent Moisture 31.0

"Dry" Molecular Weight 29.7

Gas Flow (DSCFM) 17,600

Percent Isokinetic 109.7

Average Visible Emission

$$V_{std} = 30.29 \times \frac{528}{554} \times \frac{30.30}{29.92} \times 0.95 = 27.77$$

$$\% H_2O = \frac{264.3 \times .0472 \times 100}{27.77 + (264.3 \times .0472)} = 31.0$$

$$Avg\ V_s = 85.48(.84)\frac{15.6935}{\sqrt{26.1 \times 30.31}} = 40.1$$

$$V_{Nozzle} = \frac{27.77}{97(60)}\left(\frac{1}{.0001827}\right)\left(\frac{622}{528}\right)\left(\frac{29.92}{30.31}\right)\left(\frac{1}{1-.31}\right) = 44.0$$

$$\% ISO = \frac{44.0}{40.1} \times 100 = 109.7$$

$$40.1\ ft/sec \times 60 \times \frac{528}{622} \times \frac{30.31}{29.92} \times (1-.31) \times 12.32\ ft^2 = 17,600\ DSCFM$$

CO_2 7.5
O_2 12.5
N_2 80
H_2O 31.0
26.1

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Figure 5-1. Example of Radian Preliminary Calculation Data Summary Form for Sloan Plant Testing

APPENDIX D

SAMPLING LOGS

INCLUDES

D.1 Daily Sampling Logs
D.2 Chain of Custody Logs
D.3 Sample Identification Log

APPENDIX D.1

DAILY SAMPLING LOGS

DAILY SUMMARY LOG - MAY 8, 1984

Clock Time	Inlet	Outlet	Inlet Particle Size Distribution	Visible Emissions Observations
1424	Started TOC Run 1			
1425				Observations Started
1426		Started TOC Run 1		
1430				
1440	Finished Port 1			
1445				
1500				
1515				
1520	Plant Down	Plant Down		
1521				Observations Stopped
1530				
1545				
1552	Started Port 2			
1555				Observations Continued
1558		Resumed Testing Port 1		
1600				
1604		Finished Port 1		
1608	Finished TOC Run 1	Changed Filters In Between		
1616		Port 1 and Port 2		Observations Stopped
1630				
1640		Started Port 2		Observations Continued
1700				
1715				
1730				
1739		Finished TOC Run 1[a]		
1746				Observations Stopped

[a]Outlet TOC Run 1 stopped 1 minute early because of high pressure drop across sampling system.

DAILY SUMMARY LOG - MAY 10, 1984

Clock Time	Inlet	Outlet	Inlet Particle Size Distribution	Visible Emissions Observations
0800				Observations Started
0812				Observations Stopped
0815	Started TOC Run 2			
0817		Started TOC Run 2		
0818				Observations Continued
0831	Finished Port 1			
0832		Plant Down		
0836				Observations Stopped
0845				
0900				
0911		Resumed Run 2		
0912	Started Port 2			
0914				Observations Continued
0928	Finished TOC Run 2			
0932		Finished Port 1		
0945		Started Port 2		
1000				
1015				
1021		Finished TOC Run 2		Observations Stopped
1027				
1030				
1100				
1130				
1137		Started TOC Run 3		
1139				Observations Continued
1140	Started TOC Run 3			
1155				
1156	Finished Port 1			
1200				
1213		Finished Port 1		
1215				Observations Stopped
1323				Observations Continued
1325	Started Port 2			
1328		Started Port 2		
1330				
1341	Finished TOC Run 3			
1400				
1404		Finished TOC Run 3		
1410				Observations Stopped
1411			Started PSD Run 1	
1415				
1430				
1443			Plant Down	
1452			Resumed PSD Run 1	
1500				
1530				
1537		Started TOC Run 4		
1540				Observations Continued
1545			Finished PSD Run 1	
1600				
1613		Finished Port 1		
1614	Started TOC Run 4			Observations Stopped
1621		Started Port 2		
1623				Observations Continued
1630	Finished Port 1			
1640	Started Port 2			
1656	Finished TOC Run 4			
1657		Finished TOC Run 4		
1658				Observations Stopped

DAILY SAMPLING LOG - MAY 11, 1984

Clock Time	Inlet	Outlet	Inlet Particle Size Distribution	Visible Emissions Observations
0900				
0915			Started PSD Run 2V[a]	
0930			↓	
0945				
1000				
1015				
1026		Started PAH Run 1		
1045		↓	Finished PSD Run 2V[a]	
1100				
1108	Started PAH Run 1			
1117	↓	Stopped PAH Run 1[b]		
1130				
1134	Finished Port 1			
1137		Resumed PAH Run 1		
1140		↓		
1143	Started Port 2			
1200	↓			
1207	Finished PAH Run 1			
1213		Finished Port 1		
1215				
1226		Started Port 2		
1230		↓	Started PSD Run 2	
1245			↓	
1300				
1314		Finished PAH Run 1		
1330				
1345				
1400			Finished PSD Run 2	

[a]Run void due to system leak

[b]Run stopped due to high sampling system pressure drop

APPENDIX D.2

CHAIN OF CUSTODY LOGS

CHAIN OF CUSTODY REPORT

Name Eric P. Anderson Company Radian Corp

Position Scientist Department Physical Chemistry

Samples Rec'd from Barry Chapman Contract No. 227-078-05-64

Date Samples Rec'd 5-11-84

Samples Handled (list)

SCC-03	SCC-26	SCC-38	SCC-50	SCC-81
SCC-04	SCC-27	SCC-39	SCC-51	SCC-84
SCC-07	SCC-30	SCC-42	SCC-62	SCC-97
SCC-08	SCC-31	SCC-43	SCC-66	SCC-72
SCC-21	SCC-34	SCC-46	SCC-70	
SCC-22	SCC-35	SCC-47	SCC-73	

Analyses Performed	Date	Recorded (Lab Book No.)
TOC	5-30-84 thru 6-[illegible]-84	RAS Laboratory

Samples Delivered to Donnie Heinich (RAS)

Date Delivered 5-30-84

COMMENTS (note any contamination, etc.)

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed Eric P. Anderson Date 5/30/84

Witness Barry Chapman

CORPORATION

CHAIN OF CUSTODY REPORT

Name: ERIC P ANDERSON Company: Radian Corp

Position: Scientist Department: Physical Chemistry

Samples Rec'd from: BARRY CHAPMAN Contract No. 222-018-03-64

Date Samples Rec'd: 5-11-84

Samples Handled (list) (FILTERS)

SCC-06	SCC-33	
SCC-02	SCC-37	
SCC-20	SCC-41	
SCC-24	SCC-45	
SCC-25	SCC-49	
SCC-29		

Analyses Performed	Date	Recorded (Lab Book No.)
Filters weighed to	5-16-84 thru 5-18-84	881
Constant Weight		

Samples Delivered to: - Sample Analysis Complete -

Date Delivered:

COMMENTS (note any contamination, etc.)

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed: [signature] Date: 5/18/84

Witness: [signature]

CORPORATION

CHAIN OF CUSTODY REPORT

Name Eric R. Anderson Company Radian Corp.
Position Scientist Department Physical Chemistry
Samples Rec'd from Barry Chapman Contract No. 222-078-05 C4
Date Samples Rec'd 5-17-84

Samples Bundled (list) (Acetone Probe numbers)

SCC-01	SCC-36	
SCC-05	SCC-40	
SCC-19	SCC-44	
SCC-23	SCC-48	
SCC-28		
SCC-32		

Analyses Performed	Date	Recorded (Lab Book No.)
Acetone Evaporated	5-21-84 thru 5-24-84	881
Weighed to a constant	5-29-84 thru 6-01-84	881
weight		

Samples Delivered to - Sample Analysis Complete
Date Delivered

COMMENTS (note any contamination, etc.)

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed Eric R. Anderson Date 6/01/84
Witness Barry Chapman

CORPORATION

CHAIN OF CUSTODY REPORT

Name Eric P. Anderson Company Radian Corp

Position Scientist Department

Samples Rec'd from Mike Krall Contract No.

Date Samples Rec'd 5-11-87

Samples Bundled (list)

SCC-77		
SCC-79		
SCC-80		
SCC-88		
SCC-96		
SCC-104		

Analyses Performed	Date	Recorded (Lab Book No.)
Flash Point		

Samples Delivered to

Date Delivered

COMMENTS (note any contamination, etc.)

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed Eric P. Anderson Date

Witness Bonny Chapman

CHAIN OF CUSTODY REPORT

Name Eric Anderson Company Radian Corp

Position Scientist Department Physical Chemistry

Samples Rec'd from Mike Krall Contract No. 227-C18-03-04

Date Samples Rec'd 5-11-84

Samples Handled (list)

SCC-95

SCC-96

SCC-105

SCC-104

Analyses Performed	Date	Recorded (Lab Book No.)
Percent Moisture Analysis	5-18-84 thru	881
	5-22-84	

Samples Delivered to Analysis Complete 5/22/84

Date Delivered

COMMENTS (note any contamination, etc.)

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed [signature] Date 5/22/84

Witness [signature]

CORPORATION

CHAIN OF CUSTODY REPORT

Name Eric R Anderson Company Roland Co.

Position Scientist Department Analytical Chemistry

Samples Rec'd from Mike Krall Contract No. 222-015-05-04

Date Samples Rec'd 5-11-84

Samples Handled (list)

SCC-97

SCC-100

Analyses Performed	Date	Recorded (Lab Book No.)
Total Dissolved Solids Analysis	5-15-84 thru 5-22-84	881

Samples Delivered to Sample Analysis Complete

Date Delivered

COMMENTS (note any contamination, etc.)

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed Eric R. Anderson Date 5/22/84

Witness Barry Chapman

CORPORATION

CHAIN OF CUSTODY REPORT

Name: Barry Chapman Company: Radian Corp

Position: Technician Department: Organic Chemistry

Samples Rec'd from: Eric Anderson Contract No.: 222-078-03-04

Date Samples Rec'd: _____

Samples Handled (List)

SCC-09	SCC-15	SCC-52	SCC-58
SCC-10	SCC-16	SCC-53	SCC-59
SCC-11	SCC-17	SCC-54	SCC-60
SCC-12	SCC-18	SCC-55	SCC-61
SCC-13		SCC-56	
SCC-14		SCC-57	

Analyses Performed	Date	Recorded (Lab Book No.)
PAH Extraction	5/22/84	

Samples Delivered to: _____

Date Delivered: _____

COMMENTS (note any contamination, etc.): _____

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed: Barry Chapman Date: 5/24/84

Witness: Eric R. Anderson

CORPORATION

CHAIN OF CUSTODY REPORT

Name: Barry Chapman Company: Radian Corp.
Position: Technician Department: Organic Chemistry
Samples Rec'd from: Eric P. Anderson Contract No. 222-038-03-64
Date Samples Rec'd: _____

Samples Handled (list)

SCC-97
SCC-100
SCC-101

Analyses Performed	Date	Recorded (Lab Book No.)
Extraction (PAH)	5/22/84	
GC/MS		

Samples Delivered to: Larry Garrison
Date Delivered: 5/25/84

COMMENTS (note any contamination, etc.): _____

This is to verify that the samples designated above were handled by me, that any anomalies were noted and recorded either in a laboratory notebook or on this sheet, and that the analyses were performed on the designated samples.

Signed: Barry Chapman Date: _____
Witness: Eric P. Anderson

APPENDIX D.3

SAMPLE IDENTIFICATION LOG

RAD-Code	Run #	Sample ID	Remarks
	In-Blank	TOC-0507-1400-1430	
SCC-05			Acetone Probe Rinse
SCC-06			Filter #002
SCC-07			1st Imp. Rinse
SCC-08			2nd & 3rd Imp. Rinse
	Out-Blank	TOC-0507-1300-1330	
SCC-01			Acetone Probe Rinse
SCC-02			Filter #001
SCC-03			1st & 2nd Imp. Rinse
SCC-04			3rd & 4th Imp. Rinse
	In-Blank	PAH-0508	
SCC-09			$MeCl_2$ Probe Rinse
SCC-10			Filter #026
SCC-11			XAD-2 Resin
SCC-12			1st Imp. Rinse
SCC-13			2nd Imp. Rinse
	Out-Blank	PAH-0508	
SCC-14			$MeCl_2$ Probe Rinse
SCC-15			Filter #027
SCC-16			XAD-2 Resin
SCC-17			1st Imp. Rinse
SCC-18			2nd Imp. Rinse
	In-01	TOC-0508	
SCC-19			Acetone Probe Rinse
SCC-20			Filter #004
SCC-21			1st Imp. Rinse
SCC-22			2nd Imp. Rinse

(continued)

RADIAN CORPORATION

RAD-Code	Run #	Sample ID	Remarks
	Out-01	TOC-0508	
SCC-23			Acetone Probe Rinse
SCC-24			Filter #003
SCC-25			Filter #005
SCC-26			1st & 2nd Imp. Rinse
SCC-27			3rd & 4th Imp. Rinse
	In-02	TOC-0510	
SCC-28			Acetone Probe Rinse
SCC-29			Filter #006
SCC-30			1st Imp. Rinse
SCC-31			2nd & 3rd Imp. Rinse
	Out-02	TOC-0510	
SCC-32			Acetone Probe Rinse
SCC-33			Filter #007
SCC-34			1st & 2nd Imp. Rinse
SCC-35			3rd & 4th Imp. Rinse
	In-03	TOC-0510	
SCC-36			Acetone Probe Rinse
SCC-37			Filter #008
SCC-38			1st Imp. Rinse
SCC-39			2nd & 3rd Imp. Rinse
	Out-03	TOC-0510	
SCC-40			Acetone Probe Rinse
SCC-41			Filter #009
SCC-42			1st & 2nd Imp. Rinse
SCC-43			3rd & 4th Imp. Rinse
	In-04	TOC-0510	
SCC-44			Acetone Probe Rinse
SCC-45			Filter #010
SCC-46			1st Imp. Rinse
SCC-47			2nd & 3rd Imp. Rinse

(continued)

RAD-Code	Run #	Sample ID	Remarks
	Out-04	TOC-0510	
SCC-48			Acetone Probe Rinse
SCC-49			Filter #011
SCC-50			1st & 2nd Imp. Rinse
SCC-51			3rd & 4th Imp. Rinse
	In-01	PAH-0511	
SCC-52			$MeCl_2$ Probe Rinse
SCC-53			Filter #029
SCC-54			XAD-2 Resin
SCC-55			1st Imp. Rinse
SCC-56			2nd Imp. Rinse
	Out-01	PAH-0511	
SCC-57			$MeCl_2$ Probe Rinse
SCC-58			Filter #028
SCC-59			XAD-2 Resin
SCC-60			1st Imp. Rinse
SCC-61			2nd Imp. Rinse
SCC-62	In-01	TOC-1-0508	Scrubber H_2O Filtrate
SCC-63			Scrubber Solids
SCC-64			TDS Solids
SCC-65			TDS Solids Duplicate
SCC-66	Out-01	TOC-1-0508	Scrubber H_2O Filtrate
SCC-67			Scrubber Solids
SCC-68			TDS Solids
SCC-69			TDS Solids Duplicate

(continued)

RADIAN CORPORATION

RAD-Code	Run #	Sample ID	Remarks
SCC-70	In-02	TOC-2-0510	Scrubber H_2O Filtrate
SCC-71			Scrubber Solids
SCC-72			TDS Solids
SCC-73	Out-02	TOC-2-0510	Scrubber H_2O Filtrate
SCC-74			Scrubber Solids
SCC-75			TDS Solids
SCC-76	1	TOC-1-0508	Virgin Agg. Solids
SCC-77	1		Recycle (RAP) Solids
SCC-78	2	TOC-2-0510	Virgin Agg. Solids
SCC-79	2		Recycle (RAP) Solids
SCC-80			Asphalt Cement
SCC-81	In-03	TOC-3-0510	Scrubber H_2O Filtrate
SCC-82			Scrubber Solids
SCC-83			TDS Solids
SCC-84	Out-03	TOC-3-0510	Scrubber H_2O Filtrate
SCC-85			Scrubber Solids
SCC-86			TDS Solids
SCC-87	3		Virgin Agg. Solids
SCC-88	3		Recycle (RAP) Solids
SCC-89	In-04	TOC-4-0510	Scrubber H_2O Filtrate
SCC-90			Scrubber Solids
SCC-91			TDS Solids
SCC-92	Out-04	TOC-4-0510	Scrubber H_2O Filtrate
SCC-93			Scrubber Solids
SCC-94			TDS Solids
SCC-95	4		Virgin Agg. Solids
SCC-96	4		Recycle (RAP) Solids

(continued)

RAD-Code	Run #	Sample ID	Remarks
SCC-97	In-01	PAH-1-0511	Scrubber H_2O Filtrate
SCC-98			Scrubber Solids
SCC-99			TDS Solids
SCC-100	Out-01	PAH-1-0511	Scrubber H_2O Filtrate
SCC-101			Scrubber Solids
SCC-102			TDS Solids
SCC-103	PAH		Virgin Agg. Solids
SCC-104	PAH		Recycle (RAP) Solids
SCC-105	PSD-01	PSD-01	1st Stage Solids
SCC-106			2nd Stage Solids
SCC-107			Cyclone Solids
SCC-108			Filter #020
SCC-109			1st Stage Wash
SCC-110			2nd Stage Wash
SCC-111			Cyclone Wash
SCC-112	PSD-02	PSD-02	1st Stage Solids
SCC-113			2nd Stage Solids
SCC-114			Cyclone Solids
SCC-115			Filter #022
SCC-116			1st Stage Wash
SCC-117			2nd Stage Wash
SCC-118			Cyclone Wash
SCC-119	In-	PAH-in-05-10	SCC-55+SCC-54 Combined
SCC-120	Out	PAH-out-05-10	SCC-60+SCC-59 Combined

APPENDIX E

SOURCE SAMPLING ANALYTICAL RESULTS

INCLUDES

E.1 Particulate Mass (EPA Method 5E) Results
- E.1.1 Sample Fraction Results
- E.1.2 Laboratory Notebook Data

E.2 Total Organic Carbon (Air Emissions Only) Results
- E.2.1 Sample Fraction Results
- E.2.2 Laboratory Data Computer Printouts

E.3 Particle Size Distribution
- E.3.1 Sample Fraction Results
- E.3.2 Particle Size Distribution Laboratory Notebook Weighing Data

E.4 Analytical Sample Matrices

APPENDIX E.1

PARTICULATE MASS (EPA METHOD 5E) RESULTS

INCLUDES

E.1.1 Sample Fraction Results

TABLE E.1 PARTICULATE LOADING RESULTS (FRONT-HALF ONLY)

Date	Sampling Times	Run Description	Filter Wt Gain (g)	Acetone Wash Residue (g)	Blank Corr[a,b] Acetone Residue (g)	Total Particulate Catch	Acetone Wash Volume (ml)	DSCF Sampled	gr/DSCF	mg/DSCM
				Uncontrolled Emissions						
5-08-84	1424-1608	TOC-1	0.4969	7.9798	7.9727	8.4696	744	16.149	8.09	18,500
5-10-84	0815-0928	TOC-2	0.4485	5.1953	5.1882	5.6367	663	15.706	5.54	12,700
5-10-84	1140-1341	TOC-3	0.6092	5.3837	5.3767	5.9859	578	15.017	6.15	14,100
5-10-84	1614-1656	TOC-4	0.7340	4.1875	4.1805	4.9145	578	14.355	5.28	12,100
				Controlled Emissions						
5-08-84	1426-1739	TOC-1	0.2730	0.1493	0.1424	0.4162	495	55.692	0.115	264
5-10-84	0817-1021	TOC-2	0.2675	0.0956	0.0888	0.3563	436	42.197	0.130	298
5-10-84	1137-1404	TOC-3	0.2841	0.1155	0.1087	0.3928	356	42.484	0.143	326
5-10-84	1537-1657	TOC-4	0.1430	0.1533	0.1464	0.2984	513	39.617	0.113	258
5-08-84		Inlet Probe Blank		0.0058	0.0055		338			
5-08-84		Outlet Probe Blank		0.0077	0.0073		431			
5-08-84		Solvent Blank 1		0.0007			200			
5-08-84		Solvent Blank 2		-0.0005			200			

a Blank Calculation

Corrected wash weight = residue wt. gain (g) -[(Vol of wash, ml).(solvent blank, g/ml)+(probe blank residue, g)]

b The average of the two probe and solvent blanks was used to determine the blank correction.

APPENDIX E.1

PARTICULATE MASS (EPA METHOD 5E) RESULTS

INCLUDES

E.1.2 Laboratory Notebook Data

TITLE Filter Weighing

Project No.

Book No.

From Page No.

The following filters were baked at 325°F for 3 hours, dessicated for 16 hours, ~~and~~ weighed, apart, into labled petri dishes using a model AE 163 mettler analytical balance

Filter Number	tare wt	1st Final wt	2nd wt	3rd wt	4th wt	Final wt Gain	
001	.5073	.5077	.5074			+.0009	
002	.5101	.5108	.5106			.0006	
003	.5211	.6558	.6556			.1346	
004	.5275	1.0244	1.0242			.4969	-.2738
005	.5268	.6660	.6656			.1392	
006	.5263	.9749	.9747			.4485	
007	.4998	.7671	.7675			.2675	
008	.5048	1.1141	1.1138			.6092	
009	.5115	.7955	.7957			.2841	
010	.5055	1.2397	1.2392			.7340	
011	.5067	.6508	.6495	.6498		.1430	
012	.5118						
013	.5112						
014	.5124						
015	.5118						
016	.5126						
017	.5058						
018	.5128						
019	.5116						
			Thimbles				
020	2.0558	2.3272	2.3232	2.3236			
021	2.1697						
022	1.9533	2.3039	2.3045	2.3036	2.3039	.3505	
023	2.6176						
024	2.1061						
025	2.1498						

To Page No.

Witnessed & Understood by me, Date

Invented by Date

Recorded by

Project No._____

TITLE Acetone Evaporations Book No._____ 3

From Page No.__

The beakers were washed dried @ 105°C for 3 hrs dessicated 16 hrs and weighed on a Mettler AE 163 analytical balance. Following Evaporation the beakers were dessicated hrs and weighed to a constant weight ±0.5 mg or 1% of the particulate mass.

Sample #	Beaker #	Beaker tare wt	Final wt #1	Final wt #2	Final 3rd	Final 4th	wt gain	Bottle tare wt	Bottle wt (sample)	Sample Vol	Rinse
01 *	1	105.3310	105.3367	105.3370	105.3368	—	.0058	283.2	549.0	338	0
05 *	2	106.0259	106.0316	106.0318	106.0319	106.0317	.0077	279.4	618.4	431	0
19A	3	111.5612	119.5411	119.5109	—	—	7.9798	282.0 282.9	614.1 603.4	463 281	744
19B											
23	4	105.3290	105.4700	105.4687	105.4681	105.4680	.1493	281.3	670.6	475	0
28A								280.6	650.4		
28B	5	107.2994	112.4986	112.4959	112.4948	112.4946	5.1953	278.3	390.1	663	150
32	6	109.9916	110.0966	110.0872	110.0872	—	.0956	277.3	580.5	436	150
36	7	103.8813	109.2654	109.2650	109.2647	109.2650	5.3837	281.9	677.2	578	175
40	8	108.3992	108.5142	108.5147	108.5147	—	.1155	276.4	556.0	356	0
44	9	107.0789	111.2694	111.2675	111.2668	111.2666	4.1875	277.6	672.8	578	175
48	10	107.6926	107.8458	107.8486	107.8459	107.8460	.1533	279.1	662.7	513	125
109	11	107.0361	107.2483	107.2487	107.2482	—	.2122	38.68	102.42	156	175
110	12	105.0346	105.1068	105.1068	105.1062	105.1069	.0722	39.04	86.18	110	150
111	13	115.6829	116.0200	116.0199	116.0199	—	.3375	36.06	93.37	133	60
116	14	106.3615	106.8802	106.8811	106.8805	106.8808	.5192	38.82	103.97	158	75
117	15	108.2043	108.2597	108.2612	108.2608	108.2606	.0562	38.46	90.12	116	50
118	16	103.0412	103.7395	103.7392	103.7392	—	.6950	38.81	136.29	174	150
Solvent Blank	17	106.9777	106.9770	106.9775	106.9770	—	-.0005	—	—	200	0
Solvent Blank	18	106.7714	106.7715	106.7723	106.7719	—	.0007	—	—	200	0

To Page No.____

Witnessed & Understood by me.
* Probe rinse blanks had water in them due to condensation during bagging

Date

Invented by

Date

Recorded by

APPENDIX E.2

TOTAL ORGANIC CARBON (AIR EMISSIONS ONLY) RESULTS

INCLUDES

E.2.1 Sample Fraction Results

TABLE E.2.1 SUMMARY OF SLOAN CONSTRUCTION COMPANY TOTAL ORGANIC CARBON (AS CARBON) EMISSION RESULTS

			NaOH Impinger 1 Results			NaOH Impinger 2 Results				
Date	Run I.D.	Dry Gas Volume (dscf)	TOC mg/L as C	Sample Volume (ml)	Total Imp TOC[a] (mg)	TOC mg/L as C	Sample Volume (ml)	Total Imp TOC[a] (mg)	Total TOC[b] (mg)	TOC (gr/DSCF)
					UNCONTROLLED EMISSIONS					
0508	TOC-1	16.1	707	499	352	33	425	13	365	0.35
0510	TOC-2	15.7	79	491	38	36	419	14	52	0.051
0510	TOC-3	15.0	73	434	31	56	419	22	53	0.054
0510	TOC-4	14.4	78	468	36	28	474	12	48	0.051
----	Blank	----	1	347	--	3	439	--	--	-----
					CONTROLLED EMISSIONS					
0508	TOC-1	55.7	84	843	70	38	367	13	83	0.023
0510	TOC-2	42.2	83	714	59	24	491	10	69	0.025
0510	TOC-3	42.5	66	863	56	25	502	11	67	0.024
0510	TOC-4	39.6	54	813	43	17	499	7.0	50	0.019
----	Blank	----	1	474	--	3	487	--	--	-----

[a]Values Corrected for Blank

[b]Total of NaOH Impinger 1 and 2 TOC Sample Results

TABLE E.2.2 SUMMARY OF SLOAN CONSTRUCTION COMPANY TOTAL ORGANIC CARBON (TOC) EMISSION RESULTS USING TWO ANALYTICAL PROCEDURES

Date	Run ID	Dry Gas Volume (dscf)	Original Method 2 Analysis[a]		Method 2-Reanalysis[b]		Method 1-Reanalysis[c]	
			Total mg C	gr/dscf	Total mg C	gr/dscf	Total mg C	gr/dscf
			UNCONTROLLED EMISSIONS					
0508	Run 1	16.1	365	0.35	189	0.18	587	0.56
0510	Run 2	15.7	52	0.051	40	0.039	346	0.34
0510	Run 3	15.0	53	0.054	41	0.042	428	0.44
0510	Run 4	14.4	48	0.051	-[d]	-[d]	-[d]	-[d]
			CONTROLLED EMISSIONS					
0508	Run 1	55.7	83	0.023	67	0.019	409	0.11
0510	Run 2	42.2	69	0.025	53	0.019	834	0.30
0510	Run 3	42.5	67	0.024	49	0.018	403	0.15
0510	Run 4	39.6	50	0.019	38	0.015	580	0.23

[a]Results from Original Analysis Using the EPA Method 5E Protocol
[b]Results from Reanalysis Using the EPA Method 5E Protocol
[c]Results from Reanalysis Using the Acidification and Purge Method
[d]No Sample Left for Reanalysis

APPENDIX E.2

TOTAL ORGANIC CARBON (AIR EMISSIONS ONLY) RESULTS

INCLUDES

E.2.2 Laboratory Data Computer Printouts

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-05-102

RECEIVED: 05/17/84 05/29/84 14:55:07

REPORT TO: Radian Corporation
Austin
Bl. 3

ATTEN: Eric Anderson

CLIENT: EPA EMB SAMPLES: 9
COMPANY: EPA-EMB
FACILITY:

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY:

CONTACT: KAMAS

WORK ID: TOC audit samples
TAKEN:
TRANS: EA
TYPE:
P.O. #: 222-078-03-64
INVOICE: under separate cover

SAMPLE IDENTIFICATION

01 EPA-1
02 EPA-2
03 EPA-3
04 EPA-4
05 RAD-1
06 RAD-2
07 RAD-3
08 RAD-4
09 RAD-5 blank

Analytical Serv TEST CODES and NAMES used on this report

TOC Total Organic Carbon

RECEIVED: 05/17/84

RESULTS BY TEST

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)	Sample 05 (entered units)
TOC mg/L	9.3	53.7	3.58	51.8	38.7

TEST CODE default units	Sample 06 (entered units)	Sample 07 (entered units)	Sample 08 (entered units)	Sample 09 (entered units)
TOC mg/L	192	200	1000	<1

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-06-193

RECEIVED: 06/21/84 06/28/84 09:37:20

REPORT TO: Radian Corporation
Austin
Bl. 3

ATTEN: Eric Anderson

CLIENT: EPA EMB SAMPLES 14
COMPANY: EPA-EMB
FACILITY:

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY:

CONTACT: KAMAS

WORK ID: TOC
TAKEN:
TRANS: EA
TYPE:
P.O. #: 222-078-03-64
INVOICE: under separate cover

SAMPLE IDENTIFICATION

01 SCC-111
02 SCC-112
03 SCC-113
04 SCC-114
05 SCC-115
06 SCC-116
07 SCC-117
08 SCC-118
09 SCC-119
10 SCC-120
11 SCC-121
12 SCC-122
13 SCC-123
14 SCC-124

Analytical Serv TEST CODES and NAMES used on this report

TOC Total Organic Carbon

Analytical Serv REPORT LAB # 84-06-193
RECEIVED: 06/21/84
RESULTS BY TEST

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)	Sample 05 (entered units)
TOC mg/L	80	25	73	77	29

TEST CODE default units	Sample 06 (entered units)	Sample 07 (entered units)	Sample 08 (entered units)	Sample 09 (entered units)	Sample 10 (entered units)
TOC mg/L	75	80	38	62	21

TEST CODE default units	Sample 11 (entered units)	Sample 12 (entered units)	Sample 13 (entered units)	Sample 14 (entered units)
TOC mg/L	<1	1340	325	133

CORPORATION

PAGE 1 | Analytical Serv REPORT | LAB # 84-06-193

RECEIVED 06/21/84 | 07/11/84 10:11:45

REPORT TO: Radian Corporation
Austin
Bl 3

ATTEN: Eric Anderson

CLIENT: EPA EMB | SAMPLES 14
COMPANY: EPA EMB
FACILITY:

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY

CONTACT KAMAS

WORK ID: TOC
TAKEN:
TRANS: EA
TYPE:
P.O. #: 222-078-03-64
INV. #: 3611

SAMPLE IDENTIFICATION

01 SCC-111
02 SCC-112
03 SCC-113
04 SCC-114
05 SCC-115
06 SCC-116
07 SCC-117
08 SCC-118
09 SCC-119
10 SCC-120
11 SCC-121
12 SCC-122
13 SCC-123
14 SCC-124

Analytical Serv TEST CODES and NAMES used on this report

TOC Total Organic Carbon

Analytical Serv REPORT LAB # 84-06-193

RECEIVED: 06/21/84

RESULTS BY TEST

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)	Sample 05 (entered units)
TOC mg/L	77	31	63	64	25

TEST CODE default units	Sample 06 (entered units)	Sample 07 (entered units)	Sample 08 (entered units)	Sample 09 (entered units)	Sample 10 (entered units)
TOC mg/L	80	79	23	56	17

TEST CODE default units	Sample 11 (entered units)	Sample 12 (entered units)	Sample 13 (entered units)	Sample 14 (entered units)
TOC mg/L	5	1380	322	133

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-05-186

RECEIVED 05/30/84 07/11/84 10:08:27

REPORT TO: Radian Corporation
Austin
RI 3

ATTEN: Eric Anderson

CLIENT: EPA EMB SAMPLES 37
COMPANY: EPA-EMB
FACILITY:

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P O Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY

CONTACT: KAMAS

WORK ID: TOC
TAKEN:
TRANS TYPE: EA
P. O. #: 222-078-03-64
INV. #: 3451

E-20

SAMPLE IDENTIFICATION

01 SCC-03
02 SCC-04
03 SCC-07
04 SCC-08
05 SCC-21
06 SCC-22
07 SCC-25
08 SCC-26
09 SCC-27
10 SCC-30
11 SCC-31
12 SCC-33
13 SCC-34
14 SCC-35
15 SCC-38
16 SCC-39
17 SCC-42
18 SCC-43
19 SCC-46
20 SCC-47
21 SCC-49

Analytical Serv TEST CODES and NAMES used on this report

TIC Total Inorganic Carbon
TOC Total Organic Carbon

	SAMPLE IDENTIFICATION
22	SCC-50
23	SCC-51
24	SCC-62
25	SCC-66
26	SCC-70
27	SCC-73
28	SCC-74
29	SCC-81
30	SCC-84
31	SCC-89
32	SCC-90
33	SCC-92
34	SCC-99
35	SCC-100
36	SCC-101
37	SCC-102

CORPORATION

RECEIVED: 05/30/84

Analytical Serv REPORT LAB # 84-05-186

RESULTS BY TEST

TEST CODE default units	Sample 01 (entered units)	Sample 02 (entered units)	Sample 03 (entered units)	Sample 04 (entered units)	Sample 05 (entered units)
TIC mg/L	6	<1	<1	<1	5
TOC mg/L	<1	<1	<1	3	707

TEST CODE default units	Sample 06 (entered units)	Sample 07 (entered units)	Sample 08 (entered units)	Sample 09 (entered units)	Sample 10 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	33	77	91	38	79

TEST CODE default units	Sample 11 (entered units)	Sample 12 (entered units)	Sample 13 (entered units)	Sample 14 (entered units)	Sample 15 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	36	88	87	23	73

TEST CODE default units	Sample 16 (entered units)	Sample 17 (entered units)	Sample 18 (entered units)	Sample 19 (entered units)	Sample 20 (entered units)
TIC mg/L	<1	<1	<1	<1	<1

TOC mg/L	56	62	20	75	23

TEST CODE default units	Sample 21 (entered units)	Sample 22 (entered units)	Sample 23 (entered units)	Sample 24 (entered units)	Sample 25 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	50	47	13	1120	1110

TEST CODE default units	Sample 26 (entered units)	Sample 27 (entered units)	Sample 28 (entered units)	Sample 29 (entered units)	Sample 30 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	830	910	930	930	965

TEST CODE default units	Sample 31 (entered units)	Sample 32 (entered units)	Sample 33 (entered units)	Sample 34 (entered units)	Sample 35 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	976	1010	950	1000	153

CORPORATION

RECEIVED: 05/30/84

Analytical Serv REPORT LAB # 84-05-186

RESULTS BY TEST

TEST CODE default units	Sample 36 (entered units)	Sample 37 (entered units)
TIC mg/L	<1	<1
TOC mg/L	69	322

APPENDIX E.3

PARTICLE SIZE DISTRIBUTION

INCLUDES

E.3.1 Sample Fraction Results

TABLE E.3 PARTICLE SIZE DISTRIBUTION FRACTION RESULTS

Date	Time	Run #	Flow Rate (ACFM)	Stage	Mass[1] Collected	% in Size Range	Cumulative % Less Than Size Range	Size Range µm	DP_{50} µm
5-10-84	1411-1545	PSD-01	0.584	1	4.6491	83.7	16.2	>11.8	11.8
				2	0.1629	2.9	13.3	6.0-11.8	6.0
				cyclone	0.4727	8.5	4.8	1.7-6.0	1.7
				filter	0.2676	4.8	--	<1.7	--
5-11-84	1230-1400	PSD-02	0.549	1	5.6909	69.5	30.6	>12.1	12.1
				2	1.2100	14.8	15.8	6.4-12.1	6.4
				cyclone	0.9406	11.5	4.3	1.8-6.4	1.8
				filter	0.3505	4.3	--	<1.8	--

[1]Mass includes solids associated with acetone rinse.

APPENDIX E.3

PARTICLE SIZE DISTRIBUTION

INCLUDES

E.3.2 Particle Size Distribution Laboratory Notebook Weighing Data

Project No.
TITLE
Book No.

From Page No.

ANDERSEN DEPREP 1st RUN

1st STAGE	2nd STAGE	Cyclone
.3794	.3510	.2991
4.8163, 4.8163	.4417, .4416	.4345, .434
4.4369	0.0907	0.1352

RUN 2

1st STAGE	2nd STAGE	Cyclone
5.5565, .5546	1.4733, 1.4732	.5346, .5348
.3848	.3195	.7882
5.1717	1.1538	.2456

FILTER Weighing

	TARE	1st weight			
Run 1	2.0558	2.3272	2.3232	2.3236	
Run 2	2.9533	2.3039	2.3049	2.3036	2.3039

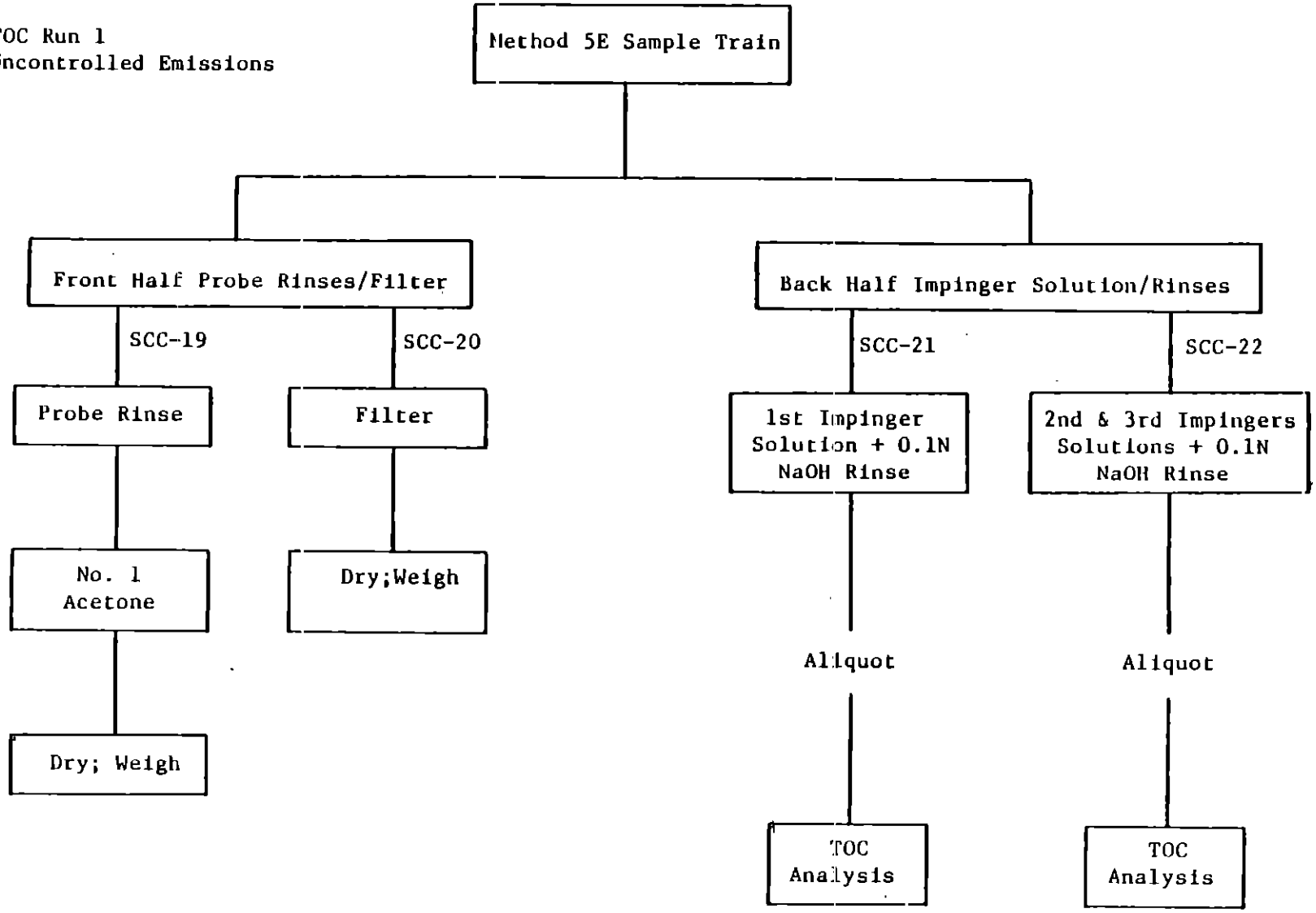
To Page No.

Witnessed & Understood by me,	Date	Invented by	Date
		Recorded by	

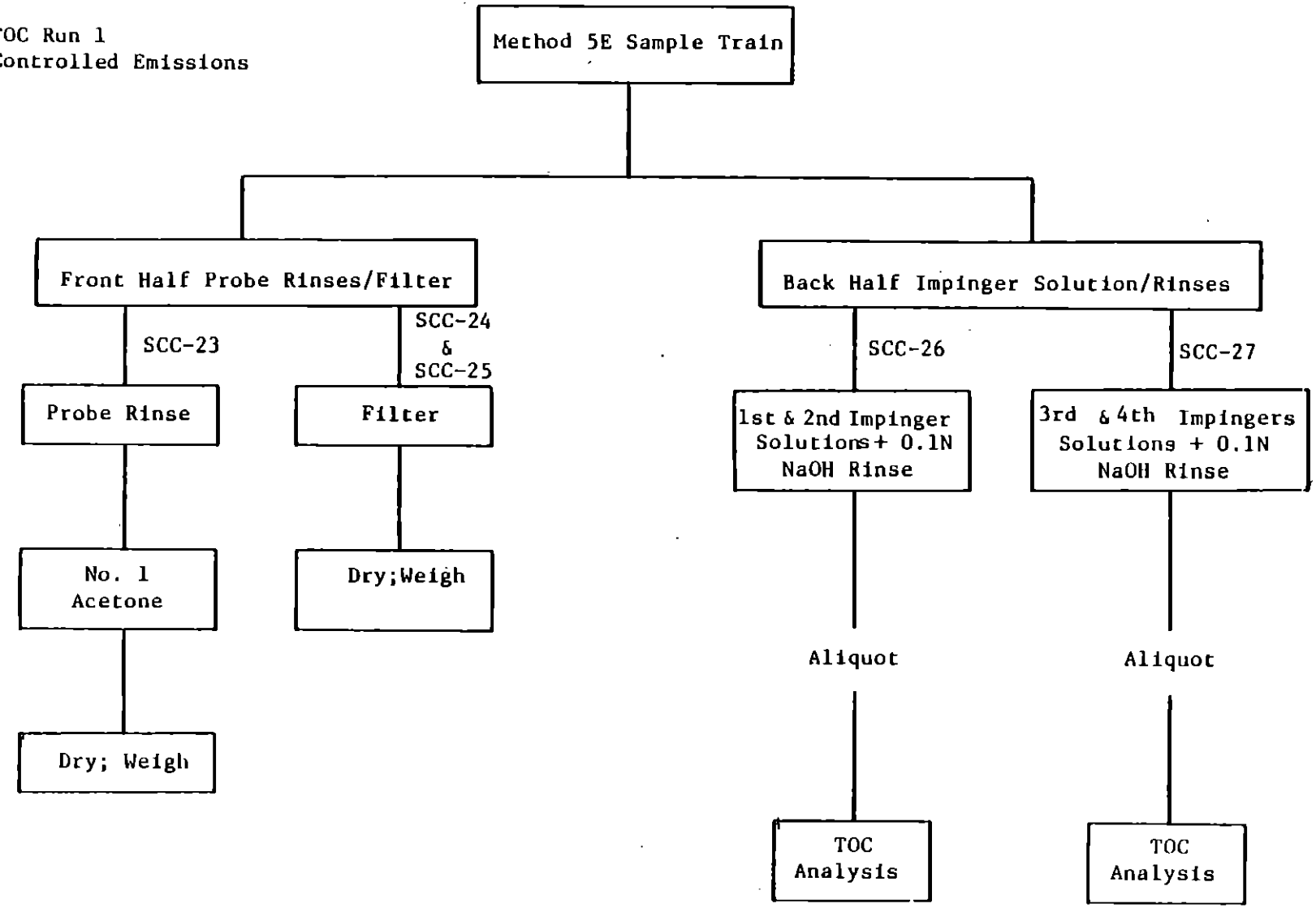
APPENDIX E.4

ANALYTICAL SAMPLE MATRICES

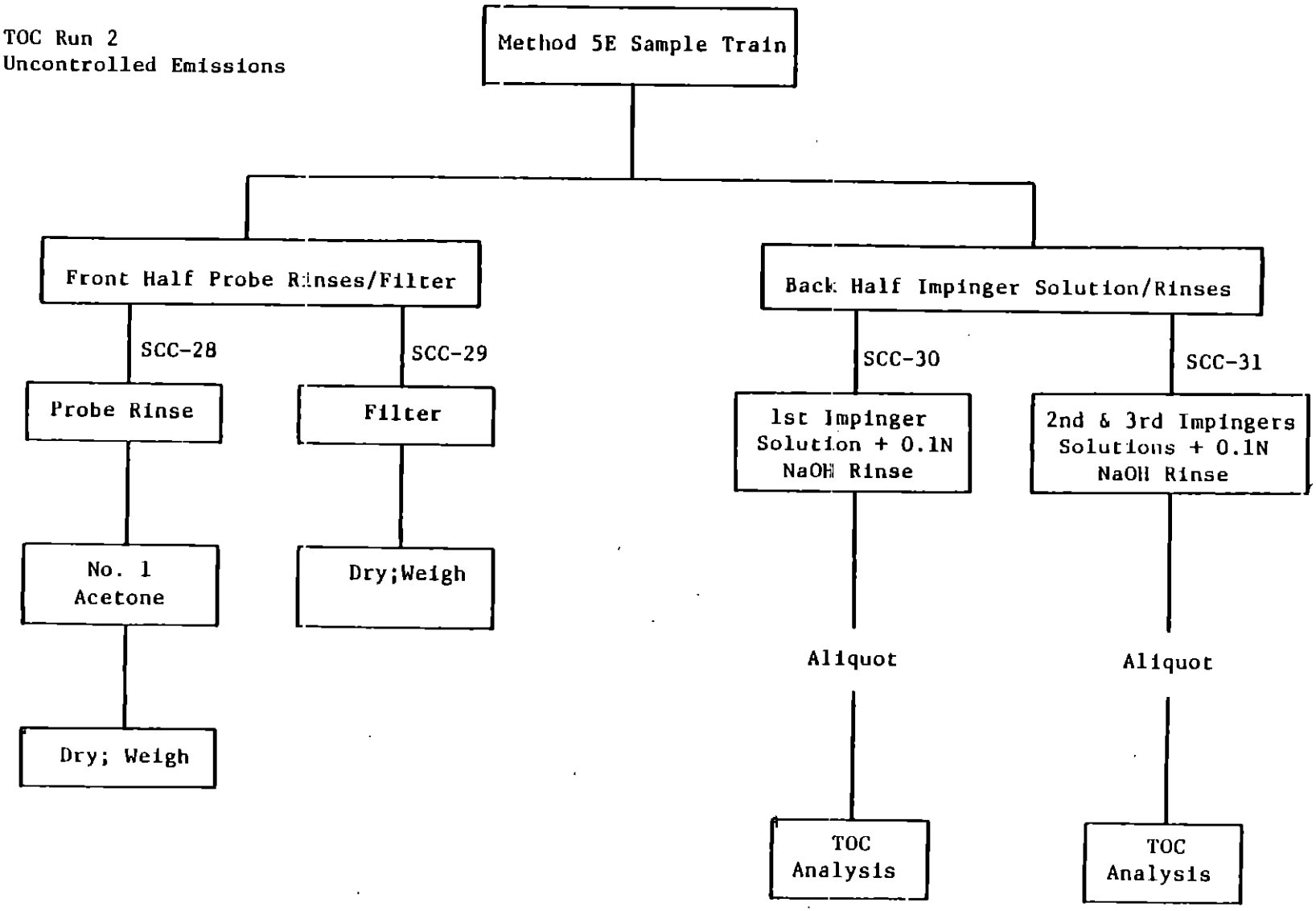
TOC Run 1
Uncontrolled Emissions



TOC Run 1
Controlled Emissions

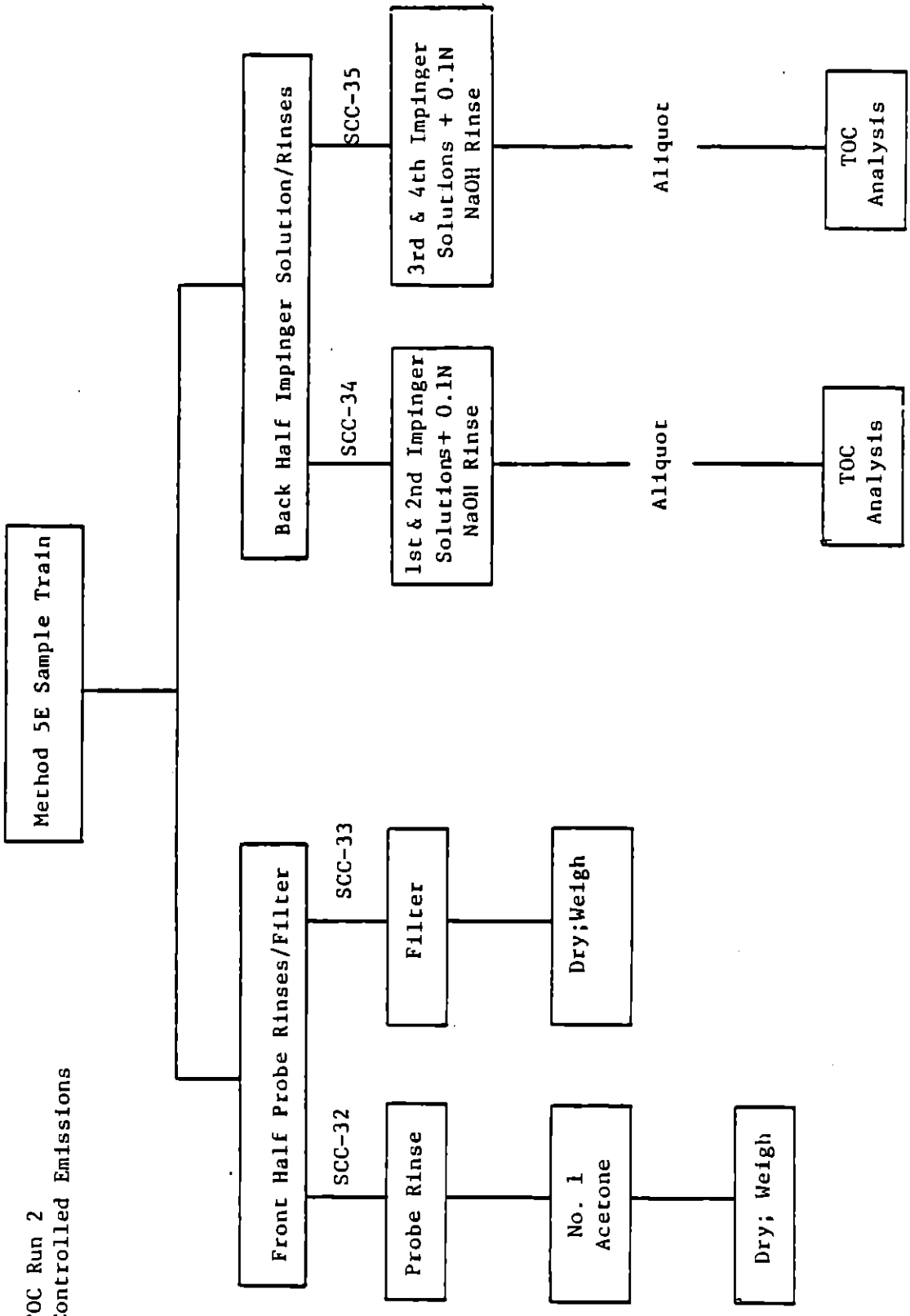


TOC Run 2
Uncontrolled Emissions

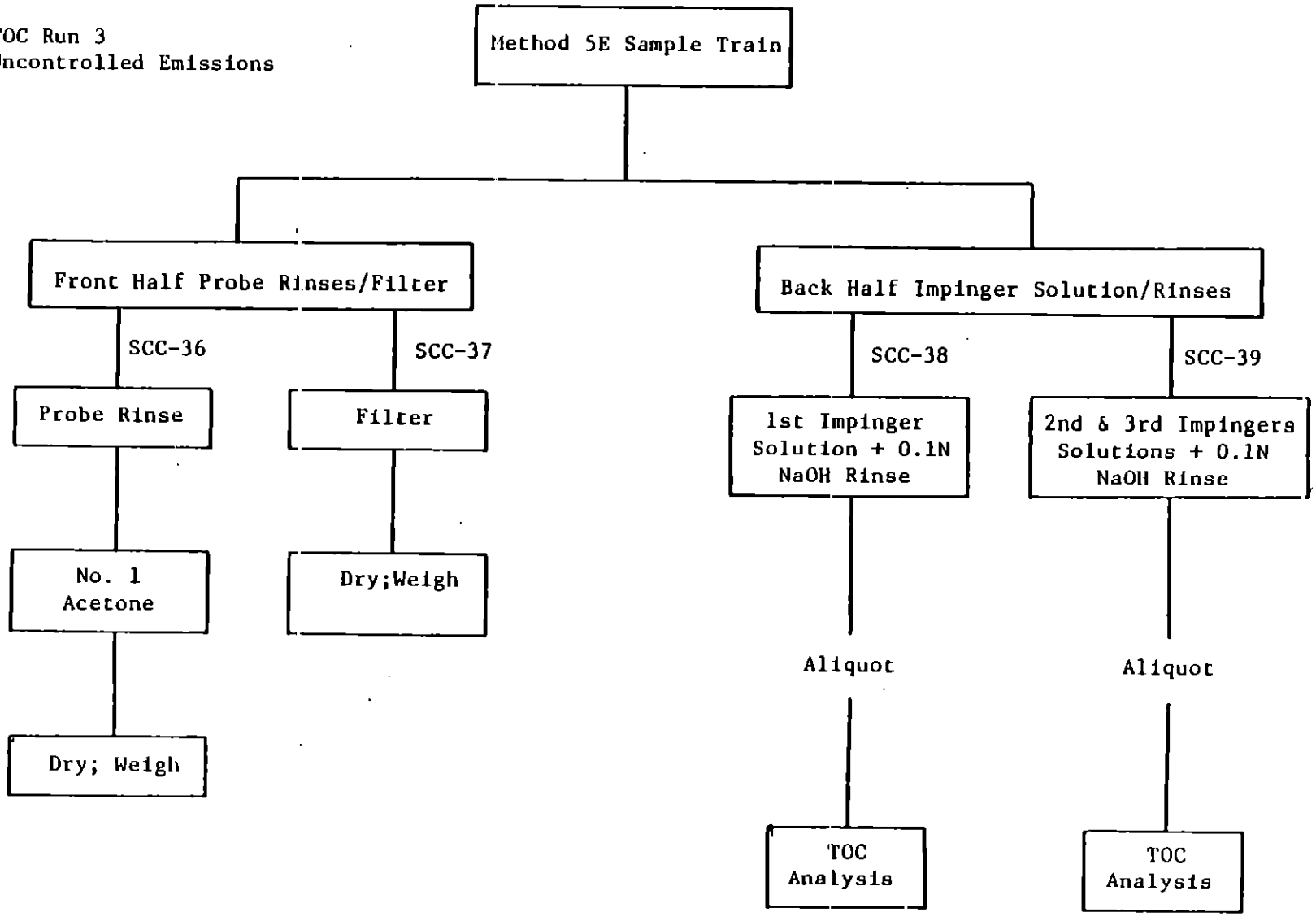


RADIAN CORPORATION

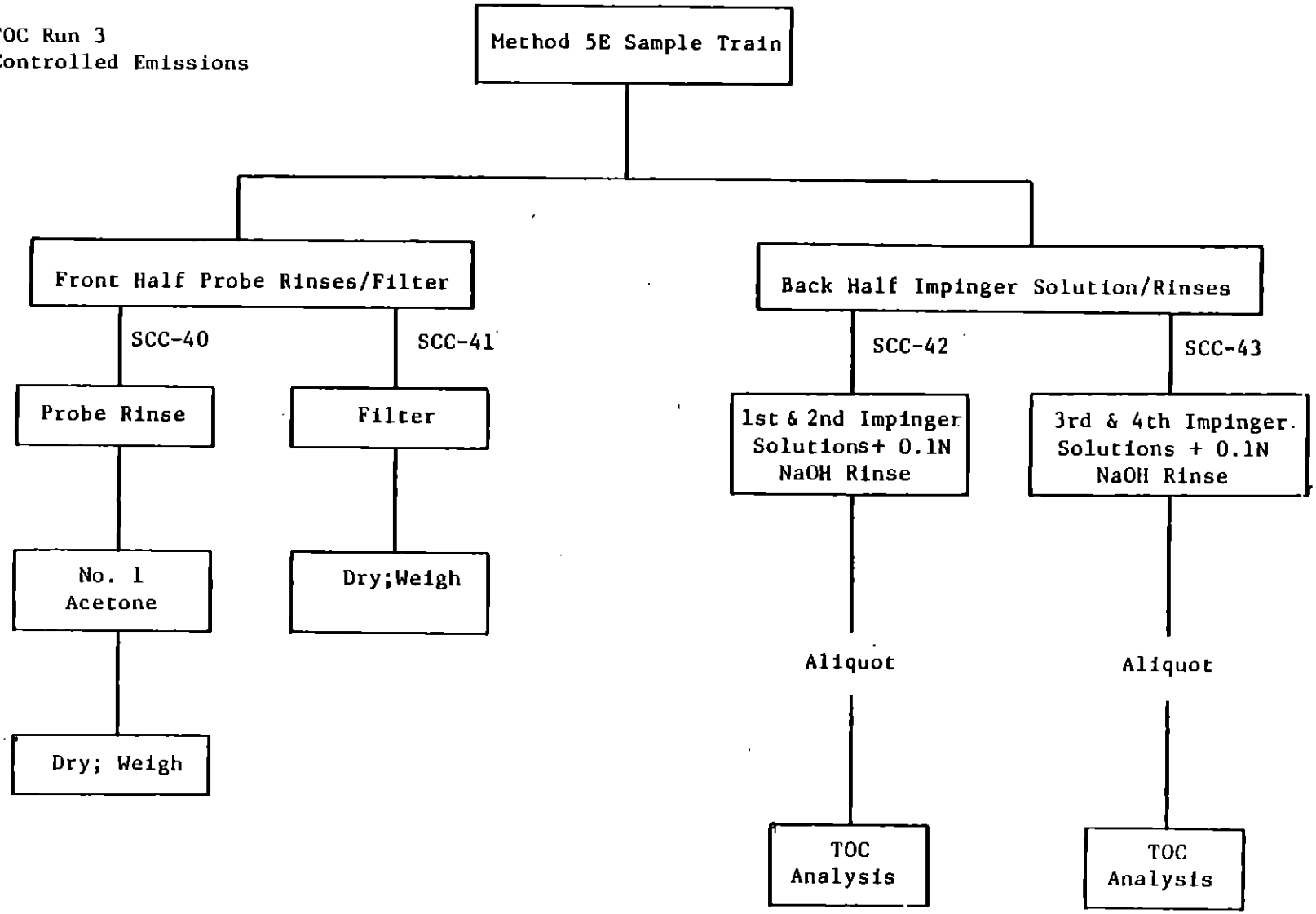
TOC Run 2
Controlled Emissions



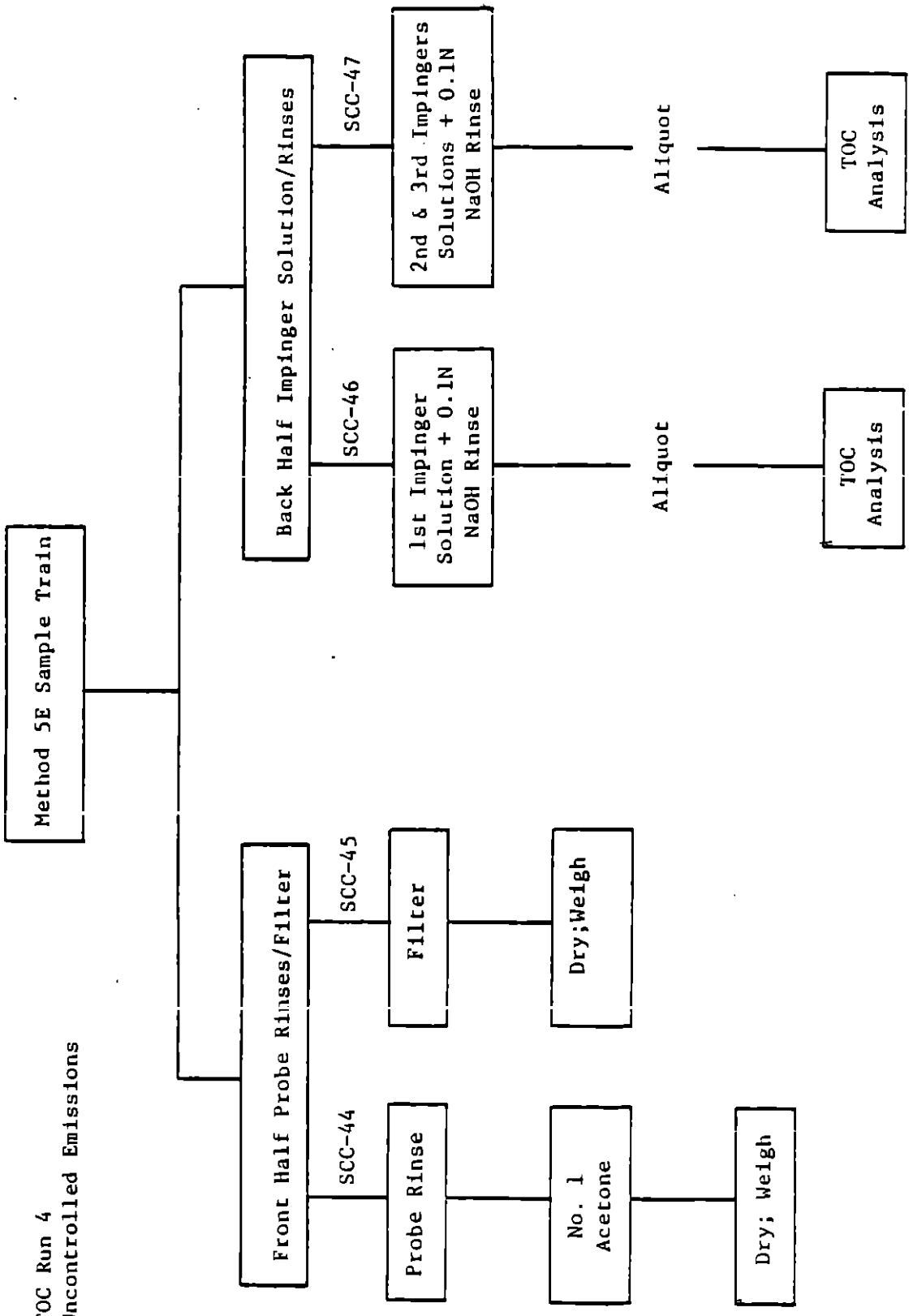
TOC Run 3
Uncontrolled Emissions



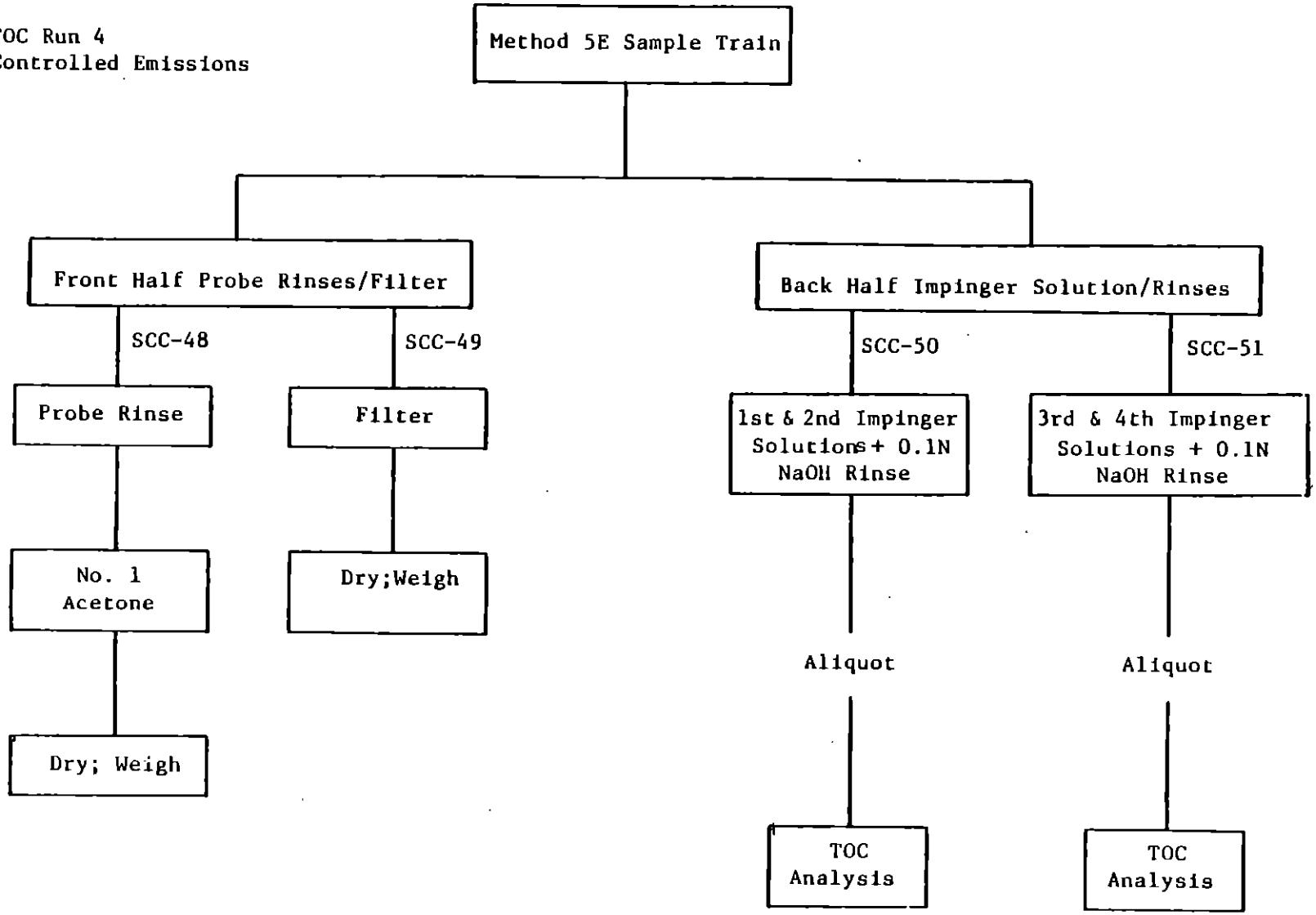
TOC Run 3
Controlled Emissions



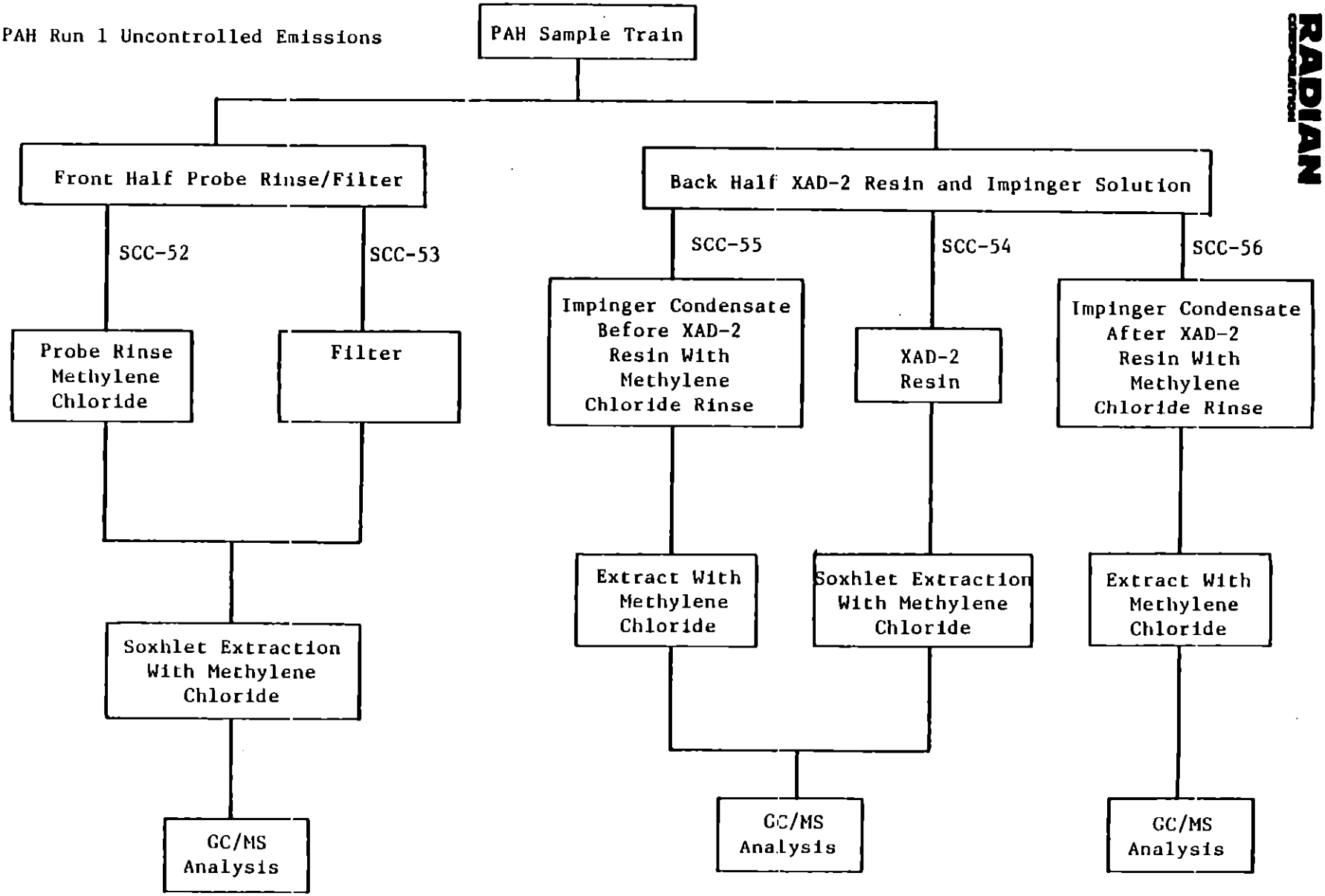
TOC Run 4
Uncontrolled Emissions



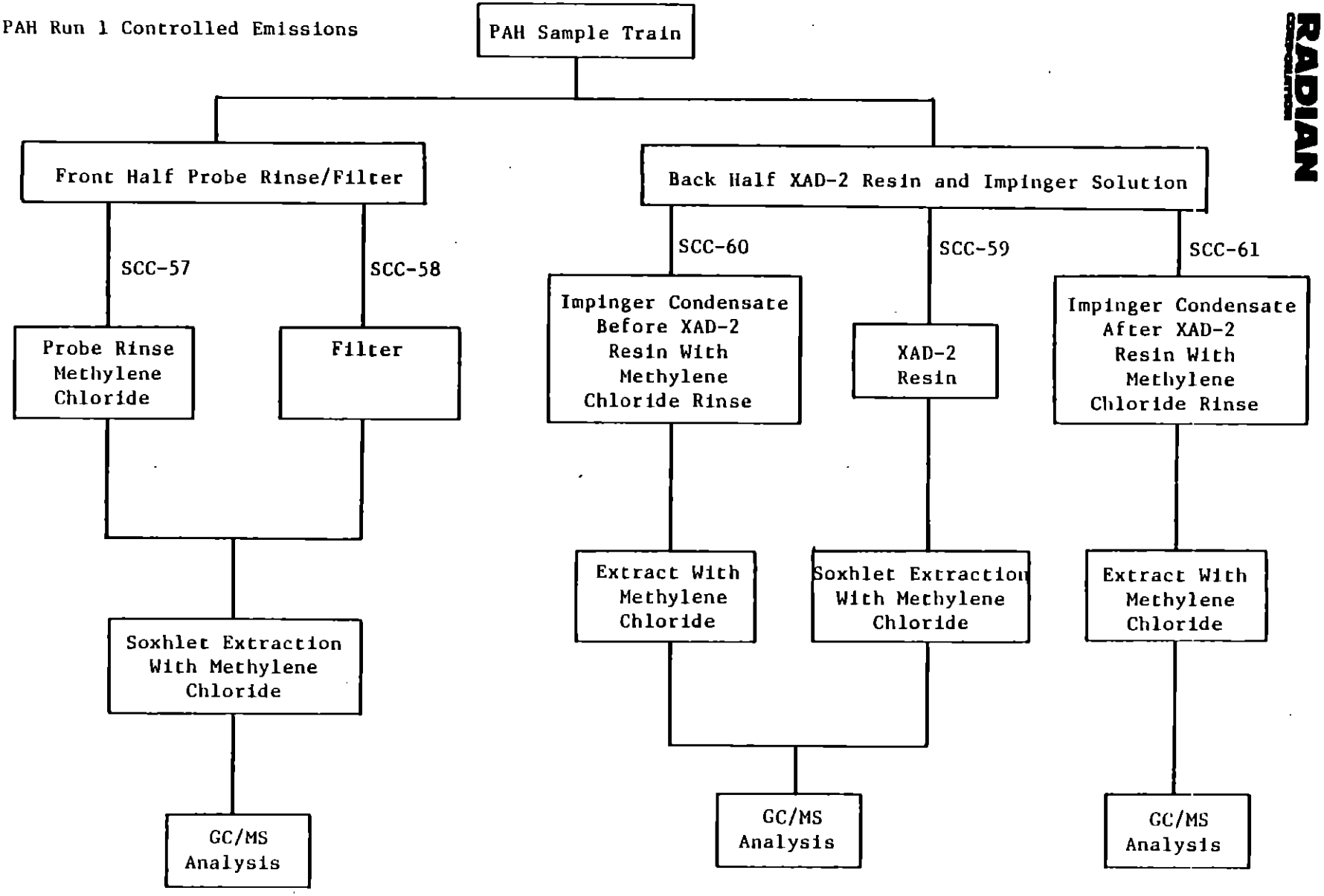
TOC Run 4
Controlled Emissions



PAH Run 1 Uncontrolled Emissions



PAH Run 1 Controlled Emissions



APPENDIX F

PROCESS SAMPLING AND MONITORING RESULTS

INCLUDES

F.1 Virgin Aggregate and Recycle Asphalt Pavement Percent Moisture Results
- F.1.1 Virgin Aggregate Percent Moisture Results Summary
- F.1.2 Recycle Asphalt Pavement Percent Moisture Results Summary
- F.1.3 Virgin Aggregate and Recycle Asphalt Pavement Percent Moisture Field Data Sheets

F.2 Venturi Scrubber Pressure Drop Measurements

F.3 Venturi Scrubber Water Flow Rates

F.4 Uncontrolled Emissions Wet Bulb/Dry Bulb Measurements

F.5 Controlled Emissions Wet Bulb/Dry Bulb Measurements

F.6 Liquid Asphalt Cement Sample Collection Data

F.7 Flash Point and Smoke Point Data
- F.7.1 Radian Smoke Point Results
- F.7.2 Oklahoma Testing Smoke Point and Flash Point Results

APPENDIX F.1

VIRGIN AGGREGATE AND RECYCLE ASPHALT PAVEMENT
PERCENT MOISTURE RESULTS

INCLUDES

F.1.1 Virgin Aggregate Percent Moisture Results Summary
F.1.2 Recycle Asphalt Pavement Percent Moisture Results Summary

F.1.1 Virgin Aggregate Percent Moisture Results

TABLE F.1.1. VIRGIN AGGREGATE PERCENT MOISTURE SUMMARY

Date	Time	% Moisture
5-08-84	1515	4.14
5-10-84	0920	5.91
5-10-84	1200	6.44
5-10-84	1600	5.73
5-11-84	1140	5.93

F.1.2 Recycle Asphalt Pavement Percent Moisture Results Summary

TABLE F.1.2 RECYCLE ASPHALT PAVEMENT PERCENT MOISTURE SUMMARY

Date	Time	% Moisture
5-08-84	1615	2.64
5-10-84	0930	1.64
5-10-84	1325	1.88
5-10-84	1615	1.80
5-11-84	1150	2.42

APPENDIX F.1

VIRGIN AGGREGATE AND RECYCLE ASPHALT
PAVEMENT PERCENT MOISTURE RESULTS

INCLUDES

F.1.3 Virgin Aggregate and Recycle Asphalt Pavement Percent Moisture Field Data Sheets

RADIAN CORPORATION

PROCESS SOLIDS MOISTURE

Date 5/8/84

Run TOC-1

Sample	Time	% Moisture			
		Beaker Tare (g)	Beaker + Wet Sample (g)	Beaker + Dry Sample	Conc. %
		W_I	W_w	W_D	$\frac{W_w - W_D}{W_w - W_I} \times 100$
V-1	1515	17.6	483.5	464.2	4.14
R-1	1615	17.6	479.3	467.1	2.64

RADIAN CORPORATION

PROCESS SOLIDS MOISTURE

Date 5/10/84

Run TOC-2

Sample	Time	% Moisture			
		Beaker Tare (g)	Beaker + Wet Sample (g)	Beaker + Dry Sample	Conc. %
		W_I	W_w	W_D	$\frac{W_w - W_D}{W_w - W_I} \times 100$
V-1	0920	17.6	471.3	444.5	5.91
R-1	0930	17.6	470.0	462.6	1.64

RADIAN CORPORATION

PROCESS SOLIDS MOISTURE

Date 5/10/84

Run TOC-3

Sample	Time	% Moisture			
		Beaker Tare (g)	Beaker + Wet Sample (g)	Beaker + Dry Sample	Conc. %
		W_I	W_w	W_D	$\frac{W_w - W_D}{W_w - W_I} \times 100$
V-1	1200	17.9	479.0	449.3	6.44
R-1	1325	18.0	475.6	467.0 ~~470.0~~	1.88

RADIAN CORPORATION

PROCESS SOLIDS MOISTURE

Date 5/10/84

Run TOC-4

Sample	Time	% Moisture			
		Beaker Tare (g)	Beaker + Wet Sample (g)	Beaker + Dry Sample	Conc. %
		W_I	W_w	W_D	$\frac{W_w - W_D}{W_w - W_I} \times 100$
V-1	1600	17.4	581.1	548.8	5.73
R-1	1615	18.0	903.1	887.2	1.80

RADIAN CORPORATION

PROCESS SOLIDS MOISTURE

Date 5/11/84

Run PAH-1

Sample	Time	% Moisture			
		Beaker Tare (g)	Beaker + Wet Sample (g)	Beaker + Dry Sample	Conc. %
		W_I	W_w	W_D	$\frac{W_w - W_D}{W_w - W_I} \times 100$
V-1	1140	17.9	817.0	769.6	5.93
R-1	1150	17.7	617.9	603.4	2.42

APPENDIX F.2

VENTURI SCRUBBER PRESSURE DROP MEASUREMENTS

F.2 Venturi Scrubber Pressure Drop Measurements

TABLE F.2. VENTURI SCRUBBER PRESSURE DROP RESULTS SUMMARY

Date	Time	ΔP inches Water Column
5-08-84	1035	18
	1040	19
	1054	19
	1115	17
	1130	15
	1145	19
	1315	21
	1423	17
	1430	16
	1445	17
	1500	15
	1515	21
	1550	10
	1600	15
	1615	15
	1630	21
	1645	21
	1700	21
	1715	21
	1730	20
	1742	21
5-10-84	0800	17
	0815	17
	0830	17
	0915	17
	0930	17
	0945	17
	1000	17
	1015	17
	1025	16
	1115	21
	1130	22
	1145	22
	1200	21
	1215	22
	1320	17
	1330	17
	1345	17
	1400	16
	1415	21
	1430	21

(continued)

TABLE F.2 (continued)

Date	Time	ΔP inches Water Column
5-10-84	1500	21
	1515	19
	1530	21
	1545	21
	1600	20
	1615	20
	1630	20
	1645	20
	1700	20
5-11-84	0815	16
	0830	16
	0845	17
	0900	15
	0915	14
	0930	16
	0945	15
	1000	14
	1015	14
	1030	14
	1045	16
	1100	17
	1115	15
	1130	15
	1145	15
	1200	13
	1215	19
	1230	16
	1245	16
	1300	14
	1315	16

APPENDIX F.3

VENTURI SCRUBBER WATER FLOW RATES

F.3 Venturi Scrubber Water Flow Rates

TABLE F.3. VENTURI SCRUBBER WATER FLOW RATE SUMMARY

Date	Time	Water Flow Rate (gpm)	Date	Time	Water Flow Rate (gpm)
5-08-84[a]	1035	370	5-10-84	1330	370
	1040	370		1345	370
	1054	370		1400	370
	1115	370		1415	370
	1130	370		1430	360
	1145	370		1500	360
	1315	370		1515	360
	1423	375		1530	360
	1430	375		1545	360
	1445	375		1600	360
	1500	370		1615	360
	1515	370		1630	360
	1550	380		1645	370
	1600	380		1700	360
	1615	380			
	1630	370	5-11-84[b]	0815	340
	1645	380		0830	340
	1700	380		0845	350
	1715	380		0900	350
	1730	380		0915	340
	1742	380		0930	340
				0945	340
5-10-84[b]	0800	360		1000	340
	0815	360		1015	340
	0830	360		1030	340
	0915	360		1045	340
	0930	360		1100	340
	0945	360		1115	340
	1000	360		1130	340
	1015	360		1145	340
	1025	360		1200	340
	1115	370		1215	340
	1130	360		1230	340
	1145	360		1245	340
	1200	360		1300	340
	1215	360		1315	340
	1320	370		1330	340
				1345	340
				1400	340

[a]Water flow rate represents average of Sloan's and Radian's meter.
[b]Radian's meter inoperable water flow rate is Sloan's meter reading plus 10 gpm.

APPENDIX F.4

UNCONTROLLED EMISSIONS WET BULB/DRY BULB MEASUREMENTS

F.4 Uncontrolled Emissions Wet Bulb/Dry Bulb Measurements

TABLE F.4. UNCONTROLLED EMISSIONS WET BULB/DRY BULB MEASUREMENTS SUMMARY

Date	Time	Wet Bulb	Dry Bulb	Percent Moisture	Method 4 Moisture (%)
5-08-84	1424-1608	161	313	30	30.2
5-08-84	1424-1608	164	308	32	
5-10-84	0815-0928	163	316	31.5	28.7
5-10-84	0815-0928	162	292	31	
5-10-84	1140-1341	163	305	32	
5-10-84	1140-1341	168	282	36.5	30.3
5-10-84	1140-1341	165	305	33.5	
5-10-84	1140-1341	165	298	33.5	
5-10-84	1411-1545	165	300	33.5	(30.3)[a]
5-10-84	1614-1656	164	289	33	32.0
5-10-84	1614-1656	164	283	33	
5-11-84	1108-1207	165	305	33.5	
5-11-84	1108-1207	166	280	35	32.1
5-11-84	1108-1207	167	296	35.5	
5-11-84	1230-1400	161	296	30	30.1
5-11-84	1230-1400	163	303	31.5	

[a]PSD-Run 1 impinger moisture data invalid, used moisture data from TOC-Run 2

APPENDIX F.5

CONTROLLED EMISSIONS WET BULB/DRY BULB MEASUREMENTS

F.5 Controlled Emissions Wet Bulb/Dry Bulb Measurements

TABLE F.5. CONTROLLED EMISSIONS WET BULB/DRY BULB MEASUREMENTS SUMMARY

Date	Time	Wet Bulb	Dry Bulb	Percent Moisture	Method 4 Moisture %
5-08-84	1055-1122	147	147	24	--
	1426-1739	159	159	32	29.5
5-10-84	0817-1021	154	154	28	24.8
	1137-1404	160	160	32.5	30.2
	1537-1657	161	161	33	30.4
5-11-84	1026-1314	156	156	30	30.6

APPENDIX F.6

LIQUID ASPHALT CEMENT SAMPLE COLLECTION DATA

TABLE F.6

Date	Time	Processing Company
5-10-84	0830	Chevron HMA-175

The sample of asphalt cement was collected when a new shipment arrived by truck. The asphalt cement used (Chevron HMA-175) is a basic asphalt to which light Arabian crude has been added.

RADIAN CORPORATION

APPENDIX F.7

FLASH POINT AND SMOKE POINT DATA

INCLUDES

F.7.1 Radian Smoke Point Results
F.7.2 Oklahoma Testing Smoke Point and Flash Point Results

F.7.1 Radian Smoke Point Results

TABLE F.7.1 SUMMARY OF RADIAN SMOKE POINT ANALYSIS

Sample Collection		Sample	
Date	Time	Description	Smoke Point °F
5-08-84	1615	RAP[a]	360
5-10-84	0930	RAP	370
5-10-84	1325	RAP	373
5-10-84	1615	RAP	370
5-11-84	1150	RAP	367

[a]Recycled Asphalt Pavement

F.7.2 Oklahoma Testing Smoke Point and Flash Point Results

TABLE F.7.2 SUMMARY OF OKLAHOMA TESTING SMOKE POINT AND FLASH POINT ANALYSIS

Sample Collection		Sample	Smoke	Flash
Date	Time	Description	Point °F	Point °F
5-08-84	1615	RAP[a]	350	--
5-10-84	0930	RAP	340	--
5-10-84	1325	RAP	340	--
5-10-84	1615	RAP	330	--
5-11-84	1150	RAP	345	--
5-10-84	0830	AC[b]	360	580

[a]Recycled Asphalt Pavement
[b]Asphalt Cement

APPENDIX G

VISIBLE EMISSION RESULTS

INCLUDES

G.1 Summary of Visible Emissions
G.2 Visible Emissions Field Data Sheets
G.3 Summary Log of Visible Emissions
G.4 Visible Emissions Observation Locations
G.5 Visible Emissions Observer Certification
G.6 EPA Method 9 Guidelines

APPENDIX G.1

SUMMARY OF VISIBLE EMISSIONS

TABLE G-1. OPACITY READINGS ON THE VENTURI SCRUBBER OUTLET

Date	Run Description	Time	Average Opacity for 6 Minutes	Date	Run Description	Time	Average Opacity for 6 Minutes
5-08-84	TOC-1	1425-1430	10.2	5-10-84	TOC-2	0800-0805	10.6
		1431-1436	8.5			0806-0811	12.3
		1437-1442	7.1				
		1443-1448	8.5			0818-0823	9.6
		1449-1454	10.6			0824-0829	12.7
		1455-1500	7.7			0830-0835	12.9
		1501-1506	8.8				
		1507-1512	6.2			0914-0919	10.6
		1513-1518	8.1			0920-0925	13.1
						0926-0931	12.3
		1555-1600	6.7			0932-0937	17.5
		1601-1606	7.3			0938-0943	14.4
		1607-1612	8.1				
						0946-0951	15.6
		1640-1645	5.4			0952-0957	17.5
		1646-1651	7.5			0958-1003	16.2
		1652-1657	5.4			1004-1009	11.8
		1658-1703	11.9			1010-1015	14.8
		1704-1709	9.2			1016-1021	16.2
		1710-1715	11.0			1022-1027	11.5
		1716-1721	11.4				
		1722-1727	11.2			Average	13.6
		1728-1733	8.1				
		1734-1739	7.9				
		1740-1745	6.9				
		Average	8.4				

(continued)

TABLE G-1 (continued)

Date	Run Description	Time	Average Opacity for 6 Minutes	Date	Run Description	Time	Average Opacity for 6 Minutes
5-10-84	TOC-3	1139-1144	10.0	5-10-84	TOC-4	1540-1545	7.7
		1145-1150	12.7			1546-1551	6.7
		1151-1156	12.5			1552-1557	7.7
		1157-1202	11.2			1558-1603	8.3
		1203-1208	12.7			1604-1609	10.6
		1209-1214	7.3			1610-1615	12.9
		1323-1328	13.3			1623-1628	11.0
		1329-1334	15.0			1629-1634	7.5
		1335-1340	16.9			1635-1640	10.2
		1341-1346	7.3			1641-1646	10.6
		1347-1352	13.1			1647-1652	11.4
		1353-1358	13.3			1653-1659	12.9
		1359-1404	14.1				
		1405-1410	15.2			Average	9.8
		Average	12.3				

APPENDIX G.2

VISIBLE EMISSIONS FIELD DATA SHEETS

RADIAN CORPORATION

DATA VALIDATION
BY
DATE

Plume Observation Rec

Date May 8th 1984
Observer David Savila
Checked By
Type of installation Asphalt Plant
Fuel Oil Stack Ht. 30
Observers Distance from Stack 175 Ft.
Wind Speed 10-15 Direct E
Sky Condition Pt. Cloudy
Plume Color White
Plume Background Blue/White
Plume Behavior Coming
Steam Plume
detached Ft. from stack
attached 100 Ft. dissipated
Start Time 1425
Ending Time 1746
Ending Weather Pt. Cloudy
Wind Speed 10-15 Direct E
Sky Condition
No. Units in Excess of standard
5 min/hr. allow 20
No. Units of VEC.

Source
Address

Page #1 of 4

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

Remarks:
Run #1

Sampling location #1

RADIAN
CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date 5/8/84
Observer David Sanza
Checked By _____
Type of installation _____

Fuel _____ Stack Ht. _____
Observers Distance from Stack _____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

Source _____
Address _____

Run #1 Page 2 of 4

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

RADIAN
CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date 5/8/84
Observer David Savin
Checked By _____
Type of installation _____

Source _____
Address _____

Fuel _____ Stack Ht. _____
Observers Distance from Stack _____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Stop Closed Filter Outlet

Remarks:

Page 3 of 4

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

RADIAN
CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date _____
Observer _____
Checked By _____
Type of installation _____
_____
Fuel _____ Stack Ht. _____
Observers Distance from Stack
_____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____
No. Units in Excess of
standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

Source _____
Address _____
_____
_____

4 of 4

Min. \ Sec.	0	15	30	45	Min. \ Sec.	0	15	30	45
12 00	15	15	10	10	30	5	10	10	10
1	10	15	15	10	31	10	5	5	10
2	10	10	10	10	32	5	5	5	5
3	10	15	15	10	33	5	5	10	5
4	10	10	10	10	34	5	5	5	15
5	10	10	10	5	35	10	5	5	5
6	5	10	10	15	36	5	10	5	5
7	10	5	5	10	37	10	10	10	10
8	15	10	15	10	38	5	5	5	10
9	10	5	5	5	39	10	10	10	15
10	10	5	10	10	40	5	5	5	5
11	15	10	10	10	41	5	5	10	5
12	15	10	15	15	42	10	10	5	5
13	15	10	10	10	43	10	10	5	10
14	10	10	10	10	44	5	5	10	10
15	5	10	15	15	45	5	5	10	5
16	10	10	10	15	46	5	5	5	5
17	10	10	10	10	47	End Test			
18	10	15	15	15	48				
19	15	10	15	10	49				
20	5	10	5	10	50				
21	10	15	15	15	51				
22	15	10	15	10	52				
23	10	15	20	15	53				
24	15	10	10	10	54				
25	10	5	5	10	55				
26	15	15	10	10	56				
27	5	10	10	10	57				
28	10	10	15	10	58				
29	10	15	10	5	59				

RADIAN CORPORATION

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: MAY 8, 1984

Type of Plant: Asphalt

RUN #1

Type of Discharge: Steam, Part, Hydrocarbons

Distance from Observer to Discharge Point:

Location of Discharge: Past steam Plume

Height of Observation Point:

Height of Point of Discharge:

Direction of Observer from Discharge Point: NE

Description of Background: Blue

Description of Sky: Clear

Wind Direction: E

Wind Velocity: 10-15

Color of Plume: white

Detached Plume:

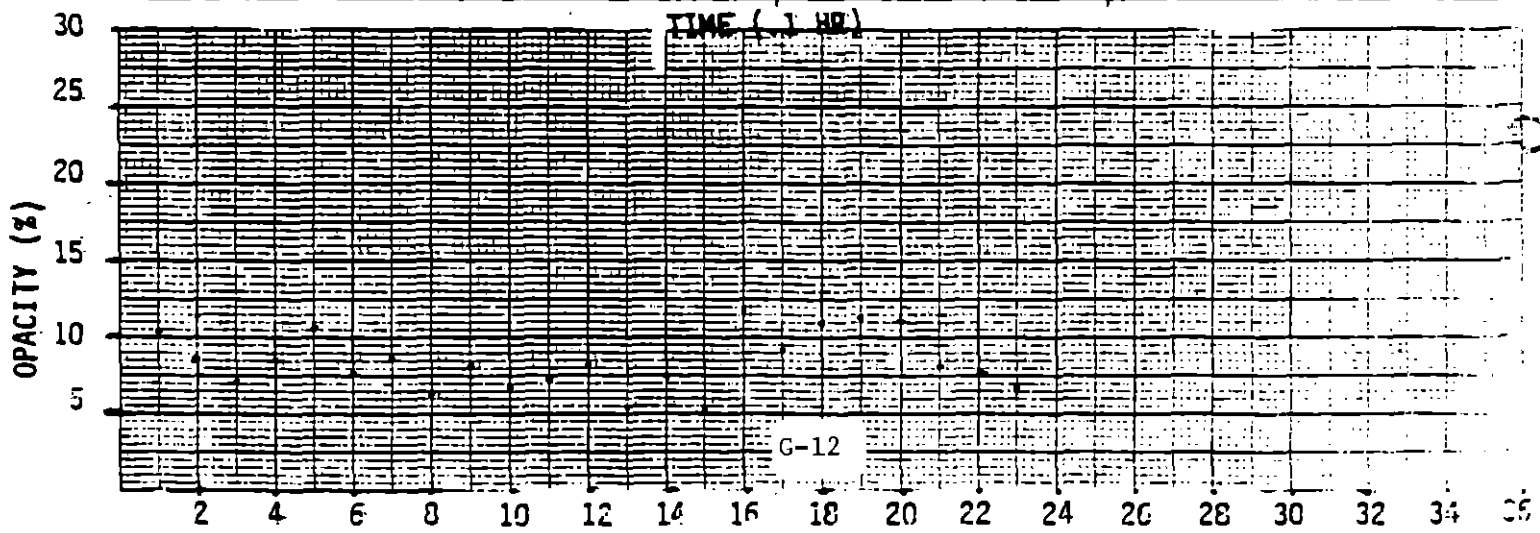
Duration of Observation: 146 minutes

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
1	1425	1430	245	10.2
2	1431	1436	205	8.5
3	1437	1442	180	7.1
4	1443	1448	205	8.5
5	1449	1454	255	10.6
6	1455	1500	185	7.7
7	1501	1506	210	8.8
8	1507	1512	150	6.2
9	1513	1518	195	8.1
10				
11	1555	1600	160	6.7
12	1601	1606	175	7.3
13	1607	1612	195	8.1
14				
15	1640	1645	130	5.4
16	1646	1651	180	7.5
17	1652	1657	130	5.4
18	1658	1703	285	11.9
19	1704	1709	220	9.2
20	1710	1715	265	11.0

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
21	1716	1721	275	11.4
22	1722	1727	270	11.2
23	1728	1733	195	8.1
24	1734	1739	190	7.9
25	1740	1745	165	6.9
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				



RADIAN CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date May 10, 1984
Observer David Savia
Checked By _____
Type of installation Asphalt Plant
Fuel Oil Stack Ht. 30'
Observers Distance from Stack 150 Ft.
Wind Speed 5-10 Direct N.W.
Sky Condition Pt Cloudy to Clear
Plume Color White
Plume Background Blue
Plume Behavior Curling
Steam Plume
detached ____ Ft. from stack
attached 100 Ft. dissipated
Start Time 0800
Ending Time 1020
Ending Weather Clear
Wind Speed 5-10 Direct East
Sky Condition Blue
No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Remarks:
During Run, after steam plume was particulate. Immediately following particulate the white plume turned to blue and dropped out (down) close to ground

Sample Location # 2 + 3

Source Sloan Const. Co
Address Cocoa Beach

Run # 2 Page 1 of 2

Sec. / Min.	0	15	30	45	Sec. / Min.	0	15	30	45
0800 0	10	10	10	10	30	10	10	10	10
1	10	10	10	10	31	10	10	10	10
2	5	10	15	10	32	10	15	15	15
3	5	10	10	15	33	15	15	10	10
4	10	10	10	10	34	10	10	10	15
5	15	15	15	10	35	10	10	10	10
6	10	10	10	15	36	10	10	10	10
7	20	15	15	15	37				
8	15	15	10	10	38				
9	10	10	10	10	39				
10	10	10	10	15	40				
11	10	10	10	10	41				
12	15	15	15	10	42				
13					43				
14					44				
15					45				
16					46				
17					47				
08 18	10	15	10	15	48				
19	10	10	10	10	49				
20	10	10	5	5	50				
21	10	10	15	10	51				
22	10	10	10	5	52				
23	10	10	10	10	53				
24	10	10	10	10	54				
25	10	10	10	15	55				
26	15	15	10	10	56				
27	10	10	15	15	57				
28	15	15	15	15	58				
29	15	15	15	15	59				

RADIAN CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date May 10, 1984
Observer David Savia
Checked By _____
Type of installation _____

Source Sloan Const Co.
Address Cocoa Beach

Fuel _____ Stack Ht. _____
Observers Distance from Stack _____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____
No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

Run # 2 2 of 3

Min. \ Sec.	0	15	30	45	Min. \ Sec.	0	15	30	45
0					30	15	15	15	15
1					31	10	10	15	20
2					32	20	15	15	10
3					33	15	20	15	20
4					34	25	20	20	20
5					35	20	20	15	15
6					36	15	15	15	25
7					37	20	20	15	10
8					38	10	10	15	10
9					39	10	10	15	15
10					40	10	20	20	15
11					41	20	15	15	20
12					42	15	15	15	15
13					43	15	15	15	10
09 14	10	10	10	10	44	10	15	15	10
15	10	10	10	15	45	15	15	20	15
16	10	10	10	10	46	15	15	10	10
17	10	10	10	10	47	10	10	10	15
18	10	10	10	10	48	20	15	15	10
19	10	10	15	15	49	10	10	15	10
20	10	10	10	15	50	15	15	15	15
21	15	15	15	15	51	20	20	20	20
22	15	15	10	15	52	20	20	20	20
23	15	15	10	15	53	15	15	20	15
24	15	10	10	10	54	20	15	15	15
25	10	15	15	15	55	20	15	15	15
26	10	15	15	15	56	15	15	15	20
27	10	10	10	10	57	25	20	20	15
28	10	10	10	10	58	15	25	20	15
29	10	10	10	15	59	15	15	15	15

RADIAN CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date May 10, 1984
Observer David Savia
Checked By _____
Type of installation _____

Fuel _____ Stack Ht. _____
Observers Distance from Stack _____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Remarks:

Source Sloan Coast. Co
Address Cocoa Beach

Run #2/3 of 3

Min. \ Sec.	0	15	30	45	Min. \ Sec.	0	15	30	45
1000	15	15	15	15	30				
1	15	15	15	20	31				
2	15	15	20	15	32				
3	15	15	15	20	33				
4	20	15	15	10	34				
5	15	15	20	15	35				
6	15	10	10	10	36				
7	10	10	10	10	37				
8	15	15	15	10	38				
9	5	10	10	10	39				
10	15	10	10	20	40				
11	15	15	20	15	41				
12	15	20	25	25	42				
13	25	20	15	15	43				
14	15	15	10	10	44				
15	15	10	10	15	45				
16	15	15	15	15	46				
17	20	20	20	20	47				
18	15	15	15	15	48				
19	10	10	15	15	49				
20	20	20	20	20	50				
21	15	15	15	15	51				
22	15	15	15	15	52				
23	15	15	15	10	53				
24	10	10	10	10	54				
25	10	10	10	10	55				
26	10	15	20	10	56				
27	10	15	10	10	57				
28					58				
29					59				

TRAPIAN CORPORATION

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: May 10, 1984

Type of Plant: Asphalt

Type of Discharge: Steam + Part. + Hydrocarbons

Location of Discharge: East Stack Plume

Height of Point of Discharge: 40-50

Description of Background: Blue

Description of Sky: Clear

Wind Direction: N - NW

Color of Plume: white

Duration of Observation: 102 minutes

Run # 2

Distance from Observer to Discharge Point: 150'

Height of Observation Point: Ground

Direction of Observer from Discharge Point: East

Wind Velocity: 5-10

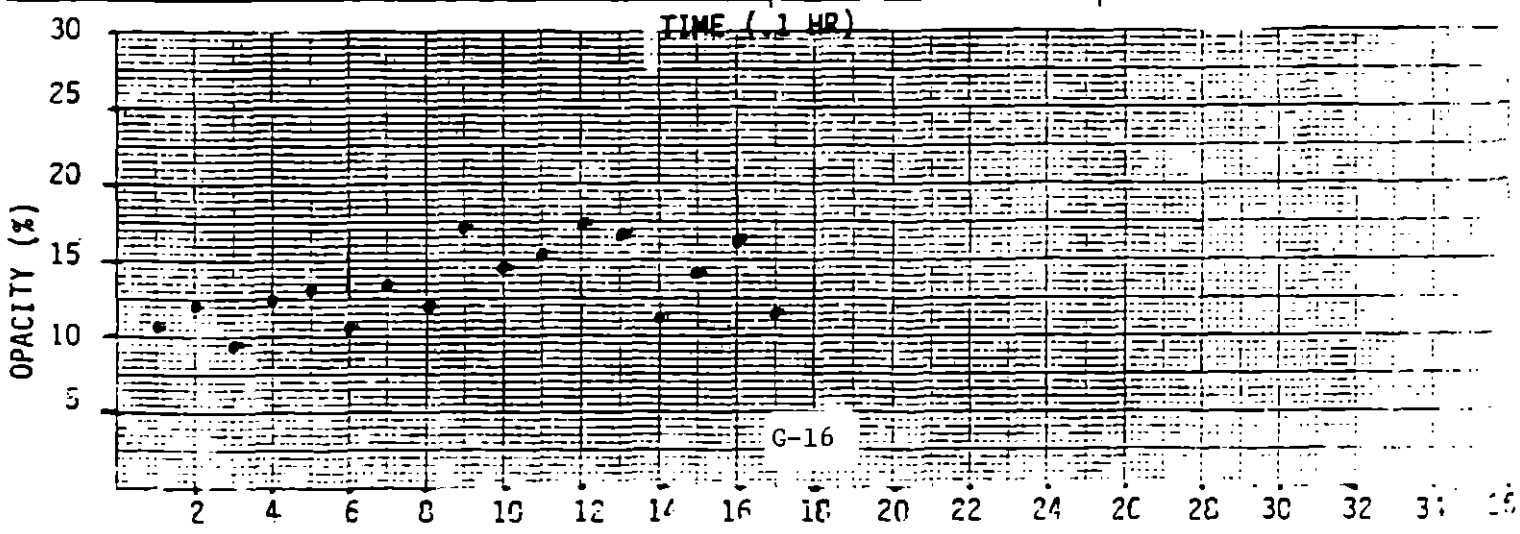
Detached Plume:

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
1	0800	05	255	10.6
2	06	11	295	12.3
3	0818	23	230	9.6
4	24	29	305	12.7
5	30	35	310	12.9
6	0914	19	255	10.6
7	20	25	315	13.1
8	26	31	291	12.3
9	32	37	400	17.5
10	38	43	345	14.4
11	0946	51	375	15.6
12	52	57	420	17.5
13	58	1003	390	16.2
14	04	09	280	11.8
15	10	15	355	14.8
16	16	21	390	16.2
17	22	27	275	11.5
18				
19				
20				

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				



RADIAN CORPORATION

DATA VALIDATION
BY
DATE

Plume Observation Record Form

Date May 10, 1984
Observer David Savia
Checked By
Type of installation Asphalt Plant
Fuel Oil Stack Ht. 30
Observers Distance from Stack 150 Ft.
Wind Speed 5-10 Direct NW
Sky Condition Clear
Plume Color White
Plume Background Blue
Plume Behavior Curving
Steam Plume
detached Ft. from stack
attached 100 Ft. dissipated
Start Time 1139
Ending Time 1410
Ending Weather Clear
Wind Speed 5-10 Direct N
Sky Condition Clear
No. Units in Excess of standard
5 min/hr. allow 20
No. Units of VIO.
Remarks:

Source Sloan Const. Co.
Address Cocoa Beach

Run # 3 1 of 3

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

Sample Location # 3

RADIAN CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date May 10, 1984
Observer David Savia
Checked By _____
Type of installation _____

Source Sloan Coast Co
Address Cocoa Beach

Fuel _____ Stack Ht. _____
Observers Distance from Stack _____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____
No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

Run # 3 2 of 3

Min. \ Sec.	0	15	30	45	Min. \ Sec.	0	15	30	45
12 00	10	10	10	10	30	15	15	15	20
1	15	10	10	15	31	5	15	15	15
2	15	15	15	15	32	15	10	15	15
3	10	15	10	15	33	15	15	15	15
4	15	15	15	15	34	15	15	20	15
5	15	15	15	15	35	10	10	15	15
6	15	15	10	10	36	15	15	15	15
7	10	10	15	15	37	20	20	25	25
8	10	10	10	5	38	15	20	25	20
9	5	5	5	5	39	15	20	15	20
10	5	5	5	5	40	15	15	15	10
11	5	10	10	10	41	15	10	10	10
12	10	5	5	5	42	10	15	10	10
13	10	5	10	5	43	10	15	15	15
14	5	5	5	5	44	15	15	15	15
15	10	5	5	5	45	20	20	20	15
16	STOP				46	00	00	00	15
17	Plume Dissipated				47	15	15	15	10
18					48	10	10	10	10
19					49	10	10	10	10
20					50	15	20	15	15
21					51	15	15	15	15
22					52	10	15	20	10
13 23	15	20	25	20	53	10	15	10	15
24	15	15	15	15	54	15	15	15	15
25	15	15	15	15	55	15	10	15	15
26	15	15	15	15	56	15	10	15	25
27	15	10	10	10	57	15	15	15	15
28	10	10	10	10	58	15	15	15	20
29	15	15	15	15	59	15	10	20	20

RADIAN CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date May 10, 1984
Observer David Savia
Checked By _____
Type of installation _____

Source Sloan Coast Co
Address Cocoa Beach

Fuel _____ Stack Ht. _____
Observers Distance from Stack _____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Remarks:

Run #3 3 of 3

Min. \ Sec.	0	15	30	45	Min. \ Sec.	0	15	30	45
1400 0	15	15	10	10	30				
1	15	15	15	15	31				
2	15	15	15	15	32				
3	15	10	10	10	33				
4	15	15	15	15	34				
5	15	20	15	15	35				
6	15	20	15	10	36				
7	10	10	15	15	37				
8	15	10	15	15	38				
9	15	15	20	20	39				
10	15	20	15	15	40				
11	END				41				
12					42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				

RADIAN CORPORATION

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: May 10, 1984

Type of Plant: Asphalt

Run # 3

Type of Discharge: Steam + Particulate + Hydrocarbons

Distance from Observer to Discharge Point: 150

Location of Discharge: Past Steam Plume

Height of Observation Point: Ground

Height of Point of Discharge:

Direction of Observer from Discharge Point: East

Description of Background: ~~Blue~~ Sky

Description of Sky: Blue / Clear

Wind Direction: NW

Wind Velocity: 5-10

Color of Plume: white

Detached Plume:

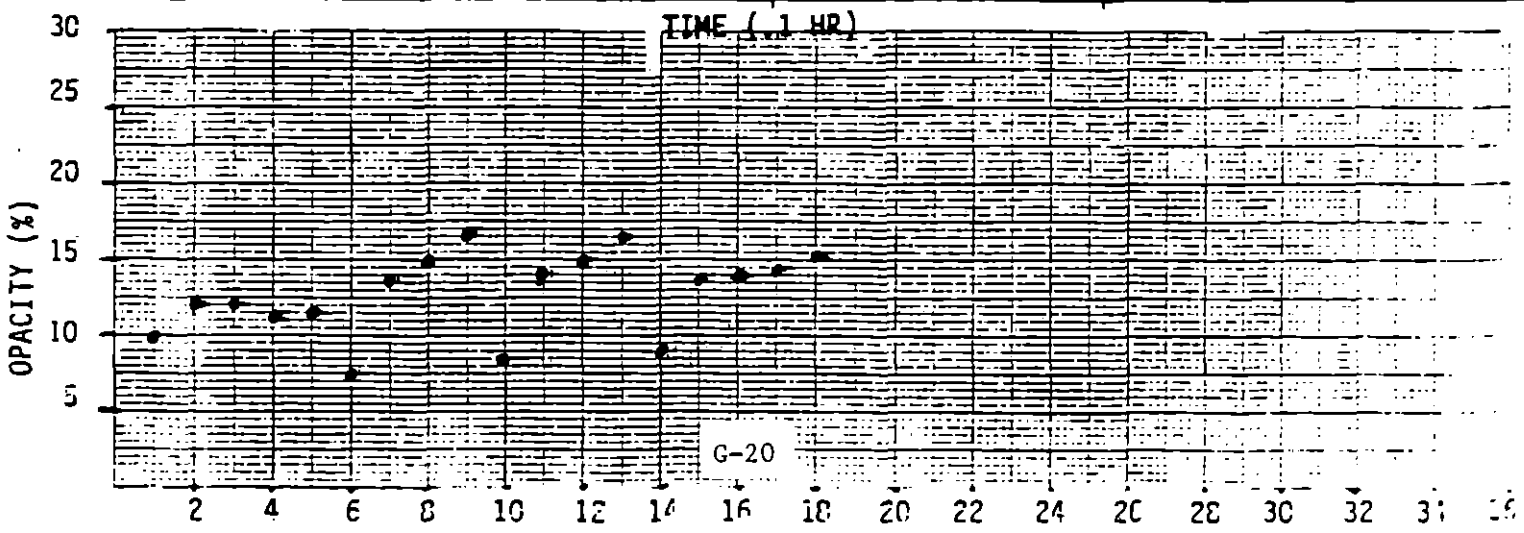
Duration of Observation: 78 minutes

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
1	1139	44	240	10
2	45	50	305	12.7
3	51	56	300	12.5
4	57	1202	270	11.2
5	03	08	305	12.7
6	09	14	175	7.3
7	1323	28	320	13.3
8	29	34	360	15.0
9	35	40	405	16.9
10	41	46	175	7.3
11	47	52	315	13.1
12	53	58	320	13.3
13	59	1404	340	14.1
14	05	10	365	15.2
15				
16				
17				
18				
19				
20				

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				



RADIAN CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date May 10, 1984
Observer David Savis
Checked By _____
Type of installation Asphalt Plant
Fuel Oil Stack Ht. 30'
Observers Distance from Stack 150 Ft.
Wind Speed 5-10 Direct N
Sky Condition Pt. Cloudy
Plume Color White
Plume Background Blue
Plume Behavior Coming
Steam Plume
detached ____ Ft. from stack
attached 100 Ft. dissipated
Start Time 1540
Ending Time 1649
Ending Weather Clear
Wind Speed 5-10 Direct N
Sky Condition Pt. Cloudy
No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

Sample Location #4

Source Sloan Const Co
Address Cocoa Beach

Run # 4 1 of 2

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

RADIAN CORPORATION

DATA VALIDATION
BY _____
DATE _____

Plume Observation Record Form

Date May 10, 1984
Observer David Savia
Checked By _____
Type of installation _____

Source Sloan Const. Co
Address Cocoa Beach

Fuel _____ Stack Ht. _____
Observers Distance from Stack _____ Ft.
Wind Speed _____ Direct _____
Sky Condition _____
Plume Color _____
Plume Background _____
Plume Behavior _____
Steam Plume
detached _____ Ft. from stack
attached _____ Ft. dissipated
Start Time _____
Ending Time _____
Ending Weather _____
Wind Speed _____ Direct _____
Sky Condition _____

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Remarks:

Run #4 2 of 2

Min. \ Sec.	0	15	30	45	Min. \ Sec.	0	15	30	45
1600 0	10	10	10	10	30	5	5	5	5
1	5	10	10	10	31	5	5	5	5
2	10	10	10	5	32	10	10	5	10
3	5	5	5	5	33	5	5	5	10
4	10	10	10	10	34	10	15	10	10
5	10	10	5	10	35	10	10	10	10
6	10	5	5	5	36	10	10	10	10
7	5	10	10	10	37	15	10	10	10
8	15	10	15	15	38	10	10	10	10
9	15	15	15	15	39	15	10	10	10
10	15	15	15	15	40	5	10	5	15
11	15	15	15	15	41	15	15	10	10
12	15	15	10	10	42	10	10	10	10
13	10	10	10	10	43	10	10	10	10
14	15	15	10	10	44	15	15	10	10
15	port				45	10	10	5	5
16	Change				46	10	10	10	15
17					47	15	10	10	10
18					48	10	10	10	10
19					49	10	10	10	10
20					50	10	10	15	15
21					51	15	15	15	15
22					52	10	10	10	10
23	5	5	10	10	53	15	15	15	10
24	10	5	5	10	54	10	10	10	10
25	15	20	15	15	55	10	15	15	15
26	15	15	15	15	56	15	15	10	10
27	15	15	15	10	57	15	15	15	20
28	5	5	5	10	58	15	15	15	15
29	5	10	10	10	59				

RADIAN CORPORATION

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: May 10, 1984

Type of Plant: Asphalt

Run # 4

Type of Discharge: Steam + Part. + Hydrocarbons

Distance from Observer to Discharge Point: 100

Location of Discharge: Post Steam Plume

Height of Observation Point: 10'

Height of Point of Discharge: 40-50

Direction of Observer from Discharge Point: W

Description of Background: Sky

Description of Sky: Clear Blue

Wind Direction: N

Wind Velocity: 5-10

Color of Plume: White

Detached Plume:

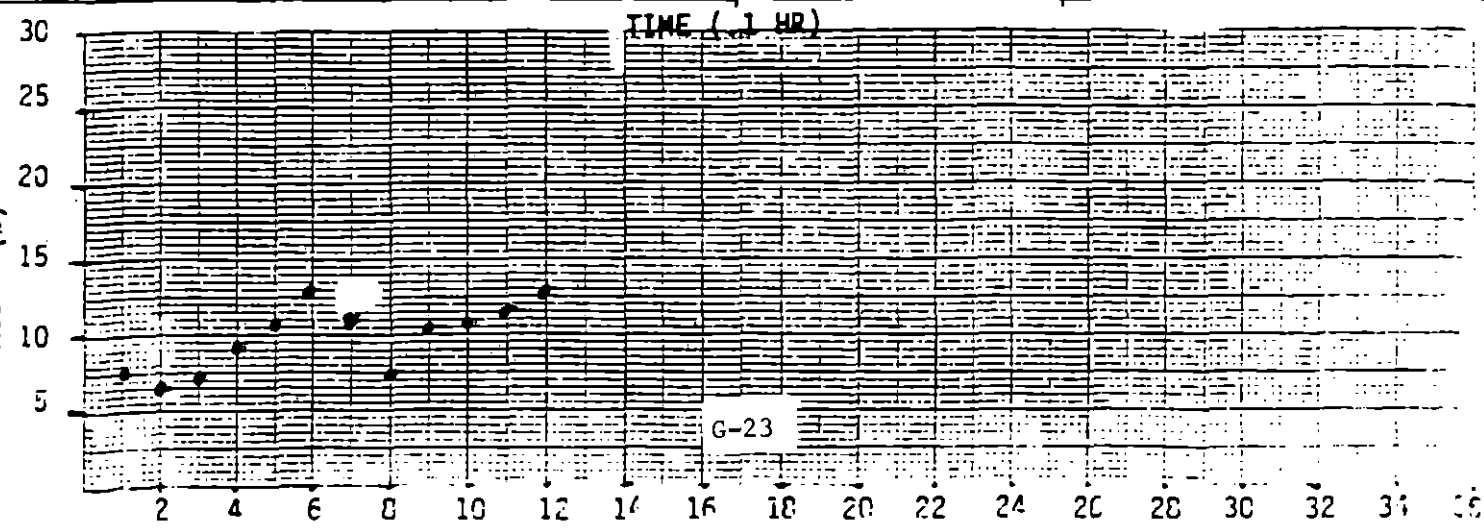
Duration of Observation: 72 minutes

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
1	1540	45	185	7.7
2	46	51	160	6.7
3	52	57	185	7.7
4	58	1603	200	8.3
5	04	09	250	10.4
6	10	15	310	12.9
7	1623	28	265	11.0
8	29	34	180	7.5
9	35	40	245	10.2
10	41	46	255	10.6
11	47	52	275	11.4
12	53	59	310	12.9
13				
14				
15				
16				
17				
18				
19				
20				

SUMMARY OF AVERAGE OPACITY

Set Number	Start	End	Sum	Average
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				



APPENDIX G.3

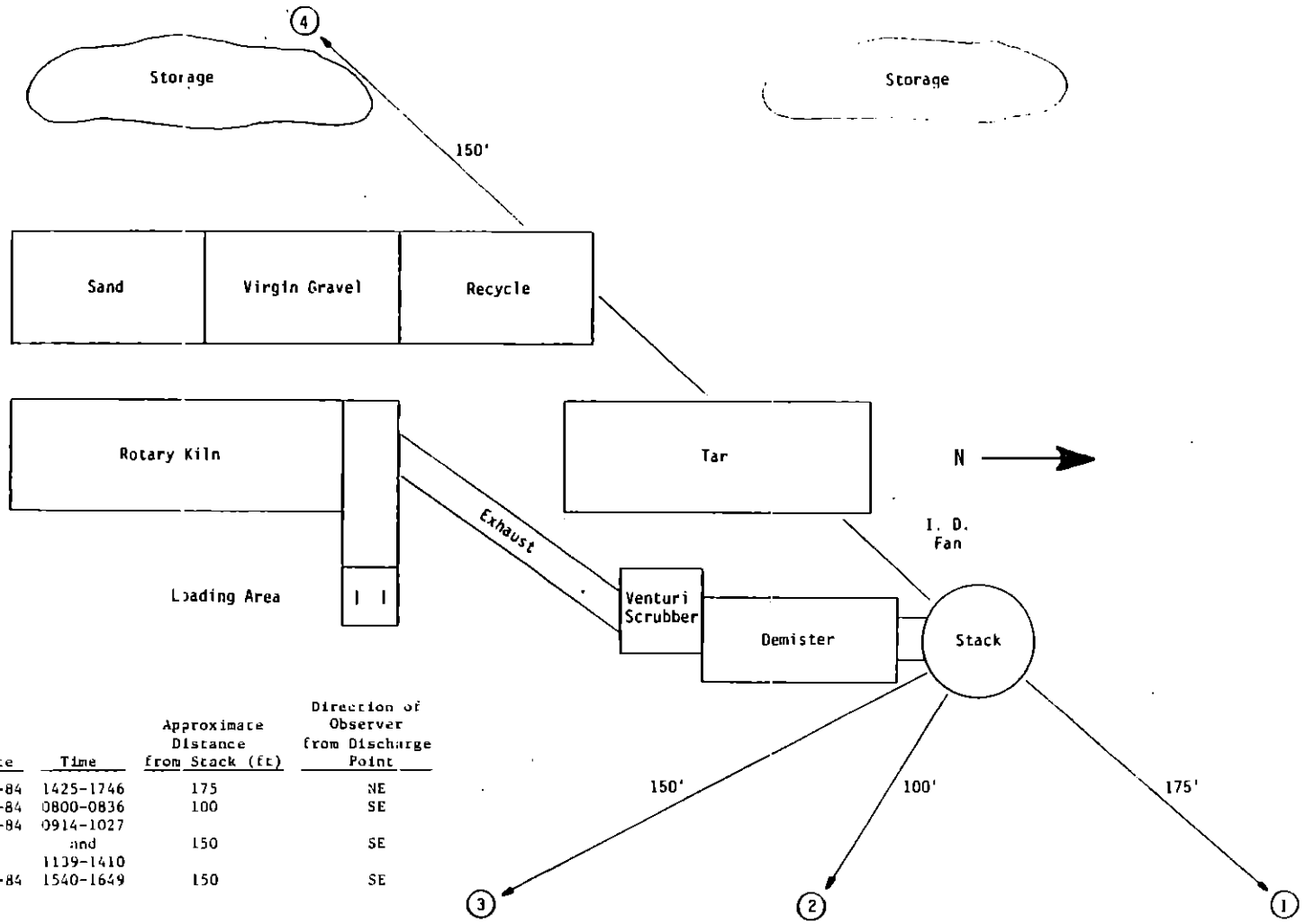
SUMMARY LOG OF VISIBLE EMISSIONS

TABLE G-2. SUMMARY LOG OF VISIBLE EMISSIONS

Date	Start Time	Stop Time	Time (min)
5-08-84	1425	1521	57
	1555	1616	22
	1640	1746	67
5-10-84	0800	0812	13
	0818	0836	19
	0914	1027	74
	1139	1215	37
	1323	1410	48
	1540	1614	35
	1623	1658	36

APPENDIX G.4

VISIBLE EMISSIONS OBSERVATION LOCATIONS



Position No.	Date	Time	Approximate Distance from Stack (ft)	Direction of Observer from Discharge Point
1	5-08-84	1425-1746	175	NE
2	5-10-84	0800-0836	100	SE
3	5-10-84	0914-1027 and 1139-1410	150	SE
4	5-10-84	1540-1649	150	SE

Figure G-1. Locations of visible emissions observations at the Sloan Construction Company asphalt concrete plant, Cocoa, Florida.

APPENDIX G.5

VISIBLE EMISSIONS OBSERVER CERTIFICATION

STATE OF NORTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES & COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT

"NOTICE"

This is to advise David Savia that on 3/30/84 you successfully completed requirements for:

✓ Renewal of "Certificate of Competency to Determine Visible Emissions" and thereby will require renewal on 3/30/85. Please attach this notice to your certificate as it is the official notice of recertification.

____ Certification to determine visible emissions, by completion of a course of instruction and having demonstrated competency in performing visible emission evaluations. Enclosed is a "Certificate of Competency to Determine Visible Emissions" issued by the State of North Carolina, Environmental Management Division. This certificate shall remain valid, until _____, at which time it will require renewal by recertification.

Schools will be made available to you for renewal purposes around the time your certificate is due to expire. For information concerning the school(s), call your regional air quality office or your local air pollution control program prior to your expiration date. Also, included below is your positive observational error (P. O. E.) if any, for black and white smoke figured from your field exam.

"P. O. E." for Black Smoke 0

"P. O. E." for White Smoke 0

____ Did not meet requirements for visible emissions certification.

APPENDIX G.6

EPA METHOD 9 GUIDELINES

$$I = \frac{T_s V_{m(std)} P_{std} 100}{T_{std} v_s \theta A_n P_s 60 (1 - B_{ws})}$$

$$= K_4 \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1 - B_{ws})}$$

Equation 8-5

where:

K_4 = 4.320 for metric units.

= 0.09450 for English units

6.6 Acceptable Results. If 90 percent < I < 110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may opt to accept the results. Use Citation 4 in the Bibliography of Method 5 to make judgments. Otherwise, reject the results and repeat the test.

7. *Bibliography*

1. Atmospheric Emissions from Sulfuric Acid Manufacturing Processes. U.S. DHEW, PHS, Division of Air Pollution. Public Health Service Publication No. 999-AP-13. Cincinnati, Ohio. 1965.

2. Corbett, P. F. The Determination of SO_2 and SO_3 in Flue Gases. Journal of the Institute of Fuel. 24:237-243. 1961.

3. Martin, Robert M. Construction Details of Isokinetic Source Sampling Equipment. Environmental Protection Agency. Research Triangle Park, N.C. Air Pollution Control Office Publication No. APTD-0581. April, 1971.

4. Patton, W. F. and J. A. Brink, Jr. New Equipment and Techniques for Sampling Chemical Process Gases. Journal of Air Pollution Control Association. 13:162. 1963.

5. Rom, J. J. Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment. Office of Air Programs, Environmental Protection Agency. Research Triangle Park, N.C. APTD-0576. March, 1972.

6. Hamil, H. F. and D. E. Camann. Collaborative Study of Method for Determination of Sulfur Dioxide Emissions from Stationary Sources (Fossil Fuel-Fired Steam Generators). Environmental Protection Agency, Research Triangle Park, N.C. EPA-650/4-74-024. December, 1973.

7. Annual Book of ASTM Standards. Part 31; Water, Atmospheric Analysis. pp. 40-42. American Society for Testing and Materials. Philadelphia, Pa. 1974.

METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

1. *Principle and applicability.*

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. *Procedure.* The observer qualified in accordance with paragraph 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g. roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g. stub stacks on baghouses).

2.2 Field records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, and the date on a field data sheet (Figure 9-1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached steam plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached steam plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9-2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9-1 for an example.)

3. *Qualifications and testing.*

3.1 Certification requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in paragraph 3.2. Smoke generators used pursuant to paragraph 3.2 shall be equipped with a smoke meter which meets the requirements of paragraph 3.3.

The certification shall be valid for a period of 6 months, at which time the quali-

[1] For a set, positive error = average opacity determined by observers' 25 observations—average opacity determined from transmissometer's 25 recordings.

Continued

90-127 O—82——28

fication procedure must be repeated by any observer in order to retain certification.

3.2 Certification procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke generator specifications. Any smoke generator used for the purposes of paragraph 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display instack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9-1. The smoke meter shall be calibrated as prescribed in paragraph 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9-1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

TABLE 9-1—SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter	Specification
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye—reference 4.3).
c. Angle of view	15° maximum total angle.
d. Angle of projection	15° maximum total angle.
e. Calibration error	±3% opacity, maximum.
f. Zero and span drift ±1% opacity, 30 minutes.	
g. Response time	5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke meter evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral response of photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9-1.

FIGURE 9-1

RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE ___ of ___

COMPANY _____
LOCATION _____
TEST NUMBER _____
DATE _____
TYPE FACILITY _____
CONTROL DEVICE _____

HOURS OF OBSERVATION _____
OBSERVER _____
OBSERVER CERTIFICATION DATE _____
OBSERVER AFFILIATION _____
POINT OF EMISSIONS _____
HEIGHT OF DISCHARGE POINT _____

	Initial			Final
CLOCK TIME				
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time Start--End	Opacity Sum	Opacity Average

Readings ranged from ____ to ____ % opacity

The source was/was not in compliance with ____ at the time evaluation was made.

FIGURE 9-2 OBSERVATION RECORD PAGE ___ OF ___

COMPANY _____ OBSERVER _____
LOCATION _____ TYPE FACILITY _____
TEST NUMBER _____ POINT OF EMISSIONS _____
DATE _____

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	COMMENTS
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							

3.3.2.3 Angle of view. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15°. The total angle of view may be calculated from: $=2 \tan^{-1} d/2L$, where θ=total angle of view; d=the sum of the photocell diameter+the diameter of the limiting aperture; and L=the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\theta=2 \tan^{-1} d/2L$, where θ= total angle of projection; d= the sum of the length of the lamp filament + the diameter of the limiting aperture; and L= the distance from the lamp to the limiting aperture.

FIGURE 9-2 OBSERVATION RECORD (Continued) PAGE ___ OF ___

COMPANY _____ OBSERVER _____
LOCATION _____ TYPE FACILITY _____
TEST NUMBER _____ POINT OF EMISSIONS _____
DATE _____

Hr.	Min.	Seconds 0	15	30	45	STEAM PLUME (check if applicable) Attached	Detached	COMMENTS
	30							
	31							
	32							
	33							
	34							
	35							
	36							
	37							
	38							
	39							
	40							
	41							
	42							
	43							
	44							
	45							
	46							
	47							
	48							
	49							
	50							
	51							
	52							
	53							
	54							
	55							
	56							
	57							
	58							
	59							

3.3.2.5 Calibration error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibrated within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each

filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and span drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response time. Determine the response time by producing the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. *References.*

4.1 Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Regulation IV, Prohibitions, Rule 50.

4.2 Weisburd, Melvin I., Field Operations and Enforcement Manual for Air. U.S. Environmental Protection Agency, Research Triangle Park, N.C., APTD-1100, August 1972, pp. 4.1-4.36.

4.3 Condon, E.U., and Odishaw, H., Handbook of Physics, McGraw-Hill Co., N.Y., N.Y., 1958, Table 3.1, p. 6-52.

Alternate Method 1—Determination of the Opacity of Emissions From Stationary Sources Remotely by Lidar

This alternate method provides the quantitative determination of the opacity of an emissions plume remotely by a mobile lidar system (laser radar; Light Detection and Ranging). The method includes procedures for the calibration of the lidar and procedures to be used in the field for the lidar determination of plume opacity. The lidar is used to measure plume opacity during either day or nighttime hours because it contains its own pulsed light source or transmitter. The operation of the lidar is not dependent upon ambient lighting conditions (light, dark, sunny or cloudy).

The lidar mechanism or technique is applicable to measuring plume opacity at numerous wavelengths of laser radiation. However, the performance evaluation and calibration test results given in support of this method apply only to a lidar that employs a ruby (red light) laser [Reference 5.1].

1. Principle and Applicability

1.1 Principle. The opacity of visible emissions from stationary sources (stacks, roof vents, etc.) is measured remotely by a mobile lidar (laser radar).

1.2 Applicability. This method is applicable for the remote measurement of the opacity of visible emissions from stationary sources during both nighttime and daylight conditions, pursuant to 40 CFR § 60.11(b). It is also applicable for the calibration and performance verification of the mobile lidar for the measurement of the opacity of emissions. A performance/design specification for a basic lidar system is also incorporated into this method.

1.3 Definitions.

Azimuth angle: The angle in the horizontal plane that designates where the laser beam is pointed. It is measured from an arbitrary fixed reference line in that plane.

Backscatter: The scattering of laser light in a direction opposite to that of the incident laser beam due to reflection from particulates along the beam's atmospheric path which may include a smoke plume.

Backscatter signal: The general term for the lidar return signal which results from laser light being backscattered by atmospheric and smoke plume particulates.

Convergence distance: The distance from the lidar to the point of overlap of the lidar receiver's field-of-view and the laser beam.

Elevation angle: The angle of inclination of the laser beam referenced to the horizontal plane.

Far region: The region of the atmosphere's path along the lidar line-of-sight beyond or behind the plume being measured.

Lidar: Acronym for Light Detection and Ranging.

Lidar range: The range or distance from the lidar to a point of interest along the lidar line-of-sight.

Near region: The region of the atmospheric path along the lidar line-of-sight between the lidar's convergence distance and the plume being measured.

Opacity: One minus the optical transmittance of a smoke plume, screen target, etc.

Pick interval: The time or range intervals in the lidar backscatter signal whose minimum average amplitude is used to calculate opacity. Two pick intervals are required, one in the near region and one in the far region.

Plume: The plume being measured by lidar.

Plume signal: The backscatter signal resulting from the laser light pulse passing through a plume.

$1/R^2$ correction: The correction made for the systematic decrease in lidar backscatter signal amplitude with range.

Reference signal: The backscatter signal resulting from the laser light pulse passing through ambient air.

Sample interval: The time period between successive samples for a digital signal or between successive measurements for an analog signal.

Signal spike: An abrupt, momentary increase and decrease in signal amplitude.

Source: The source being tested by lidar.

Time reference: The time (t_o) when the laser pulse emerges from the laser, used as the reference in all lidar time or range measurements.

2. Procedures.

The mobile lidar calibrated in accordance with Paragraph 3 of this method shall use the following procedures for remotely measuring the opacity of stationary source emissions:

2.1 Lidar Position. The lidar shall be positioned at a distance from the plume sufficient to provide an unobstructed view of the source emissions. The plume must be at a range of at least 50 meters or three consecutive pick intervals (whichever is greater) from the lidar's transmitter/receiver convergence distance along the line-of-sight. The maximum effective opacity measurement distance of the lidar is a function of local atmospheric conditions, laser beam diameter, and plume diameter. The test position of the lidar shall be selected so that the diameter of the laser beam at the measurement point within the plume shall be no larger than three-fourths the plume diameter. The beam diameter is calculated by Equation (AM1-1):

$$D(\text{lidar}) = A + R\phi < 0.75\ D(\text{Plume}) \quad \text{(AM1-1)}$$

where:

D(Plume) = diameter of the plume (cm),

ϕ = laser beam divergence measured in radians

R = range from the lidar to the source (cm)

D(Lidar) = diameter of the laser beam at range R (cm),

A = diameter of the laser beam or pulse where it leaves the laser.

The lidar range, R, is obtained by aiming and firing the laser at the emissions source structure immediately below the outlet. The range value is then determined from the backscatter signal which consists of a signal spike (return from source structure) and the atmospheric backscatter signal [Reference 5.1]. This backscatter signal should be recorded.

When there is more than one source of emissions in the immediate vicinity of the plume, the lidar shall be positioned so that the laser beam passes through only a single plume, free from any interference of the other plumes for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume along the line-of-sight (determined from the backscatter signals). The lidar shall initially be positioned so that its line-of-sight is approximately perpendicular to the plume.

When measuring the opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks, etc.), the lidar shall be placed in a position so that its line-of-sight is approximately perpendicular to the longer (major) axis of the outlet.

2.2 Lidar Operational Restrictions. The lidar receiver shall not be aimed within an angle of ± 15° (cone angle) of the sun.

This method shall not be used to make opacity measurements if thunderstorms, snowstorms, hail storms, high wind, high-ambient dust levels, fog or other atmospheric conditions cause the reference signals to consistently exceed the limits specified in Section 2.3.

2.3 Reference Signal Requirements. Once placed in its proper position for opacity measurement, the laser is aimed and fired with the line-of-sight near the outlet height and rotated horizontally to a position clear of the source structure and the associated plume. The backscatter signal obtained from this position is called the ambient-air or reference signal. The lidar operator shall inspect this signal [Section V of Reference 5.1] to: (1) determine if the lidar line-of-sight is free from interference from other plumes and from physical obstructions such as cables, power lines, etc., for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, and (2) obtain a qualitative measure of the homogeneity of the ambient air by noting any signal spikes.

Should there be any signal spikes on the reference signal within a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, the laser shall be fired three more times and the operator shall inspect the reference signals on the display. If the spike(s) remains, the azimuth angle shall be changed and the above procedures conducted again. If the spike(s) disappears in all three reference signals, the lidar line-of-sight is acceptable if there is shot-to-shot consistency and there is no interference from other plumes.

Shot-to-shot consistency of a series of reference signals over a period of twenty seconds is verified in either of two ways. (1) The lidar operator shall observe the reference signal amplitudes. For shot-to-shot consistency the ratio of R_1 to R_n [amplitudes of the near and far region pick intervals (Section 2.6.1)] shall vary by not more than ± 6% between shots; or (2) the lidar operator shall accept any one of the reference signals and treat the other two as plume signals; then the opacity for each of the subsequent reference signals is calculated (Equation AM1-2). For shot-to-shot consistency, the opacity values shall be within ± 3% of 0% opacity and the associated S_n values less than or equal to 8% (full scale) [Section 2.6].

If a set of reference signals fails to meet the requirements of this section, then all plume signals [Section 2.4] from the last set

APPENDIX H

VENTURI SCRUBBER MONITORING RESULTS

INCLUDES

H.1 Temperature and pH Measurements of Venturi Scrubber Water
- H.1.1 Inlet Venturi Scrubber Water
- H.1.2 Effluent Venturi Scrubber Water
- H.1.3 Temperature and pH Field Data Sheets

H.2 Total Organic Carbon (TOC) Measurements of Scrubber Water
- H.2.1 Summary of Scrubber Water TOC Results
- H.2.2 Laboratory Data Computer Printout of TOC Results

H.3 Major Organics Measurements of Scrubber Water and Effluent Scrubber Water Solids
- H.3.1 Major Organic Species in the Venturi Scrubber Water Samples
- H.3.2 Major Organic Species in the Effluent Scrubber Water Solids

H.4 Total Solids Measurements of Scrubber Water
- H.4.1 Inlet Venturi Scrubber Water
- H.4.2 Effluent Venturi Scrubber Water
- H.4.3 Total Solids Data Sheets

H.5 Analytical Test Matrices for Scrubber Water Samples

H.6 Sample Identification and Sampling Logs for Scrubber Water Samples

H.7 Calibration and Certification of Signet Flosensor

APPENDIX H.1

TEMPERATURE AND PH MEASUREMENTS OF
VENTURI SCRUBBER WATER

INCLUDES

H.1.1 Inlet Venturi Scrubber Water
H.1.2 Effluent Venturi Scrubber Water

H.1.1 Inlet Venturi Scrubber Water

TABLE H.1.1. INLET VENTURI SCRUBBER WATER TEMPERATURE AND PH MEASUREMENTS

Date	Time	pH	Temp. °F
5-08-84	1440	6.28	134
5-08-84	1555	6.11	136
5-08-84	1650	6.10	140
5-10-84	0820	6.25	111
5-10-84	0945	6.02	126
5-10-84	1144	6.09	143
5-10-84	1332	6.16	132
5-10-84	1540	6.09	140
5-10-84	1644	6.12	140
5-11-84	1112	6.28	142
5-11-84	1230	6.00	144

H.1.2 Effluent Venturi Scrubber Water

TABLE H.1.2 EFFLUENT VENTURI SCRUBBER WATER TEMPERATURE AND PH MEASUREMENTS

Date	Time	pH	Temp. °F
5-08-84	1445	5.87	154
5-08-84	1559	5.77	157
5-08-84	1655	5.75	156
5-10-84	0825	5.75	147
5-10-84	0950	5.77	152
5-10-84	1148	5.75	158
5-10-84	1336	5.73	156
5-10-84	1545	5.74	156
5-10-84	1647	5.80	156
5-11-84	1116	5.86	157
5-11-84	1232	5.61	158

APPENDIX H.1

TEMPERATURE AND PH MEASUREMENTS OF
VENTURI SCRUBBER WATER

INCLUDES

H.1.3 Temperature and pH Field Data Sheets

RADIAN CORPORATION

Scrubber Water INLET Venturi

Date 5/8/84

Run TOC-1

Time	pH/Temp. °F	Stream Temp. °F
1440	6.28	134
1555	6.11	136
1650	6.10	140

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water INLET Venturi

Date 5/10/84

Run TOC-2

Time	pH/Temp. °F	Stream Temp. °F
0820	6.25	111
0945	6.02	126

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water INLET Venturi

Date 5/10/84

Run TOC-3

Time	pH/Temp. °F	Stream Temp. °F
1144	6.09	145
13:32	6.16	132

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water INLET Venturi

Date 5/10/84

Run TOC-4

Time	pH/Temp. °F	Stream Temp. °F
1540.	6.09	140
1644	6.12	140

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water INLET Venturi

Date 5/11/84

Run PAH-1

Time	pH/Temp. °F	Stream Temp. °F
11:12	6.28	142
1230	6.00	144

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water OUTLET Venturi

Date 5/8/84

Run TOC-1

Time	pH/Temp. °F	Stream Temp. °F
1445	5.87	154
1559	5.77	157
1655	5.75	156

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water OUTLET Venturi

Date 5/10/84

Run TOC-2

Time	pH/Temp. °F	Stream Temp. °F
0825	5.75	147
0950	5.77	152

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water OUTLET Venturi

Date 5/10/84

Run TOC-3

Time	pH/Temp. °F	Stream Temp. °F
1148	5.75	158
1336	5.73	156

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water OUTLET Venturi

Date 5/10/84

Run TOC-4

Time	pH/Temp. °F	Stream Temp. °F
1545	5.74	156
1647	5.80	156

Figure 4- 5. Scrubber Water Sampling Form

RADIAN CORPORATION

Scrubber Water OUTLET Venturi

Date 5/11/84

Run PAH-1

Time	pH/Temp. °F	Stream Temp. °F
11:16	5.86	157.
1232	5.61	158

Figure 4- 5. Scrubber Water Sampling Form

APPENDIX H.2

TOTAL ORGANIC CARBON (TOC) MEASUREMENTS OF SCRUBBER WATER

INCLUDES

H.2.1 Summary of Scrubber Water TOC Results

TABLE H.2.1. SUMMARY OF VENTURI SCRUBBER WATER TOTAL ORGANIC CARBON RESULTS

Date	Run Description	Concentration mg/L	
		Water to Venturi	Venturi Effluent Water
5-08-84	Particulate/TOC Run 1	1120	1110
5-10-84	Particulate/TOC Run 2	830	920
5-10-84	Particulate/TOC Run 3	930	960
5-10-84	Particulate/TOC Run 4	990	950

APPENDIX H.2

TOTAL ORGANIC CARBON (TOC) MEASUREMENTS OF SCRUBBER WATER

INCLUDES

H.2.2 Laboratory Data Computer Printout of TOC Results

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-05-186

RECEIVED 05/30/84 07/11/84 10:08:27

REPORT TO: Radian Corporation
Austin
BL 3

ATTEN: Eric Anderson

CLIENT: EPA EMB SAMPLES 37
COMPANY: EPA-EMB
FACILITY:

WORK ID: TOC
TAKEN:
TRANS: EA
TYPE:
P.O. #: 222-078-03-64
INV. #: 3451

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY

CONTACT: KAMAS

SAMPLE IDENTIFICATION

01 SCC-03
02 SCC-04
03 SCC-07
04 SCC-08
05 SCC-21
06 SCC-22
07 SCC-25
08 SCC-26
09 SCC-27
10 SCC-30
11 SCC-31
12 SCC-33
13 SCC-34
14 SCC-35
15 SCC-38
16 SCC-39
17 SCC-42
18 SCC-43
19 SCC-46
20 SCC-47
21 SCC-49

Analytical Serv TEST CODES and NAMES used on this report

TIC Total Inorganic Carbon
TOC Total Organic Carbon

RECEIVED: 05/30/84

Analytical Serv REPORT LAB # 84-05-186
07/11/84 10:08:27

SAMPLE IDENTIFICATION

22 SCC-50
23 SCC-51
24 SCC-62
25 SCC-66
26 SCC-70
27 SCC-73
28 SCC-74
29 SCC-81
30 SCC-84
31 SCC-89
32 SCC-90
33 SCC-92
34 SCC-99
35 SCC-100
36 SCC-101
37 SCC-102

TOC mg/L	56	62	20	75	23

TEST CODE default units	Sample 21 (entered units)	Sample 22 (entered units)	Sample 23 (entered units)	Sample 24 (entered units)	Sample 25 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	50	47	13	1120	1110

TEST CODE default units	Sample 26 (entered units)	Sample 27 (entered units)	Sample 28 (entered units)	Sample 29 (entered units)	Sample 30 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	830	910	930	930	965

TEST CODE default units	Sample 31 (entered units)	Sample 32 (entered units)	Sample 33 (entered units)	Sample 34 (entered units)	Sample 35 (entered units)
TIC mg/L	<1	<1	<1	<1	<1
TOC mg/L	976	1010	950	1000	153

APPENDIX H.3

MAJOR ORGANICS MEASUREMENTS OF SCRUBBER WATER AND EFFLUENT SCRUBBER WATER SOLIDS

INCLUDES

H.3.1 Major Organic Species in the Venturi Scrubber Water Samples
H.3.2 Major Organic Species in the Effluent Scrubber Water Solids

TABLE H.3.1. MAJOR ORGANIC SPECIES IN THE VENTURI SCRUBBER WATER SAMPLES

Compound	Concentration Found μg/l[a]	
	Water to Venturi	Venturi Effluent Water
Phenol	670	870
Creosol	97	200
Methoxy phenol	60	54
C_2-Phenol	46	69
Unknown[b]	75	44
Unknown	60	ND
C_4-Benzene	120	190
C_3-Phenol	106	170
Hydroxy methoxy phenyl ethanone	100	200
Unknown	70	57
Unknown	ND	56

[a]Detection limit 10 ppb
[b]Unknown concentration based on relative response factor

TABLE H.3-2. SUMMARY OF MAJOR ORGANIC SPECIES IN EFFLUENT VENTURI SCRUBBER WATER SOLIDS

Compound	Concentration mg/g
Trichlorobenzaldehyde	2700
C_{20}- Alkane	120
C_{22}- Alkane	120
Unknown	110
Benzo(a)pyrene-d_{12} Spike (40)	29 (73% recovery)

APPENDIX H.4

TOTAL SOLIDS MEASUREMENTS OF SCRUBBER WATER

INCLUDES

H.4.1 Inlet Venturi Scrubber Water
H.4.2 Effluent Venturi Scrubber Water

H.4.1 Inlet Venturi Scrubber Water

TABLE H.4.1. INLET VENTURI SCRUBBER WATER TOTAL SOLIDS MEASUREMENT RESULTS

Date	Time	% Suspended Solids	Dissolved Solids mg/l
5-08-84	1440-1650	0.005	14,700
5-10-84	0820-0945	0.002	12,100
5-10-84	1144-1332	0.003	13,000
5-10-84	1540-1644	0.005	13,800
5-11-84	1112-1230	0.011	14,200

H.4.2 Effluent Venturi Scrubber Water

TABLE H.4.2 EFFLUENT VENTURI SCRUBBER WATER TOTAL SOLIDS MEASUREMENT RESULTS

Date	Time	% Suspended Solids	Dissolved Solids mg/l
5-08-84	1445-1655	0.197	15,000
5-10-84	0825-0950	0.086	12,300
5-10-84	1148-1336	0.077	13,400
5-10-84	1545-1647	0.096	14,200
5-11-84	1116-1232	0.104	14,100

APPENDIX H.4

TOTAL SOLIDS MEASUREMENTS OF SCRUBBER WATER

INCLUDES

H.4.3 Total Solids Data Sheets

Composite Sample (run/date)	TSS					TDS			
	Filter Wt. (g) F_I	Filter + Residue Wt. (g) F_S	Sample Volume-Wt. (ml/g) Beaker Tare (g) V_I	Sample Volume-Wt. (ml/g) Beaker Sample Wt. V_S	Conc. (g/ml) $\frac{F_S-F_I}{V_S-V_I}$	Aliquot (ml) A	Beaker Tare (g) F_I	Beaker + Residue Wt. (g) F_S	Conc. ~~(g/ml)~~ $\frac{F_S-F_I}{A} \times 10^6 = mg/l$
Toc-1 Outlet 050884	3.07	5.73	273.8	779.3		50 (1)	51.6278	52.3782	15,008
			1433	~~449.3~~	0.197				
				728.2		50 (2)	51.2119	51.9578	14,918
				746.9					
			(709.5 1352.5 463.3)	(1369.3 1156.0)					
Toc-1 Inlet 050884	3.14	3.19	161.7	498.7		50 (3)	49.2156	49.9532	14,792
			903.8	449.3					
				440.9	0.005	50 (4)	51.1408	51.8729	14,642
			(1020.2)	872.4 (1892.6)					

Composite Sample (run/date)	TSS					TDS			
	Filter Wt. (g) F_I	Filter + Residue Wt. (g) F_S	Sample Volume-Wt. (ml/g) Beaker Tare (g) V_I	Sample Volume-Wt. (ml/g) Beaker + Sample Wt. V_S	Conc. (g/ml) $\frac{F_S-F_I}{V_S-V_I}$	Aliquot (ml) A	Beaker Tare (g) F_I	Beaker + Residue Wt. (g) F_S	Conc. (g/ml) $\frac{F_S-F_I}{A}$
TOC-2/051084 INLET	3.14	3.15	450.2	1004.4	0.002	50	(5) 51.6585	52.2622	12,074
TOC-2/051084 OUTLET	3.18	3.96	450.6	1353.8	0.086	50	(6) 51.3605	51.9776	12,342

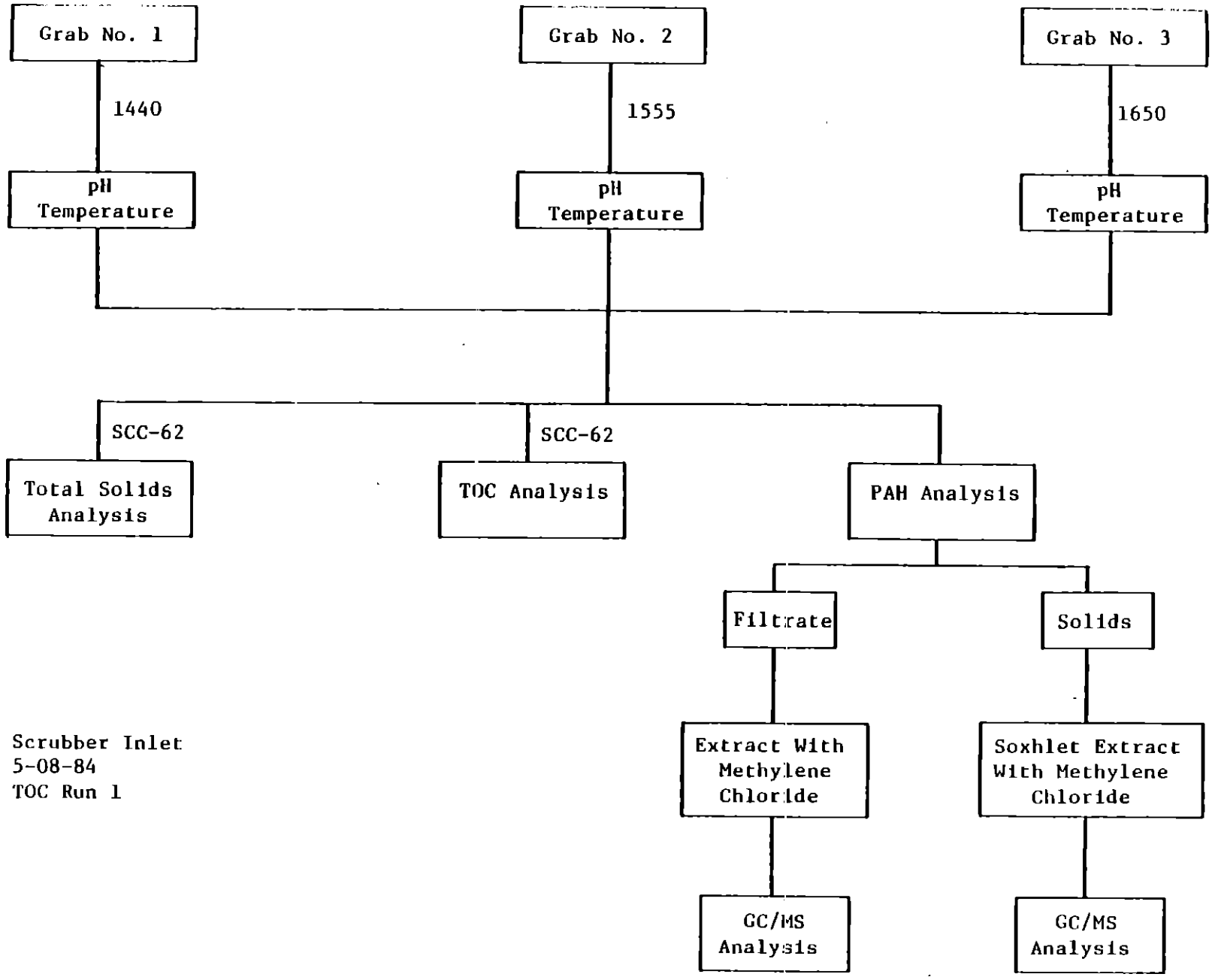
Composite Sample (run/date)	TSS					TDS			
	Filter Wt. (g) F_I	Filter + Residue Wt. (g) F_s	Sample Volume-Wt. (ml/g) Beaker Tare (g) V_I	Sample Volume-Wt. (ml/g) Beaker + Sample Wt. V_s	Conc. (g/ml) $\frac{F_s-F_I}{V_s-V_I}$	Aliquot (ml) A	Beaker Tare (g) F_I	Beaker + Residue Wt. (g) F_s	Conc. (g/ml) $\frac{F_s-F_I}{A}$
TOC-3/051084 INLET	3.13	3.15	447.1	1044.8	0.003	50	(7)51.1351	51.7866	13,030
TOC-3/051084 OUTLET	3.14	3.87	448.4	1392.1	0.077	50	(8)51.4292	52.1003	13,422

Composite Sample (run/date)	TSS					TDS			
	Filter Wt. (g) F_I	Filter + Residue Wt. (g) F_B	Sample Volume-Wt. (ml/g) Beaker Tare (g) V_I	Sample Volume-Wt. (ml/g) Beaker + Sample Wt. V_B	Conc. ~~(g/ml)~~ $\frac{F_B - F_I}{V_B - V_I}$ %	Aliquot (ml) A	Beaker Tare (g) F_I	Beaker + Residue Wt. (g) F_S	Conc. (g/ml) $\frac{F_B - F_I}{A}$
TOC-4/051084 INLET	3.27	3.30	450.2	1065.3	0.005	50	(9) 51.4609	52.1520	13,822
TOC-4/051084 OUTLET	3.23	4.14	451.7	1399.6	0.096	50	(10) 51.5785	52.2881	14,192

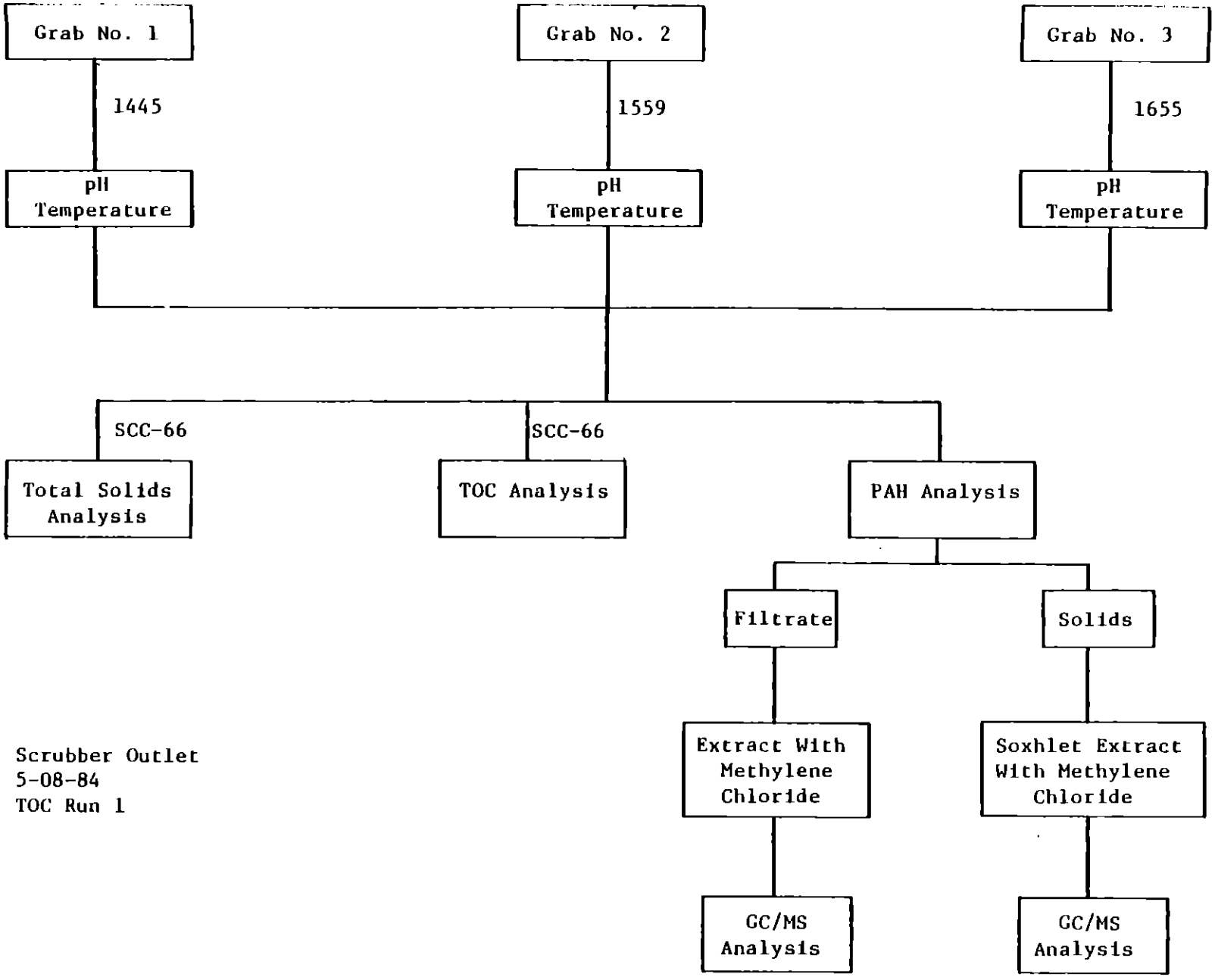
Composite Sample (run/date)	TSS					TDS			
	Filter Wt. (g) F_I	Filter + Residue Wt. (g) F_S	Sample Volume-Wt. (ml/g) Beaker Tare (g) V_I	Sample Volume-Wt. (ml/g) Beaker + Sample Wt. V_S	Conc. ~~(g/ml)~~ $\frac{F_S-F_I}{V_S-V_I}$ %	Aliquot (ml) A	Beaker Tare (g) F_I	Beaker + Residue Wt. (g) F_S	Conc. ~~(g/ml)~~ $\frac{F_S-F_I}{A}$ $\frac{mg}{l}$
PAH-1/051184 INLET	3.24	3.30	449.7	994.7	0.011	50	51.6415	52.3492	14,154
PAH-1/051184 OUTLET	3.29	4.26	451.3	1383.5	0.104	50	51.2080	51.9142	14,124

APPENDIX H.5

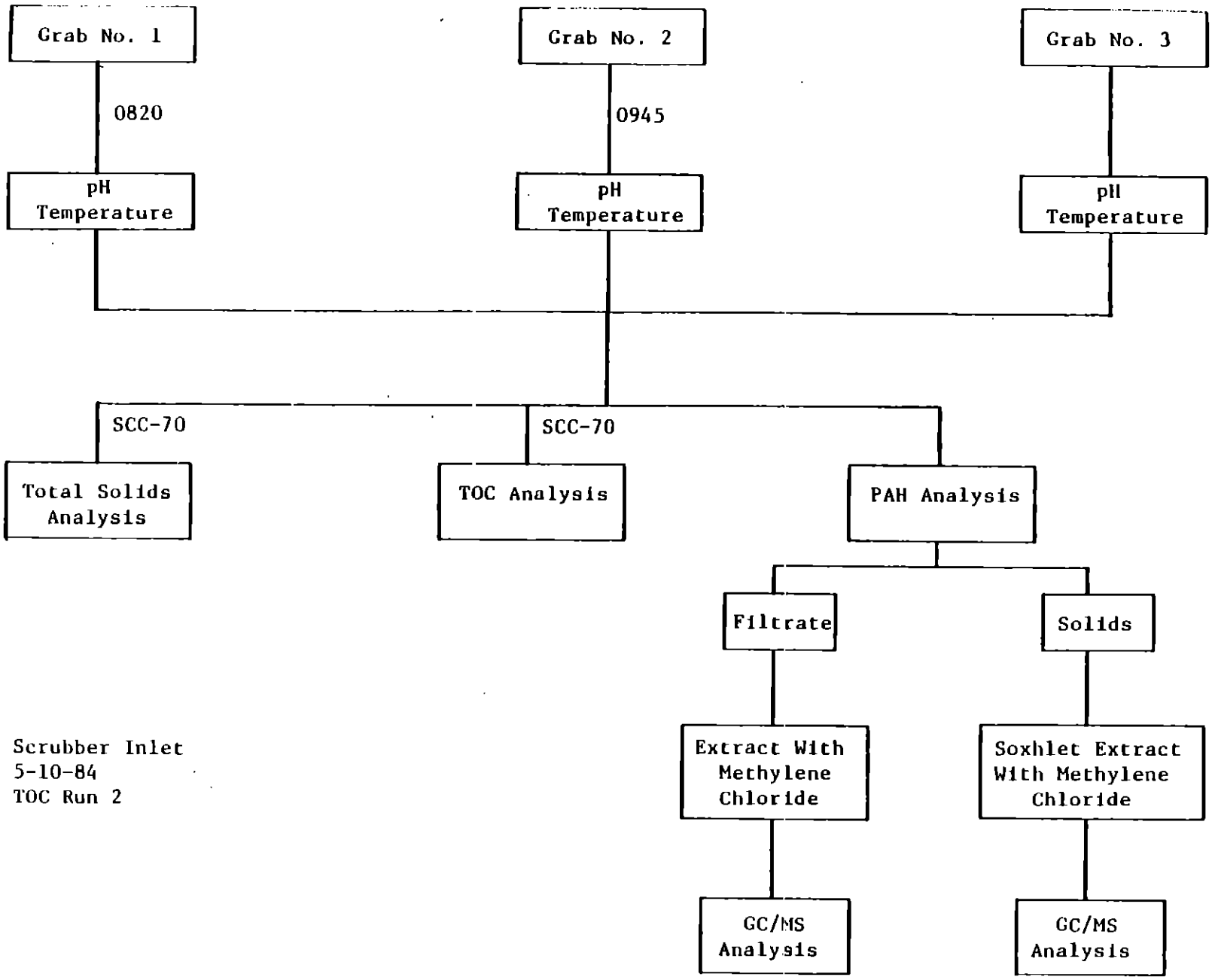
ANALYTICAL TEST MATRICES FOR SCRUBBER WATER SAMPLES



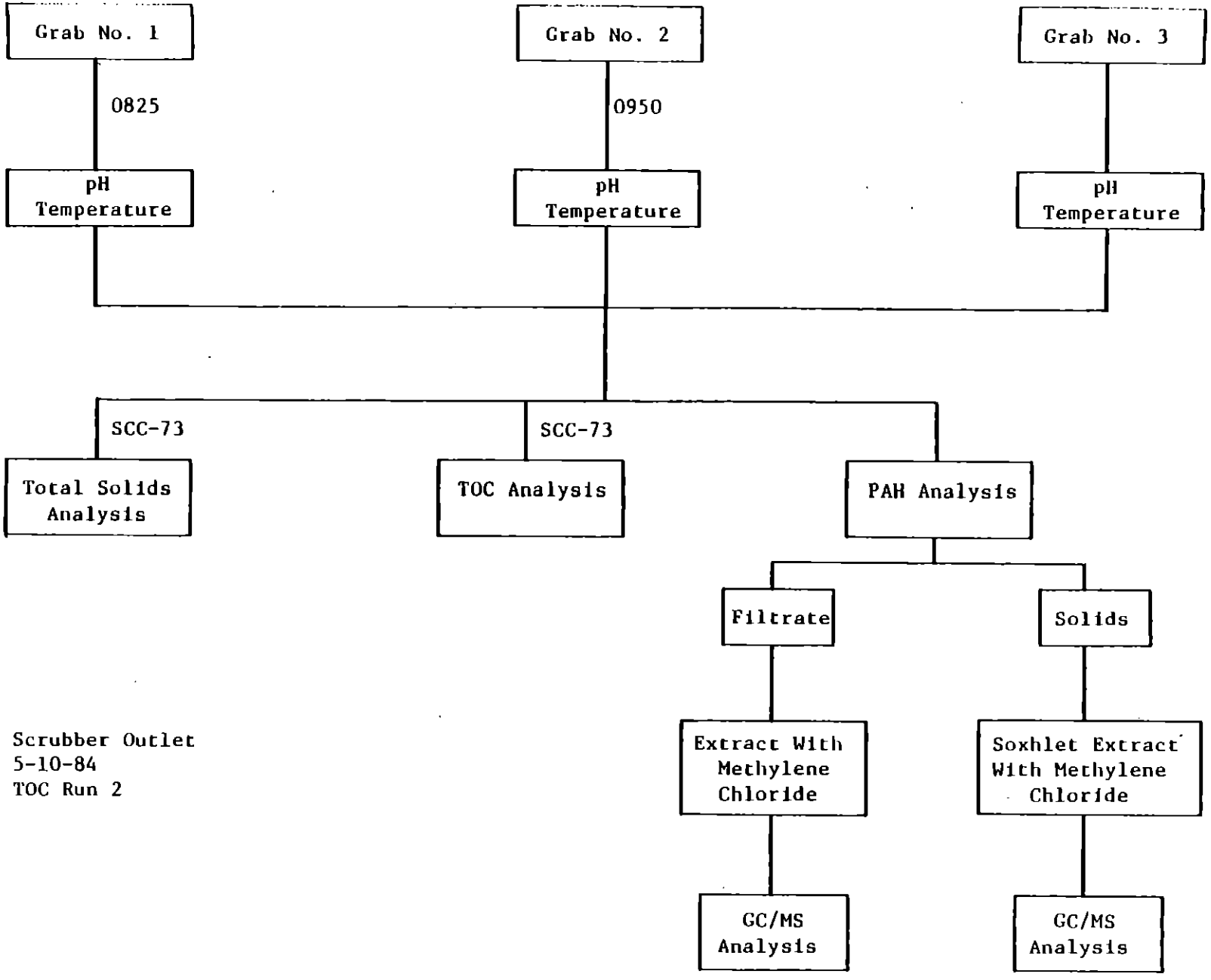
Scrubber Inlet
5-08-84
TOC Run 1



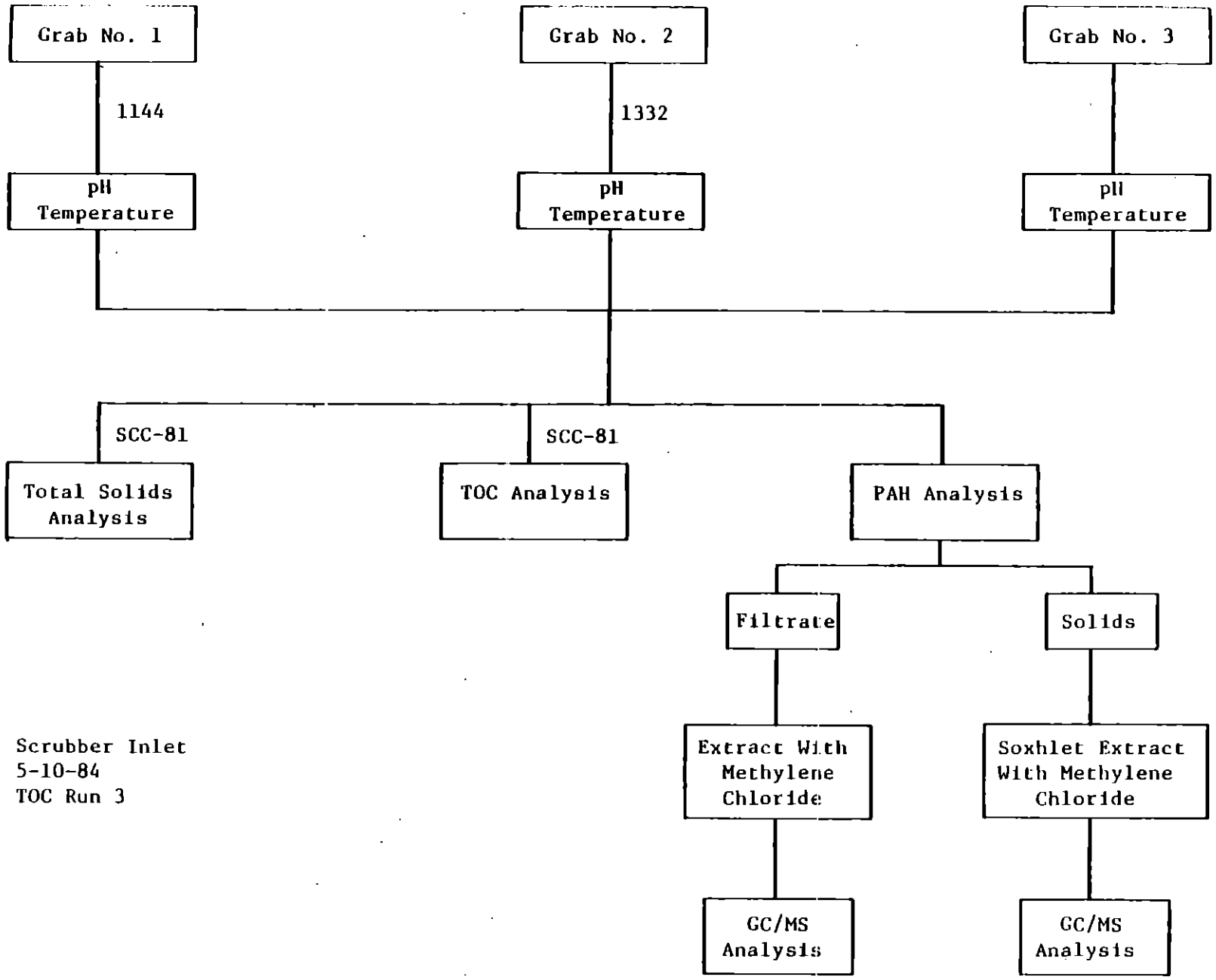
Scrubber Outlet
5-08-84
TOC Run 1



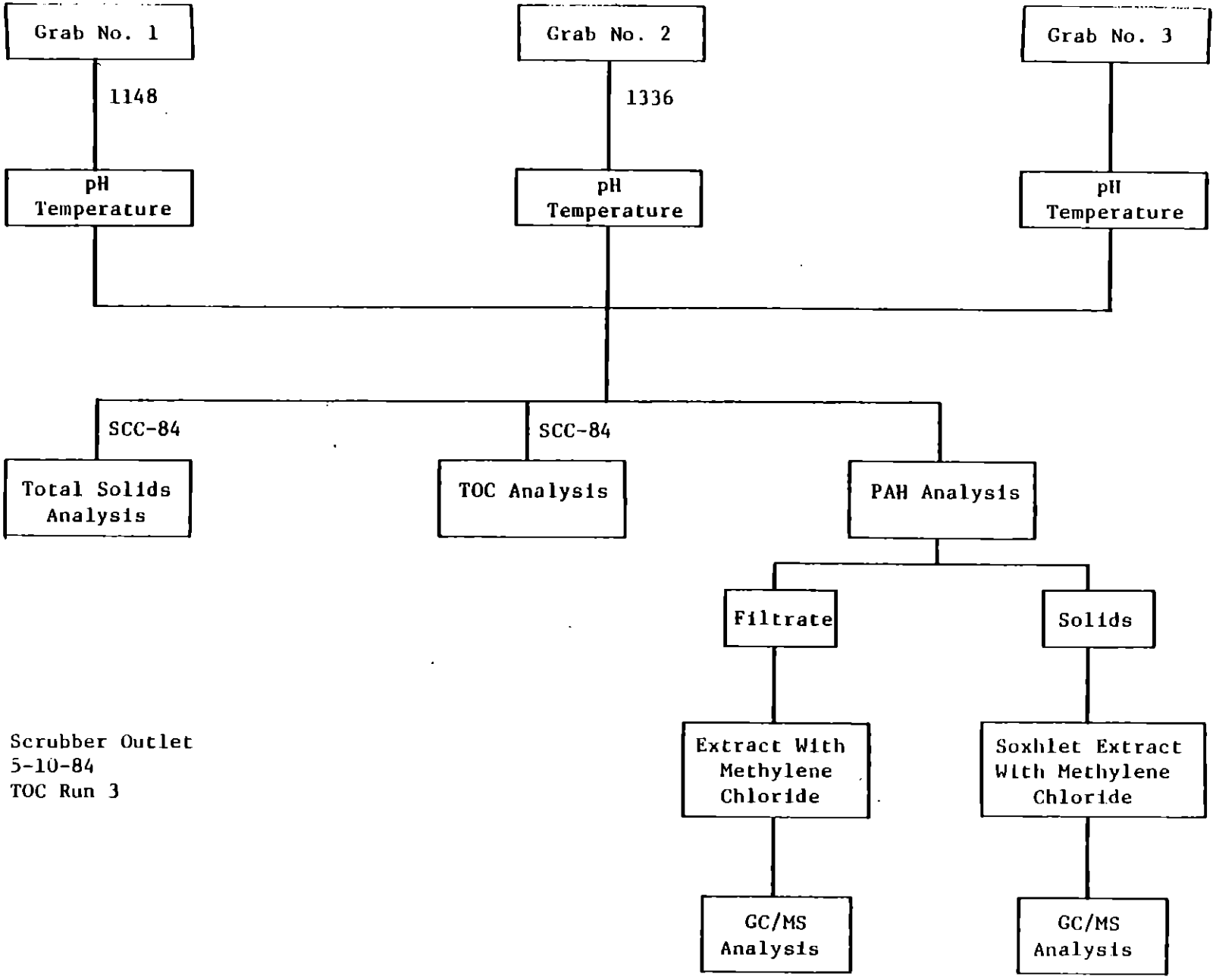
Scrubber Inlet
5-10-84
TOC Run 2



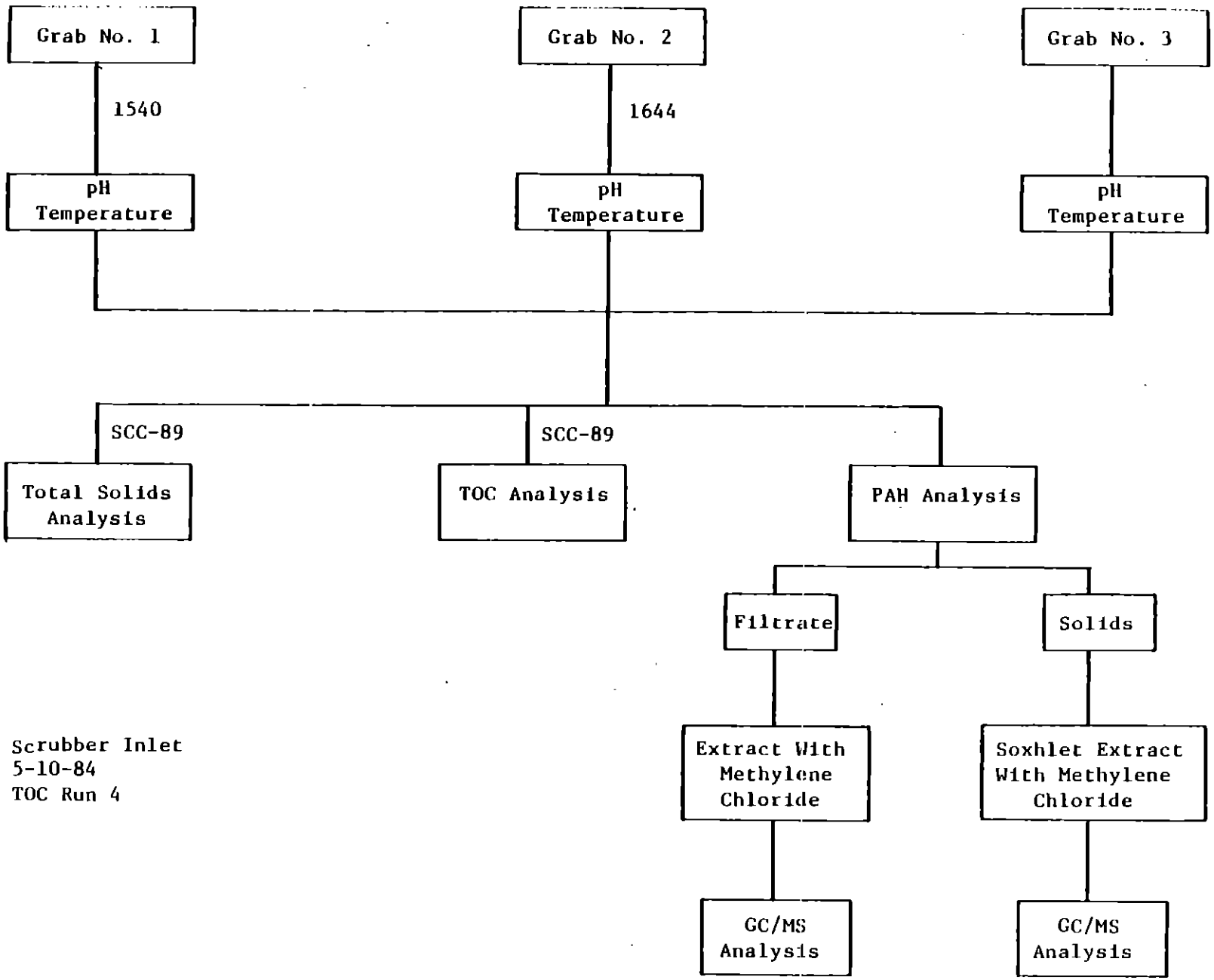
Scrubber Outlet
5-10-84
TOC Run 2



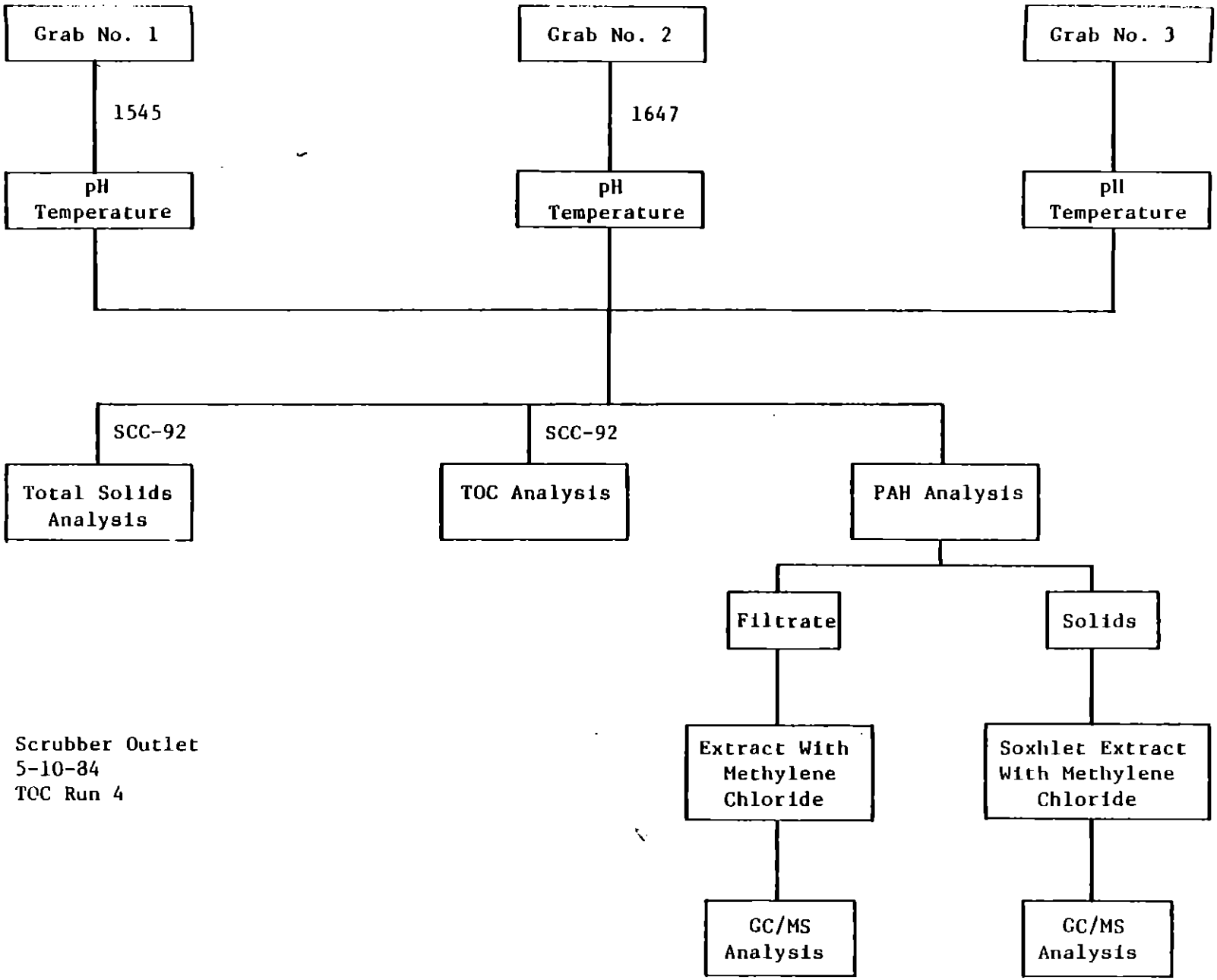
Scrubber Inlet
5-10-84
TOC Run 3



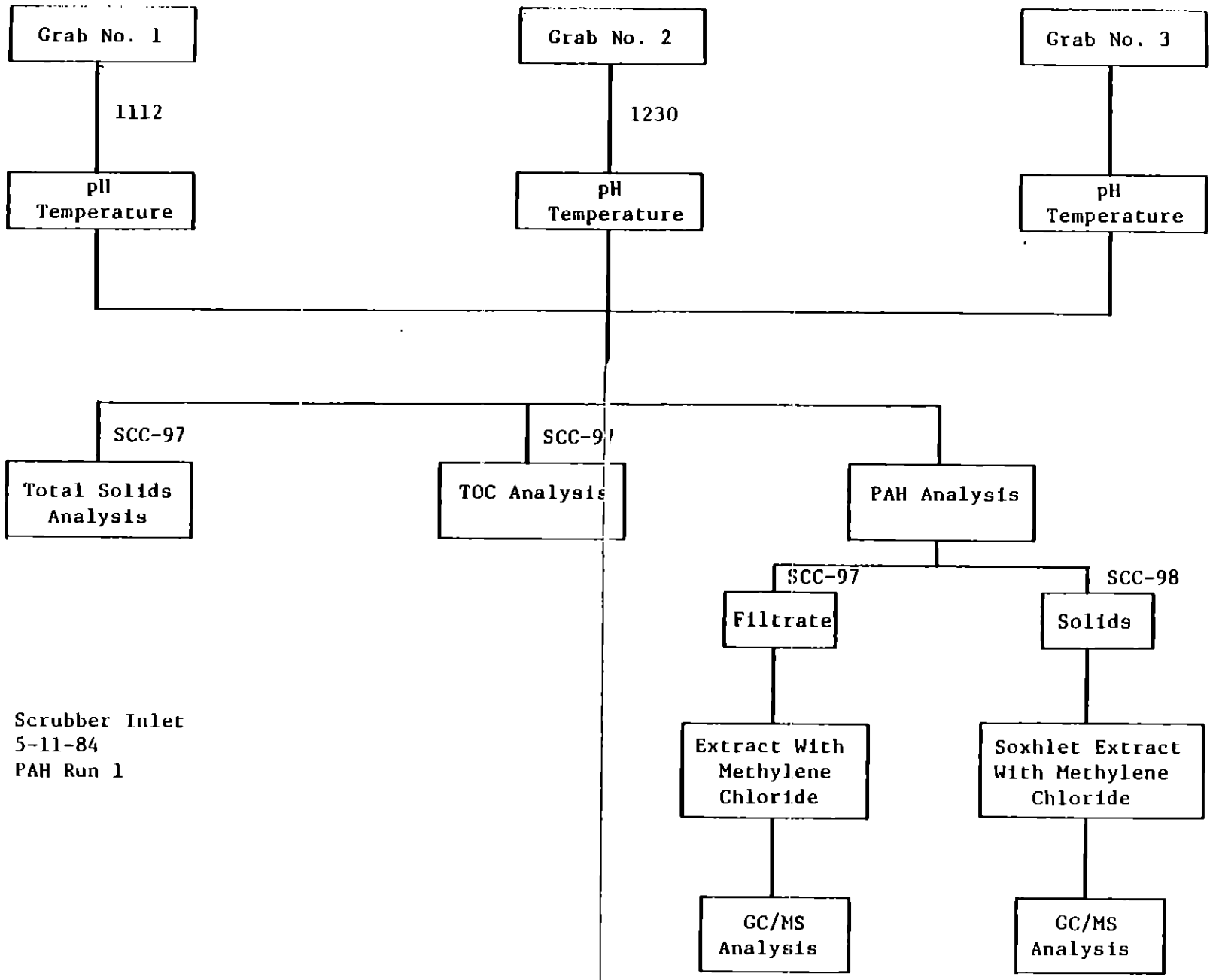
Scrubber Outlet
5-10-84
TOC Run 3



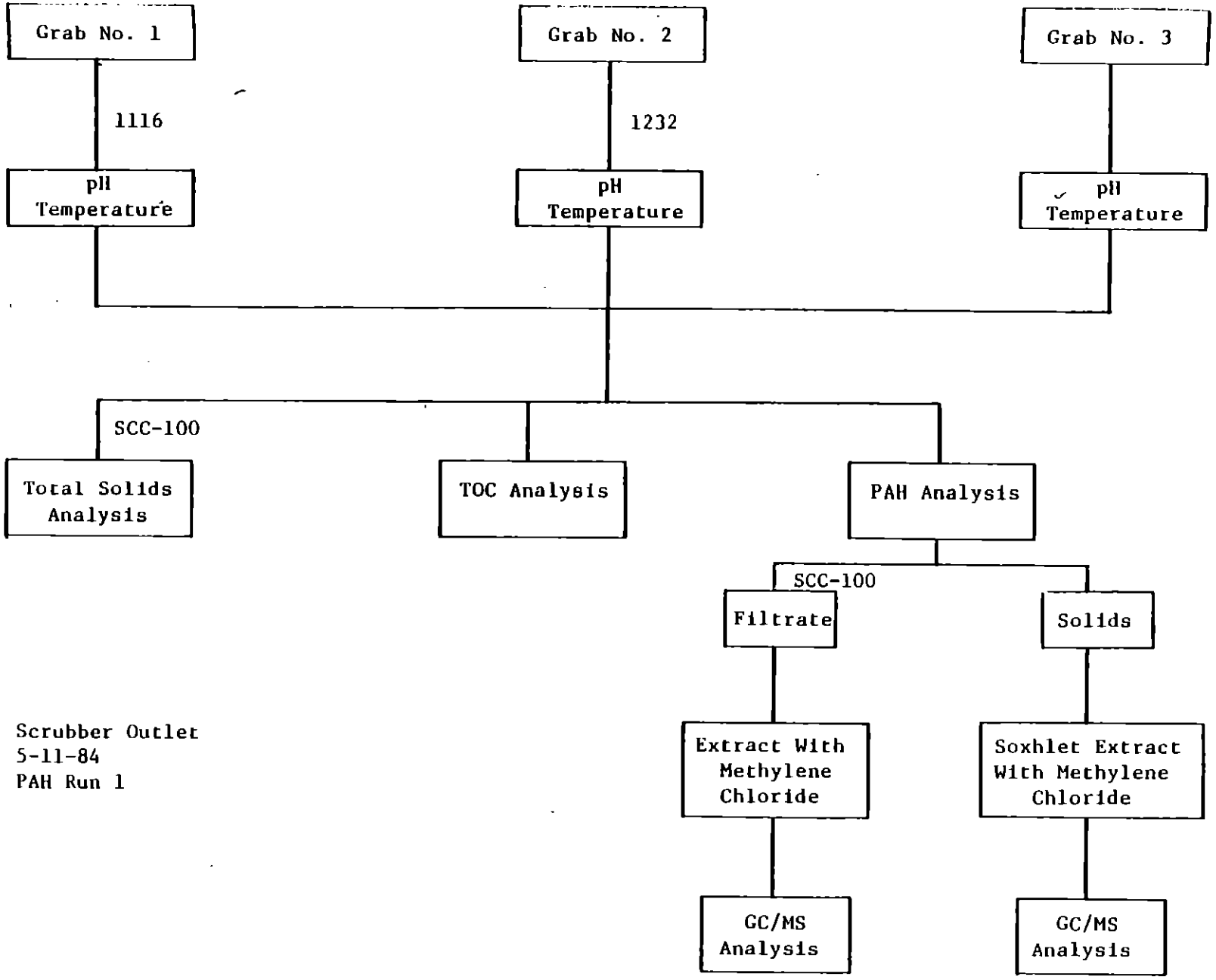
Scrubber Inlet
5-10-84
TOC Run 4



Scrubber Outlet
5-10-84
TOC Run 4



Scrubber Inlet
5-11-84
PAH Run 1



Scrubber Outlet
5-11-84
PAH Run 1

APPENDIX H.6

SAMPLE IDENTIFICATION AND SAMPLING LOGS
FOR SCRUBBER WATER SAMPLES

INCLUDES

H.6.1 Sampling Logs
H.6.2 Sample Identification Log

H.6.1 Sampling Logs of Scrubber Water Samples Collection Time

TABLE H.6.1A. INLET VENTURI SCRUBBER WATER

Date	Time
5-08-84	1440
	1555
	1650
5-10-84	0820
	0945
	1144
	1332
	1540
	1644
5-11-84	1112
	1230

TABLE H.6.1B. EFFLUENT VENTURI SCRUBBER WATER

Date	Time
5-08-84	1445
	1559
	1655
5-10-84	0825
	0950
	1148
	1336
	1545
	1647
5-11-84	1116
	1232

H.6.2 Sample Identification Log

RAD-CODE	RUN #	SAMPLE I.D.	REMARK
SCC-62	In-01	TOC-1-0508	Scrubber H_2O filtrate
SCC-63			Scrubber solids
SCC-64			TDS solids
SCC-65			TDS solids duplicate
SCC-66	Out-01	TOC-1-0508	Scrubber H_2O filtrate
SCC-67			Scrubber solids
SCC-68			TDS solids
SCC-69			TDS solids duplicate
SCC-70	In-02	TOC-2-0510	Scrubber H_2O filtrate
SCC-71			Scrubber solids
SCC-72			TDS solids
SCC-73	Out-02	TOC-2-0510	Scrubber H_2O filtrate
SCC-74			Scrubber solids
SCC-75			TDS solids
SCC-81	In-03	TOC-3-0510	Scrubber H_2O filtrate
SCC-82			Scrubber solids
SCC-83			TDS solids
SCC-84	Out-03	TOC-3-0510	Scrubber H_2O filtrate
SCC-85			Scrubber solids
SCC-86			TDS solids
SCC-89	In-04	TOC-4-0510	Scrubber H_2O filtrate
SCC-90			Scrubber solids
SCC-91			TDS solids
SCC-92	Out-04	TOC-4-0510	Scrubber H_2O filtrate
SCC-93			Scrubber solids
SCC-94			TDS solids
SCC-97	In-01	PAH-1-0511	Scrubber H_2O filtrate
SCC-98			Scrubber solids
SCC-99			TDS solids
SCC-100	Out-01	PAH-1-0511	Scrubber H_2O filtrate
SCC-101			Scrubber solids
SCC-102			TDS solids

APPENDIX H.7

CALIBRATION CERTIFICATION OF SIGNET FLOSENSOR

FSSI FERGUSON SERVICE SYSTEMS INC.

May 8, 1984

Radian Corporation
POB 9948
Austin, TX 78766

ATTN: ERIC ANDERSON

Gentlemen:

This is to certify that we have recalibrated the following:

Re: Your PO#H22254
1 - MK 575 (S) 307125 at 0-500 gpm for 3" Iron fitting
IR8S030

60Hz = 252.6 gpm
Input Bogey (K) = 14.254
(A) = 4.209
(B) = .2376

Chart attached explaining figures.

Please advise if you need additional information.

Sincerely,

Joyce Furstenfeld

Joyce Furstenfeld,
Technician

Sworn to and subscribed before me on this 8th day of May, 1984,

Norma Wanick
Notary Public in and for State of Texas

My commission expires: 3/25/85

OFFICE: TX 77[illegible] • [illegible] • HOUSTON (713) 353-6518 • TLX 77-4147 • DALLAS [illegible]

EXPLANATION OF THE SIGNET CALIBRATION CHART

The new Signet Calibration Chart is keyed by PART NUMBER. The charts are grouped by fitting family (i.e., Bronze Tees, etc.). Separate data is provided for each specific fitting. Simply look up the part number to find the calibration data for that particular fitting.

The following is a brief explanation of each column heading:

COLUMN HEADING	UNITS	EQUATION	DESCRIPTION
Part Number			Standard Signet part number.
Pipe Size			Nominal pipe size.
Pipe Schedule			Pipe Schedule
Actual I.D.			Actual inside diameter of the pipe.
K Gallon	Pulses/Gallon	$KG = Z/d^2$	Gallon Bogey: This is the number of pulses produced by the sensor per gallon of flow.
K Liter	Pulses/Liter	KL = KG/3.785	Liter Bogey: This is the number of pulses generated by the sensor per liter of flow.
A Gallon	GPM/Hz	AG = KG/60	"AG" is the GPM per Hz, where Hz is the transducer frequency. Multiplying "AG" by the transducer frequency gives the correct gallon meter reading for that frequency.

. . . . . Continued

Explan ion of the
Signet Calibration
Chart - Page 2.

COLUMN HEADING	UNITS	EQUATION	DESCRIPTION
A Liter	LPM/Hz	AL = KL/60	"AL" is the LPM per Hz, where Hz is the transducer frequency. Multiplying "AL" by the transducer frequency gives the correct liter meter reading for that frequency.
T Gallon	GPM/60 Hz	TG = 60/BG	"TG" is the GPM rate for a 60 Hz sensor frequency.
T Liter	LPM/60 Hz	TL = 60/BL	"TL" is the LPM rate for a 60 Hz sensor frequency.
B Gallon	SecPG/60 Hz	BG = 1/AG	This number expresses the time, in seconds, between increments of a volume counter for a 60 Hz sensor frequency.
B Liter	SecPL/60 Hz	BL = 1/AL	This number expresses the time, in seconds, between increments of a volume counter for a 60 Hz sensor frequency.
Z		Z = (Pulses/ Gallon) d^2	"Z" is primarily used in engineering purposes in generating other data values.

	Typical Unit	Formula	Definition
ID	INCH		The internal diameter of a specified pipe size.
Z		Z = f (ID)	A Constant which is function of ID. and is used to determine K. Its units are pulses/length which is equivalent to freq/velocity. If Z is divided by 24.5, it gives frequency per local velocity.
Z1			Corrected Z due to mounting SK 80 "Fittings" on SK 40 Pipe.
K	Puls/Gal	$Z/(ID)^2$	Specified number of pulses produced for one gallon of flow.
A	GPM/Hz	A = 60/K	The ratio of flow rate to frequency produced. A * f = GPM
B	Hz/GPM	B = 1/A	The ratio of frequency produced to flow rate. Also time in seconds for 1-gallon with 60 Hz in. B * FS = max. freq.
T	GPM/60Hz	T = 60 * A	Flow rate at 60-Hz frequency Also counts per minute (on accumulator) with 60 Hz in
T1	GPM/100Hz	T1=100 * A	Flow rate of 100-Hz frequency (use MK 504 internal frequency)
T2	GPM/F (in)	T2 = F (in) * A	Flow rate at F (in) frequency (use MK 577 internal frequency) approx. 81 Hz.
FS	GPM	approx. $50(SIZE)^2$	Max. flow rate for specified pipe size (F.S. velocity≈20 fps)
J	Hz	J = FS * B	Frequency at nominal full scale
LT	GPM		Lower threshold flow rate (MK 577)
EC	Volt		Approximate calibration voltage setting (MK 577)
N		N=K, N=10*K N= 100*K	Calibration switch setting (MK 504) N should usually be > 100
N1			Frequency prescale switch setting (MK 577)
DP			Decimal point setting (MK 504 and MK 577)
%QE			Error due to quantization (MK 577)

APPENDIX I

QUALITY ASSURANCE

INCLUDES

I.1 Source Sampling Quality Control
- I.1.1 Summary of Source Sampling Equipment Used during Testing
- I.1.2 Source Sampling Equipment Calibration
- I.1.3 Pretest Cleaning Procedure
- I.1.4 Source Sampling Quality Assurance Protocol
- I.1.5 Source Sampling Data Reduction Verification

I.2 Process Monitoring and Sample Collection
- I.2.1 Process Monitoring Quality Control
- I.2.2 Process Sample Collection Quality Control

I.3 Sample Analysis Quality Control
- I.3.1 Particulate Mass Determination
- I.3.2 Total Organic Carbon (TOC) Analysis Quality Control
- I.3.3 Polynuclear Aromatic Hydrocarbon (PAH) and Major Organics Analytical Quality Control
- I.3.4 Particle Size Distribution
- I.3.5 Venturi Scrubber Water Analytical Quality Control
- I.3.6 Virgin Aggregate, Recycle Asphalt Pavement, and Asphalt Cement Analytical Quality Control
- I.3.7 Data Reduction Validation

APPENDIX I.1

SOURCE SAMPLING QUALITY CONTROL

INCLUDES

I.1.1 Summary of Source Sampling Equipment Used during Testing

I.1 Source Sampling Quality Control

I.1.1 Summary of Source Sampling Equipment Used during Sampling

Table I.1.1 presents a summary of calibrated field equipment used during the Sloan Construction Company asphalt plant testing program. The number designations listed in the table correspond to the calibration forms presented in Section I.1.2.

TABLE I.1.1. SUMMARY OF CALIBRATED FIELD EQUIPMENT USED DURING TESTING

Date	Run #	Location	Dry Gas Meter (DGM)	Pitot	Nozzle	DGM Temperature Inlet/Outlet	Gas Stream Temperature	Stack Temperature	ΔP Magnehelic®	ΔH Magnehelic®
5-08	TOC-01	Inlet Outlet	D-548 R31-520	D-231 P-004	NZ-118 NZ-023	TC-001/TC-002 TC-003/TC-004	TCJ-1 TCJ-2	TC101 TCK-04	R00730CF9 71025MN50	R00728RB18 70809KR38
5-10	TOC-02	Inlet Outlet	D-548 R31-520	D-231 P-004	NZ-118 NZ-023	TC-001/TC-002 TC-003/TC-004	TCJ-1 TCJ-2	TC101 TCK-04	R00730CF9 71025MN50	R00728RB18 70809KR38
5-10	TOC-03	Inlet Outlet	D-548 R31-520	D-231 P-004	NZ-118 NZ-023	TC-001/TC-002 TC-003/TC-004	TCJ-1 TCJ-2	TC101 TCK-04	R00730CF9 74025MN50	R00728RB18 70809KR38
5-10	TOC-04	Inlet Outlet	D-548 R31-520	D-231 P-004	NZ-118 NZ-023	TC-001/TC-002 TC-003/TC-004	TCJ-1 TCJ-2	TC101 TCK-04	R00730CF9 71025MN50	R00728RB18 70809KR38
5-11	PAH-01	Inlet Outlet	D-548 R31-520	D-231 P-004	NZ-118 NZ-111	TC-001/TC-002 TC-003/TC-004	TCJ-1 TCJ-2	TC101 TCK-04	R00730CF9 71025MN50	R00728RB18 70809KR38
5-10	PSD-01	Inlet	D-548	--	NZ-A02	TC-001/TC-002	--	--	--	R00728RB18
5-11	PSD-02	Inlet	D-548	--	NZ-A02	TC-001/TC-002	--	--	--	R00728RB18
	wet bulb/ dry bulb		--	--	--	--	--	TCK-01/ TCK-02	--	--

APPENDIX I.1

SOURCE SAMPLING QUALITY CONTROL

INCLUDES

I.1.2 Source Sampling Equipment Calibration
- I.1.2.1 S-Type Pitot Certification
- I.1.2.2 Orifice and Dry Gas Meter System Calibration
- I.1.2.3 Differential Pressure Gauge Certification
- I.1.2.4 Temperature Measuring Device Certification
- I.1.2.5 Sampling Nozzle Certification

APPENDIX I.1.2

SOURCE SAMPLING EQUIPMENT CALIBRATION

INCLUDES

I.1.2.1 S-Type Pitot Certification

TYPE S PITOT TUBE INSPECTION DATA FORM Pitot P-004

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

α_1 = 3.0 ° (<10°), α_2 = 2.0 ° (<10°), β_1 = 1.0 ° (<5°),
β_2 = 2.0 ° (<5°)

γ = 1.0 °, θ = 1.0 °, A = .924 cm (in.)

z = A sin γ = .0161 cm (in.); <0.32 cm (<1/8 in.),
w = A sin θ = .0161 cm (in.); <.08 cm (<1/32 in.)

P_A .461 cm (in.) P_b .463 cm (in.)

D_t = .372 cm (in.)

Comments: _____

Calibration required? _____ yes ✓ no

Quality Assurance Handbook M2-1.7

ITEM: 31-674X-B / STANDARD DETACHABLE PITOT / D-231 / 5/4/84
PART NO. DESCRIPTION SERIAL NO. DATE

SOLD TO: RADIAN CORP / H 22429 / 7022 / 5/4/84
COMPANY P.O. NO. S.O. NO. DATE

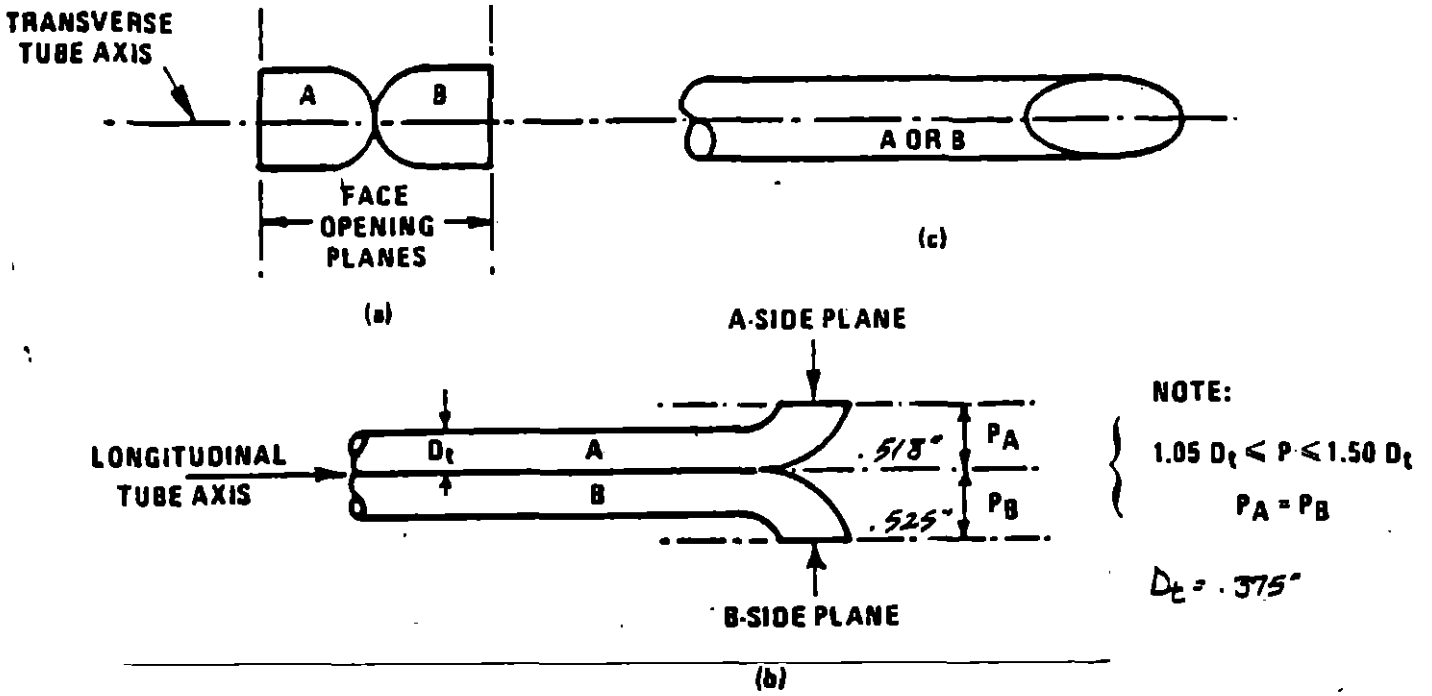
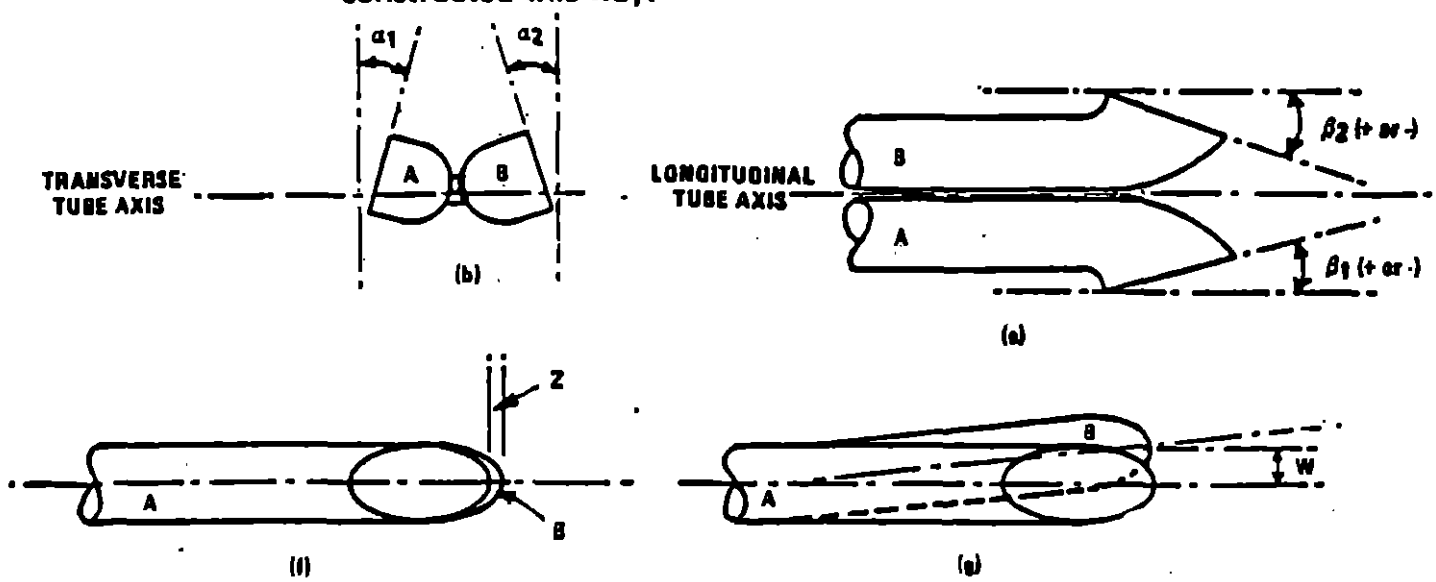


Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.



a_1 0° LESS THAN 10°
a_2 +1°
z 0" LESS THAN .32cm (1/8")

a_1 0° LESS THAN 5°
b_2 0°
w 0" LESS THAN .08cm (1/32")

Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of $\bar{C}p(s)$ so long as α_1 and $\alpha_2 < 10°$, β_1 and $\beta_2 < 5°$, $z < 0.32$ cm (1/8 in.) and $w <$ 0.08 cm (1/32 in.) (citation 11 in Section 6).

ITEM: 3-679X-B / STANDARD DETACHABLE PITOT / D-231 / 9/4/84

PART NO. DESCRIPTION SERIAL NO. DATE

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COMPANY P.O. NO. S.O. NO. DATE

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (*e.g.*, stainless steel). It is recommended that the external tubing diameter (dimension D_t, Figure 2-2b) be between 0.48 and 0.95 centimeters (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B, Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-2).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

4. *Calibration*

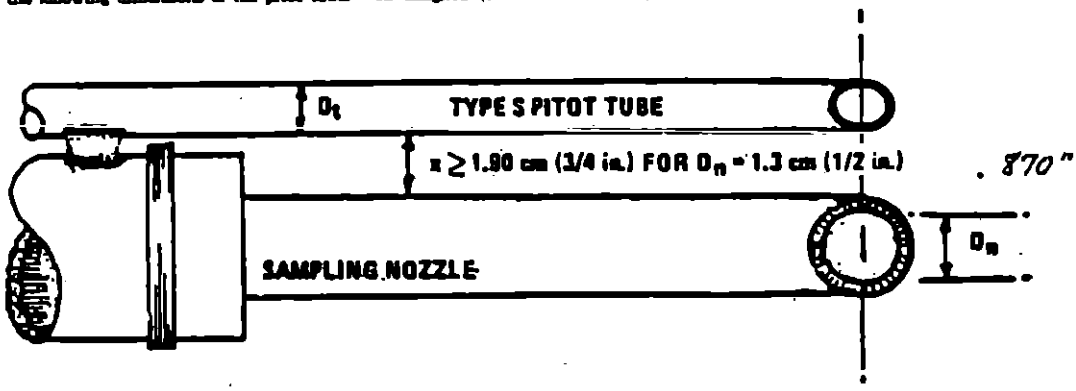
4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.) and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1).

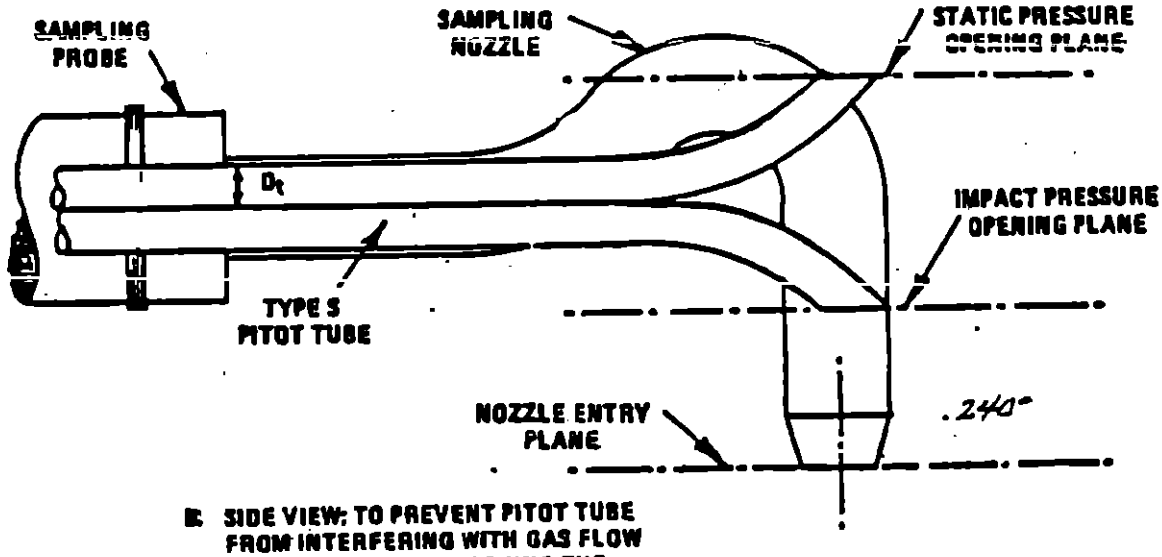
If D_t, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in 4.1.2 through 4.1.5 below.

4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-4 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-4 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE.—Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).



A. BOTTOM VIEW; SHOWING MINIMUM PITOT-NOZZLE SEPARATION.



B. SIDE VIEW; TO PREVENT PITOT TUBE FROM INTERFERING WITH GAS FLOW STREAMLINES APPROACHING THE NOZZLE, THE IMPACT PRESSURE OPENING PLANE OF THE PITOT TUBE SHALL BE EVEN WITH OR ABOVE THE NOZZLE ENTRY PLANE.

Figure 2-6. Proper pitot tube - sampling nozzle configuration to prevent aerodynamic interference; buttonhook - type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

ITEM: 3-674X-B / STANDARD DETACHABLE PITOT / D-231 / 5/4/84
PART NO. DESCRIPTION SERIAL NO. DATE

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COMPANY P.O. NO. S.O. NO. DATE

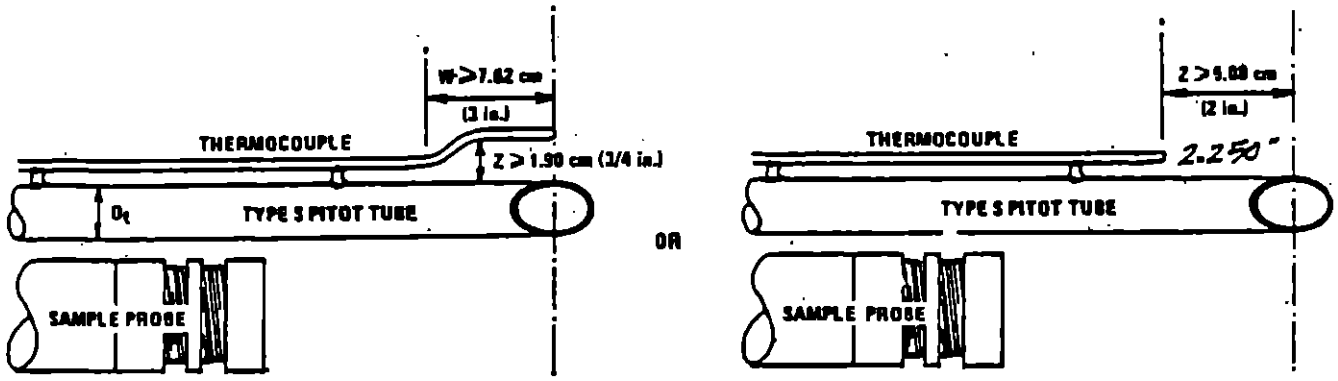


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

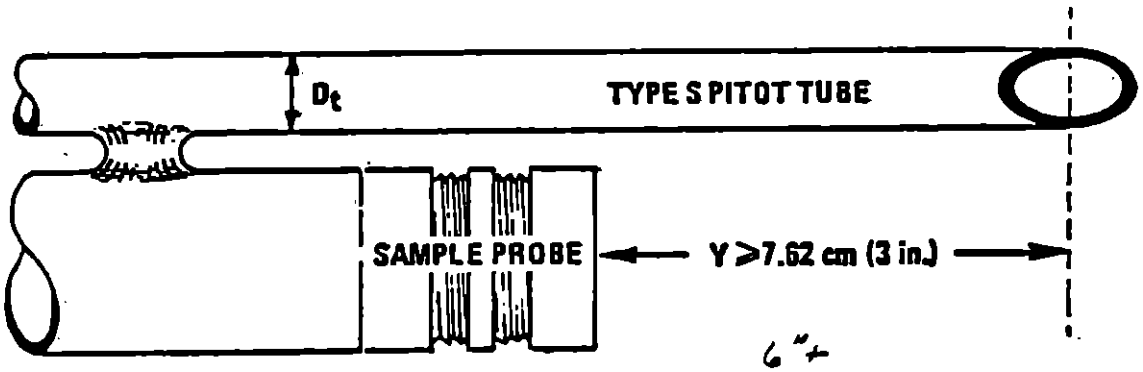


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figure 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.

APPENDIX I.1.2

SOURCE SAMPLING EQUIPMENT CALIBRATION

INCLUDES

I.1.2.2 Orifice and Dry Gas Meter System Certification

DRY GAS METER CALIBRATION DATA

Date 2-9-84 Calibrated by Ken Fahrenbach Meter or Console No. R31-520

Barometric pressure, P_b = 29.50 in. Hg Wet Test Meter No. 14AM2 # 5997

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH) (in. H_2O)	Gas Volumes (ft^3)						Temperature °F								Elapsed Time (min) (θ)	Vacuum (2-4 in. Hg)
		Wet Test Meter			Dry Gas Meter			Wet Test Meter			Dry Gas Meter						
											Inlet		Outlet				
		Initial	Final	Delta (V_{std})	Initial	Final	Delta (V_{test})	Initial	Final	Ave (T_{std})	Initial	Final	Initial	Final	Ave (T_{test})		
.217	.15	0	1.992	1.992	806.926	808.778	2.122	73	73	73	83	85	83	84	83.75	10	2
.402	.40	0	5.582	5.582	810.100	816.133	6.033	73	73	73	88	91	88	88	88.75	15	2
.620	1.00	0	5.700	5.700	817.400	823.558	6.158	73	73	73	93	95	89	89	91.5	10	2
.810	1.70	0	7.461	7.461	834.010	842.060	8.050	73	73	73	93	98	89	90	92.5	10	3
1.000	3.40	0	5.135	5.135	844.500	849.985	5.485	73	73	73	94	94	90	90	92	5	3
1.150	3.75	0	5.400	5.400	852.300	858.049	5.749	73	73	73	98	101	91	92	95.5	5	3.5

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH)	$Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$	$\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$
.217	.15	0.9573	2.1223
.402	.40	0.9516	1.6069
.600	1.00	0.9554	1.7037
.810	1.70	0.9567	1.6874
1.000	3.40	0.9614	1.7828
1.150	3.75	0.9699	1.7668
Average		Y = 0.9587	ΔH@ = 1.7783

Method 5 Acceptance Criteria

1) $Y_i = Y \pm 0.02Y$
2) $\Delta H@_i = \Delta H@ \pm 0.15\ \Delta H@$ (recommended)
3) $\Delta H@ = 1.84 \pm 0.25$ (recommended)
4) Calibration vacuum maintained at 2-4 in. Hg

DRY GAS METER CALIBRATION DATA

Date 04 25 84 Calibrated by Cliff Thirion Meter or Console No. R 31-520

Barometric pressure, P_b = 29.50 in. Hg Wet Test Meter No. 14AM2

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH) (in. H_2O)	Gas Volumes (ft^3)						Temperature °F								Elapsed Time (min) (θ)	Vacuum (2-4 in. Hg)
		Wet Test Meter			Dry Gas Meter			Wet Test Meter			Dry Gas Meter						
											Inlet		Outlet				
		Initial	Final	Delta (V_{std})	Initial	Final	Delta (V_{test})	Initial	Final	Ave (T_{std})	Initial	Final	Initial	Final	Ave (T_{test})		
0.5	1.0	0.0	5.534	5.534	918.600	924.617	6.017	74	78	76	85	88	87	87	86.75	10	4
0.5	1.0	5.534	11.025	5.491	924.617	930.561	5.944	78	80	79	89	90	88	88	88.75	10	4

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH)	$Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$	$\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$
0.5	1.0	.9358	1.8437
0.5	1.0	.9382	1.8868
Average		Y = .9370	ΔH@ = 1.8653

Method 5 Acceptance Criteria

1) $Y_i = Y \pm 0.02Y$
2) $\Delta H@_i = \Delta H@ \pm 0.15\ \Delta H@$ (recommended)
3) $\Delta H@ = 1.84 \pm 0.25$ (recommended)
4) Calibration vacuum maintained at 2-4 in. Hg

RADIAN CORPORATION

DRY GAS METER CALIBRATION DATA

Date 05 23 84 Calibrated by Cliff Thirion Meter or Console No. R31-520

Barometric pressure, P_b = 29.50 in. Hg Wet Test Meter No. 14 AM2

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH) (in. H_2O)	Gas Volumes (ft^3)						Temperature °F								Elapsed Time (min) (θ)	Vacuum (2-4 in. Hg)
		Wet Test Meter			Dry Gas Meter			Wet Test Meter			Dry Gas Meter						
											Inlet		Outlet				
		Initial	Final	Delta (V_{std})	Initial	Final	Delta (V_{test})	Initial	Final	Ave (T_{std})	Initial	Final	Initial	Final	Ave (T_{test})		
.50	.85	52.580	57.673	5.093	179.400	185.067	5.667	73	73	73	80	88	78	81	81.75	10	
.50	.85	57.673	62.778	5.105	185.067	190.629	5.562	73	73	73	83	91	82	86	85.50	10	
.50	.85	62.778	67.751	4.973	190.629	196.209	5.580	73	73	73	87	91	86	89	89.75	10	

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH)	$Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$	$\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$
.50	.85	.9115	1.8466
.50	.85	.9374	1.8253
.50	.85	.9173	1.9086
Average		Y = .9221	ΔH@ = 1.8602

Method 5 Acceptance Criteria

1) $Y_i = Y \pm 0.02Y$
2) $\Delta H@_i = \Delta H@ \pm 0.15\ \Delta H@$ (recommended)
3) $\Delta H@ = 1.84 \pm 0.25$ (recommended)
4) Calibration vacuum maintained at 2-4 in. Hg

RADIAN CORPORATION

DRY GAS METER CALIBRATION DATA

Date 05 23 84 Calibrated by Cliff Thirion Meter or Console No. 4838 D548

Barometric pressure, P_b = 29.58 in. Hg Wet Test Meter No. 14 AM 2

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH) (in. H_2O)	Gas Volumes (ft^3)						Temperature °F								Elapsed Time (min) (θ)	Vacuum (2-4 in. Hg)
		Wet Test Meter			Dry Gas Meter			Wet Test Meter			Dry Gas Meter						
											Inlet		Outlet				
		Initial	Final	Delta (V_{std})	Initial	Final	Delta (V_{test})	Initial	Final	Ave (T_{std})	Initial	Final	Initial	Final	Ave (T_{test})		
.50	.80	34.383	39.218	4.835	738.3000	743.352	5.052	73	73	73	82	86	80	84	83	10	
.50	.80	39.218	44.135	4.917	743.352	748.444	5.092	73	73	73	84	90	85	89	87	10	
.50	.80	44.135	49.027	4.892	748.444	753.543	5.099	73	73	73	88	93	88	91	90	10	

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH)	$Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$	$\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$
.50	.80	.9731	1.9187
.50	.80	.9890	1.8417
.50	.80	.9880	1.8504
Average		Y = .9834	ΔH@ = 1.8703

Method 5 Acceptance Criteria

1) $Y_i = Y \pm 0.02Y$
2) $\Delta H@_i = \Delta H@ \pm 0.15\ \Delta H@$ (recommended)
3) $\Delta H@ = 1.84 \pm 0.25$ (recommended)
4) Calibration vacuum maintained at 2-4 in. Hg

DRY GAS METER CALIBRATION DATA

RADIAN # 4838

Date 04 26 84 Calibrated by Cliff Thirion Meter or Console No. D 548

Barometric pressure, P_b = 29.50 in. Hg Wet Test Meter No. 14AM2

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH) (in. H_2O)	Gas Volumes (ft^3)						Temperature °F								Elapsed Time (min) (θ)	Vacuum (2-4 in. Hg)
		Wet Test Meter			Dry Gas Meter			Wet Test Meter			Dry Gas Meter						
											Inlet		Outlet				
		Initial	Final	Delta (V_{std})	Initial	Final	Delta (V_{test})	Initial	Final	Ave (T_{std})	Initial	Final	Initial	Final	Ave (T_{test})		
0.5	1.0	11.225	16.867	5.642	552.274	557.834	5.560	76	74	75	75	80	75	77	76.75	10	4
0.5	1.0	16.867	22.424	5.557	557.834	563.527	5.693	74	75	74.5	79	89	80	84	83	10	4

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH)	$Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$	$\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$
0.5	1.0	1.0155	1.8001
0.5	1.0	.9892	1.8308
Average		Y = 1.0024	ΔH@ = 1.8155

Method 5 Acceptance Criteria

1) $Y_i = Y \pm 0.02Y$
2) $\Delta H@_i = \Delta H@ \pm 0.15\ \Delta H@$ (recommended)
3) $\Delta H@ = 1.84 \pm 0.25$ (recommended)
4) Calibration vacuum maintained at 2-4 in. Hg

RADIAN CORPORATION

PRETEST

DRY GAS METER CALIBRATION DATA

Date 2-7-84 Calibrated by KEN PALMER Meter or Console No. D548

Barometric pressure, P_b = 29.66 in. Hg Wet Test Meter No. 14AM2 # 5997

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH) (in. H_2O)	Gas Volumes (ft^3)						Temperature °F								Elapsed Time (min) (θ)	Vacuum (2-4 in. Hg)
		Wet Test Meter			Dry Gas Meter			Wet Test Meter			Dry Gas Meter						
											Inlet		Outlet				
		Initial	Final	Delta (V_{std})	Initial	Final	Delta (V_{test})	Initial	Final	Ave (T_{std})	Initial	Final	Initial	Final	Ave (T_{test})		
.212	.15	0	2.079	2.079	265.102	267.220	2.118	72	72	72	73	76	73	77	74.75	10	3
.479	.65	0	7.020	7.020	268.600	275.818	7.218	72.5	72.5	72.5	83	85	83	87	84.5	15	3
.589	1.00	0	5.655	5.655	226.800	232.650	5.850	72	72	72	88	90	90	89	89.25	10	3
.806	1.95	0	10.145	10.145	286.606	297.104	10.498	72	72	72	90	93	90	91	91	13	3
.957	2.85	0	9.255	9.255	298.700	308.271	9.571	72	72	72	91	92	92	93	92	10	4
1.226	4.85	0	11.985	11.985	309.926	322.195	12.269	72	72	72	94	95	94	93	94	10	4

Test DGM Flow Rate (ACFM)	Orifice Setting (ΔH)	$Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$	$\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$
.212	.15	0.9863	1.9361
.479	.65	0.9929	1.6518
.589	1.00	0.9955	1.7222
.806	1.95	0.9961	1.7578
.957	2.85	0.9963	1.8233
1.226	4.85	1.0052	1.8436
Average		Y = 0.9954	ΔH@ = 1.7891

Method 5 Acceptance Criteria

1) $Y_i = Y \pm 0.02Y$
2) $\Delta H@_i = \Delta H@ \pm 0.15\ \Delta H@$ (recommended)
3) $\Delta H@ = 1.84 \pm 0.25$ (recommended)
4) Calibration vacuum maintained at 2-4 in. Hg

MEETS METHOD 5 ACCEPTANCE CRITERIA

RADIAN CORPORATION

APPENDIX I.1.2

SOURCE SAMPLING EQUIPMENT CALIBRATION

INCLUDES

I.1.2.3 Differential Pressure Gauge Certification

RADIAN CORPORATION

DATE: 05 24 84 OPERATOR INITIALS: CJT

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, (ΔH) -R31-S20, SPARE

MAGNEHELIC I.D. NO. 708091CR38 RANGE: 0 - 3 " H_2O

REFERENCE MANOMETER ΔP_1	MAGNEHELIC ΔP_2	% ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$
2.85	3.0	5.0
① 2.35	2.5	5.0
② 1.90	2.0	3.3
③ 1.45	1.5	1.7
④ 1.0	1.0	0
⑤ .5	.5	0

DATE: 05 24 84 OPERATOR INITIALS: CJT

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, (ΔH) D-548, SPARE

MAGNEHELIC I.D. NO. R00728RB18 RANGE: 0 - 3 " H_2O

REFERENCE MANOMETER ΔP_1	MAGNEHELIC ΔP_2	% ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$
3.0	3.0	0
① 2.5	2.5	0
② 2.0	2.0	0
③ 1.45	1.5	1.7
④ .95	1.0	1.7
⑤ .49	.5	0.3

Figure . Magnehelic Calibration Sheet Form I

RADIAN CORPORATION

DATE: 05 04 84 OPERATOR INITIALS: CST

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP (R31-510), ΔH, SPARE

MAGNEHELIC I.D. NO. 71025MN50 RANGE: 0-1.0 " H_2O

	REFERENCE MANOMETER ΔP_1	MAGNEHELIC ΔP_2	% ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$
1	.21	.22	1.00
2	.35	.34	1.00
3	.70	.66	4.00
4	.59	.56	3.00
5	.98	.96	2.00

DATE: 05 04 84 OPERATOR INITIALS: CST

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP (D-548), ΔH, SPARE

MAGNEHELIC I.D. NO. R00730CF9 RANGE: 0-2.0 " H_2O

	REFERENCE MANOMETER ΔP_1	MAGNEHELIC ΔP_2	% ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$
1	.58	.55	1.50
2	.90	.85	2.50
3	1.30	1.25	2.50
4	2.0	1.90	5.00
5	1.5	1.50	0

Figure . Magnehelic Calibration Sheet Form I

RADIAN CORPORATION

DATE: 05 04 84 OPERATOR INITIALS: CST

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP (Venturi Scrubber), ΔH, SPARE

MAGNEHELIC I.D. NO. R30614254 RANGE: 0-30 " H_2O

REFERENCE MANOMETER ΔP_1	MAGNEHELIC ΔP_2	% ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$
① 3.6	4.0	1.33
② 10.2	10.0	0.67
③ 15.8	16.0	0.67
④ 0.8" HG	25.0	1.73
⑤ 1.5" HG	20.0	1.33

DATE: _____ OPERATOR INITIALS: _____

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. _____ RANGE: _____ " H_2O

REFERENCE MANOMETER ΔP_1	MAGNEHELIC ΔP_2	% ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$
①		
②		
③		
④		
⑤		

Figure . Magnehelic Calibration Sheet Form I

APPENDIX I.1.2

SOURCE SAMPLING EQUIPMENT CALIBRATION

INCLUDES

I.1.2.4 Temperature Measuring Device Certification

R31-520

DGM T.C.s

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TC 003	ASTM 9547	3-2-83	[illegible]	75	77
TC 003	/	/	/	111	111.6
TC 004	/	/	/	76	77
TC 004	ASTM 9547	3-2-83	[illegible]	111	111.6

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN CORPORATION

D-598

DGM T.C.s

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TC 001	ASTM 9547	3-2-83	Henzino	77	77
TC 001	/	/	/	120	122
TC 002	/	/	/	78	75
TC 002	ASTM 9547	3-2-83	Henzino	120	122

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TCJ-1	A04835	050484	CST	86	84.2
TCJ-1	A04835	050484	CST	49	50.2
" "	582809	~~582809~~	CST	~~109~~ 111	114
	227769			186	190

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN CORPORATION

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TCS-2	A04835	050484	CST	86	84.3
" "	" "	" "	" "	51	50.2
" "	582809	" "	" "	114	110.5
" "	227769	" "	" "	190	191
" "		" "	" "		

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TCK-01	A04835	050484	CST	82	84.4
" "	" "	" "	" "	48	50.2
" "	582809	" "	" "	114	115.5
" "	227769	" "	" "	192	192

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN CORPORATION

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TCK-02	A04835	050484	CST	83	84.4
" "	" "	" "	" "	50.	50.6
" "	582809	" "	" "	114	115.5
" "	227769	" "	" "	193	192

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TCK-03	A04835	050484	CST	83	84.4
" "	" "	" "	" "	50	50.6
" "	582809	" "	" "	115	115.5
	227769			193	192

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN CORPORATION

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA	
				MEASURED T_{Test}	MEASURED T_{STD}
TCK-04	A04835	050484	CST	83	84.4
" "	" "	" "	" "	50	50.6
" "	582809	" "	" "	115	115.5
" "	227769	" "	" "	193	192

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN

TC PROBE TC 101

TEMPERATURE INDICATOR IDENTIFICATION NO. (T_{Test})	NBS THERMOMETER SERIAL NO. (T_{STD})	DATE (MMDDYY)	INITIALS OF CALIBRATOR	CALIBRATION DATA MEASURED T_{Test}	CALIBRATION DATA MEASURED T_{STD}
TC-101	ASTM 63F A 04835	060584	CST	72°F	72.4°F
TC-101	ASTM 66F 565139	060584	CST	212°F	210°F
TC-101	ASTM 63F 02286	"	CST	42°F	42°F
TC-101	ASTM 63F 02286	"	CST	33°F	32.5°F

Figure 7-3. Temperature Calibration Data Sheet Form I

RADIAN CORPORATION

APPENDIX I.1.2

SOURCE SAMPLING EQUIPMENT CALIBRATION

INCLUDES

I.1.2.5 Sampling Nozzle Certification

NOZZLE CALIBRATION FORM

Date (DDMMYY): 050484

Initials of Calibrator: LAR

Nozzle Identification No.	D_1 (inches)	D_2 (inches)	D_3 (inches)	Average Diameter (inches)
N2-017	.219	.220	.221	
N2-023	.267	.270	.270	.269
N2-035	.125	.128	.126	
N2-~~0~~111	.179	.183	.183	.182
N2-112	.370	.370	.365	
N2-113	.369	.367	.368	
N2-118	.24~~0~~2	.245	.245	.244
N2-114	.175	.178	.176	
N2-116	.168	.170	.171	
N2-A02	.173	.176	.175	.175

Note: The maximum acceptable difference between any two measurements is 0.004 inches. If this tolerance cannot be met the nozzle should not be used.

Figure . Nozzle Calibration Data Sheet

APPENDIX I.1

SOURCE SAMPLING QUALITY CONTROL

INCLUDES

I.1.3 Pretest Cleaning Procedures
- I.1.3.1 EPA Method 5E Glassware and Probe Liner Cleaning Procedure
- I.1.3.2 PAH Glassware and Probe Liner Cleaning Procedure

I.1.3 Pretest Cleaning Procedure

I.1.3.1 EPA Method 5E Glassware and Probe Liner Cleaning Procedures

All EPA Method 5E glassware was thoroughly cleaned prior to use in the field using the following procedure.

- First, the glassware was thoroughly washed with a strong laboratory grade soap (i.e. Alconox) and rinsed with distilled water.

- Second, the glassware was fired in a ceramic kiln for 24 hours at 500°C to remove any remaining volatiles. After cooling, the glassware was rinsed with methylene chloride to remove any kiln residue.

- Finally, the glassware was carefully packaged in bubble wrap for transportation to the test site.

Each glass probe liner was thoroughly brushed and rinsed using a clean probe brush and acetone. The ends of the probe liners were then capped with aluminum foil until they were ready for us in the field.

I.1.3.2 PAH Glassware and Probe Cleaning Procedures

The glassware used for collecting the PAH samples was cleaned using the procedure outlined in I.1.3.1 with the following additions.

- Following the methylene chloride rinse the glassware was again kiln fired at 500°C for 24 hours.

- After cooling, the glassware was rinsed a second time with methylene chloride and all ball joints were wrapped with methylene chloride rinsed aluminum foil. This entire step was performed while wearing latex gloves.

- The glassware was carefully packaged in bubble wrap for transport to the test site.

- This glassware was packed separately from the Method 5E glassware and used only for the PAH sampling.

The glass probe liners and stainless steel nozzles used for the PAH sampling were thoroughly brushed and rinsed using a clean probe brush and methylene chloride. The ends of the probe liners were then capped with aluminum foil until they were ready for use in the field.

APPENDIX I.1.4

SOURCE SAMPLING QUALITY ASSURANCE PROTOCOL

INCLUDES

I.1.4.1 EPA Reference Method 2
I.1.4.2 EPA Reference Method 5E
I.1.4.3 EPA Reference Method 4
I.1.4.4 Molecular Weight Determination
I.1.4.5 Polynuclear Aromatic Hydrocarbon Sampling
I.1.4.6 Particle Size Distribution Sampling

I.1.4 Source Sampling Quality Assurance Protocol

This section outlines procedures used during the sampling program to help ensure the generation of acceptable and reliable data.

I.1.4.1 EPA Reference Method 2

Data required to determine stack gas velocity and volumetric gas flow rate was collected using the methodology specified in EPA Method 2. Quality control focused on the following procedures:

- The S-type pitot tube was visually inspected before and after sampling.
- Both the low pressure and high pressure legs of the pitot tube were leak checked before and after sampling.
- The Magnehelic® gauge used to indicate the differential pressure (ΔP) across the S-type pitot tube was leveled and zeroed.
- The number and location of the sampling traverse points was checked and the probe clearly marked before taking any measurements.
- The temperature measurement system was visually checked for damage and operability by measuring the ambient temperature prior to each traverse.
- Duplicate readings of temperature and differential pressure were taken at each traverse point.
- All sampling data and calculations were recorded on preformatted data sheets.

The uncontrolled and controlled emissions volumetric gas flow rate (STP) data were compared to determine how well the data agreed. Close agreement ($\pm$10%) between the uncontrolled and controlled emissions volumetric gas flow rate data is an indication that the sampling points at both locations are representative of actual stack conditions. For the three particulate-TOC and the BaP run the ratio of the volumetric gas flow rate of the uncontrolled emissions (scrubber inlet) and the volumetric gas flow rate of the controlled emissions (scrubber outlet) averaged 100% $\pm$ 2.8%. This data indicates that the sampling points used to collect uncontrolled and controlled volumetric gas flow rate data were representative.

I.1.4.2 EPA Reference Method 5E

Total particulate mass concentration (particulate matter and TOC) in the flue gas was determined using EPA Method 5E. Quality control for Method 5E focused on the following procedures:

- Prior to sampling, each glass fiber filter was baked in an oven at 325°F for 3 hours, equilibrated in a desiccator, weighed to determine its initial mass using an analytical balance, and then each filter was packaged in labeled, individual petri dishes.
- Prior to sampling, calculations were made to determine the proper size nozzle required to maintain isokinetic sampling.
- The sampling nozzle was visually inspected before and after each run for damage.
- The S-type pitot tube was visually inspected before and after each run for damage.
- Each leg of the S-type pitot tube was leak-checked before and after each run.
- The Magnehelic® gauge used to indicate the differential pressure (ΔP) across the S-type pitot tube was leveled and zeroed.
- The number and location of the sampling points was checked and the probe clearly marked before taking measurements.
- The temperature measurement system was visually checked for damage and operability.
- During sampling the roll and pitch axis of the S-type pitot tube and the sampling nozzle were properly maintained.
- Handling of the filters was performed in a clean area out of drafts. Tweezers were used to transfer the filters at all times.
- The entire sampling train was leak-checked before and after each run. The sampling train was also leak checked each time the sampling train was moved between ports. The preleak check was performed at 15 inches Hg. The final leak check was performed at the highest vacuum encountered during the run.

- Ice was maintained in the ice bath throughout each run.

- Dry gas meter readings, ΔP and ΔH readings, temperature readings, and pump vacuum readings were properly made during sampling at each traverse point.

- In weighing the filters after sampling, repeat weighings were performed ≥24 hours after the initial weighings. Repeat weighings had to agree within ± 0.5 mg or 1% of the residue weight to be considered acceptable.

- Blank determinations were performed on the acetone rinse solution.

- Probe temperature was carefully controlled using a Variac® and monitored to 250°F ± 25 °F.

- The temperature of the filtered gas stream was carefully controlled to 248°F ± 10°F.

I.1.4.3 EPA Reference Method 4

The moisture content of the stack gas was determined simultaneous with each EPA Method 5E sampling run. Quality control was the same as that used for the EPA Method 5E determination with the following additions:

- Each impinger was weighed before and after each sampling run to the nearest 0.02 grams.

- The sampling train was purged following each run.

I.1.4.4 Molecular Weight Determination

The dry molecular weight of the flue gas was determined using the grab sampling technique described in EPA Method 3 and a Fyrite® gas analyzer. A stainless steel probe and a squeeze pump were used to collect the sample directly in the Fyrite® gas analyzer. Quality control for the molecular weight determination focused on the following:

- The probe and sample line were purged prior to sample collection.

- The sample port was properly sealed to prevent air inleakage.

- The sliding scale on the Fyrite® was zeroed prior to each sample analysis.

- Fresh absorbing solutions were installed prior to the sampling effort.

- Analyses were repeated until consecutive analyses agreed to within 0.3% for each gas.

I.1.4.5 Polynuclear Aromatic Hydrocarbon Sampling

The quality control protocol used during PAH sampling was the same as that used for the EPA Method 5E determination with the following additions:

- All glassware was wrapped with aluminum foil to minimize possible photodegredation of the PAH samples.

- All glassware used during sampling was specially prepared (see Section I.1.3.2).

I.1.4.6 Particle Size Distribution Sampling

Particle size distribution determinations were performed at the scrubber inlet (uncontrolled emissions) using an Andersen High Capacity Stack Sampler (AHCSS). The quality control measures used during the particle size distribution sampling focused on the following.

- The AHCSS was leak checked at 10 inches Hg prior to the run (no final leak check is performed since it runs the risk of redistributing the particulate mass).

- The AHCSS was allowed to heat in the stack for 45 minutes with the nozzle out of the flow prior to sampling. This allows the impactor to reach thermal equilibrium with the stack gas.

APPENDIX I.1

SOURCE SAMPLING QUALITY CONTROL

INCLUDES

I.1.5 Source Sampling Data Reduction Verification

I.1.5 Source Sampling Data Reduction Verification

Several steps were taken to verify the source sampling data reduction. First, all runs were hand calculated on-site to determine percent isokinetic, volumetric flow rate, and velocity. Following field activities all runs were reduced using Radian's Source Sampling Data Reduction Computer Program. This program takes raw field data and reduces it to engineering units. Copies of the data reduction print-outs appear in Appendix A. Data tables were prepared and reviewed and any outliers or anomalies rechecked.

APPENDIX I.2

PROCESS MONITORING AND SAMPLE COLLECTION QUALITY CONTROL

INCLUDES

I.2.1 Process Monitoring Quality Control
- I.2.1.1 Venturi Scrubber Water Flow Rate
- I.2.1.2 Venturi Scrubber Pressure Drop

I.2 Process Monitoring and Sample Collection Quality Control

This section outlines measures used to ensure the quality of the process data recorded and the collection of representative process samples.

I.2.1 Process Monitoring Quality Control

This section outlines steps taken to ensure reliable process data.

I.2.1.1 Venturi Scrubber Water Flow Rate

Radian installed a Signet Scientific paddle wheel Flosensor® to measure the water flow rate to the venturi scrubber. The flow sensor was installed in a vertical run of 3-inch schedule 40 pipe. The flow sensor was located 8 pipe diameters from the nearest downstream disturbance and 2 pipe diameters from the nearest upstream disturbance. This placement allows for an undisturbed flow pattern past the flow sensor. Prior to the installation of the flowsensor the unit was factory calibrated for 3-inch schedule 40 pipe. In addition to the Signet Flosensor® was a flow sensor operated by the Sloan Construction Company personnel. During the first day of testing (May 08, 1984) MRI personnel took both readings and averaged them for reporting purposes. It was found the Sloan flow sensor read consistently 20 gpm lower than the Signet®. During the second day of testing (May 10, 1984) the Signet® flow sensor malfunctioned and failed to operate. The remainder of the flow rate measurements were taken from Sloan's flow sensor. A ten-gallon per minute positive correction factor was applied to all of the Sloan flow sensor readings to yield values comparable with those recorded on 5-8-84.

I.2.1.2 Venturi Scrubber Pressure Drop

The venturi scrubber pressure drop (ΔP) was measured using a Dwyer® water manometer mounted on the front of the demister. The location of the pressure taps allowed for water to occasionally get in the pressure lines causing a faulty reading. Prior to each ΔP reading the manometer was checked to see if it was zeroed and the lines were checked for water. If water was present, the lines were back purged with instrument air.

APPENDIX I.2

PROCESS MONITORING AND SAMPLE COLLECTION QUALITY CONTROL

INCLUDES

I.2.2 Process Sample Collection Quality Control
- I.2.2.1 Virgin Aggregate and Recycle Asphalt Pavement Sample Collection
- I.2.2.2 Venturi Scrubber Water Sample Collection

I.2.2 Process Sample Collection Quality Control

This section outlines steps taken to ensure that representative samples were collected during process sample collection.

I.2.2.1 Virgin Aggregate and Recycle Asphalt Pavement Sample Collection

Samples of the virgin aggregate and recycle asphalt pavement were taken directly off the conveyor belt that feeds the drum mixer. Each sample was comprised of several intermittent grab samples taken off the conveyor belt over a short period of time. This sample was mixed, placed in a conical pile, and quartered. A quarter was randomly selected for sample analysis. The RAP portion not used for analysis was placed in an aluminum can for possible future use. An attempt was made to use a riffle bucket for separating the sample; however, the particle size of the material was too large.

I.2.2.2 Venturi Scrubber Water Sample Collection

Samples of water to the venturi scrubber were taken from a small auxiliary valve located on the discharge side of the feed pump. Prior to sample collection the sample line was thoroughly purged. The venturi effluent water gravity feeds from the scrubber to the settling pond via an 8-inch PVC pipe. Effluent samples were collected in a beaker held under the pipe. Care was taken to not let the beaker overflow which could cause a solids bias. At least two scrubber water samples from each point were collected during each particulate mass and PAH sampling run. The samples were composited for all analysis.

APPENDIX I.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

I.3.1 Particulate Mass Determination
- I.3.1.1 Particulate Mass Blank Cleanup Data
- I.3.1.2 Sample Handling and Weighing Procedures
- I.3.1.3 Sample Handling and Weighing Procedures
- I.3.1.4 Analytical Sample Matrices for Particulate Mass Field Blanks
- I.3.1.5 Laboratory Notebook Filter and Acetone Evaporation Weighing Data

I.3.1 Particulate Mass Determination

This section outlines steps taken to ensure the integrity of the particulate mass determination data. Included in this section are field blank cleanup data summary, description of filter and acetone sample handling and weighing procedures, analytical matrices which act as a flow scheme for the samples and raw data.

I.3.1.1 Particulate Mass Field Blank Cleanup Data

During field testing two particulate mass-TOC sampling trains were prepared and depreped in the same manner as an actual sampling train. Table I.2 presents a summary of the cleanup data. The inlet blank gained a total of 8.3 mg while the outlet blank had a total weight gain of 5.8 mg for an average weight gain of 7.1 mg.

I.3.1.2 Sample Handling and Weighing Procedures

Each EPA Method 5E sampling train produced several sample fractions. Included are:

- the filter,
- the acetone probe and nozzle rinse, and
- the back half TOC catch.

Preparation of the filters for sampling required the following measures to be taken:

- baking the filters 3 hours at 325°F,
- dessicating for 16 hours,
- weighing to the nearest 0.1 mg,
- placing in individual, labeled petri dishes, and
- packing in dessicators for transport and storage.

Following sample collection, the filters were carefully removed from the filter holder with tweezers and placed back in its original petri dish along with any material that may have been adhering to the filter holder. The used filters were then placed back in a dessicator.

TABLE I.2. SUMMARY OF EPA METHOD 5E PARTICULATE MASS FIELD BLANK CLEANUP DATA SUMMARY

Sample Description	Weight Gain (g)	Blank Value Corr. for Solvent
Inlet filter	0.0006	--
Outlet filter	0.0003	--
Inlet probe blank	0.0058	0.0055
Outlet probe blank	0.0077	0.0073
Solvent blank 1	0.0007/200 (ml)	--
Solvent blank 2	-0.0005/200 (ml)	--
Inlet blank (total)	0.0083	--
Outlet blank (total)	0.0058	--
Average	0.0071	

I.3.1.3 Sample Handling and Weighing Procedures

Each EPA Method 5E sampling train produced several sample fractions. Those include:

- the filter,
- acetone probe and nozzle rinse, and
- back half TOC catch.

Prior to sampling, particulate mass filters were baked at 325°F for three hours, dessicated for 16 hours, weighed to the nearest 0.1 mg, and placed in individual, labeled petri dishes. Filters were then packed for transport in dessicators.

Upon completion of sampling the following protocol was observed:

- Filters were removed from the filter holder with tweezers and placed back in its original petri dish along with any material adhering to the filter holder.
- The probe and nozzle were acetone washed with the wash being caught in a glass bottle sealed with a teflon cap.
- Filters were packed for transport in dessicators.

All samples were returned to Radian's Austin laboratories for final weighing and analysis. Sample handling and weighing procedures are as follows:

- Filters were weighed at 24 hour intervals until a constant weight was achieved (±0.5 mg). Since samples were transported in dessicators they were ready for immediate weighing.
- Acetone washes were transferred to clean, dry, tared beakers for evaporation. Acetones were evaporated at room temperature (70-75°F) and pressure to dryness.
- The acetone residues were dessicated for 24 hours and weighed to a constant weight (±0.5 mg) at 24 hour intervals.

During filter weighing, filters were only handled with tweezers and any particulate matter loose in the petri dish was brushed onto the filter with a camel hair brush. Beakers were only handled with tongs during both evaporation and weighing. Filters and beakers were removed from the dessicators one at a time to prevent pickup of moisture from the atmosphere.

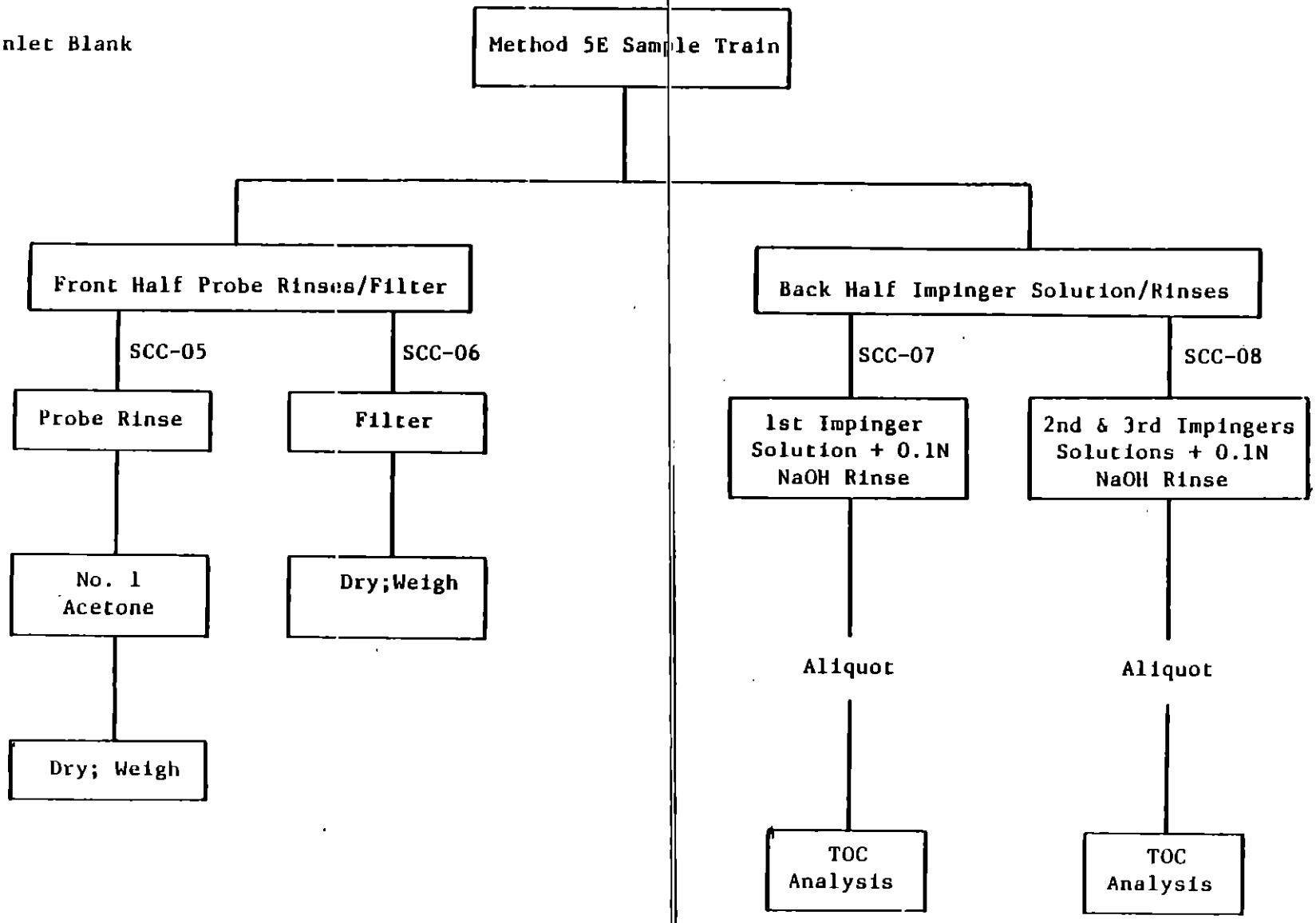
APPENDIX I.3.1

PARTICULATE MASS DETERMINATIONS

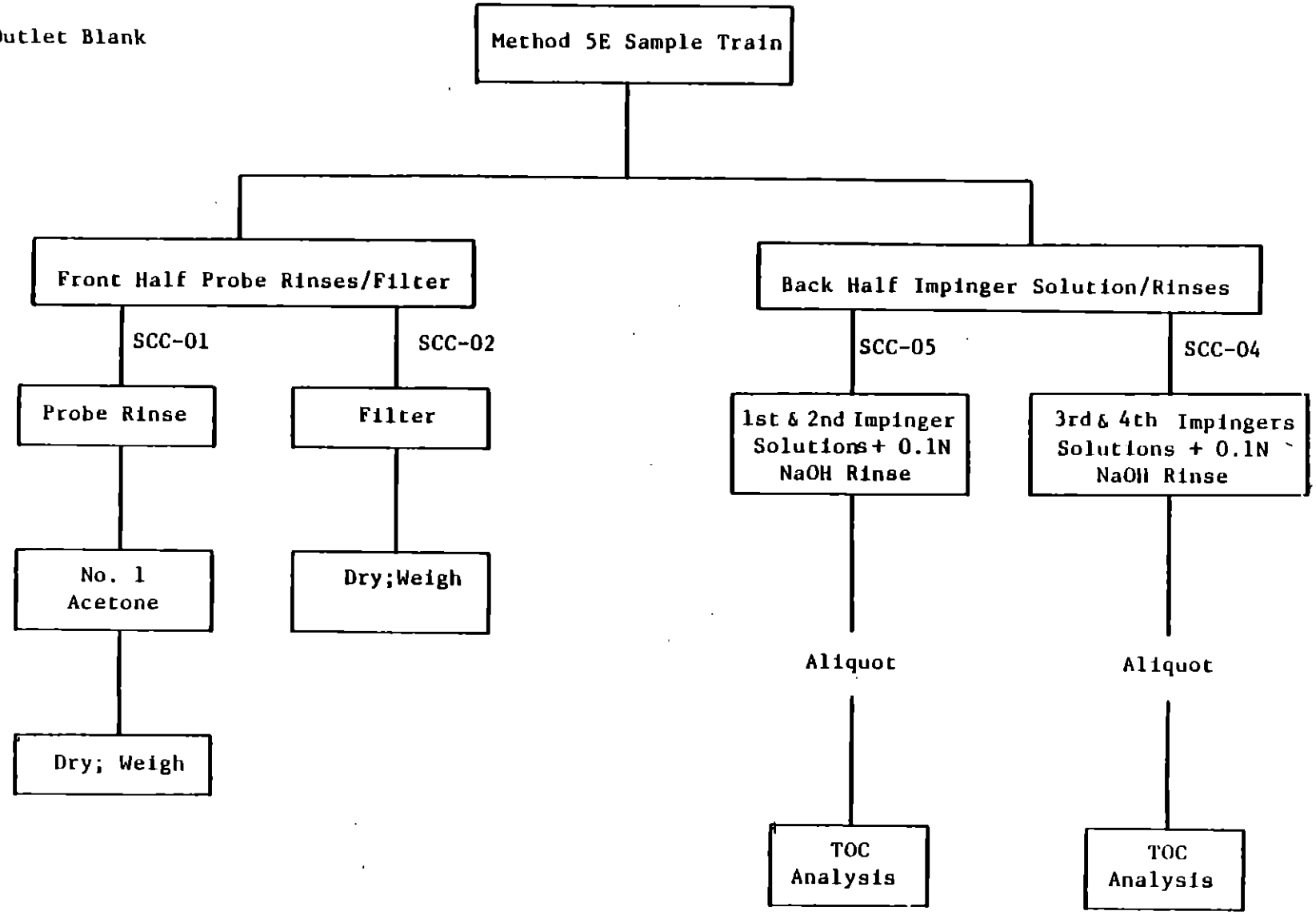
INCLUDES

I.3.1.4 Analytical Sample Matrices for Particulate Mass Field Blanks

Inlet Blank


Method 5E Sample Train
Front Half Probe Rinses/Filter
Back Half Impinger Solution/Rinses
SCC-05
SCC-06
SCC-07
SCC-08
Probe Rinse
Filter
1st Impinger Solution + 0.1N NaOH Rinse
2nd & 3rd Impingers Solutions + 0.1N NaOH Rinse
No. 1 Acetone
Dry;Weigh
Aliquot
Aliquot
Dry; Weigh
TOC Analysis
TOC Analysis

Outlet Blank



APPENDIX I.3.1

PARTICULATE MASS DETERMINATIONS

INCLUDES

I.3.1.5 Laboratory Notebook Filter and Acetone Evaporation Weighing Data

TITLE Filter Weighing

Project No.

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The following filters were baked at 325°F for 3 hours dessicated for 16 hours and weighed, apart into labled petri dishes using a model AE 163 mettler analytical balance

Filter Number	tare wt	1st Final wt	2nd wt	3rd wt	4th wt	Final wt Gain	
001	.5073	.5077	.5074			+.0003	
002	.5101	.5108	.5106			.0006	
003	.5211	.6558	6556			.1346	
004	.5275	1.0244	1.0242			.4969	.2738
005	.5266	.6660	.6656			.1392	
006	.5263	.9749	.9747			.4485	
007	.4998	.7671	.7675			.2675	
008	.5048	1.1141	1.1138			~~.6092~~	
009	.5115	.7955	.7957			.2841	
010	.5055	1.2397	1.2392			.7340	
011	.5067	.6508	.6495	.6498		.1430	
012	.5116						
013	.5112						
014	.5124						
015	.5118						
016	.5126						
017	.5058						
018	.5128						
019	.5166						
			Thimbles				
020	2.0558	2.3272	2.3232	2.3236			
021	2.1697						
022	1.9533	2.3039	2.3045	2.3036	2.3039	.3505	
023	2.6176						
024	2.1061						
025	2.1498						

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Witnessed & Understood by me, Date

Invented by Date

Recorded by

Project No._____

TITLE Acetone Evaporations

Book No._____

From Page No.__

The beakers were washed dried @ 105°C for 3 hrs dessicated 16 hrs and weighed on a Mettler AE 163 analytical balance. Following Evaporation the beakers were dessicated 24 hrs and weighed to a constant weight ±0.5 mg or 1% of the particulate mass

Sample #	Beaker #	Beaker tare wt	Final wt #1	Final wt #2	Final 3rd	Final 4th	wt gain	Bottle tare wt	Bottle wt (sample)	Sample Vol
01 *	1	105.3310	105.3367	105.3370	105.3368	—	.0058	283.2	549.0	338
05 *	2	106.0299	106.0316	106.0321	106.0319	106.0317	.0077	279.4	618.4	431
19A								282.0	614.1	463 } 744
19B	3	111.5612	119.5411	119.5109	—	—	7.9798	282.9	503.4	281
23	4	105.3490	105.4700	105.4687	105.4691	105.4680	.1493	281.3	670.6	475
28A								280.6	650.4	
28B	5	107.2994	112.4986	112.4959	112.4948	112.4946	5.1953	278.3	390.1	663
32	6	109.9916	110.0866	110.0872	110.0872	—	.0956	277.3	580.5	436
36	7	103.8813	109.2654	109.2680	109.2647	109.2650	5.3837	281.9	677.2	578
40	8	108.3992	108.5142	108.5147	108.5147	—	.1155	276.4	556.0	356
44	9	107.0789	111.2694	111.2675	111.2668	111.2666	4.1875	277.60	672.8	578
48	10	107.6926	107.8458	107.8446	107.8459	107.8460	.1533	279.1	662.7	513
109	11	107.0361	107.2483	107.2487	107.2482	—	.2122	38.68	102.42	156
110	12	105.0346	105.1068	105.1068	105.1062	105.1069	.0722	39.09	86.18	110
111	13	115.6829	116.0200	116.0199	116.0198	—	.3375	36.06	93.37	133
116	14	106.3615	106.8802	106.8811	106.8805	106.8808	.5192	38.82	103.97	158
117	15	108.2043	108.2597	108.2612	108.2608	108.2606	.0562	38.46	90.12	116
118	16	103.0442	103.7395	103.7392	103.7392	—	.6950	38.81	136.29	174
Solvent Blank	17	106.9777	106.9770	106.9775	106.9770	—	-.0005	—	—	200
Solvent Blank	18	106.7714	106.7715	106.7723	106.7719	—	.0007	—	—	200

To Page No.__

Witnessed & Understood by me,

* Probe rinse blanks had water in them due to condensation during burning

Date

Invented by

Date

Recorded by

APPENDIX I.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

1.3.2 Total Organic Carbon (TOC) Analysis Quality Control

I.3.2 Total Organic Carbon (TOC) Analysis Quality Control

The TOC content of the EPA Method 5E sodium hydroxide impinger solutions and scrubber water filtrate samples was determined instrumentally using the procedure specified in EPA Method 5E. A Beckman Model 915 B Total Carbon Aanlyzer was used to determine the total carbon content and total inorganic carbon content of the sample. The concentration of carbon present in the sample was determined by comparing the sample results with the results of standards prepared using potassium hydrogen phthalate. The total organic carbon content was determined by subtracting the total inorganic carbon content from the total carbon content.

EPA supplied TOC audit samples were submitted to the analytical laboratory prior to the submission of the field samples for analysis. Radian supplied TOC audit samples were also submitted to the analytical laboratory each time a set of TOC samples were submitted to the lab for analysis. The results of the EPA and Radian supplied TOC audit samples are presented in Table I-3.

TABLE I-3. SUMMARY OF TOTAL ORGANIC CARBON AUDIT SAMPLE MEASUREMENTS

EPA PREPARED SAMPLE RESULTS		(A)	(R)	
Sample No.	Date of Analysis	Actual Values (mg/l)	Radian Analysis Values (mg/l)	Percent Error R-A/A x 100
33790	5-17-84	4.0	9.3	127
33791	thru	61.2	53.7	-12.3
33792	5-29-84	4.1	3.58	-12.7
33793		61.2	51.8	-15.4

RADIAN PREPARED SAMPLE RESULTS		(A)	(R)	
Sample No.	Date of Analysis	Actual Values (mg/l)	Radian Analysis Values (mg/l)	Percent Error R-A/A x 100
Radian #1	Set 1,	40	38.7	-3.2
Radian #2	Submitted	200	192	-4.0
Radian #3	5/17/84	200	200	0
Radian #4		1000	1000	0
Radian #1	Set 2	1316	1340	1.8
Radian #2	Submitted	329	325	-1.5
Radian #3	6/21/84	132	133	0.8
Radian #1	Set 3	1316	1385	5.2
Radian #2	Submitted	329	322	-2.1
Radian #3	7/5/84	132	133	0.8
Radian #4		1005	1004	-0.1
Radian #5		158	153	-3.2
Radian #6		80.4	70	-12.9

APPENDIX I.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

I.3.3 Polynuclear Aromatic Hydrocarbon (PAH) and Major Organics Analytical Quality Control

I.3.3 Polynuclear Aromatic Hydrocarbon (PAH) Analytical Quality Control

The sample concentrates were analyzed by GC-MS with operation in the selected ion monitoring mode (SIM). Individual compounds were separated by employing a fused silica capillary column. Mass spectral data were stored on a magnetic disc for interpretation and reference.

Identification of individual compounds was based primarily on two criteria: chromatographic retention time and mass spectral characteristics. The appearance of key fragment ions of the compound at a precise retention time is indicative of the presence of the compound. In general, PAHs are relatively stable in the ion source of a mass spectrometer. The major (base peak) fragment corresponds to the molecular weight of the compound (M^+), other fragments are generally found at M^+-2 and $M^+/2$ (corresponding to a double charged ion). The relative intensities of these fragment ions are also examined in order to confirm the identification. Table I.3 lists the individual PAHs looked for and the key characteristics employed for the identification. The internal standard, phenanthrene-d_{10}, served as a marker to verify retention time to within +0.1 minutes. A further discussion of organic sampling and analysis is presented in Section J.1.3.

Two sample train field blanks were prepared to determine background contamination levels for the PAHs.

Once an individual compound had been identified, the selected ion area of the chromatographic peak corresponding to the base peak fragment was obtained. This area was compared to the corresponding area of the internal standard. The concentration of the compound was then calculated using a known response based on the NBS calibration standard shown in Table I.4.

TABLE I.4. KEY CHROMATOGRAPHIC AND MASS SPECTRAL DATA OF PAHs

Compound	Retention Time, Min	Key Fragment Ions (Intensity)			
		M^+	M^+-2	$M^+/2$	Other
Phenanthrene	17.2	178(100)	(176(15)	89(16)	-
Anthracene	17.4	178(100)	176(15)	89(16)	-
Fluoranthene	21.1	202(100)	200(15)	101(23)	-
Pyrene	21.8	202(100)	200(15)	101(26)	-
Benz(a)anthracene	25.7	228(100)	226(23)	-	229(19)
Chrysene	25.9	228(100)	226(23)	-	229(19)
Benzo(b)fluoranthene	29.7	252(100)	250(16)	126(23)	-
Benzo(k)fluoranthene	29.8	252(100)	250(16)	126(23)	-
Benzo(j)fluoranthene	30.1	252(100)	250(16)	126(23)	-
Benzo(e)pyrene	30.8	252(100)	250(16)	126(23)	-
Benzo(a)pyrene	31.0	252(100)	250(16)	126(23)	-
Perylene	31.2	252(100)	250(16)	126(23)	-
Indeno(1,2,3-c,d)pyrene	37.7	276(100)	274(27)	138(37)	-
Benzo(g,h,i)perylene	39.6	276(100)	274(27)	138(37)	-

TABLE I-5. COMPOSITION OF ANALYTICAL STANDARD USED FOR GC-MS ANALYSES*

Compound	NBS Certified Concentration, μg/mL
Phenanthrene	5.06 ± 0.1
Anthracene	3.29 ± 0.1
Fluoranthene	10.1 ± 0.2
Pyrene	9.8 ± 0.1
Benzo(a)anthracene	5.0 ± 0.1
Chrysene	4.7 ± 0.1
Benzo(b)fluoranthene	5.1 ± 0.1
Benzo(k)fluoranthene	5.0 ± 0.1
Benzo(a)pyrene	5.3 ± 0.1
Benzo(g,h,i)pyrene	4.0 ± 0.1
Indeno(1,2,3-c,d)pyrene	4.1 ± 0.1

* NBS SRM 1647

APPENDIX I.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

I.3.4 Particle Size Distribution

I.3.4 Particle Size Distribution

Particle size distribution samples were collected using an Andersen High Capacity Stack Sampler (AHCSS). From each sampling run seven samples were generated: Three samples of particulate, three acetone rinses, and a backup thimble. The particulate samples were contained in a tared piece of aluminum foil inside a petri dish. These samples along with the backup thimble were dessicated for at least 24 hours and weighed at 24 hour intervals until a constant weight was achieved ($\pm$0.5 mg). The acetone rinses were transferred to clean, dry, and tared beakers. The acetone rinses were evaporated at room temperature (70-75°C) and pressure to dryness. The beakers were then dessicated for 24 hours and weighed at 24 hour intervals until a constant weight was achieved ($\pm$0.5 mg).

APPENDIX I.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

I.3.5 Venturi Scrubber Water
- I.3.5.1 pH Measurements
- I.3.5.2 Temperature
- I.3.5.3 Total Suspended Solids/Total Dissolved Solids
- I.3.5.4 Total Organic Carbon (TOC) Analysis
- I.3.5.5 Polynuclear Aromatic Hydrocarbons

I.3.5 Venturi Scrubber Water Analytical Quality Control

This section outlines measures taken during the collection, preservation, and analysis of the scrubber water samples that ensure reliable results.

I.3.5.1 pH Measurements

pH measurements were performed using a hand held Orion pH meter with temperature compensator. Prior to each pH measurement, the meter was calibrated using a pH 4 and pH 7 buffer. Measurements were performed on a water sample that had been collected into a beaker at the sample site. This reduced the chance for the pH changing due to cooling or chemical changing of the sample.

I.3.5.2 Temperature Measurements

Temperature measurements were performed using a Type-K thermocouple and hand held temperature readout. Prior to use the thermocouple was calibrated against a NBS traceable mercury in glass thermometer.

I.3.5.3 Total Suspended Solids/Total Dissolved Solids

Total suspended solids (TSS) and total dissolved solids (TDS) measurements were performed on composite water samples. Quality control procedures focused on carefully controlling oven temperature during drying (50°C ± 3°C for TSS and 105°C ± 5°C for TDS) and duplicate analysis. Carefully controlling the oven temperature during drying helps eliminate bias caused by temperature fluctuations, such as overdrying one sample while not completely drying another. Duplicate analysis allows for evaluation of the methods precision. Venturi inlet and effluent water samples collected during EPA Method 5E run 1 were analyzed in duplicate for TDS. The results are presented below.

	1	2	Avg.	% Deviation Diff/Avg x 100
Venturi Inlet	14,790	14,640	14,716	1.0%
Venturi Outlet	15,010	14,920	14,965	0.6%

I.3.5.4 Total Organic Carbon (TOC) Analysis

Samples of scrubber water retained for TOC analysis were kept in amber glass bottles sealed with teflon lined caps. To help prevent degradation of the samples, samples were kept cold prior to analysis. Quality control procedures used during the analysis of the TOC samples included:

- the analysis of blank samples to correct for background interference,

- the analysis of blind quality control samples,
- the analysis of spiked samples,
- performing duplicate analysis at a frequency of 5-15%, and
- analyzing known internal quality control samples.

TOC quality control results are presented in Section I.3.2.

I.3.5.5 Polynuclear Aromatic Hydrocarbon (PAH) Analysis

Samples of scrubber water retained for PAH analysis were kept in amber glass bottles sealed with teflon lined caps. To help prevent degradation of the samples, samples were kept cold prior to extraction. After filtration effluent scrubber water solids were kept in a vial wrapped with aluminum foil to help minimize possible photodegradation of the sample. The solid sample was also kept cold prior to extraction. Analytical quality control is the same as that outlined in Section I.3.3.

APPENDIX I.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

I.3.6 Virgin Aggregate and Recycle Asphalt Pavement (RAP)
- I.3.6.1 Percent Moisture Determination Quality Control
- I.3.6.2 Smoke Point Analytical Quality Control
- I.3.6.3 Flash Point Analytical Quality Control

I.3.6 Virgin Aggregate and Recycle Asphalt Pavement (RAP)

I.3.6.1 Percent Moisture Determination Quality Control

A laboratory oven was used to determine the moisture content of the virgin aggregate and recycle asphalt pavement. The oven was closely controlled to 105°C and monitored using a dial thermometer. Close temperature control eliminated bias that could be caused by fluctuations of the drying temperature. The samples were allowed to dry overnight and cooled to room temperature before the final weight determination was made.

I.3.6.2 Smoke Point Analytical Quality Control

The RAP sample was heated in an oven set at 140°F to remove any moisture that was present. Steam generated during sample heating can yield a false smoke point. A thermometer was used to measure the temperature at which each RAP sample began to smoke. The thermometer was calibrated in the appropriate temperature range using an ASTM certified thermometer, prior to testing. Care was taken during sample heating to mix the sample thoroughly to ensure even temperature distribution and minimize the formation of hot spots. Hot spots could result in low smoke point readings.

I.3.6.3 Flash Point Analytical Quality Control

The flash point of the AC used during the Sloan testing program will be determined by the ASTM D92-Cleveland Open Cup Procedure. Close adherence to the protocol specified by the reference method is necessary to ensure quality data.

APPENDIX I.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

I.3.7 Data Reduction Verification

I.3.7 Data Reduction Verification

Several steps were taken to verify the correctness of data reduction. Steps routinely used include:

- Alternate procedures were used to reduce the data. An example is reducing source sampling data by using Radian's Source Sampling Data Reduction Program and comparing selected results against hand calculations.

- A certain percentage (approximately 10%) of the results were recalculated from raw data by someone unassociated with the original data reduction.

- The data was carefully checked for unexplained variance and internal consistency, i.e. are the results consistent with expected and/or other results.

In addition to the above measures several steps were taken to help verify the accuracy and completeness of the data generated. These measures include:

- All sampling data was recorded on preformated data sheets.

- Analytical results and calculations were recorded in bound laboratory notebooks.

- Data tables were made and reviewed for completeness and accuracy.

- All data that appeared to be outside expected ranges were carefully scrutinized for process upsets and reanalyzed as necessary.

- Data generated were compared to process operation and system upsets.

APPENDIX J

SAMPLING AND ANALYSIS PROCEDURES

INCLUDES

J.1 Summary of Source Sampling Procedures
- J.1.1 Summary of EPA Reference Methods 1, 2, 3, 4, 5E, and 9
- J.1.2 Changes and/or Modifications to EPA Reference Methods during the Test Program
- J.1.3 Polynuclear Aromatic Hydrocarbons (PAH) Sampling and Sample Recovery Procedures
- J.1.4 Particle Size Distribution Sampling and Sample Recovery Procedures

J.2 Process Sample Collection Procedures
- J.2.1 Venturi Scrubber Water Sample Collection
- J.2.2 Virgin Aggregate and Recycle Asphalt Pavement Sample Collection
- J.2.3 Asphalt Cement Sample Collection

J.3 Sample Analysis Procedures
- J.3.1 Total Organic Carbon Analysis
- J.3.2 Polynuclear Aromatic Hydrocarbon Analysis
- J.3.3 Particulate Mass Analysis
- J.3.4 Percent Moisture Analysis
- J.3.5 Smoke Point Determination of Recycled Asphalt Payment
- J.3.6 Smoke Point and Flash Point Determination of Asphalt Cement
- J.3.7 Total Suspended Solids/Total Dissolved Solids
- J.3.8 pH and Temperature Measurements

APPENDIX J.1

SUMMARY OF SOURCE SAMPLING PROCEDURES

INCLUDES

J.1.1 Summary of EPA Reference Methods 1, 2, 3, 4, 5E and 9
J.1.2 Changes and/or Modifications to EPA Reference Methods
- J.1.2.1 Modifications to EPA Reference Method 1
- J.1.2.2 Modifications to EPA Reference Method 3
- J.1.2.3 Modifications to EPA Reference Method 4
- J.1.2.4 Modifications to EPA Reference Method 5E
- J.1.2.5 Modifications to EPA Reference Method 9

J.1.3 Polynuclear Aromatic Hydrocarbons (PAH) Sampling and Sample Recovery Procedures
- J.1.3.1 PAH Sampling Procedures
- J.1.3.2 PAH Sample Recovery

J.1.4 Particle Size Distribution Sampling and Sample Recovery Procedures
- J.1.4.1 Particle Size Distribution Sampling Procedures
- J.1.4.2 Particle Size Distribution Sample Recovery Procedures

J.1.1 EPA Reference Methods 1, 2, 3, 4, 5E, and 9

The following EPA Reference Methods were used during this emission test program. These methods are taken from the Environmental Reporter, Volume I - Federal Regulations, Section 121, "air," Appendix A.

- EPA Method 1 - Sample and Velocity Traverses for Stationary Sources. This method specifies the number and location of sampling points within a duct, taking into account duct size and shape and local flow disturbances.

- EPA Method 2 - Determination of Stack Gas Velocity and Volumetric Flowrate. This method specifies the measurement of gas velocity and flowrate using a pitot tube, manometer, and temperature sensor. The physical dimensions of the pitot tube and its spatial relationship to the temperature sensor and any sample probe are also specified.

- EPA Method 3 - Determination of Stack Gas Molecular Weight. This method describes the extraction of a gas sample from a stack, removal of moisture by condensation, and analysis of the resulting gas sample for O_2, CO_2, and CO by means of an Orsat apparatus. The assembly and operation of the required sampling train is specified.

- EPA Method 4 - Determination of Moisture Content in Stack Gases. This method describes the extraction of a gas sample from a stack and the removal and measurement of the moisture in that sample by condensation impingers. The assembly and operation of the required sampling train is specified.

- EPA Method 9 - Visual Determination of the Opacity of Emissions from Stationary Sources. This method describes how trained observers are to determine the opacity of emissions. The duration and frequency of observations, orientation of the observer with respect to the source, sun and background, methods of data recording and calculation, and qualifications of observers are specified.

- EPA Method 5E - Determination of Particulate Emissions from the Wool Fiberglass Insulation Manufacturing Industry. This method describes the collection of particulate matter and total organic carbon (TOC) from a stack and the analytical specifications for the TOC analysis (see attachment).

(c) All monitoring devices required under this section are to be recalibrated quarterly in accordance with procedures under § 60.13 (b)(3).

(Sec. 114 of the Clean Air Act, as amended (42 U.S.C. 7414))

§ 60.684 Recordkeeping and reporting requirements.

(a) At 30-minute intervals during each 2-hour test run of each performance test of a wet scrubber control device and at least once every 4 hours thereafter, the owner or operator shall record the measurements required by § 60.683(a).

(b) At 30-minute intervals during each 2-hour test run of each performance test of a wet electrostatic precipitator control device and at least once every 4 hours thereafter, the owner or operator shall record the measurements required by § 60.683(b), except that the concentration of total residue in the water shall be recorded once during each performance test and once per day thereafter.

(c) Records of the measurements required in paragraphs (a) and (b) of this section must be retained for at least 2 years.

(d) Each owner or operator shall submit written semiannual reports of exceedances of control device operating parameters required to be monitored by paragraphs (a) and (b) of this section and written documentation of, and a report of corrective maintenance required as a result of, quarterly calibrations of the monitoring devices required in § 60.683(c). For the purpose of these reports, exceedances are defined as any monitoring data that are less than 70 percent of the lowest value or greater than 130 percent of the highest value of each operating parameter recorded during the most recent performance test.

(e) The requirements of this section remain in force until and unless the Agency, in delegating enforcement authority to a State under section 111(c) of the Act, approves reporting requirements or an alternative means of compliance surveillance adopted by such State. In that event, affected facilities within the State will be relieved of the obligation to comply with this section, provided that they comply with the requirements established by the State.

(Sec. 114 of the Clean Air Act, as amended (42 U.S.C. 7414))

§ 60.685 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided under § 60.8(b), shall be used to determine compliance with § 60.682 as follows:

(1) Method 1 for sample and velocity traverses;

(2) Method 2 for stack gas velocity and volumetric flow rate;

(3) Method 3 for stack gas dry molecular weight;

(4) Method 4 for stack gas moisture content; and

(5) Method 5E for the measurement of particulate emissions.

(b) The sampling time for each test run shall be at least 2 hours and the minimum volume of gas sampled shall be 2.55 dscm.

(c) The performance test shall be conducted while the product with the highest loss on ignition (LOI) expected to be produced by the affected facility is being manufactured.

(d) For each test run, the particulate mass emission rate, R, shall be computed as follows:

$$R = C_s \times Q_{std} \times \frac{6 \times 10^{-6}\ \text{min-kg}}{\text{h-mg}}$$

where:

R = mass emission rate (kg/h).

C_s = particulate concentration as determined by Reference Method 5E (mg/dscm).

Q_{std} = stack gas volumetric flow rate as determined by Reference Method 2 (dscm/min).

(e) The glass pull rate, P, for the manufacturing line shall be computed as follows:

$$P = L_s \times W_m \times M \times \left(\frac{100-LOI}{100}\right) \times \frac{6 \times 10^{-5}\ \text{min-Mg}}{\text{h-g}}$$

where:

P = glass pull rate (Mg/h).

L_s = line speed (m/min).

W_m = trimmed mat width (m).

M = mat gram weight (g/m²).

LOI = loss on ignition (weight percent), as determined by ASTM Standard Test Method D2584-68, "Ignition Loss of Cured Reinforced Resins" (incorporated by reference—see § 60.17).

For each 2-hour test run, the average glass pull rate shall be computed from at least three glass pull rates determined at intervals of at least 30 minutes during the test run.

(f) For each test run, the particulate mass emission level, E, shall be computed as follows:

$$E = \frac{R}{P_{avg}}$$

where:

E = mass emission level (kg/Mg).

R = mass emission rate (kg/h).

P_{avg} = average glass pull rate (Mg/h).

(Sec. 114 of the Clean Air Act, as amended (42 U.S.C. 7414))

3. Appendix A to Part 60 is amended by adding new Reference Method 5E as follows:

Appendix A—Reference Methods

* * * * *

Method 5E—Determination of Particulate Emissions From the Wool Fiberglass Insulation Manufacturing Industry

1. *Applicability and Principle.*

1.1 *Applicability.* This method is applicable for the determination of particulate emissions from wool fiberglass insulation manufacturing sources.

1.2 *Principle.* Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120°±14°C (248°±25°F) and in solutions of 0.1 N NaOH. The filtered particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water. The condensed particulate material collected in the impinger solutions is determined as total organic carbon (TOC) using a nondispersive infrared type of analyzer. The sum of the filtered particulate mass and the condensed particulate matter is reported as the total particulate mass.

2. *Apparatus*

2.1 *Sampling Train.* The equipment list for the sampling train is the same as described in Section 2.1 of Reference Method 5 except as follows:

2.1.1 *Probe Liner.* Same as described in Section 2.1.2 of Reference Method 5 except use only borosilicate or quartz glass liners.

2.1.2 *Filter Holder.* Same as described in Section 2.1.5 of Reference Method 5 with the addition of a leak-tight connection in the rear half of the filter holder designed for insertion of a thermocouple or other temperature gauge for measuring the sample gas exit temperature.

2.2 *Sample Recovery.* The equipment list for sample recovery is the same as described in Section 2.2 of Reference Method 5 except three wash bottles are needed instead of two and only glass storage bottles and funnels may be used.

2.3 *Analysis.* The equipment list for analysis is the same as Section 2.3 of Reference Method 5 with the additional equipment for TOC analysis as described below:

2.3.1 *Sample Blender or Homogenizer.* Waring type or ultrasonic.

2.3.2 *Magnetic Stirrer.*

2.3.3 *Hypodermic Syringe.* 0- to 100-µl capacity.

2.3.4 *Total Organic Carbon Analyzer.* Beckman Model 915 with 215 B infrared analyzer or equivalent and a recorder.

2.3.5 *Beaker.* 30 ml.

2.3.6 *Water Bath.* Temperature-controlled.

2.3.7 *Volumetric Flasks.* 1,000 ml and 500 ml.

3. *Reagents.*

3.1 *Sampling.* The reagents used in sampling are the same as used in Reference Method 5 with the addition of 0.1 N NaOH (dissolve 40 g of ACS reagent grade NaOH in distilled water and dilute to 1 liter).

3.2 *Sample Recovery.* The reagents used in sample recovery are the same as used in Reference Method 5 with the addition of

distilled water and 0.1 *N* NaOH as described in Section 3.1.

3.3 *Analysis.* The reagents used in analysis are the same as in Reference Method 5 except as follows:

3.3.1 *Carbon Dioxide-Free Water.* Distilled or deionized water that has been freshly boiled for 15 minutes and cooled to room temperature while preventing exposure to ambient air with a cover vented with an ascarite tube.

3.3.2 *Hydrochloric Acid.* HCl, concentrated, with a dropper.

3.3.3 *Organic Carbon Stock Solution.* Dissolve 2.1254 g of dried potassium biphthalate in CO_2-free water and to 1 liter in a volumetric flask. This solution contains 1,000 mg/l organix carbon.

3.3.4 *Inorganic Carbon Stock Solution.* Dissolve 4.404 g anhydrous sodium carbonate in about 500 ml of CO_2-free water in a 1 liter volumetric flask. Add 3.497 g anhydrous sodium bicarbonate to the flask and dilute to 1 liter with CO_2-free water. This solution contains 1,000 mg/l inorganic carbon.

3.3.5 *Oxygen Gas.* CO_2-free.

4. *Procedure.*

4.1 *Sampling.* The sampling procedures are the same as in Section 4.1 of Reference Method 5 except as follows:

4.1.1 *Filtration Temperature.* The temperature of the filtered gas stream, rather than the filter compartment air temperature, is maintained at 120°±14°C (248±25°F).

4.1.2 *Impinger Solutions.* 0.1 *N* NaOH is used in place of water in the impingers. The volumes of the solutions are the same as in Reference Method 5.

4.2 *Sample Recovery.* The sample recovery procedure is as follows:

Water is used to rinse and clean the probe parts prior to the acetone rinse. Save portions of the water, acetone, and 0.1 *N* NaOH used for cleanup as blanks following the procedure as in Section 4.2 of Reference Method 5.

Container No. 1. The filter is removed and stored in the same manner as in Section 4.2 of Reference Method 5.

Container No. 2. Use water to rinse the sample nozzle, probe, and front half of the filter holder three times in the manner described in Section 4.2 of Reference Method 5 except that no brushing is done. Put all the wash water in one container, seal, and label.

Container No. 3. Rinse and brush the sample nozzle, probe, and front half of the filter holder with acetone as described for Container No. 2 in Section 4.2 of Reference Method 5.

Container No. 4. Place the contents of the silica gel impinger in its original container as described for Container No. 3 in Section 4.2 of Reference Method 5.

Container No. 5. Measure the liquid in the first three impingers and record the volume or weight as described for the Impinger Water in Section 4.2 of Reference Method 5. Do not discard this liquid, but place it in a sample container using a glass funnel to aid in the transfer from the impingers or graduated cylinder (if used) to the sample container. Rinse each impinger thoroughly with 0.1 *N* NaOH three times, as well as the graduated cylinder (if used) and the funnel, and put these rinsings in the same sample container. Seal the container and label to clearly identify its contents.

4.3 *Analysis.* The procedures for analysis are the same as in Section 4.3 of Reference Method 5 with exceptions noted as follows:

Container No. 1. Determination of weight gain on the filter is the same as described for Container No. 1 in Section 4.3 of Reference Method 5 except that the filters must be dried at 20°±6°C (68°F±10°F) and at ambient pressure.

Containers Nos. 2 and 3. Analyze the contents of Containers Nos. 2 and 3 as described for Container No. 2 in Section 4.3 of Reference Method 5 except that evaporation of the samples must be at 20°±6°C (68°F±10°F) and at ambient pressure.

Container No. 4. Weigh the spent silica gel as described for Container No. 3 in Section 4.3 of Reference Method 5.

"Water and Acetone Blank" Containers. Determine the water and acetone blank values following the procedures for Acetone Blank Container in Section 4.3 of Reference Method 5. Evaporate the samples at ambient temperature [20°±6°C (68°±10°F)] and pressure.

Container No. 5. For the determination of total organic carbon, perform two analyses on successive identical samples, i.e., total carbon and inorganic carbon. The desired quantity is the difference between the two values obtained. Both analyses are based on conversion of sample carbon into carbon dioxide for measurement by a nondispersive infrared analyzer. Results of analyses register as peaks on a strip chart recorder.

The principle differences between operating parameters for the two channels involve the combustion tube packing material and temperature. In the total carbon channel, a high temperature [950°C (1740°F)] furnace heats a Hastelloy combustion tube packed with cobalt oxide-impregnated asbestos fiber. The oxygen in the carrier gas, the elevated temperature, and catalytic effect of the packing result in oxidation of both organic and inorganic carbonaceous material to CO_2 and steam. In the inorganic carbon channel, a low temperature [150°C (300°F)] furnace heats a glass tube containing quartz chips wetted with 85 percent phosphoric acid. The acid liberates CO_2 and steam from inorganic carbonates. The operating temperature is below that required to oxidize organic matter. Follow the manufacturer's instructions for assembly, testing, calibration, and operation of the analyzer.

As samples collected in 0.1 *N* NaOH often contain a high measure of inorganic carbon that inhibits repeatable determinations of TOC, sample pretreatment is necessary. Measure and record the liquid volume of each sample. If the sample contains solids or an immiscible liquid, homogenize the sample with a blender or ultrasonics until satisfactory repeatability is obtained. Transfer a representative portion of 10 to 15 ml to a 30-ml beaker, acidify with about 2 drops of concentrated HCl to a pH of 2 or less. Warm the acidified sample at 50°C (120°F) in a water bath for 15 minutes. While stirring the sample with a magnetic stirrer, withdraw a 20- to 50-µl sample from the beaker and inject it into the total carbon port of the analyzer. Measure the peak height. Repeat the injections until three consecutive peaks are obtained within ±10 percent of the average.

Repeat the analyses for all the samples and the 0.1 *N* NaOH blank. Prepare standard curves for total carbon and for inorganic carbon of 10, 20, 30, 40, 50, 60, 80, and 100 mg/l by diluting with CO_2-free water 10, 20, 30, 40, and 50 ml of the two stock solutions to 1,000 ml and 30, 40, and 50 ml of the two stock solutions to 500 ml. Inject samples of these solutions into the analyzer and record the peak heights as described above. The acidification and warming steps are not necessary for preparation of the standard curve.

Ascertain the sample concentrations for the samples from the corrected peak heights for the samples by reference to the appropriate standard curve. Calculate the corrected peak height for the standards and the samples by deducting the blank correction as follows:

$$\text{Corrected peak height} = A - B \qquad \text{Eq. 5E-1}$$

Where:

A = Peak height of standard or sample, mm or other appropriate unit.

B = Peak height of blank, mm or other appropriate unit.

If samples must be diluted for analysis, apply an appropriate dilution factor.

5. *Calibration.* Calibration of sampling and analysis equipment is the same as in Section 5 of Reference Method 5 with the addition of the calibration of the TOC analyzer described in Section 4.3 of this method.

6. *Calculations.* The calculations and nomenclature for the calculations are the same as described in Section 6 of Reference Method 5 with the addition of the following:

6.1 *Mass of Condensed Particulate Material Collected.*

$$m_c = (0.001)(C_c)(V_s) \qquad \text{Eq. 5E-2}$$

Where:

0.001 = Liters per milliliter.

m_c = Mass of condensed particulate material collected in the impingers measured as TOC, mg.

C_c = Concentration of TOC in the liquid sample from TOC analysis in Section 4.3, mg/l.

V_s = Total volume of liquid sample, ml.

6.2 *Concentration of Condensed Particulate Material.*

$$C_c = (0.001)[m_c/V_{m(std)}] \qquad \text{Eq. 5E-3}$$

Where:

0.001 = Grams per milligram.

C_c = Concentration of condensed particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm.

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm, from Section 6.3 of Reference Method 5.

6.3 *Total Particulate Concentration.*

$$C_t = C_s + C_c \qquad \text{Eq. 5E-4}$$

Where:

C_t = Total particulate concentration, dry basis, corrected to standard conditions, g/dscm.

C_s = Concentration of filtered particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm, from Equation 5-6 of Reference Method 5.

7. *Bibliography.* The bibliography is the same as in Section 8 of Reference Method 5 with the addition of the following:

7.1 American Public Health Association, American Water Works Association, Water Pollution Control Federation. Standard Methods for the Examination of Water and Wastewater, Fifteenth Edition. Washington, D.C. 1980.

[FR Doc. 84-3004 Filed 2-6-84; 8:45 am]

BILLING CODE 6560-50-M

J.1.2 Changes and/or Modifications to EPA Reference Methods

J.1.2.1 Modifications to EPA Reference Method 1

The uncontrolled emissions sampling location did not meet the minimum requirements set forth in EPA Method 1 due to the duct configuration. Samples were collected at the vertical section of duct that was directly attached to the inlet of the venturi scrubber. It was believed this location offered the best alternative for collecting representative uncontrolled particulate samples. A total of 16 sampling points were used to characterize the uncontrolled emissions. A greater number of sampling points were not feasible due to the high particulate loading. The volumetric gas flow rate determined at the venturi inlet compared favorably with the venturi outlet gas flow rate (within 3%). This comparison lends credibility to the sampling point selection of the uncontrolled emissions.

J.1.2.2 Modifications to EPA Reference Method 3

The flue gas molecular weight determination was preformed using the single point grab sample technique. The analysis of the gas sample was then performed using a Fyrite® gas analyzer instead of an Orsat® gas analyzer.

J.1.2.3 Modifications to EPA Reference Method 4

Moisture determinations were performed simultaneously with the collection of particulate mass and total organic carbon during EPA Reference Method 5E. The impinger solution consisted of 0.1 N NaOH instead of water.

J.1.2.4 Modifications to EPA Reference Method 5E

A modified version of the sampling procedure specified in EPA Reference Method 5E was used to determine the particulate emissions of the venturi inlet and outlet. Modifications to EPA Reference Method 5E included:

- eliminating the probe and nozzle water rinse prior to the acetone probe and nozzle rinse
- recovering the individual NaOH impinger samples,
- installing a variable transformer to control the probe temperature to 250°F ± 25°F, and
- installing a time proportioning temperature controller to maintain the temperature of the gas stream downstream of the filter holder at 250°F ± 10°F (controller accuracy ± 1% of full scale - 400°F).

J.1.2.5 Modifications to EPA Reference Method 9

The test plan stated that visible opacity measurements would be taken at several distances from the stack to evaluate condensation of hydrocarbons and blue haze formation. During actual testing, opacity measurements were performed only according to EPA Method 9 protocol and not at various distances from the stack. Visible emission observations were performed only against a clear, blue sky background. This minimizes interferences that can occur when reading a condensed hydrocarbon plume with a cloudy or grey sky background.

J.1.3 Polynuclear Aromatic Hydrocarbon (PAH) Sampling and Sample Recovery Procedures

J.1.3.1 PAH Sampling Procedures

Figure J-1 illustrates the sampling train that was used to collect samples of the gas stream for PAH analysis. The PAH sample collection procedure is similar to the particulate loading procedure (EPA Method 5E). The major differences between the two systems include impinger configuration, contents, and sample recovery procedures.

The PAH impinger train consisted of a dry impinger for cooling down the gas before entering the glass canister containing XAD-2 resin for PAH adsorption. Following the XAD-2 resin canister was a second dry impinger for collection of any condensate occurring downstream of the XAD-2 resin. The third impinger contained silica gel for final moisture removal. The glassware in the hot box, the two dry impingers, and the XAD-2 resin canister were wrapped with aluminum foil to reduce sample exposure to ultraviolet radiation, which can cause possible photodegradation of the PAH's.

Prior to sampling, the particulate filters used during PAH sample collection were extracted with methylene chloride, baked at 275°F for four hours, and then dessicated and weighed. The filters were stored in glass petri dishes that had previously been rinsed with methylene chloride.

A three-step extraction was used to prepare the XAD-2 resin for use. Methanol, pyridline, and ether respectively were used to extract the resin. The resin was extracted using a soxhlet extractor for 24 hours with each solvent. Following extraction, the resin was stored under methanol until its use.

J.1.3.2 PAH Sample Recovery

Upon completion of sampling, the sampling train was returned to the mobile laboratory for sample recovery. Incandescent lights were used in the mobile laboratory during sample recovery to minimize possible PAH photodegradation. The nozzle and glass probe liner were brushed and rinsed with methylene chloride. All interconnecting glassware in the hot box and impinger train (except the silica gel impinger) were also rinsed with methylene chloride. The methylene chloride rinses were stored in amber glass bottles with teflon lid inserts. The filter was transferred to its original glass petri dish and wrapped with aluminum foil to protect it from direct light during storage and shipment. The XAD-2 resin was rinsed from the canister into a pint Ball® jar with methylene chloride. The jar was sealed with a teflon-lined cap and wrapped with aluminum foil for transport.

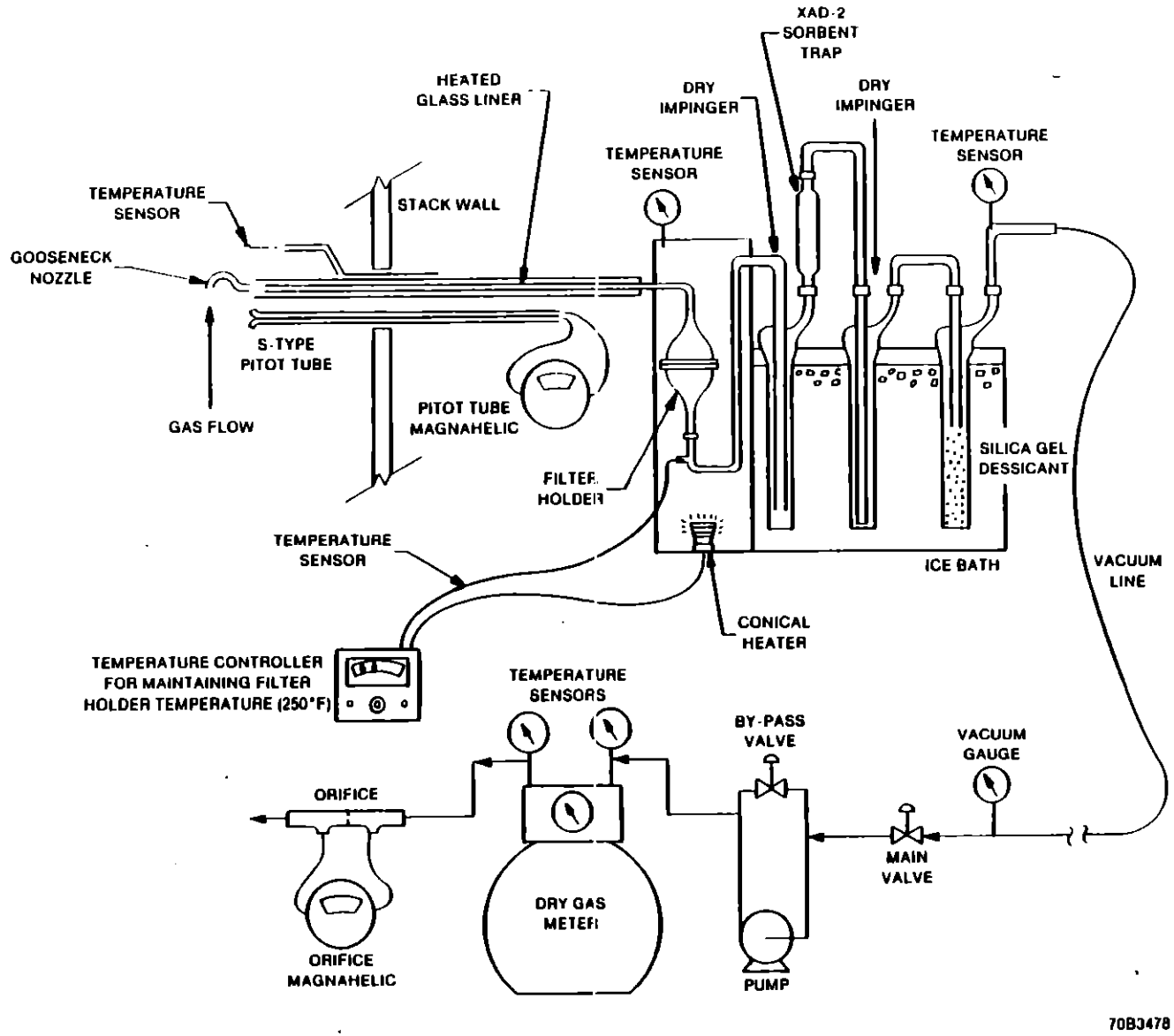

Figure J-1. Sampling train designed to collect polynuclear aromatic hydrocarbon samples at venturi scrubber inlet and outlet.

J.1.4 Particle Size Distribution Sampling and Sample Recovery Procedures

J.1.4.1 Particle Size Distribution Sampling Procedures

The particle size distribution at the venturi inlet was determined using an Andersen High Capacity Stack Sampler (AHCSS). The AHCSS was chosen because of its ability to handle gas streams with a high particulate loading without overloading the stages or using unacceptably short sampling times. The AHCSS consists of two impaction chambers, followed by a cyclone and a back-up absolute thimble (see Figure J-2). The particles are fractionated into four size ranges which can be plotted to represent the entire size fraction. Preparation of the impactor for use requires that it be washed with soap and rinsed well with water to remove all the soap. The AHCSS is then wiped with a clean, lint-free cloth and rinsed with acetone to complete drying and to remove any oil which may be present.

A right angle probe and straight-neck isokinetic sampling nozzle was used to allow the AHCSS to be oriented into the gas stream. Use of the straight nozzle minimizes the effect of pre-impaction of larger particles that might occur with a goose neck nozzle. Figures J-2 and J-3 graphically depict the AHCSS impactor, the sampling train, and sampler stack orientation respectively.

Particle size distribution sampling was performed at a single point of average velocity in the flue gas stream. This sampling point was selected from previous velocity traverse data. Isokinetic sampling flow rates at the impactor nozzle were pre-calculated based on velocity data obtained during earlier sampling (EPA Method 5E and Polynuclear Aromatic Hydrocarbon Sampling). Operation of the AHCSS requires that the flow rate through the impactor be kept constant. This requirement eliminates the possibility of adjusting the flow rate if variations in gas velocity occurs.

Prior to sampling, the AHCSS was allowed to preheat in the duct for approximately 45 minutes to allow ample time for the unit to reach thermal equilibrium with the flue gas.

J.1.4.2 Particle Size Distribution Sample Recovery Procedures

When sampling was completed, the AHCSS was brought back to the lab and allowed to cool. Care was taken during this step to ensure that the stages were not disturbed. Each stage was carefully removed, one at a time, and the particulate matter brushed into a tared petri dish. Following this step each stage was rinsed with acetone and brushed if necessary to remove any

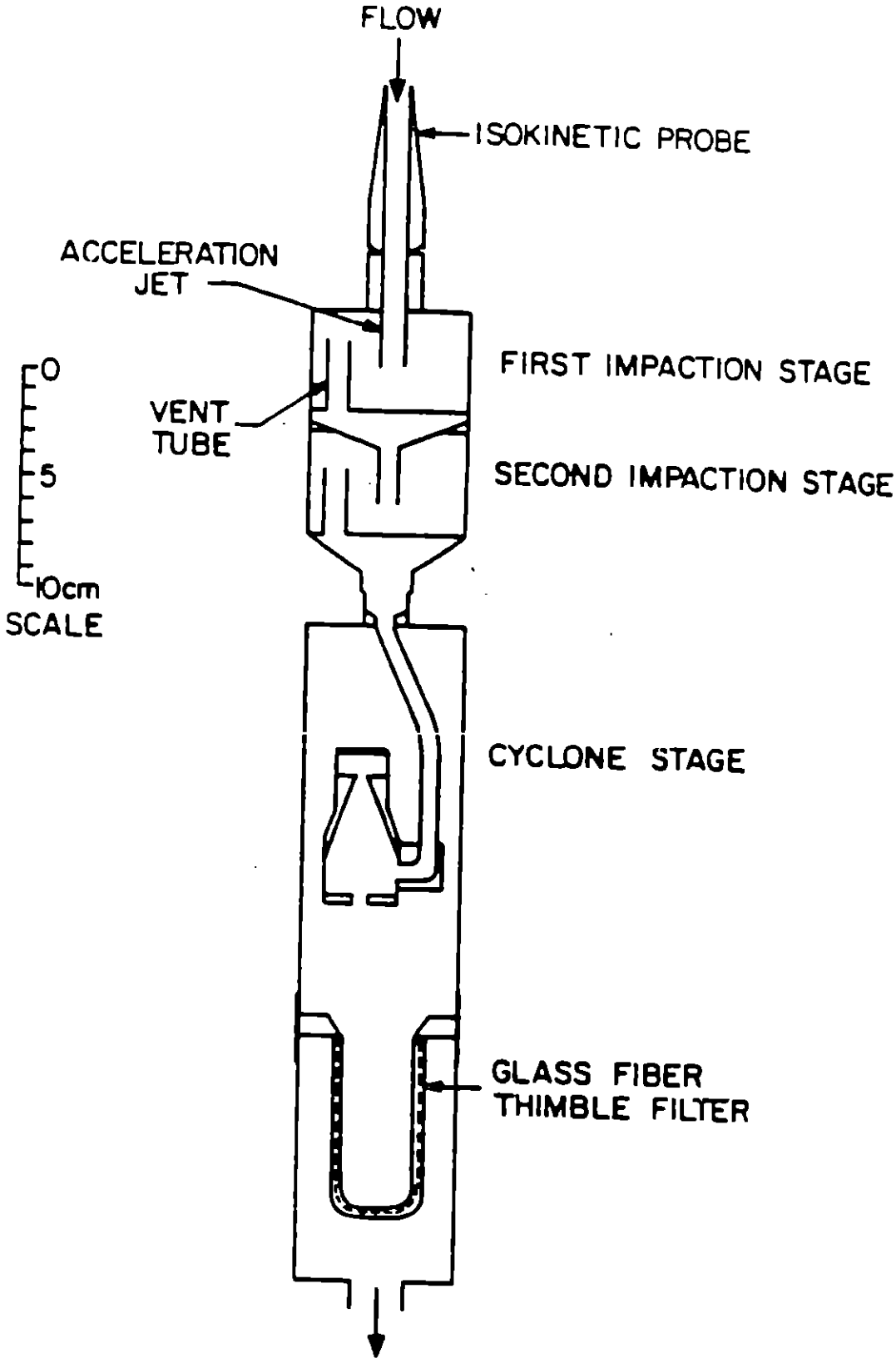

Figure J-2. Schematic of the Andersen Model HCSS High Grain-Loading Impactor

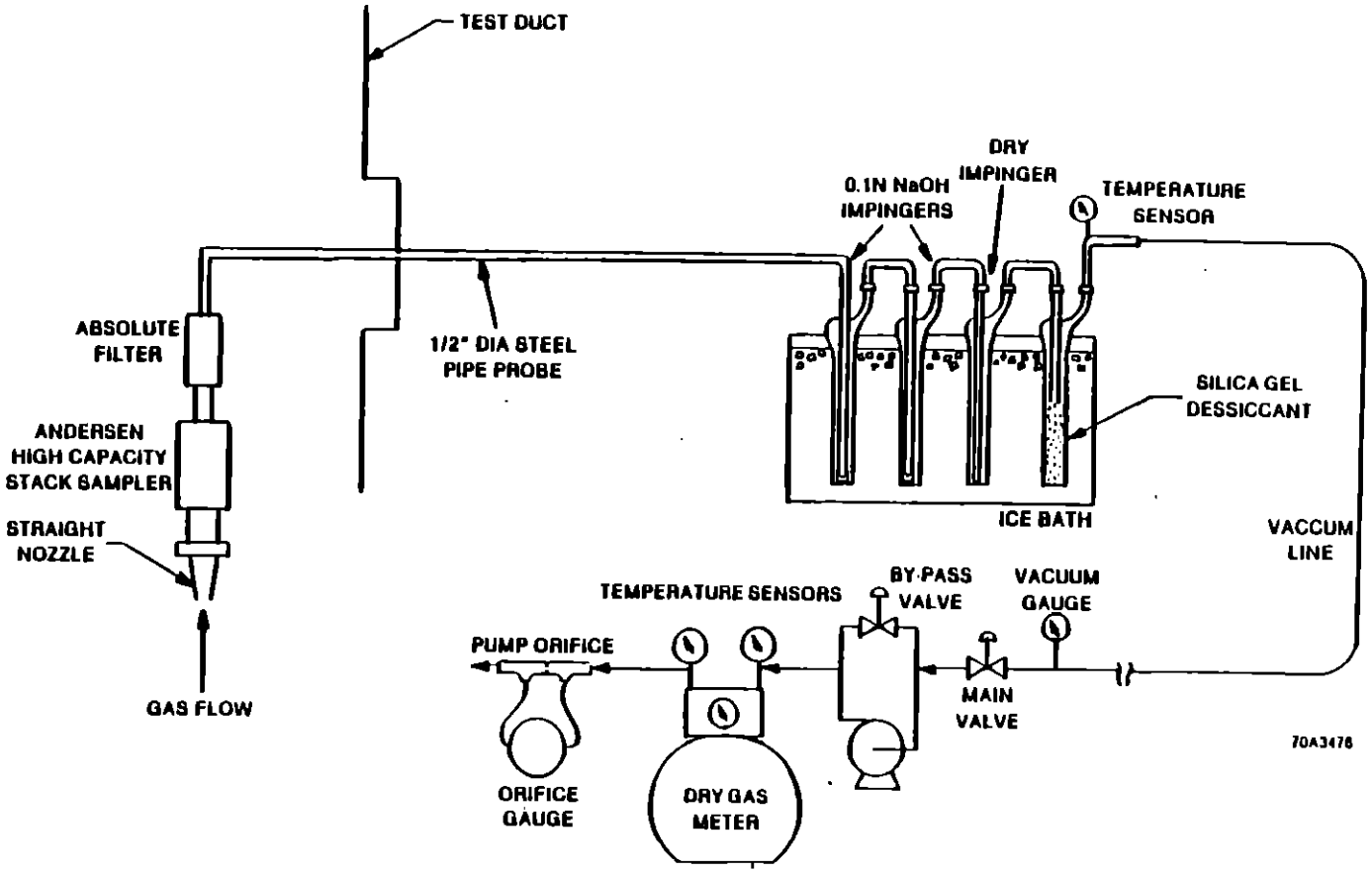

Figure J-3. In-stack Andersen high capacity sampling train used to determine the particle size distribution at the scrubber inlet.

remaining particulate matter. The backup absolute thimble was removed and placed in a glass Ball® jar in a position that would keep it upright during transport back to Austin. The petri dishes and thimbles were packed in dessicators for transport.

The sample analysis consisted of the following:

- the weighing to a constant weight of the particulate matter in each stage and the backup thimbles; and

- evaporation of the acetone rinses and the weighing of that residue.

The samples which had been transported in dessicators were ready to weigh following their return to Radian's Austin laboratories. These samples were weighed at 24-hour intervals until the weights agreed to within 0.5 mg or 1 percent of the total particulate mass.

The acetone rinses were transferred to clean tared beakers and evaporated to dryness at room temperature and pressure. They were then dessicated 24 hours and weighed at 24-hour intervals until a constant weight was achieved.

A detailed discussion of the data reduction procedure used to interpret the AHCSS data is presented in Appendix B.4.

APPENDIX J.2

PROCESS SAMPLE COLLECTION PROCEDURES

INCLUDES

J.2.1 Venturi Scrubber Water Sample Collection
J.2.2 Venturi Scrubber Process Measurements
J.2.2.1 Venturi Scrubber Water Flow Rate Measurements
J.2.2.2 Venturi Scrubber Pressure Drop Measurements
J.2.3 Virgin Aggregate and Recycle Asphalt Pavement Sample Collection
J.2.4 Asphalt Cement Sample Collection

J.2.1 Venturi Scrubber Water Sample Collection

Scrubber water influent and effluent samples were collected during the field testing program. Scrubber water was contained in two earthen ponds near the venturi scrubber. Water was supplied to the venturi scrubber by means of an above-the-ground pump. The pump intake line floated near the end of one pond. Water from the scrubber flowed by gravity through an 8-inch diameter PVC pipe into the second pond.

Samples of scrubber water to the venturi were collected by opening an inline valve on the discharge side of the feed pump. Samples of the venturi scrubber effluent were collected by passing a beaker attached to a rod through the flowing stream.

During each Method 5E and PAH sampling run two venturi inlet and venturi effluent water samples were taken. No water samples were taken concurrent with particle size distribution sampling runs.

J.2.2 Venturi Scrubber Process Measurements

J.2.2.1 Venturi Scrubber Water Flow Rate Measurements

The total flow rate of water to the venturi was monitored using a Signet Scientific paddle-wheel Flosensor® and a flow sensor provided by the Sloan Company. During the first day of testing both readings were taken and an average flowrate reported. On 5-10-84 the Signet Scientific Flosensor® malfunctioned and all subsequent data was taken from Sloan's flow sensor exclusively. A ten-gallon per minute correction factor was applied to all of the Sloan flow sensor readings to yield values comparable with those recorded on 5-8-84. All data was recorded by MRI personnel.

J.2.2.2 Venturi Scrubber Pressure Drop Measurements

Two pressure taps were installed in the venturi scrubber system so Radian could install a Magnehelic® gauge for use in monitoring the venturi pressure drop. One tap was installed upstream and the second tap was installed downstream of the venturi scrubber. Upon arriving on-site, Radian noted that both pressure taps were plugged shut with solids. The downstream tap could not be unplugged. Because of the plugged tap, the pressure drop across the venturi scrubber was measured using a water manometer supplied by the Sloan Construction Company. The water manometer was mounted on the front end of the mist eliminator. A minor problem was encountered with water getting in the lines periodically. When this occurred, the lines had to be blown out with instrument air.

J.2.3 Virgin Aggregate and Recycle Asphalt Pavement Sample Collection

Samples of virgin aggregate and recycle asphalt pavement were collected from the conveyor belts as the materials were transported from storage to the drum mixer. One virgin aggregate and one recycle asphalt pavement sample was collected during each EPA Method 5E and PAH sampling run. The grab samples were taken using a metal scoop and large collection tray. The samples were coned and quartered to obtain a representative sample and then taken directly to the mobile laboratory for moisture analysis. Additional RAP material was stored and returned for smoke point analysis.

J.2.4 Asphalt Cement Sample Collection

A sample of the asphalt cement fed to the drum mixer was collected on May 10, 1984 when a new shipment arrived by truck.

APPENDIX J.3

SAMPLE ANALYSIS PROCEDURES

INCLUDES

J.3.1 Total Organic Carbon Analysis
J.3.2 Polynuclear Aromatic Hydrocarbon Analysis
J.3.3 Particulate Mass Analysis
J.3.4 Percent Moisture Analysis
J.3.5 Smoke Point Determination of Recycled Asphalt Payment
J.3.6 Smoke Point and Flash Point Determination of Asphalt Cement
J.3.7 Total Suspended Solids/Total Dissolved Solids Analysis
J.3.8 pH and Temperature Measurements

J.3 Sample Analysis Procedure

J.3.1 Total Organic Carbon (TOC) Analysis

The TOC content of the EPA Method 5E sodium hydroxide impinger solution was determined instrumentally using the procedure specified in EPA Method 5E. A Beckman Model 915 B Total Carbon Analyzer was used to determine the total carbon content and total inorganic carbon content of the sample. The concentration of carbon present in the sample was determined by comparing the sample results with the results of standards prepared using potassium hydrogen phthalate. The total organic carbon content was determined by subtracting the total inorganic carbon content from the total carbon content.

J.3.2 Polynuclear Aromatic Hydrocarbon (PAH) Analysis

This section outlines the sample preparation and analysis procedures used to determine the concentration of PAH present in the PAH sampling train samples and scrubber water samples.

J.3.2.1 Preparation and Analysis of PAH Sampling Train Samples

The PAH sampling train produced five sample fractions:

- the methylene chloride nozzle and probe rinse,
- the filter,
- the first impinger condensate and methylene chloride glassware rinse of the glassware downstream of the filter and upstream of the XAD-2 resin canister,
- the XAD-2 resin and methylene chloride rinse, and
- the second impinger condensate and methylene chloride rinse of the glassware downstream of the XAD-2 resin canister and prior to the silica gel impinger.

Solid samples were extracted in soxhlet extractors for twenty-four hours with methylene chloride. The solid samples included:

- the front-half catch (probe and nozzle rinse plus the filter), and
- the XAD-2 resin.

The methylene chloride rinses associated with the solid sample fractions were included in the soxhlet extractions.

Liquid samples were extracted in continuous water extractors for twenty-four hours with methylene chloride. The liquid samples included:

- the first impinger condensate and methylene chloride glassware rinse, and
- the second impinger condensate and its methylene chloride glassware rinse.

During extraction, a malfunction occurred with the condensor water circulating system. This caused the evaporation of the solvents and consequent loss of samples. For this reason, no PAH sampling train sample analysis was performed.

J.3.2.2 Preparation and Analysis of Venturi Scrubber Water PAH Samples

Scrubber water samples were prepared for analysis by extraction in a continuous water extractor for twenty-four hours in methylene chloride.

The effluent scrubber water solid samples were prepared for analysis by first spiking the solid samples with isotopically labeled benzo(a)pyrene-d_{12} to serve as a sample recovery check. The solids were then extracted for 24 hours in methylene chloride using a soxhlet extractor.

The extracts were concentrated by means of a Kuderna-Danish evaporation apparatus.

The sample concentrates were analyzed by GC-MS with operation in the selected ion monitoring mode (SIM). Individual PAH compounds and major organic species were separated by employing a fused silica capillary column. The chromatographic conditions and other instrumental parameters are summarized in Table J-5. Mass spectral data were stored on a magnetic disc for interpretation and reference.

Identification of individual PAH and major organic compounds was based primarily on two criteria: chromatographic retention time and mass spectral characteristics. The appearance of key fragment ions of the compound at a precise retention time is indicative of the presence of the compound. In general, PAH compounds are relatively stable in the ion source of a mass spectrometer. The major (base peak) fragment corresponds to the molecular weight of the compound (M^+), other fragments are generally found at M^+-2 and $M^+/2$ (corresponding to a double charged ion). The relative intensities of these fragment ions are also examined in order to confirm the identification. Table J-6 lists

TABLE J-5. GC-MS CONDITIONS

Operating Parameter	Experimental Conditon
Instrument	Hewlett Packard 5985A
Ionization voltage	70eV
Scan rate	0.5 scan/second
Scan range	50→ 400 amu
Column	SE54 fused silica capillary
H_2 flow rate	60 cm/sec
Initial temp	35°C
Initial hold	1.0 min.
Program rate	10°C/min
Final temp	310°C
Final hold	20 min
Injector temp	35°C
Injection	Cool on-column
Sample size	1 µL

TABLE J-6. POLYCYCLIC AROMATIC HYDROCARBONS DETERMINED BY GC-MS

Phenanthrenes (178)	Benzopyrenes (252)
Phenanthrene	Benzo(a)pyrene
Anthracenes	Benzo(e)pyrene
	Perylene
Pyrenes (202)	Benzo(b)fluoranthrene
	Benzo(j)fluoranthrene
Pyrene	Benzo(k)fluoranthene
Fluoranthene	
	Benzoperylenes (276)
Chrysenes (278)	
	Benzo(g,h,i)perylene
Chrysene	Indeno(1,2,3-c,d)pyrene
Benz(a)anthracene	
Triphenylene	

Note: The molecular weight of each group is shown in parentheses.

several common PAH compounds. The internal standard, phenanthrene $-d_{10}$, served as a marked to verify retention time to within +0.1 minute.

Once an individual PAH on major organic compound was identified, the selected ion area of the chromatographic peak corresponding to the base peak fragment was obtained. This area was compared to the corresponding area of the internal standard. The concentration of the compound was then calculated using a known response based on a calibration standard.

J.3.3 Particulate Mass Analysis

The EPA Method 5E particulate mass sample consisted of the filter and the acetone front-half rinse. Filter analysis consisted of dessicating the filter for 24 hours and then weighing at 24-hour intervals to a constant weight.

The acetone rinse volumes were gravimetrically determined. The rinse samples were then transferred to individual clean, dry, tared 250 ml beakers for evaporation. The samples were evaporated to dryness at room temperature and pressure. When the samples were dry they were dessicated for 24 hours and then weighed at 24-hour intervals to a constant weight.

J.3.4 Percent Moisture Analysis

Each virgin aggregate and recycled asphalt pavement sample was prepared for analysis by quartering. This reduced the sample size from about 10 pounds to about 2.5 pounds.

A 500 gram sample was then transferred to a preweighed aluminum pan. The sample and pan were then weighed to the nearest 0.1 grams. The sample was dried at 105°C for 24 hours. The sample was reweighed and the difference determined. The remaining sample was saved for future analysis.

J.3.5 Smoke Point Determination of Recycled Asphalt Payment

The smoke point of RAP samples collected during the test program was determined using a test procedure developed by the Oklahoma Testing Laboratory. Based on this method a sample of RAP is first dried to a constant weight in an oven set at 140°F. 500 grams of the dried sample is then placed in a stainless steel bowl and heated at a rate of 25 to 30°F per minute while stirring the RAP with a stainless steel spatula. When the sample temperature is approximately 250°F, the heating rate is decreased so that the sample temperature rise is 5° to 10°F per minute until the smoke point is reached. The smoke point is recorded as the temperature at which the RAP starts to smoke.

J.3.6 Smoke Point and Flash Point Determination of Asphalt Cement

The smoke point and flash point of the asphalt cement used during testing was determined by the ASTM D92-Cleveland Open Cup procedure.[1] Based on this method, the test cup is filled to a specified level with the asphalt sample. The temperature of the sample is increased rapidly at first and then at a slow constant rate as the smoke point is approached. As soon as smoke is detected, the temperature of the sample is noted. To determine the flash point, the temperature is increased and at specified intervals a small test flame is passed across the cup. The lowest temperature at which application of the test flame causes the vapors above the surface of the liquid to ignite is taken as the flash point.

J.3.7 Total Suspended Solids/Total Dissolved Solids

The suspended and dissolved solids content of each scrubber water sample was determined on-site using a composite of the samples collected during each run. The suspended solids content of each composite scrubber water sample was determined by first filtering the sample using a preweighed filter. The filter and solids were then dried at 50°C and weighed.

The dissolved solids content of each scrubber water sample was determined by placing a 50 ml aliquot of the filtrate into a preweighed 100 ml beaker. The filtrate was then evaporated to dryness in an oven at 105°C, dessicated, and weighed to determine residue weight.

J.3.8 pH and Temperature Measurements

A Type-K thermocouple and digital readout was used to measure the temperature of each scrubber water sample at the collection point. An Orion hand-held portable pH meter with temperature compensator was used to measure the pH of each scrubber water sample. The pH measurement was made in a beaker immediately following sample collection. Prior to each pH measurement the meter was standardized with a pH 7 and pH 4 buffer.

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[1]Annual Book of ASTM Standards, "Standard Test Method for Flash and Fire Points by Cleveland Open Cup," Part 23, Petroleum Products and Lubricants(I), D92-72, pages 27-32.

APPENDIX K

PROJECT PARTICIPANTS

APPENDIX K

PROJECT PARTICIPANTS

INCLUDES

Sloan Construction Company Personnel
1. Paul Haigler - Vice President
2. Kelly Sherrill - Plant Manager
3. Harry Thomas - Plant Superintendent
4. Randy Watkins - Plant Foreman

Midwest Research Institute Personnel
1. Jack Butler - Project Monitor

Radian Personnel
1. Mike R. Fuchs - Project Director, Reporting
2. Eric P. Anderson - Gas Sampling Team Leader, Lab Analysis, Data Reduction, Reporting
3. Larry A. Rohlack - Gas Sampling Team Leader, Reporting
4. Michael J. Krall - Solids and Liquids Sampler
5. Carl S. Galloway - Gas Sampler
6. Clifford Thirion - Gas Sampler
7. C. Barry Chapman - Cleanup/Lab, Lab Analysis
8. David Savia - Visual Determination of Opacity
9. Donnie L. Heinrich - Sample Analysis

Environmental Protection Agency Personnel

Emission Measurement Branch (EMB)
1. Peter R. Westlin - Technical Support
2. Clyde E. Riley - Task Manager

Industrial Studies Branch (ISB)
1. Jeffrey Telander - Project Lead Engineer
2. Michael Clower - Task Manager

Standards Development Branch (SDB)
1. Rick Colyer - SDB Project Engineer

APPENDIX L

PERTINENT CORRESPONDENCE

INCLUDES

L.1 Re: Site Visit Report for Sloan Construction Company Asphalt Plant near Cocoa, Florida - to: Mr. Clyde E. Riley

L.2 Re: Summary of Field Testing Activities at Sloan Construction Company - to: Mr. Clyde E. Riley

L.3 Re: Report and Appendix Outlines for Testing and Analysis of the Sloan Construction Company Asphalt Plant near Cocoa, Florida - to: Mr. Clyde E. Riley

L.4 Re: Preliminary Data from Sloan Construction Company Asphalt Plant Sampling Program - to: Mr. Clyde E. Riley

L.5 Re: Smoke Point Test Procedure - to: Mr. Clyde E. Riley

RADIAN
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24 April 1984

Mr. Clyde E. Riley
U.S. Environmental Protection Agency
ESED/EMB (MD-13)
Research Triangle Park, NC 27711

Re: Site Visit Report for Sloan Construction Company
Asphalt Concrete Plant near Cocoa, Florida (84-ASP-8)

Dear Mr. Riley:

On April 19 a pretest site survey was conducted at the Sloan Construction Company asphalt concrete plant located near Cocoa, Florida. Sloan Construction is re-topping sections of I-95 near Cocoa using asphalt concrete produced with recycled asphalt concrete (RAP) taken from the job site. All plant production is utilizing RAP presently and will in the future through May except for a few days of conventional operation the week of April 23.

The plant is an Astec drum-mix plant incorporating a mid-drum feed chute for the RAP. Particulate emissions are controlled by an Astec wet venturi scrubber operating with a ΔP of about 15 inches of water. From the venturi, emissions enter a demister drum, then through an ID fan, through another demister, and exit through a 4-foot diameter stack. Venturi water is supplied from two earthen ponds, connected by an underground 12-inch PVC pipe. Each pond is about 20 feet wide by 50 feet long. Venturi effluent is discharged into one pond and drawn from the other. The water appears to be heavily contaminated with organics. The venturi water feed line has a flow monitor which is presently inoperable.

The test request seeks to collect particulate data, both loading and particle size distribution, on the uncontrolled emissions. There is no acceptable location for installing sampling ports to meet EPA Method 1 criteria. Gases from the drum mixer enter a knockout and then flow through a pipe having a diameter of about 2½ feet at an upward angle of about 60° for about 8 feet. The gases then bend downward at an angle of about 120° for another 8 feet where the circular duct is converted to a rectangular duct just prior to the venturi. ISB contractors have reiterated their request for uncontrolled particulate emissions data even though the accuracy of the results will be in question. Radian will perform the particulate concentration and particle size distribution measurements to respond to ISB requests, however, Radian feels that the data may well be inaccurate.

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Controlled emissions will be sampled in the 4-foot diameter stack. The sampling location is about 40 feet above ground level. A sampling platform is in place and is accessible by ladder. Two 3-inch male pipe sampling ports are mounted at the sampling location. The closest upstream disturbance is 124 inches from the sampling plane, and the downstream disturbance is 60 inches. Eyebolts are mounted on the stack above each port to support a monorail system. The gas stream has a slightly positive pressure. No significant problems are identified for the controlled sampling location except that the location does not meet the minimum requirements for upstream and downstream disturbances as stated in EPA Method 1. Controlled emissions will be sampled using the maximum number of traverse points which is 24 according to EPA Method 1R. To collect an adequate and representative sample, controlled emissions sampling time will be 120 minutes; 5 minutes per point.

There presently are no ports in the ductwork between the drum mixer and venturi. Radian will request that Sloan Construction install two ports mounted 90° with respect to each other in the circular ductwork just prior to the conversion ductwork to the rectangular duct above the venturi. One port will be male 3-inch pipe while the other will be 4-inch male pipe to accomodate insertion of the high capacity cascade impactor. Scaffolding must be installed at the uncontrolled emissions sampling location to provide a work area. Particulate and TOC sampling of controlled and uncontrolled emissions will be performed concurrently. Particle size sampling will be performed independent of other test work.

The water to the venturi will be sampled using an in-place valve on the positive pressure side of the feed pump. Sloan has a flowmeter, but it is presently not working. Radian will install a calibrated flosensor for use during the testing effort.

Venturi discharge water returns to the ponds by gravity flow through 8-inch PVC pipe. Water samples cannot now be collected. A small opening will be cut into the top of the pipe, large enough to get a beaker into the stream, to collect samples of the venturi effluent waters.

Virgin aggregate and recycled asphalt pavement are separately belt conveyed to the drum mixer. Samples of each will be collected from the conveyor belts.

The location of the plant poses no problem for visible opacity measurements. Blue haze was evident in the plume at a distance of more than 100 yards from the plant. Radian recommends determining visible opacity of the plume at several distances from the stack during each test period.

No laboratory area is available at the plant. Radian will deliver a mobile laboratory for sampling train set-up and sample retrieval. Plant personnel have agreed to supply electricity for the trailer as well as for sampling equipment.

The plant is located on Greensboro Road which is just off of State Highway 528, also know as The Beeline Expressway, a few miles outside of Cocoa. Personnel contacts at the plant include:

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Kelly Sherrill - Project Manager,
Harry Thomas - Superintendent, and
Randy Watkins - Forman.

The plant mailing address is P.O. Box 3883, Cocoa, Florida, 32924, and the plant telephone number is 305/632-4102.

Due to operating situations encountered during sampling at the T.J. Campbell Construction Company asphalt concrete plant, Radian recommends a testing schedule of one set of samples per day for a total of four sampling days. The proposed test matrix is presented in Table 1. The projected costs of the J.C. Sloan asphalt plant characterization are presented in Table 2. Testing is presently planned to begin the week of May 7. The first day on-site will be for set-up and collection of sampling train blank samples. The following four days are planned for sample collection. Two contingency days are included in the costs. Also note that the costs include a management task which was not a part of previous cost estimates. Previously management costs had been compiled in the project management task for which no budget had been established. The management budget would have been in a Work Plan.

The test plan for the Sloan plant will be on your desk no later than April 30. Please call if you have any questions or comments.

Sincerely,

Michael Fuchs

Michael Fuchs
Project Director

MF/sw

Enclosure

bcc: James Kamas
Eric Anderson
Larry Rohlack

CORPORATION

23 May 1984

Mr. Clyde E. Riley
U. S. Environmental Protection Agency
ESED/EMB (MD-13)
Research Triangle Park, North Carolina 27711

RE: Summary of Field Testing Activities at Sloan Construction Co. (84-ASP-8)

Dear Mr. Riley:

Testing activities were conducted May 7 through May 11 at the Sloan Construction Co. asphalt concrete plant located near Cocoa, Florida. The test crew arrived at the plant on May 7. As known prior to arrival, the plant was not operating that day and no preliminary measurements were performed. The laboratory trailer, testing equipment, and sampling locations were prepared for the testing effort. Considerable effort was required to set up scaffolding at the uncontrolled emissions sampling location. A venturi ΔP gauge and a venturi scrubber water flow meter were installed.

Tuesday, May 8, preliminary measurements were conducted in the late morning following a delay in operation of the asphalt plant caused by a breakdown of asphalt laying equipment. One Method 5E run (Run 1) was performed the afternoon of May 8; however, the isokinetic sampling rate of the controlled sampling location was outside of the allowable isokinetic range of 100% $\pm$10% requiring that three additional runs be conducted.

It was raining on May 9 and the plant did not operate. No sampling activities were performed.

Three Method 5E runs (Runs 2, 3, and 4) were conducted at the uncontrolled and controlled sampling locations, and one particle size distribution sample (PSD Run 1) was collected at the uncontrolled sampling location on Thursday, May 10. All runs were within isokinetic limits.

Friday, May 11, one polynuclear aromatic hydrocarbon sample (PAH Run 1) was collected at the uncontrolled and controlled sampling locations. One successful particle size distribution sample (PSD Run 2) was collected at the uncontrolled sampling location. Another particle size run was attempted; however, the sample was voided due to a leak in the impinger train occurring after the initial leak check. Sampling equipment was retrieved and packed for return to Austin. Samples were cross-checked with the sample logs and packed for shipment.

Table 1 presents the samples collected, times of collection, and other pertinent information concerning the samples.

Controlled emissions Method 5E Run 1 had a sampling time of 120 minutes, 5 minutes a point at 24 points. The isokinetic sampling rate could not be maintained at the final two traverse points on each of the two traverse diameters because of an increase in sampling pressure drop. The filter was replaced after sampling the initial traverse diameter. The pressure drop increase was apparently due to the filter loading with what appeared to be an oily, carbonaceous material. Because of the pressure drop build-up problem, subsequent Method 5E samples were collected for 72 minutes (3 minutes a point). The PAH sample was collected at 4 minutes a point--actual total sampling time 97 minutes. Method 5E runs for uncontrolled emissions were collected for 32 minutes, 2 minutes a point at 16 points. The PAH sample was collected over 48 minutes (3 minutes a point). The PSD runs were collected for 85 and 90 minutes. Several of the air emissions runs were interrupted by plant shutdowns; however, sampling was stopped at the times of plant shutdowns and no bias is expected in the results. Sampling was not continued until the process had reached steady-state operation as notified by NSS contractor personnel (MRI).

During the PAH run for controlled emissions, two sampling disturbances occurred which may in some degree affect results, the extent of which, however, cannot be measured. The nozzle used during Method 5E runs was selected for the PAH run. The nozzle size required a sampling rate up to about 0.75 cfm at the meter. However, due to the increased pressure drop caused by the XAD-2 resin in the PAH train, the higher isokinetic flow rates could not be attained. After the first traverse point (4 minutes of testing), the nozzle was changed to a smaller size to provide lower isokinetic sampling rates. The run was conducted within isokinetic limits. Both nozzles were solvent rinsed for inclusion in the sample. Later in the run, a glass crossover between the last two impingers broke and had to be replaced. There was some in-leakage of ambient air which can be estimated.

Three uncontrolled emissions particle size distribution samples were to be collected as stated in the test plan, but only two samples were collected. The third sample would have been collected between 1500 and 1700 hours on Friday, May 11. However, the ISB task manager allowed that two uncontrolled emissions particle size samples were sufficient and requested that the third sample not be collected.

The Method 5E procedure includes two impingers containing 0.1 N NaOH for collection of total organic carbon (TOC) followed by a dry impinger and an impinger containing silica gel. During this program, a dry impinger was included prior to the first NaOH impinger of the controlled emissions sampling trains. The dry impinger was included to collect excess water condensed from the sample gas and was necessitated by the high moisture content of the stack gases and the gas sampling volume. The first impinger (dry) and the second impinger (0.1 N NaOH) were collected and stored as a single sample as were the third impinger (0.1 N NaOH) and fourth impinger (dry).

The test plan called for the collection of three influent and effluent scrubber water samples during each Method 5E and PAH run. At the request of the Task Manager, only two water samples were collected during Method 5E and PAH runs, subsequent to Method 5E Run 1 during which three water samples were collected. Also, only one (instead of two as required by the test plan) sample of the RAP and virgin aggregate was collected during each Method 5E and PAH run as requested by the Task Manager.

During the site visit the scrubber water ponds were full and the venturi return line emptied into the pond below the water level. The test plan stated that a hole would be cut in the return line for collection of scrubber effluent water samples. However, during the testing effort, the scrubber water pond level was below the venturi return line and samples were collected at the end of the pipe. A beaker was attached to a rod and passed through the flowing stream to collect the sample. The temperature of the stream was measured by holding a thermocouple in the flowing stream. The pH of the venturi effluent water was measured in the sample collected in the beaker.

The above descriptions cover the known deviations from the sampling procedures prescribed in the test plan. One deviation in the Method 5E analytical protocol will be performed. The method states that the impingers and impinger rinses be combined into a single sample for analysis of TOC. In this program, the two impingers and associated rinses will be analyzed separately to allow an evaluation of the TOC collection efficiency of the impinger train.

The test plan stated that visible opacity measurements would be taken at several distances from the stack to evaluate condensation of hydrocarbons and blue haze formation. As implemented, visible opacity measurements were performed according to EPA Method 9 protocol only and not at various distances from the stack. Readings were performed only against a clear, blue sky background. Visible opacity readings were terminated during the PAH run because of cloud cover.

In the opinion of the Radian staff, the testing program was a success. The testing requirements stated in the test plan were accomplished within the time schedule even though one complete day of testing was lost due to rain which forced the plant to not operate. Two uncontrolled emissions particle size samples instead of three were collected, but the third sample was not collected at the request of the ISB task manager.

Please call if you have any questions or comments.

Sincerely,

Michael Fuchs

Michael Fuchs
Project Director
ESED Project No. 83/19

MF:kla

Attachment

CORPORATION

May 29, 1984

Mr. Clyde E. Riley
U. S. Environmental Protection Agency
ESED/EMB (MD-13)
Research Triangle Park, North Carolina 27711

Re: Report and Appendix Outlines for Testing and Analysis of the Sloan Construction Co. Asphalt Concrete Plant near Cocoa, Florida (84-ASP-8)

Dear Mr. Riley:

Please find enclosed for your review and comment, three copies of the emission test report outline and appendix outline that Radian proposes to use in documenting the results of testing performed at the Sloan Construction Co. asphalt plant. Included in the outline is a description of the gas phase polynuclear aromatic hydrocarbons (PAH) sampling procedure. But, due to the loss of the gas phase PAH samples, the gas phase PAH analysis and result sections were eliminated from the outline.

If you have any questions or comments, please give me a call.

Sincerely,

Larry A. Rohlack

Larry A. Rohlack
Staff Scientist

LAR:jm
Enclosure

CORPORATION

13 June 1984

Mr. Clyde E. Riley
U.S. Environmental Protection Agency
Emissions Measurements Branch
ESED/EMB (MD-13)
Research Trianagle Park, NC 27711

Re: Preliminary data from Sloan Construction Co. asphalt plant
Sampling Program
ESED Project No. 83-19
Project File No. 84-ASP-8

Dear Mr. Riley:

Enclosed are the preliminary data from the Sloan Construction Co. asphalt plant outside Cocoa Beach, Florida. The preliminary data include:

- particulate (front-half) loadings,
- volumetric gas flow rates,
- particulate mass emission rates, and
- particle size distributions.

The data have been tabulated for presentation. The tables included are:

- Table 1 - Particulate Loading Results (Front-Half Only)
- Table 2 - Method 5E and PAH Sampling Data
- Table 3 - Comparison of Particulate Mass Emission Rates Calculated by Concentration Method vs Area Ratio Method; and
- Table 4 - Particle Size Distribution Results.

Table 1 contains a breakdown of the front-half particulate fractions and the particulate loadings. The average particulate loading for the controlled emissions was 0.129 grains/DSCF excluding TOC Run 1, which was outside the isokinetic limit of 90 to 110%, and 0.125 grains/DSCF including the run. This is well above the NSPS of 0.04 grains/DSCF. The venturi scrubber particulate removal efficiency ranged from 98.6% to 97.6% and averaged 98.0%.

Table 2 contains voluemtric flow rate data and a listing of stack conditions. Volumetric gas flow rates at the inlet and outlet locations were within $\pm$ 10% of each other for all five runs. These data indicate that the uncontrolled emissions results are representative of actual conditions.

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Table 3 presents a comparison of mass emission rates calculated by concentration method vs area ratio method. One run was outside the isokinetic limit of 90 to 110%. The controlled emission sample collected 5/08 at 1426-1739 was subisokinetic. For comparison purposes, the results of all of the particulate sampling runs have been presented calculated by both methods.

Two successful particle size distribution (PSD) sampling runs were performed. Table 4 presents those data. Figure 1 graphically presents the particle size distribution of uncontrolled emissions.

Also enclosed are copies of the computer source sampling data reduction sheets which present both results and input data for the sampling runs.

Presently the total organic carbon and polynuclear aromatic hydrocarbon (PAH) analyses have not been completed. These results will be forwarded when available. As you know, the gas phase PAH samples were lost due to an equipment failure, and no results will be available.

If you have any questions or comments on any of data presented, please call me.

Sincerely,

Michael Fuchs

Michael Fuchs
Project Director
ESED Project 83/19

MF/mb

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June 29, 1984

Mr. Clyde E. Riley
U. S. Environmental Protection Agency
ESED/EMB (MD-13)
Research Triangle Park, North Carolina 27711

Re: Smoke Point Test Procedure

Dear Mr. Riley:

Enclosed is a copy of the letter Mr. Witte sent me concerning the test procedure he uses to determine the smoke point of recycled asphalt concrete. One RAP sample from Campbell and 5 RAP samples from Sloan were sent to Mr. Witte for smoke point analysis. Mr. Witte will use about 500 grams instead of 1000 grams of sample to conserve sample. Mr. Witte said he would use a smaller stainless steel pan to accommodate the smaller RAP sample. The 6 RAP samples will also be analyzed at Radian to determine the smoke point. Smoke test results from the two labs will be compared. Analyzing the samples at Radian will help in preparing a written test method.

In addition to the RAP, 2 asphalt samples from Campbell and 1 asphalt sample from Sloan were sent to Mr. Witte for Flash Point and Smoke Point analysis. Mr. Witte will use ASTM-D-92 (Cleveland Open Cup) to determine the Flash Point and Smoke Point of the asphalt samples.

If you have any questions, please call Mike Fuchs or myself.

Sincerely,

Larry A. Rohlack

Larry A. Rohlack
Staff Scientist

LAR:jm
Enclosure

Oklahoma Testing Laboratories

REGISTERED PROFESSIONAL ENGINEERS—CHEMISTS

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Larry Rohlack
Radian Corp.
P.O. Box 9948
Austin, Tx. 78766

Dear Sir:

The method we have been using for smoke point or reclaimed asphaltic concrete is as listed below.

I. Equipment
   A. Electric hot plate, variable heat, 8 1/2" diameter
   B. Stainless steel pan, bottom inside diameter - 7", top inside diameter - 9", depth - 3"
   C. Steel spatula, blade 1 3/4" diameter, 6" long
   D. Thermometer, either armoured asphalt testing or dial type with metal stem. Thermometer to be wired or taped to the blade of the spatula.

II. Test Method
   A. Dry sample in forced draft oven at 140°F to constant weight
   B. Weigh one thousand grams of material into pan
   C. Place on hot plate and adjust heat to give a temperature rise of about 5°F per minute. When heating is first started the temperature rise could be varied from this.
   D. Continue heating until smoking is noted. The sample must be stirred continuously during the heating period using the spatula with the attached thermometer.

In addition to the above we have kept a second glass thermometer at hand to verify the temperature when smoking is noted.

Very Truly Yours,

OKLAHOMA TESTING LABORATORIES

M. A. Witte
President

MAW:ly

STAFF MEMBERS MEMBER OF: AMERICAN COUNCIL OF INDEPENDENT LABORATORIES • AMERICAN SOCIETY FOR TESTING AND MATERIALS • AMERICAN SOCIETY OF CIVIL ENGINEERS • AMERICAN CHEMICAL SOCIETY • AMERICAN CONCRETE INSTITUTE • AMERICAN WATER WORKS ASSOCIATION • AMERICAN WELDING SOCIETY • NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS • AMERICAN INSTITUTE OF CHEMICAL ENGINEERS