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

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

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# Asphalt Concrete Industry

# Emission Test Report T.J. Campbell Company Oklahoma City, Oklahoma

## Volume 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

March 28, 1985

MEMORANDUM

SUBJECT: Source Test Report

FROM: J.E. McCarley, Chief, Field Testing Section, Emission Measurement Branch, ESED (MD-13)

TO: See Below

The enclosed final source test report is submitted for your information. Any questions regarding the test should be directed to the Project Officer (telephone: 8/629-5543). Additional copies of this report are available from the ERC Library, Research Triangle Park, North Carolina 27711.

Industry: Asphalt Concrete Industry

Process:

Company: T. J. Campbell Company

Location: Oklahoma City, Oklahoma

Project Report Number: 83-ASP-4

Project Officer: George W. Walsh

Enclosure

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DCN 222-078-03-15

# EMISSION TEST REPORT
# T.J. CAMPBELL ASPHALT CONCRETE PLANT
# OKLAHOMA CITY, OKLAHOMA

Final Report 83-ASP-4
Volume 1

Prepared for:

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EPA Contract No. 68-02-3850
Work Assignment 03
ESED Project No. 83-05

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Revised May 84

This report has been reviewed by the Emission Standards and Engineering Division, Office of Air Quality Planning and Standards, Office of Air, Noise and Radiation, Environmental Protection Agency, and approved for publication. Mention of company or product names does not constitute endorsement by EPA. Copies are available free of charge to Federal employees, current contractors and grantees, and nonprofit organizations - as supplies permit - from the Library Services Office, MD-35, Environmental Protection Agency, Research Triangle Park, NC 27711.

Order: EMB Report 83-ASP-4, Volume 1

# 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 and 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. 3.

MRI Project Monitor, William Terry, 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 T.J. Campbell Company personnel contributed substantially to the success of this emission test program. T.J. Campbell Construction Company personnel included Mr. Ted Campbell, President, and Mr. O'Flynn Sewell, Plant Manager.

Mr. Jeffrey Telander, 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 the NSPS review of the asphalt concrete industry.

## 1.1 BACKGROUND

An NSPS for asphalt concrete plants was promulgated March 8, 1974 and established a particulate limit of 0.04 grains per dry standard cubic foot and a visible emission limit of 20 percent opacity. Following a review of this NSPS in 1979, no revisions to the standard were proposed; however, a second review of the asphalt concrete NSPS was initiated in November of 1982. As part of this review, particulate and opacity limits are being evaluated for plants utilizing recycle 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 and visible) were being generated during asphalt concrete production utilizing RAP. Increased hydrocarbon emissions during RAP utilization 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 T. J. Campbell Construction Co. asphalt concrete plant in Oklahoma City, Oklahoma, as an emission test program site. Selection was based upon (1) utilization 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 conventional and recycle operations to provide a basis for comparison of the two operational modes to the promulgated NSPS.

## 1.3 BRIEF PROCESS DESCRIPTION

Figure 1-1 presents a schematic of the asphalt concrete process. Following are descriptions of conventional and recycle operations at the T. J. Campbell plant.

### 1.3.1 Conventional Operation

Conventional operation is the term used to denote process operation when feeding only virgin aggregate, i.e., unused aggregate material, to the drum mixer. 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 four bins and controlled by a computer located in the control room. 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 any of three storage silos for truck load-out.

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

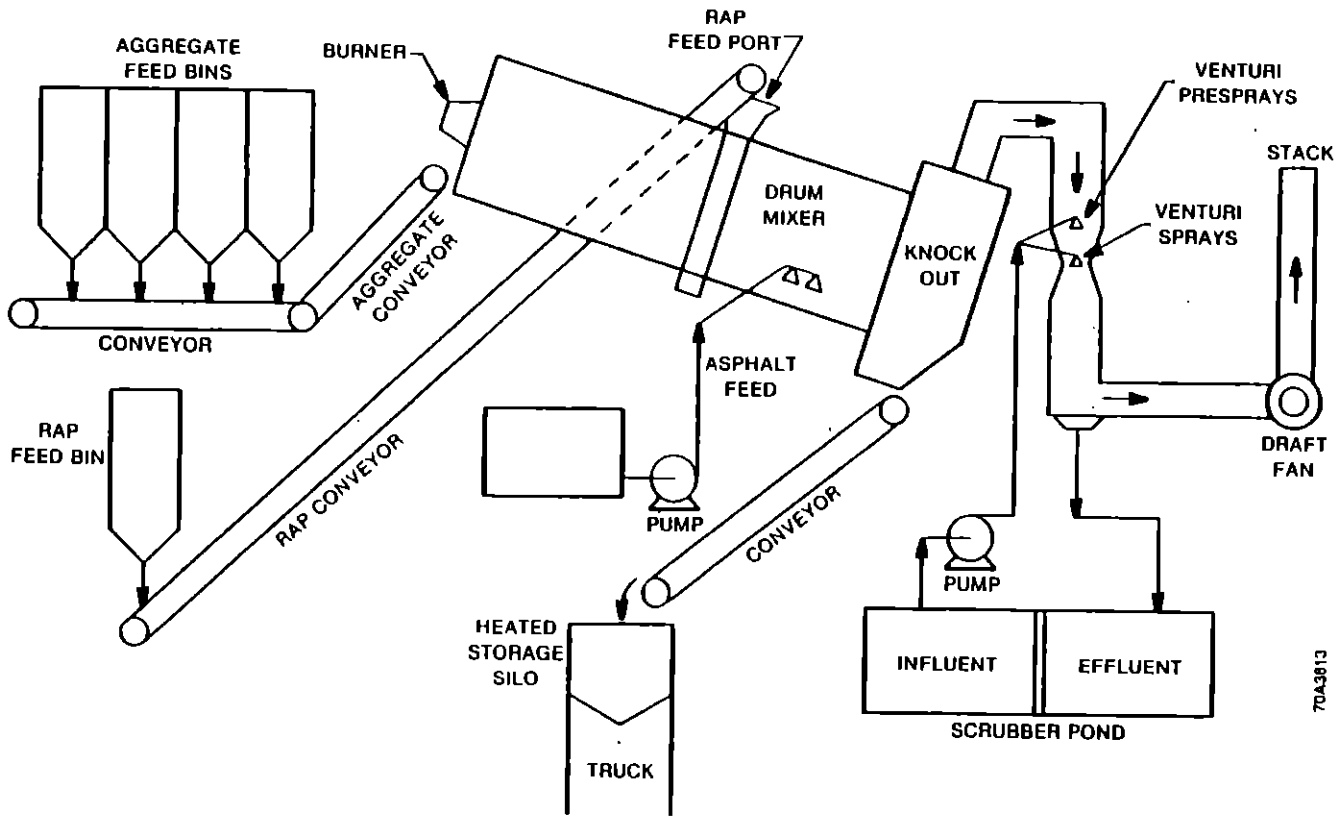


Figure 1-1. Schematic of asphalt concrete plant process and emission control equipment.

From the knockout box, the emissions are ducted to a wet venturi scrubber. In the duct work between the knockout box and venturi are water sprays to cool the emission gases. Water is also injected at the venturi throat. Additional water is flushed through a collection box below the venturi. Scrubber water is contained in two earthen ponds totaling about 120 feet by 24 feet with an effective depth of 3 to 6 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 divided by a dike which serves as a weir to reduce the suspended particulate matter in the scrubber water supply pond.

### 1.3.2 Recycle Operation

Recycle oepration differs from conventional operation in that RAP replaces a portion of the virgin aggregate in the rotary drum mixture. The remainder of the RAP or recycle process is as described in Section 1.3.1. 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.

## 1.4 EMISSIONS MEASUREMENT PROGRAM

The measurement program was conducted at the T. J. Campbell Construction Co. asphalt concrete plant in Oklahoma City, Oklahoma, November 7-15, 1983. The emission tests were designed to characterize and quantify uncontrolled (venturi scrubber inlet) and controlled (venturi scrubber outlet) emissions from the conventional and recycle asphalt operations.

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 Test Parameters of Interest

#### 1.4.1.1 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. Three particulate mass test runs were conducted during conventional operation and three were conducted during recycle operation.

#### 1.4.1.2 Total Organic Carbon and Extractable Organics--

Total organic carbon (TOC) and extractable organics samples were collected at the scrubber inlet and outlet simultaneously during the EPA Method 5E determinations described in Section 1.4.1.1. Each sample consisted of organics that condensed on the glassware downstream of the filter holder and in the first two impingers containing 0.1N NaOH. TOC impinger samples (0.1N NaOH impinger solutions) were analyzed to determine the total organic carbon and the extractable organics content. Three test runs were conducted during both conventional and recycle operation.

#### 1.4.1.3 Trace Metals--

During one recycle and one conventional particulate and TOC/extractable organics test run, a pair of nitric acid ($HNO_3$) impingers were incorporated in the sampling train to collect volatile trace metals samples. Particulate matter collected during the respective runs was also analyzed for trace metals. Both uncontrolled and controlled emissions were characterized for trace metals.

#### 1.4.1.4 Gas Stream Analysis--

The $CO_2$ and $O_2$ concentrations of the inlet and outlet flue gases were determined during recycle and conventional operations using an Orsat $O_2/CO_2$ apparatus as specified in EPA Method 3.

1.4.1.5 Particle Size Distribution--

Three particle size distribution (PSD) test runs were performed for uncontrolled emissions during conventional operation, and one inlet PSD run was performed during recycle operation. The presence of a water mist in the scrubber outlet gas stream prevented the collection of acceptable PSD data for controlled emissions.

1.4.1.6 Polynuclear Aromatic Hydrocarbons--

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

1.4.1.7 Scrubber Water Samples and Operations Monitoring--

The two process waters sampled were scrubber water to the venturi and scrubber water from the venturi. Grab samples of process waters were collected during each recycle and conventional particulate/TOC and PAH run. All samples were composited and analyzed for total dissolved solids, total suspended solids, and total organic carbon. Selected samples were analyzed for polynuclear aromatic hydrocarbons and trace metals.

The temperature and pH of water entering and exiting the scrubber were measured at the respective sampling locations coincident with the conventional and recycle process sampling.

Scrubber water flow rates to the venturi were monitored at two locations: total flow to the venturi and flow to the venturi throat. Flow rate data were recorded during each emission test run.

1.4.1.8 Process Samples and Production Monitoring--

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. No analyses were performed on the asphalt cement samples.

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 T. J. Campbell asphalt concrete plant in Oklahoma City, Oklahoma. Uncontrolled and controlled emission streams were tested. Process characterization included testing of scrubber waters and feed materials. Testing was conducted during both conventional and recycle operation.

Particulate mass, total organic carbon, and extractable organics test results are presented in Sections 2.1, 2.2, and 2.3, respectively. A comparison of total organic carbon emissions and extractable organics emissions during conventional and recycle operation is presented in Section 2.4. Sections 2.5 and 2.6 present trace metal and polynuclear aromatic hydrocarbon results, respectively. Particle size distribution data and visible emission results are presented in Sections 2.7 and 2.8. Scrubber characterization results and process sampling results are presented in Sections 2.9 through 2.11.

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.

Additional 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 conventional and recycle operation. Particulate emission results, identified in the data tables as the "front-half catch," are presented and discussed in this section.

### 2.1.1 Conventional Operation Particulate Emission Results

Table 2-1 (English units) and Table 2-2 (metric units) present results of the uncontrolled and controlled particulate emission tests performed during conventional operation. Three uncontrolled and controlled particulate emission sampling runs were conducted simultaneously during conventional operation. The three conventional operation runs are designated as C-1, C-2, and C-3.

Uncontrolled particulate loadings were 7.60, 8.49, and 5.58 grains per dry standard cubic feet (gr/DSCF) for Runs C-1, C-2, and C-3, respectively. The corresponding controlled particulate emissions were 0.0550, 0.0814, and 0.0332 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The average controlled particulate mass loading was 0.0565 gr/DSCF, which is above the present NSPS standard of 0.04 gr/DSCF. The particulate (front-half catch) collection efficiency of the wet venturi scrubber was 99.3, 99.1, and 99.4 percent for Runs C-1, C-2, and C-3, respectively.

### 2.1.2 Recycle Operation Particulate Emission Results

Table 2-3 (English units) and Table 2-4 (metric units) present results of the uncontrolled and controlled particulate emission tests performed during recycle oepration. Three uncontrolled and controlled particulate emission sampling runs were conducted simultaneously during recycle operation. The three recycle operation runs are designated as R-1, R-2, and R-3.

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

| Date | 11/12 | | 11/13 | | 11/14 | | Average | |
|---|---|---|---|---|---|---|---|---|
| Run Number | C-1 | | C-2 | | C-3 | | | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 13.5 | | 13.4 | | 13.5 | | 13.5 | |
| Scrubber Water Flow Rate (GPM) | 219 | | 219 | | 215 | | 218 | |
| Production Rate (ton/hr) | 244 | | 235 | | 213 | | 231 | |
| Process Mix Type | B-Mix | | B/C Mix | | M-Mix | | --- | |
| Average Opacity (Percent) Mean, Range | 0 (0-1.5) | | 0 (-0-) | | N/A | | 0 | |
| Particulate and Total Organic Carbon (TOC) Results | | | | | | | | |
| Front Half Catch - Particulate (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 9360 | 172 | 10,800 | 244 | 6950 | 104 | 9040 | 173 |
| gr/DSCF | 7.60 | 0.0550 | 8.49 | 0.0814 | 5.58 | 0.0332 | 7.22 | 0.0565 |
| lbs/hr* | 762 | 5.53 | 910† | 8.29 | 599 | 3.45 | 757 | 5.76 |
| lbs/ton production | 3.12 | 0.0226 | 3.87 | 0.0353 | 2.81 | 0.0162 | 3.27 | 0.0247 |
| Collection Efficiency Percent** | 99.3 | | 99.1 | | 99.4 | | 99.2 | |
| Back Half Catch - TOC (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 253 | 166 | 553 | 417 | 370 | 405 | 392 | 329 |
| gr/DSCF | 0.205 | 0.0532 | 0.434 | 0.139 | 0.297 | 0.129 | 0.312 | 0.107 |
| lbs/hr* | 20.5 | 5.34 | 43.6 | 14.2 | 31.8 | 13.4 | 32.0 | 11.0 |
| lbs/ton production | 0.0840 | 0.0219 | 0.186 | 0.0604 | 0.149 | 0.0629 | 0.139 | 0.0476 |
| Collection Efficiency Percent** | 73.9 | | 67.5 | | 57.8 | | 65.7 | |
| Total Catch | | | | | | | | |
| mg-mass | 9610 | 338 | 11,400 | 661 | 7320 | 509 | 9430 | 502 |
| gr/DSCF | 7.80 | 0.108 | 8.92 | 0.220 | 5.88 | 0.162 | 7.53 | 0.164 |
| lbs/hr* | 782 | 10.9 | 954 | 22.5 | 631 | 16.8 | 789 | 16.7 |
| lbs/ton production | 3.20 | 0.0445 | 4.06 | 0.0957 | 2.96 | 0.0791 | 3.41 | 0.0731 |
| Collection Efficiency Percent** | 98.6 | | 97.6 | | 97.3 | | 97.9 | |

†Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*lbs/hr controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using lbs/hr values

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

| Date | 11/12 | | 11/13 | | 11/14 | | Average | |
|---|---|---|---|---|---|---|---|---|
| Run Number | C-1 | | C-2 | | C-3 | | | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 34.3 | | 34.0 | | 34.3 | | 34.3 | |
| Scrubber Water Flow Rate (GPM) | 13.8 | | 13.8 | | 13.6 | | 13.7 | |
| Production Rate (ton/hr) | 61.5 | | 59.2 | | 53.7 | | 58.1 | |
| Process Mix Type | B-Mix | | B/C Mix | | M-Mix | | --- | |
| Average Opacity (Percent) Mean, Range | 0 (0-1.5) | | 0 (-0-) | | N/A | | 0 | |
| **Particulate and Total Organic Carbon (TOC) Results** | | | | | | | | |
| Front Half Catch - Particulate (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 9360 | 172 | 10,800 | 244 | 6950 | 104 | 9040 | 173 |
| mg/DSCM | 17,400 | 126 | 19,400 | 186 | 12,800 | 76.0 | 16,500 | 129 |
| g/s* | 96.1 | 0.697 | 115† | 1.05 | 75.5 | 0.435 | 95.5 | 0.726 |
| g/kg production | 1.56 | 0.0113 | 1.94 | 0.0177 | 1.41 | 0.00810 | 1.64 | 0.0125 |
| Collection Efficiency Percent** | 99.3 | | 99.1 | | 99.4 | | 99.2 | |
| Back Half Catch - TOC (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 253 | 166 | 553 | 417 | 370 | 405 | 392 | 329 |
| mg/DSCM | 470 | 122 | 995 | 319 | 681 | 296 | 715 | 245 |
| g/s* | 2.59 | 0.673 | 5.50 | 1.79 | 4.01 | 1.69 | 4.03 | 1.39 |
| g/kg production | 0.0420 | 0.0109 | 0.0931 | 0.0302 | 0.0746 | 0.0315 | 0.0694 | 0.0239 |
| Collection Efficiency Percent** | 73.9 | | 67.5 | | 57.8 | | 65.6 | |
| Total Catch | | | | | | | | |
| mg-mass | 9610 | 338 | 11,400 | 661 | 7320 | 509 | 9430 | 502 |
| mg/DSCM | 17,900 | 248 | 20,400 | 505 | 13,500 | 372 | 17,200 | 374 |
| g/s* | 98.7 | 1.37 | 120 | 2.84 | 79.5 | 2.12 | 99.5 | 2.12 |
| g/kg production | 1.60 | 0.0222 | 2.03 | 0.0479 | 1.48 | 0.0396 | 1.71 | 0.0364 |
| Collection Efficiency Percent** | 98.6 | | 97.6 | | 97.3 | | 97.9 | |

†Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*gS controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using g/s values

TABLE 2-3. SUMMARY OF PARTICULATE AND TOTAL ORGANIC CARBON EMISSIONS DURING RECYCLE OPERATION (ENGLISH UNITS)

| Date | 11/11 | | 11/11 | | 11/12 | | | |
|---|---|---|---|---|---|---|---|---|
| Run Number | R-1 | | R-2 | | R-3 | | Average | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled* | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 13.8 | | 13.8 | | 13.9 | | 13.8 | |
| Scrubber Water Flow Rate (GPM) | 223 | | 220 | | 219 | | 221 | |
| Production Rate (ton/hr) | 229 | | 250 | | 236 | | 238 | |
| Process Mix Type | Recycle-A | | Recycle-A | | Recycle-A | | -- | |
| Average Opacity (Percent) Mean, Range | 1.4 (0-5.8) | | 0.3 (0-1.7) | | N/A | | 0.85 | |
| Particulate and Total Organic Carbon (TOC) Results | | | | | | | | |
| Front Half Catch - Particulate (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 4380 | 84.0 | 5,260 | 88.2 | 5570 | 111 | 5070 | 94.5 |
| gr/DSCF | 3.24 | 0.0227 | 4.37 | 0.0229 | 3.75 | 0.0286 | 3.79 | 0.0247 |
| lbs/hr | 411 | 2.72 | 499† | 2.76† | 474† | 3.42 | 461 | 2.97 |
| lbs/ton production | 1.79 | 0.0119 | 2.00 | 0.0110 | 2.01 | 0.0145 | 1.94 | 0.0125 |
| Collection Efficiency Percent** | 99.3 | | 99.4 | | 99.3 | | 99.4 | |
| Back Half Catch - TOC (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 605 | 219 | 788 | 375 | 748 | 618 | 714 | 404 |
| gr/DSCF | 0.448 | 0.0592 | 0.655 | 0.0975 | 0.504 | 0.159 | 0.536 | 0.105 |
| lbs/hr | 56.8 | 7.09 | 69.1 | 11.1 | 60.5 | 19.0 | 62.1 | 12.4 |
| lbs/ton production | 0.248 | 0.0310 | 0.276 | 0.0445 | 0.256 | 0.0805 | 0.261 | 0.0520 |
| Collection Efficiency Percent** | 87.5 | | 83.9 | | 68.6 | | 80.4 | |
| Total Catch | | | | | | | | |
| mg-mass | 4980 | 303 | 6050 | 463 | 6320 | 729 | 5780 | 498 |
| gr/DSCF | 3.69 | 0.0819 | 5.07 | 0.120 | 4.25 | 0.188 | 4.33 | 0.130 |
| lbs/hr | 468 | 9.81 | 568 | 13.8 | 534 | 22.4 | 523 | 15.3 |
| lbs/ton production | 2.04 | 0.0430 | 2.28 | 0.0555 | 2.27 | 0.095 | 2.20 | 0.0645 |
| Collection Efficiency Percent** | 97.9 | | 97.6 | | 95.8 | | 97.1 | |

†Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*lbs/hr controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using lbs/hr values

TABLE 2-4. SUMMARY OF PARTICULATE AND TOTAL ORGANIC CARBON EMISSION DURING RECYCLE OPERATION (METRIC UNITS)

| Date | 11/11 | | 11/11 | | 11/12 | | | |
|---|---|---|---|---|---|---|---|---|
| Run Number | R-1 | | R-2 | | R-3 | | Average | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled* | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 5.43 | | 5.43 | | 5.47 | | 5.44 | |
| Scrubber Water Flow Rate (GPM) | 14.1 | | 13.9 | | 13.8 | | 13.9 | |
| Production Rate (ton/hr) | 57.8 | | 63.1 | | 59.6 | | 60.2 | |
| Process Mix Type | Recycle-A | | Recycle-A | | Recycle-A | | --- | |
| Average Opacity (Percent) Mean, Range | 1.4 (0-5.8) | | 0.3 (0-1.7) | | N/A | | 0.85 | |
| **Particulate and Total Organic Carbon (TOC) Results** | | | | | | | | |
| **Front Half Catch - Particulate** (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 4380 | 84.0 | 5260 | 88.2 | 5570 | 111 | 5070 | 94.5 |
| mg/DSCM | 7420 | 51.9 | 10,000 | 52.5 | 8590 | 65.4 | 8670 | 56.6 |
| g/s | 51.8 | 0.343 | 62.9† | 0.348† | 59.8† | 0.431 | 58.2 | 0.374 |
| g/kg production | 0.896 | 0.00593 | 0.919 | 0.00550 | 1.01 | 0.00726 | 0.942 | 0.00622 |
| Collection Efficiency Percent** | 99.3 | | 99.4 | | 99.3 | | 99.4 | |
| **Back Half Catch - TOC** (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 605 | 219 | 788 | 375 | 748 | 618 | 714 | 401 |
| mg/DSCM | 1030 | 136 | 1500 | 224 | 1160 | 365 | 1230 | 242 |
| g/s | 7.16 | 0.894 | 8.71 | 1.40 | 7.63 | 2.40 | 7.83 | 1.54 |
| g/kg production | 0.124 | 0.0155 | 0.138 | 0.0222 | 0.128 | 0.0402 | 0.130 | 0.0254 |
| Collection Efficiency Percent** | 87.5 | | 83.9 | | 68.6 | | 80.4 | |
| **Total Catch** | | | | | | | | |
| mg-mass | 4980 | 303 | 6050 | 463 | 6320 | 729 | 5780 | 498 |
| mg/DSCM | 8450 | 188 | 11,500 | 276 | 9750 | 430 | 9900 | 299 |
| g/s | 59.0 | 1.24 | 71.6 | 1.74 | 67.4 | 2.83 | 66.0 | 1.93 |
| g/kg production | 1.02 | 0.0215 | 1.06 | 0.0276 | 1.14 | 0.0475 | 1.07 | 0.0320 |
| Collection Efficiency Percent** | 97.9 | | 97.6 | | 95.8 | | 97.1 | |

†Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*gS controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using g/s values

Uncontrolled particulate loadings were 3.24, 4.37, and 3.75 gr/DSCF for Runs R-1, R-2, and R-3, respectively. The corresponding controlled particulate emissions were 0.0227, 0.0229, and 0.0286 gr/DSCF for Runs R-1, R-2, and R-3, respectively. The average controlled particulate mass loading was 0.0247 gr/DSCF which is below the present NSPS standard of 0.04 gr/DSCF. The particulate (front-half catch) collection efficiency of the wet venturi scrubber was 99.3, 99.4, and 99.3, for Tests R-1, R-2, and R-3, respectively.

### 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
- conventional versus recycle particulate mass emissions.

#### 2.1.3.1 Particulate Mass Sampling Difficulties--

Problems encountered during particulate mass sampling included:

- source sampling equipment malfunctions, and
- fluctuations in the moisture content of the process gas streams.

Glassware broke twice during controlled emission sampling Run C-1. When this occurred, sampling was stopped, the broken glassware was replaced, a new leak check was performed, and sampling was resumed. The probe liner heater also shorted out during the same run (C-1). After the liner heater shorted out, the probe was disconnected from the sampling train, the liner end and the nozzle were capped, and the probe was taken to the mobile lab

for cleanup using the procedures outlined in Section 5. The shorted-out liner was then removed and a clean glass liner inserted in the probe. The sampling train was reassembled and after a leak check, sampling was resumed. It is felt that the equipment malfunctions encountered during Run C-1 did not adversely affect or bias the data obtained during the sampling run.

It is believed that fluctuations in the moisture content of the virgin aggregate and recycle asphalt pavement feed caused the moisture content of the uncontrolled emissions gas stream to fluctuate. Two uncontrolled sampling runs conducted on November 11, 1983 using the same mix (Recycle A), had flue gas moisture values that varied by over 7%. To help alleviate this problem, a wet bulb/dry bulb reading was taken prior to and during uncontrolled sampling runs conducted in the latter stages of the testing effort. This procedure provided more accurate data, but the uncontrolled gas moisture content was still observed to fluctuate. In the case of Run C-2, the measured moisture content was 8% higher than the wet bulb/dry bulb value measured immediately prior to the run.

During four of the six controlled particulate emission runs, the moisture values determined from the impinger weight gains exceeded the temperature dependent saturation volume as determined by a psychrometric chart. Sampling runs with impinger moisture values exceeding the saturation volume indicate the presence of water mist. The saturation volume for those four runs was used as the moisture value for all further calculations.

2.1.3.2 Discussion of Anisokinetic Test Results--

Fluctuations in the moisture content of the uncontrolled emissions gas stream and the presence of water mist in the controlled emissions gas stream resulted in anisokinetic sampling rates during four particulate mass runs. These included:

- Controlled Particulate Emissions Run R-2.
- Uncontrolled Particulate Emissions Run C-2.

- Uncontrolled Particulate Emissions Run R-2.

- Uncontrolled Particulate Emissions Run R-3.

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.

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 runs that were outside of the isokinetic sampling limit of 100 $\pm$10 percent

2.1.3.3 Discussion of Particulate Emissions During Conventional and Recycle Operation--

A major objective of this program is to evaluate how the particulate emissions change during conventional asphalt concrete production and production using recycle asphalt pavement. Based on the particulate emissions data presented in Tables 2-1 through 2-4, four general observations were made. These include:

- The NSPS particulate emission standard (0.04 grains/DSCF) was met during all particulate emission runs except for Runs C-1 and C-2.

TABLE 2-5. COMPARISON OF PARTICULATE EMISSIONS CALCULATED BY THE CONCENTRATION METHOD VS. AREA-RATIO METHOD

| Date | Time | Sample Description | Percent Isokinetic | Emission Rate lbs/hr Concentration Method | Area-Ratio Method | Average |
|---|---|---|---|---|---|---|
| | | Uncontrolled Emissions | | | | |
| 11/12 | 1151-1243 | Run C-1 | 110 | 762 | 837 | 800 |
| 11/13 | 0956-1050 | Run C-2 | 113 | 853 | 967 | 910 |
| 11/14 | 0827-0936 | Run C-3 | 104 | 599 | 622 | 610 |
| | | Controlled Emissions | | | | |
| 11/12 | 1129-1319 | Run C-1 | 102 | 5.53 | 5.65 | 5.59 |
| 11/13 | 0853-1112 | Run C-2 | 96 | 8.29 | 8.01 | 8.15 |
| 11/14 | 0813-1003 | Run C-3 | 99 | 3.45 | 3.43 | 3.44 |
| | | Uncontrolled Emissions | | | | |
| 11/11 | 0843-0937 | Run R-1 | 95 | 411 | 391 | 415 |
| 11/11 | 1645-1730 | Run R-2 | 117 | 460 | 538 | 499 |
| 11/12 | 0748-0846 | Run R-3 | 111 | 451 | 498 | 474 |
| | | Controlled Emissions | | | | |
| 11/11 | 0839-1433 | Run R-1 | 104 | 2.72 | 2.85 | 2.78 |
| 11/11 | 1515-1704 | Run R-2 | 111 | 2.61 | 2.90 | 2.76 |
| 11/12 | 0713-0900 | Run R-3 | 107 | 3.42 | 3.66 | 3.54 |
| | | Uncontrolled Emissions[a] | | | | |
| 11/11 | 1253-1330 | PSD R-1 | 108 | 486 | 528 | 507 |
| 11/12 | 1418-1520 | PSD C-1 | 103 | 1080 | 1117 | 1098 |
| 11/14 | 1014-1143 | PSD C-2 | 103 | 685 | 710 | 698 |
| 11/15 | 1225-1440 | PSD C-3 | 112 | 1040 | 1170 | 1105 |

[a]Calculated particlate size distribution sampling mass emission rate results may not be representative of actual stack mass emission rate.

- The particulate collection efficiency of the venturi scrubber varied from only 99.1 to 99.4 percent.

- The data indicate that the type of mix material fed to the drum during each run has a direct effect on the uncontrolled and controlled particulate mass rates, and

- Over the range tested, the production rate of either conventional mix or recycle mix does not appear to significantly affect the uncontrolled or controlled particulate mass loading.

The controlled particulate mass loadings rates were 0.0550 and 0.0814 gr/DSCF for Runs C-1 and C-2, respectively, which is above the present NSPS standard. Achievement of the NSPS limit during Runs C-3, R-1, R-2, and R-3 was not due to improved performance of the venturi scrubber, but instead due to a decrease in the level of uncontrolled emissions. A major difference between Runs C-1 and C-2 and the rest of the runs is the type of raw materials feed to the drum during each run.

Table 2-6 includes a summary of the asphalt concrete mixes typically produced by the T. J. Campbell Construction Company. During Run C-1, Type B mix was being produced. Type B mix was also produced during most of Run C-2, with some production of Type C mix near the end of Run C-2. Type M mix was produced during Run C-3 and Type A recycled asphalt mix was produced during Runs R-1, R-2, and R-3.

Type B, C, and M mixes are top mixes that contain about 20 to 24 percent sand. The Type M mix uses washed sand while Type B and C mixes use unwashed sand. The washed sand is believed to contain less fines and adhered dissolved salts. Type A recycled asphalt mix is a base mix and contains about 9.8 percent sand. Run results indicate that the type (washed/

TABLE 2-6. AGGREGATE ADDITIONS FOR TYPICAL MIXES AT T. J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| Type Mix | Asphalt Cement Added (Percent) | Bin No. | Percent of Aggregate | Bin Contents | Moisture Content Estimated By Plant Personnel (Percent) |
|---|---|---|---|---|---|
| Type B (virgin) | 4.9 | 1 | 45 | Screenings | 2.5 |
| | | 2 | 22 | Sand | 12.0 |
| | | 3 | 8 | 3/4 in. rock | 1.5 |
| | | 4 | 25 | 5/8 in. rock | 2.0 |
| Type C | 5.0 | 1 | 43 | Screenings | 1.5 |
| | | 2 | 24 | Sand | 12.0 |
| | | 3 | 33 | 3/8 in. rock | 1.5 |
| | | 4 | 0 | -- | --- |
| Type M | 5.0 | 1 | 53 | Screenings | 2.0 |
| | | 2 | 20 | Sand (washed) | 11.0 |
| | | 3 | 0 | -- | --- |
| | | 4 | 27 | 5/8 in. rock | 2.0 |
| Type A (recycle) | 3.9 (4.6)[a] | 1 | 18 | Screenings | 2.5 |
| | | 2 | 9.8 | Sand | 12.0 |
| | | 3 | 0 | -- | --- |
| | | 4 | 47.2 | 1.5 in. rock | 2.0 |
| | | RAP | 25 | RAP | 2.0 |
| Hot Sand (recycle) | 4.5 (4.6)[a] | 1 | 15 | Screenings | 2.0 |
| | | 2 | 60 | Sand | 11.0 |
| | | 3 | — | -- | |
| | | 4 | -- | -- | |
| | | RAP | 25 | RAP | 2.0 |

[a]Asphalt cement in the RAP.

unwashed) and quantity (9.8%/20-24%) of sand in the mix feed materials affect the concentration of particulate matter entrained in the emission gases.

## 2.2 TOTAL ORGANIC CARBON RESULTS

Controlled and uncontrolled 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. TOC results, identified in the data tables as the "back-half catch," are presented and discussed in this section.

### 2.2.1 Conventional Operation TOC Emission Results

Uncontrolled and controlled TOC results for conventional operation are presented in Table 2-1 (English units) and Table 2-2 (metric units). Uncontrolled TOC loadings were 0.205, 0.434, and 0.297 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The controlled TOC loadings were 0.0532, 0.139, and 0.129 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The TOC (back-half catch) collection efficiency of the wet venturi scrubber was 73.9, 67.5, and 57.8 percent for Runs C-1, C-2, and C-3, respectively.

### 2.2.2 Recycle Operation TOC Emission Results

Table 2-3 (English units) and Table 2-4 (metric units) present results of the uncontrolled and controlled TOC measurements performed during recycle operation. Uncontrolled TOC loadings were 0.448, 0.655, and 0.504 gr/DSCF for Runs R-1, R-2, and R-3, respectively. The controlled TOC loadings were 0.0592, 0.0975, and 0.159 gr/DSCF for Runs R-1, R-2, and R-3, respectively. The TOC collection efficiency of the wet venturi scrubber was 87.5, 83.9, and 68.6 percent for Runs R-1, R-2, and R-3, respectively.

### 2.2.3 Discussion of TOC Test Results

The uncontrolled TOC loadings varied from 0.205 to 0.434 gr/DSCF during conventional operation and from 0.448 to 0.655 gr/DSCF during recycle operation. The controlled TOC loadings varied from 0.0532 to 0.139 gr/DSCF during conventional operation and from 0.0592 to 0.159 gr/DSCF during recycle operation. Based on the limited data available, it is difficult to develop any correlations between process operation and the degree of variability in the uncontrolled and controlled TOC emissions during conventional and recycle operation.

The average uncontrolled TOC loading was approximately 72 percent greater during recycle operation (0.0536 gr/DSCF) as compared to conventional operation (0.0312 gr/DSCF). But the average controlled TOC loading during recycle operation (0.105 gr/DSCF) approximated the average controlled TOC loading during conventional operation (0.107 gr/DSCF). These data indicate that although the average uncontrolled TOC emissions increased during recycle operation, they did not result in an increase in controlled TOC emissions when compared to conventional TOC data. The average removal efficiency of the venturi scrubber increased from 65.7 percent during conventional operation to 80.4 percent during recycle operation.

## 2.3 EXTRACTABLE ORGANICS EMISSION RESULTS

Extractable organics analysis was performed on the same 0.1 N NaOH impinger solutions and rinses that TOC analysis was performed on (modified EPA Method 5E samples) with the addition of the inclusion of results of a trichloroethane rinse. An aliquot of the 0.1N NaOH samples were extracted with chloroform and diethyl ether. After evaporation at room temperature, the mass of extractable organics was determined gravimetrically. The trichloroethane rinses were also evaporated at room temperature to determine the mass of extractable organics gravimetrically. Tables 2-7 and 2-8 contain a summary of uncontrolled and controlled extractable organics and particulate emission results. Extractable organics are identified as the

TABLE 2-7. SUMMARY OF UNCONTROLLED PARTICULATE AND EXTRACTABLE ORGANICS EMISSIONS

| DATE | 11/12 | 11/11 | 11/13 | 11/11 | 11/14 | 11/12 | | |
|---|---|---|---|---|---|---|---|---|
| RUN NO. | C-1 | R-1 | C-2 | R-2 | C-3 | R-3 | | |
| PROCESS OPERATION | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE |
| VOLUME GAS SAMPLED (DSCF) | 19.0 | 20.8 | 19.6 | 18.6 | 19.2 | 22.9 | 19.3 | 20.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700 | 14,800 | 11,700 | 12,300 | 12,500 | 14,000 | 12,000 | 13,700 |
| STACK TEMPERATURE (°F) | 298 | 296 | 289 | 314 | 304 | 317 | 297 | 309 |
| PERCENT MOISTURE BY VOLUME | 38.0 | 24.4 | 39.6 | 31.5 | 36.7 | 27.7 | 38.1 | 27.9 |
| PERCENT ISOKINETIC | 110 | 95 | 113 | 117 | 104 | 111 | 109 | 108 |
| PRODUCTION RATE (tons/hr) | 244 | 229 | 235 | 250 | 213 | 236 | 231 | 238 |
| PARTICULATE - EXTRACTABLE ORGANICS RESULTS | | | | | | | | |
| FRONT HALF CATCH - PARTICULATE (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 9360 | 4380 | 10,800 | 5260 | 6950 | 5570 | 9040 | 5070 |
| gr/DSCF | 7.60 | 3.24 | 8.49 | 4.37 | 5.58 | 3.75 | 7.22 | 3.79 |
| lbs/hr | 762 | 411 | 910† | 499† | 599 | 474† | 757 | 461 |
| lbs/ton production | 3.12 | 1.79 | 3.87 | 2.00 | 2.81 | 2.01 | 3.28 | 1.94 |
| BACK HALF CATCH - EXTRACTABLE ORGANICS (impinger solutions & rinses) | | | | | | | | |
| mg-mass | 217 | 208 | 72.3 | 169 | 163 | 113 | 151 | 163 |
| gr/DSCF | 0.176 | 0.154 | 0.0568 | 0.140 | 0.131 | 0.076 | 0.121 | 0.123 |
| lbs/hr | 17.6 | 19.5 | 5.70 | 14.7 | 14.0 | 9.12 | 12.4 | 14.4 |
| lbs/ton production | 0.0721 | 0.0852 | 0.0243 | 0.0588 | 0.0657 | 0.0386 | 0.0537 | 0.0605 |
| PERCENT EXTRACTABLE ORGANICS* | 2.26 | 4.54 | 0.62 | 2.86 | 2.28 | 1.88 | 1.61 | 3.02 |

†Average emission rate of concentration and area-ratio methods (Table 2-10).

*Percent Extractable Organics determined using lbs/hr values and is the percentage of extractable organics of the total catch.



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TABLE 2-8. SUMMARY OF CONTROLLED PARTICULATE AND EXTRACTABLE ORGANICS EMISSIONS

| DATE | 11/12 | 11/11 | 11/13 | 11/11 | 11/14 | 11/12 | | |
|---|---|---|---|---|---|---|---|---|
| RUN NO. | C-1 | R-1 | C-2 | R-2 | C-3 | R-3 | | |
| PROCESS OPERATION | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE |
| VOLUME GAS SAMPLED (DSCF) | 48.2 | 57.1 | 46.2 | 59.3 | 48.5 | 60.1 | 47.6 | 58.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700[a] (11,400) | 14,000 | 11,900 (11,400) | 13,300 (12,700) | 12,100 (11,800) | 14,000 | 11,900 (11,500) | 13,800 (13,600) |
| STACK TEMPERATURE (°F) | 159 | 147 | 155 | 152 | 153 | 143 | 156 | 147 |
| PERCENT MOISTURE BY VOLUME | 32.0 (32.3) | 21.3 | 29.0 (32.3) | 26.6 (30.6) | 27.5 (29.7) | 20.7 | 29.5 (32.1) | 22.9 (24.2) |
| PERCENT ISOKINETIC | 102 (105) | 104 | 96 (100) | 111 (116) | 99 (102) | 107 | 99 (102) | 107 (109) |
| PRODUCTION RATE (tons/hr) | 244 | 229 | 235 | 250 | 213 | 236 | 231 | 238 |
| PARTICULATE - EXTRACTABLE ORGANICS RESULTS | | | | | | | | |
| FRONT HALF CATCH - PARTICULATE (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 172 | 84.0 | 244 | 88.2 | 104 | 111 | 173 | 94.5 |
| gr/DSCF | 0.0550 | 0.0227 | 0.0814 | 0.0229 | 0.0332 | 0.0286 | 0.0565 | 0.0247 |
| lbs/hr | 5.53 (5.36) | 2.72 | 8.29 (7.95) | 2.76† (2.49) | 3.45 (3.36) | 3.42 | 5.76 (5.56) | 2.97 (2.88) |
| lbs/ton production | 0.0227 (0.0220) | 0.0119 | 0.0353 (0.0338) | 0.0110 (0.0100) | 0.0162 (0.0158) | 0.0145 | 0.0247 (0.0239) | 0.0125 (0.0123) |
| BACK HALF CATCH - EXTRACTABLE ORGANICS (impinger solutions & rinses) | | | | | | | | |
| mg-mass | 245 | 86.8 | 81.1 | 229 | 87.7 | 130 | 138 | 149 |
| gr/DSCF | 0.0786 | 0.0235 | 0.0271 | 0.0596 | 0.0279 | 0.0334 | 0.0445 | 0.0388 |
| lbs/hr | 7.88 (7.65) | 2.81 | 2.71 (2.65) | 6.79 (6.46) | 2.89 (2.82) | 4.00 | 4.49 (4.37) | 4.53 (4.42) |
| lbs/ton production | 0.0323 (0.0314) | 0.0123 | 0.0115 (0.0113) | 0.0272 (0.0258) | 0.0136 (0.0132) | 0.0169 | 0.0191 (0.0186) | 0.0188 (0.0183) |
| PERCENT EXTRACTABLE ORGANICS‡ | 58.8 (58.8) | 50.8 | 24.6 (25.0) | 71.1 (72.2) | 45.6 (45.6) | 53.9 | 43.8 (44.0) | 60.4 (60.5) |

NOTE: Top number based on saturation volume for moisture content of gas: (bottom number) is moisture content calculated using impinger catch indicating the presence of water mist.

†Average emission rate of concentration and area-ratio methods (Table 2-10).

‡Percent Extractable Organics determined using lbs/hr values and is the percentage of extractable organics of the total catch.

"back-half catch" in Tables 2-7 and 2-8. The extractable organics results are presented and discussed in this section.

### 2.3.1 Conventional Operation Extractable Organics Emission Results

Uncontrolled extractable organics loadings were 0.176, 0.0568, and 0.131 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The controlled extractable organics loadings were 0.0786, 0.0271, and 0.0279 gr/DSCF for Runs C-1, C-2, and C-3, respectively.

### 2.3.2 Recycle Operation Extractable Organics Emission Results

Uncontrolled extractable organics loadings were 0.154, 0.140, and 0.076 gr/DSCF for Runs R-1, R-2, and R-3, respectively. Controlled extractable organics loadings were 0.0235, 0.0596, and 0.0334 gr/DSCF for Runs R-1, R-2, and R-3, respectively.

### 2.3.3 Discussion of Extractable Organics Emission Test Results

The uncontrolled extractable organics loadings varied from 0.0568 to 0.176 gr/DSCF during conventional operation and from 0.076 to 0.154 gr/DSCF during recycle operation. The controlled extractable organics loadings varied from 0.0271 to 0.0786 gr/DSCF during conventional operation and from 0.0235 to 0.0596 gr/DSCF during recycle operation. Based on the limited data available, it is difficult to develop any correlations between process operation and the degree of variability in the uncontrolled and controlled extractable organics emissions during conventional and recycle operation.

The average uncontrolled extractable organics loading during conventional operation (0.121 gr/DSCF) approximated the average uncontrolled extractable organics loading during recycle operation (0.123 gr/DSCF). The average controlled extractable organics loading was approximately 15 percent greater during conventional operation (0.0445

gr/DSCF) as compared to recycle operation (0.0388 gr/DSCF). It is believed that the variability between the controlled extractable organics loadings is within the variability of the sampling and analytical techniques.

## 2.4 COMPARISON OF TOC AND EXTRACTABLE ORGANICS EMISSION RESULTS

Two analytical procedures were used during this program to quantify the concentration of uncontrolled and controlled organic emissions generated during conventional and recycle operation. An instrumental technique was used to determine the concentration of TOC present in the 0.1N NaOH impinger and rinse solutions generated during EPA Method 5E testing. The same samples were also analyzed using a gravimetric technique to determine the concentration of extractable organics. The main objective of performing both analyses on the same samples was to provide data that could be used to help assess the utility of both procedures in characterizing organic emissions from asphalt concrete plants.

### 2.4.1 Comparison of Uncontrolled TOC and Extractable Organic Emissions Results

Table 2-9 presents a comparison of uncontrolled TOC and extractable organics emissions during conventional and recycle operation. The average uncontrolled TOC loadings indicate that the uncontrolled organic emissions were about 72 percent greater during recycle operation (0.536 gr/DSCF) as compared to conventional operation (0.312 gr/DSCF). On the other hand the average uncontrolled extractable organics loadings indicate that the uncontrolled organic emissions were essentially the same during both recycle (0.123 gr/DSCF) and conventional (0.121 gr/DSCF) operations.

## TABLE 2-9. COMPARISON OF UNCONTROLLED TOC AND EXTRACTABLE ORGANICS EMISSIONS

| RUN NUMBER | C-1 | C-2 | C-3 | R-1 | R-2 | R-3 | AVERAGE | |
|---|---|---|---|---|---|---|---|---|
| PROCESS OPERATION | CONVENTIONAL | CONVENTIONAL | CONVENTIONAL | RECYCLE | RECYCLE | RECYCLE | CONVENTIONAL | RECYCLE |
| DATE | 11/12 | 11/13 | 11/14 | 11/11 | 11/11 | 11/12 | | |
| VOLUME GAS SAMPLES (DSCF) | 19.0 | 19.6 | 19.2 | 20.8 | 18.6 | 22.9 | 19.3 | 20.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700 | 11,700 | 12,500 | 14,800 | 12,300 | 14,000 | 12,000 | 13,700 |
| STACK TEMPERATURE (°F) | 298 | 289 | 304 | 296 | 314 | 317 | 297 | 309 |
| PERCENT MOISTURE BY VOLUME | 38.0 | 39.6 | 36.7 | 24.4 | 31.5 | 27.7 | 38.1 | 27.9 |
| PERCENT ISOKINETIC | 110 | 113 | 104 | 95 | 117 | 111 | 109 | 108 |
| PRODUCTION RATE (TONS/HR) | 244 | 235 | 213 | 229 | 250 | 236 | 231 | 238 |

| BACK HALF CATCH - ORGANICS RESULTS (impinger solutions & rinses) | TOC* | EXT** ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg-mass | 253 | 217 | 553 | 72.3 | 370 | 163 | 605 | 208 | 788 | 169 | 748 | 113 | 392 | 151 | 714 | 163 |
| gr/DSCF | 0.205 | 0.176 | 0.434 | 0.0568 | 0.297 | 0.131 | 0.448 | 0.154 | 0.655 | 0.140 | 0.504 | 0.076 | 0.312 | 0.121 | 0.536 | 0.123 |
| lbs/hr | 20.5 | 17.6 | 43.6 | 5.70 | 31.8 | 14.0 | 56.8 | 19.5 | 69.1 | 14.7 | 60.5 | 9.12 | 32.0 | 12.4 | 62.1 | 14.4 |
| lbs/ton production | 0.0840 | 0.0721 | 0.186 | 0.0243 | 0.149 | 0.0657 | 0.248 | 0.0852 | 0.276 | 0.0588 | 0.256 | 0.0386 | 0.139 | 0.0537 | 0.261 | 0.0605 |

*TOC - Total Organic Carbon

**EXT. ORG. - Extractable Organics



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### 2.4.2 Comparison of Controlled TOC and Extractable Organics Emissions Results

Table 2-10 presents a comparison of controlled TOC and extractable organics emissions during conventional and recycle operation. The average controlled TOC loadings indicate that the controlled organic emissions were essentially the same during conventional (0.107 gr/DSCF) and recycle (0.105 gr/DSCF) operations. The average controlled extractable organics loadings indicated that the controlled organic emissions were about 15 percent greater during conventional operation (0.0445 gr/DSCF) as compared to recycle operations (0.0388 gr/DSCF).

### 2.4.3 Discussion of TOC and Extractable Organics Emissions Results

Because of the limited quantity of available data, it is difficult to develop an accurate comparison between the TOC and extractable organics analytical procedures. In formulating an opinion about the two procedures, it is important that several factors be kept in mind. First, the TOC analysis results are indicative of the mass of carbon present in all of the organic species in a sample. The extractable organics analyis results are indicative of the mass of organic compounds (not just carbon) having a boiling point greater than 300°C. Also, the TOC analysis procedure is a direct instrumental technique requiring a minimal amount of sample preparation (refer to Section 5.2). On the other hand, the extractable organics analysis procedure does require sample preparation (refer to Section 5.2) by means of extraction with chloroform and diethyl ether. The remaining extract is then evaporated to dryness at room temperature before weighing.

It is believed that the TOC analysis procedure is more suitable than the extractable organics procedure for characterizing organic emissions from asphalt concrete plants.

## TABLE 2-10. COMPARISON OF CONTROLLED TOC AND EXTRACTABLE ORGANICS EMISSIONS

| RUN NUMBER | C-1 | C-2 | C-3 | R-1 | R-2 | R-3 | AVERAGE | |
|---|---|---|---|---|---|---|---|---|
| PROCESS OPERATION | CONVENTIONAL | CONVENTIONAL | CONVENTIONAL | RECYCLE | RECYCLE | RECYCLE | CONVENTIONAL | RECYCLE |
| DATE | 11/12 | 11/13 | 11/14 | 11/11 | 11/11 | 11/12 | | |
| VOLUME GAS SAMPLES (DSCF) | 48.2 | 46.2 | 48.5 | 57.1 | 59.3 | 60.1 | 47.6 | 58.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700* (11,400) | 11,900 (11,400) | 12,100 (11,800) | 14,000 | 13,300 (12,700) | 14,000 | 11,900 (11,500) | 13,800 (13,600) |
| STACK TEMPERATURE (°F) | 159 | 155 | 153 | 147 | 152 | 143 | 156 | 147 |
| PERCENT MOISTURE BY VOLUME | 32.0 (34.3) | 29.0 (32.3) | 27.5 (29.7) | 21.3 | 26.6 (30.6) | 20.7 | 29.5 (32.1) | 22.9 (24.2) |
| PERCENT ISOKINETIC | 102 (105) | 96 (100) | 99 (102) | 104 | 111 (116) | 107 | 99 (102) | 107 (109) |
| PRODUCTION RATE (TONS/HR) | 244 | 235 | 213 | 229 | 250 | 236 | 231 | 218 |

| BACK HALF CATCH - ORGANICS RESULTS (Impinger solutions & rinses) | TOC** | EXT.*** ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. | TOC | EXT. ORG. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg-mass | 166 | 245 | 417 | 81.1 | 405 | 87.7 | 219 | 86.8 | 375 | 229 | 618 | 130 | 329 | 138 | 404 | 149 |
| gr/DSCF | 0.0532 | 0.0786 | 0.139 | 0.0271 | 0.129 | 0.0279 | 0.0592 | 0.0235 | 0.0975 | 0.0596 | 0.159 | 0.0334 | 0.107 | 0.0445 | 0.105 | 0.0388 |
| lbs/hr | 5.34 | 7.88 | 14.2 | 2.71 | 13.4 | 2.89 | 7.09 | 2.81 | 11.1 | 6.79 | 19.0 | 4.00 | 11.0 | 4.49 | 12.4 | 4.53 |
| lbs/ton production | 0.0219 | 0.0323 | 0.0604 | 0.0115 | 0.0629 | 0.0136 | 0.0310 | 0.0123 | 0.0445 | 0.0272 | 0.0805 | 0.0169 | 0.0476 | 0.0191 | 0.052 | 0.0188 |

*NOTE: Top number based on saturation volume for moisture content of gas: (bottom number) is moisture content calculated using impinger catch results indicating the presence of water mist.

** TOC - Total Organic Carbon

*** EXT. ORG. - Extractable Organics

## 2.5 TRACE METAL EMISSION RESULTS

During this program the concentration of uncontrolled and controlled trace metals were derived from the analysis of "front-half" and "back-half" catches of the trace metal sampling train described in Section 5.1. The front-half catch is the sum of the analytical results of the acetone and trichloroethane probe and glassware washes, the cyclone solids (if applicable), and the filter solids. The back-half catch is the sum of the analytical results of the NaOH impingers and $HNO_3$ impingers. One set of trace metal samples (uncontrolled/controlled) was collected during conventional and recycle operation.

### 2.5.1 Conventional Operation Trace Metals Emission Results

Table 2-11 includes a summary of uncontrolled and controlled trace metals emissions during conventional operation. The collection efficiency of the wet venturi scrubber for each element during conventional operation, is presented in Table 2-11.

### 2.5.2 Recycle Operation Trace Metals Emission Results

Table 2-12 includes a summary of uncontrolled and controlled trace metals emissions during recycle operation. The collection efficiency of the wet venturi scrubber for each elementduring recycle operation is also presented in Table 2-12.

### 2.5.3 Discussion of Trace Metals Emission Results

During both conventional and recycle operations, the uncontrolled and controlled concentrations of calcium, iron, magnesium and aluminum comprised greater than 99 percent of the trace metals analyzed in the samples. Each of these elements are non-volatile, according to their elemental boiling point, and are predominantly associated with the particulate ("Front-half Catch"). The wet venturi scrubber removed greater than 99 percent of the

TABLE 2-11. SUMMARY OF TRACE METAL EMISSIONS DURING CONVENTIONAL OPERATION

| Date | 11/12 | | | | 11/12 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sampled Emissions | Uncontrolled | | | | Controlled | | | | |
| Production Rate (Ton/Hr) | | | | | 244 | | | | |
| Trace Metal Results | Mass Front Half (μg) | Mass Back Half (μg) | Mass Total (μg) | Concentration (μg/DSCM) | Mass Front Half (μg) | Mass Back Half (μg) | Mass Total (μg) | Concentration (μg/DSCM) | Removal Efficiency (%) |
| Element | | | | | | | | | |
| Aluminum | 29,500 | 66 | 29,600 | 55,000 | 453 | 98 | 551 | 404 | 99.3 |
| Beryllium | 2.33 | 0.90 | 3.23 | 6.0 | 0.187 | 2.6 | 2.8 | 2.0 | 66.7 |
| Calcium | 2,654,000 | 1260 | 2,660,000 | 4,930,000 | 41,000 | 1283 | 42,300 | 31,000 | 99.4 |
| Cadmium | 14.7 | 5.4 | 20.1 | 37 | 28 | 13 | 41 | 30 | 18.9 |
| Chromium | 138 | <1.47 | 138 | 255 | 7.2 | 12 | 19 | 14 | 14.5 |
| Iron | 57,700 | 53 | 57,800 | 107,000 | 650 | 61 | 711 | 521 | 99.5 |
| Mercury | <273 | <20 | <293 | <544 | <90 | <56 | <146 | <107 | -- |
| Magnesium | 42,900 | 50 | 43,000 | 79,600 | 1234 | 230 | 1460 | 1070 | 98.7 |
| Manganese | 911 | 1.8 | 913 | 1700 | 42.7 | 5.1 | 48 | 35 | 97.9 |
| Nickel | 104 | <4.4 | 104 | 193 | 16.4 | <5.6 | 16 | 12 | 93.8 |
| Lead | 118 | <118 | 118 | 219 | 4.7 | <152 | 4.7 | 3.4 | 98.4 |
| Vanadium | <540 | <88 | <628 | <1170 | <115 | <113 | <228 | <167 | -- |
| Zinc | 194 | 13 | 207 | 385 | 42.2 | 9.6 | 52 | 38 | 90.1 |

TABLE 2-12. SUMMARY OF TRACE METAL EMISSIONS DURING RECYCLE OPERATION

| Date | 11/11 | | | | 11/11 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sampled Emissions | Uncontrolled | | | | Controlled | | | | |
| Production Rate (Ton/Hr) | | | | | 250 | | | | |
| Trace Metal Results | Mass Front Half (μg) | Mass Back Half (μg) | Mass Total (μg) | Concentration (μg/DSCM) | Mass Front Half (μg) | Mass Back Half (μg) | Mass Total (μg) | Concentration (μg/DSCM) | Removal Efficiency (%) |
| Element | | | | | | | | | |
| Aluminum | 13,300 | 69 | 13,300 | 22,500 | 201 | <70 | 201 | 124 | 99.4 |
| Beryllium | 0.91 | 1.37 | 2.28 | 3.9 | 0.22 | <0.70 | 0.22 | 0.14 | 96.4 |
| Calcium | 1,154,000 | 751 | 1,150,000 | 1,960,000 | 18,400 | 730 | 19,100 | 11,800 | 99.4 |
| Cadmium | 13.7 | 6.6 | 20.3 | 34 | 5.8 | <2.8 | 5.8 | 3.6 | 89.4 |
| Chromium | 111 | 6.25 | 117 | 199 | 8.4 | <1.4 | 8.4 | 5.2 | 97.4 |
| Iron | 24,600 | 64 | 24,600 | 41,800 | 320 | 9.8 | 330 | 204 | 99.5 |
| Mercury | <136 | <40 | <176 | <298 | <60 | <41 | <101 | <62 | -- |
| Magnesium | 22,600 | 121 | 22,700 | 38,500 | 500 | <47 | 500 | 309 | 99.2 |
| Manganese | 362.3 | 3.2 | 366 | 620 | 18.1 | <1.4 | 18.1 | 11 | 98.2 |
| Nickel | 63.6 | 2.8 | 66 | 112 | 12 | 4.8 | 16.8 | 10 | 91.1 |
| Lead | 89 | <113 | 89 | 150 | 4.2 | <118 | 4.2 | 2.6 | 98.3 |
| Vanadium | <141 | <82 | <223 | <378 | <120 | <84 | <204 | <126 | -- |
| Zinc | 230 | 14 | 244 | 414 | 67.3 | 7.6 | 74.9 | 46 | 88.9 |

calcium, iron, and aluminum during both conventional and recycle operation. Magnesium was removed at an efficiency of about 98.7.

Several "more volatile" elements were also detected in the trace metal samples. These elements included beryllium, cadmium, and zinc. Because of the greater volatility of these elements, a greater percentage of the volatile elements were found in the "back-half" portion of the trace metal sample than the above mentioned nonvolatile elements.

## 2.6 POLYNUCLEAR AROMATIC HYDROCARBONS EMISSION TEST RESULTS

Polynuclear aromatic hydrocarbon (PAH) samples were collected in the uncontrolled and controlled air emissions, during this program, using an adaption of EPA Method 5E. The technique, described in Section 5, includes the use of Method 5E front-half (filter) and back-half (XAD-2 resin) for adsorption of organic compounds. One set of PAH samples (uncontrolled/controlled) was collected during conventional and recycle operation. The PAH emission results are presented and discussed in the following section.

### 2.6.1 Conventional Operation PAH Emission Results

A summary of the uncontrolled and controlled PAH emissions during conventional operation are presented in Table 2-13. Included in Table 2-13 are the front- and back-half concentrations of both active and nonactive carcinogenic PAH species. The activity of the PAH species was determined using a reference book entitled "Polycyclic Aromatic Hydrocarbons in Water Systems."[1] The removal efficiency of the wet venturi scrubber for each of the PAH compounds is included in Table 2-13. The removal efficiency of the venturi scrubber ranged from 1 percent for benzo(b)fluoranthene to 100 percent for benzo(a)pyrene during conventional operation.

## TABLE 2-13. SUMMARY OF POLYNUCLEAR AROMATIC HYDROCARBON EMISSIONS DURING CONVENTIONAL OPERATION

| Sampled Emissions | Uncontrolled | Controlled |
|---|---|---|
| Date | 11/14 | 11/14 |
| Volume Gas Sampled - DSCF (DSCM) | 12.3 (0.3472) | 42.2 (1.1963) |
| Stack Gas Flow Rate - DSCFM ($M^3$/Min) | 10,200 (289) | 11,700 (331) |
| Stack Temperature (°F) | 313 | 158 |
| Scrubber Pressure Drop (in. $H_2O$) | 13.4 | 13.4 |
| Scrubber Water Flow Rate (GPM) | 220 | 220 |
| Percent Moisture by Volume | 42.2 | 32.2 |
| Percent Isokinetic | 111 | 103 |
| Production Rate (tons/hr) | 196 | 196 |

CONCENTRATIONS AND MASS EMISSION RATES

| Polynuclear Aromatic Hydrocarbon Results | Uncontrolled Front Half | | Uncontrolled Back Half | | Uncontrolled Total | | Controlled Front Half | | Controlled Back Half | | Controlled Total | | Removal Efficiency (Percent) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Active Carcinogenic[a] Species | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | |
| Benz(a)anthracene | 1.1 | 19 | 0.28 | 4.9 | 1.4 | 24 | <0.10 | <2.0 | 0.22 | 4.4 | 0.22 | 4.4 | 82 |
| Chrysene | 6.2 | 110 | 1.1 | 19 | 7.3 | 130 | 0.15 | 3.0 | 1.0 | 20 | 1.2 | 24 | 82 |
| Benzo(b)fluoranthene | 0.58 | 10 | <0.10 | <1.7 | 0.58 | 10 | 0.50 | 9.9 | ND | | 0.50 | 9.9 | 1 |
| Benzo(j)fluoranthene | ND | | ND | | ND | | ND | | ND | | ND | | |
| Benzo(e)pyrene | 2.6 | 45 | 0.86 | 15 | 3.5 | 61 | 0.17 | 3.4 | ND | | 0.17 | 3.4 | 94 |
| Benzo(a)pyrene | 1.4 | 24 | ND | | 1.4 | 24 | ND | | ND | | ND | | 100 |
| Indeno(1,2,3-c,d)-pyrene | 1.4 | 24 | 0.29 | 5.0 | 1.7 | 29 | 0.084 | 1.7 | ND | | 0.084 | 1.7 | 94 |
| Nonactive Carcinogenic Species | | | | | | | | | | | | | |
| Phenanthrene | 20 | 350 | 120 | 2100 | 140 | 2400 | 0.66 | 13 | 100 | 2000 | 100 | 2000 | 17 |
| Anthracene | 2.6 | 45 | 17 | 290 | 20 | 350 | ND | | 7.1 | 140 | 7.1 | 140 | 60 |
| Fluoranthene | 5.4 | 94 | 7.4 | 130 | 13 | 230 | 0.29 | 5.8 | 2.5 | 50 | 2.5 | 56 | 76 |
| Pyrene | 16 | 280 | 20 | 350 | 36 | 620 | 0.97 | 19 | 6.4 | 130 | 6.4 | 150 | 76 |
| Benzo(k)fluoranthene | 0.58 | 10 | ND | | 0.58 | 10 | 0.50 | 9.9 | ND | | 0.50 | 9.9 | 1 |
| Perylene | 0.29 | 5.0 | 0.29 | 5.0 | 0.58 | 10 | 0.17 | 3.4 | ND | | 0.17 | 3.4 | 66 |
| Benzo(g,h,i)perylene | ND | | ND | | ND | | ND | | ND | | ND | | |

ND = not detected.

[a] Futoma, David, et al. Polycyclic Aromatic Hydrocarbons in Water Systems. Boca Raton, FL, CRC Press, Inc., 1981 - Reference used to determine if PNA species were active or nonactive carcinogens.

### 2.6.2 Recycle Operation PAH Emission Test Results

Table 2-14 includes a summary of uncontrolled and controlled PAH emissions during recycle operations. The controlled concentrations of benzo(b)fluoranthene, indeno(1,2,3-c,d)-pyrene, anthracene, and benzo(K)fluoranthene was greater than the uncontrolled concentrations for these compounds. The removal efficiency of the wet venturi scrubber for the remaining PAH compounds ranged from 31 percent for pyrene to 73 percent for benzo(e)pyrene and 41 percent for benzo(a)pyrene.

### 2.6.3 Discussion of PAH Emission Test Results

Based on the limited amount of available data, it is difficult to develop correlations between PAH concentrations and conventional or recycle operations. For most of the PAH compounds analyzed, the concentrations of the controlled emissions were less than the concentrations of the uncontrolled emissions. However, during recycle operation, there were several PAH compounds for which the controlled emissions were greater than the uncontrolled emissions. It is believed that these results are most probably caused by sampling and analytical error.

## 2.7 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 without overloading or using short sampling periods.

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[1]Futoma, David, et al. Polycyclic Aromatic Hydrocarbons in Water Systems. Roca Raton, FL, CRC Press, Inc., 1981.

TABLE 2-14. SUMMARY OF POLYNUCLEAR AROMATIC HYDROCARBON EMISSIONS DURING RECYCLE OPERATION

| Sampled Emissions | Uncontrolled | Controlled |
|---|---|---|
| Date | 11/15 | 11/15 |
| Volume Gas Sampled - DSCF (DSCM) | 16.2 (0.4590) | 45.2 (1.2789) |
| Stack Gas Flow Rate - DSCFM ($M^3$/Min) | 10,400 (294) | 9,900 (280) |
| Stack Temperature (°F) | 299 | 173 |
| Scrubber Pressure Drop (in. $H_2O$) | 12.7 | 12.7 |
| Scrubber Water Flow Rate (GPM) | 214 | 214 |
| Percent Moisture by Volume | 48.0 | 43.4 |
| Percent Isokinetic | 105 | 113 |
| Production Rate (tons/hr) | 166 | 166 |

| Polynuclear Aromatic Hydrocarbon Results | CONCENTRATIONS AND MASS EMISSION RATES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Front Half | | Back Half | | Total | | Front Half | | Back Half | | Total | | Removal Efficiency (Percent) |
| Active Carcinogenic[a] Species | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | (μg/DSCM) | (mg/hr) | |
| Benz(a)anthracene | 0.64 | 11 | 1.1 | 19 | 1.8 | 32 | 0.75 | 13 | 0.0010 | 0.02 | 0.75 | 13 | 59 |
| Chrysene | 3.6 | 64 | 4.8 | 85 | 8.4 | 150 | 0.15 | 2.5 | 2.4 | 40 | 2.6 | 44 | 71 |
| Benzo(b)fluoranthene | ND | | 0.087 | 1.5 | 0.087 | 1.5 | ND | | 0.24 | 4.0 | 0.24 | 4.0 | -170 |
| Benzo(j)fluoranthene | ND | | ND | | ND | | ND | | ND | | ND | | |
| Benzo(e)pyrene | 1.3 | 23 | 0.57 | 10 | 1.9 | 34 | 0.078 | 1.3 | 0.47 | 7.9 | 0.55 | 9.2 | 73 |
| Benzo(a)pyrene | 0.41 | 7.2 | 0.087 | 1.5 | 0.50 | 8.8 | ND | | 0.31 | 5.2 | 0.31 | 5.2 | 41 |
| Indeno(1,2,3-c,d)-pyrene | ND | | 0.15 | 2.6 | 0.15 | 2.6 | ND | | 0.31 | 5.2 | 0.31 | 5.2 | -100 |
| Nonactive Carcinogenic Species | | | | | | | | | | | | | |
| Phenanthrene | 8.3 | 150 | 210 | 3700 | 220 | 3900 | 1.0 | 17 | 86 | 1400 | 87 | 1500 | 62 |
| Anthracene | 1.5 | 26 | 15 | 260 | 16 | 280 | ND | | 18 | 300 | 18 | 300 | -7 |
| Fluoranthene | 1.9 | 34 | 18 | 320 | 20 | 350 | 0.30 | 5.0 | 13 | 220 | 13 | 220 | 37 |
| Pyrene | 3.4 | 60 | 33 | 580 | 36 | 640 | 0.83 | 14 | 25 | 420 | 26 | 440 | 31 |
| Benzo(k)fluoranthene | ND | | 0.11 | 1.9 | 0.11 | 1.9 | ND | | 0.24 | 4.0 | 0.24 | 4.0 | -110 |
| Perylene | ND | | 0.33 | 5.8 | 0.33 | 5.8 | 0.078 | 1.3 | 0.078 | 1.3 | 0.16 | 2.7 | 53 |
| Benzo(g,h,i)perylene | ND | | ND | | ND | | ND | | ND | | ND | | |

ND - not detected

[a] Futoma, David, et al. Polycyclic Aromatic Hydrocarbons in Water Systems. Boca Raton, FL. CRC Press, Inc., 1981 - Reference used to determine if PNA species were active or nonactive carcinogens.

Attempts were made at determining the PSD of the controlled emissins using an Andersen Mark III cascade impactor. The attempts were unsuccessful because of the presence of water mist in the controlled emissions stream. As a result, no controlled PSD data are present.

### 2.7.1 Conventional Operation Uncontrolled Emissions PSD Results

Three uncontrolled PSD sampling runs were performed during conventional operation. The results of these runs are presented graphically in Figure 2-1 and tabularly in Table 2-15. During Run C-1 aggregate mix B was produced. During Run C-2 aggregate mix B and C were produced while aggregate mix M was produced during Run C-3. It should be noted that mix M contains washed sand.

### 2.7.2 Recycle Operation Uncontrolled Emissions PSD Results

A total of three PSD samples were scheduled for collection during recycle operation, but only one uncontrolled PSD sampling run was performed during recycle operation. The results of the single PSD recycle run (R-1) are presented graphically in Figure 2-1 and tabularly in Table 2-15. RAP mix A was produced during the sampling period.

### 2.7.3 Discussion of Uncontrolled Emissions PSD Results

The three PSD curves of uncontrolled emissions during conventional operation (Figure 2-1) are similar in shape. The mass mean diameter for Runs C-1, C-2, and C-3 are 10.5 μm, 6.0 μm, and 8.0 μm respectively.

The mass mean diameter for the single PSD test performed during recycle operation is approximately 16 μm.

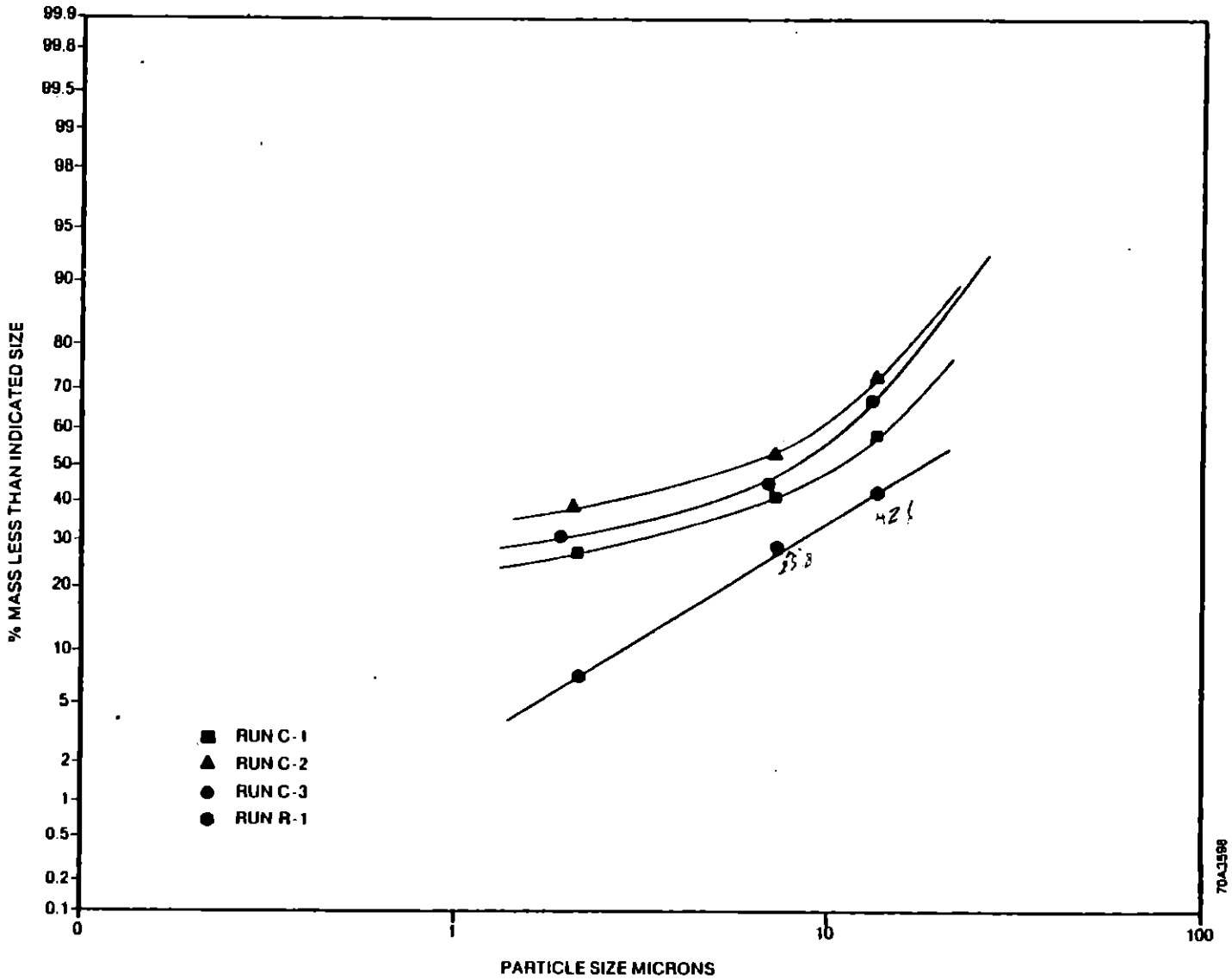


Figure 2-1. Particle size distribution curves of uncontrolled emissions collected during recycle and conventional operation.

TABLE 2-15. SUMMARY OF UNCONTROLLED PARTICLE SIZE DISTRIBUTION TESTS

| Date | Time | Run In | Flow Rate (ACFM[1]) | Stage | Mass Collected (g) | % In Size Range | Cumulative % less than Size Range | Size Range (μm) | $DP_{50}$ (μm) | % Isokinetic |
|---|---|---|---|---|---|---|---|---|---|---|
| | | RECYCLE | | | | | | | | |
| 1111 | 1253-1330 | 1 | 0.439 | 1 | 1.1838 | 57.5 | 42.6 | >13.3 | 13.3 | 108 |
| | | | 0.439 | 2 | 0.2831 | 13.8 | 28.8 | 7.2-13.3 | 7.2 | |
| | | | 0.439 | Cyclone | 0.4340 | 21.1 | 7.7 | 2.1-7.2 | 2.1 | |
| | | | 0.439 | Filter | 0.1581 | 7.7 | 0 | >0-2.1 | - | |
| | | CONVENTIONAL | | | | | | | | |
| 1112 | 1418-1520 | C-1 | 0.430 | 1 | 2.9926 | 41.0 | 58.9 | >13.3 | 13.3 | 103 |
| | | | 0.430 | 2 | 1.2359 | 16.9 | 42.0 | 7.2-13.3 | 7.2 | |
| | | | 0.430 | Cyclone | 1.0506 | 14.4 | 27.6 | 2.2-7.2 | 2.2 | |
| | | | 0.430 | Filter | 2.0152 | 27.6 | 0 | >0-2.2 | 0 | |
| 1114 | 1014-1143 | C-2 | 0.442 | 1 | 1.5725 | 27.3 | 72.7 | >13.3 | 13.3 | 103 |
| | | | 0.442 | 2 | 1.0991 | 19.1 | 53.6 | 7.2-13.3 | 7.2 | |
| | | | 0.442 | Cyclone | 0.8769 | 15.2 | 38.4 | 2.1-7.2 | 2.1 | |
| | | | 0.442 | Filter | 2.2131 | 38.4 | 0 | >0-2.1 | - | |
| 1115 | 1225-1440 | C-3 | 0.456 | 1 | 3.2178 | 32.2 | 67.8 | >13.0 | 13.0 | 112[2] |
| | | | 0.456 | 2 | 2.3035 | 23.1 | 44.7 | 6.9-13.0 | 6.9 | |
| | | | 0.456 | Cyclone | 1.3990 | 14.0 | 30.7 | 1.9-6.9 | 1.9 | |
| | | | 0.456 | Filter | 3.0625 | 30.7 | 0 | >0-1.9 | - | |

[1]ACFM = actual cubic feet per minute
[2]Wet bulb/dry bulb indicated 35% moisture; 42.5% moisture measured which caused super isokinetic run

## 2.8 VISIBLE EMISSIONS RESULTS

Visible emissions were measured by a certified reader during most testing periods when a clear, blue sky was available. The blue sky background was required for detection of emissions caused by condensed hydrocarbons in the plume. Opacity readings taken during emission tests are presented and discussed in this section. Additional measurements were performed and are included in Appendix G.

### 2.8.1 Conventional Operation Visible Emissions Results

Opacity readings performed during conventional operation are presented in Table 2-16. The opacity readings are graphically represented in Figure 2-2. The average measured opacity reading during conventional operation test periods was 0 percent.

### 2.8.2 Recycle Operation Visible Emissions Results

Table 2-17 presents opacity measurements performed during recycle tests. These results are graphically represented in Figures 2-3 and 2-4. The average opacity measurement was 1.4 and 0.3 percent during Runs R-1 and R-2. The maximum six minute opacity measurement was 5.8 and 1.7 percent during Runs R-1 and R-2 respectively. During the recycle PAH sample collection period the average opacity measurement was zero percent.

### 2.8.3 Discussion of Visible Emission Results

One objective of this program was to investigate the "blue haze" plume caused by condensible hydrocarbons. On the afternoon of November 10, 1983 the water flow to the presprays was turned off for over an hour in an effort to generate "blue haze" by eliminating the prespray cooling. No "blue haze" was observed during this period. With concurrence of the EPA Industrial Studies Branch (ISB) and Emission Measurements Branch (EMB) representatives, testing under reduced water flow conditions was cancelled.

TABLE 2-16. SUMMARY OF VISIBLE EMISSION OBSERVATIONS DURING CONVENTIONAL OPERATION

| Date | Run No. | Time | Average Opacity for 6 Minutes | Date | Run No. | Time | Average Opacity for 6 Minutes |
|---|---|---|---|---|---|---|---|
| 11/12/83 | T.M.Part/ Cond.Hyd. (C-1) | 1130-1135 | 0 | 11/13/83 | Part/ Cond./ Hyd. (C-2) | 0848-0853 | 0 |
| | | 1136-1141 | 0 | | | 0854-0859 | 0 |
| | | 1142-1147 | 0 | | | 0900-0905 | 0 |
| | | 1148-1153 | 0 | | | 0906-0911 | 0 |
| | | 1154-1159 | 0 | | | 0912-0917 | 0 |
| | | 1200-1205 | 0 | | | 0918-0923 | 0 |
| | | 1206-1211 | 0 | | | 0924-0929 | 0 |
| | | 1212-1217 | 0 | | | 0930-0935 | 0 |
| | | 1218-1223 | 0 | | | 0936-0941 | 0 |
| | | 1224-1229 | 0 | | | 0942-0947 | 0 |
| | | 1230-1235 | 0 | | | 0948-0953 | 0 |
| | | 1236-1241 | 0 | | | 0954-0959 | 0 |
| | | 1242-1247 | 0 | | | 1000-1005 | 0 |
| | | 1248-1253 | 0 | | | 1006-1011 | 0 |
| | | 1254-1259 | 0 | | | 1012-1017 | 0 |
| | | 1300-1305 | 0 | | | 1018-1023 | 0 |
| | | 1306-1311 | 0 | | | 1024-1029 | 0 |
| | | 1312-1317 | 0 | | | 1030-1035 | 0 |
| | | 1318-1323 | 0 | | | 1036-1041 | 0 |
| | | 1318-1323 | 0 | | | 1042-1047 | 0 |
| | | | 0 (ave.) | | | 1048-1053 | 0 |
| 11/12/83 | N/A* | 1324-1329 | 0 | | | 1103-1108 | 0 |
| | | 1330-1335 | 0 | | | 1109-1114 | 0 |
| | | 1336-1341 | 0 | | | | 0 (ave.) |
| | | 1342-1347 | 0 | | | | |
| | | 1348-1353 | 0 | | | | |
| | | 1354-1359 | 0 | | | | |
| | | 1400-1405 | 0 | | | | |
| | | 1406-1411 | 0.6 | | | | |
| | | 1412-1417 | 1.5 | | | | |
| | | 1418-1423 | 0.2 | | | | |
| | | 1424-1429 | 0 | | | | |
| | | | 0.21 (ave.) | | | | |

*No source sampling performed during this visible emissions measurement period.

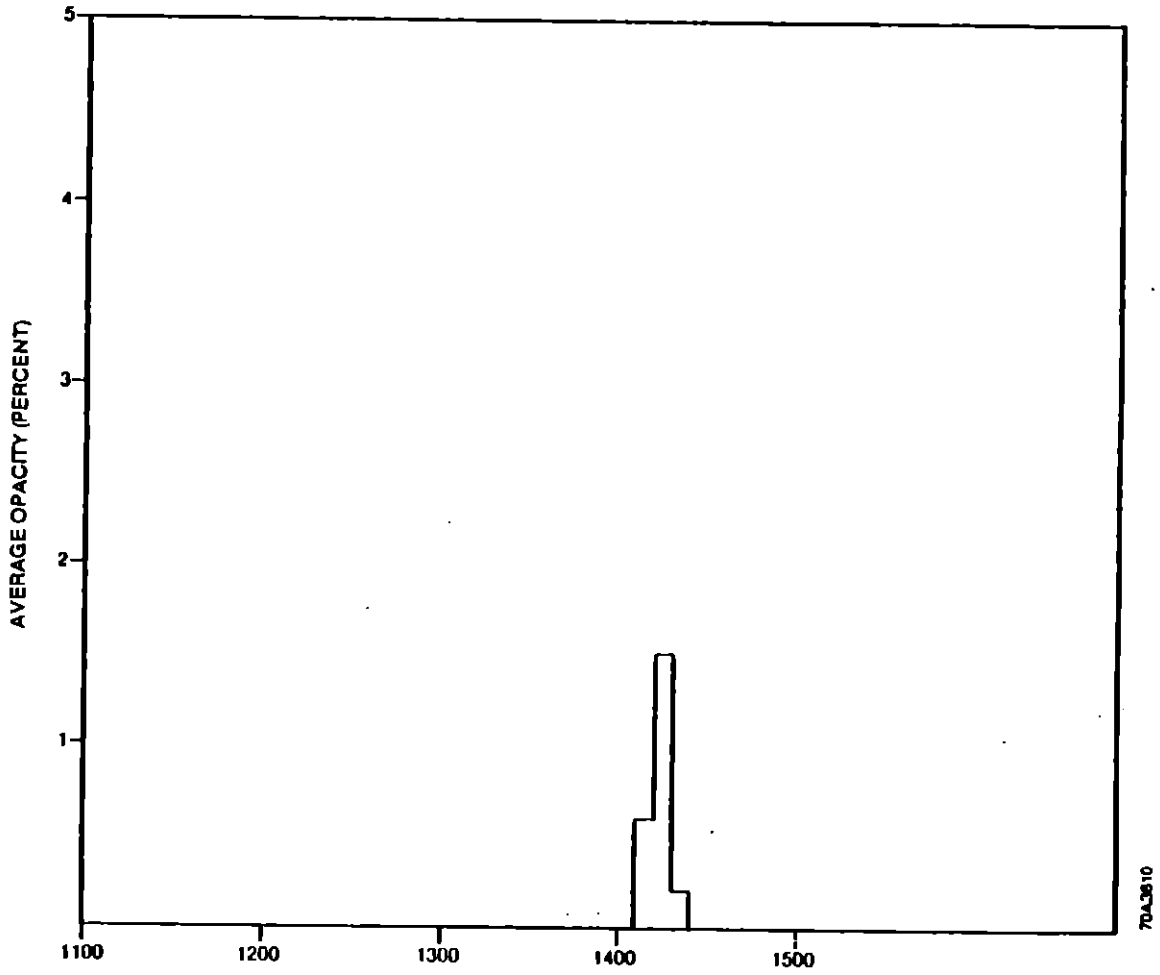


Figure 2-2. Six-minute averages of November 12, 1983. Opacity readings on the venturi scrubber stack during conventional operation.

TABLE 2-17. SUMMARY OF VISIBLE EMISSION OBSERVATIONS DURING RECYCLE OPERATION

| Date | Run No. | Time | Average Opacity for 6 Minutes | Date | Run No. | Time | Average Opacity for 6 Minutes |
|---|---|---|---|---|---|---|---|
| 11/11/83 | T.M.Part/ Cond.Hyd. (R-1) | 0837-0842 | 0 | 11/15/83 | PAH R-1 | 0855-0900 | 0 |
| | | 0843-0848 | 0 | | | 0901-0906 | 0 |
| | | 0849-0854 | 0 | | | 0907-0912 | 0 |
| | | 0855-0900 | .2 | | | 0913-0918 | 0 |
| | | 0901-0906 | 0 | | | 0919-0924 | 0 |
| | | 0907-0912 | 0 | | | 0925-0930 | 0 |
| | | 0913-0918 | 0 | | | 0931-0936 | 0 |
| | | 0919-0924 | 0 | | | 0937-0942 | 0 |
| | | 0925-0930 | 0 | | | 0943-0948 | 0 |
| | | 0931-0936 | 0 | | | 0949-0954 | 0 |
| | | 0937-0942 | 0 | | | 0955-1000 | 0 |
| | | 0943-0948 | 0 | | | 1001-1006 | 0 |
| | | 0949-0954 | 0 | | | 1007-1012 | 0 |
| | | 0955-1000 | .8 | | | 1013-1018 | 0 |
| | | | | | | 1019-1024 | 0 |
| | | 1009-1014 | .8 | | | 1025-1030 | 0 |
| | | | | | | 1031-1036 | 0 |
| | | 1104-1109 | .4 | | | 1037-1042 | 0 |
| | | 1110-1115 | 0 | | | 1043-1048 | 0 |
| | | 1116-1121 | .6 | | | 1049-1054 | 0 |
| | | 1122-1127 | 0 | | | | |
| | | 1128-1133 | 0 | | | Average | 0 |
| | | 1308-1313 | 5.8 | | | | |
| | | 1314-1319 | 2.3 | | | | |
| | | 1320-1325 | 2.3 | | | | |
| | | 1326-1331 | 4.6 | | | | |
| | | 1332-1337 | 4.0 | | | | |
| | | 1400-1405 | 1.5 | | | | |
| | | 1406-1411 | 2.3 | | | | |
| | | 1412-1417 | 5.0 | | | | |
| | | 1418-1423 | 3.5 | | | | |
| | | 1424-1429 | 2.3 | | | | |
| | | 1430-1435 | 2.1 | | | | |
| | | 1436-1441 | 5.2 | | | | |
| | | Average | 1.4 | | | | |
| 11/11/83 | Part/Cond. Hyd. (R-2) | 1530-1535 | 0 | | | | |
| | | 1536-1541 | 0 | | | | |
| | | 1545-1550 | 1.7 | | | | |
| | | 1551-1556 | .4 | | | | |
| | | 1557-1602 | 0 | | | | |
| | | 1603-1608 | 1.3 | | | | |
| | | 1609-1614 | 1.0 | | | | |
| | | 1615-1620 | 0 | | | | |
| | | 1621-1626 | 0 | | | | |
| | | 1627-1632 | 0 | | | | |
| | | 1633-1638 | 0 | | | | |
| | | 1639-1644 | 0 | | | | |
| | | 1645-1650 | 0 | | | | |
| | | 1651-1656 | 0 | | | | |
| | | 1657-1702 | 0 | | | | |
| | | 1703-1708 | 0 | | | | |
| | | 1709-1714 | 0 | | | | |
| | | Average | 0.3 | | | | |

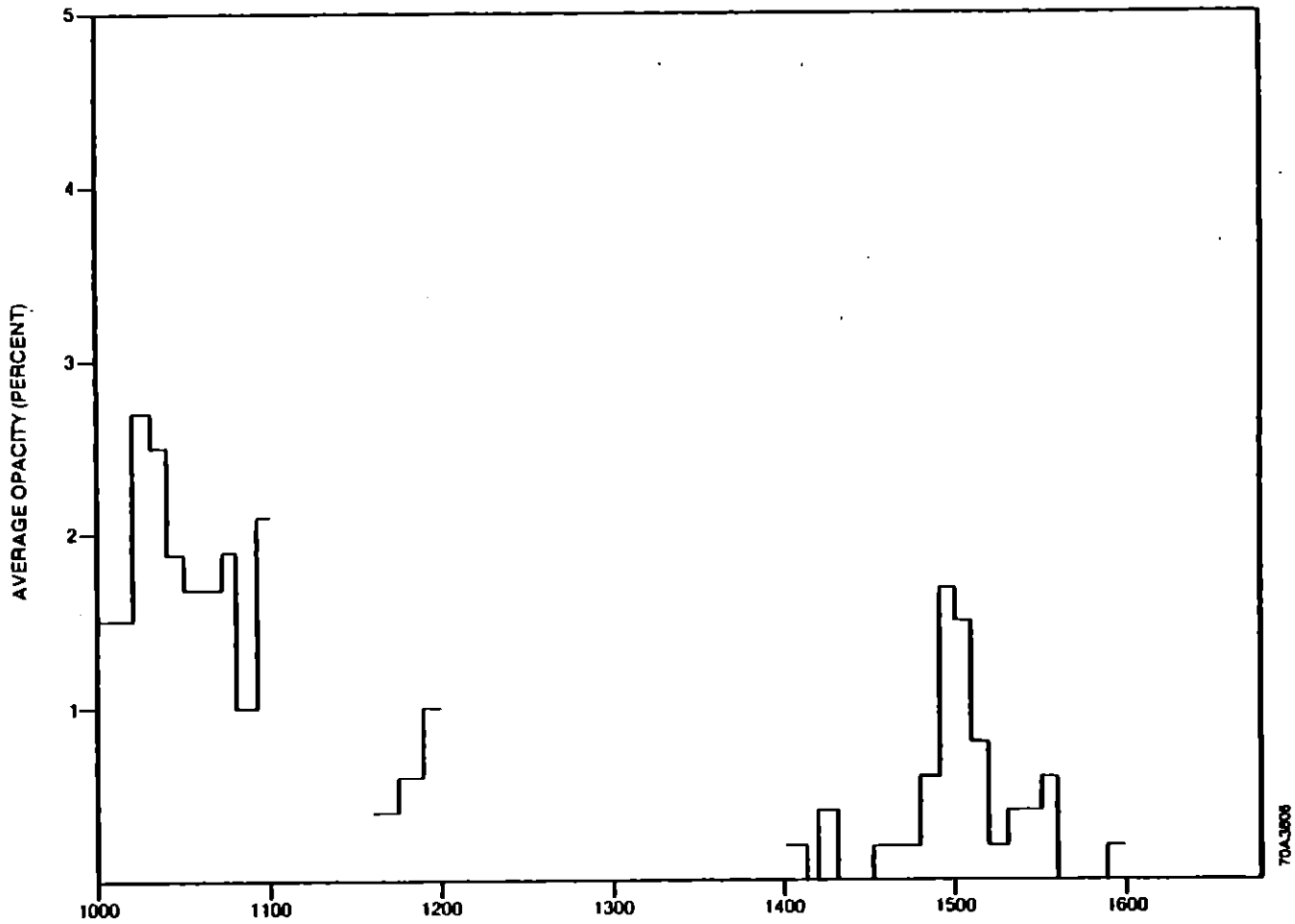


Figure 2-3. Six-minute averages of November 10, 1983. Opacity readings on venturi scrubber stack during recycle operation.

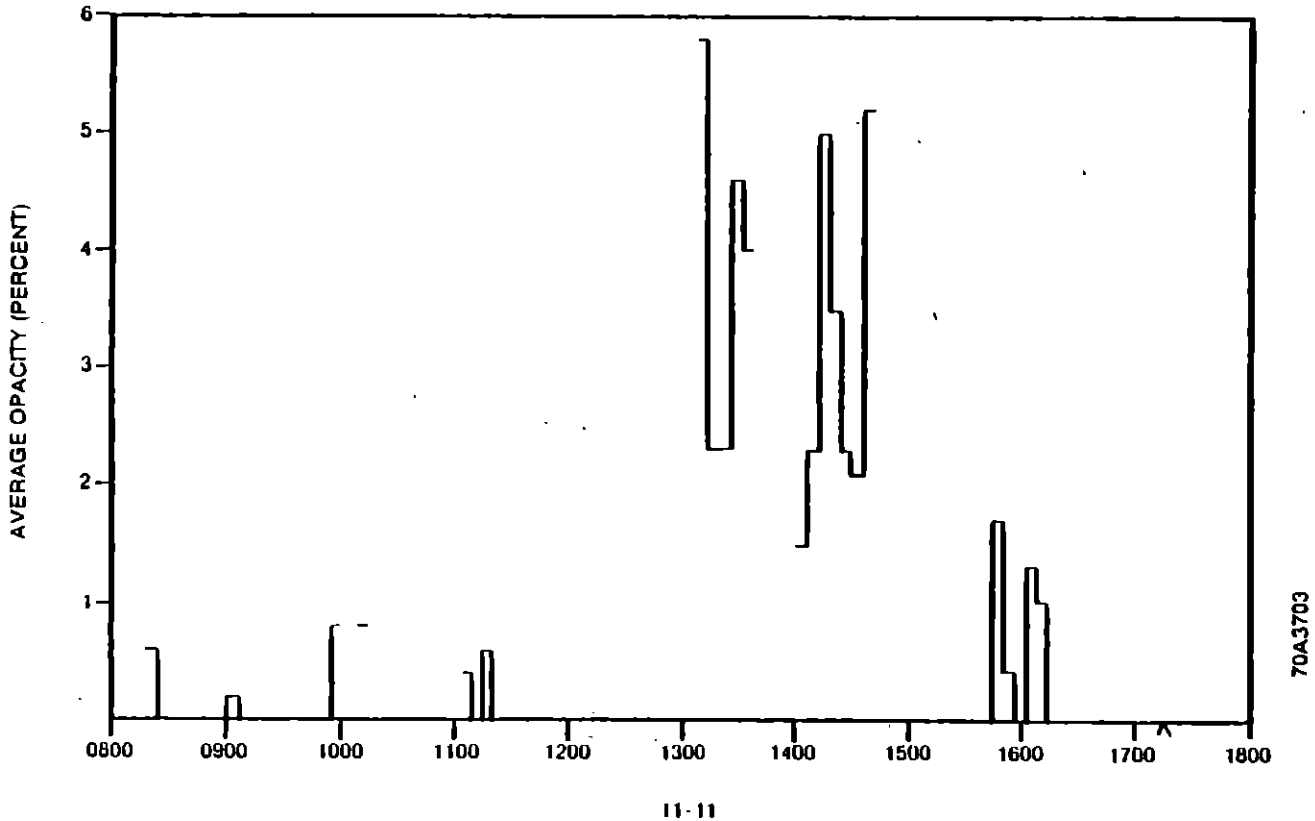


Figure 2-4. Six-minute averages of November 11, 1983. Opacity readings on venturi scrubber stack during recycle operation.

## 2.9 SCRUBBER WATER GRAB SAMPLE MEASUREMENTS

Periodically during each sampling run, grab samples were taken of the venturi scrubber water influent (pond water) and venturi scrubber water effluent. The pH and temperature were measured for all grab samples (see Section 2.11 for analytical results). This section presents results of pH and temperature measurements performed on scrubber water samples.

### 2.9.1 Conventional Operation Scrubber Water pH and Temperature Results

Scrubber water pH and temperature results during conventional operation are presented in Table 2-18. Average pH results for the venturi scrubber influent were 7.30, 7.30, and 7.36 for Runs C-1, C-2, and C-3, respectively. Average venturi scrubber effluent pH's were 7.17, 7.18 and 7.17 for Runs C-1, C-2, and C-3, respectively.

The average venturi scrubber water influent temperatures for Runs C-1, C-2, and C-3 were 132°F, 126°F and 118°F, respectively. Two main factors affect pond temperature, ambient temperature and length of scrubber operation for each day.

The average venturi effluent temperature is a direct function of the flue gas temperature. Since water has a much higher capacity for heat transfer than air the flue gas can be cooled substantially with a relatively small increase in the scrubber water temperature. The average scrubber water effluent temperatures for Runs C-1, C-2, and C-3 were 156°F, 151°F, and 152°F, respectively. The average venturi inlet flue gas temperatures corresponding to the above sampling runs were 298°F, 289°F, and 304°F, respectively.

### 2.9.2 Recycle Operation Scrubber Water pH and Temperature Results

Results of pH and temperature measurements during recycle operation are presented in Table 2-19. The average pH measurements for the venturi scrub-

TABLE 2-18. SUMMARY OF SCRUBBER WATER pH AND TEMPERATURE MEASUREMENTS FOR CONVENTIONAL OPERATION

| | | | Water to Venturi | | Venturi Exit Water | | Pond Water[1] | | |
|---|---|---|---|---|---|---|---|---|---|
| Run No. | Date | Time | pH | Temperature, °F | pH | Temperature, °F | Time | Temperature,[2] °F | |
| Part/C1 | 11/12 | 1140 | 7.28 | 127 | 7.18 | 153 | 1130 | 134 | 142 |
| | | 1240 | 7.30 | 133 | 7.15 | 154 | 1230 | 137 | 143 |
| | | 1340 | 7.31 | 136 | 7.18 | 160 | 1430 | 139 | 145 |
| | | Average | 7.30 | 132 | 7.17 | 156 | | | |
| Part/C2 | 11/13 | 0920 | 7.31 | 124 | 7.24 | 149 | 0929 | 130 | 139 |
| | | 1020 | 7.29 | 129 | 7.12 | 153 | 1030 | 134 | 143 |
| | | Average | 7.30 | 126 | 7.18 | 151 | | | |
| Part/C3 | 11/14 | 0850 | 7.43 | 99 | 7.12 | 145 | 0830 | 104 | 110 |
| | | 0945 | 7.36 | 115 | 7.18 | 147 | 0900 | 114 | 124 |
| | | 1230 | 7.31 | 127 | 7.15 | 156 | 0930 | 121 | 130 |
| | | 1400 | 7.34 | 129 | 7.22 | 160 | 1000 | 128 | 136 |
| | | Average | 7.36 | 118 | 7.17 | 152 | | | |
| PAH/C1 | 11/14 | 0850 | 7.43 | 99 | 7.12 | 145 | 0830 | 104 | 110 |
| | | 0945 | 7.36 | 115 | 7.18 | 147 | 0900 | 114 | 124 |
| | | 1230 | 7.31 | 127 | 7.15 | 156 | 0930 | 121 | 130 |
| | | 1400 | 7.34 | 129 | 7.22 | 160 | 1000 | 128 | 136 |
| | | Average | 7.36 | 118 | 7.17 | 152 | | | |

[1]Data collected by MRI personnel
[2]Temperatures expressed as inlet temperature - outlet temperature

TABLE 2-19. SUMMARY OF SCRUBBER WATER pH AND TEMPERATURE MEASUREMENTS DURING RECYCLE OPERATION

| | | | Water to Venturi | | Venturi Exit Water | | Pond Water[1] | | |
|---|---|---|---|---|---|---|---|---|---|
| Run No. | Date | Time | pH | Temperature, °F | pH | Temperature, °F | Time | Temperature,[2] °F | |
| Part/R1 | 11/11 | 0900 | 7.46 | 91 | 7.18 | 131 | 0901 | 99 | 110 |
| | | 0945 | 7.32 | 108 | 7.10 | 131 | 0930 | 107 | 114 |
| | | 1440 | 7.25 | 129 | 7.22 | 149 | 1430 | 132 | 138 |
| | | Average | 7.34 | 109 | 7.17 | 137 | | | |
| Part/R2 | 11/11 | 1605 | 7.28 | 131 | 7.20 | 153 | 1602 | 136 | 140 |
| | | 1650 | 7.28 | 131 | 7.22 | 154 | 1700 | 137 | 142 |
| | | Average | 7.28 | 131 | 7.21 | 154 | | | |
| Part/R3 | 11/12 | 0830 | 7.46 | 109 | 7.22 | 142 | 0830 | 114 | 121 |
| | | 0900 | 7.40 | 111 | 7.11 | 145 | 0900 | 118 | 128 |
| | | Average | 7.43 | 110 | 7.16 | 144 | | | |
| PAH/R1 | 11/15 | 0915 | 7.44 | 118 | 7.11 | 176 | 0903 | 124 | 132 |
| | | 1000 | 7.46 | 129 | 7.10 | 171 | 0957 | 136 | 145 |
| | | 1050 | 7.49 | 135 | 7.15 | 174 | 1055 | 143 | 151 |
| | | Average | 7.46 | 127 | 7.12 | 174 | | | |

[1]Data collected by MRI personnel
[2]Values expressed as inlet temperature - outlet temperature

ber water influent were 7.34, 7.28, 7.43, and 7.46 for particulate sampling Runs R-1, R-2, R-3, and PAH sampling Run R-1, respectively. The average venturi scrubber water effluent pH readings corresponding to the above sampling runs were 7.17, 7.21, 7.16, and 7.12, respectively.

The average venturi scrubber water influent temperatures were 109°F, 131°F, 110°F, and 127°F for Method 5E Runs R-1, R-2, R-3, and PAH Run R-1, respectively. The average corresponding water effluent temperatures were 137°F, 154°F, 144°F, and 174°F. The average venturi scrubber inlet gas temperatures for those sampling runs were 296°F, 314°F, 317°F, and 299°F.

### 2.9.3 Discussion of Scrubber Water Grab Sample Measurement Results

The scrubber water influent and effluent temperature and pH values did not vary significantly during conventional and recycle operations.

## 2.10 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, trace metals, and/or polynuclear hydrocarbons.

### 2.10.1 Conventional Operation Scrubber Water Analytical Results

Table 2-20 presents the scrubber water analytical results during conventional operation. Total suspended solids (TSS) concentrations for the venturi scrubber water influent samples were 161 mg/l, 23.9 mg/l, and 23.5 mg/l for sampling Runs C-1, C-2, and C-3. The corresponding total dissolved solids (TDS) concentrations were 1860 mg/l, 1780 mg/l, and 1770 mg/l. TSS concentrations for the venturi scrubber water effluent samples were 6710

## TABLE 2-20. SUMMARY OF SCRUBBER WATER ANALYTICAL RESULTS DURING CONVENTIONAL OPERATION

| Run No. | C1 | | C2 | | C3 | | PAH C1 | | Average | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | 11/12 | | 11/13 | | 11/14 | | 11/14 | | | |
| Sample Type | 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 | 7.30 | 7.17 | 7.30 | 7.18 | 7.36 | 7.17 | 7.36 | 7.17 | 7.33 | 7.17 |
| Temperature, °F | 132 | 156 | 126 | 151 | 118 | 152 | 118 | 152 | 124 | 153 |
| **Total Organic Carbon Results** | | | | | | | | | | |
| mg/l (as C) | 160 | 160 | 180 | 250 | 186 | 230 | 180 | 200 | 176 | 210 |
| **Trace Metals Results** | | | | | | | | | | |
| Element (µg/mL) | | | | | | | | | | |
| Aluminum | <0.05 | <0.05 | | | | | | | | |
| Beryllium | 0.001 | <0.005 | | | | | | | | |
| Calcium | 290 | 300 | | | | | | | | |
| Cadmium | 0.007 | <0.002 | | | | | | | | |
| Chromium | 0.004 | <0.001 | | | | | | | | |
| Iron | 0.026 | <0.008 | | | | | | | | |
| Mercury | <0.03 | <0.03 | | | | | | | | |
| Magnesium | 54 | 54 | | | | | | | | |
| Manganese | 0.047 | 0.053 | | | | | | | | |
| Nickel | <0.003 | 0.005 | | | | | | | | |
| Lead | <0.08 | <0.084 | | | | | | | | |
| Vanadium | 0.069 | <0.003 | | | | | | | | |
| Zinc | <0.003 | <0.003 | | | | | | | | |
| **Polyaromatic Hydrocarbon Results** | | | | | | | | | | |
| Active Carcinogenic Species (µg/L) | | | | | | | | | | |
| Benz(a)anthracene | | | | | | | <0.1 | <0.1 | | |
| Chrysene | | | | | | | 0.1 | 0.1 | | |
| Benzo(b)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 | | |
| Nonactive Carcinogenic Series (µg/L) | | | | | | | | | | |
| Phenanthrene | | | | | | | 10 | 6.8 | | |
| Anthracene | | | | | | | 0.4 | ND | | |
| Fluoranthene | | | | | | | 0.6 | 0.3 | | |
| Pyrene | | | | | | | 1.4 | 0.6 | | |
| Benzo(k)fluoranthene | | | | | | | ND | ND | | |
| Perylene | | | | | | | ND | ND | | |
| Benzo(g,h,i)perylene | | | | | | | ND | ND | | |
| **Total Solids Results** | | | | | | | | | | |
| Suspended Solids mg/l | 161 | 6710 | 23.9 | 6530 | 21.5 | 5180 | ND | 5240 | 69.5 | 5920 |
| Dissolved Solids mg/l | 1860 | 1850 | 1780 | 1760 | 1770 | 1770 | 1790 | 1810 | 1800 | 1800 |

mg/l, 6530 mg/l, and 5180 mg/l for sampling Runs C-1, C-2, and C-3. The corresponding TDS concentrations were 1850 mg/l, 1760 mg/l, and 1770 mg/l.

There are no significant differences between the venturi scrubber influent and effluent trace metals concentrations. Calcium and magnesium were the only species found in excess of 100 ppb. The concentrations were 290 mg/l and 54 mg/l for the influent and 300 mg/l and 54 mg/l for the effluent for calcium and magnesium respectively.

Polynuclear aromatic hydrocarbons were found in trace amounts in the scrubber water during conventional operation. Phenathrene and pyrene were found in levels in excess of 1 ppb. Three other species anthracene, fluoranthrene, and chrysene were detected in levels of less than 1 ppb. Benz(a) anthracene was detected, but not at a quantifiable level.

### 2.10.2 Recycle Operation Scrubber Water Analytical Results

Table 2-21 presents the scrubber water analytical results during recycle operation. TSS concentrations for the venturi scrubber water influent were 77.8 mg/l, 144 mg/l and 179 mg/l for Runs R-1, R-2, and R-3, respectively. The corresponding TDS concentrations were 1960 mg/l, 1970 mg/l, and 1890 mg/l. TSS concentrations for the venturi scrubber water effluent were 3090 mg/l, 4690 mg/l, and 3010 mg/l for Runs R-1, R-2, and R-3, respectively. The corresponding TDS contents were 1950 mg/l, 1970 mg/l, and 1900 mg/l.

No significant differences were seen between the venturi scrubber influent and effluent trace metals concentrations. As with conventional operation calcium and magnesium were the only soluble species found in excess of 100 ppb. Their concentrations were 300 mg/l and 54 mg/l for the influent and 300 mg/l and 53 mg/l for the effluent for calcium and magnesium respectively.

TABLE 2-21. SUMMARY OF SCRUBBER WATER ANALYTICAL RESULTS DURING RECYCLE OPERATION

| Run No. | R1 | | R2 | | R3 | | PAH R1 | | Average | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | 11/11 | | 11/11 | | 11/12 | | 11/15 | | | |
| Sample Type | 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 | 7.34 | 7.17 | 7.28 | 7.21 | 7.43 | 7.16 | 7.46 | 7.12 | 7.38 | 7.16 |
| Temperature, °F | 109 | 137 | 131 | 154 | 110 | 144 | 127 | 174 | 119 | 152 |
| **Total Organic Carbon Results** | | | | | | | | | | |
| mg/l (as C) | 170 | 170 | 180 | 190 | 170 | 170 | 190 | 190 | 178 | 180 |
| **Trace Metals Results** | | | | | | | | | | |
| Element (mg/mL) | | | | | | | | | | |
| Aluminum | <0.05 | <0.05 | | | | | | | | |
| Beryllium | <0.005 | <0.005 | | | | | | | | |
| Calcium | 100 | 300 | | | | | | | | |
| Cadmium | <0.002 | <0.002 | | | | | | | | |
| Chromium | <0.001 | <0.001 | | | | | | | | |
| Iron | <0.008 | <0.008 | | | | | | | | |
| Mercury | <0.03 | <0.03 | | | | | | | | |
| Magnesium | 54 | 53 | | | | | | | | |
| Manganese | 0.060 | 0.061 | | | | | | | | |
| Nickel | 0.003 | <0.003 | | | | | | | | |
| Lead | <0.084 | <0.084 | | | | | | | | |
| Vanadium | <0.003 | <0.003 | | | | | | | | |
| Zinc | <0.003 | <0.003 | | | | | | | | |
| **Polyaromatic Hydrocarbon Results** | | | | | | | | | | |
| Active Carcinogenic Species (μg/L) | | | | | | | | | | |
| Benz(a)anthracene | | | | | | | <0.1 | <0.1 | | |
| Chrysene | | | | | | | 0.1 | 0.1 | | |
| Benzo(b)fluoranthene | | | | | | | ND | ND | | |
| Benzo(j)fluoranthene | | | | | | | ND | ND | | |
| Benzo(e)pyrene | | | | | | | ND | ND | | |
| Benzo(a)pyrene | | | | | | | ND | 0.4 | | |
| Indeno(1,2,3-c,d)pyrene | | | | | | | ND | ND | | |
| Nonactive Carcinogenic Series (μg/L) | | | | | | | | | | |
| Phenanthrene | | | | | | | 7.0 | 5.0 | | |
| Anthracene | | | | | | | ND | ND | | |
| Fluoranthene | | | | | | | 0.7 | 0.5 | | |
| Pyrene | | | | | | | 1.3 | 0.8 | | |
| Benzo(k)fluoranthene | | | | | | | ND | ND | | |
| Perylene | | | | | | | ND | 0.5 | | |
| Benzo(g,h,i)perylene | | | | | | | ND | ND | | |
| **Total Solids Results** | | | | | | | | | | |
| Suspended Solids mg/L | 77.8 | 3090 | 144 | 4690 | 179 | 3010 | 60 | 1150 | 115 | 2980 |
| Dissolved Solids mg/L | 1960 | 1950 | 1970 | 1970 | 1890 | 1900 | 1860 | 1820 | 1920 | 1910 |

Polynuclear aromatic hydrocarbons were found in trace amounts in the scrubber water during recycle operation. Phenanthrene and fluoranthrene were the only species found in excess of 1 ppb. Four other species anthracene, perylene, chrysene, and benzo(a)pyrene were detected in levels less than 1 ppb. The presence of benz(a)anthracene was detected but not quantified.

### 2.10.3 Discussion of Scrubber Water Analytical Results

Fluctuations in the TSS concentrations of influent scrubber water samples occurred during both conventional and recycle operations. The exact cause for the TSS fluctuations is not known at this time. Floculant was added to the ponds to help reduce TSS after dredging operations on November 7 and 14, 1984. It is believed that the fluctuations in TSS concentrations of the influent scrubber water samples were not caused by the addition of floculant on November 7 and 14, 1983.

The average TSS concentration of scrubber water effluent samples was approximately 70 percent greater during conventional operation (5920 mg/L) as compared to recycle operation (2980 mg/L). The higher TSS concentrations in the scrubber effluent water during conventional operation are due to the high uncontrolled particulate emissions observed during conventional operations as compared to recycle operation. The particulate removal efficiency of the venturi scrubber was basically the same during both modes of production.

The average TDS concentration of influent scrubber water samples was 1800 mg/l during conventional operation and 1920 mg/l during recycle operation. The average TDS concentration of effluent scrubber water samples was 1800 mg/l during conventional operation and 1910 mg/l during recycle operation. Based on the above data, the average concentration of TDS did not vary significantly in the scrubber water influent and effluent samples.

The concentration of trace metals and PAH's present in scrubber water influent and effluent samples were essentially the same during conventional and recycle operation.

## 2.11 PROCESS SAMPLING RESULTS

During each conventional and recycle operation test period, samples of virgin aggregate and recycled asphalt pavement (during recycle operation) were collected and analyzed for percent moisture. Care was taken to obtain a representative sample including collecting very large samples (approximately 10 pounds) and riffling the sample to the 500-700 grams used for analysis.

### 2.11.1 Conventional Operation Grab Sampling Results

Table 2-22 presents moisture values of the virgin aggregate during conventional operation. The percent moisture by weight values were 2.68%, 2.32%, and 2.63% for Runs C-1, C-2, and C-3. These moisture values are slightly lower than the 3-4% estimated by plant personnel.

### 2.11.2 Recycle Operation Grab Sampling Results

Table 2-23 presents moisture values of the virgin aggregate and recycle asphalt pavement used during recycle operation. The percent moisture by weight values were 1.46%, 1.83%, 1.20%, and 6.88% for the virgin aggregate and 1.48%, 1.40%, 2.12%, and 4.88% for the recycled asphalt pavement, for particulate Runs R-1, R-2, R-3 and polynuclear aromatic hydrocarbons Run R-1, respectively. Plant operators estimated 3-4% moisture for the virgin aggregate and 2% moisture for the recycled asphalt pavement during the particulate runs. During PAH Run R-1, plant estimates were 8% for the virgin aggregate and 3.5% for the recycled asphalt pavement.

TABLE 2-22. SUMMARY OF PROCESS SAMPLE MEASUREMENTS FOR CONVENTIONAL OPERATION

| Run No. | Date | Time | Virgin Aggregate Sample amount (g) | Virgin Aggregate Percent Moisture by Weight |
|---|---|---|---|---|
| Part/C1 | 11/12 | 1345 | 666 | 2.68 |
| Part/C2 | 11/13 | 0920 | 676 | 2.32 |
| Part/C3 | 11/14 | 0850 | 669 | 2.64 |
| | | 1235 | 717 | 2.62 |
| | | | 693 (ave.) | 2.63 (ave.) |
| PAH/C1 | 11/14 | 0850 | 669 | 2.64 |
| | | 1235 | 717 | 2.62 |
| | | | 693 (ave.) | 2.63 (ave.) |

TABLE 2-23. SUMMARY OF PROCESS SAMPLE MEASUREMENTS FOR RECYCLE OPERATION

| Run No. | Date | Time | Virgin Aggregate Sample Amount (g) | Virgin Aggregate % Moisture by Weight | Recycle Asphalt Pavement Sample Amount (g) | Recycle Asphalt Pavement % Moisture by Weight |
|---|---|---|---|---|---|---|
| Part/R1 | 11/11 | 0900 | 607 | 1.46 | 456 | 1.48 |
| Part/R2 | 11/11 | 1400 | 924 | 1.83 | 846 | 1.40 |
| Part/R3 | 11/12 | 0835 | 734 | 1.20 | 517 | 2.12 |
| PAH/R1 | 11/15 | 0915 | 638 | 6.88 | 573 | 4.88 |

### 2.11.3 Discussion of Process Sampling Results

The average moisture content of the virgin aggregate was 2.54% during conventional operation and 1.50% during recycle Runs R-1, R-2, and R-3. The moisture content of the virgin aggregate increased to 6.88% during PAH Run R-1. The average moisture content of the RAP was 1.67% during recycle Runs R-1, R-2, and R-3. The moisture content of the RAP increased to 4.88% during Run R-1.

# SECTION 3
# PROCESS DESCRIPTION AND OPERATION

This section provides a brief description of the asphalt concrete plant operated by the T. J. Campbell Construction Co. in Oklahoma City, Oklahoma. The procedures used to monitor the operation of the asphalt concrete plant during both conventional and recycle testing are also presented in this section.

## 3.1 PROCESS DESCRIPTION

A description of the T. J. Campbell asphalt plant (including the emissions control system) is presented in this section.

### 3.1.1 Process Equipment Description

T. J. Campbell Construction Company operates a CMI drum-mix asphalt plant in Oklahoma City, Oklahoma (refer to Figure 1-1). Plant operation began in 1979 and was modified in March 1983 to include a new, larger capacity drum which was designed to handle recycled asphalt pavement (RAP). Primary design changes for utilization of RAP were an injection system for the RAP in the center area of the drum and a heat shield between the RAP injection point and the burner. The modifications were designed to reduce the temperature to which the RAP is exposed. Table 3-1 presents a summary of technical data on the asphalt concrete plant.

The CMI drum at T. J. Campbell is 36 feet long and has expanded front and back ends. The expanded ends are 8.5 feet in diameter, and the mid-section is 7 feet in diameter. The expanded front end allows for greater heat transfer near the burner flame, while the expanded back end causes the

TABLE 3-1. TECHNICAL DATA ON THE ASPHALT CONCRETE PLANT OPERATED BY THE T. J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| | |
|---|---|
| Type: | Drum-mix |
| Manufacturer: | CMI |
| Model Number: | UVM-1200RS-162 |
| Dated Installed: | March 1983 |
| Capacity: rated | 250-350 tons/h |
| typical | 240 tons/h |
| Dryer: fuel | Natural gas |
| capacity | 109 million BTUs |
| firing rate | 80-90 million BTUs/h |
| Drum Size: diameter | ends--8.5 ft<br>middle--7 ft |
| length | 36 ft |
| Drum Slope: | 0.75 in. per ft |
| Product Temperature: | 275° to 325°F |
| RAP Entry Position: | Center feed |
| Asphalt Heater: | Fuel--Natural gas<br>Storage capacity--35,000 gal |
| Storage Silos (3): | Capacity--235 tons each<br>Heating--Heat transfer oil |

exhaust gas velocity to decrase to allow the larger particles to settle out in this region. The drum is natural gas-fired. The burner at T. J. Campbell is a Hauck power flame burner with a 109 million BTU rating. Virgin aggregate is stored in four cold feed bins and RAP is stored in a separate cold feed bin. The liquid asphalt is stored in a heated 35,000 gallon tank on site. The asphalt storage container is maintained at 300°F. The finished asphalt concrete mix is stored in one of three heated storage silos.

### 3.1.2 Emission Control System Description

Figure 3-1 illustrates the emission control system (venturi scrubber) used by T. J. Campbell. 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. After the knockout box, the emissions are ducted to a wet venturi scrubber. Specifications for the venturi scrubber are listed in Table 3-2. In the duct work between the knockout and venturi are water sprays, two nozzle bars with 13 nozzles per bar, to cool the emission gases. Water is also injected at the venturi throat through a 12-nozzle spray bar. Additional water is flushed through a collection box below the venturi.

Scrubber water is contained in two adjacent earthen ponds that are interconnected by means of a dike. One pond is approximately 55 feet x 24 feet and the other is approximately 65 feet x 24 feet with an effective depth of 3 to 6 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. Silt is cleaned from the ponds weekly and is landfilled. Pond make-up water is supplied from a well. The pH of the ponds is controlled by addition of lime; flocculant is occasionally added to the ponds to aid settling. The venturi pressure drop is variable (12.5 to 18 inches of water column).

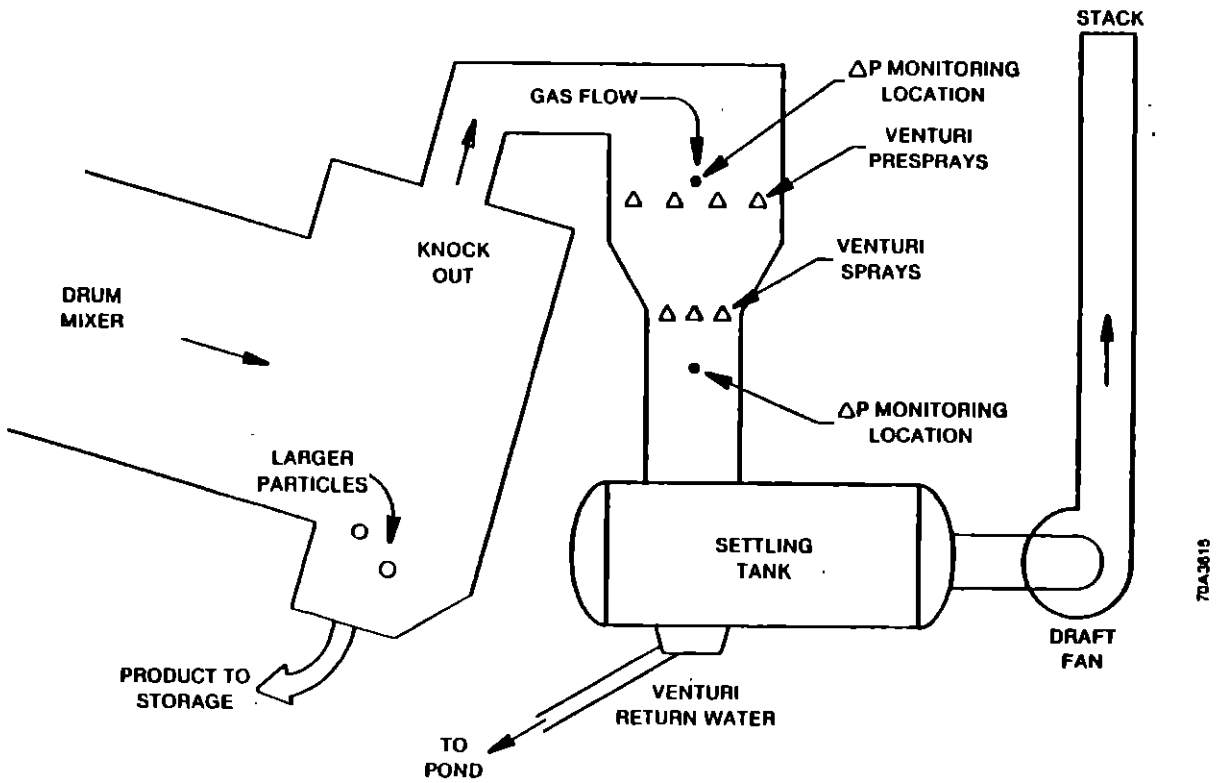


Figure 3-1. Wet venturi emissions control scrubber operated by the T.J. Campbell Construction Company, Oklahoma City, Oklahoma

TABLE 3-2. TECHNICAL DATA ON THE WET VENTURI SCRUBBER AT THE T. J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| | |
|---|---|
| Type: | Venturi scrubber |
| Manufacturer: | CMI |
| Date Installed: | Spring 1979 |
| Total Air Flow: | 35,000-36,000 acfm |
| Water Circulation Rate: | 300 gpm (design) |
| Makeup water: | Well water as needed |
| Pressure Drop: | 12.5 to 14.5 inches w.c. |
| Scrubber Inlet Temperature: | 300°F |
| Scrubber Motor | 60 hp |
| Pressure in Venturi Nozzle: | 100 lbs |
| Fan Motor: | 150 hp |
| Ponds - number | 2 |
| sizes (approx) | 55 ft x 24 ft and 65 ft x 24 ft; both approx. 3 to 6 ft deep |
| capacity (approx) | 70,000 gal and 100,000 gal |
| Scrubber Outlet: | Rectangular steel stack with sampling ports |
| Scrubber Sludge: quantity | 2 percent of the No. 200 and less fines run through drum |
| disposal | Fill |

## 3.2 PROCESS OPERATION

Operation of the T. J. Campbell plant is typical of other drum-mix plants. The T. J. Campbell plant operates about 10 hours per day, typically 8:00 AM to 6:00 PM, and does not operate on weekends unless requested by a customer. 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 T. J. Campbell plant is 350 tons per hour at a product temperature of 240°F and 1-2 percent feed moisture. The T. J. Campbell plant operates at a product temperature higher than normal for the industry (300°F as opposed to 275 to 285°F) to produce a more workable mix for smaller paving jobs. With a product temperature of 300°F and a feed moisture content of 5 to 6 percent, the rated capacity of the plant is 250 tons per hour. A daily production of 2,000 tons is considered very good. The T. J. Campbell plant produces a variety of commercial and recycle mixes. A brief description of the process operating procedures used during conventional and recycle operation is presented below.

### 3.2.1 Conventional Process Operation

During conventional operation, virgin aggregate is added to the burner end of the rotating drum. The virgin aggregate is stored in four cold feed bins. Aggregate from each bin is metered onto a conveyor according to the desired commercial mix. Table 3-3 includes a description of the various commercial mixes produced by T. J. Campbell during the test program.

The liquid asphalt is injected into the dryer about 2 feet downstream from the center of the drum. The liquid asphalt is stored in a heated 35,000 gallon (gal) tank on site, maintained at a temperature of 300°F. The grade of asphalt used during the test period is designated AC-20, which has a 60 to 100 penetration grade. Campbell has two suppliers of liquid asphalt, Kerr McGee (Wynnewood, Oklahoma) and Allied Chemical (Stroud, Oklahoma). No recycling agents are used by Campbell. The finished asphalt concrete mix drops out the end of the drum and is lifted by bucket conveyor

TABLE 3-3. AGGREGATE ADDITIONS FOR TYPICAL CONVENTIONAL MIXES PRODUCED AT THE T.J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| Type Mix | Asphalt Cement Added (Percent) | Bin No. | Percent of Aggregate | Bin Contents | Moisture Content Estimated By Plant Personnel (Percent) |
|---|---|---|---|---|---|
| Type B (virgin) | 4.9 | 1 | 45 | Screenings | 2.5 |
| | | 2 | 22 | Sand | 12.0 |
| | | 3 | 8 | 3/4 in. rock | 1.5 |
| | | 4 | 25 | 5/8 in. rock | 2.0 |
| Type C | 5.0 | 1 | 43 | Screenings | 1.5 |
| | | 2 | 24 | Sand | 12.0 |
| | | 3 | 33 | 3/8 in. rock | 1.5 |
| | | 4 | 0 | -- | --- |
| Type M | 5.0 | 1 | 53 | Screenings | 2.0 |
| | | 2 | 20 | Sand (washed) | 11.0 |
| | | 3 | 0 | -- | --- |
| | | 4 | 27 | 5/8 in. rock | 2.0 |

TABLE 3-4. AGGREGATE ADDITIONS FOR TYPICAL RAP MIXES PRODUCED AT THE T. J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| Type Mix | Asphalt Cement Added (Percent) | Bin No. | Percent of Aggregate | Bin Contents | Moisture Content Estimated By Plant Personnel (Percent) |
|---|---|---|---|---|---|
| Type A (recycle) | 3.9 (4.6)[a] | 1 | 18 | Screenings | 2.5 |
| | | 2 | 9.8 | Sand | 12.0 |
| | | 3 | 0 | --- | --- |
| | | 4 | 47.2 | 1.5 in. rock | 2.0 |
| | | RAP | 25 | RAP | 2.0 |
| Hot Sand (recycle) | 4.5 (4.6)[a] | 1 | 15 | Screenings | 2.0 |
| | | 2 | 60 | Sand | 11.0 |
| | | 3 | -- | -- | |
| | | 4 | -- | -- | |
| | | RAP | 25 | RAP | 2.0 |

[a]Asphalt cement in the RAP

to one of three storage silos. These silos are heated with heat transfer oil and are insulated. The asphalt concrete is then loaded onto trucks on a scale. The truck used by Campbell to haul the product are owned and operated by independent truckers.

### 3.2.2 Recycle Progress Operation

RAP is predominantly used in base course mixes. Table 3-4 includes a description of the various RAP mixes produced by T. J. Campbell during the test program. During recycle operation, RAP was added to the center of the rotating drum and the quantity of virgin aggregate added to the rotating drum was reduced. Typical RAP percentages are 25 to 30 percent. The remaining recycle process operating procedures are similar to the conventional process operating procedures presented in Section 3.2.1.

## 3.3 PROCESS MONITORING DURING THE EMISSION TEST PROGRAM

The operation of the drum-mix asphalt plant was monitored by MRI personnel during both the conventional and recycle test periods. Table 3-5 contains a summary of the process data collected during the emissions testing program. The test period included the company's peak production week of over 9,000 tons and its peak production day, November 11, 1983, when 2,354 tons were sold.

## 3.4 EMISSION CONTROL SYSTEM MONITORING DURING THE EMISSION TEST PROGRAM

The operation of the venturi scrubber emission control system was monitored by MRI personnel during both the conventional and recycle test periods. Emission control system parameters that were monitored during testing included:

- venturi scrubber pressure drop,
- total scrubber water flow to the venturi, and
- scrubber water flow to the venturi throat.

TABLE 3-5. PROCESS INFORMATION DURING EMISSION TESTING, T.J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| Date | Time | Production rate, tph[a] | Virgin, tph[a] | RAP, tph[a] | Aphalt, tph[b] | Mix temp., °F | Burner setting, % | Operator estimate moisture content | | Drum internal pressure, ΔP | Mix design | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Virgin | RAP | | | |
| 11/10/83 | 9:30 | 201.3 | 191.1 | -- | 10.2 | 270 | 30 | 5 | -- | -0.25 | C mix | |
| (a.m.) | 10:00 | 219.2 | 208.3 | -- | 10.9 | 290 | 40 | 5 | -- | -0.09 | C mix | |
| | 10:33 | 232.4 | 221.0 | -- | 11.4 | 290 | 40 | 5 | -- | -0.10 | C mix | |
| | 11:00 | 228.5 | 217.5 | -- | 11.0 | 310 | 40 | 5 | -- | -0.09 | C mix | |
| | 11:30 | 219.2 | 208.7 | -- | 10.5 | 310 | 40 | 5 | -- | -0.10 | C mix | |
| | 11:50 | 217.4 | 206.7 | -- | 10.7 | 290 | 40 | 5 | | -0.01 | C mix | |
| (p.m.) | 2:01 | 209.1 | 150.8 | 52.5 | 5.8 | 290 | 30 | 4-5 | 3 | -0.34 | Recycle-A[c] | |
| | 2:31 | 248.3 | 177.3 | 64.1 | 6.9 | 290 | 35 | 4-5 | 2 | -0.30 | Recycle-A | Turned off prespray water flow at 2:41 p.m. |
| | 2:57 | 250.7 | 179.3 | 64.5 | 6.8 | 290 | 40 | 4-5 | 2 | -0.33 | Recycle-A | |
| | 3:31 | 262.8 | 192.5 | 62.9 | 7.4 | 285 | 40 | 4-5 | 2 | -0.32 | Recycle-A | |
| | 3:52 | 274.3 | 195.5 | 71.4 | 7.4 | 285 | 40 | 4-5 | 2 | -0.17 | Recycle-A | Turned on prespray water flow at 3:44 p.m. |
| | 4:12 | 248.1 | 181.9 | 59.1 | 7.1 | 305 | 45 | 4-5 | 2 | -0.16 | Recycle-A | |
| | 4:28 | 231.2 | 167.4 | 57.6 | 6.2 | 290 | 35 | 4-5 | 2 | -0.25 | Recycle-A | |
| 11/11/83 | 8:37 | 226.7 | 164.1 | 56.4 | 6.3 | 295 | 30 | 3-4 | 2 | -0.19 | Recycle-A | |
| (a.m.) | 9:01 | 208.2 | 161.7 | 40.1 | 6.2 | 295 | 30 | 3-4 | 2 | -0.18 | Recycle-A | |
| | 9:30 | 214.6 | 157.4 | 51.2 | 6.0 | 290 | 30 | 3-4 | 2 | -0.15 | Recycle-A | 9:45-9:50 RAP bin clog reduced production rate |
| | 10:01 | 231.5 | 167.1 | 58.2 | 6.2 | 295 | 35 | 3-4 | 2 | -0.12 | Recycle-A | |
| | 10:30 | 245.6 | 173.7 | 65.2 | 6.7 | 295 | 40 | 3-4 | 2 | -0.05 | Recycle-A | |
| | 11:00 | 262.2 | 191.8 | 63.3 | 7.1 | 290 | 40 | 3-4 | 2 | -0.04 | Recycle-A | |
| | 11:30 | 279.2 | 198.3 | 73.4 | 7.5 | 260 | 40 | 3-4 | 2 | -0.04 | Recycle-A | |
| (p.m.) | 12:10 | 213.8 | 157.1 | 50.8 | 5.9 | 325 | 30 | 3-4 | 2 | -0.13 | Recycle-A | Reduced production rate due to loader problems |
| | 12:30 | 215.4 | 153.9 | 55.3 | 6.2 | 295 | 30 | 3-4 | 2 | -0.09 | Recycle-A | |
| | 1:00 | 223.7 | 157.6 | 60.2 | 5.9 | 305 | 30 | 3-4 | 2 | -0.11 | Recycle-A | |
| | 1:30 | 212.4 | 151.0 | 55.8 | 5.6 | 310 | 30 | 3-4 | 2 | -0.10 | Recycle-A | |
| | 2:00 | 218.3 | 157.3 | 55.0 | 6.0 | 290 | 30 | 3-4 | 2 | -0.14 | Recycle-A | |
| | 2:30 | 205.3 | 139.9 | 58.9 | 6.5 | 300 | 20 | 3-4 | 2 | -0.14 | Recycle-A | |
| | 3:01 | 238.3 | 171.4 | 60.4 | 6.5 | 290 | 35 | 3-4 | 2 | -0.06 | Recycle-A | |
| | 3:31 | 254.2 | 180.3 | 67.9 | 6.0 | 285 | 40 | 3-4 | 2 | -0.02 | Recycle-A | Stopped operation 3:41 to 3:44; drag slat clogged |
| | 4:02 | 208.5 | 165.3 | 36.1 | 7.1 | 255 | 30 | 3-4 | 2 | -0.02 | Recycle-A | |
| | 4:30 | 265.4 | 188.9 | 69.8 | 6.7 | 270 | 45 | 3-4 | 2 | -0.01 | Recycle-A | |
| | 5:00 | 267.8 | 189.8 | 71.7 | 6.3 | 285 | 45 | 3-4 | 2 | -0.01 | Recycle-A | |
| | 5:26 | 264.8 | 197.0 | 60.8 | 7.0 | 280 | 50 | 3-4 | 2 | 0 | Recycle-A | Stopped process at 5:30 to switch to C mix (virgin) |

(continued)

TABLE 3-5 (continued)

| Date | Time | Production rate, tph[a] | Virgin, tph[a] | RAP, tph[a] | Aphalt, tph[b] | Mix temp., °F | Burner setting, % | Operator estimate moisture content: Virgin | Operator estimate moisture content: RAP | Drum internal pressure, ΔP | Mix design | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11/12/83 (a.m.) | 7:10 | 215.6 | 155.0 | 55.4 | 5.2 | 290 | 40 | 3-4 | 2 | 0.09 | Recycle-A | |
| | 7:30 | 237.8 | 173.5 | 58.1 | 6.2 | 290 | 35 | 3-4 | 2 | 0.08 | Recycle-A | |
| | 8:01 | 238.1 | 174.1 | 57.4 | 6.6 | 295 | 35 | 3-4 | 2 | 0.11 | Recycle-A | 8:05 to 8:10--drum off; switching to load different storage silo |
| | 8:30 | 234.1 | 171.6 | 56.5 | 6.0 | 290 | 35 | 3-4 | 2 | 0.11 | Recycle-A | |
| | 9:00 | 253.5 | 183.4 | 63.6 | 6.5 | 270 | 40 | 3-4 | 2 | 0.03 | Recycle-A | At 9:20 stopped adding RAP to drum; switching to B mix |
| | 11:00 | 256.8 | 244.2 | -- | 12.6 | 275 | 60 | ~3 | -- | 0 | B mix | |
| | 11:30 | 247.6 | 235.1 | -- | 12.5 | 270 | 60 | ~3 | -- | 0 | B mix | |
| (p.m.) | 12:00 | 250.8 | 238.5 | -- | 12.3 | 280 | 60 | ~3 | -- | 0 | B mix | 11:55 took asphalt cement sample--Source Allied, Stroud, Oklahoma |
| | 12:30 | 248.8 | 236.8 | -- | 12.0 | 290 | 55 | ~3 | -- | 0 | B mix | |
| | 1:01 | 235.0 | 223.3 | -- | 11.7 | 280 | 50 | ~3 | -- | 0 | B mix | |
| | 1:30 | 235.4 | 223.6 | -- | 11.8 | 280 | 50 | 3-4 | -- | 0 | B mix | |
| | 2:00 | 222.2 | 211.5 | -- | 10.7 | 285 | 50 | 3-4 | -- | 0 | B mix | Reduced production rate; not enough trucks to haul the asphalt concrete |
| | 2:30 | 215.7 | 205.3 | -- | 10.4 | 290 | 35 | 3-4 | -- | 0.01 | B mix | |
| | 3:01 | 209.7 | 199.4 | -- | 10.3 | 285 | 35 | 3-4 | -- | 0.02 | B mix | |
| 11/13/83 (a.m.) | 8:01 | 212.8 | 202.9 | -- | 9.9 | 295 | 35 | 3-4 | -- | 0.13 | B mix | |
| | 8:29 | 256.9 | 244.3 | -- | 12.6 | 275 | 50 | 3-4 | -- | 0 | B mix | |
| | 8:58 | 236.7 | 225.1 | -- | 11.6 | 275 | 60 | 3-4 | -- | 0 | B mix | |
| | 9:29 | 238.3 | 226.7 | -- | 11.6 | 285 | 50 | 3-4 | -- | 0 | B mix | |
| | 9:59 | 241.1 | 229.0 | -- | 12.1 | 285 | 45 | 3-4 | -- | 0.02 | B mix | |
| | 10:30 | 243.4 | 231.7 | -- | 11.7 | 280 | 45 | 3-4 | -- | 0 | B mix | 10:54 stopped operation to switch to C mix |
| | 11:05 | 230.1 | 218.1 | -- | 11.4 | 280 | 60 | 3-4 | -- | 0 | C mix | |
| | 11:29 | 222.8 | 211.6 | -- | 11.2 | 255 | 60 | 3-4 | -- | 0 | C mix | 11:52 stopped operation to switch to M mix |
| 11/14/83 (a.m.) | 8:03 | 185.1 | 176.2 | -- | 8.9 | 305 | 40 | 3-4 | -- | 0.01 | M mix | |
| | 8:30 | 209.1 | 198.4 | -- | 10.7 | 305 | 45 | 3-4 | -- | 0 | M mix | |
| | 9:00 | 219.9 | 208.9 | -- | 11.0 | 290 | 45 | 3-4 | -- | 0 | M mix | |
| | 9:30 | 218.9 | 207.9 | -- | 11.0 | 290 | 50 | 3-4 | -- | 0 | M mix | |
| | 10:00 | 224.6 | 213.3 | -- | 11.3 | 285 | 50 | 3-4 | -- | 0 | M mix | |
| | 10:30 | 219.3 | 208.5 | -- | 10.8 | 275 | 50 | 3-4 | -- | 0 | M mix | |
| | 11:08 | 201.5 | 191.2 | -- | 10.3 | 280 | 50 | 3-4 | -- | 0 | C mix | 10:55 stopped operation to switch to C Mix |

(continued)

TABLE 3-5 (continued)

| Date | Time | Production rate, tph[a] | Virgin, tph[a] | RAP[a] tph | Aphalt, tph[b] | Mix temp., °F | Burner setting, % | Operator estimate moisture content Virgin | Operator estimate moisture content RAP | Drum internal pressure, ΔP | Mix design | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11:30 | 206.8 | 196.5 | -- | 10.3 | 295 | 35 | 3-4 | -- | 0 | C mix | |
| | | | | | | | | | | | | 11:43 plant shut off to switch to M mix |
| (p.m.) | 12:00 | 182.6 | 173.4 | -- | 9.2 | 300 | 40 | 3-4 | -- | 0 | M mix | |
| | 12:30 | 199.7 | 189.8 | -- | 9.9 | 285 | 40 | 3-4 | -- | 0 | M mix | |
| | 1:00 | 202.5 | 192.4 | -- | 10.1 | 300 | 35 | 3-4 | -- | 0.03 | M mix | 1:18 plant shut down; silo filled; slow laydown operation |
| | 2:06 | 204.5 | 194.5 | -- | 10.1 | 270 | 55 | 3-4 | -- | 0 | C mix | |
| | 2:25 | 190.1 | 180.5 | -- | 9.6 | 290 | 50 | 3-4 | -- | 0 | C mix | |
| 11/15/83 | 7:38 | 222.1 | 211.0 | -- | 11.1 | 255 | 50 | 3-4 | -- | 0 | M mix | |
| (a.m.) | 8:00 | 215.6 | 204.8 | -- | 10.8 | 205 | 45 | 3-4 | -- | 0 | M mix | |
| | 8:30 | 241.5 | 229.4 | -- | 12.1 | 290 | 50 | 3-4 | -- | 0 | M mix | Stopped operation at 8:44 to switch to hot sand RAP mix |
| | 9:03 | 178.6 | 134.2 | 37.9 | 6.5 | 205 | 55 | 8 | 3.5 | 0 | Recycle-HS[d] | 8:56 started recycle mix; hot |
| | 9:30 | 157.7 | 116.0 | 36.4 | 5.3 | 310 | 65 | 8 | 3.5 | 0 | Recycle-HS | hot sand mix typically runs at lower production rate |
| | 9:57 | 170.7 | 126.5 | 38.1 | 6.1 | 255 | 60 | 8 | 3.5 | 0 | Recycle-HS | |
| | 10:30 | 156.1 | 119.8 | 30.8 | 5.5 | 255 | 65 | 8 | 3.5 | 0 | Recycle-HS | |
| | 10:55 | 166.6 | 117.1 | 43.9 | 5.6 | 265 | 65 | 8 | 3.5 | 0 | Recycle-HS | 11:00 shut off operation to switch to M mix |
| (p.m.) | 12:07 | 245.6 | 233.3 | -- | 12.3 | 280 | 60 | 3-4 | -- | 0 | M mix | |
| | 12:30 | 241.1 | 229.1 | -- | 12.0 | 285 | 60 | 3-4 | -- | 0 | M mix | |
| | 1:00 | 237.4 | 225.3 | -- | 12.1 | 265 | 60 | 3-4 | -- | 0 | M mix | 1:21 stopped to switch to C mix |
| | 1:35 | 226.7 | 215.5 | -- | 11.2 | 270 | 60 | 3-4 | -- | 0 | C mix | 1:38 to 1:41 shut off water to prespray and venturi throat |
| | 1:55 | 223.8 | 212.8 | -- | 11.0 | 295 | 65 | 3-4 | -- | 0 | C mix | |

[a]Measured by weigh bridge on feed conveyors.
[b]Measured by flow meter at asphalt storage tank.
[c]Recycle-A = recylce A mix.
[d]Recylce-HS = recycle hot sand mix.



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Tables 3-6 and 3-7 contain a summary of the venturi scrubber operating data collected during the test program.

## 3.5. SUMMARY OF PERTINENT PLANT OPERATION INFORMATION DURING THE EMISSION TEST PROGRAM

This section includes a summary of pertinent information concerning the operation and monitoring of the asphalt concrete plant and venturi scrubber.

### 3.5.1 Asphalt Concrete Production Summary

Table 3-8 presents a summary of the average asphalt concrete production and mix type produced during each test period.

### 3.5.2 Blue Haze Production

The water flow to the presprays was turned off for over an hour on the afternoon of November 10, 1983 in an effort to generate blue haze by eliminating the prespray cooling. No blue haze was observed during this period. With the concurrence of the EPA Industrial Studies Branch (ISB) and Emission Measurements Branch (EMB) representatives, testing under reduced water flow conditions was cancelled.

TABLE 3-6. SUMMARY OF VENTURI SCRUBBER OPERATING DATA COLLECTED DURING CONVENTIONAL OPERATION AT T. J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| Run No. | Date | Time | Pressure Drop (In. $H_2O$) | Scrubber Water Flow Rates (GPM) Total to System | Venturi Throat |
|---|---|---|---|---|---|
| Part C1 | 11/12 | 1100 | 13.5 | 215 | 41 |
| | | 1200 | 13.5 | 220 | 41 |
| | | 1230 | 13.5 | 220 | 41 |
| | | 1301 | 13.5 | 220 | 42 |
| | | 1330 | 13.5 | 220 | 42 |
| | | | 13.5 (avg) | 219 (avg) | 41 (avg) |
| Part C2 | 11/13 | 0801 | 13.5 | 215 | 41 |
| | | 0829 | 13.5 | 220 | 42 |
| | | 0858 | 13.5 | 215 | 42 |
| | | 0929 | 13.5 | 220 | 42 |
| | | 0959 | 13.5 | 220 | 42 |
| | | 1030 | 13.5 | 220 | 42 |
| | | 1105 | 13.5 | 220 | 42 |
| | | 1129 | 13.0 | 220 | 42 |
| | | | 13.4 (avg) | 219 (avg) | 42 (avg) |
| Part C3 | 11/14 | 0803 | 13.5 | 215 | 42 |
| | | 0830 | 13.5 | 215 | 42 |
| | | 0900 | 13.5 | 215 | 41 |
| | | 0930 | 13.5 | 215 | 41 |
| | | 1000 | 13.5 | 215 | 42 |
| | | 1030 | 13.5 | 215 | 42 |
| | | | 13.5 (avg) | 215 (avg) | 42 (avg) |
| PAH C1 | 11/14 | 1200 | 13.5 | 220 | 43 |
| | | 1230 | 13.5 | 220 | 42 |
| | | 1300 | 13.5 | 220 | 42 |
| | | 1406 | 13.0 | 220 | 42 |
| | | | 13.4 (avg) | 220 (avg) | 42 (avg) |

TABLE 3-7. SUMMARY OF VENTURI SCRUBBER OPERATING DATA COLLECTED DURING RECYCLE OPERATION AT T. J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| Run No. | Date | Time | Pressure Drop (In. $H_2O$) | Scrubber Water Flow Rates (GPM) Total to System | Venturi Throat |
|---|---|---|---|---|---|
| Part R1 | 11/11 | 0837 | 12.5 | 235 | 40 |
| | | 0901 | 12.5 | 235 | 40 |
| | | 0930 | 12.5 | 225 | 40 |
| | | 1001 | 14.5 | 220 | 38 |
| | | 1030 | 14.5 | 220 | 41 |
| | | 1100 | 14.5 | 220 | 41 |
| | | 1130 | 14.5 | 220 | 41 |
| | | 1210 | 14.0 | 220 | 41 |
| | | 1230 | 14.0 | 220 | 42 |
| | | 1300 | 14.0 | 220 | 41 |
| | | 1332 | 14.0 | 220 | 42 |
| | | 1400 | 14.0 | 220 | 42 |
| | | 1430 | 14.0 | 220 | 41 |
| | | | 13.8 (avg) | 223 (avg) | 41 (avg) |
| Part R2 | 11/11 | 1501 | 14.0 | 220 | 41 |
| | | 1531 | 13.5 | 220 | 41 |
| | | 1602 | 13.5 | 220 | 41 |
| | | 1630 | 14.0 | 220 | 42 |
| | | 1700 | 14.0 | 220 | 41 |
| | | 1726 | 14.0 | 220 | 41 |
| | | | 13.8 (avg) | 220 (avg) | 41 (avg) |
| Part R3 | 11/12 | 0700 | 14.0 | 215 | 42 |
| | | 0730 | 14.0 | 220 | 42 |
| | | 0801 | 14.0 | 220 | 41 |
| | | 0830 | 14.0 | 220 | 42 |
| | | 0900 | 13.5 | 220 | 41 |
| | | | 13.9 (avg) | 219 (avg) | 42 (avg) |
| PAH R1 | 11/15 | 0903 | 13.0 | 225 | 30 |
| | | 0930 | 13.0 | 210 | 30 |
| | | 0957 | 12.5 | 215 | 30 |
| | | 1030 | 12.5 | 210 | 30 |
| | | 1055 | 12.5 | 210 | 30 |
| | | | 12.7 (avg) | 214 (avg) | 30 (avg) |

TABLE 3-8. AVERAGE PRODUCTION AND MIX TYPE DURING TESTING PERIOD--
T.J. CAMPBELL CONSTRUCTION COMPANY, OKLAHOMA CITY, OKLAHOMA

| Date | Test period time (beginning-end) | Average production rate, tph | Product type |
|---|---|---|---|
| 11/11/83 | 08:39-14:33[a] | 229.3 | Recycle A mix |
| 11/11/83 | 15:15-17:04[a] | 249.8 | Recycle A mix |
| 11/12/83 | 07:13-09:00[a] | 235.8 | Recycle A mix |
| 11/12/83 | 11:39-13:19[a] | 243.5 | Virgin B mix |
| 11/12/83 | 14:18-15:20[b] | 215.9 | Virgin B mix |
| 11/13/83 | 08:53-11:12[a] | 235.4 | Virgin B&C mix |
| 11/14/83 | 08:13-10:03[a] | 212.8 | Virgin M mix |
| 11/14/83 | 10:14-11:43[b] | 209.2 | Virgin M&C mix |
| 11/15/83 | 12:25-14:00[b] | 232.3 | Virgin M&C mix |

[a]Controlled emission test periods - uncontrolled emission tests conducted sometime during the indicated time periods.
[b]Uncontrolled particle size test periods.

# SECTION 4
# 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 T. J. Campbell 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 and top 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 10 to 12 feet where the flue gas then flows horizontally in a triangular duct. The triangular duct funnels the gas to a 90° downward bend into the wet venturi scrubber. Uncontrolled emissions samples were collected in the triangular duct.

Figure 4-3 presents the location of the four 3-inch ports that were used to measure the gas flow rate and collect particulate mass, TOC, extractable organics, trace metals, and polynuclear aromatic hydrocarbon samples at the venturi inlet. The four sampling ports were located about two feet upstream from the water sprays in the triangular duct. These cocurrent sprays, used to cool flue gases prior to venturi entry, did not interfere with the sampling activities. Figure 4-3 includes a description of the 16 sampling points used to characterize the inlet duct.

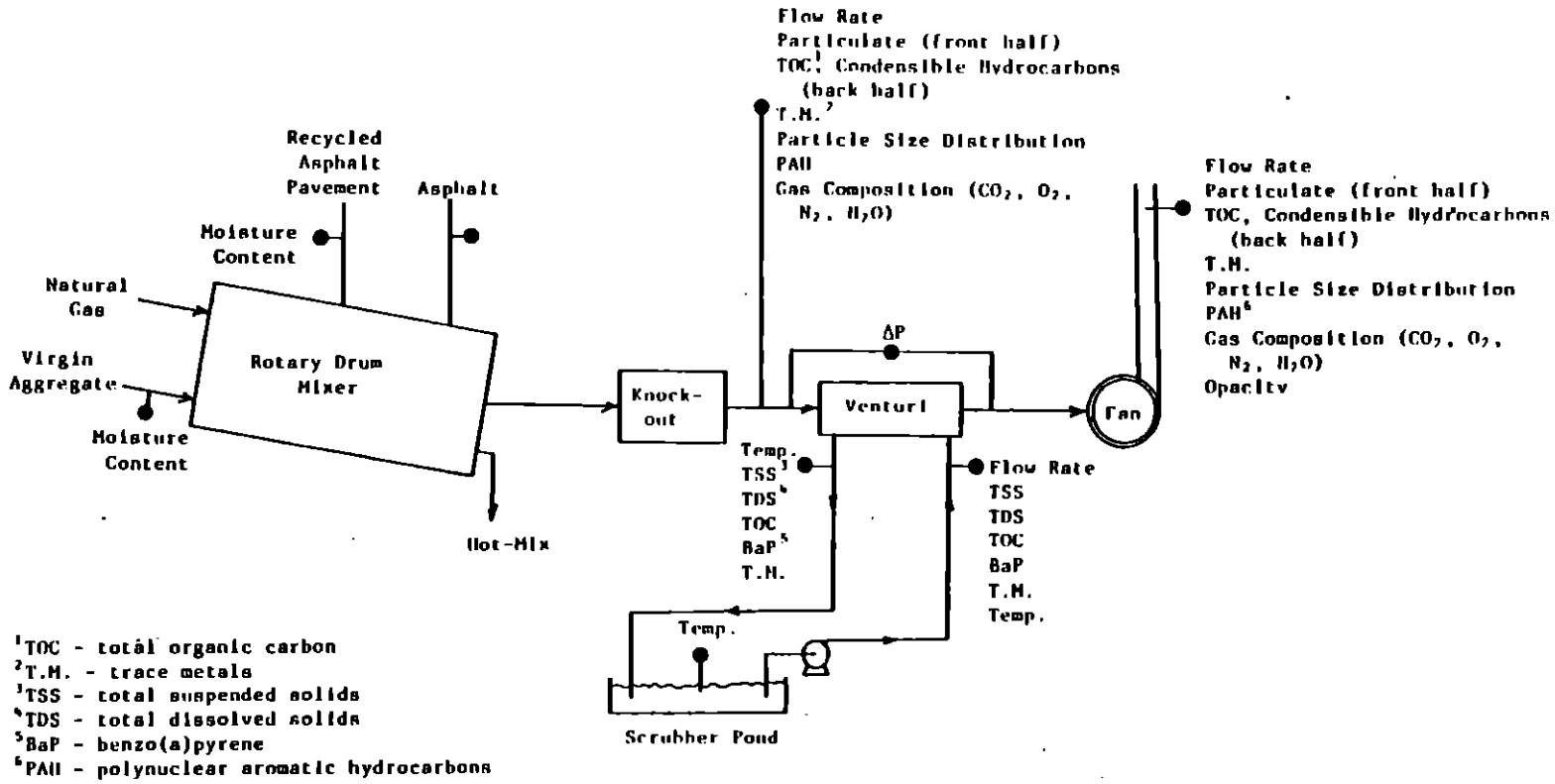



Figure 4-1. Schematic of asphalt concrete process including sampling point locations and sampling matrix.

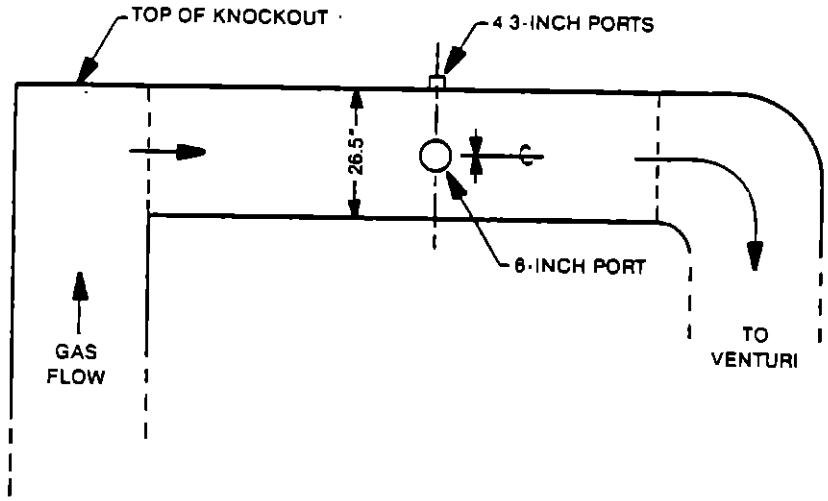



Figure 4-2A. Side View of Inlet Duct Sampling Ports.

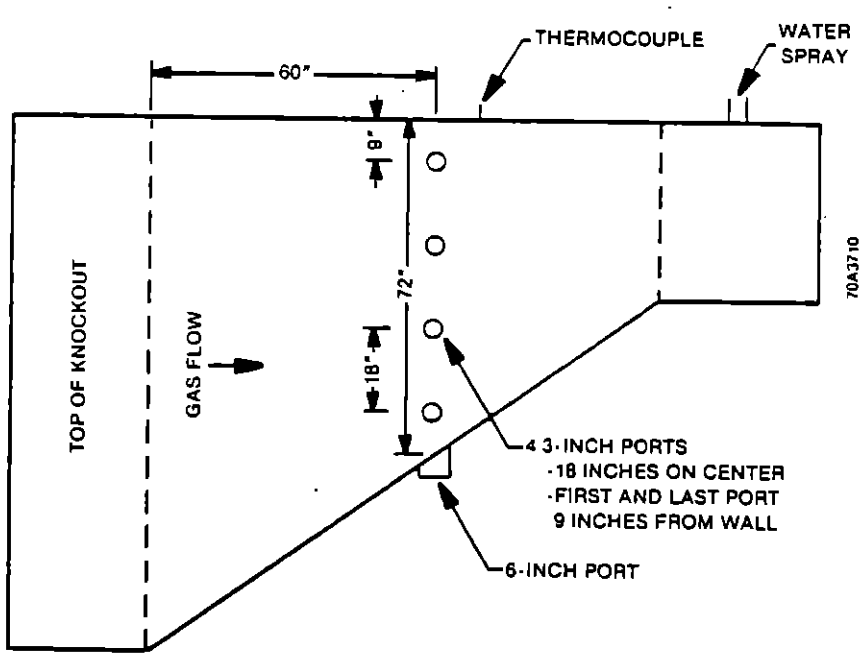



Figure 4-2B. Top View of Inlet Duct Sampling Ports.

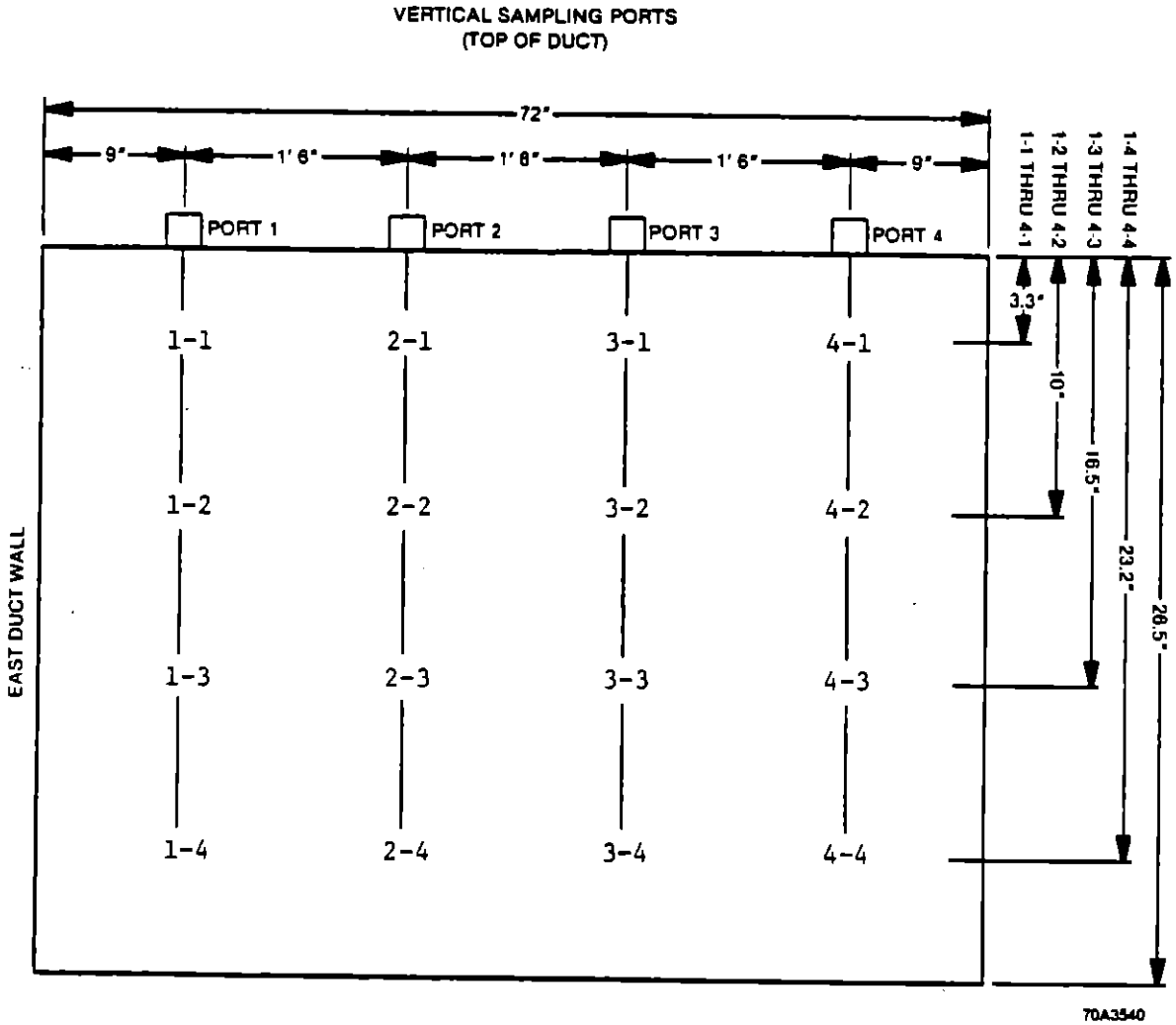



Figure 4-3. Venturi scrubber inlet sampling location for gas flow rate, particulate mass, condensible hydrocarbons, trace metals, and polyaromatic hydrocarbons emissions sampling.

Uncontrolled flue gas samples for $O_2$ and $CO_2$ analysis were collected at sampling point 2-2 as illustrated in Figure 4-3.

Particle size distribution (PSD) samples were collected through the single 6-inch port (Port 5 illustrated in Figure 4-4) mounted on the east side of the triangular duct. The center of Port 5 is situated 13.25 inches from the top of the duct. PSD samples were collected 27 inches from the east duct wall (Point 5-1).

## 4.2 VENTURI SCRUBBER OUTLET SAMPLING LOCATIONS

Controlled emissions samples were collected at the outlet of the venturi scrubber. Flue gas exiting the venturi scrubber entered the exhaust fan and then passed through a flow control damper. The flue gas then exited through a rectangular stack. Controlled emissions samples were collected from two sets of sampling ports on the stack.

The first set of ports consisted of three 3-inch ports located about eight feet downstream of the control damper. The second set of ports consisted of six 3-inch ports located about six feet further downstream from the first set of ports.

Particle size distribution tests were unsuccessfully attempted through the three ports located immediately downstream of the control damper. Figure 4-5 illustrates the location of the port and point used for the particle size distribution tests on controlled emissions.

Gas flow rate measurements and particulate mass, TOC, extractable organics, trace metals, and polynuclear aromatic hydrocarbon samples were collected using the set of six 3-inch ports. Figure 4-6 illustrates the location of the six ports and the locations of the twenty-four sampling points used to collect controlled emissions samples.

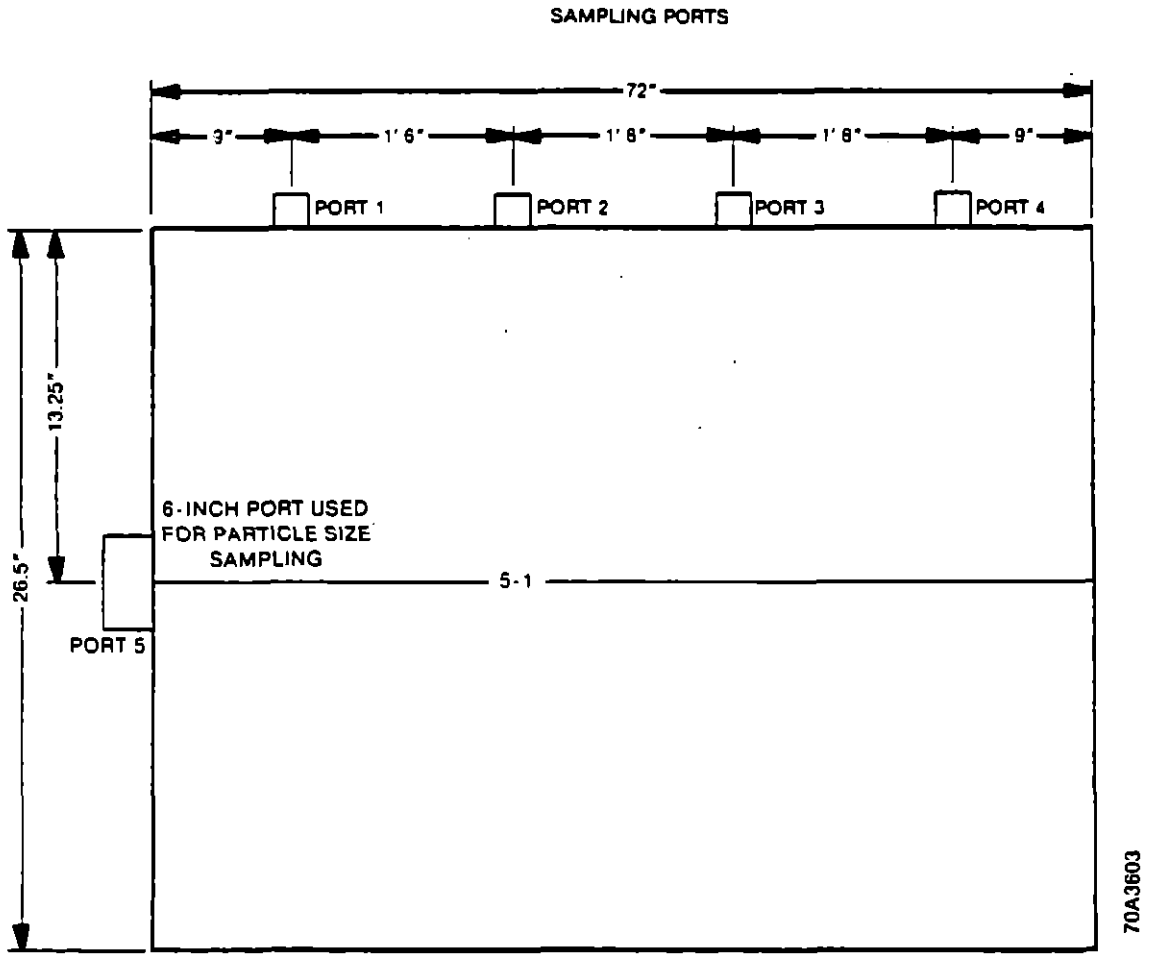



Figure 4-4. Venturi scrubber inlet sampling location for the collection of particle size distribution samples.

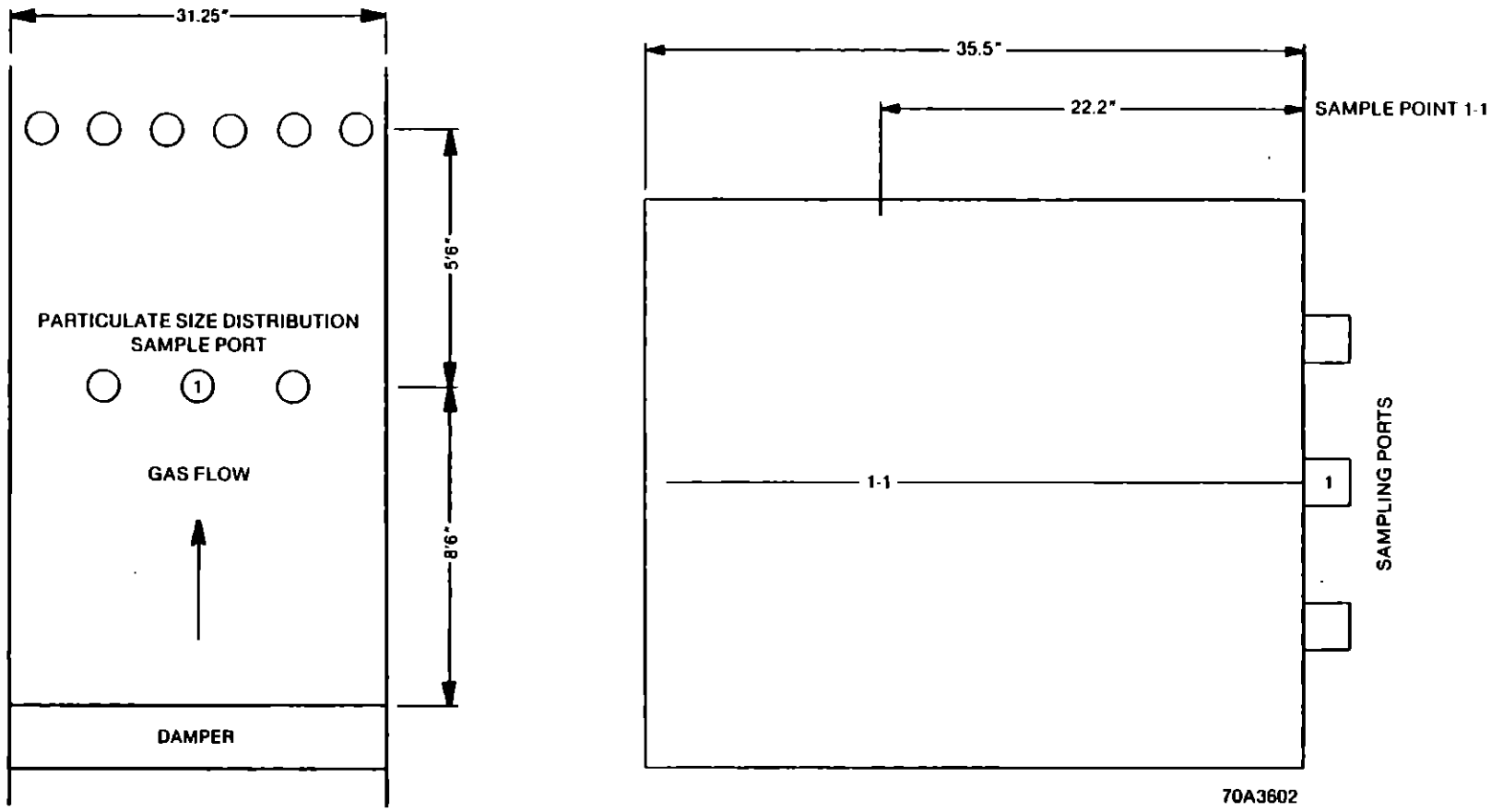



Figure 4-5. Venturi scrubber outlet sampling location for particle size distribution sampling.

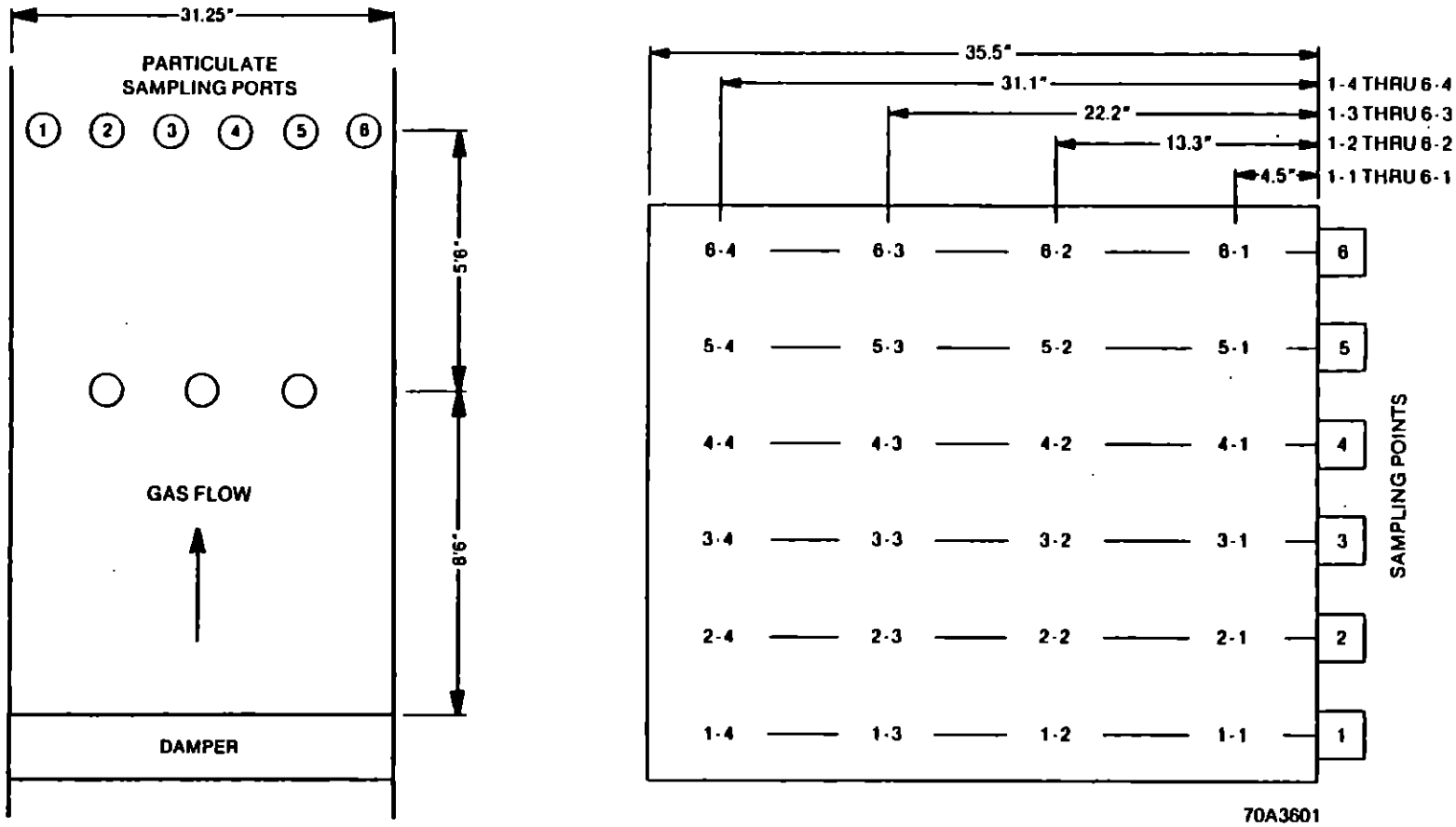



Figure 4-6. Venturi scrubber outlet sampling location for gas flow, particulate mass, condensible hydrocarbons, trace metals, and polyaromatic hydrocarbons emission sampling.

## 4.3 VISIBLE EMISSION OBSERVATION LOCATIONS

Visible opacity 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 T. J. Campbell asphalt plant and the approximate location of the observer with respect to the stack at each position during visible emissions measurements.

## 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 at the floating pump intake (refer to Figure 4-8). The intake line floats out in the pond and access to the intake is by means of a wooden plank. Water samples were collected near the pump intake by dipping a sample container into the pond at the intake position.

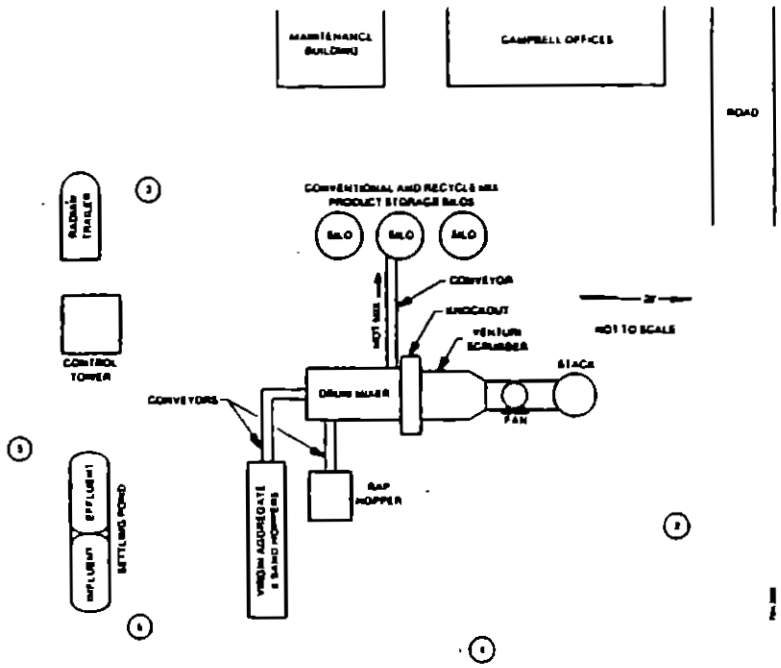
Venturi scrubber water drains into a collection box below the venturi. The scrubber water then drains back to the settling pond by means of an 8-inch diameter plastic pipe. Samples of the scrubber effluent water were collected from the collection box below the venturi scrubber.

## 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

Figure 4-9 illustrates the locations used to monitor the venturi pressure drop. Swagelok® connectors were installed in the duct work immediately upstream and downstream of the venturi scrubber. Tygon® tubing was used to




| Position No. | Date | Time | Approximate Distance from Stack (ft) | Direction of Observer from Discharge Point | Plant Mode[1] |
|---|---|---|---|---|---|
| 1 | 11-10-83 | 1000-1625 | 1000 | SE | R |
| 2 | 11-11-83 | 0819-1126 | 125 | NE | R |
| 3 | 11-11-83 | 1308-1718 | 100 | SW | R |
| 4 | 11-12-83 | 0722-1429 | 200 | E | C&R |
| 5 | 11-13-83 | 0800-1150 | 80-100 | S-SE | C |
| 6 | 11-15-83 | 0815-1054 | 250 | E-SE | R |

[1] C - conventional operation
R - recycle operation

Figure 4-7. Locations of visible emission observations at the T.J. Campbell asphalt plant, Oklahoma City, Oklahoma.

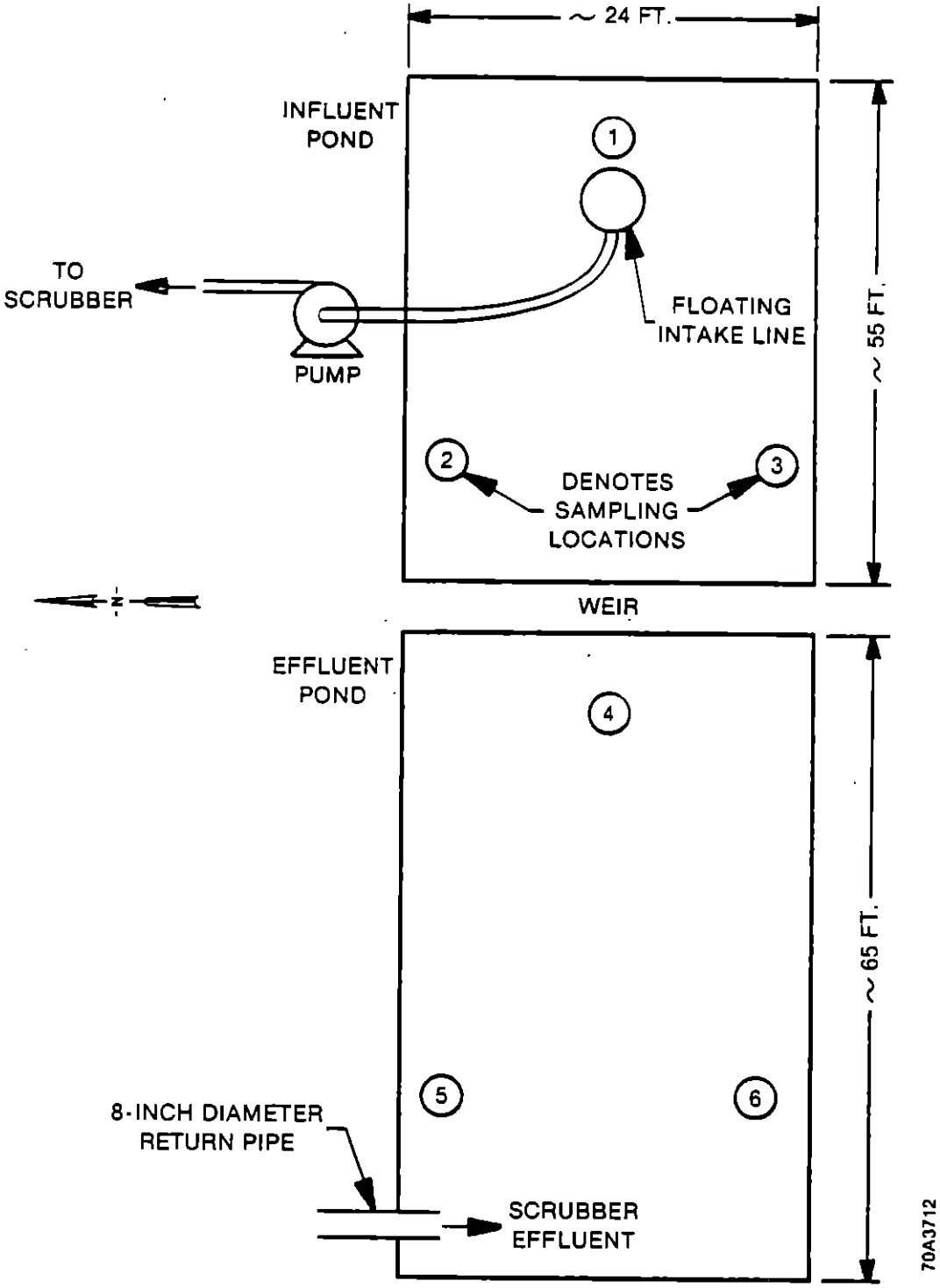



Figure 4-8. Layout of effluent and influent scrubber ponds including sampling locations.

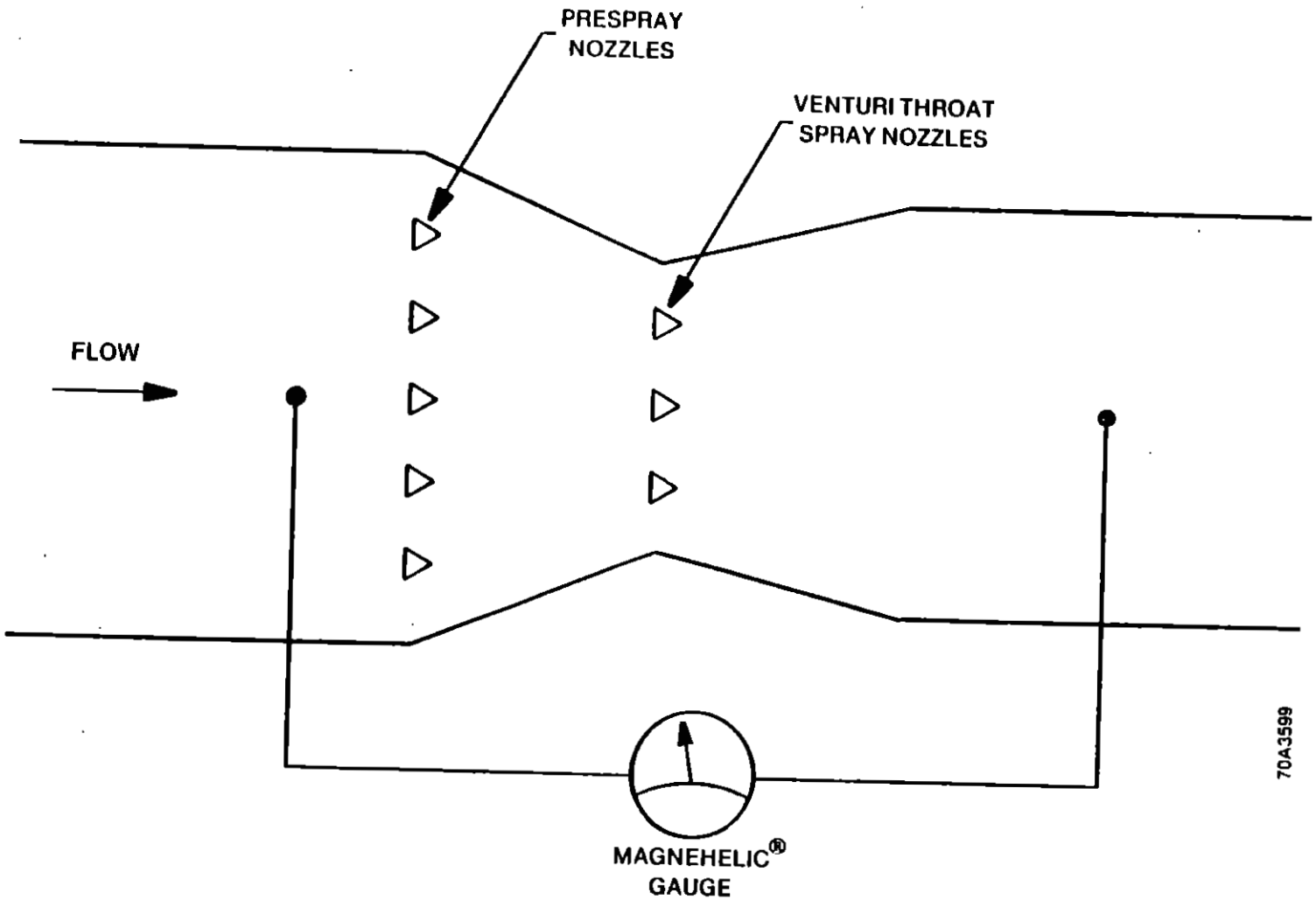



Figure 4-9. Venturi scrubber pressure drop monitoring location.

connect the sample taps to a Magnehelic® differential pressure gauge for use in monitoring the scrubber differential pressure.

### 4.5.2 Venturi Scrubber Water Flow Rate Monitoring

The total water flow rate to the venturi scrubber system and the flow rate of water to the venturi spray nozzles were monitored using paddle wheel type sensors. Flosensors® were used to monitor the water flow rate at the two locations. Figure 4-10 depicts the locations of the two Flosensors® in the scrubber system. One Flosensor® was installed in the 4-inch main line to monitor the total flow of water to the scrubber system. A second Flosensor® was installed in the 2-inch line that supplies water to the venturi spray nozzles. Both Flosensors® were installed in vertical sections of pipe to ensure full-pipe flow of water during monitoring.

## 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.

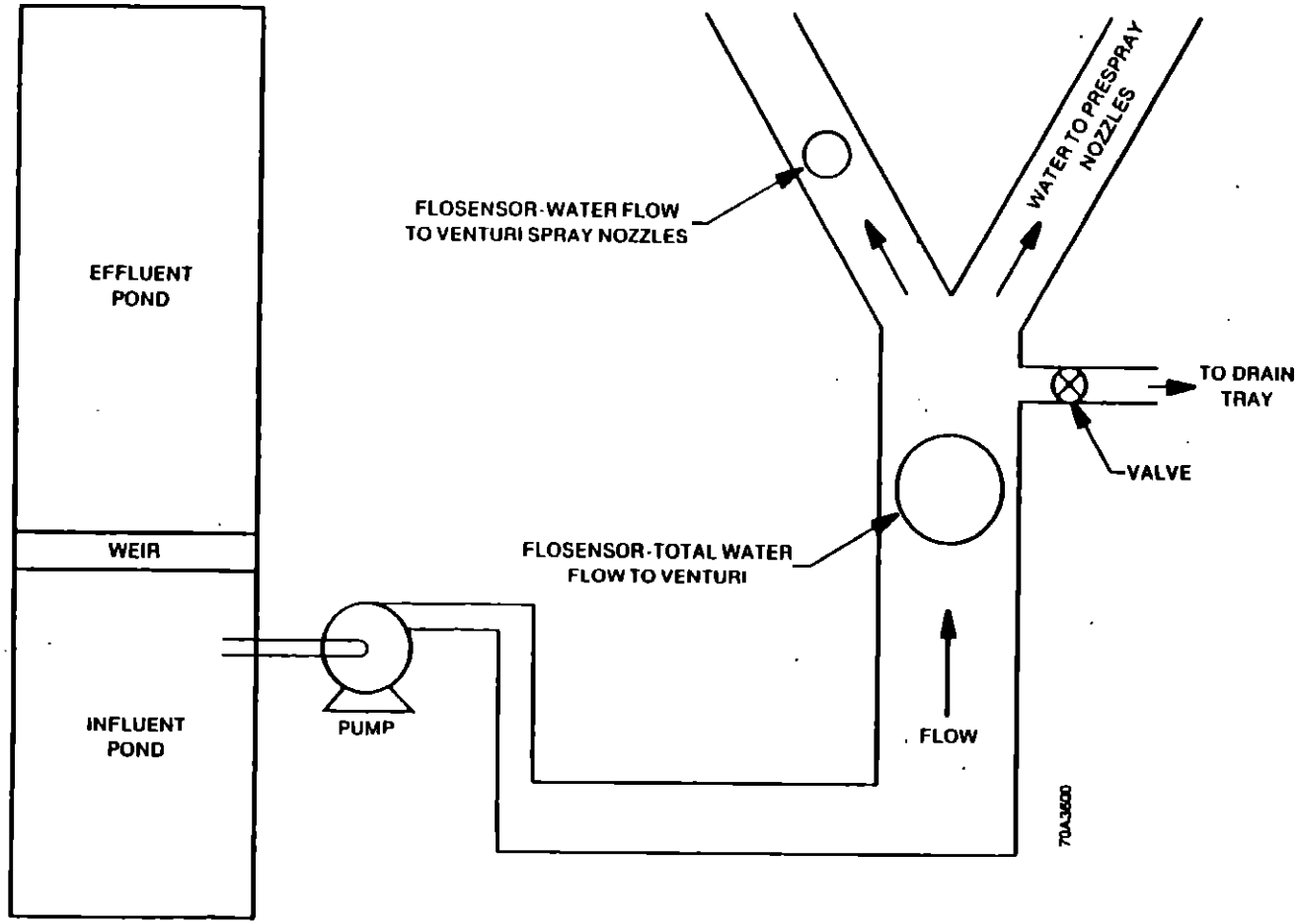



Figure 4-10. Location of flosensors used to monitor the flow rate of water to the T.J. Campbell wet venturi scrubber.

# SECTION 5
# 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 T.J. Campbell 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 gas, 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] | | | |
|---|---|---|---|---|---|---|
| | | | Conventional | | Recycle | |
| | | | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Number and location of sampling points, gas velocity and volumetric gas flow | Inlet/outlet | EPA Methods 1 & 2 | 6 | 6 | 4 | 4 |
| Gas phase composition/dew point | Inlet/outlet | Wet bulb/dry bulb | 8 | 1 | 1 | 2 |
| Gas phase composition and molecular weight | Inlet/outlet | EPA Method 3 | 5 | 1 | 4 | 0 |
| Gas phase composition moisture content | Inlet/outlet | EPA Method 4 | 4 | 4 | 4 | 4 |
| Particulate loading | Inlet/outlet | Modified EPA Method 5E | 3 | 3 | 3 | 3 |
| TOC/Extractable hydrocarbons | Inlet/outlet | Modified EPA Method 5E with 0.1N NaOH impinger solutions | 3 | 3 | 3 | 3 |
| Trace metals | Inlet/outlet | Modified EPA Method 5E with acid/base impingers | 1 | 1 | 1 | 1 |
| Polynuclear Aromatic hydrocarbons | Inlet/outlet | Modified EPA Method 5E with XAD-2 resin canister | 1 | 1 | 1 | 1 |
| Particle size distribution | Inlet | Andersen High Capacity Stack Sampler | 3 | - | 1 | - |
| Particle size distribution | Outlet | Andersen Mark III cascade impactor | - | 3[2] | - | 2[2] |

[1]Number of valid sampling runs performed
[2]Number of attempted sampling runs

Moisture Determination--The moisture content of the outlet gas stream 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 gas stream 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 wet bulb/dry bulb temperatures were determined at least once during each test run to verify the moisture content of the gas streams.

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 an Orsat apparatus. $N_2$ was determined by difference.

A small diaphragm pump with a stainless steel probe were used to extract a small volume (~10 liters) of the gas sample which was collected in a Tedlar® bag. Collection of the gas sample in the Tedlar® bag required 15 to 20 minutes and was performed immediately following a source sampling run (ex. EPA Method 5E). A specific volume of gas is then transferred to the Orsat. During analysis, the gas sample is passed through two absorbing solutions designed to selectively remove $CO_2$ and then $O_2$. The decrease in the gas volume in the Orsat 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 area of the inlet duct and the stack was determined by direct measurement.

The number of sampling points required 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 disturbance. A total of 24 sampling points (4x6 matrix) were used at the stack sampling location.

The inlet sampling location (refer to Section 4) did not meet EPA Method 1 criteria but represented the best possible location available for collecting uncontrolled emission samples. The number of inlet sampling points were limited to 16 (4x4 matrix) because of the high particulate loading and limited sample collection time.

The gas stream velocity was calculated from the average gas velocity pressure ($\Delta P$), the average flue gas temperature, wet molecular weight, and absolute pressure. $\Delta P$ 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 pressure drop ($\Delta P$) across the S-type pitot.

Barometric pressure readings were obtained daily by phoning Tinker Air Force Base. 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 Method 5E was used to measure the particulate and condensible hydrocarbon loadings. The primary modifications to the standard procedure include:

- impinger train configuration and impinger contents depending upon the chemical specie(s) of interest,
- the sample recovery procedure(s),
- performing an acetone probe rinse prior to the trichloroethane probe rinse, and
- maintaining the filter temperature at 250°F $\pm$ 10°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 stainless steel or glass-lined heat traced probe transported the flue gas from the duct to the hot box. Problems were encountered with glass liners breaking during the runs. To eliminate this problem a stainless steel probe was used during later runs. The trace metal samples were collected using a glass liner. The probe temperature was closely monitored and controlled at 250°F ±10°F. After entering the hot box, the particulate matter was removed from the gas stream by means of a glass 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.

The filtered gas stream then entered a series of impingers immersed in an ice bath. The configuration and contents of the impingers depended on the type of chemical specie(s) of interest. The impinger train used during condensible hydrocarbons and particulate determinations consisted of four impingers situated in an ice bath. The first two impingers were of the Greenburg-Smith design and contained 250 ml of 0.1 N sodium hydroxide (NaOH) for hydrocarbon collection. The third and fourth impingers were of the modified Greenburg-Smith design. The third impinger was dry and the fourth impinger contained about 250 grams of silica gel for final moisture removal. Section 5.1.1.4 provides a description of the trace metals impinger train configuration that was used simultaneously with the particulate loading determination. All impingers were weighed before and after sampling using a top loader balance. The impinger weight gain data was used to calculate the moisture content of the flue gas.

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

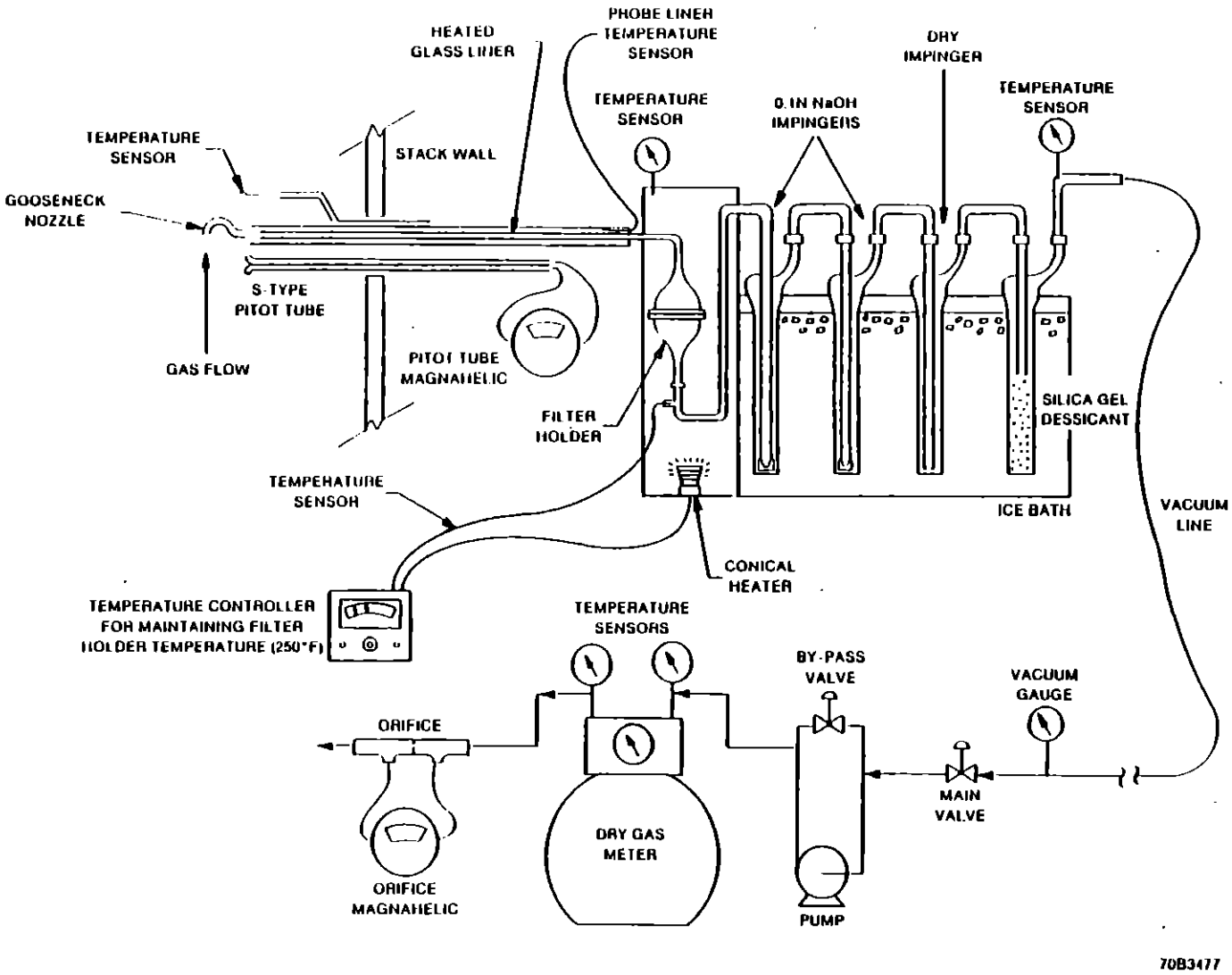



Figure 5-1. Modified EPA Method 5E sampling train designed to collect particulate and condensible hydrocarbon samples at the venturi scrubber inlet and outlet.

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 completed, the nozzle, probe, and interconnecting glass pieces prior to the filter were brushed and washed, first with three volumes of acetone and then with a volume of 1,1,1-trichloroethane. The dual solvent rinse was requested by EPA to relate results to comparative Method 5 data and collect samples within the protocol of Method 5E. The acetone and trichloroethane "front-half" rinses were stored separately in individual 500 ml glass bottles with teflon lid inserts. The filter was transferred to the filter's original petri dish along with any particles or loose filter material in the holder.

After weighing, the impinger contents were quantitatively transferred to individual 500 ml glass bottles with teflon lid inserts. All of the glassware from the filter to the silica gel impinger was rinsed, first with two aliquots of 0.1 N NaOH and then with a volume of trichloroethane. The trichloroethane "back-half" rinses were stored separately in individual 500 ml glass bottles with teflon lid inserts.

The filters, impinger solutions, and acetone, trichloroethane, and NaOH rinses were carefully packaged for shipment back to Radian for weighing and other analyses.

5.1.1.4 Trace Metals Sample Collection--

Samples of the gas streams were collected during this program for trace metals analysis. Collection of the volatile trace metals samples was achieved by incorporating an acid impinger into the impinger train described in Section 5.1.1.3. The impinger, containing 250 ml of 10% ultrex nitric acid ($HNO_3$), was placed immediately downstream of the two 0.1 N NaOH impingers used for hydrocarbons collection. Sample collection was similar to the procedure described in Section 5.1.1.3. Figure 5-2 graphically illustrates the trace metals sampling train.

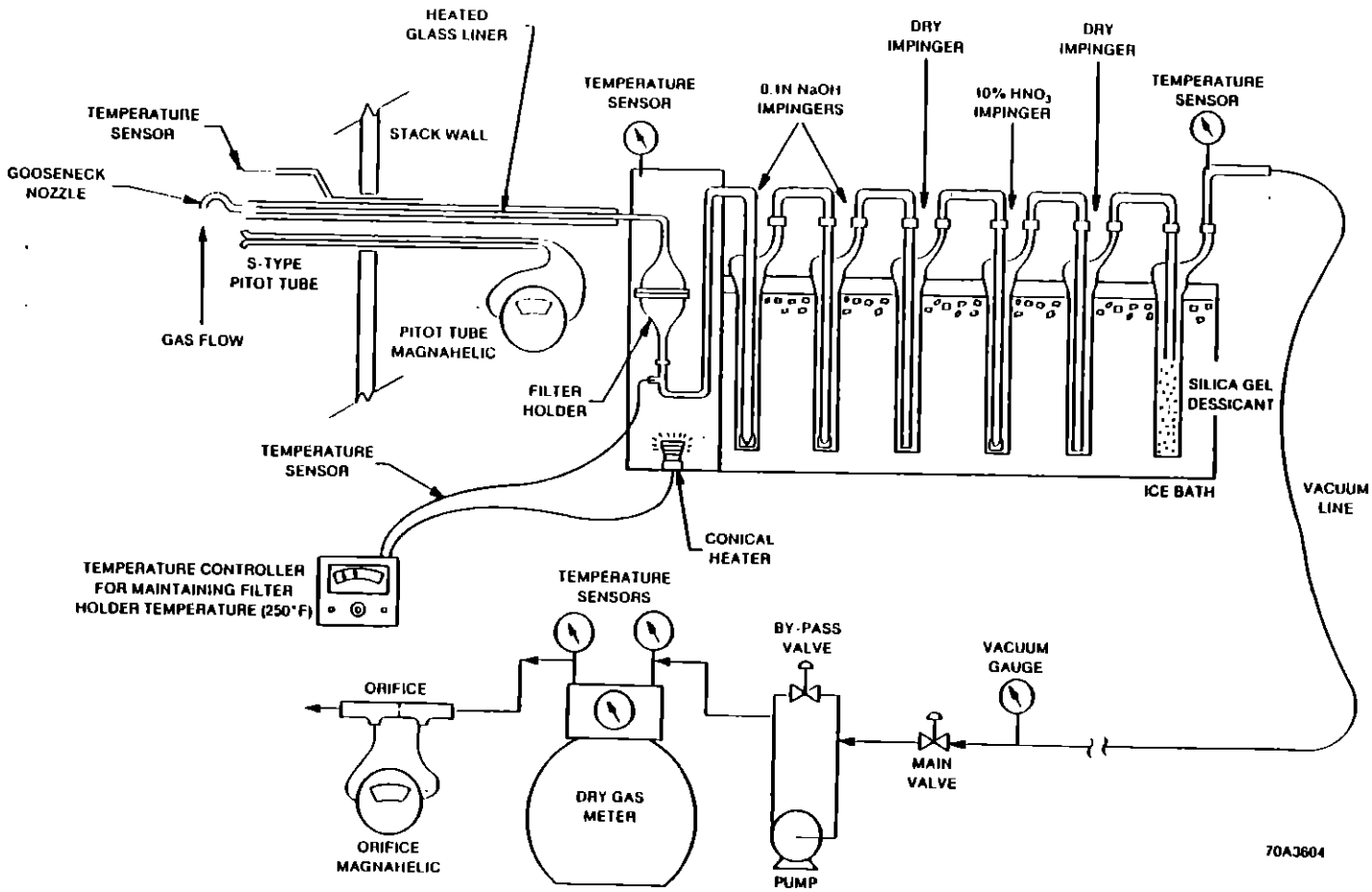



Figure 5-2. Sampling train designed to collect trace metals samples at the venturi scrubber inlet and outlet.

Upon completion of sampling, the particulate and TOC/extractable hydrocarbon sample recovery procedure described in Section 5.1.1.3 was used. The $HNO_3$ impinger solution was stored in a 500 ml Nalgene bottle. The $HNO_3$ impinger was rinsed with an aliquot of 10% $HNO_3$ and the rinse added to the sample bottle.

The filter, acid and base impinger solutions, and the acetone and trichloroethane rinse solutions were shipped back to Radian for trace metals analysis using procedures described in Section 5.2.

5.1.1.5 Polynuclear Aromatic Hydrocarbons Sample Collection--

Figure 5-3 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 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.

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 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

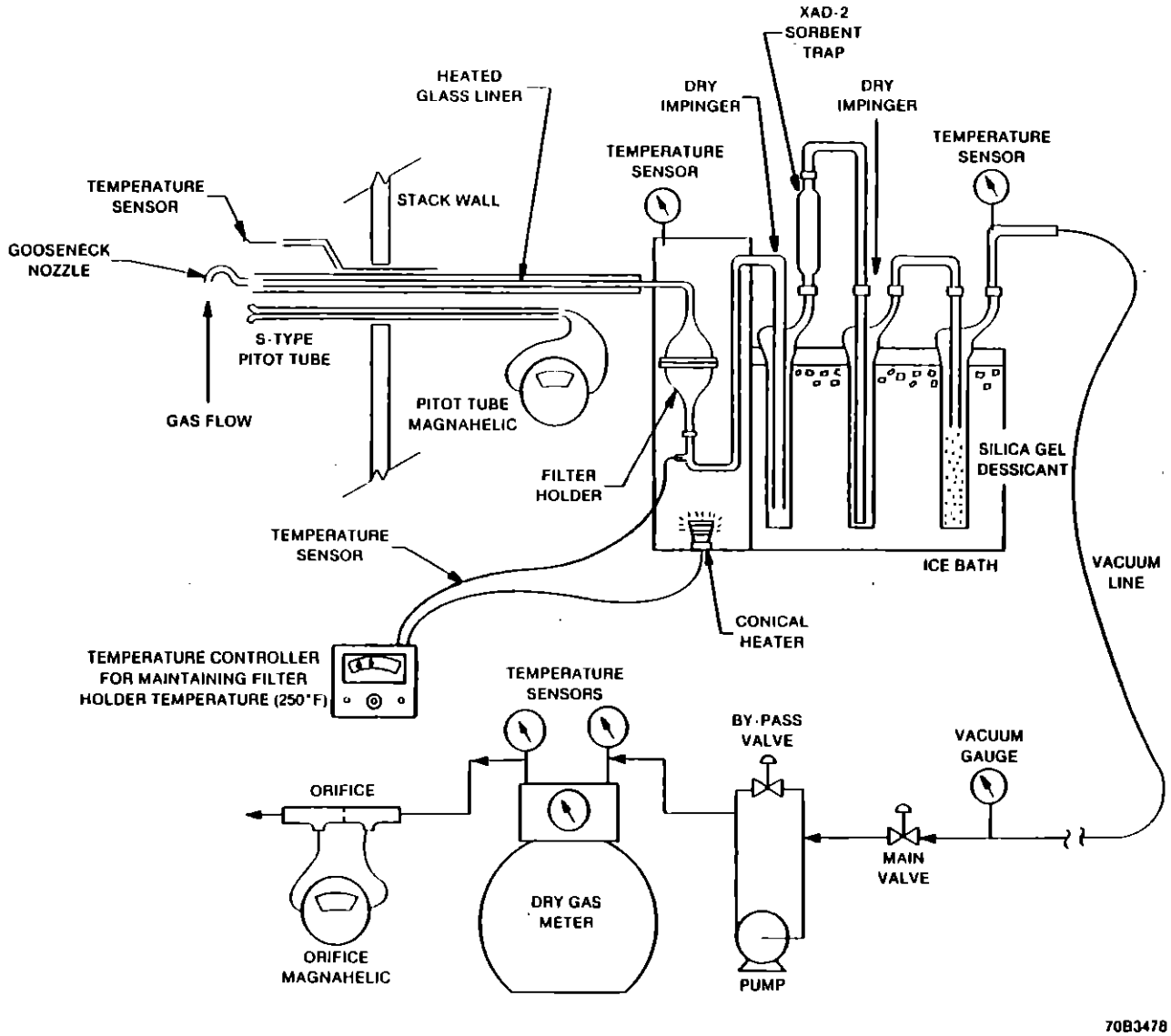



Figure 5-3. Sampling train designed to collect polynuclear aromatic hydrocarbon samples at venturi scrubber inlet and outlet.

(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 pint Ball 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. The PAH sample was analyzed at Radian using the procedure described in Section 5.2.

5.1.1.6 Particle Size Distribution Determination--

During this project the particle size distribution at the inlet and outlet of the scrubber was determined using the sampling trains illustrated in Figures 5-4 and 5-5, respectively. Both sampling trains were similar in design and used equipment designed to classify particles present in the gas stream with respect to their aerodynamic size.

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. 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 might otherwise occur using a gooseneck nozzle at the inlet.

PSD sampling at the scrubber outlet was attempted using an Andersen Mark III cascade impactor. The impactor classifies aerosols aerodynamically into nine size fractions. Glass fiber impactor substrates were used to collect the particles from the gas stream. The substrates decrease the

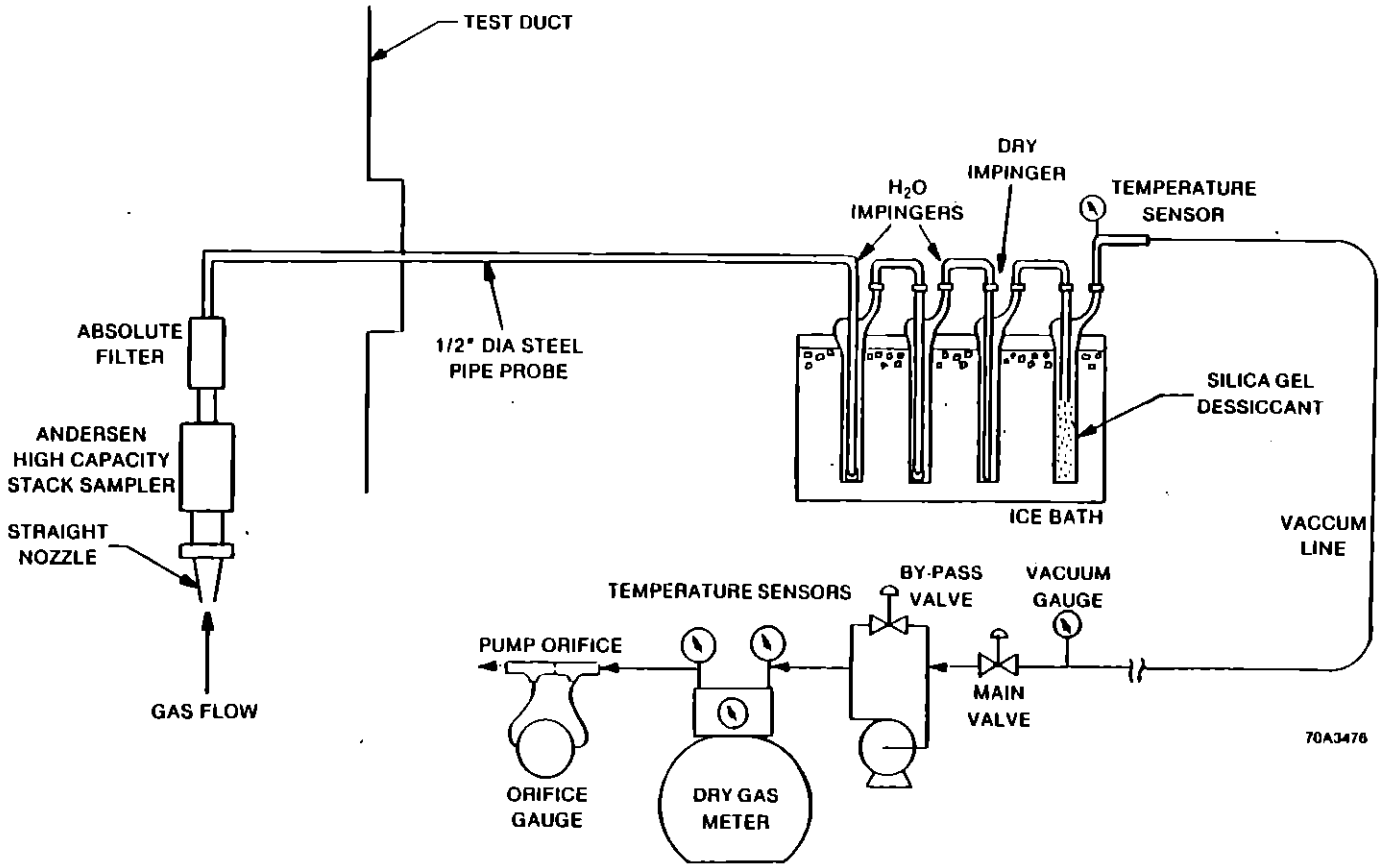



Figure 5-4. In-stack Andersen high capacity stack sampler sampling train used to determine the particle size distribution at the venturi scrubber inlet.

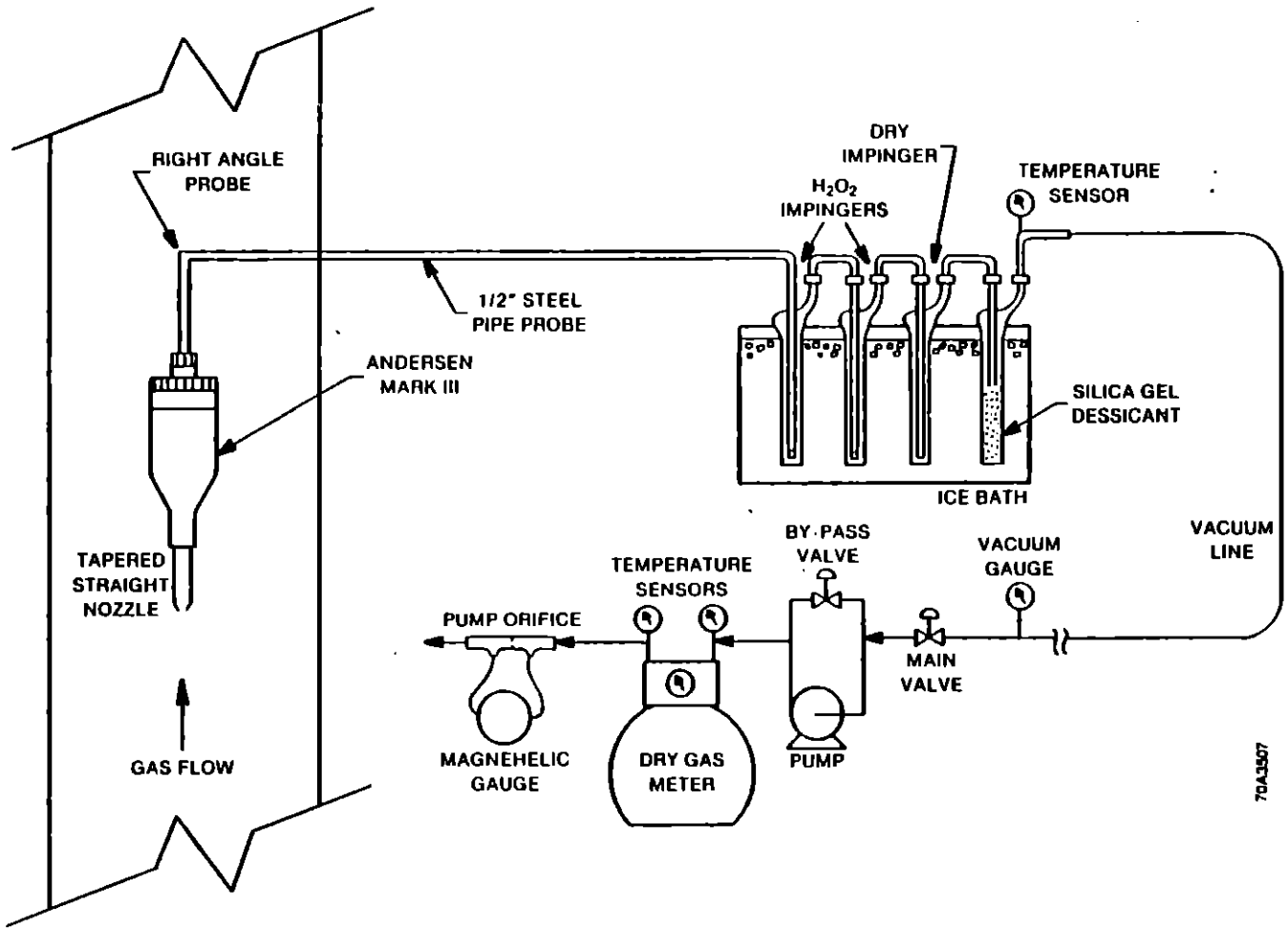



Figure 5-5. In-stack Andersen Mark III Cascade impactor sampling train used to determine the particle size distribution at the venturi scrubber outlet.

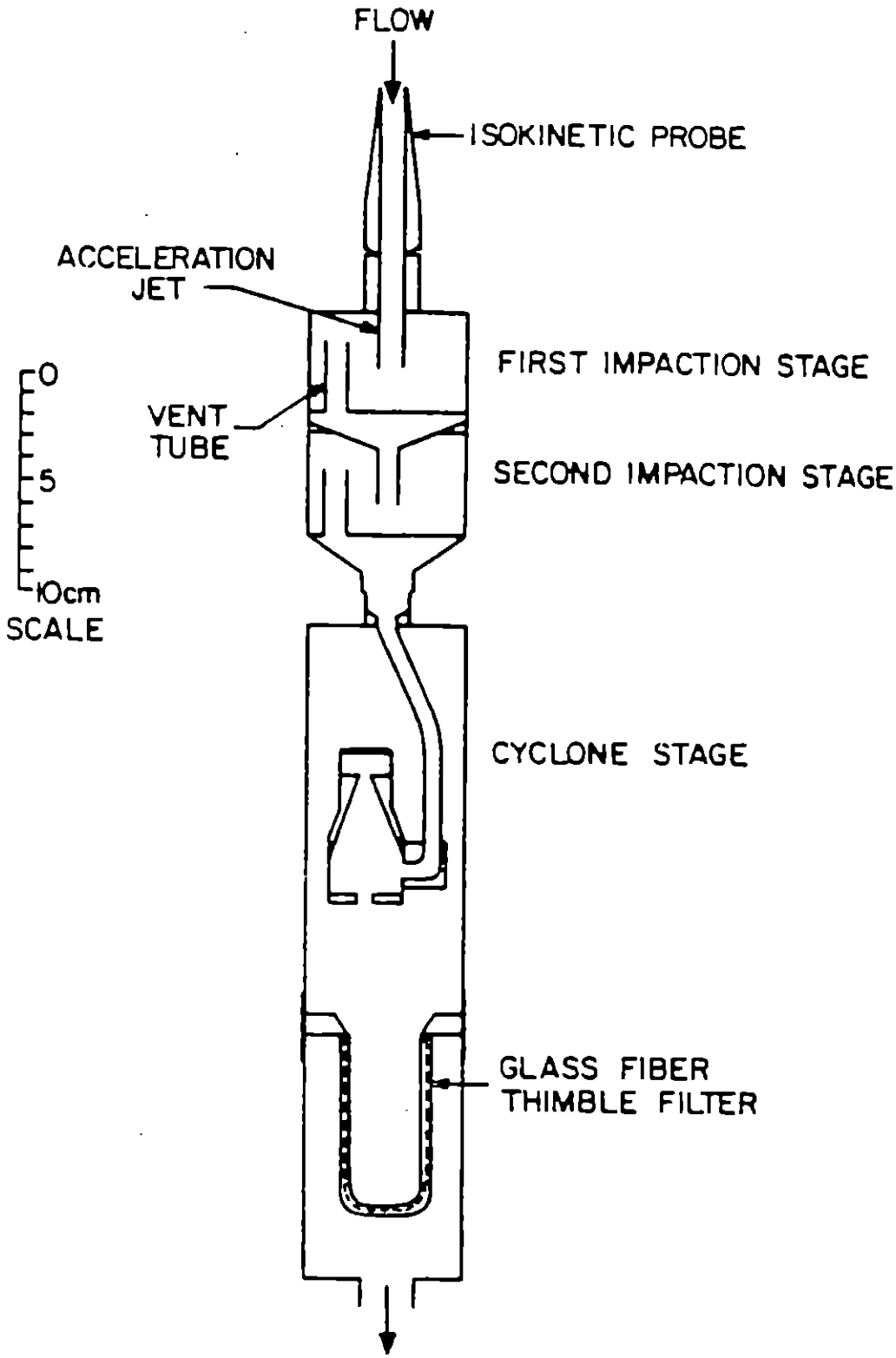



Figure 5-6. Schematic of the Andersen Model HCSS High Grain-Loading Impactor

errors that are encountered in weighing the large metal plates. The substrates were pretreated before use by baking the filters at 500°F for two hours. The substrates were then desiccated and weighed using a Mettler AE163 analytical balance. Preweighed sets of substrates were stored in polyethylene petri dishes until use in the field.

The Andersen impactor was oriented horizontally and a straight-neck nozzle used. Because of the high moisture content of the outlet flue gas, an auxiliary heating system (heating tape and insulation) was required to elevate the operating temperature of the Andersen. An elevated temperature was used to try to evaporate water droplets present in the gas stream. A discussion of the problems encountered during this sampling is presented in Section 2. To assist in this evaporation process, a ten- to twelve-inch heated extension (0.5-inch ID stainless steel tube) was used between the nozzle and impactor. A thermocouple mounted in the gas stream directly behind the Andersen was used to monitor the Andersen operation. A variac was used to control the heating tape, and thereby the exit gas temperature of the impactor.

Impactor sampling at the inlet and outlet 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 (modified Method 5E). Operation of both the AHCSS and Andersen Mark III required that the flow rate through the impactor be kept constant. This requirement eliminated 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 and the Andersen Mark III were carefully unloaded and the solids and/or substrates desiccated and weighed. The majority of the Andersen Mark III substrates lost weight due to the moisture droplets wetting the substrates and making sample recovery impossible. 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.

5.1.1.7 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/extractable hydrocarbons loading, trace metals, and polynuclear aromatic hydrocarbons. Readings were performed when there was a clear blue sky background. The clear blue sky background was required for detectin 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 opposite end of the second pond. A dike across the two ponds 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 the floating intake pump. The venturi scrubber return water samples were collected at the bottom of the venturi as the water was gravity fed to the settling pond. Samples were collected in 500 ml amber glass bottles with Teflon® liners. An attempt was made to collect at least three samples during each particulate and TOC/-extractable hydrocarbons loading, trace metals, and polynuclear aromatic hydrocarbons run.

Scrubber Water Flow Rate--The total flow rate of water to the venturi and to the venturi throat was monitored using Signet Scientific paddle-wheel Flosensors® The Flosensors® were installed in vertical sections of pipe on the discharge side of the pump. Installation of the sensors in this manner was necessary to ensure that flow of water covers the entire cross-sectional area of the pipes for an accurate measure of flow rate which is based upon stream velocity. The Flosensors® were coupled with analog read-out devices which include flow accumulators. Flow rate data was recorded several times during each particulate and TOC/extractable hydrocarbons loading, trace metals, and PAH run. The 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 mercury thermometer 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 water was measured by direct insertion of the pH probe into the pond at the collection point. Effluent scrubber water pH was measured at the sampling location in a collected beaker of the water.

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 mercury thermometer.

### 5.1.3 Process Solids Sampling

Three process solids streams were sampled:

- virgin aggregate,

- recycled asphalt pavement, and
- asphalt.

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 riffled 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 and TOC/extractable hydrocarbons loading, trace metals, and polynuclear aromatic hydrocarbons run. Additional samples of the virgin aggregate and recycled asphalt pavement were collected for storage.

Samples of the asphalt were collected during the testing program in one-gallon metal cans. No analyses have as yet been performed.

### 5.1.4 Process Parameters

MRI was responsible for monitoring the venturi pressure drop across the venturi scrubber. Radian installed connections in the ductwork just before and after the venturi. Tubes were fitted to the two locations and connected to a Magnehelic® differential pressure gauge. MRI was also responsible for monitoring the water flow rate to the venturi throat and total flow to the venturi scrubber.

## 5.2 ANALYTICAL METHODOLOGY

The previous section described sampling procedures. This section describes the analytical procedures and points out 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:

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

Figures 5-7 through 5-10 present analytical schemes for the three 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:

- o gravimetric analysis of solvent rinses,
- o gravimetric analysis of ether chloroform extract of impingers,
- o total organic carbon,
- o major organics and benzo(a)pyrene,
- o trace metals,
- o total solids,

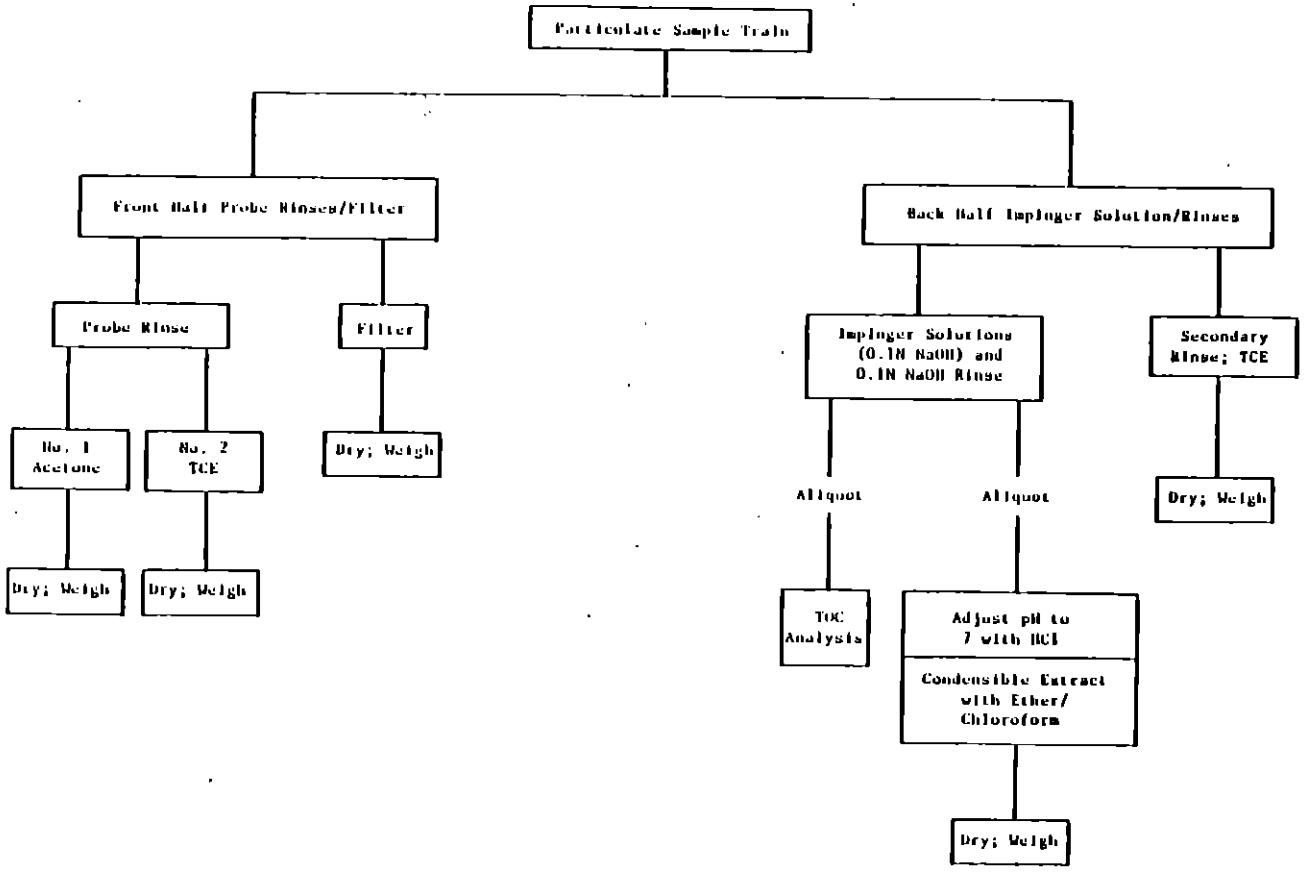



Figure 5-7. Particulate and condensible hydrocarbons sample recovery analytical matrix.

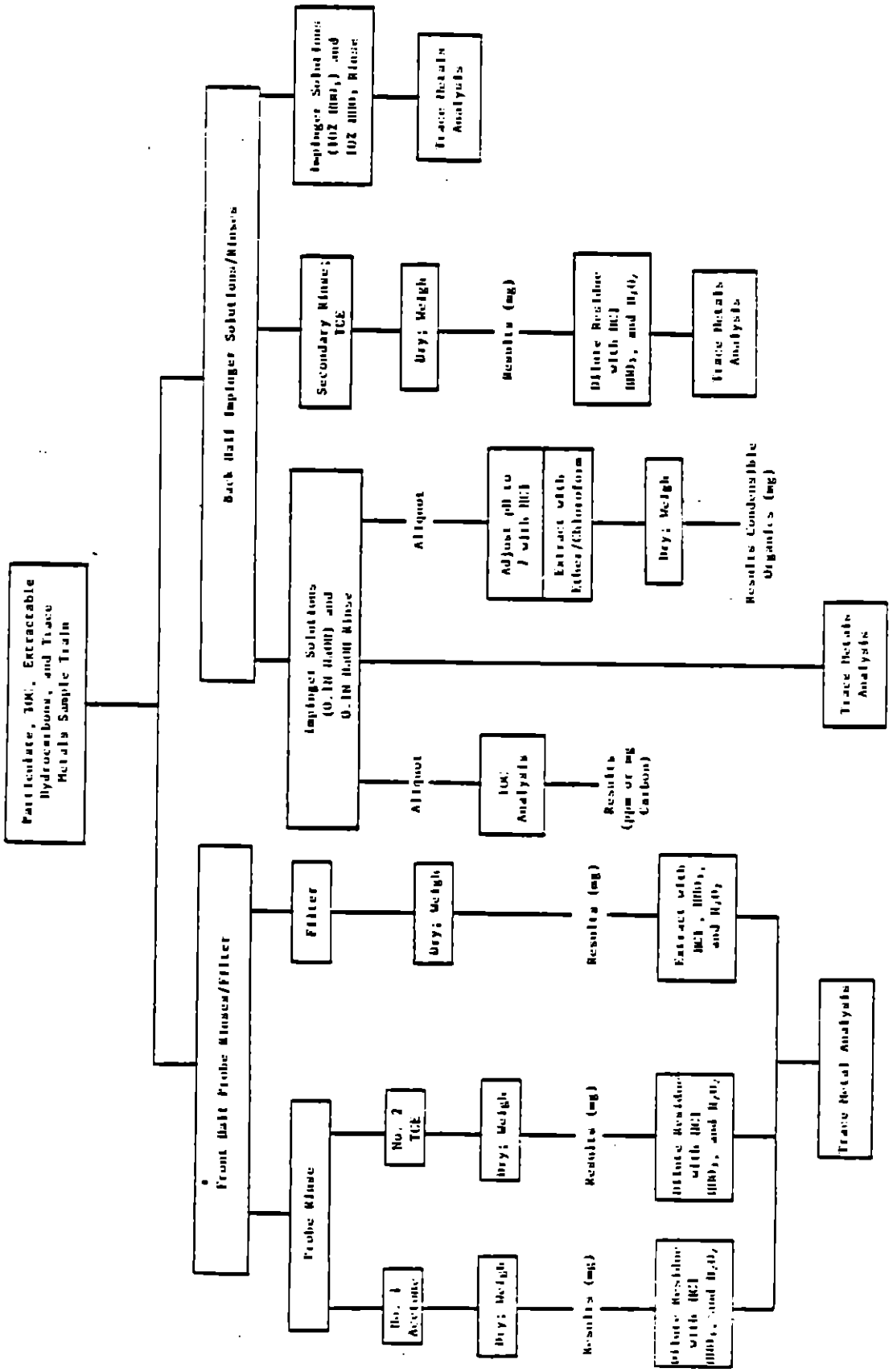



Figure 5-8 Particulate, extractable hydrocarbons, and trace metals sample recovery analytical matrix.

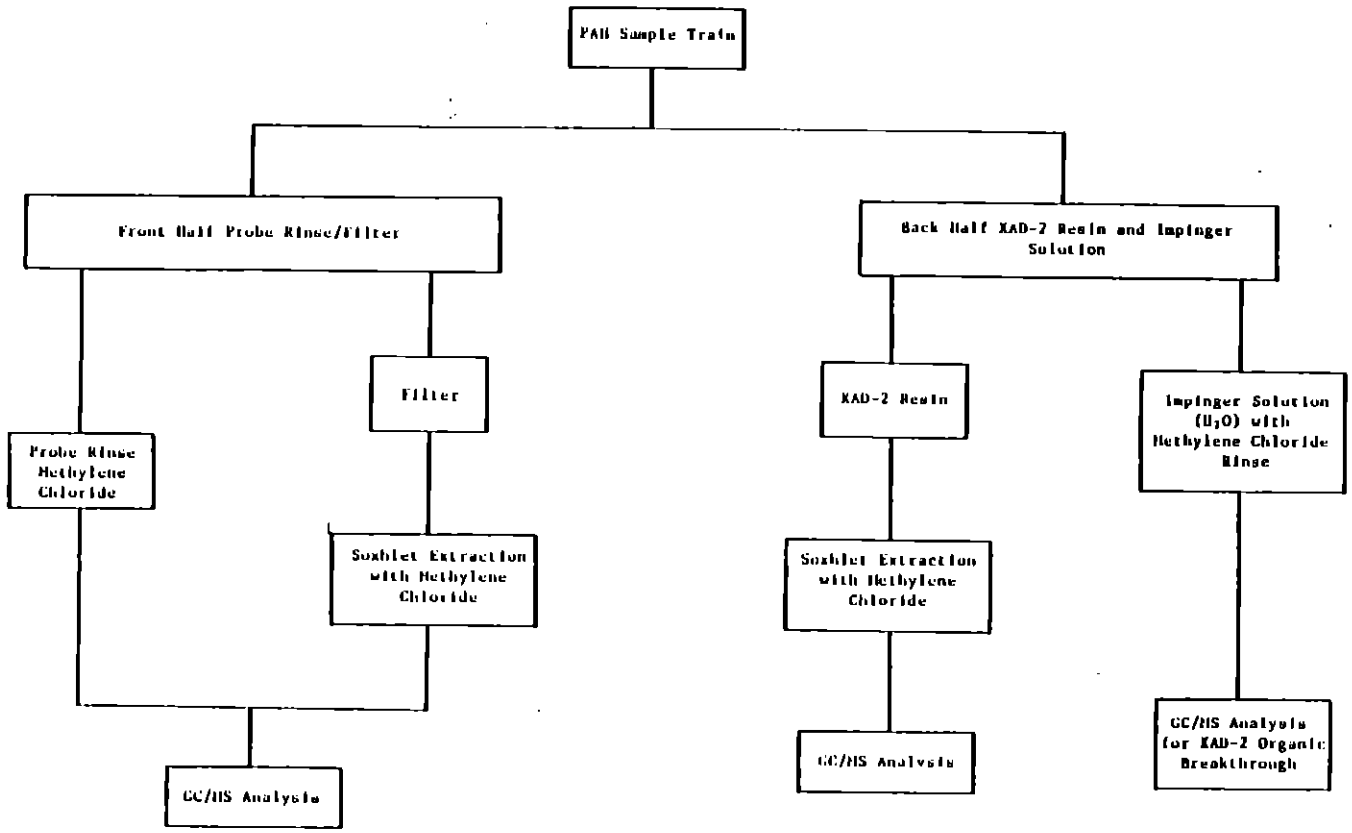



Figure 5-9. Polynuclear aromatic hydrocarbons sample recovery analytical matrix.

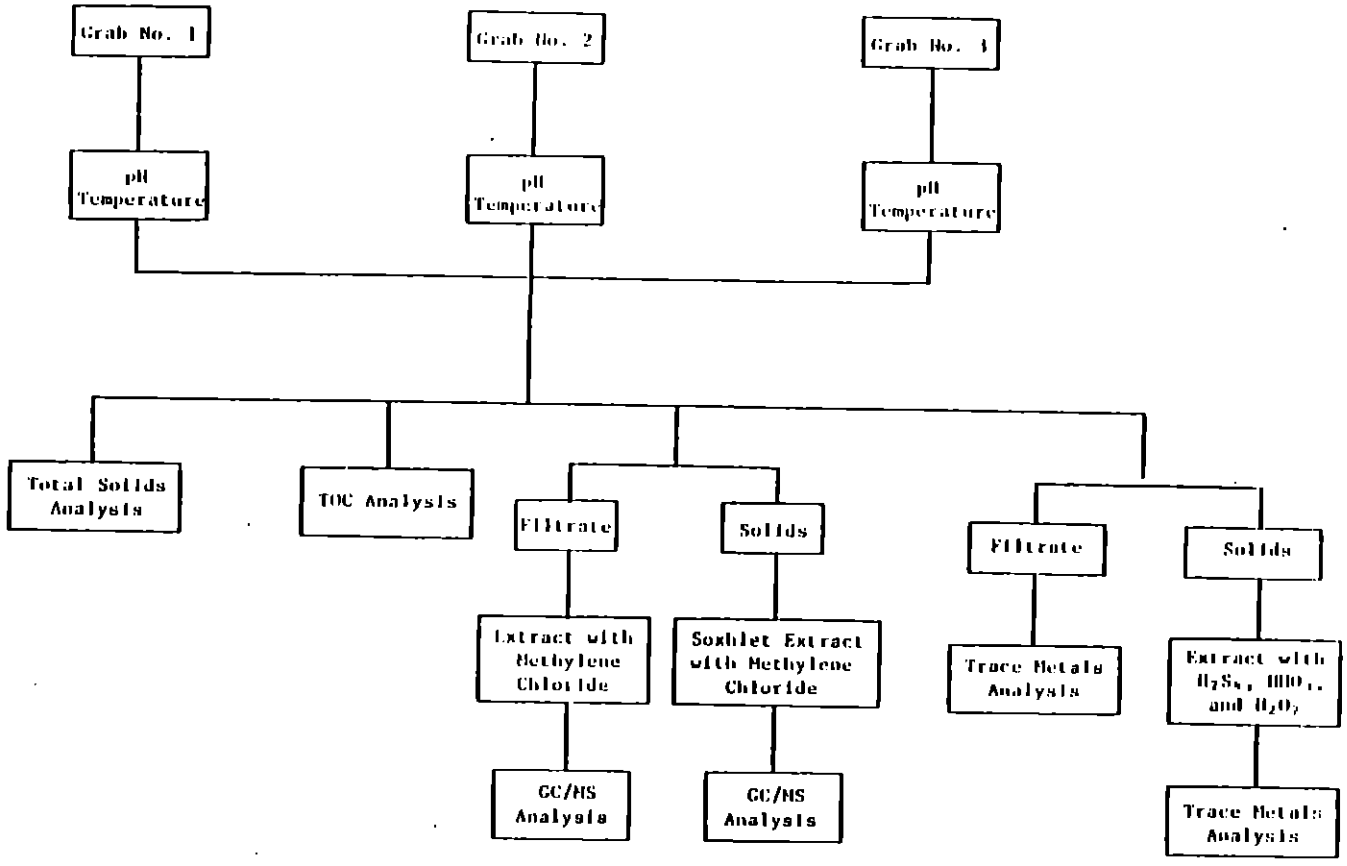



Figure 5-10. Scrubber water samples analytical matrix.

- pH and temperature, and
- moisture.

Gravimetric Analysis of Solvent Rinses--The sampling train for particulate and TOC/extractable organics and the train which combined trace metals with particulate and TOC/extractable organics produced several solvent rinses requiring gravimetric analysis. The solvent rinses included:

- acetone probe rinse,
- trichloroethane probe rinse, and
- trichloroethane rinse of impingers and associated glassware.

The rinse samples were placed in glass bottles and transported to Radian's Austin laboratories for analysis. The volume of solvent in each sample was determined gravimetrically and then the entire sample was evaporated at room temperature. The sample could not be dried at elevated temperatures because of the potential loss of hydrocarbons. When dry, the sample was desiccated and weighed to a constant weight.

The residue in the solvent rinses collected during the trace metals runs was dissolved in HCl, $HNO_3$, and $H_2O_2$ and was analyzed by Inductively Coupled Argon Plasma Emissions Spectroscopy (ICAPES).

Gravimetric Analysis of Extractable Organics--The extractable organics sample consisted of the EPA Method 5E "back-half" trichloroethane rinse and 0.1N NaOH impinger solution and rinse described in Section 5.1.1.

Analysis of the trichloroethane "back-half" rinse consisted of several steps. First, the volume of each rinse sample was determined gravimetrically. Each rinse sample was then transferred to a clean and preweighed beaker. The rinse samples were then allowed to evaporate to dryness at room

temperature. The beakers were dessicated for 24 hours and then weighed to a constant weight. A constant weight is defined as two weighings that agree within 0.5 mg or 1 percent of the residue mass.

Each trichloroethane rinse sample was corrected for the solvent blank. The actual magnitude of the solvent blank correction was dependent upon the volume of trichloroethane present in each sample. To determine the magnitude of the trichloroethane blank, a known volume of unused trichloroethane solvent was evaporated using the above procedure. The mass of residue remaining after evaporation was then correlated to the volume of trichloroethane to generate a blank correction factor (mg of blank residue/volume of trichloroethane in the sample).

The extractable organics content of the NaOH impinger samples was determined using the following procedure. First, a 400 ml sample aliquot was adjusted to pH 7 using HCl to improve extraction efficiency. The sample was then extracted with three portions of a 3:1 mixture of chloroform and diethyl ether for a total of 200 mls. The solvent was then filtered. The filtrate was evaporated to dryness at room temperature (70-75°) and weighed to a constant weight following desiccation. The trichloroethane rinse of the impingers and associated glassware was also evaporated to dryness and weighed and the mass of residue added to the ether/chloroform extraction mass. The summed results were related to the gas sample volume to determine the gas phase concentration of extractable organics.

The TOC content of the EPA Method 5E sodium hydroxide impinger solution was determined instrumentally during this program. A 20 ml aliquot of the NaOH impinger solution was acidified with $H_2SO_4$ and then sparged with nitrogen gas to remove any inorganic carbon.

The sample was then analyzed using a Beckman 915B Total Carbon Analyzer. The TOC concentration of the sample was determined by comparing the

sample results with the results of standards prepared with potassium hydrogen phthalate. Blank TOC corrections were not required because of insignificant TOC blank values.

This procedure differed from that proposed in EPA Reference Method 5E in that Method 5E specifies analyzing for inorganic carbon total carbon and subtracting inorganic carbon from total carbon to give total organic carbon.

Major Organics and Benzo(a)Pyrene--Major organics and benzo(a)pyrene were analyzed by gas chromatography-mass spectrometry (GC-MS) in samples retrieved from the polynuclear aromatic hydrocarbons sampling train and scrubber water samples. The analytical scheme quantifies benzo(a)pyrene (BaP) and a group of isomers of BaP, several major polynuclear aromatic hydrocarbons (PAH), and several major organic compounds. The PAHs and major organic compounds which were analyzed were selected based upon relative peak heights of the GC-MS scan.

The samples produced in the PAH sampling train were the methylene chloride ($MeCL_2$) probe rinse, the filter, the condensate, the XAD-2 resin, and resin trap $MeCL_2$ rinse. The filter and XAD-2 resin were extracted individually in soxhlet extractors for 24 hours each with $MeCL_2$. The $MeCL_2$ rinses of the probe and resin were incorporated in the soxhlet extractions.

Scrubber water samples were collected and filtered on-site and the filtrate stored in amber glass bottles with Teflon® liners, and kept cold prior to analysis.

Organic analyses were performed by GC-MS for both benzo(a)pyrene (BaP) and related polynuclear aromatic hydrocarbons (PAH). Table 5-2 lists the PAH compounds which were quantified.

Isotopically labeled benzo(a)pyrene-$d_{12}$ was added to all samples prior to extraction as a check on extraction efficiency. Table 5-3 summarizes the analytical conditions which were employed for the GC-MS analyses.

TABLE 5-2. 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.

TABLE 5-3. 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 |

Trace Metals--The concentrations of the following trace metals were determined in the controlled and uncontrolled air emissions and influent and effluent scrubber waters.

| | | |
|---|---|---|
| nickel | lead | vanadium |
| calcium | manganese | iron |
| chromium | magnesium | zinc |
| cadmium | beryllium | aluminum |
| mercury | | |

The analysis for trace metals was performed using Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES). The technique combines the multielemental capabilities of emission spectroscopy with a radio-frequency generated argon plasma source.

The sample is aspirated into the argon plasma which may reach temperatures of 10,000°K. The emission is focused onto a grating which diffracts the light according to the Paschen Runge theory. The diffracted light bands are passed through slits selected for each element of interest and measured by photomultiplier tubes. The system is computer-controlled which allows for simultaneous multielement determinations by comparing the electrical charge of each photomultiplier tube to the current measured during standardization. ICAPES also provides automatic background correction to adjust for matrix interferences.

The Radian system is an ARL Model 34000B which is capable of analyzing up to 40 elements simultaneously with detection limit of 1 to 5 ppmv.

Solid samples were dissolved into an acidic solution of HCl, $HNO_3$, and $H_2O_2$ for analysis.

Scrubber Water TOC Analysis--The TOC content of scrubber water filtrate samples was determined instrumentally during this program. A 20 ml sample

aliquot was acidified with $H_2SO_4$ and then sparged with nitrogen gas to remove any inorganic carbon. The sample was then analyzed using a Beckman 915B Total Carbon Analyzer. The TOC concentration of the sample was determined by comparing the sample results with the results of standards prepared using potassium hydrogen phthalate.

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, samples of the influent and effluent venturi scrubber waters were collected. Samples were filtered through one filter to determine a composite TSS concentration by measuring the residue collected on the filter and relating the mass to the volume of scrubber water determined gravimetrically. The TDS concentration in the resulting composite sample was determined by measuring a 50 milliliter aliquot of the sample into a tared 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 and TOC/extractable hydrocarbons loading and PAH runs. pH measurements were performed at the sampling location during sample collection with a hand-held pH meter.

Scrubber water temperatures were monitored at the sampling location during sample collection using a mercury thermometer.

Moisture--During each particulate and TOC/extractable hydrocarbons loading, trace metals, and/or 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, riffled to obtain a representative sample and taken directly to the on-site mobile laboratory for moisture analysis. In the mobile lab, approximately 600 grams of the material was weighed into an aluminum pan and dried overnight at 105°C. The sample was then weighed to within $\pm$ 0.1 gram.

## 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. No significant differences were found.

#### 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. 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 runs that were outside of the isokinetic sampling limit of 100 $\pm$ 10 percent.

Total Organic Carbon (TOC) Emissins 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

Trace Metals Emission Data Reduction

Equation:

$$TM_{(E)} = \frac{A + T + (C x C_T) + F + (S \times S_T) + N \times N_T)}{DGV}$$

Nomenclature:

$TM_{(E)}$ = Total trace metal specie mass concentration, μg/dscm

A = Total concentration of trace metal specie in acetone probe wash, μg

T = Total concentration of trace metal specie in trichloroethane probe wash, μg

C = Concentration of trace metal in the cyclone catch, μg/g

$C_T$ = Total weight of cyclone solids, g

F = Total concentration of trace metal specie in the filter, μg

S = Concentration of trace metal in the NaOH impinger, μg/ml

$S_T$ = Total volume of NaOH impinger catch, ml

N = Concentration of trace metal in the nitric acid impinger, μg/ml

$N_T$ = Total volume of the nitric acid impinger, ml

DGV = Dry gas volume, 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 5-11 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.

Polynuclear Aromatic Hydrocarbon (PAH) Emissions Data Reduction

Equation:

$$PAH_{(G)} = \frac{P_T - B}{DGV}$$

Nomenclature:

$PAH_{(G)}$ = Concentration of PAH specie in flue gas, μg/dscm

$P_T$ = Total concentration of PAH specie, μg

B = Specie blank, μg

DGV = dry gas volume, standard conditions, dscm

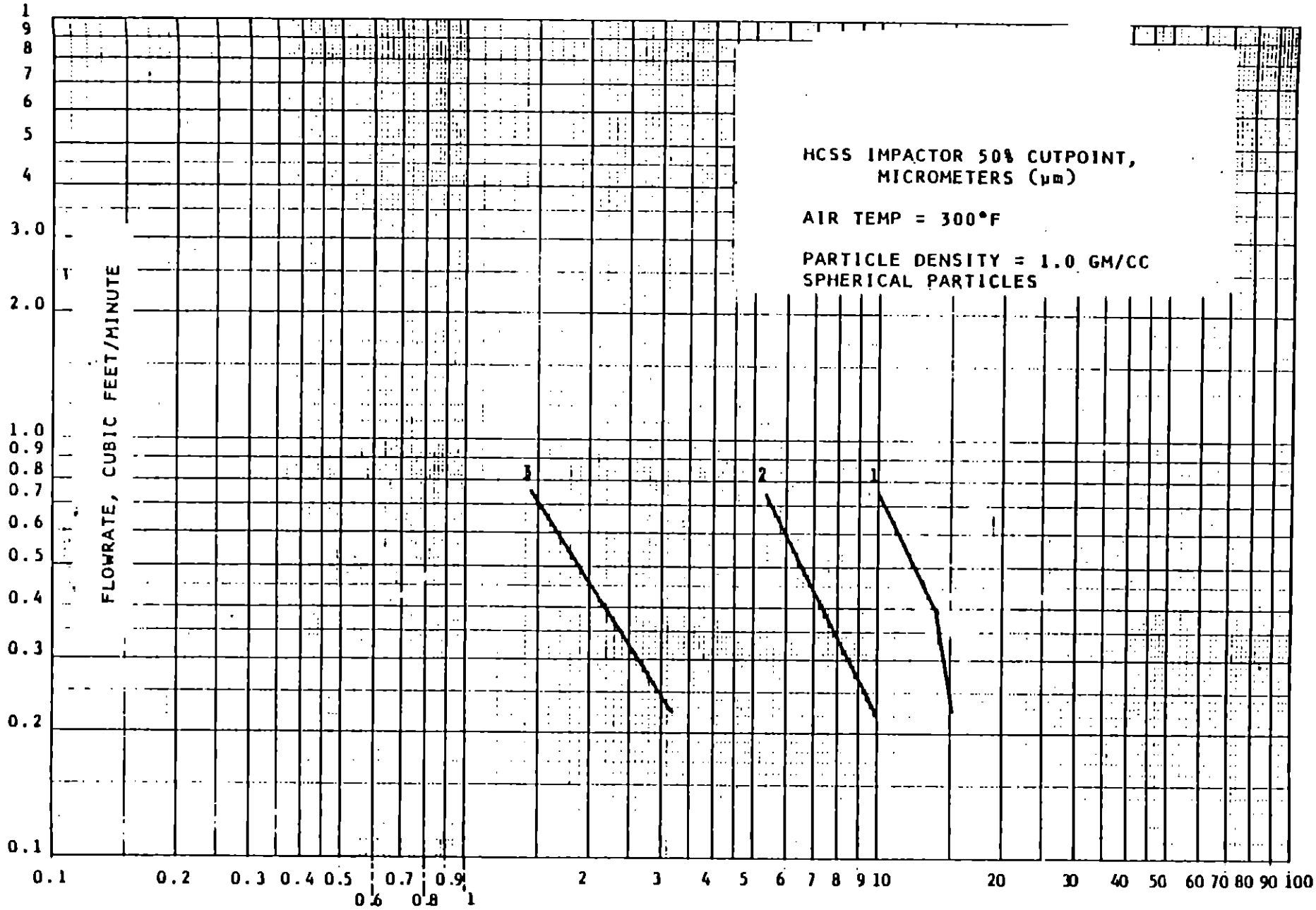



Figure 5-11. Gas flow rate at stack conditions and stack temperature.

### 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
# 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 segment were followed to ensure the production of quality data from the sampling and analytical efforts.

## 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 | Orsat | Isokinetic Nozzles |
| Volumetric Gas Flow Rate | EPA-1, EPA-2 | * | * | * | | | |
| Gas Phase Composition | | | | | | | |
| Moisture | EPA-4 | | * | * | * | | |
| Molecular Weight | EPA-3 | | | | | * | |
| Particulate Mass & TOC/ Extractable Hydrocarbons | Modified EPA-5E | * | * | * | * | * | * |
| Trace Metals | Modified EPA-5 | * | * | * | * | * | * |
| Polynuclear Aromatic Hydrocarbons | Modified EPA-5 | * | * | * | * | * | * |
| Particle Size Distribution | | * | * | * | * | * | * |



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

- Equipment requiring pretest calibration (Table 6-1) was calibraed 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 Andersen Mark III Impactor and AHCSS were 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.

- 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 Andersen Mark III Impactor and AHCSS were preheated to minimize 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 ports 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 Orsat analyzer was leveled and the fluid levels zeroed prior to use.

- The Orsat analyzer was leak-checked prior to use.

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

- Analyses were repeated until the analysis agreed within 0.3% absolute.

- The Orsat 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 contaminatin.
- 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 sample 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 samples were checked for leakage or damage and any anomalies were noted.

### 6.1.5 Sample Analysis

The exact quality assurance/quality control procedures taken during analysis were dependent on the specific analysis. 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 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. A common 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 T.J. Campbell 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 $\pm 10°F$.

- A heated twelve-inch extension was placed between the nozzle and Andersen Mark III impactor. This was to evaporate flue gas moisture and prevent impaction of droplets on the substrates.

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.

- Particulate filters used during polynuclear aromatic hydrocarbon sampling were methylene chloride extracted prior to use and stored in glass petri dishes.

- All glassware used during sampling was specially cleaned.

All particulate mass collection filters were baked at 500°F prior to use. They were then desiccated, weighed, and placed in clean petri dishes. The particulate filters used during polynuclear aromatic hydrocarbon sampling were extracted with methylene chloride, baked at 500°F, and stored after weighing in methylene chloride rinsed 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 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 preliinary moisture determinations were performed 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 taken. The samples were riffled 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 hydrocarbon sampling trains. This was to reduce the chance of photodegradation of the organic species by ultraviolet light.

- Polynuclear aromatic hydrocarbon 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 hydrocarbon 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.

- Each polynuclear aromatic hydrocarbon sample was spiked with deuterated benzo(a)pyrene-$d^{12}$ prior to sample extraction as a QC check on extraction efficiency.

- 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:

- Immediately prior to sample analysis each polynuclear aromatic hydrocarbon sample was spiked with benzo(a)pyrene-$d^{12}$ as an internal QC standard.

- Total organic carbon audit samples were submitted to the analytical laboratory prior to the submission of the field samples.

- Field blanks were evaluated to determine species background and possible contamination problems.

The results of the total organic carbon audit samples are presented in Table 6-2. A statistical evaluation of the audit samples is presented in Appendix I.3.3.3.

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

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

EPA Prepared Sample Results (9/9/83)

| Sample No. | Date of Analysis | (A) Actual Values | (R) Radian Analysis Values (mg/L) | Percent Error R-A/A x 100 |
|---|---|---|---|---|
| EPA 1 | 10-28-83 | 4.1 | 4.5 | 9.76 |
| EPA 2 | thru | 61.2 | 70 | 14.4 |
| EPA 3 | 11-02-83 | 61.2 | 69 | 12.7 |
| EPA 5 | | 4.1 | 3 | -26.8 |

Radian Prepared Sample Results

| Sample No. | Date of Analysis | (A) Actual Values | (R) Radian Analysis Values (mg/L) | Percent Error R-A/A x 100 |
|---|---|---|---|---|
| Set 1 - Submitted 11-30-83 | | | | |
| Radian #1 | | 80 | 85 | 6.25 |
| Radian #2 | | 40 | 45 | 12.5 |
| Radian #3 | | 80 | 81 | 1.2 |
| Radian #4 | | 4 | 4 | 0 |
| Radian #5 | | 4 | 3 | -25.0 |
| Radian #6 | | 40 | 41 | 2.5 |
| Set 2 - Submitted 12-12-83 | | | | |
| Radian #1[1] | | 80[1] | 85 | 6.25 |
| Radian #2 | | 20[2] | 21 | 5.0 |
| Radian #3 | | 20[1] | 19 | -5.0 |
| Radian #4 | | 80[2] | 84 | 5.0 |
| Radian #5 | | 80[1] | 77 | -3.75 |
| Radian #6 | | 20[1] | 21 | 5.0 |

[1]Sample in 0.1 in NaOH matrix
[2]Sample in distilled water

TABLE 6-3. SUMMARY OF CLEANUP RESULTS

| Particulate and Condensible Organic Sample Blanks | Train 1 Uncontrolled | Train 2 Controlled | Average |
|---|---|---|---|
| Front Half (mg) | | | |
| Probe rinses | 31.7*<br>20.1** | 11.9* | 21.8 |
| Back Half (mg) | | | |
| Condensible hydrocarbons | 1.4 | 1.4 | 1.4[1] |
| Total organic carbon (mg/L) | <1 | 2 | 1 |

Trace Metals Sample Blanks

| Element | Train 1 Filter Blank | Train 1 NaOH Blank | Train 1 $HNO_3$ Blank | Train 2 Filter Blank | Train 2 NaOH Blank | Train 2 $HNO_3$ Blank |
|---|---|---|---|---|---|---|
| Al | <.5 | <.05 | <0.05 | <5 | <0.05 | <0.05 |
| Be | <0.5 | <0.0005 | <0.0005 | <0.5 | <0.005 | <0.0005 |
| Ca | <3 | <0.04 | <0.04 | <3 | <0.04 | <0.04 |
| Cd | <0.2 | <0.002 | <0.0002 | <0.2 | <0.0002 | <0.0002 |
| Cr | <0.1 | <0.001 | <0.001 | <0.1 | <0.001 | <0.001 |
| Fe | <0.8 | <0.008 | <0.008 | <0.8 | <0.008 | <0.008 |
| Hg | <3 | <0.03 | <0.03 | <3 | <0.03 | <0.03 |
| Mg | <3 | <0.034 | <0.034 | <3 | <0.034 | <0.034 |
| Mn | <0.1 | <0.001 | <0.001 | <0.1 | <0.001 | <0.001 |
| Ni | <0.3 | <0.003 | <0.003 | <0.3 | <0.003 | <0.003 |
| Pb | <8 | <0.084 | <0.084 | <8 | <0.084 | <0.084 |
| V | <6 | <0.003 | <0.003 | <6 | <0.003 | <0.003 |
| Zn | <0.6 | <0.003 | <0.003 | <0.3 | <0.003 | <0.003 |

| Polyaromatic Hydrocarbon Blanks (μg) | Train 3 Uncontrolled Front Half | Train 3 Uncontrolled Back Half | Train 3 Uncontrolled Total | Train 4 Controlled Front Half | Train 4 Controlled Back Half | Train 4 Controlled Total | Average Front Half | Average Back Half | Average Total |
|---|---|---|---|---|---|---|---|---|---|
| Active carcinogenic species | | | | | | | | | |
| Benz(a)anthracene | ND | 0.02 | 0.02 | ND | 0.04 | 0.04 | ND | 0.03 | 0.03 |
| Chrysene | ND | 0.05 | 0.05 | ND | 0.11 | 0.11 | ND | 0.08 | 0.08 |
| Benzo(b)fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo(j)fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo(e)pyrene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo(a)pyrene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno(1,2,3-c,d)pyrene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Nonactive carcinogenic species | | | | | | | | | |
| Phenanthrene | 0.07 | 0.65 | 0.72 | 0.10 | 0.79 | 0.89 | 0.08 | 0.72 | 0.80 |
| Anthracene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Fluoranthene | 0.03 | 0.24 | 0.27 | 0.06 | 0.40 | 0.46 | 0.04 | 0.32 | 0.36 |
| Pyrene | 0.07 | 0.49 | 0.56 | 0.19 | 0.85 | 1.04 | 0.13 | 0.67 | 0.80 |
| Benzo(k)fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Perylene | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | ND | ND | ND | ND | ND | ND | ND | ND | ND |

* glass probe
** stainless steel probe
[1] based on an average of five blank values

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EPA

# Asphalt Concrete Industry

# Emission Test Report T.J. Campbell Company Oklahoma City Oklahoma

## Volume 1
## Addendum

RADIAN
CORPORATION

DCN 222-078-03-15

# EMISSION TEST REPORT
# T.J. CAMPBELL ASPHALT CONCRETE PLANT
# OKLAHOMA CITY, OKLAHOMA

Addendum

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# INTRODUCTION

This addendum presents revisions and new data to be included with the report, "Emission Test Report T.J. Campbell Company, Oklahoma City, Oklahoma" (EMB Report 83-ASP-4). The purpose of this addendum is threefold:

- to present smoke point/flash point results for the recycled asphalt pavement and asphalt cement which were not available when the report was published;
- to include total organic carbon (TOC) results determined according to the analytical protocol of EPA Method 5E; and
- to separate condensible hydrocarbons data from the extractable organics data presented in the report.

The term condensible hydrocarbons is new to the report. As explained in the original report, extractable organics are related to the gravimetric analysis of the ether/chloroform extract of the 0.1 N NaOH impinger solutions. The extractable organics results in the original report included the gravimetric analysis of the trichloroethane (TCE) rinse of the impingers glassware. In this addendum, condensible hydrocarbon results are from the gravimetric analysis of the TCE rinse. The gravimetric analysis results of the TCE rinse have been removed from the extractable organics presentation.

Because of the above revisions, several sections of the report have been rewritten. Section 2.2, Total Organic Carbon Results, has been revised to present TOC results determined by the EPA Method 5E analytical protocol. Tables 2-1, 2-2, 2-3, and 2-4 contain the revised TOC values. Section 2.3, Extractable Organics Emissions Results, contains results from the 0.1N NaOH impinger solution ether/chloroform extract only. Tables 2-7, 2-8, 2-9, and 2-10 contain the revised extractable organic emission results. Section 2.4, Comparison of TOC and Extractable Organic Emission Results, reflects the EPA Method 5E TOC results and ether/chloroform extract results. Section 5.2,

Analytical Methodology, discusses the new or revised methods for TOC and extractable organics analysis. Table 6-2 has been addended to include TOC quality control data for the 0.1N NaOH impinger solutions reanalysis.

In addition, three new sections have been added. Section 2.11 contains a discussion of the flash point and smoke point data which are presented in Table 2-24. Section 2.12 contains a discussion of the condensible hydrocarbon results which are presented in Table 2-25. Section 2.13 contains a comparison of the two analytical methodologies used to analyze the 0.1N NaOH impinger solutions for TOC. The data are presented in Table 2-26.

## 2.2 TOTAL ORGANIC CARBON RESULTS

Controlled and uncontrolled 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 0.1N NaOH impinger and rinse solutions were analyzed directly using an instrumental technique. TOC results, identified in the data tables as the "back-half catch," are presented and discussed in this section.

### 2.2.1 Conventional Operation TOC Emission Results

Uncontrolled and controlled TOC results for conventional operation are presented in Table 2-1 (English units) and Table 2-2 (metric units). Uncontrolled TOC loadings were 0.242, 0.0512, and 0.0562 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The controlled TOC loadings were 0.0410, 0.0501, and 0.0494 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The TOC (back-half catch) collection efficiency of the wet venturi scrubber was 83.1, 0.39, and 15.0 percent for Runs C-1, C-2, and C-3, respectively.

### 2.2.2 Recycle Operation TOC Emission Results

Table 2-3 (English units) and Table 2-4 (metric units) present results of the uncontrolled and controlled TOC measurements performed during recycle operation. Uncontrolled TOC loadings were 0.0534, 0.0523, and 0.389 gr/DSCF for Runs R-1, R-2, and R-3, respectively. The controlled TOC loadings were 0.0643, 0.0421, and 0.0185 gr/DSCF for Runs R-1, R-2, and R-3, respectively. The TOC collection efficiency of the wet venturi scrubber was 6.65, 12.9, and 95.2 percent for Runs R-1, R-2, and R-3, respectively.

### 2.2.3 Discussion of TOC Test Results

The uncontrolled TOC loadings varied from 0.0521 to 0.242 gr/DSCF during conventional operation and from 0.0523 to 0.389 gr/DSCF during recycle operation. The controlled TOC loadings varied from 0.0410 to 0.0501

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

| Date | 11/12 | | 11/13 | | 11/14 | | Average | |
|---|---|---|---|---|---|---|---|---|
| Run Number | C-1 | | C-2 | | C-3 | | | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 13.5 | | 13.4 | | 13.5 | | 13.5 | |
| Scrubber Water Flow Rate (GPM) | 219 | | 219 | | 215 | | 218 | |
| Production Rate (ton/hr) | 244 | | 235 | | 213 | | 231 | |
| Process Mix Type | B-Mix | | B/C Mix | | M-Mix | | --- | |
| Average Opacity (Percent) Mean, Range | 0 (0-1.5) | | 0 (-0-) | | N/A | | 0 | |
| **Particulate and Total Organic Carbon (TOC) Results** | | | | | | | | |
| **Front Half Catch - Particulate** (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 9360 | 172 | 10,800 | 244 | 6950 | 104 | 9040 | 173 |
| gr/DSCF | 7.60 | 0.0550 | 8.49 | 0.0814 | 5.58 | 0.0332 | 7.22 | 0.0565 |
| lbs/hr* | 762 | 5.53 | 910 | 8.29 | 599 | 3.45 | 757 | 5.76 |
| lbs/ton production | 3.12 | 0.0226 | 3.87 | 0.0353 | 2.81 | 0.0162 | 3.27 | 0.0247 |
| Collection Efficiency Percent** | 99.3 | | 99.1 | | 99.4 | | 99.2 | |
| **Back Half Catch - TOC** (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 299 | 128 | 65 | 150 | 70 | 155 | 145 | 144 |
| gr/DSCF | 0.242 | 0.0410 | 0.0512 | 0.0501 | 0.0562 | 0.0494 | 0.116 | 0.0468 |
| lbs/hr* | 24.3 | 4.11 | 5.13 | 5.11 | 6.01 | 5.11 | 11.8 | 4.78 |
| lbs/ton production | 0.0995 | 0.0168 | 0.0218 | 0.0217 | 0.0282 | 0.0240 | 0.0498 | 0.0208 |
| Collection Efficiency Percent** | 83.1 | | 0.39 | | 15.0 | | 59.5 | |
| **Total Catch** | | | | | | | | |
| mg-mass | 9660 | 300 | 10,900 | 394 | 7020 | 259 | 9190 | 318 |
| gr/DSCF | 7.84 | 0.0961 | 8.53 | 0.132 | 5.64 | 0.0823 | 7.34 | 0.103 |
| lbs/hr* | 785 | 9.63 | 855 | 13.4 | 604 | 8.53 | 748 | 10.5 |
| lbs/ton production | 3.22 | 0.0395 | 3.64 | 0.0571 | 2.83 | 0.0400 | 3.23 | 0.0455 |
| Collection Efficiency Percent** | 98.8 | | 98.4 | | 98.6 | | 98.6 | |

Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*lbs/hr controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using lbs/hr values

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

| Date | 11/12 | | 11/13 | | 11/14 | | Average | |
|---|---|---|---|---|---|---|---|---|
| Run Number | C-1 | | C-2 | | C-3 | | | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 34.3 | | 34.0 | | 34.3 | | 34.3 | |
| Scrubber Water Flow Rate (LPS) | 13.8 | | 13.8 | | 13.6 | | 13.7 | |
| Production Rate (Kg/S) | 61.5 | | 59.2 | | 53.7 | | 58.1 | |
| Process Mix Type | B-Mix | | B/C Mix | | M-Mix | | --- | |
| Average Opacity (Percent) Mean, Range | 0 (0-1.5) | | 0 (-0-) | | N/A | | 0 | |
| **Particulate and Total Organic Carbon (TOC) Results** | | | | | | | | |
| **Front Half Catch - Particulate** (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 9360 | 172 | 10,800 | 244 | 6950 | 104 | 9040 | 173 |
| mg/DSCM | 17,400 | 126 | 19,400 | 186 | 12,800 | 76.0 | 16,500 | 129 |
| g/s* | 96.1 | 0.697 | 115 | 1.05 | 75.5 | 0.435 | 95.5 | 0.726 |
| g/kg production | 1.56 | 0.0113 | 1.94 | 0.0177 | 1.41 | 0.00810 | 1.64 | 0.0125 |
| Collection Efficiency Percent** | 99.3 | | 99.1 | | 99.4 | | 99.2 | |
| **Back Half Catch - TOC** (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 299 | 128 | 65 | 150 | 70 | 155 | 145 | 144 |
| mg/DSCM | 554 | 93.8 | 117 | 115 | 129 | 113 | 265 | 107 |
| g/s* | 3.06 | 0.518 | 0.647 | 0.644 | 0.758 | 0.644 | 1.49 | 0.602 |
| g/kg production | 0.0498 | 0.0084 | 0.0109 | 0.0108 | 0.0141 | 0.0120 | 0.0249 | 0.0104 |
| Collection Efficiency Percent** | 83.1 | | 0.39 | | 15.0 | | 59.5 | |
| **Total Catch** | | | | | | | | |
| mg-mass | 9660 | 300 | 10,900 | 394 | 7020 | 259 | 9190 | 318 |
| mg/DSCM | 17,900 | 220 | 19,500 | 302 | 12,900 | 188 | 16,800 | 236 |
| g/s* | 99.0 | 1.21 | 108 | 1.69 | 76.2 | 1.08 | 94.3 | 1.32 |
| g/kg production | 1.61 | 0.0198 | 1.82 | 0.0286 | 1.42 | 0.0200 | 1.62 | 0.0228 |
| Collection Efficiency Percent** | 98.8 | | 98.4 | | 98.6 | | 98.6 | |

Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*g/s controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using g/s values

TABLE 2-3. SUMMARY OF PARTICULATE AND TOTAL ORGANIC CARBON EMISSIONS DURING RECYCLE OPERATION (ENGLISH UNITS)

| Date | 11/11 | | 11/11 | | 11/12 | | Average | |
|---|---|---|---|---|---|---|---|---|
| Run Number | R-1 | | R-2 | | R-3 | | | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 13.8 | | 13.8 | | 13.9 | | 13.8 | |
| Scrubber Water Flow Rate (GPM) | 223 | | 220 | | 219 | | 221 | |
| Production Rate (ton/hr) | 229 | | 250 | | 236 | | 238 | |
| Process Mix Type | Recycle-A | | Recycle-A | | Recycle-A | | --- | |
| Average Opacity (Percent) Mean, Range | 1.4 (0-5.8) | | 0.3 (0-1.7) | | N/A | | 0.85 | |
| **Particulate and Total Organic Carbon (TOC) Results** | | | | | | | | |
| **Front Half Catch - Particulate** (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 4380 | 84.0 | 5,260 | 88.2 | 5570 | 111 | 5070 | 94.5 |
| gr/DSCF | 3.24 | 0.0227 | 4.37 | 0.0229 | 3.75 | 0.0286 | 3.79 | 0.0247 |
| lbs/hr | 411 | 2.72 | 499 | 2.76 | 474 | 3.42 | 461 | 2.97 |
| lbs/ton production | 1.79 | 0.0119 | 2.00 | 0.0110 | 2.01 | 0.0145 | 1.94 | 0.0125 |
| Collection Efficiency Percent** | 99.3 | | 99.4 | | 99.3 | | 99.4 | |
| **Back Half Catch - TOC** (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 72.0 | 238 | 63.0 | 162 | 576 | 72.0 | 237 | 157 |
| gr/DSCF | 0.0534 | 0.0643 | 0.0523 | 0.0421 | 0.389 | 0.0185 | 0.165 | 0.0416 |
| lbs/hr | 6.77 | 7.22 | 5.51 | 4.80 | 46.6 | 2.22 | 19.6 | 4.91 |
| lbs/ton production | 0.0296 | 0.0337 | 0.0220 | 0.0192 | 0.198 | 0.0094 | 0.0832 | 0.0208 |
| Collection Efficiency Percent** | -6.65 | | 12.9 | | 95.2 | | 74.9 | |
| **Total Catch** | | | | | | | | |
| mg-mass | 4450 | 322 | 5320 | 250 | 6150 | 183 | 5310 | 252 |
| gr/DSCF | 3.30 | 0.0870 | 4.42 | 0.0650 | 4.14 | 0.0470 | 3.95 | 0.0663 |
| lbs/hr | 418 | 10.4 | 466 | 7.41 | 496 | 5.63 | 460 | 7.81 |
| lbs/ton production | 1.82 | 0.0456 | 1.86 | 0.0296 | 2.10 | 0.0239 | 1.93 | 0.0330 |
| Collection Efficiency Percent** | 97.5 | | 98.4 | | 98.9 | | 98.3 | |

Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*lbs/hr controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using lbs/hr values

TABLE 2-4. SUMMARY OF PARTICULATE AND TOTAL ORGANIC CARBON EMISSIONS DURING RECYCLE OPERATION (METRIC UNITS)

| Date | 11/11 | | 11/11 | | 11/12 | | | |
|---|---|---|---|---|---|---|---|---|
| Run Number | R-1 | | R-2 | | R-3 | | Average | |
| Type Emissions | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled | Uncontrolled | Controlled |
| Scrubber Pressure Drop (in. $H_2O$) | 5.43 | | 5.43 | | 5.47 | | 5.44 | |
| Scrubber Water Flow Rate (LPS) | 14.1 | | 13.9 | | 13.8 | | 13.9 | |
| Production Rate (Kg/S) | 57.8 | | 63.1 | | 59.6 | | 60.2 | |
| Process Mix Type | Recycle-A | | Recycle-A | | Recycle-A | | --- | |
| Average Opacity (Percent) Mean, Range | 1.4 (0-5.8) | | 0.3 (0-1.7) | | N/A | | 0.85 | |
| **Particulate and Total Organic Carbon (TOC) Results** | | | | | | | | |
| **Front Half Catch - Particulate** (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 4380 | 84.0 | 5,260 | 88.2 | 5570 | 111 | 5070 | 94.5 |
| mg/DSCM | 7420 | 51.9 | 10,000 | 52.5 | 8590 | 65.4 | 8670 | 56.6 |
| g/s* | 51.8 | 0.343 | 62.9 | 0.348 | 59.8 | 0.431 | 58.2 | 0.374 |
| g/kg production | 0.896 | 0.00593 | 0.919 | 0.00550 | 1.01 | 0.00726 | 0.942 | 0.00622 |
| Collection Efficiency Percent** | 99.3 | | 99.4 | | 99.3 | | 99.4 | |
| **Back Half Catch - TOC** (impinger solutions and rinses) | | | | | | | | |
| mg-mass | 72.0 | 238 | 63.0 | 162 | 576 | 72.0 | 237 | 157 |
| mg-DSCM | 122 | 147 | 120 | 96.4 | 890 | 42.3 | 378 | 95.2 |
| g/s* | 0.854 | 0.910 | 0.965 | 0.605 | 5.88 | 0.280 | 2.47 | 0.619 |
| g/kg production | 0.0148 | 0.0168 | 0.0110 | 0.0096 | 0.0990 | 0.0047 | 0.0416 | 0.0104 |
| Collection Efficiency Percent** | -6.65 | | 12.9 | | 95.2 | | 74.9 | |
| **Total Catch** | | | | | | | | |
| mg-mass | 4450 | 322 | 5320 | 250 | 6150 | 183 | 5310 | 252 |
| mg/DSCM | 7550 | 199 | 10,100 | 149 | 9480 | 108 | 9040 | 152 |
| g/s* | 52.7 | 1.31 | 58.8 | 0.934 | 62.6 | 0.710 | 58.0 | 0.985 |
| g/kg production | 0.910 | 0.0228 | 0.930 | 0.0148 | 1.05 | 0.0120 | 0.965 | 0.0165 |
| Collection Efficiency Percent** | 97.5 | | 98.4 | | 98.9 | | 98.3 | |

Average emission rate of concentration and area-ratio methods (Table 2-10)
N/A = not available
*g/s controlled emission rate based on gas flow rate using saturation volume for the moisture content of the gas
**Collection efficiency percent determined using g/s values

gr/DSCF during conventional operation and from 0.0185 to 0.0643 gr/DSCF during recycle operation. With the limited data available, it is difficult to develop any correlations between process operation and the degree of variability in the uncontrolled and controlled TOC emissions during conventional and recycle operation.

The average uncontrolled TOC loading was 29.7 percent greater during recycle operation (0.165 gr/DSCF) than during conventional operation (0.116 gr/DSCF). However, the average controlled TOC loading during recycle operation (0.0416 gr/DSCF) was 14.4 percent less than the average conventional operation loading (0.0486 gr/DSCF). The average removal efficiency of the venturi scrubber was 74.8 percent during recycle operation and 64.1 percent during conventional operation.

## 2.3 EXTRACTABLE ORGANICS EMISSION RESULTS

Analysis for extractable organics was performed on the 0.1N NaOH impinger solutions. Aliquots of the 0.1N NaOH samples were extracted with chloroform and diethyl ether. The solvent was evaporated at room temperature to dryness and the mass of extractable organics determined gravimetrically. Tables 2-7 and 2-8 contain a summary of uncontrolled and controlled extractable organics and particulate emission results. Extractable organics are identified as the "back-half catch" in Tables 2-7 and 2-8.

### 2.3.1 Conventional Operation Extractable Organics Emission Results

Uncontrolled extractable organics loadings were 0.0032, 0.0111, and 0.0169 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The controlled extractable organics loadings were 0.0227, 0.0131, and 0.0193 gr/DSCF for Runs C-1, C-2, and C-3, respectively.

### 2.3.2 Recycle Operation Extractable Organics Emission Results

Uncontrolled extractable organics loadings were 0.0186, 0.0077, and 0.0140 gr/DSCF for Runs R-1, R-2, and R-3, respectively. Controlled extractable organics loadings were 0.0121, 0.0286, and 0.0162 gr/DSCF for Runs R-1, R-2, and R-3, respectively.

### 2.3.3 Discussion of Extractable Organics Emission Test Results

The uncontrolled extractable organics loadings varied from 0.0032 to 0.0169 gr/DSCF during conventional operation and from 0.0077 to 0.0186 gr/DSCF during recycle operation. The controlled extractable organics loadings varied from 0.0131 to 0.0227 gr/DSCF during conventional operation and from 0.0121 to 0.0286 gr/DSCF during recycle operation. Based on the limited data available, it is difficult to develop any correlations between process operation and the degree of variability in the uncontrolled and

TABLE 2-7. SUMMARY OF UNCONTROLLED PARTICULATE AND EXTRACTABLE ORGANICS EMISSIONS

| DATE | 11/12 | 11/11 | 11/13 | 11/11 | 11/14 | 11/12 | | |
|---|---|---|---|---|---|---|---|---|
| RUN NO. | C-1 | R-1 | C-2 | R-2 | C-3 | R-3 | | |
| PROCESS OPERATION | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE |
| VOLUME GAS SAMPLED (DSCF) | 19.0 | 20.8 | 19.6 | 18.6 | 19.2 | 22.9 | 19.3 | 20.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700 | 14,800 | 11,700 | 12,300 | 12,500 | 14,000 | 12,000 | 13,700 |
| STACK TEMPERATURE (°F) | 298 | 296 | 289 | 314 | 304 | 317 | 297 | 309 |
| PERCENT MOISTURE BY VOLUME | 38.0 | 24.4 | 39.6 | 31.5 | 36.7 | 27.7 | 38.1 | 27.9 |
| PERCENT ISOKINETIC | 110 | 95 | 113 | 117 | 104 | 111 | 109 | 108 |
| PRODUCTION RATE (tons/hr) | 244 | 229 | 235 | 250 | 213 | 236 | 231 | 238 |
| PARTICULATE - EXTRACTABLE ORGANICS RESULTS | | | | | | | | |
| FRONT HALF CATCH - PARTICULATE (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 9360 | 4380 | 10,800 | 5260 | 6950 | 5570 | 9040 | 5070 |
| gr/DSCF | 7.60 | 3.24 | 8.49 | 4.37 | 5.58 | 3.75 | 7.22 | 3.79 |
| lbs/hr | 762 | 411 | 910 | 499 | 599 | 474 | 757 | 461 |
| lbs/ton production | 3.12 | 1.79 | 3.87 | 2.00 | 2.81 | 2.01 | 3.28 | 1.94 |
| BACK HALF CATCH - EXTRACTABLE ORGANICS (impinger solutions & rinses) | | | | | | | | |
| mg-mass | 4.0 | 25.1 | 14.1 | 9.3 | 21.1 | 20.8 | 13.1 | 18.4 |
| gr/DSCF | 0.0032 | 0.0186 | 0.0111 | 0.0077 | 0.0169 | 0.0140 | 0.0104 | 0.0134 |
| lbs/hr | 0.325 | 2.36 | 1.11 | 0.811 | 1.81 | 1.68 | 1.08 | 1.62 |
| lbs/ton production | 0.0013 | 0.0103 | 0.0047 | 0.0032 | 0.0085 | 0.0071 | 0.0048 | 0.0069 |
| PERCENT EXTRACTABLE ORGANICS* | 0.04 | 0.57 | 0.12 | 0.16 | 0.30 | 0.35 | 0.14 | 0.35 |

Average emission rate of concentration and area-ratio methods (Table 2-10).
*Percent Extractable Organics determined using lbs/hr values and is the percentage of extractable organics of the total catch.

TABLE 2-8. SUMMARY OF CONTROLLED PARTICULATE AND EXTRACTABLE ORGANICS EMISSIONS

| DATE | 11/12 | 11/11 | 11/13 | 11/11 | 11/14 | 11/12 | | |
|---|---|---|---|---|---|---|---|---|
| RUN NO. | C-1 | R-1 | C-2 | R-2 | C-3 | R-3 | | |
| PROCESS OPERATION | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE | CONVENTIONAL | RECYCLE |
| VOLUME GAS SAMPLED (DSCF) | 48.2 | 57.1 | 46.2 | 59.3 | 48.5 | 60.1 | 47.6 | 58.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700* (11,400) | 14,000 | 11,900 (11,400) | 13,300 (12,700) | 12,100 (11,800) | 14,000 | 11,900 (11,500) | 13,800 (13,600) |
| STACK TEMPERATURE (°F) | 159 | 147 | 155 | 152 | 153 | 143 | 156 | 147 |
| PERCENT MOISTURE BY VOLUME | 32.0 (32.3) | 21.3 | 29.0 (32.3) | 26.6 (30.6) | 27.5 (29.7) | 20.7 | 29.5 (32.1) | 22.9 (24.2) |
| PERCENT ISOKINETIC | 102 (105) | 104 | 96 (100) | 111 (116) | 99 (102) | 107 | 99 (102) | 107 (109) |
| PRODUCTION RATE (tons/hr) | 244 | 229 | 235 | 250 | 213 | 236 | 231 | 238 |
| PARTICULATE - EXTRACTABLE ORGANICS RESULTS | | | | | | | | |
| FRONT HALF CATCH - PARTICULATE (probe, cyclone, and filter) | | | | | | | | |
| mg-mass | 172 | 84.0 | 244 | 88.2 | 104 | 111 | 173 | 94.5 |
| gr/DSCF | 0.0550 | 0.0227 | 0.0814 | 0.0229 | 0.0332 | 0.0286 | 0.0565 | 0.0247 |
| lbs/hr | 5.53 (5.36) | 2.72 | 8.29 (7.95) | 2.76 (2.49) | 3.45 (3.36) | 3.42 | 5.76 (5.56) | 2.97 (2.88) |
| lbs/ton production | 0.0227 (0.0220) | 0.0119 | 0.0353 (0.0338) | 0.0110 (0.0100) | 0.0162 (0.0158) | 0.0145 | 0.0247 (0.0239) | 0.0125 (0.0123) |
| BACK HALF CATCH - EXTRACTABLE ORGANICS (impinger solutions & rinses) | | | | | | | | |
| mg-mass | 71.0 | 44.7 | 39.3 | 110 | 60.7 | 63.0 | 57.0 | 72.6 |
| gr/DSCF | 0.0227 | 0.0121 | 0.0131 | 0.0286 | 0.0193 | 0.0162 | 0.0184 | 0.0190 |
| lbs/hr | 2.28 (2.22) | 1.45 | 1.34 (1.28) | 3.25 (3.11) | 2.00 (1.95) | 1.94 | 1.88 (1.81) | 2.24 (2.21) |
| lbs/ton production | 0.0093 (0.0091) | 0.0063 | 0.0057 (0.0054) | 0.0130 (0.0124) | 0.0094 (0.0092) | 0.0082 | 0.0081 (0.0078) | 0.0094 (0.0093) |
| PERCENT EXTRACTABLE ORGANICS* | 29.2 (29.3) | 34.8 | 13.9 (13.9) | 54.1 (55.5) | 36.7 (36.7) | 36.2 | 24.6 (24.6) | 43.0 (43.4) |

NOTE: Top number based on saturation volume for moisture content of gas: (bottom number) is moisture content calculated using impinger catch indicating the presence of water mist.
Average emission rate of concentration and area-ratio methods (Table 2-10).
Percent Extractable Organics determined using lbs/hr values and is the percentage of extractable organics of the total catch.

controlled extractable organics emissions during conventional and recycle operation.

The average uncontrolled extractable organics loading during recycle operation (0.0134 gr/DSCF) was approximately 22 percent greater than during conventional operation (0.0104 gr/DSCF). The average controlled extractable organics loading during recycle operation (0.0190 gr/DSCF) approximated the average controlled organics loading during conventional operation (0.0184 gr/DSCF).

The average uncontrolled extractable organics loadings are less than the average controlled extractable organics loadings during both recycle and conventional operation. Controlled emissions of extractable organics were 27.7 percent higher than uncontrolled emissions during recycle operation and 42.6 percent higher during conventional operation. A review of the data indicates that the results are representative of conditions. The mass of extractable organics per unit volume measured in the controlled emissions was significantly higher than the mass of extractable organics measured in the uncontrolled emissions. A possible explanation is that the scrubber water contributes to the extractable organics concentration of controlled emissions due to the concentration of extractable organics in the water mist carried over from the venturi. The scrubber water would include organic compounds that are water soluble or miscible that would concentrate in the scrubber water to a degree depending on gas phase concentration, water recycle, and make-up. Condensible hydrocarbons on the other hand would tend to condense on particulate and be physically removed by the venturi. The condensible hydrocarbons would then be removed with the venturi pond sludge or appear as an oily film on the pond water which would not be recycled. The results indicate that the venturi controls condensible hydrocarbons by an average of 82.0 percent during recycle operation and 76.8 percent during conventional operation.

## 2.4 COMPARISON OF TOC AND EXTRACTABLE ORGANICS EMISSION RESULTS

Two analytical procedures were used during this program to quantify the concentration of uncontrolled and controlled organic emissions generated during conventional and recycle operation. An instrumental technique was used to determine the concentration of TOC present in the 0.1N NaOH impinger solutions generated during EPA Method 5E testing. The same samples were also analyzed using a extraction/gravimetric technique to determine the concentration of extractable organics. The main objective of performing both analyses on the same samples was to provide data that could be used to assess the utility of both procedures in characterizing organic emissions from asphalt concrete plants.

### 2.4.1 Comparison of Uncontrolled TOC and Extractable Organics Emission Results

Table 2-9 presents a comparison of uncontrolled TOC and extractable organics emissions during conventional and recycle operation. The average uncontrolled TOC loadings during recycle operation (0.165 gr/DSCF) were 29.7 percent higher than during conventional operation (0.116 gr/DSCF). The average uncontrolled extractable organics loadings during recycle operation (0.0134 gr/DSCF) were 22.4 percent higher than during conventional operation (0.0104 gr/DSCF). During recycle operation, the average extractable organics loading was 8.1 percent of the TOC loading and 9.0 percent during conventional operation.

### 2.4.2 Comparison of Controlled TOC and Extractable Organics Emission Results

Table 2-10 presents a comparison of controlled TOC and extractable organics emissions during conventional and recycle operation. Average controlled TOC loadings during recycle operation (0.0416 gr/DSCF) were 12.5 percent lower than during conventional operation (0.0468 gr/DSCF). Average controlled extractable organics loadings during recycle operation (0.0190

TABLE 2-9. COMPARISON OF UNCONTROLLED TOC AND EXTRACTABLE ORGANICS EMISSIONS

| RUN NUMBER | C-1 | C-2 | C-3 | R-1 | R-2 | R-3 | AVERAGE | |
|---|---|---|---|---|---|---|---|---|
| PROCESS OPERATION | CONVENTIONAL | CONVENTIONAL | CONVENTIONAL | RECYCLE | RECYCLE | RECYCLE | CONVENTIONAL | RECYCLE |
| DATE | 11/12 | 11/13 | 11/14 | 11/11 | 11/11 | 11/12 | | |
| VOLUME GAS SAMPLES (DSCF) | 19.0 | 19.6 | 19.2 | 20.8 | 18.6 | 22.9 | 19.3 | 20.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700 | 11,700 | 12,500 | 14,800 | 12,300 | 14,000 | 12,000 | 13,700 |
| STACK TEMPERATURE (°F) | 298 | 289 | 304 | 296 | 314 | 317 | 297 | 309 |
| PERCENT MOISTURE BY VOLUME | 38.0 | 39.6 | 36.7 | 24.4 | 31.5 | 27.7 | 38.1 | 27.9 |
| PERCENT ISOKINETIC | 110 | 113 | 104 | 95 | 117 | 111 | 109 | 108 |
| PRODUCTION RATE (TONS/HR) | 244 | 235 | 213 | 229 | 250 | 236 | 231 | 238 |

| BACK HALF CATCH ORGANICS RESULTS (impinger solutions & rinses) | TOC* | EXT** ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG | TOC | EXT ORG. | TOC | EXT ORG. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg-mass | 299 | 4.0 | 65.0 | 14.1 | 70.0 | 21.1 | 72.0 | 25.1 | 63.0 | 9.30 | 576 | 20.8 | 145 | 13.1 | 237 | 18.4 |
| gr/DSCF | 0.242 | 0.0032 | 0.0512 | 0.0111 | 0.0562 | 0.0169 | 0.0534 | 0.0186 | 0.0523 | 0.0077 | 0.389 | 0.0140 | 0.116 | 0.0104 | 0.165 | 0.0134 |
| lbs/hr | 24.3 | 0.325 | 5.13 | 1.11 | 6.01 | 1.81 | 6.77 | 2.36 | 5.51 | 0.81 | 46.6 | 1.68 | 11.8 | 1.08 | 19.6 | 1.62 |
| lbs/ton production | 0.0995 | 0.0013 | 0.0218 | 0.0047 | 0.0282 | 0.0085 | 0.0296 | 0.0103 | 0.0220 | 0.0032 | 0.198 | 0.0071 | 0.0498 | 0.0048 | 0.0832 | 0.0069 |

* TOC - Total Organic Carbon

**EXT. ORG. - Extractable Organics

TABLE 2-10. COMPARISON OF CONTROLLED TOC AND EXTRACTABLE ORGANICS EMISSIONS

| RUN NUMBER | C-1 | C-2 | C-3 | R-1 | R-2 | R-3 | AVERAGE | |
|---|---|---|---|---|---|---|---|---|
| PROCESS OPERATION | CONVENTIONAL | CONVENTIONAL | CONVENTIONAL | RECYCLE | RECYCLE | RECYCLE | CONVENTIONAL | RECYCLE |
| DATE | 11/12 | 11/13 | 11/14 | 11/11 | 11/11 | 11/12 | | |
| VOLUME GAS SAMPLES (DSCF) | 48.2 | 46.2 | 48.5 | 57.1 | 59.3 | 60.1 | 47.6 | 58.8 |
| STACK GAS FLOW RATE (DSCFM) | 11,700* (11,400) | 11,900 (11,400) | 12,100 (11,800) | 14,000 | 13,300 (12,700) | 14,000 | 11,900 (11,500) | 13,800 (13,600) |
| STACK TEMPERATURE (°F) | 159 | 155 | 153 | 147 | 152 | 143 | 156 | 147 |
| PERCENT MOISTURE BY VOLUME | 32.0 (34.3) | 29.0 (32.3) | 27.5 (29.7) | 21.3 | 26.6 (30.6) | 20.7 | 29.5 (32.1) | 22.9 (24.2) |
| PERCENT ISOKINETIC | 102 (105) | 96 (100) | 99 (102) | 104 | 111 (116) | 107 | 99 (102) | 107 (109) |
| PRODUCTION RATE (TONS/HR) | 244 | 235 | 213 | 229 | 250 | 236 | 231 | 238 |

| BACK HALF CATCH ORGANICS RESULTS (impinger solutions & rinses) | TOC** | EXT*** ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG. | TOC | EXT ORG. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg-mass | 128 | 71.0 | 150 | 39.3 | 155 | 60.7 | 238 | 44.7 | 162 | 110 | 72 | 63.0 | 144 | 57.0 | 157 | 72.6 |
| gr/DSCF | 0.0410 | 0.0227 | 0.0501 | 0.0131 | 0.0494 | 0.0193 | 0.0643 | 0.0121 | 0.0421 | 0.0286 | 0.0185 | 0.0162 | 0.0468 | 0.0184 | 0.0416 | 0.0190 |
| lbs/hr | 4.11 | 2.28 | 5.11 | 1.34 | 5.11 | 2.00 | 7.22 | 1.45 | 4.80 | 3.25 | 2.22 | 1.94 | 4.78 | 1.88 | 4.91 | 2.24 |
| lbs/ton production | 0.0168 | 0.0093 | 0.0217 | 0.0057 | 0.0240 | 0.0094 | 0.0337 | 0.0063 | 0.0192 | 0.0130 | 0.0094 | 0.0082 | 0.0208 | 0.0081 | 0.0208 | 0.0094 |

*NOTE: Top number based on saturation volume for moisture content of gas: (bottom number) is moisture content calculated using impinger catch results indicating the presence of water mist.

** TOC - Total Organic Carbon

***EXT. ORG. - Extractable Organics

gr/DSCF) were slightly higher (3.2 percent) than during conventional operation (0.0184 gr/DSCF). The extractable organics loading was 45.7 percent of the TOC loading during recycle operation and 39.3 percent during conventional operation.

### 2.4.3 Discussion of TOC and Extractable Organics Emissions Results

Because of the limited quantity of available data, it is difficult to develop an accurate comparison between the TOC and extractable organics results. To formulate an opinion about the two procedures, one must first evaluate the analytical procedures. It is important that several factors be kept in mind. First, the TOC analysis results are indicative of the total mass of soluble carbon, as organic species, in the sample. The extractable organics analysis results are related to the mass of organic species having a boiling point greater than 300°F. Also, the TOC analysis procedure is a direct instrumental technique requiring a minimal amount of sample preparation (refer to Section 5.2). On the other hand, the extractable organics analysis procedure requires sample preparation (refer to Section 5.2) by means of extraction with chloroform and diethyl ether. The remaining extract is then evaporated to dryness at room temperature before weighing.

It is believed that the TOC analysis procedure is more suitable than the extractable organics procedure for characterizing organic emissions from asphalt concrete plants.

### 2.11.4 Recycled Asphalt Pavement and Asphalt Cement Smoke Point and Flash Point Results

Smoke point determination was performed on a single sample of recycled asphalt pavement (RAP) collected during the Campbell test program. The sample was analyzed by the Oklahoma Testing Laboratory and by Radian. The smoke point test results are presented in Table 2-24. The smoke point determined by Oklahoma Testing Laboratory was 340°F. The smoke point determined by Radian was 370°F.

Samples of the asphalt cement (AC) used during the Campbell test program were analyzed for smoke point and flash point. The AC smoke point and flash point analyses were performed by the Oklahoma Testing Laboratory. The smoke point and flash point data are presented in Table 2-24.

TABLE 2-24. SUMMARY OF RECYCLED ASPHALT PAVEMENT (RAP) SMOKE POINT RESULTS AND ASPHALT CEMENT (AC) SMOKE POINT AND FLASH POINT RESULTS

| Collection Date | Sample Description | Sample Type | Oklahoma Testing Smoke Point (°F) | Radian[a] Smoke Point (°F) | Flash Point (°F) |
|---|---|---|---|---|---|
| 11-12-83 | Recycled Asphalt Pavement | RAP | 340 | 370 | - |
| 11-08-83 | McGee Asphalt Cement | AC | 420 | - | 640 |
| 11-12-83 | Allied Chemical Asphalt Cement | AC | 345 | - | 550 |

[a]Flash point and smoke point analysis of the AC performed by Oklahoma Testing Laboratories only.

## 2.12 CONDENSIBLE HYDROCARBONS EMISSION RESULTS

The sample fraction which condensed on the walls of the chilled glassware is referred to as condensible hydrocarbons. A trichloroethane (TCE) rinse was used to recover the condensed hydrocarbons from the impingers. The TCE was evaporated to dryness at room temperature to determine the mass of condensible hydrocarbons. Condensible hydrocarbons results are presented in Table 2-25.

### 2.12.1 Conventional Operation Condensible Hydrocarbons Emission Results

Uncontrolled condensible hydrocarbons loadings were 0.173, 0.0457, and 0.114 gr/DSCF for Runs C-1, C-2, and C-3, respectively. The controlled condensible hydrocarbons loadings were 0.0558, 0.0140, and 0.0086 gr/DSCF for Runs C-1, C-2, and C-3, respectively.

### 2.12.2 Recycle Operation Condensible Hydrocarbons Emission Results

Uncontrolled condensible hydrocarbons loadings were 0.136, 0.133, and 0.0619 gr/DSCF for Runs R-1, R-2, and R-3, respectively. The controlled condensible hydrocarbons loadings were 0.0114, 0.0311, and 0.0173 gr/DSCF for Runs R-1, R-2, and R-3, respectively.

### 2.12.3 Discussion of Condensible Hydrocarbons Emission Results

The uncontrolled condensible hydrocarbons loadings varied from 0.0457 to 0.173 gr/DSCF during conventional operation and from 0.0619 to 0.136 gr/DSCF during recycle operation. The controlled condensible hydrocarbons loadings varied from 0.0086 to 0.0558 gr/DSCF during conventional operation and from 0.0114 to 0.0311 gr/DSCF during recycle operation. With the limited data available, it is difficult to develop any correlations between process operation and degree of variability of the controlled and uncontrolled condensible hydrocarbon emissions during conventional and recycle operation.

TABLE 2-25. SUMMARY OF CONDENSIBLE HYDROCARBONS EMISSIONS

| Date | Run Description | Corrected TCE Rinse Wt (mg)[a] | gr/DSCF | lbs/hr | lbs/ton |
|---|---|---|---|---|---|
| | | CONTROLLED EMISSIONS | | | |
| Recycle Operation | | | | | |
| 11-11-83 | Run R-1 | 42.1 | 0.0114 | 1.36 | 0.0060 |
| 11-11-83 | Run R-2 | 120 | 0.0311 | 3.54 | 0.0142 |
| 11-12-83 | Run R-3 | 67.3 | 0.0173 | 2.07 | 0.0088 |
| | Average | 76.3 | 0.0199 | 2.32 | 0.0097 |
| Conventional Operation | | | | | |
| 11-12-83 | Run C-1 | 174 | 0.0558 | 5.59 | 0.0229 |
| 11-13-83 | Run C-2 | 41.8 | 0.0140 | 1.43 | 0.0061 |
| 11-14-83 | Run C-3 | 27.0 | 0.0086 | 0.89 | 0.0042 |
| | Average | 81.0 | 0.0261 | 2.64 | 0.0111 |
| | | UNCONTROLLED EMISSIONS | | | |
| Recycle Operation | | | | | |
| 11-11-83 | Run R-1 | 183 | 0.136 | 17.2 | 0.0750 |
| 11-11-83 | Run R-2 | 160 | 0.133 | 14.0 | 0.0559 |
| 11-12-83 | Run R-3 | 91.9 | 0.0619 | 7.42 | 0.0315 |
| | Average | 145 | 0.110 | 12.9 | 0.0541 |
| Conventional Operation | | | | | |
| 11-12-83 | Run C-1 | 213 | 0.173 | 17.3 | 0.0710 |
| 11-13-83 | Run C-2 | 58.2 | 0.0457 | 4.58 | 0.0195 |
| 11-14-83 | Run C-3 | 142 | 0.114 | 12.2 | 0.0571 |
| | Average | 138 | 0.111 | 11.4 | 0.0492 |

[a]Corrected for trichloroethane blank residue

The average uncontrolled condensible hydrocarbons loading during recycle operation (0.110 gr/DSCF) approximated the average uncontrolled condensible hydrocarbons loading during conventional operation (0.111 gr/DSCF). The average controlled condensible hydrocarbons loading during recycle operation (0.0199 gr/DSCF) was approximately 24 percent less than the conventional operation condensible hydrocarbons loading (0.0261 gr/DSCF). The average removal efficiency of the venturi scrubber was 82.0 percent during recycle operation and 76.8 percent during conventional operation.

## 2.13 COMPARISON OF TOC ANALYTICAL METHODS

Two analytical methods were used to determine the TOC concentrations of the 0.1N NaOH impinger solutions. The original method (the values reported in the original report) consisted of acidifying the sample below pH 2 with $H_2SO_4$ and purging with nitrogen to remove inorganic carbon. This method was specified in the test plan for the T.J. Campbell emission test. The second method was the EPA Method 5E protocol (see Appendix Section J.1).

To determine if the two methodologies yielded different results, the original samples were reanalyzed using both methods. Table 2-26 presents a comparison of the original analysis (acidification) and the reanalysis using both methods (EPA Method 5E and acidification).

Results of the sample reanalysis indicate that EPA Method 5E protocol yields lower results than the acidification and purge technique. A possible explanation for the lower values obtained by EPA Method 5E is that the absence of inorganic carbon is verified and if present the results are corrected accordingly. With the acidification and purge method, this step is not performed and if there is incomplete inorganic carbon removal, a high bias would occur.

TABLE 2-26. SUMMARY OF T.J. CAMPBELL TOTAL ORGANIC CARBON (TOC) EMISSION RESULTS COMPARING TWO ANALYTICAL METHODS

| Run ID | Original Campbell TOC Emissions: Method 1[a] | | | Campbell TOC Reanalysis: Method 1[a] | | | Campbell TOC Reanalysis: Method 2[b] | | |
|---|---|---|---|---|---|---|---|---|---|
| | gr/DSCF | lbs/hr | lbs/ton | gr/DSCF | lbs/hr | lbs/ton | gr/DSCF | lbs/hr | lbs/ton |
| UNCONTROLLED EMISSIONS | | | | | | | | | |
| Recycle Run 1 | 0.448 | 56.8 | 0.248 | 0.685 | 86.8 | 0.379 | 0.0534 | 6.77 | 0.0296 |
| Run 2 | 0.655 | 68.9 | 0.276 | 1.16 | 122 | 0.490 | 0.0523 | 5.51 | 0.0220 |
| Run 3 | 0.504 | 60.5 | 0.256 | 0.963 | 115 | 0.489 | 0.389 | 46.6 | 0.198 |
| Average | 0.536 | 62.1 | 0.260 | 0.936 | 108 | 0.453 | 0.165 | 19.6 | 0.0832 |
| Conventional Run 1 | 0.205 | 20.6 | 0.0843 | 0.958 | 96.0 | 0.394 | 0.242 | 24.3 | 0.0995 |
| Run 2 | 0.434 | 43.6 | 0.186 | 0.684 | 68.5 | 0.291 | 0.0512 | 5.13 | 0.0218 |
| Run 3 | 0.297 | 31.9 | 0.150 | 0.602 | 64.4 | 0.302 | 0.0562 | 6.01 | 0.0282 |
| Average | 0.312 | 32.0 | 0.140 | 0.748 | 76.3 | 0.329 | 0.116 | 11.8 | 0.0498 |
| CONTROLLED EMISSIONS | | | | | | | | | |
| Recycle Run 1 | 0.0592 | 7.10 | 0.0310 | 0.290 | 34.8 | 0.152 | 0.0643 | 7.72 | 0.0337 |
| Run 2 | 0.0975 | 11.1 | 0.0444 | 0.159 | 18.1 | 0.0724 | 0.0421 | 4.80 | 0.0192 |
| Run 3 | 0.159 | 19.0 | 0.0808 | 0.190 | 22.8 | 0.0964 | 0.0185 | 2.22 | 0.0094 |
| Average | 0.105 | 12.4 | 0.0521 | 0.213 | 25.2 | 0.107 | 0.0416 | 4.91 | 0.0208 |
| Conventional Run 1 | 0.0532 | 5.32 | 0.0218 | 0.188 | 18.9 | 0.0773 | 0.0410 | 4.11 | 0.0168 |
| Run 2 | 0.139 | 14.2 | 0.0604 | 0.154 | 15.7 | 0.0669 | 0.0501 | 5.11 | 0.0217 |
| Run 3 | 0.129 | 13.4 | 0.0627 | 0.233 | 24.1 | 0.113 | 0.0494 | 5.11 | 0.0240 |
| Average | 0.107 | 11.0 | 0.0483 | 0.192 | 19.6 | 0.0857 | 0.0468 | 4.78 | 0.0208 |

[a]Acidificationa nd purge analysis
[b]EPA Method 5E protocol analysis

## 5.2 ANALYTICAL METHODOLOGY

The previous section described sampling procedures. This section describes the analytical procedures and points out 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/extractable organics/condensible hydrocarbons sampling train for controlled and uncontrolled air emissions;
- particulate, TOC/extractable organics/condensible hydrocarbons, and trace metals 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 and recycled asphalt pavement.

Figures 5-7 through 5-10 present analytical schemes for the three sampling trains, scrubber waters, and process samples. These figures indicate where samples were retrieved from the various systems and the analyses performed. The following analyses were performed:

- gravimetric analysis of solvent rinses,
- gravimetric analysis of ether chloroform extract of impingers,
- total organic carbon,

- major organics and benzo(a)pyrene,
- trace metals,
- total solids,
- pH and temperature, and
- moisture.

Analysis of Extractable Organics--The extractable organics sample consisted of the material obtained by extracting the 0.1N NaOH impinger solutions with a mixture of chloroform and diethyl ether. The extractable organics content of the NaOH impinger samples was determined using the following procedure. First, a 400 ml sample aliquot was adjusted to pH 7 using HCl to improve extraction efficiency. The sample was then extracted with three portions of a 3:1 mixture of chloroform and diethyl ether for a total of 200 mls. The solvent was then filtered. The filtrate was evaporated to dryness at room temperature (70-75°) and weighed to a constant weight following desiccation.

Analysis of Condensible Hydrocarbons--The condensible hydrocarbon sample consisted of the material that condensed on the walls of the chilled glassware. The condensed hydrocarbon content was determined using the following gravimetric procedure. The impingers and associated glassware were rinsed with trichloroethane (TCE). The volume of each rinse was determined gravimetrically, the entire sample was transferred to a tared beaker, and evaporated at room temperature. When dry, the beakers were desiccated 24 hours and weighed to a constant weight to determine the mass of condensed hydrocarbon. Each sample weight was corrected for the residue contributed by the solvent.

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 915B 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.

Gravimetric Analysis of Solvent Rinses--The sampling train for particulate and TOC/extractable organics and the train which combined trace metals with particulate and TOC/extractable organics produced several solvent rinses requiring gravimetric analysis. The solvent rinses included:

- acetone probe rinse, and
- trichloroethane probe rinse.

The rinse samples were placed in glass bottles and transported to Radian's Austin laboratories for analysis. The volume of solvent in each sample was determined gravimetrically and then the entire sample was evaporated at room temperature. The sample could not be dried at elevated temperatures because of the potential loss of hydrocarbons. When dry, the beakers were desiccated for 24 hours and then weighed to a constant weight. A constant weight is defined as two weighings that agree within 0.5 mg or 1 percent of the residue mass.

The residue in the solvent probe rinses collected during the trace metals runs was dissolved in HCl, $HNO_3$, and $H_2O_2$ and was analyzed by Inductively Coupled Argon Plasma Emissions Spectroscopy (ICAPES).

Smoke Point Determination of Recycled Asphalt Pavement--The smoke point of the RAP samples 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 the 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.

---

[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.

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

| Sample No. | Date of Analysis | (A) Actual Values | (R) Radian Analysis Values (mg/L) | Percent Error R-A/A x 100 |
|---|---|---|---|---|
| EPA Prepared Sample Results (9/9/83) | | | | |
| EPA 1 | 10-28-83 | 4.1 | 4.5 | 9.76 |
| EPA 2 | thru | 61.2 | 70 | 14.4 |
| EPA 3 | 11-02-83 | 61.2 | 69 | 12.7 |
| EPA 5 | | 4.1 | 3 | -26.8 |
| Radian Prepared Sample Results | | | | |
| Set 1 - Submitted 11-30-83 | | | | |
| Radian #1 | | 80 | 85 | 6.25 |
| Radian #2 | | 40 | 45 | 12.5 |
| Radian #3 | | 80 | 81 | 1.2 |
| Radian #4 | | 4 | 4 | 0 |
| Radian #5 | | 4 | 3 | -25.0 |
| Radian #6 | | 40 | 41 | 2.5 |
| Set 2 - Submitted 12-12-83 | | | | |
| Radian #1[a] | | 80[a] | 85 | 6.25 |
| Radian #2 | | 20[b] | 21 | 5.0 |
| Radian #3 | | 20[a] | 19 | -5.0 |
| Radian #4 | | 80[b] | 84 | 5.0 |
| Radian #5 | | 80[a] | 77 | -3.75 |
| Radian #6 | | 20[a] | 21 | 5.0 |

[a]Sample in 0.1 in. NaOH matrix
[b]Sample in distilled water

| Sample Number | Date of Analysis | (A) Actual Value | (R) Radian Analysis Method 1[a] | Percent Error R-A/Ax100 | (R) Radian Analysis Method 2[b] | Percent Error R-A/Ax100 |
|---|---|---|---|---|---|---|
| Radian 1 | Submitted 8-09-84 | 593 | 562 | -5.2 | 604 | 1.8 |
| Radian 2 | | 119 | 108 | -9.2 | 167 | 40.3 |
| Radian 3 | | 59.3 | 40.9 | -31.0 | 128 | 116 |

[a]EPA Method 5E Protocol
[b]Acidification

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

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EPA

# Asphalt Concrete Industry

# Emission Test Report T.J. Campbell Company Oklahoma City, Oklahoma

## Volume 2

DCN 222-078-03-12

# EMISSION TEST REPORT

# T.J. CAMPBELL ASPHALT CONCRETE PLANT

# OKLAHOMA CITY, OKLAHOMA

Final Report
Appendices A through E
Volume 2

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# APPENDIX A

## COMPUTER PRINTOUT OF TEST RESULTS

INCLUDES


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APPENDIX A.1

CONVENTIONAL OPERATION DATA

INCLUDES

A.1.1 Particulate Mass (Modified EPA Method 5E)
A.1.1.1 Uncontrolled Particulate Emission Data

CORPORATION

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

PLANT NAME CAMPBELL ASPHALT — Run Preliminary 1
SAMPLING LOCATION INLET — SAMPLE IDENT. CAR-1106-PAH-IN-01
DATE 11/ 8/81 (MMDDYY) TIME START 14:16 (HHMM) TIME FINISH 15:21 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012 — TEST DURATION 48. MIN.
NOZZLE DIA. .272 INCHES — % CO .0 — % N2 87.1
BAR PRESS. 28.55 "HG — % CO2 5.7 — % H2 .0
STATIC PRESS. -1.3 "H2O .0 — % O2 7.2 — % CH4 .0
INITIAL LEAK RATE .012 CFM — CONDENSED WATER 187.2 GMS
FINAL LEAK RATE .010 CFM — FILTER WT. GAIN 1.51450 GMS
OPERATOR INITIALSEPA/TWT — PROBE WASH WT. GAIN 7.66180 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 | 1416. | 628.349 | .23 | .30 | 304. | 69. | 67. | 250. | 56. | 4.0 |
| 1-2 | 1419. | 629.420 | .27 | .33 | 306. | 66. | 66. | 250. | 56. | 4.5 |
| 1-3 | 1422. | 630.550 | .32 | .40 | 312. | 68. | 66. | 250. | 56. | 5.0 |
| 1-4 | 1425. | 631.020 | .32 | .40 | 318. | 68. | 67. | 250. | 56. | 5.0 |
| STOP | 1428. | 632.914 | | | | | | | | |
| 2-1 | 1431. | 632.914 | .20 | .28 | 274. | 69. | 69. | 250. | 56. | 4.2 |
| 2-2 | 1434. | 633.930 | .25 | .33 | 287. | 70. | 69. | 250. | 52. | 5.0 |
| 2-3 | 1437. | 635.070 | .25 | .33 | 292. | 71. | 70. | 250. | 50. | 5.0 |
| 2-4 | 1440. | 636.220 | .28 | .36 | 302. | 72. | 71. | 250. | 50. | 5.5 |
| STOP | 1443. | 637.398 | | | | | | | | |
| 3-1 | 1445. | 637.398 | .28 | .38 | 274. | 73. | 73. | 250. | 50. | 5.5 |
| 3-2 | 1448. | 638.530 | .35 | .45 | 282. | 74. | 73. | 250. | 52. | 8.0 |
| 3-3 | 1451. | 639.630 | .25 | .33 | 296. | 75. | 74. | 250. | 52. | 6.0 |
| 3-4 | 1454. | 640.680 | .27 | .35 | 308. | 75. | 75. | 250. | 52. | 6.2 |
| STOP | 1457. | 641.846 | | | | | | | | |
| 4-1 | 1509. | 641.846 | .32 | .42 | 274. | 75. | 74. | 250. | 52. | 6.5 |
| 4-2 | 1512. | 643.050 | .27 | .35 | 275. | 75. | 75. | 250. | 52. | 6.5 |
| 4-3 | 1515. | 644.240 | .25 | .33 | 295. | 75. | 75. | 250. | 54. | 6.2 |
| 4-4 | 1518. | 645.350 | .28 | .38 | 297. | 75. | 76. | 250. | 54. | 7.0 |
| STOP | 1521. | 646.504 | | | | | | | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run Preliminary 1

REMARKS FILTER #003 .5250 HOT BOX TEMP=155 1433 HOT BOX ON FULL HIGH W/20UF READING

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1108-PAH-IN-01

PLANT NAME: CAMPBELL ASPHALT
SAMPLING LOCATION: INLET
DATE: 11/ 8/81 TIME START: 14:16 TIME FINISH: 15:21

Run Preliminary 1

REMARKS: FILTER #003 .5250 HOT BOX TEMP=155 1433 HOT BOX ON FULL HIGH W/200F READING

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 293.5 | (F) | 145.3 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.46 | "HG | 72.28 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.25 | "H2O | -3.175 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.43 | LB/LB-MOLE | 25.4326 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 33.64 | % | 33.64 | % |
| AVERAGE FLUE GAS VELOCITY | 38.2824 | FPS | 11.6685 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 30457. | ACFM | 863. | M3/MIN |
| | 13469. | DSCFM | 381. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 17.5060 | DSCF | .4958 | M3 |
| TEST DURATION | 48. | MIN | 48. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.0 | (F) | 121.1 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 53.1 | (F) | 11.7 | (C) |
| MAXIMUM FINAL VACUUM | 8.0 | "HG | 20.32 | CMHG |
| FINAL LEAK RATE | .010 | CFM | .0003 | M3/MIN |
| PERCENT ISOKINETIC | 88.6 | % | 88.6 | % |
| PARTICULATE MASS CONCENTRATION | .809+001 | GR/DSCF | .185+002 | GMS/M3 |
| | .116-002 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .934+003 | LBS/HR | .424+003 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1108-PAH-IN-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run Preliminary 1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-1 | 35.37 | 304.00 |
| 1-2 | 38.38 | 306.00 |
| 1-3 | 41.94 | 312.00 |
| 1-4 | 42.10 | 318.00 |
| STOP | | |
| 2-1 | 32.33 | 274.00 |
| 2-2 | 36.47 | 287.00 |
| 2-3 | 36.59 | 292.00 |
| 2-4 | 38.98 | 302.00 |
| STOP | | |
| 3-1 | 38.25 | 274.00 |
| 3-2 | 43.00 | 282.00 |
| 3-3 | 36.68 | 296.00 |
| 3-4 | 38.43 | 308.00 |
| STOP | | |
| 4-1 | 40.90 | 274.00 |
| 4-2 | 37.59 | 275.00 |
| 4-3 | 36.66 | 295.00 |
| 4-4 | 38.85 | 297.00 |
| STOP | | |

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run C-1

PLANT NAME CAMPBELL ASPHALT
SAMPLING LOCATION INLET
DATE 11/12/83 (MMDDYY) TIME START 11:51 (HHMM)
SAMPLE IDENT. CAM-1112-TM-IN-02
TIME FINISH 12:43 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 28.50 "HG
STATIC PRESS. -1.2 "H20 .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .016 CFM
OPERATOR INITIALSEPA/CBC

TEST DURATION 48. MIN.
% CO .0 % N2 88.8
% CO2 6.2 % H2 .0
% O2 5.0 % CH4 .0
CONDENSED WATER 246.0 GMS
FILTER WT. GAIN 4.85400 GMS
PROBE WASH WT. GAIN 4.50560 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 1151. | 839.409 | .20 | .38 | 302. | 65. | 65. | 250. | 50. | 4.0 |
| 1-2 | 1154. | 840.510 | .25 | .50 | 316. | 65. | 64. | 250. | 50. | 5.0 |
| 1-3 | 1157. | 841.780 | .25 | .50 | 316. | 66. | 65. | 250. | 50. | 5.0 |
| 1-4 | 1200. | 843.050 | .24 | .48 | 317. | 66. | 65. | 250. | 50. | 5.5 |
| STOP | 1203. | 844.290 | | | | | | | | |
| 2-1 | 1204. | 844.290 | .19 | .38 | 281. | 67. | 66. | 250. | 49. | 5.5 |
| 2-2 | 1207. | 845.400 | .20 | .40 | 279. | 67. | 66. | 250. | 49. | 6.1 |
| 2-3 | 1210. | 846.540 | .23 | .46 | 292. | 68. | 67. | 250. | 49. | 7.4 |
| 2-4 | 1213. | 847.760 | .25 | .50 | 311. | 69. | 67. | 250. | 49. | 8.6 |
| STOP | 1216. | 849.033 | | | | | | | | |
| 3-1 | 1218. | 849.033 | .25 | .50 | 266. | 69. | 68. | 250. | 49. | 8.0 |
| 3-2 | 1221. | 850.330 | .27 | .54 | 290. | 70. | 68. | 250. | 49. | 10.8 |
| 3-3 | 1224. | 851.660 | .21 | .42 | 301. | 70. | 69. | 250. | 49. | 10.2 |
| 3-4 | 1227. | 852.850 | .20 | .40 | 314. | 70. | 69. | 250. | 49. | 10.6 |
| STOP | 1230. | 854.012 | | | | | | | | |
| 4-1 | 1231. | 854.012 | .32 | .64 | 264. | 71. | 70. | 250. | 49. | 13.5 |
| 4-2 | 1234. | 855.390 | .24 | .48 | 293. | 71. | 70. | 250. | 49. | 13.5 |
| 4-3 | 1237. | 856.640 | .22 | .44 | 308. | 72. | 71. | 250. | 49. | 13.5 |
| 4-4 | 1240. | 857.840 | .23 | .46 | 312. | 72. | 71. | 250. | 49. | 13.5 |
| STOP | 1243. | 859.028 | | | | | | | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-1

REMARKS 1050 1226
HOT BOX 1020 184 AT END OF RUN VACCUM GAGE REMAINED STUCK ON 13.5

CONFIDENTIAL

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1112-TM-IN-02

PLANT NAME: CAMPBELL ASPHALT
SAMPLING LOCATION: INLET
DATE: 11/12/83 TIME START: 11:51 TIME FINISH: 12:43

Run C-1

REMARKS: 185@1226
HOT BOX 182@ 184 AT END OF RUN VACCUM GAGE REMAINED STUCK ON 13.5

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 297.6 | (F) | 147.6 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.41 | "HG | 72.17 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H20 | -3.048 | CMH20 |
| FLUE GAS MOLECULAR WEIGHT (WET) | 24.94 | LB/LB-MOLE | 24.9975 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 38.01 | % | 38.01 | % |
| AVERAGE FLUE GAS VELOCITY | 35.8512 | FPS | 10.9275 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 28523. | ACFM | 808. | M3/MIN |
| | 11699. | DSCFM | 331. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 19.0140 | DSCF | .5385 | M3 |
| TEST DURATION | 48. | MIN | 48. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.0 | (F) | 121.1 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 49.3 | (F) | 9.6 | (C) |
| MAXIMUM LINE VACUUM | 13.5 | "HG | 34.29 | CMHG |
| FINAL LEAK RATE | .016 | CFM | .0005 | M3/MIN |
| PERCENT ISOKINETIC | 109.9 | % | 109.9 | % |
| PARTICULATE MASS CONCENTRATION | .760+001 | GR/DSCF | .174+002 | GMS/M3 |
| | .109-002 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .762+003 | LBS/HR | .346+003 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1112-TM-IN-02

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-1

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-1 | 35.29 | 302.00 |
| 1-2 | 37.56 | 316.00 |
| 1-3 | 37.56 | 316.00 |
| 1-4 | 36.83 | 317.00 |
| STOP | | |
| 2-1 | 32.00 | 281.00 |
| 2-2 | 32.79 | 272.00 |
| 2-3 | 35.47 | 292.00 |
| 2-4 | 37.44 | 311.00 |
| STOP | | |
| 3-1 | 36.33 | 266.00 |
| 3-2 | 38.38 | 290.00 |
| 3-3 | 34.09 | 301.00 |
| 3-4 | 35.56 | 314.00 |
| STOP | | |
| 4-1 | 41.05 | 264.00 |
| 4-2 | 36.26 | 293.00 |
| 4-3 | 35.06 | 308.00 |
| 4-4 | 35.94 | 312.00 |
| STOP | | |

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run C-2

PLANT NAME CAMPBELL
SAMPLING LOCATION INLET
DATE 11/13/83 (MMDDYY) TIME START 9:56 (HHMM)
SAMPLE IDENT. CAM-1113-PAH-IN-01
TIME FINISH 10:50 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 28.52 "HG
STATIC PRESS. -1.2 "H2O .0
INITIAL LEAK RATE .010 CFM
FINAL LEAK RATE .008 CFM
OPERATOR INITIALSEPA/ULL

TEST DURATION 48. MIN.
% CO .0 % N2 88.9
% CO2 6.0 % H2 .0
% O2 5.1 % CH4 .0
CONDENSED WATER 271.8 GMS
FILTER WT. GAIN 4.33090 GMS
PROBE WASH WT. GAIN 6.47950 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 | 956. | 871.679 | .19 | .40 | 304. | 70. | 70. | 255. | 50. | 2.2 |
| 1-2 | 959. | 872.820 | .26 | .54 | 323. | 70. | 69. | 250. | 50. | 2.8 |
| 1-3 | 1002. | 874.130 | .27 | .57 | 336. | 70. | 69. | 250. | 50. | 3.0 |
| 1-4 | 1005. | 875.470 | .25 | .53 | 316. | 70. | 69. | 250. | 48. | .0 |
| STOP | 1008. | 876.784 | | | | | | | | |
| 2-7 | 1009. | 876.784 | .20 | .42 | 289. | 70. | 69. | 250. | 48. | 3.8 |
| 2-2 | 1012. | 877.950 | .21 | .44 | 296. | 70. | 69. | 250. | 48. | 4.2 |
| 2-3 | 1015. | 879.140 | .23 | .48 | 288. | 71. | 70. | 250. | 51. | 5.0 |
| 2-4 | 1018. | 880.380 | .24 | .50 | 288. | 72. | 70. | 250. | 51. | 6.1 |
| STOP | 1021. | 881.640 | | | | | | | | |
| 3-1 | 1024. | 881.640 | .26 | .55 | 260. | 72. | 71. | 250. | 51. | 5.8 |
| 3-2 | 1027. | 882.930 | .29 | .61 | 278. | 73. | 72. | 250. | 51. | 8.0 |
| 3-3 | 1030. | 884.430 | .22 | .46 | 275. | 73. | 72. | 250. | 54. | 8.5 |
| 3-4 | 1033. | 885.570 | .24 | .51 | 260. | 73. | 72. | 250. | 54. | 10.0 |
| STOP | 1036. | 886.844 | | | | | | | | |
| 4-1 | 1038. | 886.844 | .33 | .69 | 248. | 74. | 73. | 250. | 56. | 9.0 |
| 4-2 | 1041. | 888.270 | .24 | .51 | 245. | 75. | 73. | 250. | 56. | 10.8 |
| 4-3 | 1044. | 889.560 | .21 | .44 | 295. | 75. | 73. | 250. | 56. | 11.0 |
| 4-4 | 1047. | 890.820 | .25 | .53 | 300. | 75. | 74. | 250. | 56. | 13.5 |
| STOP | 1050. | 892.067 | | | | | | | | |

CORPORATION

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

REMARKS HOT BOX 205 F @ 1019

Run C-2

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1113-PAH-IN-01

PLANT NAME: CAMPBELL
SAMPLING LOCATION: INLET
DATE: 11/13/83 TIME START: 9:56 TIME FINISH: 10:50

Run C-2

REMARKS: HOT BOX 205 F @ 1019

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 288.8 | (F) | 142.7 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.43 | "HG | 72.22 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 24.74 | LB/LB-MOLE | 24.7428 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 39.60 | % | 39.60 | % |
| AVERAGE FLUE GAS VELOCITY | 36.4179 | FPS | 11.1002 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 28974. | ACFM | 821. | M3/MIN |
| | 11724. | DSCFM | 332. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 19.6486 | DSCF | .5564 | M3 |
| TEST DURATION | 48. | MIN | 48. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.3 | (F) | 121.3 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 51.9 | (F) | 11.0 | (C) |
| MAXIMUM LINE VACUUM | 13.5 | "HG | 34.29 | CMHG |
| FINAL LEAK RATE | .008 | CFM | .0002 | M3/MIN |
| PERCENT ISOKINETIC | 113.3 | % | 113.3 | % |
| PARTICULATE MASS CONCENTRATION | .849+001 | GR/DSCF | .194+002 | GMS/M3 |
| | .121-002 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .853+003 | LBS/HR | .387+003 | KG/HR |

WET bulb / Dry bulb showed 32% moisture

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1113-PAH-IN-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-2

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-1 | 32.61 | 304.00 |
| 1-2 | 38.62 | 325.00 |
| 1-3 | 39.68 | 336.00 |
| 1-4 | 37.70 | 316.00 |
| STOP | | |
| 2-7 | 33.13 | 287.00 |
| 2-2 | 34.10 | 296.00 |
| 2-3 | 35.50 | 286.00 |
| 2-4 | 36.26 | 288.00 |
| STOP | | |
| 3-1 | 37.03 | 260.00 |
| 3-2 | 39.60 | 278.00 |
| 3-3 | 34.42 | 275.00 |
| 3-4 | 36.07 | 280.00 |
| STOP | | |
| 4-1 | 41.37 | 248.00 |
| 4-2 | 35.21 | 245.00 |
| 4-3 | 34.08 | 295.00 |
| 4-4 | 37.31 | 300.00 |
| STOP | | |

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run C-3

PLANT NAME CAMPBELL
SAMPLING LOCATION INLET
SAMPLE IDENT. CAM-1114-PAH-IN-01
DATE 11/14/83 (MMDDYY) TIME START 8:27 (HHMM) TIME FINISH 9:36 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 28.32 "HG
STATIC PRESS. -1.2 "H20 .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .006 CFM
OPERATOR INITIALSEPA/VAL

TEST DURATION 48. MIN.
% CO .0 % N2 89.2
% CO2 6.1 % H2 .0
% O2 4.7 % CH4 .0
CONDENSED WATER 235.1 GMS
FILTER WT. GAIN 2.91040 GMS
PROBE WASH WT. GAIN 4.04200 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 827. | 894.051 | .22 | .41 | 318. | 60. | 60. | 255. | 50. | 2.0 |
| 1-2 | 830. | 895.200 | .27 | .50 | 336. | 61. | 60. | 250. | 50. | 2.5 |
| 1-3 | 833. | 896.460 | .28 | .52 | 340. | 61. | 60. | 250. | 50. | 3.0 |
| 1-4 | 836. | 897.750 | .27 | .50 | 341. | 62. | 60. | 250. | 52. | 3.2 |
| STOP | 839. | 899.028 | | | | | | | | |
| 2-1 | 840. | 899.028 | .20 | .37 | 298. | 62. | 61. | 250. | 52. | 3.0 |
| 2-2 | 843. | 900.120 | .22 | .41 | 303. | 63. | 61. | 250. | 52. | 3.5 |
| 2-3 | 846. | 901.260 | .23 | .43 | 301. | 64. | 62. | 250. | 52. | 4.0 |
| 2-4 | 849. | 902.430 | .27 | .50 | 308. | 64. | 63. | 250. | 52. | 4.8 |
| STOP | 852. | 903.702 | | | | | | | | |
| 3-1 | 854. | 903.702 | .29 | .54 | 243. | 65. | 64. | 250. | 52. | 5.0 |
| 3-2 | 857. | 905.030 | .30 | .56 | 287. | 66. | 65. | 250. | 52. | 6.0 |
| 3-3 | 900. | 906.330 | .25 | .46 | 301. | 66. | 65. | 250. | 52. | 6.2 |
| 3-4 | 903. | 907.600 | .26 | .48 | 303. | 67. | 65. | 250. | 56. | 7.0 |
| STOP | 906. | 908.824 | | | | | | | | |
| 4-1 | 924. | 912.837 | .35 | .65 | 251. | 69. | 69. | 255. | 56. | 7.0 |
| 4-2 | 927. | 914.160 | .25 | .46 | 289. | 70. | 69. | 255. | 56. | 7.5 |
| 4-3 | 930. | 915.380 | .25 | .46 | 314. | 70. | 69. | 250. | 56. | 8.0 |
| 4-4 | 933. | 916.580 | .29 | .54 | 324. | 71. | 69. | 250. | 54. | 9.5 |
| STOP | 936. | 917.878 | | | | | | | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-3

REMARKS HOT BOX 200 F

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1114-PAH-IN-01

Run C-3

PLANT NAME: CAMPBELL
SAMPLING LOCATION: INLET
DATE: 11/14/83 TIME START: 8:27 TIME FINISH: 9:56

REMARKS: HOT BOX 200 F

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 303.6 | (F) | 150.9 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.23 | "HG | 71.71 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.07 | LB/LB-MOLE | 25.0660 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 36.71 | % | 36.71 | % |
| AVERAGE FLUE GAS VELOCITY | 38.0993 | FPS | 11.6127 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 30312. | ACFM | 858. | M3/MIN |
| | 12516. | DSCFM | 354. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 19.2148 | DSCF | .5442 | M3 |
| TEST DURATION | 48. | MIN | 48. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.9 | (F) | 121.6 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 52.8 | (F) | 11.5 | (C) |
| MAXIMUM LINE VACUUM | 9.5 | "HG | 24.13 | CMHG |
| FINAL LEAK RATE | .006 | CFM | .0002 | M3/MIN |
| PERCENT ISOKINETIC | 103.8 | % | 103.8 | % |
| PARTICULATE MASS CONCENTRATION | .558+001 | GR/DSCF | .128+002 | GMS/M3 |
| | .798-003 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .599+003 | LBS/HR | .272+003 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1114-PAH-IN-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-3

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-1 | 35.31 | 318.00 |
| 1-2 | 39.56 | 336.00 |
| 1-3 | 40.39 | 340.00 |
| 1-4 | 39.69 | 341.00 |
| STOP | | |
| 2-1 | 33.23 | 298.00 |
| 2-2 | 34.96 | 305.00 |
| 2-3 | 35.70 | 301.00 |
| 2-4 | 38.66 | 308.00 |
| STOP | | |
| 3-1 | 38.53 | 245.00 |
| 3-2 | 40.40 | 287.00 |
| 3-3 | 37.22 | 301.00 |
| 3-4 | 38.01 | 305.00 |
| STOP | | |
| 4-1 | 42.57 | 251.00 |
| 4-2 | 36.93 | 287.00 |
| 4-3 | 37.54 | 314.00 |
| 4-4 | 40.69 | 324.00 |
| STOP | | |

APPENDIX A.1

CONVENTIONAL OPERATION DATA

INCLUDES

A.1.1 Particulate Mass (Modified EPA Method 5E)
A.1.1.2 Controlled Particulate Emission Data

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run Preliminary 1

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1108-PAH-OUT-01
DATE 11/ 8/83 (MMDDYY) TIME START 14: 9 (HHMM) TIME FINISH 16: 8 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
TEST DURATION 100. MIN.
NOZZLE DIA. .180 INCHES
% CO .0 % N2 86.2
BAR PRESS. 28.58 "HG
% CO2 5.4 % H2 .0
STATIC PRESS. .5 "H20 .0
% O2 8.4 % CH4 .0
INITIAL LEAK RATE .012 CFM
CONDENSED WATER 419.8 GMS
FINAL LEAK RATE .016 CFM
FILTER WT. GAIN .02460 GMS
OPERATOR INITIALSMJK/VLL
PROBE WASH WT. GAIN .04820 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 1405. | 896.911 | .30 | .40 | 155. | 61. | 61. | 250. | 56. | 1.3 |
| 1-3 | 1410. | 898.400 | .20 | .30 | 157. | 70. | 63. | 250. | 54. | 1.2 |
| 1-2 | 1415. | 900.220 | .15 | .25 | 154. | 72. | 65. | 250. | 52. | 1.0 |
| 1-1 | 1420. | 901.670 | .15 | .25 | 156. | 75. | 67. | 250. | 51. | 1.1 |
| STOP | 1425. | 903.171 | | | | | | | | |
| 2-4 | 1431. | 903.171 | .75 | .90 | 158. | 76. | 70. | 250. | 52. | 2.6 |
| 2-3 | 1436. | 905.780 | .60 | .75 | 159. | 75. | 72. | 250. | 51. | 2.4 |
| 2-2 | 1441. | 908.190 | .40 | .60 | 155. | 77. | 71. | 250. | 54. | 2.4 |
| 2-1 | 1446. | 910.390 | .30 | .40 | 153. | 74. | 71. | 250. | 56. | 1.5 |
| STOP | 1451. | 912.165 | | | | | | | | |
| 3-4 | 1458. | 912.165 | .85 | 1.10 | 158. | 76. | 74. | 255. | 60. | 3.2 |
| 3-3 | 1503. | 914.970 | .70 | .85 | 160. | 78. | 71. | 250. | 58. | 2.8 |
| 3-2 | 1508. | 917.520 | .50 | .70 | 160. | 78. | 70. | 250. | 60. | 2.6 |
| 3-1 | 1513. | 919.800 | .35 | .45 | 162. | 79. | 71. | 250. | 61. | 2.3 |
| STOP | 1518. | 921.809 | | | | | | | | |
| 4-4 | 1523. | 921.809 | .85 | 1.15 | 155. | 77. | 72. | 250. | 59. | 3.7 |
| 4-3 | 1528. | 924.610 | .70 | .85 | 157. | 80. | 71. | 250. | 60. | 2.7 |
| 4-2 | 1533. | 927.170 | .60 | .75 | 153. | 80. | 71. | 250. | 61. | 2.6 |
| 4-1 | 1538. | 929.660 | .40 | .60 | 150. | 81. | 72. | 245. | 62. | 2.5 |
| STOP | 1543. | 931.797 | | | | | | | | |
| 5-4 | 1548. | 931.797 | .75 | .90 | 153. | 77. | 72. | 255. | 58. | 2.8 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run Preliminary 1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-3 | 1553. | 934.410 | .75 | .90 | 157. | 82. | 73. | 250. | 58. | 2.8 |
| 5-2 | 1558. | 937.040 | .60 | .75 | 157. | 81. | 72. | 250. | 59. | 2.7 |
| 5-1 | 1603. | 939.430 | .35 | .45 | 157. | 81. | 75. | 250. | 60. | 2.5 |
| STOP | 1608. | 941.348 | | | | | | | | |

REMARKS FINAL FILTER WT .5493

# SOURCE SAMPLING RESULTS SUMMARY
## SAMPLE IDENT: CAM-1108-PAH-OUT-01

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/ 8/83 TIME START: 12: 5 TIME FINISH: 16: 8

Run Preliminary 1

REMARKS: FINAL FILTER WT .5493

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 156.7 | (F) | 69.3 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.62 | "HG | 72.70 | CMHG |
| FLUE GAS STATIC PRESSURE | .55 | "H2O | 1.397 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.60 | LB/LB-MOLE | 25.5991 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 32.15 | % | 32.15 | % |
| AVERAGE FLUE GAS VELOCITY | 45.8139 | FPS | 13.9641 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21155. | ACFM | 599. | M3/MIN |
| | 11754. | DSCFM | 333. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 41.9929 | DSCF | 1.1892 | M3 |
| TEST DURATION | 100. | MIN | 100. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.3 | (F) | 121.2 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 57.1 | (F) | 13.9 | (C) |
| MAXIMUM LINE VACUUM | 3.7 | "HG | 9.40 | CMHG |
| FINAL LEAK RATE | .016 | CFM | .0005 | M3/MIN |
| PERCENT ISOKINETIC | 154.8 | % | 154.8 | % |
| PARTICULATE MASS CONCENTRATION | .268-001 | GR/DSCF | .612-001 | GMS/M3 |
| | .382-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .270+001 | LBS/HR | .122+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1108-PAH-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run Preliminary 1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 36.02 | 155.00 |
| 1-3 | 29.46 | 157.00 |
| 1-2 | 25.45 | 154.00 |
| 1-1 | 25.49 | 156.00 |
| STOP | | |
| 2-4 | 57.10 | 158.00 |
| 2-3 | 51.11 | 159.00 |
| 2-2 | 41.60 | 155.00 |
| 2-1 | 35.96 | 159.00 |
| STOP | | |
| 3-4 | 60.78 | 158.00 |
| 3-3 | 55.25 | 160.00 |
| 3-2 | 46.69 | 160.00 |
| 3-1 | 39.13 | 162.00 |
| STOP | | |
| 4-4 | 60.64 | 155.00 |
| 4-3 | 55.12 | 157.00 |
| 4-2 | 50.66 | 155.00 |
| 4-1 | 41.70 | 158.00 |
| STOP | | |
| 5-4 | 56.86 | 155.00 |
| 5-3 | 57.05 | 157.00 |
| 5-2 | 51.03 | 157.00 |
| 5-1 | 38.97 | 157.00 |
| STOP | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-1

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-0001-TM-OUT-02
DATE 11/12/83 (MMDDYY) TIME START 11:29 (HHMM) TIME FINISH 13:19 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.49 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .015 CFM
FINAL LEAK RATE .010 CFM
OPERATOR INITIALSMJK/TWT

TEST DURATION 96. MIN.
% CO .0 % N2 88.8
% CO2 6.2 % H2 .0
% O2 5.0 % CH4 .0
CONDENSED WATER 530.3 GMS
FILTER WT. GAIN .03440 GMS
PROBE WASH WT. GAIN .13730 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 1129. | 238.839 | .25 | .42 | 156. | 52. | 52. | 245. | 45. | 3.9 |
| 1-3 | 1133. | 240.430 | .20 | .34 | 156. | 51. | 50. | 250. | 48. | 3.2 |
| 1-2 | 1137. | 241.790 | .20 | .34 | 157. | 52. | 51. | 250. | 48. | 3.2 |
| 1-1 | 1141. | 243.120 | .20 | .34 | 155. | 53. | 53. | 250. | 49. | 3.2 |
| STOP | 1145. | 244.450 | | | | | | | | |
| 2-4 | 1147. | 244.450 | .75 | 1.26 | 160. | 58. | 58. | 250. | 46. | 9.5 |
| 2-3 | 1151. | 247.000 | .50 | .84 | 158. | 59. | 58. | 250. | 46. | 6.2 |
| 2-2 | 1155. | 249.130 | .40 | .67 | 160. | 59. | 57. | 250. | 45. | 5.1 |
| 2-1 | 1159. | 251.000 | .30 | .50 | 160. | 60. | 57. | 250. | 46. | 4.2 |
| STOP | 1203. | 252.630 | | | | | | | | |
| 3-4 | 1204. | 252.630 | .75 | 1.26 | 162. | 58. | 56. | 250. | 47. | 9.4 |
| 3-3 | 1208. | 255.120 | .65 | 1.09 | 161. | 57. | 57. | 250. | 47. | 8.5 |
| 3-2 | 1212. | 257.510 | .50 | .84 | 159. | 58. | 57. | 250. | 47. | 6.6 |
| 3-1 | 1216. | 259.620 | .40 | .67 | 159. | 60. | 60. | 250. | 46. | 5.1 |
| STOP | 1220. | 261.434 | | | | | | | | |
| 4-4 | 1222. | 261.434 | .75 | 1.26 | 158. | 58. | 58. | 250. | 47. | 9.6 |
| 4-3 | 1226. | 263.900 | .70 | 1.18 | 159. | 59. | 57. | 250. | 48. | 9.2 |
| 4-2 | 1230. | 266.400 | .55 | .92 | 159. | 57. | 57. | 250. | 48. | 7.2 |
| 4-1 | 1234. | 268.650 | .45 | .76 | 155. | 57. | 57. | 250. | 49. | 6.1 |
| STOP | 1238. | 270.654 | | | | | | | | |
| 5-4 | 1239. | 270.654 | .75 | 1.26 | 158. | 58. | 58. | 250. | 50. | 9.9 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STOP | 1243. | 273.259 | | | | | | | | |
| 5-3 | 1250. | 273.259 | .75 | 1.26 | 159. | 58. | 57. | 250. | 48. | 9.9 |
| 5-2 | 1254. | 275.820 | .60 | 1.01 | 158. | 59. | 58. | 250. | 48. | 8.1 |
| 5-1 | 1258. | 278.180 | .45 | .76 | 160. | 59. | 58. | 250. | 48. | 6.3 |
| STOP | 1302. | 280.200 | | | | | | | | |
| 6-4 | 1303. | 280.200 | .60 | 1.01 | 159. | 59. | 59. | 250. | 50. | 8.2 |
| 6-3 | 1307. | 282.500 | .55 | .92 | 160. | 60. | 58. | 250. | 50. | 7.4 |
| 6-2 | 1311. | 284.710 | .40 | .67 | 160. | 60. | 57. | 250. | 51. | 6.0 |
| 6-1 | 1315. | 286.610 | .35 | .59 | 160. | 61. | 58. | 250. | 52. | 5.8 |
| STOP | 1319. | 288.374 | | | | | | | | |

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-0001-TM-OUT-02

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/12/83 TIME START: 11:29 TIME FINISH: 13:19

Run C-1

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 158.7 | (F) | 70.4 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.54 | "HG | 72.48 | CMHG |
| FLUE GAS STATIC PRESSURE | .55 | "H2O | 1.397 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.35 | LB/LB-MOLE | 25.3539 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 34.29 | % | 34.29 | % |
| AVERAGE FLUE GAS VELOCITY | 46.0303 | FPS | 14.0900 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21255. | ACFM | 602. | M3/MIN |
| | 11367. | DSCFM | 322. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 48.1624 | DSCF | 1.3640 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.8 | (F) | 121.0 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 48.0 | (F) | 8.9 | (C) |
| MAXIMUM LINE VACUUM | 9.9 | "HG | 25.15 | CMHG |
| FINAL LEAK RATE | .010 | CFM | .0003 | M3/MIN |
| PERCENT ISOKINETIC | 105.0 | % | 105.0 | % |
| PARTICULATE MASS CONCENTRATION | .550-001 | GR/DSCF | .126+000 | GMS/M3 |
| | .786-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .536+001 | LBS/HR | .243+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-UCUI-TM-OUT-02

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 33.12 | 156.00 |
| 1-3 | 29.62 | 156.00 |
| 1-2 | 29.65 | 157.00 |
| 1-1 | 29.60 | 155.00 |
| STOP | | |
| 2-4 | 57.55 | 160.00 |
| 2-3 | 46.91 | 158.00 |
| 2-2 | 42.03 | 160.00 |
| 2-1 | 36.40 | 160.00 |
| STOP | | |
| 3-4 | 57.64 | 162.00 |
| 3-3 | 53.62 | 161.00 |
| 3-2 | 46.95 | 159.00 |
| 3-1 | 41.99 | 159.00 |
| STOP | | |
| 4-4 | 57.46 | 158.00 |
| 4-3 | 55.55 | 159.00 |
| 4-2 | 49.24 | 159.00 |
| 4-1 | 44.40 | 155.00 |
| STOP | | |
| 5-4 | 57.46 | 158.00 |
| STOP | | |
| 5-3 | 57.50 | 159.00 |
| 5-2 | 51.39 | 158.00 |
| 5-1 | 44.58 | 160.00 |
| STOP | | |
| 6-4 | 51.43 | 159.00 |
| 6-3 | 49.28 | 160.00 |
| 6-2 | 42.03 | 160.00 |
| 6-1 | 39.31 | 160.00 |
| STOP | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-2

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1113-PAH-OUT-01
DATE 11/13/83 (MMDDYY) TIME START 8:53 (HHMM) TIME FINISH 11:12 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.52 "HG
STATIC PRESS. .5 "H2O .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .020 CFM
OPERATOR INITIALSTWT/MJK

TEST DURATION 96. MIN.
% CO .0 % N2 88.9
% CO2 6.0 % H2 .0
% O2 5.1 % CH4 .0
CONDENSED WATER 463.9 GMS
FILTER WT. GAIN .08620 GMS
PROBE WASH WT. GAIN .15730 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 853. | 289.687 | .20 | .35 | 154. | 56. | 57. | 245. | 46. | 2.2 |
| 1-3 | 857. | 291.100 | .15 | .25 | 152. | 56. | 56. | 245. | 46. | 1.9 |
| 1-2 | 901. | 292.240 | .15 | .25 | 152. | 57. | 57. | 248. | 46. | 1.8 |
| 1-1 | 905. | 293.370 | .15 | .25 | 152. | 56. | 56. | 250. | 46. | 1.8 |
| STOP | 909. | 294.510 | | | | | | | | |
| 2-4 | 912. | 294.510 | .75 | 1.26 | 152. | 60. | 60. | 250. | 46. | 5.1 |
| 2-3 | 916. | 296.900 | .60 | 1.01 | 150. | 58. | 58. | 250. | 46. | 4.3 |
| 2-2 | 920. | 299.250 | .40 | .67 | 152. | 57. | 57. | 250. | 46. | 3.0 |
| 2-1 | 924. | 301.170 | .35 | .60 | 151. | 55. | 55. | 248. | 46. | 3.0 |
| STOP | 928. | 302.945 | | | | | | | | |
| 3-4 | 930. | 302.945 | .80 | 1.35 | 152. | 58. | 58. | 245. | 50. | 5.0 |
| 3-3 | 934. | 305.600 | .60 | 1.00 | 154. | 57. | 56. | 255. | 50. | 3.8 |
| STOP | 935. | 306.171 | | | | | | | | |
| 3-3 | 943. | 306.171 | .60 | 1.00 | 154. | 57. | 58. | 255. | 50. | 3.8 |
| 3-2 | 946. | 307.800 | .45 | .76 | 152. | 58. | 58. | 255. | 50. | 3.4 |
| 3-1 | 950. | 309.810 | .35 | .59 | 153. | 58. | 59. | 255. | 50. | 3.0 |
| STOP | 954. | 311.620 | | | | | | | | |
| 4-4 | 1000. | 311.620 | .80 | 1.35 | 152. | 58. | 59. | 255. | 50. | 4.0 |
| 4-3 | 1004. | 314.190 | .60 | 1.00 | 157. | 62. | 63. | 255. | 45. | 4.7 |
| 4-2 | 1008. | 316.590 | .50 | .84 | 155. | 61. | 61. | 255. | 45. | 4.0 |
| 4-1 | 1012. | 318.750 | .40 | .67 | 157. | 57. | 58. | 255. | 44. | 3.3 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-2

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STOP | 1016. | 320.627 | | | | | | | | |
| 5-4 | 1017. | 320.627 | .75 | 1.26 | 157. | 59. | 59. | 255. | 45. | 5.5 |
| 5-3 | 1021. | 323.200 | .60 | 1.00 | 154. | 57. | 58. | 255. | 45. | 4.8 |
| 5-2 | 1025. | 325.580 | .55 | .92 | 155. | 59. | 59. | 255. | 46. | 4.5 |
| 5-1 | 1029. | 327.800 | .45 | .76 | 161. | 59. | 59. | 255. | 47. | 4.0 |
| STOP | 1033. | 329.827 | | | | | | | | |
| 6-4 | 1034. | 329.827 | .55 | .92 | 162. | 57. | 58. | 255. | 47. | 4.8 |
| 6-3 | 1038. | 331.870 | .50 | .84 | 162. | 59. | 59. | 255. | 48. | 5.0 |
| STOP | 1042. | 333.868 | | | | | | | | |
| 6-2 | 1104. | 333.868 | .35 | .60 | 161. | 68. | 67. | 240. | 48. | 3.5 |
| 6-1 | 1108. | 335.560 | .35 | .60 | 158. | 63. | 64. | 255. | 48. | 3.8 |
| STOP | 1112. | 337.288 | | | | | | | | |

# SOURCE SAMPLING RESULTS SUMMARY
## SAMPLE IDENT: CAM-1113-PAH-OUT-01

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/13/83 TIME START: 6:55 TIME FINISH: 11:12

Run C-2

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 154.8 | (F) | 68.2 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.56 | "HG | 72.53 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.56 | LB/LB-MOLE | 25.5627 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 32.26 | % | 32.26 | % |
| AVERAGE FLUE GAS VELOCITY | 44.4676 | FPS | 13.5537 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 20533. | ACFM | 582. | M3/MIN |
| | 11400. | DSCFM | 323. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 46.1773 | DSCF | 1.3077 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 251.8 | (F) | 122.1 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 47.0 | (F) | 8.4 | (C) |
| MAXIMUM LINE VACUUM | 5.5 | "HG | 13.97 | CMHG |
| FINAL LEAK RATE | .020 | CFM | .0006 | M3/MIN |
| PERCENT ISOKINETIC | 100.3 | % | 100.3 | % |
| PARTICULATE MASS CONCENTRATION | .814-001 | GR/DSCF | .186+000 | GMS/M3 |
| | .116-004 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .795+001 | LBS/HR | .361+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1113-PAH-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-2

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 29.44 | 154.00 |
| 1-3 | 25.46 | 152.00 |
| 1-2 | 25.46 | 152.00 |
| 1-1 | 25.46 | 152.00 |
| STOP | | |
| 2-4 | 56.92 | 152.00 |
| 2-3 | 50.83 | 150.00 |
| 2-2 | 41.57 | 152.00 |
| 2-1 | 38.65 | 151.00 |
| STOP | | |
| 3-4 | 58.79 | 152.00 |
| 3-3 | 51.00 | 154.00 |
| STOP | | |
| 3-3 | 51.00 | 154.00 |
| 3-2 | 44.09 | 152.00 |
| 3-1 | 38.92 | 150.00 |
| STOP | | |
| 4-4 | 58.79 | 152.00 |
| 4-3 | 51.12 | 157.00 |
| 4-2 | 46.59 | 155.00 |
| 4-1 | 41.74 | 157.00 |
| STOP | | |
| 5-4 | 57.15 | 157.00 |
| 5-3 | 51.00 | 154.00 |
| 5-2 | 48.86 | 155.00 |
| 5-1 | 44.41 | 161.00 |
| STOP | | |
| 6-4 | 49.14 | 162.00 |
| 6-3 | 46.86 | 162.00 |
| STOP | | |
| 6-2 | 39.17 | 161.00 |
| 6-1 | 39.08 | 158.00 |
| STOP | | |

CONFIDENTIAL

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run C-3

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
DATE 11/14/83 (MMDDYY) TIME START 8:13 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.32 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .012 CFM
FINAL LEAK RATE .016 CFM
OPERATOR INITIALSMJK/TWT

SAMPLE IDENT. CAM-1114-PAH-OUT-01
TIME FINISH 10: 3 (HHMM)

TEST DURATION 96. MIN.
% CO .0 % N2 89.2
% CO2 6.1 % H2 .0
% O2 4.7 % CH4 .0
CONDENSED WATER 433.3 GMS
FILTER WT. GAIN .02960 GMS
PROBE WASH WT. GAIN .07480 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 813. | 338.354 | .20 | .34 | 157. | 52. | 52. | 250. | 46. | 4.0 |
| 1-3 | 817. | 339.730 | .15 | .26 | 155. | 53. | 52. | 250. | 45. | 3.3 |
| 1-2 | 821. | 340.930 | .15 | .26 | 153. | 53. | 52. | 255. | 45. | 3.1 |
| 1-1 | 825. | 342.100 | .15 | .26 | 152. | 53. | 52. | 250. | 45. | 3.1 |
| STOP | 829. | 343.246 | | | | | | | | |
| 2-4 | 830. | 343.246 | .65 | 1.09 | 150. | 54. | 52. | 240. | 46. | 9.8 |
| STOP | 834. | 345.938 | | | | | | | | |
| 2-3 | 841. | 346.225 | .55 | .92 | 153. | 55. | 54. | 245. | 49. | 3.2 |
| 2-2 | 845. | 348.490 | .45 | .76 | 152. | 54. | 53. | 235. | 48. | 3.0 |
| 2-1 | 849. | 350.470 | .35 | .59 | 151. | 56. | 54. | 250. | 48. | 2.7 |
| STOP | 853. | 352.273 | | | | | | | | |
| 3-4 | 854. | 352.273 | .75 | 1.26 | 151. | 55. | 53. | 250. | 47. | 4.0 |
| 3-3 | 858. | 354.800 | .65 | 1.09 | 153. | 57. | 56. | 250. | 46. | 4.0 |
| 3-2 | 902. | 357.340 | .55 | .92 | 155. | 57. | 56. | 250. | 46. | 3.6 |
| 3-1 | 906. | 359.610 | .35 | .59 | 154. | 57. | 56. | 250. | 47. | 2.9 |
| STOP | 910. | 361.461 | | | | | | | | |
| 4-4 | 913. | 361.461 | .70 | 1.18 | 151. | 56. | 56. | 250. | 45. | 4.4 |
| 4-3 | 917. | 364.020 | .65 | 1.09 | 153. | 57. | 56. | 250. | 46. | 4.1 |
| 4-2 | 921. | 366.470 | .55 | .92 | 152. | 57. | 56. | 250. | 45. | 4.0 |
| 4-1 | 925. | 368.760 | .40 | .67 | 152. | 58. | 57. | 250. | 46. | 3.0 |
| STOP | 929. | 370.647 | | | | | | | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-3

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-4 | 930. | 370.647 | .75 | 1.26 | 152. | 58. | 57. | 250. | 45. | 5.0 |
| 5-3 | 934. | 373.400 | .70 | 1.18 | 152. | 59. | 57. | 245. | 46. | 4.8 |
| 5-2 | 938. | 375.970 | .60 | 1.01 | 152. | 59. | 57. | 250. | 46. | 4.1 |
| 5-1 | 942. | 378.370 | .50 | .84 | 150. | 59. | 57. | 250. | 46. | 4.0 |
| STOP | 946. | 380.573 | | | | | | | | |
| 6-4 | 947. | 380.573 | .55 | .92 | 152. | 59. | 58. | 250. | 45. | 4.0 |
| 6-3 | 951. | 382.810 | .50 | .84 | 152. | 58. | 57. | 250. | 46. | 4.0 |
| 6-2 | 955. | 384.990 | .40 | .67 | 156. | 59. | 57. | 250. | 46. | 3.2 |
| 6-1 | 959. | 386.930 | .35 | .59 | 153. | 59. | 57. | 250. | 47. | 3.1 |
| STOP | 1003. | 388.750 | | | | | | | | |

REMARKS SILICA GEL PLUGGED; FIXED & LEAK OK

CONFIDENTIAL

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1114-PAH-OUT-01

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/14/83 TIME START: 8:13 TIME FINISH: 10: 3

Run C-3

REMARKS: SILICA GEL PLUGGED: FIXED & LEAK OK

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 152.6 | (F) | 67.0 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.36 | "HG | 72.03 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.84 | LB/LB-MOLE | 25.8447 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 29.73 | % | 29.73 | % |
| AVERAGE FLUE GAS VELOCITY | 44.5661 | FPS | 13.5837 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 20579. | ACFM | 583. | M3/MIN |
| | 11811. | DSCFM | 334. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 48.5398 | DSCF | 1.3746 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 248.8 | (F) | 120.4 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 46.1 | (F) | 7.8 | (C) |
| MAXIMUM LINE VACUUM | 9.8 | "HG | 24.89 | CMHG |
| FINAL LEAK RATE | .016 | CFM | .0005 | M3/MIN |
| PERCENT ISOKINETIC | 101.8 | % | 101.8 | % |
| PARTICULATE MASS CONCENTRATION | .332-001 | GR/DSCF | .759-001 | GMS/M3 |
| | .474-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .336+001 | LBS/HR | .152+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1114-PAH-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-3

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-4 | 29.46 | 157.00 |
| 1-3 | 25.47 | 155.00 |
| 1-2 | 25.43 | 159.00 |
| 1-1 | 25.41 | 152.00 |
| STOP | | |
| 2-4 | 52.80 | 150.00 |
| STOP | | |
| 2-3 | 48.69 | 159.00 |
| 2-2 | 44.00 | 152.00 |
| 2-1 | 38.79 | 151.00 |
| STOP | | |
| 3-4 | 56.76 | 151.00 |
| 3-3 | 52.93 | 159.00 |
| 3-2 | 48.77 | 155.00 |
| 3-1 | 38.87 | 154.00 |
| STOP | | |
| 4-4 | 54.84 | 151.00 |
| 4-3 | 52.93 | 159.00 |
| 4-2 | 48.65 | 152.00 |
| 4-1 | 41.49 | 152.00 |
| STOP | | |
| 5-4 | 56.81 | 152.00 |
| 5-3 | 54.88 | 152.00 |
| 5-2 | 50.81 | 152.00 |
| 5-1 | 46.31 | 150.00 |
| STOP | | |
| 6-4 | 48.65 | 152.00 |
| 6-3 | 46.39 | 152.00 |
| 6-2 | 41.62 | 156.00 |
| 6-1 | 38.84 | 159.00 |
| STOP | | |

APPENDIX A.1

CONVENTIONAL OPERATION DATA

INCLUDES

A.1.1 Particulate Mass (Modified EPA Method 5E)
A.1.1.3 Controlled Particulate Emission Data Based on Psychometric Chart Moisture Values

RADIAN

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run C-1

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-0001-TM-OUT-02
DATE 11/12/83 (MMDDYY) TIME START 11:29 (HHMM) TIME FINISH 13:19 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.49 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .015 CFM
FINAL LEAK RATE .010 CFM
OPERATOR INITIALSMJK/TWT

TEST DURATION 96. MIN.
% CO .0 % N2 88.8
% CO2 6.2 % H2 .0
% O2 5.0 % CH4 .0
CONDENSED WATER 476.5 GMS
FILTER WT. GAIN .03440 GMS
PROBE WASH WT. GAIN .13730 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 1129. | 238.839 | .25 | .42 | 156. | 52. | 52. | 245. | 45. | 3.9 |
| 1-3 | 1133. | 240.430 | .20 | .34 | 156. | 51. | 50. | 250. | 48. | 3.2 |
| 1-2 | 1137. | 241.790 | .20 | .34 | 157. | 52. | 51. | 250. | 48. | 3.2 |
| 1-1 | 1141. | 243.120 | .20 | .34 | 155. | 53. | 53. | 250. | 49. | 3.2 |
| STOP | 1145. | 244.450 | | | | | | | | |
| 2-4 | 1147. | 244.450 | .75 | 1.26 | 160. | 58. | 58. | 250. | 46. | 9.5 |
| 2-3 | 1151. | 247.000 | .50 | .84 | 158. | 59. | 58. | 250. | 46. | 6.2 |
| 2-2 | 1155. | 249.130 | .40 | .67 | 160. | 59. | 57. | 250. | 45. | 5.1 |
| 2-1 | 1159. | 251.000 | .30 | .50 | 160. | 60. | 57. | 250. | 46. | 4.2 |
| STOP | 1203. | 252.630 | | | | | | | | |
| 3-4 | 1204. | 252.630 | .75 | 1.26 | 162. | 58. | 56. | 250. | 47. | 9.4 |
| 3-3 | 1208. | 255.120 | .65 | 1.09 | 161. | 57. | 57. | 250. | 47. | 8.5 |
| 3-2 | 1212. | 257.510 | .50 | .84 | 159. | 58. | 57. | 250. | 47. | 6.6 |
| 3-1 | 1216. | 259.620 | .40 | .67 | 159. | 60. | 60. | 250. | 48. | 5.1 |
| STOP | 1220. | 261.434 | | | | | | | | |
| 4-4 | 1222. | 261.434 | .75 | 1.26 | 158. | 58. | 58. | 250. | 47. | 9.6 |
| 4-3 | 1226. | 263.900 | .70 | 1.18 | 159. | 59. | 57. | 250. | 48. | 9.2 |
| 4-2 | 1230. | 266.400 | .55 | .92 | 159. | 57. | 57. | 250. | 48. | 7.2 |
| 4-1 | 1234. | 268.650 | .45 | .76 | 155. | 57. | 57. | 250. | 49. | 6.1 |
| STOP | 1238. | 270.654 | | | | | | | | |
| 5-4 | 1239. | 270.654 | .75 | 1.26 | 158. | 58. | 58. | 250. | 50. | 9.9 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STOP | 1243. | 273.259 | | | | | | | | |
| 5-3 | 1250. | 273.259 | .75 | 1.26 | 159. | 58. | 57. | 250. | 48. | 9.9 |
| 5-2 | 1254. | 275.820 | .60 | 1.01 | 158. | 59. | 58. | 250. | 48. | 8.1 |
| 5-1 | 1258. | 278.180 | .45 | .76 | 160. | 59. | 58. | 250. | 48. | 6.3 |
| STOP | 1302. | 280.200 | | | | | | | | |
| 6-4 | 1303. | 280.200 | .60 | 1.01 | 159. | 59. | 59. | 250. | 50. | 8.2 |
| 6-3 | 1307. | 282.500 | .55 | .92 | 160. | 60. | 58. | 250. | 50. | 7.4 |
| 6-2 | 1311. | 284.710 | .40 | .67 | 160. | 60. | 57. | 250. | 51. | 6.0 |
| 6-1 | 1315. | 286.610 | .35 | .59 | 160. | 61. | 58. | 250. | 52. | 5.8 |
| STOP | 1319. | 288.374 | | | | | | | | |

RADIAN CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-0001-TM-001-02

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/12/83 TIME START: 11:29 TIME FINISH: 13:19

Run C-1

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 158.7 | (F) | 70.4 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.54 | "HG | 72.48 | CMHG |
| FLUE GAS STATIC PRESSURE | .55 | "H2O | 1.397 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.62 | LB/LB-MOLE | 25.6190 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 31.92 | % | 31.92 | % |
| AVERAGE FLUE GAS VELOCITY | 45.7916 | FPS | 13.9573 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21145. | ACFM | 599. | M3/MIN |
| | 11715. | DSCFM | 332. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 48.1624 | DSCF | 1.3640 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.8 | (F) | 121.0 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 48.0 | (F) | 8.9 | (C) |
| MAXIMUM LINE VACUUM | 9.9 | "HG | 25.15 | CMHG |
| FINAL LEAK RATE | .010 | CFM | .0003 | M3/MIN |
| PERCENT ISOKINETIC | 101.8 | % | 101.8 | % |
| PARTICULATE MASS CONCENTRATION | .550-001 | GR/DSCF | .126+000 | GMS/M3 |
| | .786-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .553+001 | LBS/HR | .251+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-0001-TM-OUT-02

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-1

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-4 | 32.95 | 156.00 |
| 1-3 | 29.47 | 156.00 |
| 1-2 | 29.49 | 157.00 |
| 1-1 | 29.45 | 159.00 |
| STOP | | |
| 2-4 | 57.25 | 160.00 |
| 2-3 | 46.67 | 158.00 |
| 2-2 | 41.81 | 160.00 |
| 2-1 | 36.21 | 160.00 |
| STOP | | |
| 3-4 | 57.34 | 162.00 |
| 3-3 | 53.34 | 161.00 |
| 3-2 | 46.71 | 159.00 |
| 3-1 | 41.78 | 159.00 |
| STOP | | |
| 4-4 | 57.16 | 158.00 |
| 4-3 | 55.27 | 159.00 |
| 4-2 | 48.99 | 159.00 |
| 4-1 | 44.17 | 159.00 |
| STOP | | |
| 5-4 | 57.16 | 158.00 |
| STOP | | |
| 5-3 | 57.21 | 159.00 |
| 5-2 | 51.12 | 158.00 |
| 5-1 | 44.35 | 160.00 |
| STOP | | |
| 6-4 | 51.17 | 159.00 |
| 6-3 | 49.03 | 160.00 |
| 6-2 | 41.81 | 160.00 |
| 6-1 | 39.11 | 160.00 |
| STOP | | |

RADIAN CORPORATION

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run C-2

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
DATE 11/13/83 (MMDDYY) TIME START 8:53 (HHMM)
SAMPLE IDENT. CAM-1113-PAH-OUT-01
TIME FINISH 11:12 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.52 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .020 CFM
OPERATOR INITIALSTWT/MJK

TEST DURATION 96. MIN.
% CO .0 % N2 88.9
% CO2 6.0 % H2 .0
% O2 5.1 % CH4 .0
CONDENSED WATER 396.3 GMS
FILTER WT. GAIN .08620 GMS
PROBE WASH WT. GAIN .15730 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 853. | 289.687 | .20 | .35 | 154. | 56. | 57. | 245. | 46. | 2.2 |
| 1-3 | 857. | 291.100 | .15 | .25 | 152. | 56. | 56. | 245. | 46. | 1.9 |
| 1-2 | 901. | 292.240 | .15 | .25 | 152. | 57. | 57. | 248. | 46. | 1.8 |
| 1-1 | 905. | 293.370 | .15 | .25 | 152. | 56. | 56. | 250. | 46. | 1.8 |
| STOP | 909. | 294.510 | | | | | | | | |
| 2-4 | 912. | 294.510 | .75 | 1.26 | 152. | 60. | 60. | 250. | 46. | 5.1 |
| 2-3 | 916. | 296.900 | .60 | 1.01 | 150. | 58. | 58. | 250. | 46. | 4.3 |
| 2-2 | 920. | 299.250 | .40 | .67 | 152. | 57. | 57. | 250. | 46. | 3.0 |
| 2-1 | 924. | 301.170 | .35 | .60 | 151. | 55. | 55. | 248. | 46. | 3.0 |
| STOP | 928. | 302.945 | | | | | | | | |
| 3-4 | 930. | 302.945 | .80 | 1.35 | 152. | 58. | 58. | 245. | 50. | 5.0 |
| 3-3 | 934. | 305.600 | .60 | 1.00 | 154. | 57. | 58. | 255. | 50. | 3.8 |
| STOP | 935. | 306.171 | | | | | | | | |
| 3-3 | 943. | 306.171 | .60 | 1.00 | 154. | 57. | 58. | 255. | 50. | 3.8 |
| 3-2 | 946. | 307.800 | .45 | .76 | 152. | 58. | 58. | 255. | 50. | 3.4 |
| 3-1 | 950. | 309.810 | .35 | .59 | 153. | 58. | 59. | 255. | 50. | 3.0 |
| STOP | 954. | 311.620 | | | | | | | | |
| 4-4 | 1000. | 311.620 | .80 | 1.35 | 152. | 58. | 59. | 255. | 50. | 4.0 |
| 4-3 | 1004. | 314.190 | .60 | 1.00 | 157. | 62. | 63. | 255. | 45. | 4.7 |
| 4-2 | 1008. | 316.590 | .50 | .84 | 155. | 61. | 61. | 255. | 45. | 4.0 |
| 4-1 | 1012. | 318.750 | .40 | .67 | 157. | 57. | 58. | 255. | 44. | 3.3 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-2

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STOP | 1016. | 320.627 | | | | | | | | |
| 5-4 | 1017. | 320.627 | .75 | 1.26 | 157. | 59. | 59. | 255. | 45. | 5.5 |
| 5-3 | 1021. | 323,200 | .60 | 1.00 | 154. | 57. | 58. | 255. | 45. | 4.8 |
| 5-2 | 1025. | 325.580 | .55 | .92 | 155. | 59. | 59. | 255. | 46. | 4.5 |
| 5-1 | 1029. | 327.800 | .45 | .76 | 161. | 59. | 59. | 255. | 47. | 4.0 |
| STOP | 1033. | 329.827 | | | | | | | | |
| 6-4 | 1034. | 329.827 | .55 | .92 | 162. | 57. | 58. | 255. | 47. | 4.8 |
| 6-3 | 1038. | 331.870 | .50 | .84 | 162. | 59. | 59. | 255. | 48. | 5.0 |
| STOP | 1042. | 333.868 | | | | | | | | |
| 6-2 | 1104. | 333.868 | .35 | .60 | 161. | 68. | 67. | 240. | 48. | 3.5 |
| 6-1 | 1108. | 335.560 | .35 | .60 | 158. | 63. | 64. | 255. | 48. | 3.8 |
| STOP | 1112. | 337.288 | | | | | | | | |

RADIAN

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1113-PAH-OUT-01

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/13/83 TIME START: 8:53 TIME FINISH: 11:12

Run C-2

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 154.8 | (F) | 68.2 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.56 | "HG | 72.53 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.94 | LB/LB-MOLE | 25.9358 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 28.92 | % | 28.92 | % |
| AVERAGE FLUE GAS VELOCITY | 44.1466 | FPS | 13.4559 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 20385. | ACFM | 577. | M3/MIN |
| | 11876. | DSCFM | 336. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 46.1773 | DSCF | 1.3077 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 251.8 | (F) | 122.1 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 47.0 | (F) | 8.4 | (C) |
| MAXIMUM LINE VACUUM | 5.5 | "HG | 13.97 | CMHG |
| FINAL LEAK RATE | .020 | CFM | .0006 | M3/MIN |
| PERCENT ISOKINETIC | 96.3 | % | 96.3 | % |
| PARTICULATE MASS CONCENTRATION | .814-001 | GR/DSCF | .186+000 | GMS/M3 |
| | .116-004 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .829+001 | LBS/HR | .376+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1113-PAH-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-2

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-4 | 29.23 | 154.00 |
| 1-3 | 25.27 | 152.00 |
| 1-2 | 25.27 | 152.00 |
| 1-1 | 25.27 | 152.00 |
| STOP | | |
| 2-4 | 56.51 | 152.00 |
| 2-3 | 50.46 | 150.00 |
| 2-2 | 41.27 | 152.00 |
| 2-1 | 38.57 | 151.00 |
| STOP | | |
| 3-4 | 58.36 | 152.00 |
| 3-3 | 50.63 | 154.00 |
| STOP | | |
| 3-3 | 50.63 | 154.00 |
| 3-2 | 43.77 | 152.00 |
| 3-1 | 38.64 | 153.00 |
| STOP | | |
| 4-4 | 58.36 | 152.00 |
| 4-3 | 50.75 | 157.00 |
| 4-2 | 46.25 | 155.00 |
| 4-1 | 41.44 | 157.00 |
| STOP | | |
| 5-4 | 56.74 | 157.00 |
| 5-3 | 50.63 | 154.00 |
| 5-2 | 48.51 | 155.00 |
| 5-1 | 44.09 | 161.00 |
| STOP | | |
| 6-4 | 48.79 | 162.00 |
| 6-3 | 46.52 | 162.00 |
| STOP | | |
| 6-2 | 38.89 | 161.00 |
| 6-1 | 38.79 | 158.00 |
| STOP | | |

RADIAN

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-3

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
DATE 11/14/83 (MMDDYY) TIME START 8:13 (HHMM)
SAMPLE IDENT. CAM-1114-PAH-OUT-01
TIME FINISH 10: 3 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.32 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .012 CFM
FINAL LEAK RATE .016 CFM
OPERATOR INITIALSMJK/TWT

TEST DURATION 96. MIN.

| | | | |
|---|---|---|---|
| % CO | .0 | % N2 | 89.2 |
| % CO2 | 6.1 | % H2 | .0 |
| % O2 | 4.7 | % CH4 | .0 |

CONDENSED WATER 390.0 GMS
FILTER WT. GAIN .02960 GMS
PROBE WASH WT. GAIN .07480 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 813. | 338.354 | .20 | .34 | 157. | 52. | 52. | 250. | 46. | 4.0 |
| 1-3 | 817. | 339.730 | .15 | .26 | 155. | 53. | 52. | 250. | 45. | 3.3 |
| 1-2 | 821. | 340.930 | .15 | .26 | 153. | 53. | 52. | 255. | 45. | 3.1 |
| 1-1 | 825. | 342.100 | .15 | .26 | 152. | 53. | 52. | 250. | 45. | 3.1 |
| STOP | 829. | 343.246 | | | | | | | | |
| 2-4 | 830. | 343.246 | .65 | 1.09 | 150. | 54. | 52. | 240. | 46. | 9.8 |
| STOP | 834. | 345.938 | | | | | | | | |
| 2-3 | 841. | 346.225 | .55 | .92 | 153. | 55. | 54. | 245. | 49. | 3.2 |
| 2-2 | 845. | 348.490 | .45 | .76 | 152. | 54. | 53. | 235. | 48. | 3.0 |
| 2-1 | 849. | 350.470 | .35 | .59 | 151. | 56. | 54. | 250. | 48. | 2.7 |
| STOP | 853. | 352.273 | | | | | | | | |
| 3-4 | 854. | 352.273 | .75 | 1.26 | 151. | 55. | 53. | 250. | 47. | 4.8 |
| 3-3 | 858. | 354.880 | .65 | 1.09 | 153. | 57. | 56. | 250. | 46. | 4.0 |
| 3-2 | 902. | 357.340 | .55 | .92 | 155. | 57. | 56. | 250. | 46. | 3.6 |
| 3-1 | 906. | 359.610 | .35 | .59 | 154. | 57. | 56. | 250. | 47. | 2.9 |
| STOP | 910. | 361.461 | | | | | | | | |
| 4-4 | 913. | 361.461 | .70 | 1.18 | 151. | 56. | 56. | 250. | 45. | 4.4 |
| 4-3 | 917. | 364.020 | .65 | 1.09 | 153. | 57. | 56. | 250. | 46. | 4.1 |
| 4-2 | 921. | 366.470 | .55 | .92 | 152. | 57. | 56. | 250. | 45. | 4.0 |
| 4-1 | 925. | 368.760 | .40 | .67 | 152. | 58. | 57. | 250. | 46. | 3.0 |
| STOP | 929. | 370.647 | | | | | | | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run C-3

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-4 | 930. | 370.647 | .75 | 1.26 | 152. | 58. | 57. | 250. | 45. | 5.0 |
| 5-3 | 934. | 373.400 | .70 | 1.18 | 152. | 59. | 57. | 245. | 46. | 4.8 |
| 5-2 | 938. | 375.970 | .60 | 1.01 | 152. | 59. | 57. | 250. | 46. | 4.1 |
| 5-1 | 942. | 378.370 | .50 | .84 | 150. | 59. | 57. | 250. | 46. | 4.0 |
| STOP | 946. | 380.573 | | | | | | | | |
| 6-4 | 947. | 380.573 | .55 | .92 | 152. | 59. | 58. | 250. | 45. | 4.0 |
| 6-3 | 951. | 382.810 | .50 | .84 | 152. | 58. | 57. | 250. | 46. | 4.0 |
| 6-2 | 955. | 384.990 | .40 | .67 | 156. | 59. | 57. | 250. | 46. | 3.2 |
| 6-1 | 959. | 386.930 | .35 | .59 | 153. | 59. | 57. | 250. | 47. | 3.1 |
| STOP | 1003. | 388.750 | | | | | | | | |

REMARKS SILICA GEL PLUGGED; FIXED & LEAK OK

RADIAN

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1114-PAH-OUT-01

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/14/83 TIME START: 8:13 TIME FINISH: 10: 3

Run C-3

REMARKS: SILICA GEL PLUGGED; FIXED & LEAK OK

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 152.6 | (F) | 67.0 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.36 | "HG | 72.03 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 26.08 | LB/LB-MOLE | 26.0849 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 27.58 | % | 27.58 | % |
| AVERAGE FLUE GAS VELOCITY | 44.3604 | FPS | 13.5211 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 20484. | ACFM | 580. | M3/MIN |
| | 12116. | DSCFM | 343. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 48.5398 | DSCF | 1.3746 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 248.8 | (F) | 120.4 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 46.1 | (F) | 7.8 | (C) |
| MAXIMUM LINE VACUUM | 9.8 | "HG | 24.89 | CMHG |
| FINAL LEAK RATE | .016 | CFM | .0005 | M3/MIN |
| PERCENT ISOKINETIC | 99.3 | % | 99.3 | % |
| PARTICULATE MASS CONCENTRATION | .332-001 | GR/DSCF | .759-001 | GMS/M3 |
| | .474-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .345+001 | LBS/HR | .156+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1114-PAH-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run C-3

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 29.32 | 157.00 |
| 1-3 | 25.35 | 155.00 |
| 1-2 | 25.31 | 155.00 |
| 1-1 | 25.29 | 152.00 |
| STOP | | |
| 2-4 | 52.56 | 150.00 |
| STOP | | |
| 2-3 | 48.46 | 155.00 |
| 2-2 | 45.80 | 152.00 |
| 2-1 | 38.60 | 151.00 |
| STOP | | |
| 3-4 | 56.50 | 151.00 |
| 3-3 | 52.69 | 155.00 |
| 3-2 | 48.54 | 155.00 |
| 3-1 | 38.69 | 154.00 |
| STOP | | |
| 4-4 | 54.59 | 151.00 |
| 4-3 | 52.69 | 155.00 |
| 4-2 | 48.42 | 152.00 |
| 4-1 | 41.30 | 152.00 |
| STOP | | |
| 5-4 | 56.55 | 152.00 |
| 5-3 | 54.63 | 152.00 |
| 5-2 | 50.58 | 152.00 |
| 5-1 | 46.10 | 150.00 |
| STOP | | |
| 6-4 | 48.42 | 152.00 |
| 6-3 | 46.17 | 152.00 |
| 6-2 | 41.43 | 156.00 |
| 6-1 | 38.66 | 155.00 |
| STOP | | |

APPENDIX A.1

CONVENTIONAL OPERATION DATA

INCLUDES

A.1.2 Particle Size Distribution
A.1.2.1 Uncontrolled Particle Size Distribution Emission Data

SUMMARY OF UNCONTROLLED PARTICLE SIZE
DISTRIBUTION SAMPLING DATA COLLECTED AT THE
T.J. CAMPBELL ASPHALT PLANT DURING
CONVENTIONAL OPERATION

| Run Number | C-1 | C-2 | C-3 |
|---|---|---|---|
| Date | 11-12-83 | 11-14-83 | 11-15-83 |
| Total mass collected (grams) | 7.2943 | 5.7616 | 9.9928 |
| Total meter volume | 11.549 | 13.798 | 15.006 |
| Barometric pressure (inches Hg) | 28.495 | 28.32 | 28.825 |
| Orifice pressure drop ($\Delta H$) inches $H_2O$ | 0.11 | 0.10 | 0.10 |
| Meter temperature (°F) | 83 | 72 | 77 |
| Dry gas fraction | .622 | .584 | .575 |
| Stack temperature (°F) | 318 | 303 | 298 |
| Static pressure (inches Hg) | -1.20 | -1.20 | -1.20 |
| Sample time (minutes) | 62 | 77 | 81 |
| Molecular weight wet (grams/gram-mole) | 24.970 | 24.526 | 28.40 |
| Percent isokinetic | 103 | 103 | 112 |
| Particle density (grams/cc) | 1.0 | 1.0 | 1.0 |
| Stage 1 (grams collected) | 2.9926 | 1.5725 | 3.2178 |
| Stage 2 (grams collected) | 1.2359 | 1.0991 | 2.3035 |
| Cyclone (grams collected) | 1.0506 | 0.8769 | 1.3990 |
| Filter (grams collected) | 2.0152 | 2.2131 | 3.0625 |
| Volume of gas sampled (DSCF) | 10.704 | 12.964 | 14.218 |
| Particulate concentration (gr/DSCF) | 10.5 | 6.9 | 10.8 |
| Volumetric flow rate (ACFM) | 29,900 | 30,600 | 29,100 |

APPENDIX A.1

CONVENTIONAL OPERATION DATA

INCLUDES

A.1.3 Polynuclear Aromatic Hydrocarbons
A.1.3.1 Uncontrolled Polynuclear Aromatic Hydrocarbon Emission Data

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run PAH C-1

PLANT NAME CAMPBELL ASPHALT
SAMPLING LOCATION INLET
SAMPLE IDENT. CAM-1114-BAP-IN-C1
DATE 11/14/83 (MMDDYY) TIME START 13: 1 (HHMM) TIME FINISH 14:26 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 26.32 "HG
STATIC PRESS. -1.2 "H20 .0
INITIAL LEAK RATE .019 CFM
FINAL LEAK RATE .000 CFM
OPERATOR INITIALSEPA/VAL

TEST DURATION 35. MIN.
% CO .0 % N2 89.2
% CO2 6.1 % H2 .0
% O2 4.7 % CH4 .0
CONDENSED WATER 189.1 GMS
FILTER WT. GAIN .00000 GMS
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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 1301. | 931.891 | .13 | .24 | 284. | 71. | 72. | 235. | 62. | 4.5 |
| 1-2 | 1304. | 932.740 | .24 | .40 | 338. | 71. | 71. | 245. | 62. | 7.0 |
| 1-3 | 1307. | 933.880 | .24 | .40 | 348. | 71. | 70. | 250. | 62. | 7.0 |
| 1-4 | 1310. | 935.030 | .24 | .40 | 351. | 70. | 70. | 250. | 62. | 7.0 |
| STOP | 1313. | 936.217 | | | | | | | | |
| 2-1 | 1315. | 936.217 | .15 | .25 | 269. | 70. | 70. | 250. | 62. | 7.0 |
| STOP | 1318. | 937.030 | | | | | | | | |
| 2-2 | 1404. | 937.030 | .17 | .28 | 297. | 67. | 66. | 250. | 59. | 7.5 |
| 2-3 | 1406. | 937.600 | .20 | .33 | 309. | 66. | 65. | 250. | 58. | 8.5 |
| 2-4 | 1409. | 938.550 | .23 | .39 | 332. | 65. | 65. | 240. | 58. | 10.0 |
| STOP | 1412. | 939.784 | | | | | | | | |
| 3-1 | 1413. | 939.784 | .24 | .41 | 267. | 64. | 64. | 240. | 58. | 11.0 |
| 3-2 | 1416. | 940.870 | .26 | .44 | 297. | 64. | 64. | 245. | 58. | 12.5 |
| 3-3 | 1419. | 942.120 | .21 | .35 | 324. | 64. | 64. | 245. | 58. | 12.0 |
| 3-4 | 1422. | 943.150 | .15 | .25 | 328. | 64. | 63. | 250. | 54. | 10.5 |
| STOP | 1425. | 944.162 | | | | | | | | |
| 4-1 | 1426. | 944.162 | .25 | .42 | 269. | 63. | 63. | 250. | 54. | .0 |
| STOP | 1427. | 944.595 | | | | | | | | |

REMARKS NO LEAK CHECK, FINAL. GLASSWARE BROKE ON REMOVAL FROM PORT FLAT BOX 195F

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1114-BAP-IN-01

PLANT NAME: CAMPBELL ASPHALT — Run PAH C-1
SAMPLING LOCATION: INLET
DATE: 11/14/83 TIME START: 13: 1 TIME FINISH: 14:26

REMARKS: PG LEAK CHECK, FINAL, GLASSWARE BROKE ON REMOVAL FROM PORT ~~HEAT~~ HO BOX 195F

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 313.3 | (F) | 156.3 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.23 | "HG | 71.71 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 24.45 | LB/LB-MOLE | 24.4492 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 42.23. | % | 42.23 | % |
| AVERAGE FLUE GAS VELOCITY | 34.5129 | FPS | 10.5195 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 27458. | ACFM | 778. | M3/MIN |
| | 10217. | DSCFM | 289. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 12.2608 | DSCF | .3472 | M3 |
| TEST DURATION | 35. | MIN | 35. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 246.2 | (F) | 119.0 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 59.0 | (F) | 15.0 | (C) |
| MAXIMUM LINE VACUUM | 12.5 | "HG | 31.75 | CMHG |
| FINAL LEAK RATE | .000 | CFM | .0000 | M3/MIN |
| PERCENT ISOKINETIC | 111.3 | % | 111.3 | % |
| 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: CAM-1114-BAP-IN-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run PAH C-1

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-1 | 26.87 | 284.00 |
| 1-2 | 37.82 | 338.00 |
| 1-3 | 38.05 | 348.00 |
| 1-4 | 38.12 | 351.00 |
| STOP | | |
| 2-1 | 28.96 | 287.00 |
| STOP | | |
| 2-2 | 31.00 | 297.00 |
| 2-3 | 33.89 | 307.00 |
| 2-4 | 36.88 | 332.00 |
| STOP | | |
| 3-1 | 36.59 | 287.00 |
| 3-2 | 38.33 | 297.00 |
| 3-3 | 35.06 | 324.00 |
| 3-4 | 29.71 | 328.00 |
| STOP | | |
| 4-1 | 37.39 | 287.00 |
| STOP | | |

APPENDIX A.1

CONVENTIONAL OPERATION DATA

INCLUDES

A.1.3 Polynuclear Aromatic Hydrocarbons
A.1.3.2 Controlled Polynuclear Aromatic Hydrocarbon Emission Data

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run PAH C-1

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1114-BAP-OUT-01
DATE 11/14/83 (MMDDYY) TIME START 12: 9 (HHMM) TIME FINISH 14:26 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.32 "HG
STATIC PRESS. .5 "H2O .0
INITIAL LEAK RATE .020 CFM
FINAL LEAK RATE .012 CFM
OPERATOR INITIALSMJK/TWT

TEST DURATION 83. MIN.

| | | | |
|---|---|---|---|
| % CO | .0 | % N2 | 89.2 |
| % CO2 | 6.1 | % H2 | .0 |
| % O2 | 4.7 | % CH4 | .0 |

CONDENSED WATER 423.3 GMS
FILTER WT. GAIN .00000 GMS
PROPE 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 1209. | 389.100 | .20 | .34 | 158. | 60. | 60. | 245. | 48. | 1.0 |
| 1-3 | 1213. | 390.550 | .15 | .26 | 159. | 58. | 57. | 250. | 47. | .9 |
| 1-2 | 1217. | 391.770 | .15 | .26 | 157. | 58. | 57. | 250. | 48. | .9 |
| 1-1 | 1221. | 392.960 | .15 | .26 | 157. | 58. | 56. | 250. | 48. | .9 |
| STOP | 1225. | 394.151 | | | | | | | | |
| 2-4 | 1226. | 394.151 | .70 | 1.18 | 159. | 58. | 57. | 250. | 47. | 5.9 |
| 2-3 | 1230. | 396.660 | .60 | 1.01 | 158. | 59. | 57. | 250. | 62. | 5.8 |
| 2-2 | 1234. | 399.060 | .50 | .84 | 158. | 60. | 58. | 250. | 60. | 4.7 |
| 2-1 | 1238. | 401.210 | .40 | .67 | 158. | 59. | 58. | 250. | 56. | 3.9 |
| STOP | 1242. | 403.139 | | | | | | | | |
| 3-4 | 1243. | 403.139 | .70 | 1.18 | 157. | 59. | 58. | 250. | 52. | 6.5 |
| 3-3 | 1247. | 405.630 | .65 | 1.09 | 157. | 60. | 56. | 250. | 53. | 6.1 |
| 3-2 | 1251. | 408.080 | .55 | .92 | 158. | 60. | 58. | 250. | 52. | 5.2 |
| 3-1 | 1255. | 410.370 | .45 | .76 | 156. | 60. | 59. | 250. | 53. | 4.5 |
| STOP | 1259. | 412.425 | | | | | | | | |
| 4-4 | 1306. | 412.425 | .75 | 1.26 | 153. | 61. | 59. | 250. | 49. | 6.7 |
| 4-3 | 1310. | 415.030 | .65 | 1.09 | 154. | 60. | 58. | 250. | 51. | 6.0 |
| 4-2 | 1314. | 417.480 | .55 | .92 | 158. | 60. | 59. | 250. | 52. | 5.3 |
| STOP | 1318. | 419.750 | | | | | | | | |
| 4-1 | 1401. | 419.750 | .45 | .76 | 162. | 57. | 58. | 250. | 46. | 5.0 |
| STOP | 1405. | 421.800 | | | | | | | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run PAH C-1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-4 | 1406. | 421.000 | .75 | 1.26 | 158. | 57. | 56. | 250. | 45. | 7.1 |
| 5-3 | 1410. | 424.400 | .75 | 1.26 | 157. | 56. | 56. | 250. | 46. | 7.1 |
| 5-2 | 1414. | 427.020 | .55 | .92 | 158. | 56. | 56. | 250. | 45. | 5.2 |
| 5-1 | 1418. | 429.320 | .50 | .84 | 160. | 57. | 56. | 250. | 46. | 5.1 |
| STOP | 1422. | 431.440 | | | | | | | | |
| 6-6 | 1423. | 431.440 | .60 | 1.01 | 160. | 56. | 57. | 250. | 47. | 6.1 |
| STOP | 1426. | 432.905 | | | | | | | | |

REMARKS RUN STOPPED! PLANT DOWN

# SOURCE SAMPLING RESULTS SUMMARY
## SAMPLE IDENT: CAM-1114-BAP-OUT-01

PLANT NAME: CAMPBELL — Run PAH C-1
SAMPLING LOCATION: OUTLET
DATE: 11/14/83 TIME START: 12: 9 TIME FINISH: 14:26

REMARKS: RUN STOPPED: PLANT DOWN

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 157.7 | (F) | 69.8 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.36 | MHG | 72.03 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | MH2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.57 | LB/LB-MOLE | 25.5692 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 32.20 | % | 32.20 | % |
| AVERAGE FLUE GAS VELOCITY | 46.2370 | FPS | 14.0931 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21350. | ACFM | 605. | M3/MIN |
| | 11726. | DSCFM | 332. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 42.2478 | DSCF | 1.1965 | M3 |
| TEST DURATION | 35. | MIN | 83. | MIN |
| TEMPERATURE AT THE PARTICULATE COLLECTED | 249.8 | (F) | 121.0 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 50.1 | (F) | 10.1 | (C) |
| TOTAL LINE VACUUM | 7.1 | MHG | 18.03 | CMHG |
| LEAK RATE | .012 | CFM | .0003 | M3/MIN |
| PERCENT ISOKINETIC | 103.2 | % | 103.2 | % |
| 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: CAM-1114-BAP-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run PAH C-1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 29.64 | 158.00 |
| 1-3 | 25.69 | 159.00 |
| 1-2 | 25.65 | 157.00 |
| 1-1 | 25.65 | 157.00 |
| STOP | | |
| 2-4 | 55.49 | 159.00 |
| 2-3 | 51.34 | 158.00 |
| 2-2 | 46.86 | 158.00 |
| 2-1 | 41.92 | 158.00 |
| STOP | | |
| 3-4 | 55.40 | 157.00 |
| 3-3 | 53.39 | 157.00 |
| 3-2 | 49.15 | 158.00 |
| 3-1 | 44.39 | 156.00 |
| STOP | | |
| 4-4 | 57.16 | 159.00 |
| 4-3 | 53.26 | 154.00 |
| 4-2 | 49.15 | 158.00 |
| STOP | | |
| 4-1 | 44.60 | 162.00 |
| STOP | | |
| 5-4 | 57.39 | 158.00 |
| 5-3 | 57.35 | 157.00 |
| 5-2 | 49.15 | 158.00 |
| 5-1 | 46.94 | 160.00 |
| STOP | | |
| 6-4 | 51.42 | 160.00 |
| STOP | | |

APPENDIX A.2

RECYCLE OPERATION DATA

INCLUDES

A.2.1 Particulate Mass (Modified EPA Method 5E)
A.2.1.1 Uncontrolled Particulate Emission Data

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run Preliminary 1

PLANT NAME T.J. CAMPBELL
SAMPLING LOCATION INLET
SAMPLE IDENT. CAM-1110-TM-IN-01
DATE 11/10/83 (MMDDYY) TIME START 11:21 (HHMM) TIME FINISH 11:53 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .272 INCHES
BAR PRESS. 28.76 "HG
STATIC PRESS. -1.2 "H2O .0
INITIAL LEAK RATE .016 CFM
FINAL LEAK RATE .010 CFM
OPERATOR INITIALSEPA/TWT

TEST DURATION 30. MIN.
% CO .0 % N2 86.5
% CO2 4.7 % H2 .0
% O2 8.8 % CH4 .0
CONDENSED WATER 137.0 GMS
FILTER WT. GAIN 1.95210 GMS
PROBE WASH WT. GAIN 4.62530 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 | 1121. | 699.976 | .22 | .46 | 270. | 57. | 57. | 250. | 39. | 5.0 |
| 1-2 | 1124. | 701.200 | .30 | .63 | 306. | 57. | 57. | 250. | 39. | 6.2 |
| 1-3 | 1127. | 702.580 | .34 | .72 | 330. | 57. | 56. | 250. | 39. | 7.0 |
| 1-4 | 1130. | 704.020 | .33 | .69 | 332. | 57. | 56. | 250. | 39. | 7.1 |
| STOP | 1133. | 705.485 | | | | | | | | |
| 2-1 | 1134. | 705.485 | .23 | .48 | 304. | 56. | 55. | 250. | 39. | 6.0 |
| 2-2 | 1137. | 706.680 | .26 | .54 | 303. | 56. | 55. | 250. | 39. | 6.6 |
| 2-3 | 1140. | 707.950 | .26 | .54 | 296. | 57. | 56. | 250. | 42. | 6.6 |
| 2-4 | 1143. | 709.230 | .29 | .61 | 296. | 57. | 56. | 250. | 42. | 8.5 |
| STOP | 1146. | 710.592 | | | | | | | | |
| 3-1 | 1147. | 710.592 | .28 | .60 | 254. | 58. | 57. | 250. | 42. | 7.0 |
| 3-2 | 1150. | 711.910 | .35 | .73 | 259. | 57. | 56. | 250. | 42. | 9.0 |
| STOP | 1153. | 713.369 | | | | | | | | |

REMARKS HOT BOX 165 F 172

# SOURCE SAMPLING RESULTS SUMMARY
## SAMPLE IDENT: CAM-1110-TM-IN-01

PLANT NAME: T.J. CAMPBELL — Run Preliminary 1
SAMPLING LOCATION: INLET
DATE: 11/10/83 TIME START: 11:21 TIME FINISH: 11:53

REMARKS: HOT BOX 165 F 172

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 295.0 | (F) | 146.1 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.67 | "HG | 72.83 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.48 | LB/LB-MOLE | 25.4789 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 32.65 | % | 32.65 | % |
| AVERAGE FLUE GAS VELOCITY | 38.9266 | FPS | 11.8648 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 30970. | ACFM | 877. | M3/MIN |
| | 13977. | DSCFM | 396. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 13.3970 | DSCF | .3794 | M3 |
| TEST DURATION | 30. | MIN | 30. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.0 | (F) | 121.1 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 40.2 | (F) | 4.6 | (C) |
| MAXIMUM LINE VACUUM | 9.0 | "HG | 22.86 | CMHG |
| FINAL LEAK RATE | .010 | CFM | .0003 | M3/MIN |
| PERCENT ISOKINETIC | 104.5 | % | 104.5 | % |
| PARTICULATE MASS CONCENTRATION | .758+001 | GR/DSCF | .173+002 | GMS/M3 |
| | .108-002 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .908+003 | LBS/HR | .412+003 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1110-TM-IN-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run Preliminary 1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-1 | 33.66 | 270.00 |
| 1-2 | 40.26 | 306.00 |
| 1-3 | 43.53 | 330.00 |
| 1-4 | 42.94 | 332.00 |
| STOP | | |
| 2-1 | 35.21 | 304.00 |
| 2-2 | 37.41 | 303.00 |
| 2-3 | 37.24 | 296.00 |
| 2-4 | 39.33 | 296.00 |
| STOP | | |
| 3-1 | 37.55 | 254.00 |
| 3-2 | 42.13 | 259.00 |
| STOP | | |

CORPORATION

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run R-1

PLANT NAME CAMPBELL ASPHALT
SAMPLING LOCATION INLET
SAMPLE IDENT. CAM-111-TM-IN-01
DATE 11/11/83 (MMDDYY) TIME START 8:43 (HHMM) TIME FINISH 9:37 (HHMM)
DUCT DIMENSIONS 6.000X 2.200FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 28.79 "HG
STATIC PRESS. -1.2 "H20 .0
INITIAL LEAK RATE .012 CFM
FINAL LEAK RATE .005 CFM
OPERATOR INITIALS EPA

TEST DURATION 48. MIN.
% CO .0 % N2 85.1
% CO2 4.2 % H2 .0
% O2 10.7 % CH4 .0
CONDENSED WATER 142.1 GMS
FILTER WT. GAIN 1.54300 GMS
PROBE WASH WT. GAIN 2.83210 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 843. | 756.218 | .18 | .38 | 240. | 56. | 56. | 250. | 39. | 5.0 |
| 1-2 | 846. | 757.330 | .28 | .58 | 309. | 56. | 56. | 250. | 39. | 6.0 |
| 1-3 | 849. | 758.650 | .30 | .63 | 319. | 56. | 56. | 250. | 39. | 6.5 |
| 1-4 | 852. | 760.020 | .31 | .65 | 331. | 56. | 55. | 250. | 39. | 6.8 |
| STOP | 855. | 761.418 | | | | | | | | |
| 2-1 | 857. | 761.418 | .22 | .46 | 304. | 55. | 55. | 250. | 37. | 5.5 |
| 2-2 | 900. | 762.580 | .23 | .48 | 304. | 56. | 55. | 250. | 37. | 6.0 |
| 2-3 | 903. | 763.820 | .24 | .50 | 313. | 56. | 55. | 255. | 37. | 6.0 |
| 2-4 | 906. | 765.070 | .30 | .63 | 303. | 56. | 55. | 250. | 37. | 6.8 |
| STOP | 909. | 766.446 | | | | | | | | |
| 3-1 | 911. | 766.446 | .32 | .67 | 243. | 57. | 56. | 255. | 37. | 7.1 |
| 3-2 | 914. | 767.840 | .32 | .67 | 268. | 57. | 56. | 250. | 38. | 7.1 |
| 3-3 | 917. | 769.260 | .26 | .54 | 293. | 58. | 57. | 250. | 39. | 6.5 |
| 3-4 | 920. | 770.570 | .26 | .54 | 331. | 58. | 57. | 250. | 39. | 6.5 |
| STOP | 923. | 771.874 | | | | | | | | |
| 4-1 | 925. | 771.874 | .26 | .54 | 279. | 58. | 58. | 250. | 39. | 6.5 |
| 4-2 | 928. | 773.190 | .26 | .54 | 286. | 50. | 58. | 250. | 39. | 6.8 |
| 4-3 | 931. | 774.460 | .26 | .54 | 303. | 60. | 59. | 250. | 44. | 7.0 |
| 4-4 | 934. | 775.750 | .26 | .54 | 313. | 60. | 59. | 250. | 44. | 7.1 |
| STOP | 937. | 777.030 | | | | | | | | |

# SOURCE SAMPLING RESULTS SUMMARY
## SAMPLE IDENT: CAM-111-TM-IN-01

PLANT NAME: CAMPBELL ASPHALT
SAMPLING LOCATION: INLET
DATE: 11/11/83 TIME START: 6:43 TIME FINISH: 9:37

Run R-1

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 296.2 | (F) | 146.8 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.70 | "HG | 72.90 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 26.39 | LB/LB-MOLE | 26.3875 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 24.44 | % | 24.44 | % |
| AVERAGE FLUE GAS VELOCITY | 36.9210 | FPS | 11.2535 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 29241. | ACFM | 828. | M3/MIN |
| | 14797. | DSCFM | 419. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 20.8275 | DSCF | .5898 | M3 |
| TEST DURATION | 48. | MIN | 48. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.6 | (F) | 121.4 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 38.9 | (F) | 3.9 | (C) |
| MAXIMUM LINE VACUUM | 7.1 | "HG | 18.03 | CMHG |
| FINAL LEAK RATE | .005 | CFM | .0001 | M3/MIN |
| PERCENT ISOKINETIC | 94.8 | % | 94.8 | % |
| PARTICULATE MASS CONCENTRATION | .324+001 | GR/DSCF | .742+001 | GMS/M3 |
| | .463-003 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .411+003 | LBS/HR | .187+003 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-111-TM-IN-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-1

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-1 | 29.28 | 240.00 |
| 1-2 | 38.28 | 309.00 |
| 1-3 | 39.88 | 319.00 |
| 1-4 | 40.85 | 331.00 |
| STOP | | |
| 2-1 | 33.82 | 304.00 |
| 2-2 | 34.58 | 304.00 |
| 2-3 | 35.53 | 315.00 |
| 2-4 | 39.47 | 305.00 |
| STOP | | |
| 3-1 | 39.12 | 245.00 |
| 3-2 | 39.81 | 268.00 |
| 3-3 | 36.50 | 295.00 |
| 3-4 | 37.41 | 331.00 |
| STOP | | |
| 4-1 | 36.16 | 279.00 |
| 4-2 | 36.33 | 286.00 |
| 4-3 | 36.74 | 305.00 |
| 4-4 | 36.98 | 315.00 |
| STOP | | |

CORPORATION

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run R-2

PLANT NAME CAMPBELL
SAMPLING LOCATION INLET
SAMPLE IDENT. CAM-1111-PAH-IN-02
DATE 11/11/83 (MMDDYY) TIME START 16:45 (HHMM) TIME FINISH 17:30 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 28.79 "HG
STATIC PRESS. -1.2 "H20 .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .010 CFM
OPERATOR INITIALSEPA/MUF

TEST DURATION 42. MIN.

| | | | |
|---|---|---|---|
| % CO | .0 | % N2 | 86.5 |
| % CO2 | 4.7 | % H2 | .0 |
| % O2 | 8.8 | % CH4 | .0 |

CONDENSED WATER 180.0 GMS
FILTER WT. GAIN 2.09980 GMS
PROBE WASH WT. GAIN 3.16250 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 1645. | 788.846 | .18 | .47 | 305. | 76. | 76. | 245. | 48. | 3.8 |
| 1-2 | 1648. | 790.060 | .24 | .63 | 348. | 76. | 75. | 255. | 48. | 4.0 |
| 1-3 | 1651. | 791.490 | .24 | .67 | 347. | 75. | 74. | 255. | 48. | 4.2 |
| 1-4 | 1654. | 792.930 | .24 | .65 | 347. | 75. | 75. | 250. | 48. | 4.4 |
| STOP | 1657. | 794.367 | | | | | | | | |
| 2-1 | 1658. | 794.367 | .16 | .42 | 292. | 73. | 73. | 250. | 48. | 3.9 |
| 2-2 | 1701. | 795.530 | .19 | .50 | 311. | 73. | 73. | 250. | 48. | 4.1 |
| 2-3 | 1704. | 796.800 | .20 | .52 | 318. | 73. | 72. | 250. | 48. | 4.0 |
| 2-4 | 1707. | 798.090 | .24 | .66 | 335. | 73. | 72. | 250. | 48. | 4.5 |
| STOP | 1710. | 799.525 | | | | | | | | |
| 3-1 | 1711. | 799.525 | .25 | .66 | 268. | 72. | 71. | 250. | 48. | 4.5 |
| 3-2 | 1714. | 801.000 | .25 | .66 | 300. | 71. | 71. | 250. | 48. | 5.0 |
| 3-3 | 1717. | 802.440 | .22 | .58 | 318. | 71. | 70. | 250. | 48. | 5.0 |
| 3-4 | 1720. | 803.960 | .18 | .48 | 320. | 71. | 70. | 250. | 49. | 5.0 |
| STOP | 1723. | 805.101 | | | | | | | | |
| 4-1 | 1724. | 805.101 | .26 | .69 | 271. | 70. | 69. | 250. | 49. | 5.6 |
| 4-2 | 1727. | 806.530 | .22 | .58 | 310. | 70. | 69. | 250. | 49. | 6.0 |
| STOP | 1730. | 807.963 | | | | | | | | |

REMARKS HOT BOX 185 @ 1704

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-PAH-IN-02

PLANT NAME: CAMPBELL
SAMPLING LOCATION: INLET
DATE: 11/11/83 TIME START: 16:45 TIME FINISH: 17:50

Run R-2

REMARKS: HOT BOX 185 @ 1704

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 313.6 | (F) | 156.4 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.70 | "HG | 72.90 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.61 | LB/LB-MOLE | 25.6080 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 31.48 | % | 31.48 | % |
| AVERAGE FLUE GAS VELOCITY | 34.3975 | FPS | 10.4844 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 27367. | ACFM | 775. | M3/MIN |
| | 12275. | DSCFM | 348. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 18.5676 | DSCF | .5258 | M3 |
| TEST DURATION | 42. | MIN | 42. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.4 | (F) | 121.3 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 48.2 | (F) | 9.0 | (C) |
| MAXIMUM LINE VACUUM | 6.0 | "HG | 15.24 | CMHG |
| FINAL LEAK RATE | .010 | CFM | .0003 | M3/MIN |
| PERCENT ISOKINETIC | 116.9 | % | 116.9 | % |
| PARTICULATE MASS CONCENTRATION | .437+001 | GR/DSCF | .100+002 | GMS/M3 |
| | .625-003 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .460+003 | LBS/HR | .209+003 | KG/HR |

Previous Run
Same operating conditions
24.4% Moisture

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-PAH-IN-02

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-2

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-1 | 31.07 | 305.00 |
| 1-2 | 36.67 | 348.00 |
| 1-3 | 36.85 | 347.00 |
| 1-4 | 36.85 | 347.00 |
| STOP | | |
| 2-1 | 29.05 | 292.00 |
| 2-2 | 32.05 | 311.00 |
| 2-3 | 33.03 | 318.00 |
| 2-4 | 36.58 | 335.00 |
| STOP | | |
| 3-1 | 35.72 | 268.00 |
| 3-2 | 36.50 | 300.00 |
| 3-3 | 34.64 | 318.00 |
| 3-4 | 31.38 | 320.00 |
| STOP | | |
| 4-1 | 36.51 | 271.00 |
| 4-2 | 34.46 | 310.00 |
| STOP | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-3

PLANT NAME CAMPBELL
SAMPLING LOCATION INLET
SAMPLE IDENT. CAM-1112-PAH-IN-01
DATE 11/12/83 (MMDDYY) TIME START 7:46 (HHMM) TIME FINISH 8:46 (HHMM)
DUCT DIMENSIONS 6.000X 2.210FT.
PTCF .84 DGMCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 28.49 "HG
STATIC PRESS. -1.2 "H20 .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .004 CFM
OPERATOR INITIALSEPA/MUF

TEST DURATION 48. MIN.
% CO .0 % N2 87.8
% CO2 4.9 % H2 .0
% O2 7.3 % CH4 .0
CONDENSED WATER 185.6 GMS
FILTER WT. GAIN 1.99900 GMS
PROBE WASH WT. GAIN 3.57460 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 748. | 814.464 | .20 | .51 | 300. | 53. | 54. | 255. | 37. | 3.2 |
| 1-2 | 751. | 815.740 | .28 | .72 | 334. | 54. | 54. | 250. | 37. | 4.0 |
| 1-3 | 754. | 817.180 | .28 | .72 | 344. | 55. | 54. | 250. | 37. | 4.0 |
| 1-4 | 757. | 818.660 | .28 | .72 | 362. | 56. | 54. | 250. | 37. | 4.0 |
| STOP | 800. | 820.139 | | | | | | | | |
| 2-1 | 801. | 820.139 | .22 | .56 | 290. | 55. | 55. | 250. | 37. | 3.8 |
| 2-2 | 804. | 821.430 | .21 | .53 | 304. | 56. | 55. | 250. | 37. | 3.8 |
| STOP | 805. | 822.016 | | | | | | | | |
| 2-2 | 811. | 822.016 | .21 | .53 | 305. | 56. | 57. | 250. | 37. | 3.8 |
| 2-3 | 813. | 822.900 | .23 | .60 | 330. | 57. | 57. | 250. | 37. | 4.0 |
| 2-4 | 816. | 824.260 | .27 | .67 | 347. | 57. | 57. | 250. | 37. | 4.3 |
| STOP | 819. | 825.685 | | | | | | | | |
| 3-1 | 820. | 825.685 | .31 | .80 | 289. | 58. | 57. | 250. | 37. | 4.8 |
| 3-2 | 823. | 827.220 | .32 | .83 | 302. | 58. | 57. | 250. | 37. | 5.0 |
| 3-3 | 826. | 829.760 | .26 | .66 | 317. | 58. | 57. | 250. | 39. | 5.0 |
| 3-4 | 829. | 830.200 | .26 | .66 | 328. | 59. | 58. | 250. | 39. | 5.2 |
| STOP | 832. | 831.634 | | | | | | | | |
| 4-1 | 834. | 831.634 | .39 | .86 | 284. | 59. | 58. | 258. | 39. | 6.2 |
| 4-2 | 837. | 833.270 | .26 | .66 | 306. | 59. | 58. | 250. | 39. | 6.0 |
| 4-3 | 840. | 834.700 | .25 | .64 | 323. | 59. | 58. | 250. | 39. | 6.2 |
| 4-4 | 843. | 836.110 | .28 | .72 | 324. | 60. | 59. | 250. | 39. | 7.5 |

CORPORATION

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-3

STOP 846. 837.594

REMARKS HOT BOX 172 @0821

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1112-PAH-IN-01

Run R-3

PLANT NAME: CAMPBELL
SAMPLING LOCATION: INLET
DATE: 11/12/63 TIME START: 7:46 TIME FINISH: 8:46

REMARKS: HOT BOX 172 60821

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 317.0 | (F) | 158.3 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.41 | "HG | 72.15 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 26.00 | LB/LB-MOLE | 26.0038 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 27.74 | % | 27.74 | % |
| AVERAGE FLUE GAS VELOCITY | 37.7832 | FPS | 11.5163 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 30060. | ACFM | 851. | M3/MIN |
| | 14012. | DSCFM | 397. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 22.9191 | DSCF | .6491 | M3 |
| TEST DURATION | 48. | MIN | 48. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.8 | (F) | 121.5 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 37.7 | (F) | 3.2 | (C) |
| MAXIMUM LINE VACUUM | 7.5 | "HG | 19.05 | CMHG |
| FINAL LEAK RATE | .004 | CFM | .0001 | M3/MIN |
| PERCENT ISOKINETIC | 110.6 | % | 110.6 | % |
| PARTICULATE MASS CONCENTRATION | .375+001 | GR/DSCF | .859+001 | GMS/M3 |
| | .536-003 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .451+003 | LBS/HR | .205+003 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1112-PAH-IN-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-3

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-1 | 32.56 | 300.00 |
| 1-2 | 39.38 | 334.00 |
| 1-3 | 39.63 | 344.00 |
| 1-4 | 40.07 | 364.00 |
| STOP | | |
| 2-1 | 33.93 | 290.00 |
| 2-2 | 33.46 | 304.00 |
| STOP | | |
| 2-2 | 33.48 | 305.00 |
| 2-3 | 35.60 | 330.00 |
| 2-4 | 38.99 | 347.00 |
| STOP | | |
| 3-1 | 40.25 | 287.00 |
| 3-2 | 41.25 | 302.00 |
| 3-3 | 37.54 | 317.00 |
| 3-4 | 37.81 | 328.00 |
| STOP | | |
| 4-1 | 44.99 | 284.00 |
| 4-2 | 37.28 | 306.00 |
| 4-3 | 36.96 | 323.00 |
| 4-4 | 39.14 | 324.00 |
| STOP | | |

APPENDIX A.2

RECYCLE OPERATION DATA

INCLUDES

A.2.1 Particulate Mass (Modified EPA Method 5E)
A.2.1.2 Controlled Particulate Emission Data

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run Preliminary 1

PLANT NAME T.J. CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1110-TM-OUT-01
DATE 11/10/83 (MMDDYY) TIME START 10:43 (HHMM) TIME FINISH 11:50 (HHMM)
DUCT DIMENSIONS 2.600X 2.960FT.
PTCF .84 DGMCF .994
TEST DURATION 60. MIN.
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.77 "HG
STATIC PRESS. .5 "H2O .0
INITIAL LEAK RATE .016 CFM
FINAL LEAK RATE .020 CFM
OPERATOR INITIALS MJK/VLL

| | |
|---|---|
| % CO | .0 |
| % CO2 | 4.2 |
| % O2 | 10.7 |
| % N2 | 85.1 |
| % H2 | .0 |
| % CH4 | .0 |
| CONDENSED WATER | 227.1 GMS |
| FILTER WT. GAIN | .03710 GMS |
| PROBE WASH WT. GAIN | .06200 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 1043. | 988.310 | .60 | 1.01 | 151. | 45. | 45. | 250. | 40. | 4.0 |
| 1-3 | 1048. | 991.130 | .35 | .59 | 165. | 46. | 44. | 250. | 38. | 3.2 |
| 1-2 | 1053. | 993.390 | .20 | .34 | 157. | 43. | 43. | 250. | 37. | 3.0 |
| 1-1 | 1058. | 995.140 | .20 | .34 | 151. | 42. | 42. | 250. | 36. | 3.0 |
| STOP | 1103. | 996.934 | | | | | | | | |
| 2-4 | 1105. | 996.934 | .85 | 1.43 | 150. | 44. | 43. | 250. | 38. | 9.8 |
| 2-3 | 1110. | 1000.240 | .65 | 1.09 | 152. | 44. | 44. | 250. | 36. | 7.9 |
| 2-2 | 1115. | 1003.240 | .45 | .76 | 154. | 46. | 44. | 250. | 36. | 6.2 |
| 2-1 | 1120. | 1005.810 | .30 | .50 | 157. | 44. | 44. | 250. | 37. | 5.0 |
| STOP | 1125. | 1007.850 | | | | | | | | |
| 3-4 | 1130. | 1007.850 | .85 | 1.43 | 154. | 47. | 46. | 250. | 39. | 6.9 |
| 3-3 | 1135. | 1011.230 | .75 | 1.26 | 155. | 47. | 46. | 250. | 40. | 6.1 |
| 3-2 | 1140. | 1014.440 | .55 | .92 | 156. | 47. | 46. | 250. | 39. | 5.1 |
| 3-1 | 1145. | 1017.360 | .30 | .50 | 165. | 46. | 46. | 250. | 40. | 3.3 |
| STOP | 1150. | 1019.350 | | | | | | | | |

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1110-TM-OUT-01

PLANT NAME: T.J. CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/10/83 TIME START: 10:43 TIME FINISH: 11:50

Run Preliminary 1

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 155.6 | (F) | 68.7 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.81 | "HG | 73.17 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 26.25 | LB/LB-MOLE | 26.2538 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 25.64 | % | 25.64 | % |
| AVERAGE FLUE GAS VELOCITY | 44.6937 | FPS | 13.6226 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 20638. | ACFM | 584. | M3/MIN |
| | 12672. | DSCFM | 359. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 31.2161 | DSCF | .8840 | M3 |
| TEST DURATION | 60. | MIN | 60. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 250.0 | (F) | 121.1 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 38.0 | (F) | 3.3 | (C) |
| MAXIMUM LINE VACUUM | 9.8 | "HG | 24.89 | CMHG |
| FINAL LEAK RATE | .020 | CFM | .0006 | M3/MIN |
| PERCENT ISOKINETIC | 97.7 | % | 97.7 | % |
| PARTICULATE MASS CONCENTRATION | .490-001 | GR/DSCF | .112+000 | GMS/M3 |
| | .700-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .532+001 | LBS/HR | .241+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1110-TM-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run Preliminary 1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 49.99 | 151.00 |
| 1-3 | 38.61 | 165.00 |
| 1-2 | 29.00 | 157.00 |
| 1-1 | 28.86 | 151.00 |
| STOP | | |
| 2-4 | 59.44 | 150.00 |
| 2-3 | 52.06 | 152.00 |
| 2-2 | 43.39 | 154.00 |
| 2-1 | 35.51 | 157.00 |
| STOP | | |
| 3-4 | 59.63 | 154.00 |
| 3-3 | 56.06 | 155.00 |
| 3-2 | 48.05 | 156.00 |
| 3-1 | 35.74 | 165.00 |
| STOP | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-1

PLANT NAME T.J. CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1111-OUT-IM-01
DATE 11/11/83 (MMDDYY) TIME START 8:39 (HHMM) TIME FINISH 14:33 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.79 "HG
STATIC PRESS. .5 "H2O .0
INITIAL LEAK RATE .010 CFM
FINAL LEAK RATE .006 CFM
OPERATOR INITIALS MJK/VLL

TEST DURATION 93. MIN.
% CO .0 % N2 85.1
% CO2 4.2 % H2 .0
% O2 10.7 % CH4 .0
CONDENSED WATER 325.7 GMS
FILTER WT. GAIN .02420 GMS
PROBE WASH WT. GAIN .05980 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 839. | 38.353 | .25 | .42 | 139. | 47. | 48. | 250. | 39. | 2.2 |
| 1-3 | 843. | 39.800 | .20 | .34 | 143. | 45. | 45. | 250. | 40. | 2.0 |
| 1-2 | 847. | 41.150 | .40 | .67 | 145. | 44. | 44. | 250. | 41. | 3.0 |
| 1-1 | 851. | 42.940 | .55 | .92 | 145. | 43. | 42. | 250. | 41. | 4.0 |
| STOP | 855. | 45.259 | | | | | | | | |
| 2-4 | 857. | 45.259 | .40 | .67 | 139. | 43. | 42. | 245. | 40. | 3.1 |
| 2-3 | 901. | 47.120 | .40 | .67 | 145. | 44. | 43. | 250. | 39. | 3.1 |
| 2-2 | 905. | 49.200 | .55 | 1.35 | 143. | 44. | 42. | 250. | 39. | 5.3 |
| 2-1 | 909. | 51.740 | .70 | 1.70 | 140. | 45. | 43. | 250. | 40. | 6.6 |
| STOP | 913. | 54.713 | | | | | | | | |
| 3-4 | 915. | 54.713 | .35 | .86 | 135. | 46. | 44. | 250. | 41. | 3.9 |
| 3-3 | 919. | 56.860 | .40 | 1.00 | 136. | 47. | 46. | 250. | 42. | 4.1 |
| 3-2 | 923. | 59.180 | .40 | 1.00 | 142. | 47. | 45. | 250. | 42. | 4.1 |
| 3-1 | 927. | 61.500 | .40 | 1.30 | 144. | 46. | 45. | 250. | 42. | 5.2 |
| STOP | 931. | 64.011 | | | | | | | | |
| 4-4 | 955. | 64.011 | .75 | 1.80 | 147. | 55. | 55. | 250. | 43. | 6.9 |
| STOP | 956. | 65.110 | | | | | | | | |
| 4-4 | 1007. | 65.440 | .75 | 1.80 | 147. | 55. | 55. | 250. | 44. | 6.9 |
| 4-3 | 1010. | 67.680 | .75 | 1.80 | 143. | 47. | 45. | 250. | 40. | 6.9 |
| STOP | 1012. | 69.428 | | | | | | | | |
| 4-3 | 1344. | 73.555 | .75 | 1.80 | 145. | 71. | 72. | 250. | 56. | 6.9 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4-2 | 1346. | 74.980 | .70 | 1.70 | 152. | 74. | 71. | 250. | 54. | 6.6 |
| 4-1 | 1350. | 78.010 | .55 | 1.32 | 155. | 68. | 68. | 250. | 53. | 5.5 |
| STOP | 1354. | 80.636 | | | | | | | | |
| 5-4 | 1356. | 80.636 | .75 | 1.80 | 147. | 62. | 63. | 250. | 50. | 6.9 |
| 5-3 | 1400. | 83.630 | .75 | 1.80 | 153. | 64. | 65. | 250. | 52. | 6.9 |
| 5-2 | 1404. | 86.640 | .55 | 1.32 | 156. | 63. | 63. | 245. | 54. | 5.8 |
| 5-1 | 1408. | 89.500 | .45 | 1.09 | 157. | 61. | 60. | 240. | 54. | 5.0 |
| STOP | 1412. | 91.881 | | | | | | | | |
| 6-4 | 1420. | 91.881 | .60 | 1.45 | 146. | 66. | 66. | 250. | 56. | 6.3 |
| 6-3 | 1424. | 94.580 | .60 | 1.45 | 154. | 65. | 64. | 250. | 57. | 6.3 |
| 6-2 | 1428. | 97.300 | .55 | 1.32 | 156. | 66. | 65. | 250. | 57. | 5.9 |
| 6-1 | 1432. | 100.060 | .35 | .86 | 157. | 66. | 64. | 250. | 56. | 3.9 |
| STOP | 1433. | 100.592 | | | | | | | | |

REMARKS BROKEN GLASSWARE; NEW GLASS LEAK OK
PROBE HEATER MALFUNCTION, CHANGED PROBE LINERS, LEAK CHECK OK

CORPORATION

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-OUT-TM-01

PLANT NAME: T.J. CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/11/83 TIME START: 8:39 TIME FINISH: 14:33

Run R-1

REMARKS: BROKEN GLASSWARE; NEW GLASS LEAK OK
PROBE HEATER MALFUNCTION, CHANGED PROBE LINERS, LEAK CHECK OK

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 146.6 | (F) | 63.6 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.83 | "HG | 73.22 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 26.74 | LB/LB-MOLE | 26.7380 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 21.28 | % | 21.28 | % |
| AVERAGE FLUE GAS VELOCITY | 45.8687 | FPS | 13.9808 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21180. | ACFM | 600. | M3/MIN |
| | 13982. | DSCFM | 396. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 57.1107 | DSCF | 1.6174 | M3 |
| TEST DURATION | 93. | MIN | 93. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.2 | (F) | 120.7 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 46.7 | (F) | 8.2 | (C) |
| MAXIMUM LINE VACUUM | 6.9 | "HG | 17.53 | CMHG |
| FINAL LEAK RATE | .006 | CFM | .0002 | M3/MIN |
| PERCENT ISOKINETIC | 104.5 | % | 104.5 | % |
| PARTICULATE MASS CONCENTRATION | .227-001 | GR/DSCF | .519-001 | GMS/M3 |
| | .324-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .272+001 | LBS/HR | .123+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-OUT-TM-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 31.64 | 139.00 |
| 1-3 | 28.40 | 145.00 |
| 1-2 | 40.22 | 145.00 |
| 1-1 | 47.17 | 145.00 |
| STOP | | |
| 2-4 | 40.02 | 139.00 |
| 2-3 | 40.22 | 145.00 |
| 2-2 | 47.09 | 145.00 |
| 2-1 | 52.99 | 140.00 |
| STOP | | |
| 3-4 | 37.31 | 135.00 |
| 3-3 | 39.92 | 136.00 |
| 3-2 | 40.12 | 142.00 |
| 3-1 | 40.19 | 144.00 |
| STOP | | |
| 4-4 | 55.17 | 147.00 |
| STOP | | |
| 4-4 | 55.17 | 147.00 |
| 4-3 | 54.99 | 145.00 |
| STOP | | |
| 4-3 | 55.08 | 145.00 |
| 4-2 | 53.52 | 152.00 |
| 4-1 | 47.55 | 155.00 |
| STOP | | |
| 5-4 | 55.17 | 147.00 |
| 5-3 | 55.44 | 155.00 |
| 5-2 | 47.59 | 156.00 |
| 5-1 | 43.08 | 157.00 |
| STOP | | |
| 6-4 | 49.30 | 146.00 |
| 6-3 | 49.63 | 154.00 |
| 6-2 | 47.59 | 156.00 |
| 6-1 | 38.00 | 157.00 |

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-OUT-TM-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-1

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| STOP | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-2

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1111-PAH-OUT-02
DATE 11/11/83 (MMDDYY) TIME START 15:15 (HHMM). TIME FINISH 17: 4 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
TEST DURATION 96. MIN.
NOZZLE DIA. .243 INCHES
% CO .0 % N2 86.5
BAR PRESS. 28.79 "HG
% CO2 4.7 % H2 .0
STATIC PRESS. .5 "H20 .0
% O2 8.8 % CH4 .0
INITIAL LEAK RATE .018 CFM
CONDENSED WATER 553.0 GMS
FINAL LEAK RATE .019 CFM
FILTER WT. GAIN .02400 GMS
OPERATOR INITIALSMJK/TWT
PROBE WASH WT. GAIN .06420 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 1515. | 100.819 | .25 | .59 | 146. | 70. | 71. | 250. | 52. | 2.2 |
| 1-3 | 1519. | 102.530 | .20 | .48 | 151. | 66. | 65. | 250. | 54. | 2.0 |
| 1-2 | 1523. | 104.150 | .20 | .48 | 156. | 66. | 65. | 250. | 53. | 2.0 |
| 1-1 | 1527. | 105.760 | .15 | .34 | 157. | 64. | 62. | 250. | 52. | 1.0 |
| STOP | 1531. | 107.168 | | | | | | | | |
| 2-4 | 1533. | 107.168 | .80 | 1.95 | 147. | 60. | 60. | 250. | 48. | 5.0 |
| 2-3 | 1537. | 110.350 | .75 | 1.80 | 153. | 61. | 60. | 250. | 48. | 4.9 |
| 2-2 | 1541. | 113.430 | .75 | 1.80 | 156. | 62. | 60. | 250. | 48. | 4.9 |
| STOP | 1542. | 114.116 | | | | | | | | |
| 2-2 | 1545. | 114.116 | .55 | 1.32 | 157. | 62. | 62. | 250. | 49. | 3.9 |
| 2-1 | 1548. | 116.060 | .30 | .75 | 156. | 64. | 64. | 250. | 49. | 3.0 |
| STOP | 1552. | 118.127 | | | | | | | | |
| 3-4 | 1555. | 118.127 | .80 | 1.95 | 147. | 61. | 61. | 245. | 49. | 5.0 |
| 3-3 | 1559. | 121.220 | .70 | 1.70 | 152. | 64. | 63. | 250. | 48. | 4.6 |
| 3-2 | 1603. | 124.130 | .60 | 1.48 | 157. | 64. | 63. | 250. | 40. | 4.2 |
| 3-1 | 1607. | 126.840 | .45 | 1.09 | 158. | 62. | 62. | 250. | 51. | 3.2 |
| STOP | 1611. | 129.123 | | | | | | | | |
| 4-4 | 1613. | 129.123 | .80 | 1.95 | 146. | 62. | 61. | 245. | 49. | 5.1 |
| 4-3 | 1617. | 132.070 | .70 | 1.70 | 151. | 64. | 63. | 250. | 49. | 4.8 |
| 4-2 | 1621. | 134.980 | .55 | 1.32 | 154. | 64. | 62. | 250. | 48. | 4.0 |
| 4-1 | 1625. | 137.510 | .50 | 1.22 | 156. | 61. | 62. | 250. | 47. | 3.9 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-2

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STOP | 1629. | 139.950 | | | | | | | | |
| 5-4 | 1630. | 139.950 | .80 | 1.95 | 145. | 60. | 60. | 250. | 46. | 5.2 |
| 5-3 | 1634. | 143.060 | .70 | 1.70 | 151. | 60. | 60. | 250. | 46. | 4.8 |
| 5-2 | 1638. | 146.040 | .60 | 1.48 | 154. | 61. | 60. | 250. | 45. | 4.3 |
| 5-1 | 1642. | 148.800 | .50 | 1.22 | 156. | 60. | 60. | 250. | 45. | 4.0 |
| STOP | 1646. | 151.292 | | | | | | | | |
| 6-4 | 1648. | 151.292 | .70 | 1.70 | 144. | 60. | 60. | 250. | 48. | 4.9 |
| 6-3 | 1652. | 154.240 | .60 | 1.48 | 149. | 60. | 60. | 250. | 46. | 4.5 |
| 6-2 | 1656. | 156.990 | .50 | 1.22 | 153. | 60. | 59. | 250. | 45. | 4.2 |
| 6-1 | 1700. | 159.500 | .40 | .97 | 155. | 59. | 58. | 250. | 45. | 3.8 |
| STOP | 1704. | 161.746 | | | | | | | | |

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-PAH-OUT-02

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/11/83 TIME START: 1?:15 TIME FINISH: 17: 4

Run R-2

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 152.3 | (F) | 66.8 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.83 | "HG | 73.22 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 25.70 | LB/LB-MOLE | 25.7028 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 30.63 | % | 30.63 | % |
| AVERAGE FLUE GAS VELOCITY | 47.5375 | FPS | 14.4894 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21951. | ACFM | 622. | M3/MIN |
| | 12650. | DSCFM | 358. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 59.3629 | DSCF | 1.6812 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.6 | (F) | 120.9 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 48.3 | (F) | 9.1 | (C) |
| MAXIMUM LINE VACUUM | 5.2 | "HG | 13.21 | CMHG |
| FINAL LEAK RATE | .019 | CFM | .0005 | M3/MIN |
| PERCENT ISOKINETIC | 116.3 | % | 116.3 | % |
| PARTICULATE MASS CONCENTRATION | .229-001 | GR/DSCF | .525-001 | GMS/M3 |
| | .328-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .249+001 | LBS/HR | .113+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-PAH-OUT-02

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-2

| PT. | VELOCITY (FPS) | TEMPERATURE (°F) |
|---|---|---|
| 1-4 | 32.46 | 146.00 |
| 1-3 | 29.15 | 151.00 |
| 1-2 | 29.27 | 156.00 |
| 1-1 | 25.37 | 157.00 |
| STOP | | |
| 2-4 | 58.11 | 147.00 |
| 2-3 | 56.55 | 153.00 |
| 2-2 | 56.68 | 156.00 |
| STOP | | |
| 2-2 | 48.58 | 157.00 |
| 2-1 | 35.85 | 156.00 |
| STOP | | |
| 3-4 | 58.11 | 147.00 |
| 3-3 | 54.58 | 152.00 |
| 3-2 | 50.74 | 157.00 |
| 3-1 | 43.98 | 158.00 |
| STOP | | |
| 4-4 | 58.07 | 146.00 |
| 4-3 | 54.54 | 151.00 |
| 4-2 | 48.46 | 154.00 |
| 4-1 | 46.28 | 156.00 |
| STOP | | |
| 5-4 | 58.02 | 145.00 |
| 5-3 | 54.54 | 151.00 |
| 5-2 | 50.62 | 154.00 |
| 5-1 | 46.28 | 156.00 |
| STOP | | |
| 6-4 | 54.23 | 144.00 |
| 6-3 | 50.41 | 149.00 |
| 6-2 | 46.17 | 153.00 |
| 6-1 | 41.36 | 153.00 |
| STOP | | |

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run R-3

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1112-PAH-OUT-01
DATE 11/12/83 (MMDDYY) TIME START 7:13 (HHMM) TIME FINISH 9: 0 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.49 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .020 CFM
FINAL LEAK RATE .020 CFM
OPERATOR INITIALSMJK/TWT

TEST DURATION 96. MIN.
% CO .0 % N2 87.8
% CO2 4.9 % H2 .0
% O2 7.3 % CH4 .0
CONDENSED WATER 330.6 GMS
FILTER WT. GAIN .02400 GMS
PROBE WASH WT. GAIN .08730 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 713. | 178.184 | .25 | .60 | 141. | 43. | 43. | 250. | 40. | 1.0 |
| 1-3 | 717. | 179.990 | .25 | .60 | 141. | 42. | 42. | 250. | 40. | 1.0 |
| 1-2 | 721. | 181.800 | .20 | .48 | 139. | 42. | 42. | 245. | 39. | 1.0 |
| 1-1 | 725. | 183.380 | .20 | .48 | 140. | 42. | 42. | 250. | 38. | 1.0 |
| STOP | 729. | 184.902 | | | | | | | | |
| 2-4 | 730. | 184.902 | .80 | 1.90 | 141. | 43. | 43. | 250. | 40. | 4.2 |
| 2-3 | 734. | 187.970 | .60 | 1.40 | 142. | 44. | 42. | 250. | 40. | 3.7 |
| 2-2 | 738. | 190.680 | .50 | 1.20 | 142. | 44. | 42. | 245. | 41. | 3.4 |
| 2-1 | 742. | 193.090 | .40 | .98 | 141. | 44. | 43. | 250. | 41. | 3.0 |
| STOP | 746. | 195.355 | | | | | | | | |
| 3-4 | 750. | 195.355 | .80 | 1.90 | 140. | 45. | 45. | 245. | 42. | 4.9 |
| 3-3 | 754. | 198.440 | .70 | 1.65 | 144. | 46. | 45. | 250. | 42. | 4.8 |
| 3-2 | 758. | 201.350 | .60 | 1.40 | 141. | 46. | 44. | 250. | 41. | 4.3 |
| 3-1 | 802. | 204.050 | .40 | .98 | 141. | 45. | 44. | 250. | 41. | 3.3 |
| STOP | 806. | 206.375 | | | | | | | | |
| 4-4 | 810. | 206.375 | .80 | 1.90 | 144. | 46. | 45. | 250. | 42. | 5.1 |
| 4-3 | 814. | 209.450 | .70 | 1.65 | 145. | 47. | 46. | 245. | 41. | 4.9 |
| 4-2 | 818. | 212.370 | .55 | 1.30 | 143. | 46. | 45. | 250. | 41. | 4.0 |
| 4-1 | 822. | 214.990 | .45 | 1.10 | 141. | 46. | 45. | 245. | 40. | 3.6 |
| STOP | 826. | 217.380 | | | | | | | | |
| 5-4 | 827. | 217.380 | .80 | 1.90 | 143. | 47. | 46. | 250. | 41. | 5.3 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-3

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-3 | 831. | 220.480 | .75 | 1.78 | 141. | 47. | 45. | 250. | 40. | 5.1 |
| 5-2 | 835. | 223.470 | .60 | 1.40 | 141. | 48. | 47. | 250. | 40. | 4.6 |
| 5-1 | 839. | 226.180 | .50 | 1.20 | 141. | 47. | 46. | 250. | 40. | 4.1 |
| STOP | 843. | 228.691 | | | | | | | | |
| 6-4 | 844. | 228.691 | .65 | 1.53 | 142. | 47. | 46. | 250. | 41. | 5.0 |
| 6-3 | 848. | 231.460 | .60 | 1.40 | 147. | 48. | 47. | 250. | 41. | 5.0 |
| 6-2 | 852. | 234.150 | .40 | .98 | 149. | 49. | 47. | 250. | 42. | 4.0 |
| 6-1 | 856. | 236.500 | .30 | .75 | 149. | 49. | 47. | 250. | 42. | 3.3 |
| STOP | 900. | 238.497 | | | | | | | | |

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1112-PAR-OUT-01

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/12/83 TIME START: 7:13 TIME FINISH: 9: 0

Run R-3

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 142.5 | (F) | 61.4 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.54 | "HG | 72.48 | CMHG |
| FLUE GAS STATIC PRESSURE | .55 | "H2O | 1.397 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 26.79 | LB/LB-MOLE | 26.7855 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 20.68 | % | 20.68 | % |
| AVERAGE FLUE GAS VELOCITY | 45.6437 | FPS | 13.9122 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21076. | ACFM | 597. | M3/MIN |
| | 13973. | DSCFM | 396. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 60.1071 | DSCF | 1.7022 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.0 | (F) | 120.5 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 40.7 | (F) | 4.8 | (C) |
| MAXIMUM LINE VACUUM | 5.3 | "HG | 13.46 | CMHG |
| FINAL LEAK RATE | .020 | CFM | .0006 | M3/MIN |
| PERCENT ISOKINETIC | 106.6 | % | 106.6 | % |
| PARTICULATE MASS CONCENTRATION | .286-001 | GR/DSCF | .654-001 | GMS/M3 |
| | .408-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .342+001 | LBS/HR | .155+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1112-PAH-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-3

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 31.83 | 141.00 |
| 1-3 | 31.83 | 141.00 |
| 1-2 | 28.42 | 139.00 |
| 1-1 | 28.44 | 140.00 |
| STOP | | |
| 2-4 | 56.93 | 141.00 |
| 2-3 | 49.35 | 142.00 |
| 2-2 | 45.05 | 142.00 |
| 2-1 | 40.26 | 141.00 |
| STOP | | |
| 3-4 | 56.89 | 140.00 |
| 3-3 | 53.39 | 144.00 |
| 3-2 | 49.31 | 141.00 |
| 3-1 | 40.26 | 141.00 |
| STOP | | |
| 4-4 | 57.08 | 144.00 |
| 4-3 | 53.43 | 145.00 |
| 4-2 | 47.29 | 145.00 |
| 4-1 | 42.70 | 141.00 |
| STOP | | |
| 5-4 | 57.03 | 145.00 |
| 5-3 | 55.13 | 141.00 |
| 5-2 | 49.31 | 141.00 |
| 5-1 | 45.01 | 141.00 |
| STOP | | |
| 6-4 | 51.36 | 142.00 |
| 6-3 | 49.55 | 147.00 |
| 6-2 | 40.53 | 149.00 |
| 6-1 | 35.10 | 149.00 |
| STOP | | |

APPENDIX A.2

RECYCLE OPERATION DATA

INCLUDES

A.2.1 Particulate Mass (Modified EPA Method 5E)
A.2.1.3 Controlled Particulate Emission Data Based on Psychometric Chart Moisture Value

RADIAN

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run R-2

PLANT NAME CAMPBELL
SAMPLING LOCATION OUTLET
DATE 11/11/83 (MMDDYY) TIME START 15:15 (HHMM)
SAMPLE IDENT. CAM-1111-PAH-OUT-02
TIME FINISH 17: 4 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PTCF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.79 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .019 CFM
OPERATOR INITIALSMJK/TWT

TEST DURATION 96. MIN.

| | | | |
|---|---|---|---|
| % CO | .0 | % N2 | 86.5 |
| % CO2 | 4.7 | % H2 | .0 |
| % O2 | 8.8 | % CH4 | .0 |

CONDENSED WATER 451.7 GMS
FILTER WT. GAIN .02400 GMS
PROBE WASH WT. GAIN .06420 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 1515. | 100.819 | .25 | .59 | 146. | 70. | 71. | 250. | 52. | 2.2 |
| 1-3 | 1519. | 102.530 | .20 | .48 | 151. | 66. | 65. | 250. | 54. | 2.0 |
| 1-2 | 1523. | 104.150 | .20 | .48 | 156. | 66. | 65. | 250. | 53. | 2.0 |
| 1-1 | 1527. | 105.760 | .15 | .34 | 157. | 64. | 62. | 250. | 52. | 1.0 |
| STOP | 1531. | 107.168 | | | | | | | | |
| 2-4 | 1533. | 107.168 | .80 | 1.95 | 147. | 60. | 60. | 250. | 48. | 5.0 |
| 2-3 | 1537. | 110.350 | .75 | 1.80 | 153. | 61. | 60. | 250. | 48. | 4.9 |
| 2-2 | 1541. | 113.430 | .75 | 1.80 | 156. | 62. | 60. | 250. | 48. | 4.9 |
| STOP | 1542. | 114.116 | | | | | | | | |
| 2-2 | 1545. | 114.116 | .55 | 1.32 | 157. | 62. | 62. | 250. | 49. | 3.9 |
| 2-1 | 1548. | 116.060 | .30 | .75 | 156. | 64. | 64. | 250. | 49. | 3.0 |
| STOP | 1552. | 118.127 | | | | | | | | |
| 3-4 | 1555. | 118.127 | .80 | 1.95 | 147. | 61. | 61. | 245. | 49. | 5.0 |
| 3-3 | 1559. | 121.220 | .70 | 1.70 | 152. | 64. | 63. | 250. | 48. | 4.6 |
| 3-2 | 1603. | 124.130 | .60 | 1.48 | 157. | 64. | 63. | 250. | 48. | 4.2 |
| 3-1 | 1607. | 126.840 | .45 | 1.09 | 158. | 62. | 62. | 250. | 51. | 3.2 |
| STOP | 1611. | 129.123 | | | | | | | | |
| 4-4 | 1613. | 129.123 | .80 | 1.95 | 146. | 62. | 61. | 245. | 49. | 5.1 |
| 4-3 | 1617. | 132.070 | .70 | 1.70 | 151. | 64. | 63. | 250. | 49. | 4.8 |
| 4-2 | 1621. | 134.980 | .55 | 1.32 | 154. | 64. | 62. | 250. | 48. | 4.0 |
| 4-1 | 1625. | 137.510 | .50 | 1.22 | 156. | 61. | 62. | 250. | 47. | 3.9 |

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run R-2

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STOP | 1629. | 139.950 | | | | | | | | |
| 5-4 | 1630. | 139.950 | .80 | 1.95 | 145. | 60. | 60. | 250. | 46. | 5.2 |
| 5-3 | 1634. | 143.060 | .70 | 1.70 | 151. | 60. | 60. | 250. | 46. | 4.8 |
| 5-2 | 1638. | 146.040 | .60 | 1.48 | 154. | 61. | 60. | 250. | 45. | 4.3 |
| 5-1 | 1642. | 148.800 | .50 | 1.22 | 156. | 60. | 60. | 250. | 45. | 4.0 |
| STOP | 1646. | 151.292 | | | | | | | | |
| 6-4 | 1648. | 151.292 | .70 | 1.70 | 144. | 60. | 60. | 250. | 48. | 4.9 |
| 6-3 | 1652. | 154.240 | .60 | 1.48 | 149. | 60. | 60. | 250. | 46. | 4.5 |
| 6-2 | 1656. | 156.990 | .50 | 1.22 | 153. | 60. | 59. | 250. | 45. | 4.2 |
| 6-1 | 1700. | 159.500 | .40 | .97 | 155. | 59. | 58. | 250. | 45. | 3.8 |
| STOP | 1704. | 161.746 | | | | | | | | |

RADIAN

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-PAH-OUT-02

PLANT NAME: CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/11/83 TIME START: 15:15 TIME FINISH: 17: 4

Run R-2

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 152.3 | (F) | 66.8 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.83 | "HG | 73.22 | CMHG |
| FLUE GAS STATIC PRESSURE | .50 | "H2O | 1.270 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 26.16 | LB/LB-MOLE | 26.1607 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 26.51 | % | 26.51 | % |
| AVERAGE FLUE GAS VELOCITY | 47.1196 | FPS | 14.3621 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21758. | ACFM | 616. | M3/MIN |
| | 13285. | DSCFM | 376. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 59.3629 | DSCF | 1.6812 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.6 | (F) | 120.9 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 48.3 | (F) | 9.1 | (C) |
| MAXIMUM LINE VACUUM | 5.2 | "HG | 13.21 | CMHG |
| FINAL LEAK RATE | .019 | CFM | .0005 | M3/MIN |
| PERCENT ISOKINETIC | 110.7 | % | 110.7 | % |
| PARTICULATE MASS CONCENTRATION | .229-001 | GR/DSCF | .525-001 | GMS/M3 |
| | .328-005 | LBS/DSCF | | |
| PARTICULATE MASS RATE | .261+001 | LBS/HR | .118+001 | KG/HR |

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

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1111-PAH-OUT-02

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run R-2

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 32.17 | 146.00 |
| 1-3 | 28.90 | 151.00 |
| 1-2 | 29.01 | 156.00 |
| 1-1 | 25.15 | 157.00 |
| STOP | | |
| 2-4 | 57.60 | 147.00 |
| 2-3 | 56.05 | 153.00 |
| 2-2 | 56.19 | 156.00 |
| STOP | | |
| 2-2 | 48.15 | 157.00 |
| 2-1 | 35.54 | 156.00 |
| STOP | | |
| 3-4 | 57.60 | 147.00 |
| 3-3 | 54.10 | 152.00 |
| 3-2 | 50.30 | 157.00 |
| 3-1 | 43.59 | 158.00 |
| STOP | | |
| 4-4 | 57.56 | 146.00 |
| 4-3 | 54.06 | 151.00 |
| 4-2 | 48.04 | 154.00 |
| 4-1 | 45.88 | 156.00 |
| STOP | | |
| 5-4 | 57.51 | 145.00 |
| 5-3 | 54.06 | 151.00 |
| 5-2 | 50.17 | 154.00 |
| 5-1 | 45.88 | 156.00 |
| STOP | | |
| 6-4 | 53.75 | 144.00 |
| 6-3 | 49.97 | 149.00 |
| 6-2 | 45.76 | 153.00 |
| 6-1 | 41.00 | 155.00 |
| STOP | | |

APPENDIX A.2

RECYCLE OPERATION DATA

INCLUDES

A.2.2 Particle Size Distribution
A.2.2.1 Uncontrolled Particle Size Distribution Emission Data

SUMMARY OF UNCONTROLLED PARTICLE SIZE
DISTRIBUTION SAMPLING DATA COLLECTED AT THE
T.J. CAMPBELL ASPHALT PLANT DURING
RECYCLE OPERATION

| Run Number | R-1 |
|---|---|
| Date | 11-11-83 |
| Total mass collected (grams) | 2.0590 |
| Total meter volume | 8.413 |
| Barometric pressure (inches Hg) | 28.79 |
| Orifice pressure drop ($\Delta H$) inches $H_2O$ | 0.14 |
| Meter temperature (°F) | 76 |
| Dry gas fraction | .748 |
| Stack temperature (°F) | 312 |
| Static pressure (inches Hg) | -1.20 |
| Sample time (minutes) | 37 |
| Molecular weight wet (grams/gram-mole) | |
| Percent isokinetic | 108 |
| Particle density (grams/cc) | 1.0 |
| Stage 1 (grams collected) | 1.1838 |
| Stage 2 (grams collected) | 0.2831 |
| Cyclone (grams collected) | 0.4340 |
| Filter (grams collected) | 0.1581 |
| Volume of gas sampled (DSCF) | 7.983 |
| Particulate concentration (gr/DSCF) | 3.98 |
| Volumetric flow rate (ACFM) | 29,000 |

APPENDIX A.2

RECYCLE OPERATION DATA

INCLUDES

A.2.3 Polynuclear Aromatic Hydrocarbons
A.2.3.1 Uncontrolled Polynuclear Aromatic Hydrocarbon Emission Data

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run PAH R-1

PLANT NAME CAMPBELL ASPHALT
SAMPLE LOCATION INLET
SAMPLE IDENT. CAM-1115-BAP-IN-01
DATE 11/15/83 (MMDDYY) TIME START 9: 9 (HHMM) TIME FINISH 10: 5 (HHMM)
DUCT DIMENSIONS 6.000x 2.200FT.
PTCF .84 LGBCF 1.012
NOZZLE DIA. .273 INCHES
BAR PRESS. 28.03 "HG
STATIC PRESS. -1.2 "H2O .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .012 CFM
OPERATOR INITIALSEPA/CBC

TEST DURATION 48. MIN.

| | | | |
|---|---|---|---|
| % CO | .0 | % N2 | 89.1 |
| % CO2 | 7.7 | % H2 | .0 |
| % O2 | 3.2 | % CH4 | .0 |

CONDENSED WATER 316.2 GMS
FILTER WT. GAIN .00000 GMS
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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | 909. | 954.380 | .22 | .28 | 296. | 64. | 64. | 250. | 46. | 5.0 |
| 1-2 | 912. | 955.200 | .24 | .32 | 329. | 64. | 64. | 250. | 46. | 5.5 |
| 1-3 | 915. | 956.210 | .27 | .35 | 326. | 64. | 64. | 250. | 47. | 5.5 |
| 1-4 | 918. | 957.290 | .27 | .35 | 308. | 64. | 63. | 250. | 47. | 5.6 |
| STOP | 921. | 958.369 | | | | | | | | |
| 2-1 | 922. | 958.369 | .21 | .27 | 289. | 64. | 64. | 250. | 47. | 6.8 |
| 2-2 | 925. | 959.280 | .22 | .29 | 303. | 64. | 64. | 250. | 47. | 6.8 |
| 2-3 | 928. | 960.240 | .25 | .34 | 334. | 64. | 64. | 250. | 47. | 7.0 |
| 2-4 | 931. | 961.270 | .28 | .36 | 362. | 64. | 64. | 250. | 47. | 7.5 |
| STOP | 934. | 962.362 | | | | | | | | |
| 3-1 | 937. | 962.362 | .30 | .39 | 319. | 65. | 65. | 250. | 47. | 7.8 |
| 3-2 | 940. | 965.480 | .31 | .40 | 317. | 65. | 65. | 250. | 53. | 8.0 |
| 3-3 | 943. | 964.640 | .26 | .36 | 326. | 66. | 65. | 250. | 53. | 7.8 |
| 3-4 | 946. | 965.710 | .25 | .33 | 326. | 66. | 66. | 250. | 53. | 7.8 |
| STOP | 949. | 966.767 | | | | | | | | |
| 4-1 | 953. | 966.767 | .36 | .45 | 298. | 67. | 67. | 245. | 54. | 9.5 |
| 4-2 | 956. | 967.940 | .21 | .27 | 305. | 67. | 67. | 250. | 54. | 9.0 |
| 4-3 | 959. | 968.670 | .18 | .24 | 320. | 67. | 67. | 250. | 54. | 8.2 |
| 4-4 | 1002. | 969.890 | .22 | .28 | 33. | 67. | 67. | 250. | 54. | 9.0 |
| STOP | 1005. | 970.829 | | | | | | | | |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run PAH R-1

REMARKS HOT BOX 163 @ 0916 0936-WET BULB-3RD PORT 181 F STILL 46%

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAS-1115-BAP-10-01

TEST [illegible]: [illegible] ASPHALT — Run PAH R-1
SAMPLING LOCATION: INLET
DATE: 11/15/[illegible] TIME START: 9: 9 TIME FINISH: 10: 5

REMARKS: HOT BOX 163 @ 0916 0936-WET BULB-3RD PORT 181 F STILL 48%

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 299.4 | (F) | 148.6 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.74 | "HG | 72.99 | CMHG |
| FLUE GAS STATIC PRESSURE | -1.20 | "H2O | -3.048 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 23.90 | LB/LB-MOLE | 23.9026 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 48.04 | % | 48.04 | % |
| AVERAGE FLUE GAS VELOCITY | 37.8275 | FPS | 11.5298 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 29959. | ACFM | 848. | M3/MIN |
| | 10393. | DSCFM | 294. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 16.2100 | DSCF | .4591 | M3 |
| TEST DURATION | 48. | MIN | 48. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.7 | (F) | 120.9 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 49.8 | (F) | 9.9 | (C) |
| MAXIMUM LINE VACUUM | 9.5 | "HG | 24.13 | CMHG |
| FINAL LEAK RATE | .012 | CFM | .0003 | M3/MIN |
| PERCENT ISOKINETIC | 105.0 | % | 105.0 | % |
| 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.

SOURCE SAMPLING RESULTS SUMMARY
SAMPLE IDENT: CAM-1115-BAP-4N-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run PAH R-1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-1 | 35.33 | 296.00 |
| 1-2 | 37.69 | 329.00 |
| 1-3 | 39.90 | 326.00 |
| 1-4 | 39.44 | 308.00 |
| STOP | | |
| 2-1 | 34.35 | 289.00 |
| 2-2 | 35.49 | 305.00 |
| 2-3 | 38.59 | 334.00 |
| 2-4 | 41.56 | 362.00 |
| STOP | | |
| 3-1 | 41.67 | 319.00 |
| 3-2 | 42.51 | 317.00 |
| 3-3 | 39.16 | 326.00 |
| 3-4 | 38.40 | 326.00 |
| STOP | | |
| 4-1 | 45.25 | 298.00 |
| 4-2 | 34.72 | 305.00 |
| 4-3 | 32.46 | 329.00 |
| 4-4 | 28.52 | 35.00 |
| STOP | | |

APPENDIX A.2

RECYCLE OPERATION DATA

INCLUDES

A.2.3 Polynuclear Aromatic Hydrocarbons
A.2.3.2 Controlled Polynuclear Aromatic Hydrocarbon Emission Data

# SOURCE SAMPLING FIELD DATA
## INPUT VERIFICATION

Run PAH R-1

PLANT NAME T.J. CAMPBELL
SAMPLING LOCATION OUTLET
SAMPLE IDENT. CAM-1115-BAP-OUT-01
DATE 11/15/83 (MMDDYY) TIME START 8:55 (HHMM) TIME FINISH 10:53 (HHMM)
DUCT DIMENSIONS 2.960X 2.600FT.
PICF .84 DGMCF .994
NOZZLE DIA. .243 INCHES
BAR PRESS. 28.83 "HG
STATIC PRESS. .5 "H20 .0
INITIAL LEAK RATE .018 CFM
FINAL LEAK RATE .020 CFM
OPERATOR INITIALSMJK/TWT

TEST DURATION 96. MIN.

| | | | |
|---|---|---|---|
| % CO | .0 | % N2 | 89.1 |
| % CO2 | 7.7 | % H2 | .0 |
| % O2 | 5.2 | % CH4 | .0 |

| | | |
|---|---|---|
| CONDENSED WATER | 731.7 | GMS |
| FILTER WT. GAIN | .00000 | GMS |
| 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1-4 | 859. | 433.416 | .20 | .30 | 170. | 52. | 52. | 250. | 42. | 1.3 |
| 1-3 | 903. | 434.680 | .15 | .22 | 172. | 51. | 51. | 250. | 44. | 1.0 |
| 1-2 | 907. | 435.750 | .15 | .22 | 171. | 51. | 50. | 250. | 46. | 1.0 |
| 1-1 | 911. | 436.900 | .10 | .15 | 175. | 51. | 51. | 250. | 46. | .8 |
| STOP | 915. | 437.693 | | | | | | | | |
| 2-4 | 916. | 437.693 | .65 | .95 | 177. | 51. | 51. | 250. | 45. | 3.4 |
| 2-3 | 920. | 440.000 | .55 | .82 | 176. | 52. | 51. | 250. | 60. | 3.1 |
| 2-2 | 924. | 442.010 | .45 | .65 | 167. | 52. | 52. | 250. | 61. | 2.4 |
| 2-1 | 928. | 443.450 | .45 | .65 | 168. | 52. | 52. | 250. | 62. | 2.4 |
| STOP | 932. | 445.596 | | | | | | | | |
| 3-4 | 934. | 445.596 | .80 | 1.25 | 169. | 53. | 52. | 245. | 49. | 4.1 |
| 3-3 | [illegible] | 447.9[illegible] | .70 | 1.10 | 169. | 52. | 52. | 250. | 52. | 4.0 |
| 3-2 | [illegible] | 450.330 | .55 | .82 | 170. | 53. | 52. | 250. | 54. | 3.2 |
| 3-1 | [illegible] | 452.440 | .45 | .65 | 171. | 52. | 52. | 250. | [illegible] | 3.0 |
| STOP | [illegible] | 454.253 | | | | | | | | |
| 4-4 | [illegible] | 454.253 | .75 | 1.18 | 172. | 54. | 53. | 250. | 50. | 4.4 |
| 4-3 | [illegible] | 456.800 | .70 | 1.10 | 172. | 53. | 52. | 250. | 49. | 4.4 |
| 4-2 | 1061. | 459.670 | .60 | .90 | 170. | 52. | 52. | 250. | 52. | 4.0 |
| 4-1 | 1065. | 461.200 | .45 | .65 | 172. | 54. | 53. | 250. | 52. | 3.0 |
| STOP | 1067. | 462.123 | | | | | | | | |
| 4-1 | 1017. | 462.182 | .45 | .65 | 172. | 53. | 52. | 250. | 44. | 3.0 |

SOURCE SAMPLING FIELD DATA
INPUT VERIFICATION

Run PAH R-1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STOP | 1019. | 463.072 | | | | | | | | |
| 5-4 | 1020. | 463.072 | .75 | 1.18 | 175. | 54. | 52. | 250. | 45. | 4.6 |
| 5-3 | 1024. | 465.490 | .70 | 1.10 | 177. | 56. | 53. | 250. | 46. | 5.0 |
| 5-2 | 1028. | 467.800 | .60 | .90 | 179. | 56. | 54. | 250. | 48. | 4.1 |
| 5-1 | 1032. | 469.860 | .50 | .70 | 174. | 55. | 53. | 250. | 50. | 3.2 |
| STOP | 1036. | 471.745 | | | | | | | | |
| 6-4 | 1037. | 471.745 | .55 | .82 | 176. | 55. | 54. | 250. | 48. | 3.8 |
| 6-3 | 1041. | 473.730 | .50 | .70 | 175. | 55. | 54. | 250. | 51. | 3.5 |
| 6-2 | 1045. | 475.630 | .45 | .65 | 175. | 55. | 53. | 250. | 50. | 3.2 |
| 6-1 | 1049. | 477.420 | .35 | .50 | 173. | 54. | 53. | 250. | 49. | 3.0 |
| STOP | 1053. | 479.013 | | | | | | | | |

REMARKS BROKEN GLASSWARE! REPLACED & LEAK OK

# SOURCE SAMPLING RESULTS SUMMARY
## SAMPLE IDENT: CAM-1115-BAP-OUT-01

PLANT NAME: T.J. CAMPBELL
SAMPLING LOCATION: OUTLET
DATE: 11/15/83 TIME START: 8:59 TIME FINISH: 10:53

Run PAH R-1

REMARKS: BROKEN GLASSWARE; REPLACED & LEAK OK

| | | | | |
|---|---|---|---|---|
| AVERAGE FLUE GAS TEMPERATURE | 172.7 | (F) | 78.1 | (C) |
| FLUE GAS PRESSURE (ABSOLUTE) | 28.87 | "HG | 73.32 | CMHG |
| FLUE GAS STATIC PRESSURE | .55 | "H2O | 1.397 | CMH2O |
| FLUE GAS MOLECULAR WEIGHT (WET) | 24.43 | LB/LB-MOLE | 24.4255 | GM/GM-MOLE |
| FLUE GAS PERCENT MOISTURE | 43.44 | % | 43.44 | % |
| AVERAGE FLUE GAS VELOCITY | 47.0203 | FPS | 14.3318 | M/S |
| AVERAGE FLUE GAS FLOWRATE | 21712. | ACFM | 615. | M3/MIN |
| | 9887. | DSCFM | 280. | M3/MIN |
| VOLUME OF FLUE GAS SAMPLED (DRY, STANDARD CONDITIONS) | 45.1626 | DSCF | 1.2790 | M3 |
| TEST DURATION | 96. | MIN | 96. | MIN |
| TEMPERATURE AT WHICH PARTICULATE COLLECTED | 249.8 | (F) | 121.0 | (C) |
| AVERAGE TEMPERATURE AT EXIT OF LAST IMPINGER/CONDENSER | 50.0 | (F) | 10.0 | (C) |
| MAXIMUM LINE VACUUM | 5.0 | "HG | 12.70 | CMHG |
| FINAL LEAK RATE | .020 | CFM | .0006 | M3/MIN |
| PERCENT ISOKINETIC | 113.1 | % | 113.1 | % |
| 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: CAM-1115-BAP-OUT-01

FLUE GAS VELOCITY/TEMPERATURE PROFILE

Run PAH R-1

| PT. | VELOCITY (FPS) | TEMPERATURE (F) |
|---|---|---|
| 1-4 | 30.35 | 170.00 |
| 1-3 | 26.32 | 172.00 |
| 1-2 | 26.30 | 171.00 |
| 1-1 | 21.54 | 173.00 |
| STOP | | |
| 2-4 | 55.01 | 177.00 |
| 2-3 | 50.56 | 176.00 |
| 2-2 | 45.41 | 167.00 |
| 2-1 | 45.45 | 168.00 |
| STOP | | |
| 3-4 | 60.65 | 169.00 |
| 3-3 | 56.73 | 169.00 |
| 3-2 | 50.32 | 170.00 |
| 3-1 | 45.56 | 171.00 |
| STOP | | |
| 4-4 | 58.86 | 172.00 |
| 4-3 | 56.86 | 172.00 |
| 4-2 | 52.56 | 170.00 |
| 4-1 | 45.59 | 172.00 |
| STOP | | |
| 4-1 | 45.59 | 172.00 |
| STOP | | |
| 5-4 | 59.00 | 173.00 |
| 5-3 | 57.09 | 177.00 |
| 5-2 | 52.94 | 179.00 |
| 5-1 | 48.13 | 174.00 |
| STOP | | |
| 6-4 | 50.56 | 176.00 |
| 6-3 | 46.17 | 173.00 |
| 6-2 | 45.70 | 173.00 |
| 6-1 | 40.24 | 173.00 |
| 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 Volumetric Flow Rate Dry Standard Conditions
- B.1.5 Modified EPA Reference Method 5E
  - B.1.5.1 Determination of Particulate Emission Concentrations
  - B.1.5.2 Determination of Percent Isokinetic During Sampling
  - B.1.5.3 Determination of Mass Emission Rate Using the Area Ratio Method

B.2 Determination of Total Organic Carbon (TOC) Emissions

B.3 Determination of Trace Metals Emissions

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

B.5 Determination of Polynuclear Aromatic Hydrocarbon (PAH) Emissions
- B.5.1 Concentration of PAH in Flue Gas
- B.5.2 Concentration of PAH in Scrubber Water
- B.5.3 Concentration of PAH in Scrubber Solids

B.6 Total Solids Determination
- B.6.1 Determination of Weight Percent Solids
- B.6.2 Determination of Total 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 Volumetric Flow Rate Dry Standard Conditions
B.1.5 Modified EPA Reference Method 5E

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 $\frac{ft}{sec} \left[\frac{(lb/Lbmole)(in\ Hg)}{(^{\circ}R)(in\ H_2O)}\right]^{1/2}$

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

$\Delta P$ = 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

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

Equation:

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

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:

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

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 = Constant for converting 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 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.1.5 Modified EPA Reference Method 5A

B.1.5.1 - 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.1.5.2 - 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.1.5.2 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.1.5.3 - 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 TOTAL ORGANIC CARBON (TOC) EMISSIONS

## B.2 Determination of Total Organic Carbon (TOC) Emissions

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 = Amount of gas sampled, standard conditions dry standard cubic meters, dscm

# APPENDIX B.3

## DETERMINATION OF TRACE METALS EMISSIONS

## B.3 Determination of Trace Metals Emissions

Equation:

$$TM_{(E)} = \frac{A + T + (CxC_T) + F + (S \times S_T) + N \times N_T)}{DGV}$$

Nomenclature:

$TM_{(E)}$ = Total trace metal specie mass concentration, μg/dscm

A = Total concentration of trace metal specie in acetone probe wash, μg

T = Total concentration of trace metal specie in trichloroethane probe wash, μg

C = Concentration of trace metal in the cyclone catch, μg/g

$C_T$ = Total weight of cyclone solids, g

F = Total concentration of trace metal specie in the filter, μg

S = Concentration of trace metal in the NaOH impinger, μg/ml

$S_T$ = Total volume of NaOH impinger catch, ml

N = Concentration of trace metal in the nitric acid impinger, μg/ml

$N_T$ = Total volume of the nitric acid impinger, ml

DGV = Dry gas volume, standard conditions, dry standard cubic meters (dscm)

APPENDIX B.4

PARTICLE SIZE DISTRIBUTION - ANDERSEN HIGH

CAPACITY STACK SAMPLER

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.

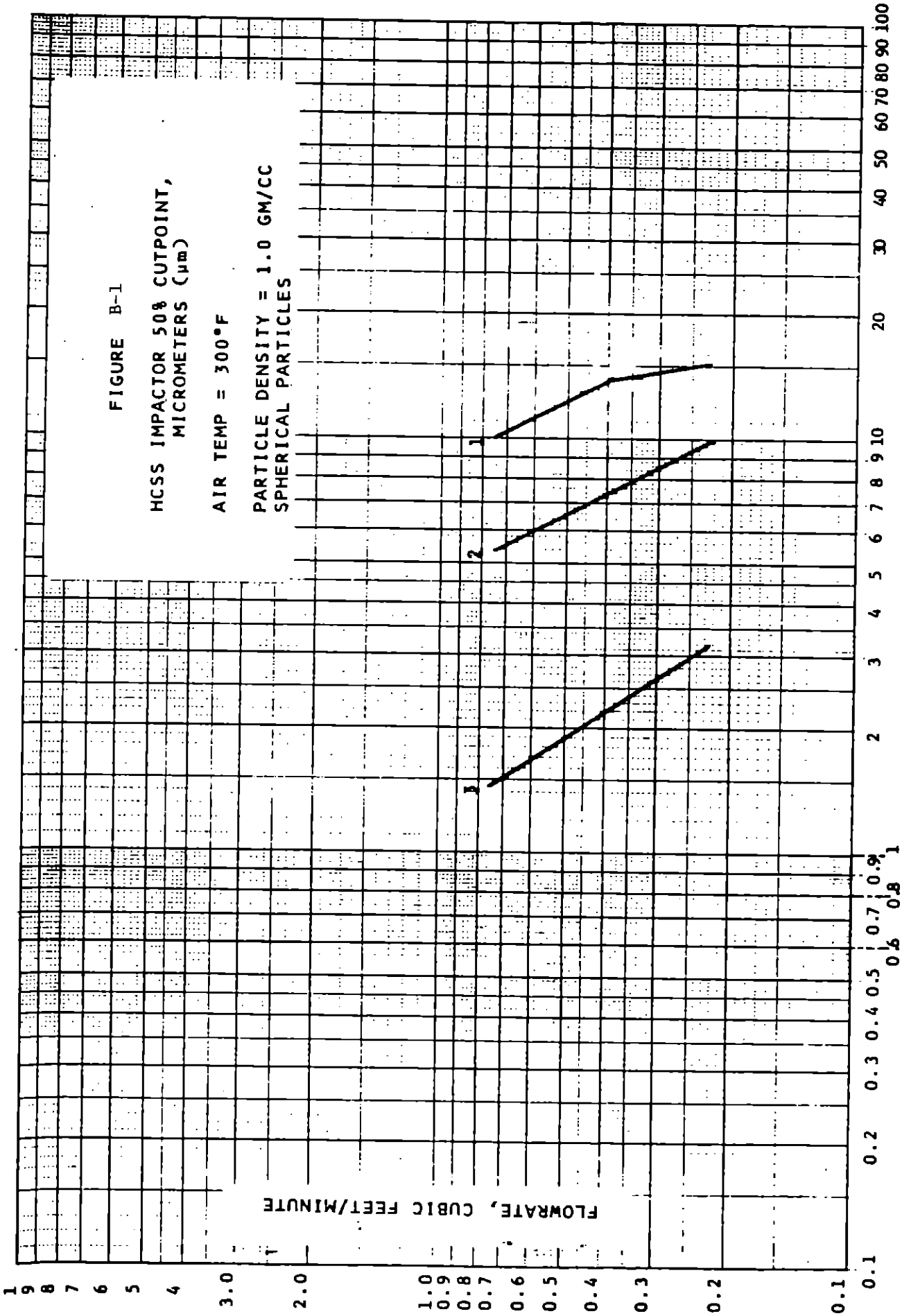
FIGURE B-1
HCSS IMPACTOR 50% CUTPOINT, MICROMETERS (μm)
AIR TEMP = 300°F
PARTICLE DENSITY = 1.0 GM/CC
SPHERICAL PARTICLES
FLOWRATE, CUBIC FEET/MINUTE
1
2
3
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 2 3 4 5 6 7 8 9 10 20 30 40 50 60 70 80 90 100
1 9 8 7 6 5 4 3.0 2.0 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1

APPENDIX B.5

DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBON (PAH) EMISSIONS

INCLUDES

B.5.1 Concentration of PAH in Flue Gas
B.5.2 Concentration of PAH in Scrubber Water
B.5.3 Concentration of PAH in Scrubber Solids

## B.5 Determination of Polynuclear Aromatic Hydrocarbon (PAH) Emissions

### B.5.1 Concentration of PAH in Flue Gas

Equation:

$$PAH_{(G)} = \frac{P_T - B}{DGV}$$

Nomenclature:

$PAH_{(G)}$ = Concentration of PAH specie in flue gas, μg/dscm

$P_T$ = Total concentration of PAH specie, μg

B = Specie blank, μg

DGV = dry gas volume, standard conditions, dscm

### B.5.2 Concentration of PAH in Scrubber Water

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

### B.5.3 Concentration of PAH in Scrubber 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
B.6.2 Determination of Total Dissolved Solids

## B.6 Total Solids Determination

### B.6.1 Determination of Weight Percent 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

APPENDIX C

FIELD SAMPLING DATA SHEETS

INCLUDES


C.1 Conventional Operation Testing
- C.1.1 EPA Reference Methods 2, 3, 4, and 5E
  - C.1.1.1 Uncontrolled Emissions - EPA Reference Method 2, 3, 4, and 5E Data Sheets
  - C.1.1.2 Controlled Emissions - EPA Reference Method 2, 3, 4, and 5E Data Sheets
- C.1.2 Particle Size Distribution Data Sheets
  - C.1.2.1 Uncontrolled Emissions - Particle Size Data Sheets
  - C.1.2.2 Controlled Emissions - Particle Size Data Sheets
- C.1.3 Polynuclear Aromatic Hydrocarbon (PAH) Data Sheets
  - C.1.3.1 Uncontrolled Emissions - PAH Data Sheets
  - C.1.3.2 Controlled Emissions - PAH Data Sheets

C.2 Recycle Operation Testing
- C.2.1 EPA Reference Methods 2, 3, 4, and 5E
  - C.2.1.1 Uncontrolled Emissions - EPA Reference Method 2, 3, 4, and 5E Data Sheets
  - C.2.1.2 Controlled Emissions - EPA Reference Method 2, 3, 4, and 5E Data Sheets
- C.2.2 Particle Size Distribution Data Sheets
  - C.2.2.1 Uncontrolled Emissions - Particle Size Data Sheets
  - C.2.2.2 Controlled Emissions Particle Size Data Sheets
- C.2.3 Polynuclear Aromatic Hydrocarbon (PAH) Data Sheets
  - C.2.3.1 Uncontrolled Emissions - PAH Data Sheets
  - C.2.3.2 Controlled Emissions - PAH Data Sheets

APPENDIX C.1

CONVENTIONAL OPERATION TESTING

INCLUDES

C.1.1 EPA Reference Methods 2, 3, 4, and 5E
C.1.1.1 Uncontrolled Emissions - EPA Reference Methods 2, 3, 4, and 5E Data Sheets

# VELOCITY PROFILE FIELD DATA

001 (1-1) Plant Name> Campbell IN

Sampling Location> Inlet Sample Ident.> Cam-1108-VTP01

002 (1-3) Date 11-07-83 (MMDDYY) Time Start 1614 (HHMM) Time Finish 1638 (HHMM)

Duct Dimensions 2.2 x 6 ft. or Diameter — ft.

PTCF 0.84 % $H_2O$

003 (1-3) Bar Press. 29.55 "Hg % CO % $N_2$

Static Press. -1.18 "$H_2O$ % $CO_2$ % $H_2$

Operator Initials EPA/TWT % $O_2$ % $CH_4$

| | Pt. | Stack Temp. °F #1 | #2 | Ave. | Velocity Pressure "$H_2O$ #1 | #2 | Ave. | Other ( ) #1 | #2 | Ave. |
|---|---|---|---|---|---|---|---|---|---|---|
| 004 | 1-1 | 316 | | | .23 | .24 | .24 | | | |
| 005 | 1-2 | 315 | | | .27 | .25 | .26 | | | |
| 006 | 1-3 | 316 | | | .28 | .30 | .29 | | | |
| 007 | 1-4 | 316 | | | .25 | .25 | .25 | | | |
| 008 | 2-4 | 300 | | | .25 | | .25 | | | |
| 009 | 2-3 | 292 | | | .22 | | .22 | | | |
| 010 | 2-2 | 289 | | | .22 | | .22 | | | |
| 011 | 2-1 | 286 | | | .19 | | .19 | | | |
| 012 | | | | | | | | | | |
| 013 | 3-4 | 301 | | | .26 | | .26 | | | |
| 014 | 3-3 | 297 | | | .25 | | .25 | | | |
| 015 | 3-2 | 288 | | | .30 | | .30 | | | |
| 016 | 3-1 | 275 | | | .30 | | .30 | | | |
| 017 | 4-4 | 301 | | | .25 | | .25 | | | |
| 018 | 4-3 | 304 | | | .25 | | .25 | | | |
| 019 | 4-2 | 275 | | | .26 | | .26 | | | |
| 020 | 4-1 | 250 | | | .32 | | .32 | | | |
| 021 | | | | | | | | | | |
| | (4:2) | (11:5) | (18:5) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) |

Weather

Remarks 13.5%

237 Prod Rate

ΔP = .2638

Temp = 300°F

Wet Bulb = 78°C 172

Dry Bulb = 149 300

40% $H_2O$

Static 1 = 1.15

2 = 1.20

4 1.15

1.18" $H_2O$

RADIAN

# ORSAT DATA SHEET

Location Campbell Inlet Comments

Date 11/8

Time 1600 hrs

Operator MRT

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 | ~~150~~ 0 | 5.6 | 5.6 | 12.6 | 7.0 | | |
| 2 | 0 | 5.8 | 5.8 | 13.2 | 7.4 | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 5.7 % $O_2$ 7.2

% CO 0 % $N_2$ 87.1

Dry Molecular Weight, MW (dry) =

$$= 0.44 \frac{5.7}{(\%\ CO_2)} + 0.32 \frac{7.2}{(\%\ O_2)} + 0.28 \frac{\cancel{24.288}\ 87.1}{(\%\ CO + \%\ N_2)}$$

$$= 2.508 + 2.304 + 24.388$$

$$= 29.20 \text{ g/mole}$$

29.20(.664) + 18(.336)

25.44

Figure 5-3. Orsat field data sheet.

RADIAN CORPORATION

# ORSAT DATA SHEET

Location Campbell Inlet Comments

Date 11/12

Time 1400 hrs

Operator MRF

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 | 0.2 | 6.0 | 5.8 | 10.8 | 4.8 | | |
| 2 | 0 | 6.4 | 6.4 | 11.6 | 5.2 | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 6.2 % $O_2$ 5.0

% CO -0- % $N_2$ _____

Dry Molecular Weight, MW (dry) =

$$= 0.44 \underset{(\%\ CO_2)}{6.2} + 0.32 \underset{(\%\ O_2)}{5.0} + 0.28 \underset{(\%\ CO + \%\ N_2)}{88.80}$$

$$= 2.728 + 1.60 + 24.864$$

$$= 29.19 \text{ g/mole}$$

Figure 5-3. Orsat field data sheet.

RADIAN CORPORATION

# ORSAT DATA SHEET

Location INLET Comments GRAB

Date 11-13-83

Time 1200

Operator EPA

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 | 6.0 | 6.0 | 11.1 | 5.1 | | |
| | 0 | 6.0 | 6.0 | 11.0 | 5.0 | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 6.0 % $O_2$ 5.05

% CO _____ % $N_2$ _____

Dry Molecular Weight, MW (dry) =

$$= 0.44 \underset{(\%\ CO_2)}{6.0} + 0.32 \underset{(\%\ O_2)}{5.05} + 0.28 \underset{(\%\ CO + \%\ N_2)}{88.95}$$

$$= 2.64 + 1.616 + 24.906$$

$$= 29.16 \text{ g/mole}$$

Figure 5-3. Orsat field data sheet.

RADIAN CORPORATION

# ORSAT DATA SHEET

Location Campbell Inlet Comments

Date 11/14

Time 1030

Operator MRF

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 | 5.8 | 5.8 | 10.6 | 4.8 | | |
| 2 | 0 | 6.4 | 6.4 | 11.0 | 4.6 | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 6.1 % $O_2$ 4.7

% CO _____ % $N_2$ _____

Dry Molecular Weight, MW (dry) =

$$= 0.44 \underset{(\%\ CO_2)}{6.1} + 0.32 \underset{(\%\ O_2)}{4.7} + 0.28 \underset{(\%\ CO + \%\ N_2)}{89.2}$$

24.66 MW @ Inlet

= 2.684 + 1.504 + 24.976

= 29.16 g/mole

Figure 5-3. Orsat field data sheet.

RADIAN CORPORATION

# ORSAT DATA SHEET

Location Campbell Inlet Comments

Date 11-15-83

Time 1200 hrs Conditional

Operator EPA

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 | 6.0 | 6.0 | 13.0 | 7.0 | | |
| | .2 | 6.5 | 6.3 | 12.0 | 5.5 | | |
| | .1 | 6.3 | 6.2 | 11.8 | 5.5 | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 6.25 % $O_2$ 5.5

% CO 0 % $N_2$ 88.25

Dry Molecular Weight, MW (dry) =

$$= 0.44 \frac{6.25}{(\% CO_2)} + 0.32 \frac{5.50}{(\% O_2)} + 0.28 \frac{88.25}{(\% CO + \% N_2)}$$

$$= 2.750 + 1.760 + 24.710$$

$$= 29.22 \text{ g/mole}$$

Figure 5-3. Orsat field data sheet.

1/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Inlet Sample Ident.> Cam-1108-PAH-IN-01

A02 (1-3) Date 11-08-81 (MMDDYY) Time Start 1416 (HHMM) Time Finish 1521 (HHMM)

Duct Dimensions 6 x 2.21 ft. or Diameter — ft.

PTCF .84 DGMCF 1.0122 Test Duration 45 min.

A03 (1-3) Nozzle Dia. .272 inches % CO -0- % $N_2$ 87.1

Bar Press. 28.55 "Hg % $CO_2$ 5.7 % $H_2$ -0-

Static Press. -1.25 "$H_2O$ % $O_2$ 7.2 % $CH_4$ -0-

A04 (1-3) Initial leak rate .012 cfm Condensed Water 187.2 gms

Final leak rate .010 cfm Filter wt. gain 1.5145 gms

Operator initials EM/TWT Probe wash wt. gain 7.6618 gms

K = .85

| | 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 | GAS Temp. °F | Last Impinger Temp. °F | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 1-1 | 1416 | 628.349 | .23 | .30 | 304 | 69 | 67 | 250 | 40 | 4.0 |
| A06 | 1-2 | 1419 | 629.42 | .27 | .33 | 306 | 66 | 66 | 250 | 56 | 4.5 |
| | 1-3 | 1422 | 630.55 | .32 | .40 | 312 | 68 | 66 | 250 | 56 | 5.0 |
| A08 | 1-4 | 1425 | 631.82 | .32 | .40 | 318 | 68 | 67 | 250 | 56 | 5.0 |
| A09 | stop | 1428 | 632.914 | | | | | | | | |
| A10 | 2-1 | 1431 | 632.914 | .20 | .28 | 274 | 69 | 69 | 250 | 56 | 4.2 |
| A11 | 2-2 | 1434 | 633.93 | .25 | .33 | 287 | 70 | 69 | 250 | 52 | 5.0 |
| A12 | 2-3 | 1437 | 635.07 | .25 | .33 | 292 | 71 | 70 | 250 | 50 | 5.0 |
| A13 | 2-4 | 1440 | 636.22 | .28 | .38 | 302 | 72 | 71 | 250 | 50 | 5.5 |
| A14 | stop | 1443 | 637.398 | | | | | | | | |
| A15 | 3-1 | 1445 | 637.398 | .28 | .38 | 274 | 73 | 73 | 250 | 50 | 5.5 |
| A16 | 3-2 | 1448 | 638.53 | .35 | .45 | 282 | 74 | 73 | 250 | 52 | 8.0 |
| A17 | 3-3 | 1451 | 639.63 | .25 | .33 | 296 | 75 | 74 | 250 | 52 | 6.0 |
| A18 | 3-4 | 1454 | 640.68 | .27 | .35 | 304 | 75 | 75 | 250 | 52 | 6.2 |
| A19 | Stop | 1457 | 641.846 | | | | | | | | |
| A20 | 4-1 | 1509 | 641.846 | .32 | .42 | 274 | 75 | 74 | 250 | 52 | 6.5 |
| A21 | 4-2 | 1512 | 643.05 | .27 | .35 | 275 | 75 | 75 | 250 | 52 | 6.5 |
| A22 | 4-3 | 1515 | 644.24 | .25 | .33 | 295 | 75 | 75 | 250 | 54 | 6.8 |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (70:5) |

Console D-548 Filter # 003 Initial Wt. .5250 gms

Sample Analysis

Weather

A23 Remarks Filter # 003 .5250 gm

Hot Box Temp = 155°F @ 1433 Hot Box on full high w/ 200°F Reading

Final Filter Wt. 2.0500

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> CHM-1108-PAH IN-01

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 $ft^3$ | 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 | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 4-4 | 1518 | 645.35 | .28 | .38 | 297 | 75 | 76 | 250 | 54 | 7.0 |
| A06 | Stop | 1521 | 646.504 | | | | | | | | |
| A08 | | | | | | | | | | | |
| A09 | | | | | | | | | | | |
| A10 | | | | | | | | | | | |
| A11 | | | | | | | | | | | |
| A12 | | | | | | | | | | | |
| A13 | | | | | | | | | | | |
| A14 | | | | | | | | | | | |
| A15 | | | | | | | | | | | |
| A16 | | | | | | | | | | | |
| A17 | | | | | | | | | | | |
| A18 | | | | | | | | | | | |
| A19 | | | | | | | | | | | |
| A20 | | | | | | | | | | | |
| A21 | | | | | | | | | | | |
| A22 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (44:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console _____ Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks _____

Inlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | 0.1 N NaOH | ~250 | G-S | Final | 870.0g. |
| | | | | Initial | 699.4 |
| | | | | Wt. Gain | 170.6 |
| 2 | 0.1N NaOH | ~250 | G-S | Final | 693.4 |
| | | | | Initial | 685.9 |
| | | | | Wt. Gain | 7.5 |
| 3 | Dry | | Mod. | Final | 431.5 |
| | | | | Inital | 432.2 |
| | | | | Wt. Gain | -.7 |
| 4 | Silica Gel | | Mod. | Final | 693.1g. |
| | | | | Initial | 683.3 |
| | | | | Wt. Gain | 9.8 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 187.2 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 18.376 ft³

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 532 °R

Total imp. wt. gain, MWC 187.2 grams $H_2O$

Pressure at meter, PM 28.55 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{.3363}$$

33.6

12.3078

– Dry solids

tare 9.1436

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Inlet Sample Ident.> CAM-112-TM-IN-Q2

A02 (1-3) Date 11/12/83 (MMDDYY) Time Start 1151 (HHMM) Time Finish 1243 (HHMM)

Duct Dimensions 6 x 2.21 ft. or Diameter _____ ft.

PTCF .84 DGMCF 1.0122 Test Duration 48 min.

A03 (1-3) Nozzle Dia. .273 inches % CO -0- % $N_2$ 88.8

Bar Press. 28.50 "Hg % $CO_2$ 6.2 % $H_2$ -0-

Static Press. -1.20 "$H_2O$ % $O_2$ 5.0 % $CH_4$ -0-

A04 (1-3) Initial leak rate .015 cfm Condensed Water 246.0 gms

Final leak rate .016 cfm Filter wt. gain 4.8540 gms

Operator initials EPA/CBC/VAL Probe wash wt. gain 4.5056 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 | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 1-1 | 1151 | 839.409 | .20 | .38 | 302 | 65 | 65 | 250 | 50 | 4.0 |
| A06 | 1-2 | 1154 | 840.51 | .25 | .50 | 316 | 65 | 64 | 250 | 50 | 5.0 |
| | 1-3 | 1157 | 841.78 | .25 | .50 | 316 | 66 | 65 | 250 | 50 | 5.0 |
| A8 | 1-4 | 1200 | 843.05 | .24 | .48 | 317 | 66 | 65 | 250 | 50 | 5.5 |
| A09 | STOP | 1203 | 844.290 | | | | | | | | |
| A10 | 2-1 | 1204 | 844.290 | .19 | .38 | 291 | 67 | 66 | 250 | 49 | 5.5 |
| A11 | 2-2 | 1207 | 845.40 | .20 | .40 | 279 | 67 | 66 | 250 | 49 | 6.1 |
| A12 | 2-3 | 1210 | 846.54 | .23 | .46 | 292 | 68 | 67 | 250 | 49 | 7.4 |
| A13 | 2-4 | 1213 | 847.76 | .25 | .50 | 311 | 69 | 67 | 250 | 49 | 8.6 |
| A14 | STOP | 1216 | 849.033 | | | | | | | | |
| A15 | 3-1 | 1218 | 849.033 | .25 | .50 | 268 | 69 | 68 | 250 | 49 | 8.0 |
| A16 | 3-2 | 1221 | 850.33 | .27 | .54 | 290 | 70 | 68 | 250 | 49 | 10.8 |
| A17 | 3-3 | 1224 | 851.66 | .21 | .42 | 301 | 70 | 69 | 250 | 49 | 10.2 |
| A18 | 3-4 | 1227 | 852.85 | .20 | .40 | 314 | 70 | 69 | 250 | 49 | 10.6 |
| A19 | STOP | 1230 | 854.012 | | | | | | | | |
| A20 | 4-1 | 1231 | 854.012 | .32 | .64 | 264 | 71 | 70 | 250 | 49 | 13.5 |
| A21 | 4-2 | 1234 | 855.39 | .24 | .48 | 293 | 71 | 70 | 250 | 49 | 13.5 |
| A22 | 4-3 | 1237 | 856.64 | .22 | .44 | 308 | 72 | 71 | 250 | 49 | 13.5 |
| | | (4:2) | (11:6) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console D-348 Filter 0/0 Initial Wt. 5072 gms

Sample Analysis _____

Weather _____

A23 Remarks 185° @ 1226

156 -312

78 172

| .20 | .25 | .30 | .35 |
|---|---|---|---|
| .38 | .48 | .58 | .67 |

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> Cam-1112-Tm-IN-02

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. _____ (25:6) "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 | 44 | 1240 | 857.84 | .23 | .46 | 312 | 72 | 71 | 250 | 49 | 13.5 |
| A06 | STOP | 1243 | 859.028 | | | | | | | | |
| | | | | | | | | | | | |
| A08 | | | | | | | | | | | |
| A09 | | | | | | | | | | | |
| A10 | | | | | | | | | | | |
| A11 | | | | | | | | | | | |
| A12 | | | | | | | | | | | |
| 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 Hot Box 182 @ 1241 At END of Run Vacuum Gage Remained stuck on 13.5

Inlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) |
|---|---|---|---|---|
| 1 | NaOH | 250 ml | | Final 863.6<br>Initial 678.7<br>Wt. Gain 184.9 |
| 2 | NaOH | 250 ml | | Final 744.5<br>Initial 697.0<br>Wt. Gain 47.5 |
| 3 | Dry | | | Final 433.4<br>Inital 431.1<br>Wt. Gain 2.3 |
| 4 | $HNO_3$ | 250 ml | | Final 730.9<br>Initial 729.1<br>Wt. Gain 1.8 |
| 5 | Dry | | | Final 443.4<br>Initial 443.4<br>Wt. Gain 0.0 |
| 6 | Silica Gel | | | Final 709.0<br>Initial 699.5<br>Wt. Gain 9.5 |
| 7 | | | | Final<br>Initial<br>Wt. Gain |

Total Impingers Weight Gain (MWC)(grams) 246.0 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 19.858 ft³

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 528 °R

Total imp. wt. gain, MWC _____ grams $H_2O$

Pressure at meter, PM 28.495 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = .3899$$

1/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Inlet Sample Ident.> CAM-P113-PAH-IN-0

A02 (1-3) Date 11/13/83 (MMDDYY) Time Start 0956 (HHMM) Time Finish 1050 (HHMM)

Duct Dimensions 6 x 2.21 ft. or Diameter — ft.

PTCF .84 DGMCF 1.0122 Test Duration 48 min.

A03 (1-3) Nozzle Dia. .273 inches % CO -0- % $N_2$ 88.9

Bar Press. 28.52 "Hg % $CO_2$ 6.0 % $H_2$ -0-

Static Press. -1.20 "$H_2O$ % $O_2$ 5.1 % $CH_4$ -0-

A04 (1-3) Initial leak rate .010 cfm Condensed Water 271.8 gms

Final leak rate .008 cfm Filter wt. gain 4.3309 gms

Operator initials EPA/JLL Probe wash wt. gain 6.4795 gms

.48

| | 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 | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 1-1 | 0956 | 871.679 | .19 | .40 | 304 | 70 | 70 | 255 | 50 | 2.2 |
| A06 | 1-2 | 0959 | 872.82 | .26 | .54 | 323 | 70 | 69 | 250 | 50 | 2.8 |
| | 1-3 | 1002 | 874.13 | .27 | .57 | 336 | 70 | 69 | 250 | 50 | 3.0 |
| A08 | 1-4 | 1005 | 875.47 | .25 | .53 | 316 | 70 | 69 | 250 | 48 | |
| A09 | STOP | 1008 | 876.784 | | | | | | | | |
| A10 | 2-1 | 1009 | 876.784 | .20 | .42 | 289 | 70 | 69 | 250 | 48 | 3.8 |
| A11 | 2-2 | 1012 | 877.95 | .21 | .44 | 296 | 70 | 69 | 250 | 48 | 4.2 |
| A12 | 2-3 | 1015 | 879.14 | .27 | .48 | 288 | 71 | 70 | 250 | 51 | 5.0 |
| A13 | 2-4 | 1018 | 880.38 | .24 | .50 | 288 | 72 | 70 | 250 | 51 | 6.1 |
| A14 | STOP | 1021 | 881.640 | | | | | | | | |
| A15 | 3-1 | 1024 | 881.640 | .26 | .55 | 260 | 72 | 71 | 250 | 51 | 5.8 |
| A16 | 3-2 | 1027 | 882.93 | .29 | .61 | 278 | 73 | 72 | 250 | 51 | 8.0 |
| A17 | 3-3 | 1030 | 884.43 | .22 | .46 | 275 | 73 | 72 | 250 | 54 | 8.5 |
| A18 | 3-4 | 1033 | 885.57 | .24 | .51 | 280 | 73 | 72 | 250 | 54 | 10.0 |
| A19 | STOP | 1036 | 886.844 | | | | | | | | |
| A20 | 4-1 | 1038 | 886.844 | .33 | .69 | 248 | 74 | 73 | 250 | 56 | 9.0 |
| A21 | 4-2 | 1041 | 888.27 | .24 | .51 | 245 | 75 | 73 | 250 | 56 | 10.8 |
| A22 | 4-3 | 1044 | 889.56 | .21 | .44 | 285 | 75 | 73 | 250 | 56 | 11.0 |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console D-5118 Filter #030 Initial Wt. .4988 gms

Sample Analysis

Weather

A23 Remarks Hot Box 205°F @ 1019



WET = 73 = 163°F
Dry = 143 289

| | | | | | | |
|---|---|---|---|---|---|---|
| .18 | .20 | .23 | .25 | .28 | .30 | .32 |
| .38 | .42 | .45 | .53 | .59 | .63 | .67 |

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> Cam-1113-PAH-IN-01

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. _____ (25:6) "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 $ft^3$ | 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 | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 44 | 1047 | 890.82 | .25 | .53 | 300 | 75 | 74 | 250 | 56 | 13.5 |
| A06 | STOP | 1050 | 892.067 | | | | | | | | |
| A08 | | | | | | | | | | | |
| A09 | | | | | | | | | | | |
| A10 | | | | | | | | | | | |
| A11 | | | | | | | | | | | |
| A12 | | | | | | | | | | | |
| 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 _____

Inlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) |
|---|---|---|---|---|
| 1 | NaOH | 250 ml | | Final 854.0<br>Initial 703.2<br>Wt. Gain 150.8 |
| 2 | NaOH | 250 ml | | Final 826.4<br>Initial 716.9<br>Wt. Gain 109.5 |
| 3 | Dry | — | | Final 444.3<br>Inital 442.9<br>Wt. Gain 1.4 |
| 4 | SilicaGel | — | | Final 676.0<br>Initial 665.9<br>Wt. Gain 10.1 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| 7 | | | | Final<br>Initial<br>Wt. Gain |

Total Impingers Weight Gain (MWC)(grams) 271.8 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 20.637 $ft^3$

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 531.5 °R

Total imp. wt. gain, MWC 271.8 grams $H_2O$

Pressure at meter, PM 28.52 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)\ (1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = \underline{\underline{3958}}$$

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Inlet Sample Ident.> CAM-1114-PAH-IN-Q

A02 (1-3) Date 11-14-83 (MMDDYY) Time Start 0827 (HHMM) Time Finish 0936 (HHMM)

Duct Dimensions 6 x 2.21 ft. or Diameter — ft.

PTCF .84 DGMCF 1.0122 Test Duration 48 min.

A03 (1-3) Nozzle Dia. .273 inches % CO -0- % $N_2$ 89.2

Bar Press. 28.32 "Hg % $CO_2$ 6.1 % $H_2$ -0-

Static Press. -1.20 "$H_2O$ % $O_2$ 4.7 % $CH_4$ -0-

A04 (1-3) Initial leak rate .018 cfm Condensed Water 235.1 gms

Final leak rate .006 cfm Filter wt. gain 2.9104 gms

Operator initials EPA / VAL Probe wash wt. gain 4.0420 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 | GAS ~~Hot Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 1-1 | 0827 | 894.051 | .22 | .41 | 318 | 60 | 60 | 255 | 50 | 2.0 |
| A06 | 1-2 | 0830 | 895.20 | .27 | .50 | 336 | 61 | 60 | 250 | 50 | 2.5 |
| | 1-3 | 0833 | 896.46 | .28 | .52 | 340 | 61 | 60 | 250 | 50 | 3.0 |
| A08 | 1-4 | 0836 | 897.75 | .27 | .50 | 341 | 62 | 60 | 250 | 52 | 3.2 |
| A09 | STOP | 0839 | 899.028 | | | | | | | | |
| A10 | 2-1 | 0840 | 899.028 | .20 | .37 | 298 | 62 | 61 | 250 | 52 | 3.0 |
| A11 | 2-2 | 0843 | 900.12 | .22 | .41 | 303 | 63 | 61 | 250 | 52 | 3.5 |
| A12 | 2-3 | 0846 | 901.26 | .23 | .43 | 301 | 64 | 62 | 250 | 52 | 4.0 |
| A13 | 2-4 | 0849 | 902.43 | .27 | .50 | 308 | 64 | 63 | 250 | 52 | 4.8 |
| A14 | STOP | 0852 | 903.702 | | | | | | | | |
| A15 | 3-1 | 0854 | 903.702 | .28 | .54 | 243 | 65 | 64 | 250 | 52 | 5.0 |
| A16 | 3-2 | 0857 | 905.03 | .30 | .56 | 287 | 66 | 65 | 250 | 52 | 6.0 |
| A17 | 3-3 | 0900 | 906.33 | .25 | .46 | 301 | 66 | 65 | 250 | 52 | 6.2 |
| A18 | 3-4 | 0903 | 907.60 | .26 | .48 | 303 | 67 | 65 | 250 | 56 | 7.0 |
| A19 | STOP | 0906 | 908.824 | | | | | | | | |
| A20 | 4-1 | 0924 | 912.937 | .35 | .65 | 251 | 69 | 69 | 255 | 56 | 7.0 |
| A21 | 4-2 | 0927 | 914.16 | .25 | .46 | 289 | 70 | 69 | 255 | 56 | 7.5 |
| A22 | 4-3 | 0930 | 915.38 | .25 | .46 | 314 | 70 | 69 | 250 | 56 | 8.0 |
| | (8:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (70:5) |

Console D-548 Filter 019 Initial Wt. .5245 gms

Sample Analysis

Weather

A23 Remarks Hot Box 200°F



wet-79°-174 .20 | .23 | .25 | .28 | .30 | .32 wet 171 38%

Dry-157-315 .37 | .43 | .46 | .53 | .56 | .59 300

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> Cam.1114-BAH-IN-Ø(

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 $ft^3$ | 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 | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 4-1 | 0933 | 916.58 | .29 | .51 | 328 | 71 | 69 | 250 | 54 | 9.5 |
| A06 | STOP | 0936 | 917.878 | | | | | | | | |
| | | | | | | | | | | | |
| A08 | | | | | | | | | | | |
| A09 | | | | | | | | | | | |
| A10 | | | | | | | | | | | |
| A11 | | | | | | | | | | | |
| A12 | | | | | | | | | | | |
| 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 _____

Inlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) |
|---|---|---|---|---|
| 1 | NaOH | 250 ml | | Final 851.4<br>Initial 648.4<br>Wt. Gain 203 |
| 2 | NaOH | 250 ml | | Final 693.9<br>Initial 670.1<br>Wt. Gain 23.8 |
| 3 | Dry | — | | Final 444.9<br>Inital 443.4<br>Wt. Gain 1.5 |
| 4 | Silica Gel | — | | Final 682.7<br>Initial 675.9<br>Wt. Gain 6.8 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| 7 | | | | Final<br>Initial<br>Wt. Gain |

Total Impingers Weight Gain (MWC)(grams) 235.1 Analyst _____

Corrected sample Vol. (DGV) 20.656

(net vol) x (DGMCF) = ~~20.019~~ $ft^3$

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 524.5 °R

Total imp. wt. gain, MWC 235.1 grams $H_2O$

Pressure at meter, PM 28.32 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = .4037$$

APPENDIX C.1

CONVENTIONAL OPERATION TESTING

INCLUDES

C.1.1 EPA Reference Methods 2, 3, 4, and 5E
C.1.1.2 Controlled Emissions - EPA Reference Method 2, 3, 4, and 5E Data Sheets

# VELOCITY PROFILE FIELD DATA

1/2

Plant Name> CAMPBELL

Sampling Location> OUTLET Sample Ident.> ~~[illegible]~~ CAM-1108-VTP-01 OUT

Date 11/7/83 (MMDDYY) Time Start 1600 (HHMM) Time Finish 1630 (HHMM)

Duct Dimensions 2.9 x 2.6 ft. or Diameter _____ ft.

PTCF 0.84 % $H_2O$ _____

Bar Press. ~~29.40~~ 28.58 "Hg % CO _____ % $N_2$ _____

Static Press. + .50 "$H_2O$ % $CO_2$ _____ % $H_2$ _____

Operator Initials MJK/VLL % $O_2$ _____ % $CH_4$ _____

| | Pt. | Stack Temp. °F #1 | #2 | Ave. | Velocity Pressure "$H_2O$ #1 | #2 | Ave. | Other ( ) #1 | #2 | Ave. |
|---|---|---|---|---|---|---|---|---|---|---|
| D04 | 1-4 | 153 | 154 | | .50 | .60 | .55 | | | |
| D05 | 1-3 | 154 | 153 | | .30 | .45 | .38 | | | |
| D06 | 1-2 | 153 | 153 | | .30 | .45 | .38 | | | |
| D07 | 1-1 | 152 | 153 | | .20 | .30 | .25 | | | |
| D08 | 2-4 | 155 | 156 | | .90 | .85 | .88 | | | |
| D09 | 2-3 | 156 | 156 | | .60 | .70 | .65 | | | |
| D10 | 2-2 | 156 | 156 | | .45 | .50 | .48 | | | |
| D11 | 2-1 | 155 | 156 | | .35 | .35 | .35 | | | |
| D12 | 3-4 | 158 | 157 | | .90 | .85 | .88 | | | |
| D13 | 3-3 | 158 | 158 | | .70 | .75 | .73 | | | |
| D14 | 3-2 | 158 | 157 | | .50 | .55 | .53 | | | |
| D15 | 3-1 | 157 | 157 | | .40 | .35 | .38 | | | |
| D16 | 4-4 | 157 | 158 | | .90 | .90 | .90 | | | |
| D17 | 4-3 | 157 | 157 | | .75 | .80 | .78 | | | |
| D18 | 4-2 | 157 | 158 | | .60 | .60 | .60 | | | |
| D19 | 4-1 | 158 | 157 | | .40 | .40 | .40 | | | |
| D20 | | | | | | | | | | |
| D21 | | | | | | | | | | |

Weather _____

Remarks _____

Gas Comp

| | | | |
|---|---|---|---|
| $CO_2$ | 6.5 | 4.55 | 2.002 |
| $O_2$ | 5 | 3.5 | 1.12 |
| $N_2$ | 88.5 | 61.95 | 17.346 |
| $H_2O$ | | 30 | 5.4 |

M.W. = 25.87

Ave ΔP = .~~[illegible]~~

Avg T = 157

# VELOCITY PROFILE FIELD DATA

Plant Name> _____

Sampling Location> _____ Sample Ident.> _____

Date _____ (MMDDYY) Time Start _____ (HHMM) Time Finish _____ (HHMM)

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

PTCF _____ % $H_2O$ _____

Bar Press. _____ "Hg % CO _____ % $N_2$ _____

Static Press. _____ "$H_2O$ _____ % $CO_2$ _____ % $H_2$ _____

Operator Initials _____ % $O_2$ _____ % $CH_4$ _____

| | Pt. | Stack Temp. °F #1 | #2 | Ave. | Velocity Pressure "$H_2O$ #1 | #2 | Ave. | Other ( ) #1 | #2 | Ave. |
|---|---|---|---|---|---|---|---|---|---|---|
| 004 | 5-4 | 158 | 158 | | .90 | .90 | .90 | | | |
| 005 | 5-3 | 158 | 158 | | .75 | .80 | .78 | | | |
| 006 | 5-2 | 158 | 158 | | .55 | .55 | .55 | | | |
| 007 | 5-1 | 157 | 158 | | .40 | .35 | .38 | | | |
| 008 | 6-4 | 160 | 160 | | .75 | .80 | .78 | | | |
| 009 | 6-3 | 160 | 160 | | .65 | .65 | .65 | | | |
| 010 | 6-2 | 160 | 160 | | .40 | .40 | .40 | | | |
| 011 | 6-1 | 159 | 158 | | .30 | .30 | .30 | | | |
| 012 | | | | | | | | | | |
| 013 | | | | | | | | | | |
| 014 | | | | | | | | | | |
| 015 | | | | | | | | | | |
| 016 | | | | | | | | | | |
| 017 | | | | | | | | | | |
| 018 | | | | | | | | | | |
| 019 | | | | | | | | | | |
| 020 | | | | | | | | | | |
| 021 | | | | | | | | | | |

Weather _____

Remarks _____

$\Delta P_{AOE} = .578$

$$V_s = 85.48(.84)\sqrt{\frac{.578 \times 617}{25.87 \times 28.62}}$$

$$= 49.83 \text{ F/s} \; \frac{530}{617} \times \frac{25.87}{29.92} \times \left(1 - \frac{30}{100}\right)$$

$$= 25.91 \text{ SF/s} \times 7.54 \text{ ft}^2$$

$$= 195.4 \text{ SCFS}$$

Duct 7.54 ft

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> CAMBELL

Sampling Location> OUTLET 1 Sample Ident.> MOISTURE-1

A02 (1-3) Date 11/7/83 (4:6) (MMDDYY) Time Start 1710 (11:4) (HHMM) Time Finish 1738 (18:4) (HHMM)

Duct Dimensions ____ (29:5) x ____ (32:5) ft. or Diameter ____ ft.

PTCF 0.84 (46:5) DGMCF .9935 (53:5) Test Duration 23 (39:5) (60:5) min.

A03 (1-3) Nozzle Dia. N/A (6:4) inches % CO ____ (11:5) % $N_2$ ____ (18:5)

Bar Press. 29.40 (25:6) "Hg % $CO_2$ ____ (32:5) % $H_2$ ____ (39:5)

Static Press. -.50 (46:5) "$H_2O$ ____ (53) % $O_2$ ____ (40:5) % $CH_4$ ____ (67:5)

A04 (1-3) Initial leak rate .010 (4:5) cfm Condensed Water 107.5 (11:6) gms

Final leak rate .010 (18:5) cfm Filter wt. gain ____ (25:7) gms

Operator initials MJK/VL (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 | 4-3 | 1710 | 749.849 | .80 | .80 | 163 | 60 | 60 | — | 52 | 3.0 |
| A06 | 4-3 | 1720 | 755.243 | .80 | .80 | 160 | 61 | 60 | — | 47 | 3.5 |
| | ~~4-3~~ | ~~1740~~ | | | | | | | | | |
| A08 | ~~4-3~~ | ~~1800~~ | | | | | | | | | |
| A09 | STOP | 1732 | 760.902 | | | | | | | | |
| A10 | 4-3 | 1737 | 760.902 | .80 | .80 | 163 | 62 | 60 | — | 48 | 3.5 |
| A11 | STOP | 1738 | 761.460 | | | | | | | | |
| A12 | | | | | | | | | | | |
| A13 | | | 11.611 | | | | | | | | |
| 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) | (70:5) |

Console 4837 Filter ____ Initial Wt. ____ gms

Sample Analysis ____

Weather ____

A23 Remarks WET BULB TEMP. 157°F
DRY " " " 164°F

30% $H_2O$

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | $H_2O$ | 250 ml | | Final | 808.6 |
| | | | | Initial | 707.5 g |
| | | | | Wt. Gain | 101.1 |
| 2 | $H_2O$ | 250 ml | | Final | 728.4 |
| | | | | Initial | 724.9 g |
| | | | | Wt. Gain | 3.5 |
| 3 | Dry | — | | Final | 428.8 |
| | | | | Inital | 428.6 g |
| | | | | Wt. Gain | 0.2 |
| 4 | Silica Gel | | | Final | 577.3 |
| | | | | Initial | 574.6 g |
| | | | | Wt. Gain | 2.7 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC) (grams) 107.5 Analyst _____

Corrected sample Vol. (DGV) $11.611 \times \frac{530}{521} \times \frac{29.40}{29.92}$

(net vol) x (DGMCF) = 11.536 ft³

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 521 °R

Total imp. wt. gain, MWC 107.5 grams $H_2O$

Pressure at meter, PM 29.40 inches Hg

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

$$\text{Moisture Fraction} = \frac{(107.5)\ (1.339)}{\left[(107.5)\ (1.339)\right] + \left[\frac{(11.536)\ (29.40)}{(521)}\ (501.7)\right]} = .3059$$

$501.7 = \left(\frac{528\ (28.27)}{29.92}\right)$

# VELOCITY PROFILE FIELD DATA

001 Plant Name> T. J. Campbell

Sampling Location> Outlet - Lower Ports Sample Ident.>

002 (1-3) Date 11/8/83 (MMDDYY) Time Start 1300 (HHMM) Time Finish 1305 (HHMM)

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

PTCF ____ % $H_2O$ ____

003 (1-3) Bar Press. 28.58 "Hg % CO ____ % $N_2$ ____

Static Press. +.5 "$H_2O$ ____ % $CO_2$ ____ % $H_2$ ____

Operator Initials MRT % $O_2$ ____ % $CH_4$ ____

| | Pt. | Stack Temp. °F #1 | #2 | Ave. | Velocity Pressure "$H_2O$ #1 | #2 | Ave. | Other ( ) #1 | #2 | Ave. |
|---|---|---|---|---|---|---|---|---|---|---|
| 004 | S 1 | | | | .3 | .3 | .3 | | | |
| 005 | 2 | | | | .5 | .5 | .5 | | | |
| 006 | 3 | | | | .8 | .8 | .8 | | | |
| 007 | 4 | | | | 1. | 1. | 1. | | | |
| 008 | | | | | | | | | | |
| 009 | M 1 | | | | .3 | | | | | |
| 010 | 2 | | | | .5 | | | | | |
| 011 | 3 | | | | .8 | | | | | |
| 012 | 4 | | | | 1. | | | | | |
| 013 | | | | | | | | | | |
| 014 | N 1 | | | | .3 | | | | | |
| 015 | 2 | | | | .5 | | | | | |
| 016 | 3 | | | | .8 | | | | | |
| 017 | 4 | | | | 1. | | | | | |
| 018 | | | | | | | | | | |
| 019 | | | | | | | | | | |
| 020 | | | | | | | | | | |
| 021 | | | | | | | | | | |

Weather ____

Remarks Readings noisy ± 0.1 at best

Avg $\Delta p$ = .65 (right in the middle)
use 0.8

$$V_s = 85.48\,(.84)\sqrt{\frac{.8 \times 617}{25.87 \times 28.62}}$$

$$= 58.6$$

RADIAN CORPORATION

# ORSAT DATA SHEET

Location Campbell Outlet Comments

Date 11/8

Time 1610 hrs

Operator MRF

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 | 0.4 | 5.6 | 5.2 | 14.0 | 8.4 | | |
| 2 | 0 | 5.6 | 5.6 | 14.0 | 8.4 | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 5.4 % $O_2$ 8.4

% CO _____ % $N_2$ _____

Dry Molecular Weight, MW (dry) =

$$= 0.44 \frac{5.4}{(\%\ CO_2)} + 0.32 \frac{8.4}{(\%\ O_2)} + 0.28 \frac{0 + 86.2}{(\%\ CO + \%\ N_2)}$$

29.20

= 2.376 + 2.688 + 24.136

= 29.2 g/mole

Figure 5-3. Orsat field data sheet.

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> CAMPBELL

Sampling Location> OUTLET Sample Ident.> CAM-1108-PAH-OUT-01

A02 (1-3) Date 11/08/83 (MMDDYY) Time Start 1405 (HHMM) Time Finish 1608 (HHMM)

Duct Dimensions 2.96 x 2.60 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9935 Test Duration 100 min.

A03 (1-3) Nozzle Dia. .180 inches % CO -0- % $N_2$ 86.2

Bar Press. 28.38 "Hg % $CO_2$ 5.4 % $H_2$ -0-

Static Press. +.55 "$H_2O$ % $O_2$ 8.4 % $CH_4$ -0-

A04 (1-3) Initial leak rate .012 cfm Condensed Water 419.8 gms

Final leak rate .016 cfm Filter wt. gain 0.0246 gms

Operator initials MTK/VLL Probe wash wt. gain 0.0482 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 | 1-4 | 1405 | 896.911 | .30 | .40 | 155 | 61 | 61 | 250 | 56 | 1.3 |
| A06 | 1-3 | 1410 | 898.40 | .20 | .30 | 157 | 70 | 63 | 250 | 54 | 1.2 |
| | 1-2 | 1415 | 900.22 | .15 | .25 | 154 | 72 | 65 | 250 | 52 | 1.0 |
| A08 | 1-1 | 1420 | 901.67 | .15 | .25 | 156 | 75 | 67 | 250 | 51 | 1.1 |
| A09 | STOP | 1425 | 903.171 | | | | | | | | |
| A10 | 2-4 | 1431 | 903.171 | .75 | .90 | 158 | 76 | 70 | 250 | 52 | 2.6 |
| A11 | 2-3 | 1436 | 905.78 | .60 | .75 | 159 | 75 | 72 | 250 | 51 | 2.4 |
| A12 | 2-2 | 1441 | 908.19 | .40 | .60 | 155 | 77 | 71 | 250 | 54 | 2.4 |
| A13 | 2-1 | 1446 | 910.39 | .30 | .40 | 153 | 74 | 71 | 250 | 56 | 1.5 |
| A14 | STOP | 1451 | 912.165 | | | | | | | | |
| A15 | 3-4 | 1458 | 912.165 | .85 | 1.10 | 158 | 76 | 74 | 255 | 60 | 3.2 |
| A16 | 3-3 | 1503 | 914.97 | .70 | .85 | 160 | 78 | 71 | 250 | 58 | 2.8 |
| A17 | 3-2 | 1508 | 917.52 | .50 | .70 | 160 | 78 | 70 | 250 | 60 | 2.6 |
| A18 | 3-1 | 1513 | 919.80 | .35 | .45 | 162 | 79 | 71 | 250 | 61 | 2.3 |
| A19 | STOP | 1518 | 921.809 | | | | | | | | |
| A20 | 4-4 | 1523 | 921.809 | .85 | 1.15 | 155 | 77 | 72 | 250 | 59 | 3.7 |
| A21 | 4-3 | 1528 | 924.61 | .70 | .85 | 157 | 80 | 71 | 250 | 60 | 2.7 |
| A22 | 4-2 | 1533 | 927.17 | .60 | .75 | 153 | 80 | 71 | 250 | 61 | 2.6 |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console RS495N Filter 004 Initial Wt. .5241 gms

Sample Analysis

Weather

A23 Remarks

Final Filter Wt 0.5493

* WET BULB 156°F

DRY " 157°F

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> CAM-1108-PAH-OUT -01

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 | 4-1 | 1538 | 929.66 | .40 | .60 | 158 | 81 | 72 | 245 | 62 | 2.5 |
| A06 | STOP | 1543 | 931.797 | . | | | | | | | |
| | 5-4 | 1548 | 931.797 | .75 | .90 | 153 | 77 | 72 | 255 | 58 | 2.8 |
| A08 | 5-3 | 1553 | 934.41 | .75 | .90 | 157 | 82 | 73 | 250 | 58 | 2.8 |
| A09 * | 5-2 | 1558 | 937.04 | .60 | .75 | 157 | 81 | 72 | 250 | 59 | 2.7 |
| A10 | 5-1 | 1603 | 939.43 | .35 | .45 | 157 | 81 | 75 | 250 | 60 | 2.5 |
| A11 | STOP | 1608 | 941.348 | | | | | | | | |
| A12 | | | | | | | | | | | |
| 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 _____

Outlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | 0.1N NaOH | ~250 | G-S | Final | 840.5 |
| | | | | Initial | 709.3 |
| | | | | Wt. Gain | 131.2 |
| 2 | 0.1N NaOH | ~250 | G-S | Final | 858.1 |
| | | | | Initial | 706.2 |
| | | | | Wt. Gain | 151.9 |
| 3 | Dry | — | Mod. | Final | 554.8 |
| | | | | Inital | 434.3 |
| | | | | Wt. Gain | 120.5 |
| 4 | Silica Gel | — | Mod. | Final | 702.1 |
| | | | | Initial | 685.9 |
| | | | | Wt. Gain | 16.2 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 419.8 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 44.148 ft3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 533 °R

Total imp. wt. gain, MWC _____ grams $H_2O$

Pressure at meter, PM 29.55 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)\ (1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = .3215$$

1/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Out let Sample Ident.> CAM-1112-TM-Out-02

A02 (1-3) Date 11/12/93 (MMDDYY) Time Start 1129 (HHMM) Time Finish 1319 (HHMM)

Duct Dimensions 2.96 x 2.6 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9935 Test Duration 96 min.

A03 (1-3) Nozzle Dia. .243 inches % CO -0- % $N_2$ 88.8

Bar Press. 28.495 "Hg % $CO_2$ 6.2 % $H_2$ -0-

Static Press. +.55 "$H_2O$ % $O_2$ 5.0 % $CH_4$ -0-

A04 (1-3) Initial leak rate .015 cfm Condensed Water 530.3 gms

Final leak rate .010 cfm Filter wt. gain 0.0344 gms

Operator initials MJK/TWT Probe wash wt. gain 0.1393 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 | 1-4 | 1129 | 238.839 | .25 | .42 | 156 | 52 | 52 | 245 | 45 | 3.9 |
| | 1-3 | 1133 | 240.43 | .20 | .34 | 156 | 51 | 50 | 250 | 48 | 3.2 |
| | 1-2 | 1137 | 241.79 | .20 | .34 | 157 | 52 | 51 | 250 | 48 | 3.2 |
| A8 | 1-1 | 1141 | 243.12 | .20 | .34 | 155 | 53 | 53 | 250 | 49 | 3.2 |
| A09 | STOP | 1145 | 244.450 | | | | | | | | |
| A10 | 2-4 | 1147 | 244.450 | .75 | 1.26 | 160 | 58 | 58 | 250 | 46 | 9.5 |
| A11 | 2-3 | 1157 | 247.00 | .50 | .84 | 158 | 59 | 58 | 250 | 46 | 6.2 |
| A12 | 2-2 | 1155 | 249.13 | .40 | .67 | 160 | 59 | 57 | 250 | 45 | 5.1 |
| A13 | 2-1 | 1159 | 251.00 | .30 | .50 | 160 | 60 | 57 | 250 | 46 | 4.2 |
| A14 | STOP | 1203 | 252.630 | | | | | | | | |
| A15 | 3-4 | 1204 | 252.630 | .75 | 1.26 | 162 | 58 | 56 | 250 | 47 | 9.4 |
| A16 | 3-3 | 1208 | 255.12 | .65 | 1.09 | 161 | 57 | 57 | 250 | 47 | 8.5 |
| A17 | 3-2 | 1212 | 257.51 | .50 | .84 | 159 | 58 | 57 | 250 | 47 | 6.6 |
| A18 | 3-1 | 1216 | 259.62 | .40 | .67 | 159 | 60 | 60 | 250 | 48 | 5.1 |
| A19 | STOP | 1220 | 261.434 | | | | | | | | |
| A20 | 4-4 | 1222 | 261.434 | .75 | 1.26 | 158 | 58 | 58 | 250 | 47 | 9.6 |
| A21 | 4-3 | 1226 | 263.90 | .70 | 1.18 | 159 | 59 | 57 | 250 | 48 | 9.2 |
| A22 | 4-2 | 1230 | 266.40 | .53 | .92 | 159 | 57 | 57 | 250 | 48 | 7.2 |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console 4837 Filter 013 Initial Wt. .5052 gms

Sample Analysis

Weather

A23 Remarks

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> Cam-1112-TM-OUT-92

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 | 4-1 | 1234 | 268.65 | .45 | .76 | 155 | 57 | 57 | 250 | 49 | 6.1 |
| A06 | STOP | 1238 | 270.654 | | | | | | | | |
| | 5-4 | 1239 | 270.654 | .75 | 1.26 | 158 | 58 | 58 | 250 | 50 | 9.9 |
| A8 | * STOP | 1243 | 273.259 | | | | | | | | |
| A09 | 5-3 | 1250 | 273.259 | .75 | 1.26 | 159 | 58 | 57 | 250 | 48 | 9.9 |
| A10 | 5-2 | 1254 | 275.82 | .60 | 1.01 | 158 | 59 | 58 | 250 | 48 | 8.1 |
| A11 | 5-1 | 1258 | 278.18 | .45 | .76 | 160 | 59 | 58 | 250 | 48 | 6.3 |
| A12 | STOP | 1302 | 280.200 | | | | | | | | |
| A13 | 6-4 | 1303 | 280.200 | .60 | 1.01 | 159 | 59 | 59 | 250 | 50 | 8.2 |
| A14 | 6-3 | 1307 | 282.50 | .55 | .92 | 160 | 60 | 58 | 250 | 50 | 7.4 |
| A15 | 6-2 | 1311 | 284.71 | .40 | .67 | 160 | 60 | 57 | 250 | 51 | 6.0 |
| A16 | 6-1 | 1315 | 286.61 | .35 | .59 | 160 | 61 | 58 | 250 | 52 | 5.8 |
| A17 | STOP | 1319 | 288.374 | | | | | | | | |
| 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 * MALFUNCTION OF BOX

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | NaOH | 250 ml | | Final | 850.1 |
| | | | | Initial | 688.6 |
| | | | | Wt. Gain | 161.5 |
| 2 | NaOH | 250 ml | | Final | 875.6 |
| | | | | Initial | 716.0 |
| | | | | Wt. Gain | 159.6 |
| 3 | Dry | — | | Final | 557.1 |
| | | | | Inital | 446.1 |
| | | | | Wt. Gain | 111.0 |
| 4 | $HNO_3$ | 250 ml | | Final | 689.2 |
| | | | | Initial | 720.6 |
| | | | | Wt. Gain | -31.4 |
| 5 | Dry | — | | Final | 553.5 |
| | | | | Initial | 440.4 |
| | | | | Wt. Gain | 113.1 |
| 6 | SilicaGel | — | | Final | 719.6 |
| | | | | Initial | 703.1 |
| | | | | Wt. Gain | 16.5 |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 530.3 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

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

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

1/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Outlet Sample Ident.> CAM-1113-PAH-OUT-01

A02 (1-3) Date 11/17/83 (MMDDYY) Time Start 0853 (HHMM) Time Finish 1112 (HHMM)

Duct Dimensions 2.96 x 2.6 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9935 Test Duration 96 min.

A03 (1-3) Nozzle Dia. .243 inches % CO -0- % $N_2$ 88.9

Bar Press. 28.52 "Hg % $CO_2$ 6.0 % $H_2$ -0-

Static Press. +.50 "$H_2O$ % $O_2$ 5.1 % $CH_4$ -0-

A04 (1-3) Initial leak rate .018 cfm Condensed Water 463.9 gms

Final leak rate .020 cfm Filter wt. gain 0.0862 gms

Operator initials TWT/MJK Probe wash wt. gain 0.1573 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 284.687 | | | | | | | | |
| A05 | 1-4 | 0853 | ~~294.555~~ | .20 | .35 | 154 | 56 | 57 | 245 | 46 | 2.2 |
| A06 | 1-3 | 0857 | 291.10 | .15 | .25 | 152 | 56 | 56 | 245 | 46 | 1.9 |
| | 1-2 | 0901 | 292.24 | .15 | .25 | 152 | 57 | 57 | 248 | 46 | 1.8 |
| A08 | 1-1 | 0905 | 293.37 | .15 | .25 | 152 | 56 | 56 | 250 | 46 | 1.8 |
| A09 | STOP | 0909 | 294.510 | | | | | | | | |
| A10 | 2-4 | 0912 | 294.510 | .75 | 1.26 | 152 | 60 | 60 | 250 | 46 | 5.1 |
| A11 | 2-3 | 0916 | 296.90 | .60 | 1.01 | 150 | 58 | 58 | 250 | 46 | 4.3 |
| A12 | 2-2 | 0920 | 299.25 | .9 | .67 | 152 | 57 | 57 | 250 | 46 | 3.6 |
| A13 | 2-1 | 0924 | 301.17 | .35 | .60 | 151 | 55 | 55 | 248 | 46 | 3.0 |
| A14 | STOP | 0928 | 302.945 | | | | | | | | |
| A15 | 3-4 | 0930 | 303.945 | .80 | 1.35 | 152 | 58 | 58 | 245 | 50 | 5.0 |
| A16 | 3-3 | 0934 | 305.60 | .60 | 1.00 | 154 | 57 | 58 | 255 | 50 | 3.8 |
| A17 | | | | | | | | | | | |
| A18 * | STOP | 0935 | 306.171 | | | | | | | | |
| A19 | 3-3 | 0943 | 306.171 | .60 | 1.00 | 154 | 57 | 58 | 255 | 50 | 3.8 |
| A20 | 3-2 | 0946 | 307.80 | .45 | .76 | 152 | 58 | 58 | 255 | 50 | 3.4 |
| A21 | 3-1 | 0950 | 309.81 | .35 | .59 | 153 | 58 | 59 | 255 | 50 | 3.0 |
| A22 | STOP | 0954 | 311.620 | | | | | | | | |
| | | (4:8) | (11:4) (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console 4837 Filter ± 029 Initial Wt. .5090 gms

Sample Analysis

Weather * Hot Box Element came loose

A23 Remarks

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> OUTLET Sample Ident.> CGM-1113-PAH-OUT-01

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 | 4-4 | 1000 | 311.620 | .80 | 1.35 | 152 | 58 | 59 | 255 | 50 | 4.0 |
| A06 | 4-3 | 1004 | 314.19 | .60 | 1.00 | 157 | 62 | 63 | 255 | 45 | 4.7 |
| | 4-2 | 1008 | 316.59 | .50 | .84 | 155 | 61 | 61 | 255 | 45 | 4.0 |
| A8 | 4-1 | 1012 | 318.75 | .40 | .67 | 157 | 57 | 58 | 255 | 49 | 3.3 |
| A09 | STOP | 1016 | 320.627 | | | | | | | | |
| A10 | 5-4 | 1017 | 320.627 | .75 | 1.26 | 157 | 59 | 59 | 255 | 45 | 5.5 |
| A11 | 5-3 | 1021 | 323.20 | .60 | 1.00 | 154 | 57 | 58 | 255 | 45 | 4.8 |
| A12 | 5-2 | 1025 | 325.58 | .55 | .92 | 155 | 59 | 59 | 255 | 46 | 4.5 |
| A13 | 5-1 | 1029 | 327.80 | .45 | .76 | 161 | 59 | 59 | 255 | 47 | 4.0 |
| A14 | STOP | 1033 | 329.827 | | | | | | | | |
| A15 | 6-4 | 1034 | 329.827 | .55 | .92 | 162 | 57 | 58 | 255 | 47 | 4.8 |
| A16 | 6-3 | 1038 | 331.87 | .50 | .84 | 162 | 59 | 59 | 255 | 48 | 5.0 |
| A17 | STOP | 1042 | 333.865 | PROBE TEMP DROPPED - MOISTURE IN FILTER | | | | | | | |
| A18 | 6-2 | 1104 | 333.868 | .35 | .60 | 161 | 68 | 67 | 240 | 48 | 3.5 |
| A19 | 6-1 | 1108 | 335.56 | .35 | .60 | 158 | 63 | 64 | 255 | 48 | 3.8 |
| A20 | STOP | 1112 | 337.288 | | | | | | | | |
| 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 _____

Outlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | NaOH | 250 ml | | Final | 830.6 |
| | | | | Initial | 711.7 |
| | | | | Wt. Gain | 118.9 |
| 2 | NaOH | 250 ml | | Final | 826.7 |
| | | | | Initial | 694.6 |
| | | | | Wt. Gain | 132.1 |
| 3 | Dry | | | Final | 646.5 |
| | | | | Inital | 449.2 |
| | | | | Wt. Gain | 197.3 |
| 4 | SilicaGel | | | Final | 715.4 |
| | | | | Initial | 699.8 |
| | | | | Wt. Gain | 15.6 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 463.9 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

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

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

1/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Outlet Sample Ident.> CAm-1114-PAH-OUT-01

A02 (1-3) Date 11/14/83 (MMDDYY) Time Start 0813 (HHMM) Time Finish 1003 (HHMM)

Duct Dimensions 2.96 x 2.6 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9935 Test Duration 96 min.

A03 (1-3) Nozzle Dia. .243 inches % CO -0- % $N_2$ 89.2

Bar Press. 28.32 "Hg % $CO_2$ 6.1 % $H_2$ -0-

Static Press. +.50 "$H_2O$ % $O_2$ 4.7 % $CH_4$ -0-

A04 (1-3) Initial leak rate .012 cfm Condensed Water 433.3 gms

Final leak rate .016 cfm Filter wt. gain 0.0296 gms

Operator Initials MJL/MWT Probe wash wt. gain 0.0748 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 | 1-4 | 0813 | 338.354 | .20 | .34 | 157 | 52 | 52 | 250 | 48 | 4.0 |
| A06 | 1-3 | 0817 | 339.73 | .15 | .26 | 155 | 53 | 52 | 250 | 45 | 3.3 |
| A08 | 1-2 | 0821 | 340.93 | .15 | .26 | 153 | 53 | 52 | 255 | 45 | 3.1 |
| | 1-1 | 0825 | 342.10 | .15 | .26 | 152 | 53 | 52 | 250 | 45 | 3.1 |
| A09 | STOP | 0829 | 343.246 | | | | | | | | |
| A10 | 2-4 | 0830 | 343.246 | .65 | 1.09 | 150 | 54 | 52 | 240 | 46 | 9.8 |
| A11 * | STOP | 0834 | 345.938 | | | | | | | | |
| A12 | 2-3 | 0841 | 346.225 | .55 | .92 | 153 | 55 | 54 | 245 | 49 | 3.2 |
| A13 | 2-2 | 0845 | 348.49 | .45 | .76 | 152 | 54 | 53 | 235 | 48 | 3.0 |
| A14 | 2-1 | 0849 | 350.47 | .35 | .59 | 151 | 56 | 54 | 250 | 48 | 2.7 |
| A15 | STOP | 0853 | 352.273 | | | | | | | | |
| A16 | 3-4 | 0854 | 352.273 | .75 | 1.26 | 151 | 55 | 53 | 250 | 47 | 4.8 |
| A17 | 3-3 | 0858 | 354.88 | .65 | 1.09 | 153 | 57 | 56 | 250 | 46 | 4.0 |
| A18 | 3-2 | 0902 | 357.34 | .55 | .92 | 155 | 57 | 56 | 250 | 46 | 3.6 |
| A19 | 3-1 | 0906 | 359.61 | .35 | .59 | 154 | 57 | 56 | 250 | 47 | 2.9 |
| A20 | STOP | 0910 | 361.461 | | | | | | | | |
| A21 | 4-4 | 0913 | 361.461 | .70 | 1.18 | 151 | 56 | 56 | 250 | 45 | 4.4 |
| A22 | 4-3 | 0917 | 364.02 | .65 | 1.09 | 153 | 57 | 56 | 250 | 46 | 4.1 |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console 4837 Filter 014 Initial Wt. 5076 gms

Sample Analysis

Weather

A23 Remarks * SILICA GEL PLUGGED; FIXED & LEAK ✓ OK

WET BULB 68°C

DRY " 68.5°C

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> Cam-1114-PA4-OUT-01

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 $ft^3$ | 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 | t. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 4-2 | 0921 | 366.47 | .55 | .92 | 152 | 57 | 56 | 250 | 45 | 4.0 |
| A06 | 4-1 | 0925 | 368.76 | .40 | .67 | 152 | 58 | 57 | 250 | 46 | 3.0 |
| | STOP | 0929 | 370.647 | | | | | | | | |
| A8 | 5-4 | 0930 | 370.647 | .75 | 1.26 | 152 | 58 | 57 | 250 | 45 | 5.0 |
| A09 | 5-3 | 0934 | 373.40 | .70 | 1.18 | 152 | 59 | 57 | 245 | 46 | 4.8 |
| A10 | 5-2 | 0938 | 375.47 | .60 | 1.01 | 152 | 59 | 57 | 250 | 46 | 4.1 |
| A11 | 5-1 | 0942 | 378.37 | .50 | .84 | 150 | 59 | 57 | 250 | 46 | 4.0 |
| A12 | STOP | 0946 | 380.573 | | | | | | | | |
| A13 | 6-4 | 0947 | 380.573 | .55 | .92 | 152 | 59 | 58 | 250 | 45 | 4.0 |
| A14 | 6-3 | 0951 | 382.81 | .50 | .84 | 152 | 58 | 57 | 250 | 46 | 4.0 |
| A15 | 6-2 | 0955 | 384.99 | .40 | .67 | 156 | 59 | 57 | 250 | 46 | 3.2 |
| A16 | 6-1 | 0959 | 386.93 | .35 | .59 | 153 | 59 | 57 | 250 | 47 | 3.1 |
| A17 | STOP | 1003 | 388.750 | | | | | | | | |
| 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 _____

Outlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | NaOH | 250 ml | | Final | 902.5 |
| | | | | Initial | 695.0 |
| | | | | Wt. Gain | 207.5 |
| 2 | NaOH | 250 ml | | Final | 896.9 |
| | | | | Initial | 705.0 |
| | | | | Wt. Gain | 191.9 |
| 3 | Dry | — | | Final | 473.4 |
| | | | | Inital | 449.0 |
| | | | | Wt. Gain | 24.4 |
| 4 | Silica Gel | — | | Final | 724.9 |
| | | | | Initial | 715.4 |
| | | | | Wt. Gain | 9.5 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) _____ 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

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

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

APPENDIX C.1

CONVENTIONAL OPERATION TESTING

INCLUDES

C.1.2 Particle Size Distribution Data Sheets
C.1.2.1 Uncontrolled Emissions - Particle Size Data Sheets

# IMPACTOR FIELD DATA

901 (1-3) Plant Name> Campbell

Sampling Location> Inlet PSD @ 1 Sample Ident.> CAM-1112-PSD-IN-01

Type of Impactor> ANDERSEN (HCSS) Impactor Substrate> Thimble

802 (1-3) Date 11-12-83 (4:6) (MMDDYY) Time Start 1418 (11:4) (HHMM) Time Finish 1520 (18:4) (HHMM)

Duct Dimensions 6 (25:5) x 2.21 (32:5) ft. or Diameter — (39:5) ft.

PTCF .84 (46:5) DGMCF 1.0122 (53:5) Test Duration 62 (60:5) min.

803 (1-3) Bar Press. 28.455 (6:5) "Hg Static Press. -1.20 (11:5) "$H_2O$ (18)

Nozzle Dia. .164 (25:6) inches Condensed Water 137.9 (32:6) gms

Intake leak rate .016 (39:5) cfm Operator initials EPA HWT (46:7)

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | 1 | 1418 | 860.072 | .25 | .10 | 331 | 83 | 83 | — | 60 | 2.5 |
| 805 | | 1431 | 862.54 | .25 | .11 | 335 | 82 | 81 | — | 56 | 2.8 |
| 806 | | 1446 | 865.45 | .25 | .11 | 325 | 82 | 82 | — | 56 | 3.0 |
| 807 | | 1502 | 868.26 | .25 | .11 | 311 | 84 | 82 | — | 58 | 3.0 |
| 808 | | 1520 | 871.43 | .25 | .11 | 310 | 84 | 84 | — | 58 | 3.0 |
| 809 | STOP | 1520 | 871.482 | | | | | | | | |
| 810 | | | | | | | | | | | |
| 811 | | | | | | | | | | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

* Dry air purge when sampling wet streams

Console D-548

Weather

Remarks Back-up filter Tare 1.8628 g - Impactor Warmed Jul
Stick 45 min Final 3.8780

wet = 78 = 172
Dry = 154 309

IMPINGER CATCH
Inlet

Sample Ident. Inlet AND- Date 11-12-83

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | 250 ml | | Final 886.4<br>Initial 752.8<br>Wt. gain 133.6 |
| 2 | $H_2O$ | 250 ml | | Final 693.4<br>Initial 693.2<br>Wt. gain .2 |
| 3 | Dry | — | | Final 430.1<br>Initial 430.1<br>Wt. gain |
| 4 | Silica Gel | — | | Final 607.3<br>Initial 603.2<br>Wt. gain 4.1 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 137.9

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

# IMPACTOR FIELD DATA

Sample Ident. Cam-1112-PSD-IN-01 Date 11-12-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 1.2359 |
| C03 | 2 | | | | 1.0506 |
| C04 | 3 | | | | 2.0152 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | | | 2.9926 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 6.2 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 88.8 (39:5)

% $O_2$ (dry) 5.0 (46:5) Other (dry) 0 (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell

Sampling Location> Inlet  Sample Ident.> CAM-1114-PSD-IN-01

Type of Impactor> ANDERSEN (HCSS)  Impactor Substrate> Thimbel

802 (1-3) Date 11/14/83 (MMDDYY) (4:6) Time Start 1014 (HHMM) (11:4) Time Finish 1143 (HHMM) (18:4)

Duct Dimensions 6 (25:5) x 2.21 (32:5) ft. or Diameter — (39:5) ft.

PTCF .84 (46:5) DGMCF 1.0122 (53:5) Test Duration 77 (60:5) min.

803 (1-3) Bar Press. 28.32 (4:5) "Hg  Static Press. -1.20 (11:5) "$H_2O$ (18)

Nozzle Dia. .184 (25:6) inches  Condensed Water 195.6 (32:6) gms

Intake leak rate .010 (39:5) cfm  Operator initials EPA/DAI (46:7)

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B04 | 1 | 1014 | 918.012 | .26 | .10 | 287 | 73 | 72 | | 56 | 1.5 |
| B05 | 1 | 1030 | 921.035 | .26 | .10 | 300 | 70 | 70 | | 51 | 2.0 |
| B06 | 1 | 1045 | 923.79 | .26 | .10 | 295 | 71 | 71 | | 51 | 2.0 |
| B07 | STOP | 1055 | 925.624 | | | | | | | | |
| B08 | | 1107 | 925.624 | .26 | .10 | 321 | 73 | 73 | | 53 | 2.0 |
| B09 | | 1129 | 929.37 | .26 | .10 | 321 | 73 | 73 | | 53 | 2.2 |
| B10 | | 1140 | 931.20 | .26 | .10 | 315 | 73 | 73 | | 52 | 2.2 |
| B11 | Stop | 1143 | 931.644 | | | | | | | | |
| B12 | | | | | | | | | | | |
| B13 | | | | | | | | | | | |
| B14 | | | | | | | | | | | |
| B15 | | | | | | | | | | | |
| B16 | | | | | | | | | | | |
| B17 | | | | | | | | | | | |
| B18 | | | | | | | | | | | |
| B19 | | | | | | | | | | | |
| B20 | | | | | | | | | | | |
| B21 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

• Dry air purge when sampling wet streams

Console 1121 Dry .56-313 wet = 76-169 -37%

Weather

Final 4.0058

Remarks Backup filter 1.7927 g

In Duct 90 min to warm up

WET = 76 169

Dry = 145 295

IMPINGER CATCH

Sample Ident. Inlet AND- Date 11/13/83

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | 250 ml | | Final 1025.8<br>Initial 750.8<br>Wt. gain 275.0 |
| 2 | $H_2O$ | 250 ml | | Final 506.1<br>Initial 693.4<br>Wt. gain -83.3 |
| 3 | Dry | — | | Final 431.1<br>Initial 430.1<br>Wt. gain 1.0 |
| 4 | Silica Gel | — | | Final 600.4<br>Initial 607.3<br>Wt. gain 6.9 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 195.6

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. Cam-1114-PSD Date 11-14-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 1.5725 |
| C03 | 2 | | | | 1.0991 |
| C04 | 3 | | | | 0.8769 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | | | 2.2131 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 6.1 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 89.2 (39:5)

% $O_2$ (dry) 4.7 (46:5) Other (dry) _____ (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell

Sampling Location> Inlet Sample Ident.> Cam-1115-250-IN-01

Type of Impactor> ANDERSEN (HCSS) Impactor Substrate> Thimbel

802 (1-3) Date 11-15-83 (4:6) (MMDDYY) Time Start 1225 (11:4) (HHMM) Time Finish 1400 (18:4) (HHMM)

Duct Dimensions 6 (25:5) x 2.21 (32:5) ft. or Diameter ____ (39:5) ft.

PTCF .84 (46:5) DGMCF 1.0122 (53:5) Test Duration 81 (60:5) min.

803 (1-3) Bar Press. 28.825 (4:5) "Hg Static Press. -1.20 (11:5) "$H_2O$ ____ (18)

Nozzle Dia. .184 (25:5) inches Condensed Water 223.2 (32:5) gms

Intake leak rate .008 (39:5) cfm Operator initials EPA/VAL (46:7)

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | 1 | 1225 | 971.042 | .24 | .10 | 302 | 69 | 70 | — | 61 | 1.5 |
| 805 | | 1245 | 974.73 | .24 | .10 | 285 | 71 | 70 | — | 61 | 1.5 |
| 806 | | 1301 | 977.54 | .24 | .10 | 303 | 75 | 75 | — | 66 | 1.5 |
| 807 | | 1312 | 979.35 | .24 | .10 | 307 | 77 | 77 | — | 64 | 1.5 |
| 808 | Stop | 1321 | 981.188 | .24 | .10 | 304 | 79 | 79 | — | 64 | 1.5 |
| 809 | Start | 1335 | 981.188 | .24 | .10 | 262 | 83 | 81 | — | 66 | 1.5 |
| 810 | | 1345 | 983.07 | .24 | .10 | 302 | 81 | 81 | — | 64 | 2 |
| 811 | Stop | 1400 | 985.867 | | | 312 | 82 | 81 | — | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

WET Bulb = 80°C - 176°F
Dry " : 148 - 298
35% Moi

* Dry air purge when sampling wet streams

Console D-548

Weather

Remarks Filter tare 1.8965 g WARMED IN Stack 45 min

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | | | | Final 909.3<br>Initial 688.9<br>Wt. gain 220.4 |
| 2 | | | | Final 606.4<br>Initial 606.1<br>Wt. gain .3 |
| 3 | | | | Final 428.6<br>Initial 428.5<br>Wt. gain .1 |
| 4 | | | | Final 602.8<br>Initial 600.4<br>Wt. gain 2.4 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams)

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
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| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. Cam-1115-PSD-IM-01 Date 11-5-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 3.2178 |
| C03 | 2 | | | | 2.3035 |
| C04 | 3 | | | | 1.3990 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | | | 3.0625 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 6.3 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 88.2 (39:5)

% $O_2$ (dry) 5.5 (46:5) Other (dry) _____ (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

APPENDIX C.1

CONVENTIONAL OPERATION TESTING

INCLUDES

C.1.2 Particle Size Distribution Data Sheets
C.1.2.2 Controlled Emissions - Particle Size Data Sheets

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell

Sampling Location> Outlet  Sample Ident.> CAM-1112-PSD-Out-05

Type of Impactor> ANDERSEN MK III  Impactor Substrate> REEVES ANGEL

802 (1-3) Date 11/12 (4:6) (MMDDYY)  Time Start 1232 (11:4) (HHMM)  Time Finish 1514 (18:4) (HHMM)

Duct Dimensions 2.96 (25:5) x 2.60 (32:5) ft. or Diameter — (39:5) ft.

PTCF .84 (46:5)  DGMCF .9749 (53:5)  Test Duration 43 (60:5) min.

803 (1-3) Bar Press. 28.495 (4:5) "Hg  Static Press. +.55 (11:5) "$H_2O$ — (18)

Nozzle Dia. 0.185 (25:6) inches  Condensed Water 156.5 (32:6) gms

Intake leak rate 0.04 (39:5) cfm  Operator initials MRF (46:7)

| | Pt. | Clock Time | Dry Gas Meter Reading ft³ | ΔP in. $H_2O$ | Meter Rate ~~.84~~ .39 in. $H_2O$ | Stack Temp. °F | Dry Gas Meter Temperature Inlet °F | Dry Gas Meter Temperature Outlet °F | Impactor ~~Hot Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | M3 | 1232 | 692.578 | 0.8 | .43 | 152 | 58 | 57 | 210 | 52 | 4 |
| 805 | M3 | 1239 | 695.44 | 0.8 | | 152 | 62 | 58 | 238 | 50 | 4 |
| 806 | Stop | 1240 | 695.647 | | | Shut down - pressure drop up | | | | | |
| 807 | Start | 1311 | 696.114 | 0.8 | | | | | | | |
| 808 | Stop | 1311 | 696.186 | | | | | | | | |
| 809 | Start | 1322 | 696.186 | 0.8 | | 152 | 63 | 62 | 234 | 54 | 4 1/2 |
| 810 | M3 | 1328 | 698.42 | 0.8 | | 152 | 66 | 63 | 219 | 54 | 6 |
| 811 | M3 | 1338 | 702.80 | 0.8 | | 152 | 68 | 63 | 217 | 54 | 6 |
| 812 | Stop | 1339 | 703.172 | | | | | | | | |
| 813 | Start | 1404 | 703.172 | | | | | | | | |
| 814 | Stop | 1404 | 703.225 | | | | | | | | |
| 815 | Start | 1458 | 703.225 | 0.8 | | 152 | 75 | 74 | 300 | 58 | 5 1/2 |
| 816 | M3 | 1505 | 706.03 | 0.8 | | 152 | 75 | 74 | 290 | 56 | 5 1/2 |
| 817 | M3 | 1512 | 708.94 | 0.8 | | 152 | 73 | 72 | 230 | 55 | 6 |
| 818 | ~~M3~~ | 1514 | 709.156 | 0.8 | | 152 | 73 | 72 | 205 | 55 | 6 |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

* Dry air purge when sampling wet streams

Console R31-520

Weather

Remarks

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | | | Final 884.9<br>Initial 734.6<br>Wt. gain 150.3 |
| 2 | $H_2O$ | | | Final 639.6<br>Initial 637.4<br>Wt. gain 2.2 |
| 3 | Dry | | | Final 448.3<br>Initial 447.9<br>Wt. gain .4 |
| 4 | Silica Gel | | | Final 643.6<br>Initial 640.0<br>Wt. gain 3.6 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams)

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. Campbell Outlet PSD 5 Date 11/12

Analyst MRF

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16502 | .16513 | |
| C03 | 2 | | .14380 | .14380 | |
| C04 | 3 | | .16285 | .16249 | |
| C05 | 4 | | .14489 | .14450 | |
| C06 | 5 | | .16418 | .16289 | |
| C07 | 6 | | .14743 | .14538 | |
| C08 | 7 | | .16329 | .16292 | |
| C09 | 8 | | .14185 | .14359 | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21986 | .2173 | |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

# IMPACTOR FIELD DATA

B01 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Outlet Sample Ident.> CAM-1113-PSD-Out -Q6

Type of Impactor> Anderson Mk III Impactor Substrate> Reeves Angel

B02 (1-3) Date 11/13/83 (MMDDYY) (4:6) Time Start 0940 (HHMM) (11:4) Time Finish 1112 (HHMM) (18:4)

Duct Dimensions 2.96 (25:5) x 2.60 (32:5) ft. or Diameter _____ ft.

PTCF .84 (46:5) DGMCF .9749 (53:5) Test Duration 46 (39:5) min. (60:5)

B03 (1-3) Bar Press. 28.52 (4:6) "Hg Static Press. +.55 (11:5) "$H_2O$ _____ (18)

Nozzle Dia. 0.185 (25:6) inches Condensed Water 138.4 (32:6) gms

Intake leak rate 0.004 (39:5) cfm Operator initials MRF (46:7)

| | Pt. | Clock Time | Dry Gas Meter Reading ft³ | ΔP in. $H_2O$ | Meter Rate, 42 ΔH in. $H_2O$ | Stack Temp. °F | Dry Gas Meter Temperature Inlet °F | Dry Gas Meter Temperature Outlet °F | Impactor ~~Not Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B04 | M3 | 0940 | 709.883 | 0.8 | .48 | 152 | 70 | 70 | 360 | 54 | 5 |
| B05 | M3 | 0946 | 712.34 | 0.8 | .48 | 152 | 71 | 71 | 340 | 50 | 5 |
| B06 | M3 | 0957 | 716.93 | 0.8 | .48 | 152 | 72 | 70 | 288 | 48 | 5 |
| B07 | M3 | 1007 | 721.07 | 0.8 | .48 | 152 | 72 | 71 | 272 | 48 | 5 |
| B08 | M3 | 1013 | 723.53 | 0.8 | .48 | 152 | 73 | 70 | 248 | 48 | 4 |
| B09 | M3 | 1020 | 726.63 | 0.8 | .48 | 152 | 73 | 72 | 222 | 48 | 4 |
| B10 | Stop | 1025 | 728.307 | 0.8 | .48 | 152 | 73 | 71 | 201 | 48 | 4 |
| B11 | Start | 1112 | 728.307 | 0.8 | .48 | 152 | 73 | 72 | | 48 | 4 |
| B12 | Stop | 1112 | 728.340 | | | Pressure drop up | | | | | |
| B13 | | | | | | | | | | | |
| B14 | | | | | | | | | | | |
| B15 | | | | | | | | | | | |
| B16 | | | | | | | | | | | |
| B17 | | | | | | | | | | | |
| B18 | | | | | | | | | | | |
| B19 | | | | | | | | | | | |
| B20 | | | | | | | | | | | |
| B21 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

• Dry air purge when sampling wet streams

Console R31-520

Weather _____

Remarks _____

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | 250 ml | | Final 889.5<br>Initial 678.9<br>Wt. gain 210.6 |
| 2 | $H_2O$ | 250 ml | | Final 564.2<br>Initial 639.6<br>Wt. gain -75.4 |
| 3 | Dry | — | | Final 448.1<br>Initial 448.6<br>Wt. gain |
| 4 | Silica Gel | — | | Final 646.8<br>Initial 643.6<br>Wt. gain 3.2 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 138.4

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. CAMPBELL OUTLET PSD6 Date 11/13

Analyst MJK

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16062 | .16417 | |
| C03 | 2 | | .14535 | .14645 | |
| C04 | 3 | | .16015 | .16101 | |
| C05 | 4 | | .14297 | .14480 | |
| C06 | 5 | | .16265 | .16363 | |
| C07 | 6 | | .14954 | .14438 | |
| C08 | 7 | | .16119 | .16309 | |
| C09 | 8 | | .14572 | .14749 | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21839 | .2181 | |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell

Sampling Location> Outlet PSD 7 Sample Ident.> CAM-1114-PSD-Out-07

Type of Impactor> Anderson MkIII Impactor Substrate> REEVES ANGEL

802 (1-3) Date 11/14 (4:6) (MMDDYY) Time Start 0908 (11:4) (HHMM) Time Finish 0949 (18:4) (HHMM)

Duct Dimensions 2.96 (25:5) x 2.60 (32:5) ft. or Diameter ____ (39:5) ft.

PTCF .84 (46:5) DGMCF .9749 (53:5) Test Duration 41 (60:5) min.

803 (1-3) Bar Press. 28.32 (4:5) "Hg Static Press. +.55 (11:5) "$H_2O$ ____ (18)

Nozzle Dia. 0.185 (25:6) inches Condensed Water 112.9 (32:4) gms

Intake leak rate 0.016 (39:5) cfm Operator initials MRZ (46:7)

| | Pt. | Clock Time | Dry Gas Meter Reading ft³ | ΔP in. $H_2O$ | Meter Rate .41 ΔH in. $H_2O$ | Stack Temp. °F | Dry Gas Meter Temperature Inlet °F | Dry Gas Meter Temperature Outlet °F | Impactor ~~Hot Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | M3 | 0908 | 728.456 | 0.8 | .48 | 152 | 61 | 60 | 410 | | 4½ |
| 805 | M3 | 0918 | 732.74 | 0.8 | .48 | 152 | 65 | 60 | 358 | 55 | 5 |
| 806 | M3 | 0925 | 735.74 | 0.8 | .48 | 152 | 67 | 62 | 317 | 56 | 5 |
| 807 | M3 | 0931 | 738.17 | 0.8 | .48 | 152 | 67 | 63 | 286 | 57 | 4½ |
| 808 | M3 | 0938 | 740.97 | 0.8 | .48 | 152 | 68 | 64 | 281 | 57 | 4½ |
| | STOP | 0949 | 744.822 | | | | | | 220 | 57 | |
| 810 | | | | | | | | | | | |
| 811 | | | | | | | | | | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

* Dry air purge when sampling wet streams

Console R31-520

Weather ____

Remarks ____

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | 250 ml. | | Final 806<br>Initial 699.1<br>Wt. gain 106.9 |
| 2 | $H_2O$ | 250 ml | | Final 564.9<br>Initial 564.2<br>Wt. gain .7 |
| 3 | Dry | — | | Final 448.6<br>Initial 448.6<br>Wt. gain 0.0 |
| 4 | Silica Gel | — | | Final 652.1<br>Initial 646.8<br>Wt. gain 5.3 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 112.9

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. Campbell Outlet PSD 7 Date 11/14

Analyst MRT

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16195 | .16240 | |
| C03 | 2 | | .14515 | .14546 ~~.16240~~ | |
| C04 | 3 | | .16288 | .16250 | |
| C05 | 4 | | .14539 | .14489 | |
| C06 | 5 | | .16510 | .16213 | |
| C07 | 6 | | .14498 | .14527 | |
| C08 | 7 | | .16398 | .16504 | |
| C09 | 8 | | .14400 | .14596 | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .22041 | .2203 | |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

APPENDIX C.1

CONVENTIONAL OPERATION TESTING

INCLUDES

C.1.3 Polynuclear Aromatic Hydrocarbon (PAH) Data Sheets
C.1.3.1 Uncontrolled Emissions - PAH Data Sheets

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Inlet Sample Ident.> CAM-1114-BAP-IN-01

A02 (1-3) Date 11-14-83 (MMDDYY) (4:6) Time Start 1301 (11:4) (HHMM) Time Finish 1426 (18:4) (HHMM)

Duct Dimensions 6 (25:5) x 2.21 (32:5) ft. or Diameter — ft.

PTCF .84 (46:5) DGMCF 1.0122 (53:5) Test Duration 35 (39:5) min.

A03 (1-3) Nozzle Dia. .273 (4:5) inches % CO -0- (11:5) % $N_2$ 89.2 (18:5)

Bar Press. 28.32 (25:5) "Hg % $CO_2$ 6.1 (32:5) % $H_2$ -0- (39:5)

Static Press. -1.20 (46:5) "$H_2O$ (53) % $O_2$ 4.7 (60:5) % $CH_4$ -0- (67:5)

A04 (1-3) Initial leak rate .019 (4:5) cfm Condensed Water 203.4 (11:6) gms

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

Operator initials EPA/WAL (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 | 1-1 | 1301 | 931.891 | .13 | .24 | 284 | 71 | 72 | 235 | 62 | 4.5 |
| A06 | 1-2 | 1304 | 932.74 | .24 | .40 | 338 | 71 | 71 | 245 | 62 | 7.0 |
| | 1-3 | 1307 | 933.88 | .24 | .40 | 348 | 71 | 70 | 250 | 62 | 7.0 |
| A08 | 1-4 | 1310 | 935.03 | .24 | .40 | 351 | 70 | 70 | 250 | 62 | 7.0 |
| A09 | STOP | 1313 | 936.217 | | | | | | | | |
| A10 | 2-1 | 1315 | 936.217 | .15 | .25 | 289 | 70 | 70 | 250 | 62 | 7.0 |
| A11 | STOP | 1317.5 | 937.030 | | | | | | | | |
| A12 | 2-2 | 1404 | 937.030 | .17 | .28 | 297 | 67 | 66 | 250 | 58 | 7.5 |
| A13 | 2-3 | 1406 | 937.6 | .20 | .33 | 309 | 66 | 65 | 250 | 58 | 8.5 |
| A14 | 2-4 | 1409 | 938.55 | .23 | .39 | 332 | 65 | 65 | 240 | 58 | 10.0 |
| A15 | STOP | 1411.5 | 939.784 | | | | | | | | |
| A16 | 3-1 | 1413 | 939.784 | .24 | .41 | 287 | 64 | 64 | 240 | 58 | 11.0 |
| A17 | 3-2 | 1416 | 940.87 | .26 | .44 | 297 | 64 | 64 | 245 | 58 | 12.5 |
| A18 | 3-3 | 1419 | 942.12 | .21 | .35 | 324 | 64 | 64 | 245 | 58 | 12.0 |
| A19 | 3-4 | 1422 | 943.15 | .15 | .25 | 328 | 64 | 63 | 260 | 54 | 10.5 |
| A20 | STOP | 1425 | 944.162 | | | | | | | | |
| A21 | 4-1 | 1426 | 944.162 | .25 | .42 | 289 | 63 | 63 | 250 | 54 | |
| A22 | STOP | 1427 | 944.595 | | | | | | | | |
| | (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 _____ Initial Wt. _____ gms

Sample Analysis _____

Weather Cold Rainy

A23 Remarks No Leak Check, Final. Glassware Broke on Removal from Port
Hot Box 195°F wet = 176° Dry = 309°

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | Dry | — | | Final | 519.1 |
| | | | | Initial | 409.3 |
| | | | | Wt. Gain | 109.8 |
| 2 | Dry | — | | Final | 449.1 |
| | | | | Initial | 438.1 |
| | | | | Wt. Gain | 11.0 |
| 3 | Silica Gel | — | | Final | 651.3 |
| | | | | Inital | 623.1 |
| | | | | Wt. Gain | 28.2 |
| 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) 149g 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.1

CONVENTIONAL OPERATION TESTING

INCLUDES

C.1.3 Polynuclear Aromatic Hydrocarbon (PAH) Data Sheets
C.1.3.2 Controlled Emissions - PAH Data Sheets

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Outlet Sample Ident.> CAM-1114-BAP-out-01

A02 (1-3) Date 11/14/83 (MMDDYY) Time Start 1209 (HHMM) Time Finish 1426 (HHMM)

Duct Dimensions 2.96 x 2.6 ft. or Diameter _____ ft.

PTCF 0.84 DGMCF .9935 Test Duration 83 min.

A03 (1-3) Nozzle Dia. .243 inches % CO 0 % $N_2$ 89.2

Bar Press. 28.32 "Hg % $CO_2$ 6.1 % $H_2$ 0

Static Press. +.50 "$H_2O$ % $O_2$ 4.7 % $CH_4$ 0

A04 (1-3) Initial leak rate .020 cfm Condensed Water 123.3 gms

Final leak rate .012 cfm Filter wt. gain _____ gms

Operator Initials MJK/TWT Probe wash wt. gain _____ 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 | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 1-4 | 1209 | 389.108 | .20 | .34 | 158 | 60 | 60 | 245 | 48 | 1.0 |
| A06 | 1-3 | 1213 | 390.55 | .15 | .26 | 159 | 58 | 57 | 250 | 47 | 0.9 |
| A07 | 1-2 | 1217 | 391.77 | .15 | .26 | 157 | 58 | 57 | 250 | 48 | 0.9 |
| A08 | 1-1 | 1221 | 392.96 | .15 | .26 | 157 | 58 | 56 | 250 | 48 | 0.9 |
| A09 | STOP | 1225 | 394.157 | | | | | | | | |
| A10 | 2-4 | 1226 | 394.151 | .70 | 1.18 | 159 | 58 | 57 | 250 | 47 | 5.9 |
| A11 | 2-3 | 1230 | 396.66 | .60 | 1.01 | 158 | 59 | 57 | 250 | 462 | 5.8 |
| A12 | 2-2 | 1234 | 399.06 | .50 | .84 | 158 | 60 | 58 | 250 | 60 | 4.7 |
| A13 | 2-1 | 1238 | 401.21 | .40 | .67 | 158 | 59 | 58 | 250 | 56 | 3.9 |
| A14 | STOP | 1242 | 403.139 | | | | | | | | |
| A15 | 3-4 | 1243 | 403.139 | .70 | 1.18 | 157 | 59 | 58 | 250 | 52 | 6.5 |
| A16 | 3-3 | 1247 | 405.63 | .65 | 1.09 | 157 | 60 | 58 | 250 | 53 | 6.1 |
| A17 | 3-2 | 1251 | 408.08 | .55 | .92 | 158 | 60 | 58 | 250 | 52 | 5.2 |
| A18 | 3-1 | 1255 | 410.37 | .45 | .76 | 156 | 60 | 59 | 250 | 53 | 4.5 |
| A19 | STOP | 1259 | 412.425 | | | | | | | | |
| A20 | 4-4 | 1306 | 412.425 | .75 | 1.26 | 153 | 61 | 59 | 250 | 49 | 6.7 |
| A21 | 4-3 | 1310 | 415.03 | .65 | 1.09 | 154 | 60 | 58 | 250 | 51 | 6.0 |
| A22 | 4-2 | 1314 | 417.48 | .55 | .92 | 158 | 60 | 59 | 250 | 52 | 5.3 |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console 4837 Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks _____

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

2/2

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> CAM-1114-BAP-OUT-01

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 | STOP | 1318 | 419.750 | | | | | | | | |
| A06 | 4-1 | 1401 | 419.750 | .45 | .76 | 162 | 57 | 58 | 250 | 46 | 5.0 |
| | STOP | 1405 | 421.800 | | | | | | | | |
| | 5-4 | 1406 | 421.800 | .75 | 1.26 | 158 | 57 | 56 | 250 | 45 | 7.1 |
| | 5-3 | 1410 | 424.40 | .75 | 1.26 | 157 | 56 | 56 | 250 | 46 | 7.1 |
| A10 | 5-2 | 1414 | 427.02 | .55 | .92 | 158 | 56 | 56 | 250 | 45 | 5.2 |
| A11 | 5-1 | 1418 | 429.32 | .50 | .84 | 160 | 57 | 56 | 250 | 46 | 5.1 |
| A12 | STOP | 1422 | 431.440 | | | | | | | | |
| A13 | 6-4 | 1423 | 431.440 | .60 | 1.01 | 160 | 56 | 57 | 250 | 47 | 6.1 |
| A14 | *STOP | 1426 | 432.905 | | | | | | | | |
| 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 _____

C3 Remarks * RUN STOPPED; PLANT DOWN

Outlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | Dry | | | Final | |
| | | | | Initial | 418.4 |
| | | | | Wt. Gain | |
| 2 | Dry | | | Final | |
| | | | | Initial | 449.3 |
| | | | | Wt. Gain | |
| 3 | Silica Gel | | | Final | |
| | | | | Inital | 719.3 |
| | | | | Wt. Gain | |
| 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) _____ 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.2

RECYCLE OPERATION TESTING

INCLUDES

C.2.1 EPA Reference Methods 2, 3, 4, and 5E
C.2.1.1 Uncontrolled Emissions - EPA Reference Method 2, 3, 4, and 5E Data Sheets

RADIAN CORPORATION

# ORSAT DATA SHEET

Location Iliit

Comments Grab Sample

Date 11-11-83

Time 1400

Operator EPA

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 | .2 | 5.0 | 4.8 | 13.8 | 8.8 | | |
| 2 | .5 | 5.0 | 4.5 | 13.7 | 8.7 | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 4.65 % $O_2$ 8.75

% CO _____ % $N_2$ 82.5

Dry Molecular Weight, MW (dry) =

$$= 0.44 \underset{(\%\ CO_2)}{4.65} + 0.32 \underset{(\%\ O_2)}{8.75} + 0.28 \underset{(\%\ CO + \%\ N_2)}{86.5}$$

= 2.046 + 2.800 + 24.248

= 29.09 g/mole

Figure 5-3. Orsat field data sheet.

RADIAN

# ORSAT DATA SHEET

Location T.J. Campbell Comments

Date 11/11

Time 0915 hrs

Operator MRT

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 | 4.0 | 4.0 | 13.2 | 9.2 | | |
| 2 | 0 | 4.4 | 4.4 | 14.8 | 10.8 | | |
| 3 | 0 | 3.0 | 3.0 | 13.6 | 10.6 | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 4.2 % $O_2$ 10.7

% CO _____ % $N_2$ _____

Dry Molecular Weight, MW (dry) =

$$= 0.44 \frac{4}{(\%\ CO_2)} + 0.32 \frac{10.7}{(\%\ O_2)} + 0.28 \frac{85.3}{(\%\ CO + \%\ N_2)}$$

= 1.76 + 3.424 + 23.88

= 29.07 g/mole

Figure 5-3. Orsat field data sheet.

RADIAN CORPORATION

# ORSAT DATA SHEET

Location Inlet Comments Grab Sample

Date 11-12-83

Time 0855

Operator EPA Imuf

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 | .4 | .4 | 0 | 20.8 | | Fucked up | |
| 1 | 0 | 4.0 | 4.0 | 11.6 | | | |
| 2 | 0 | 4.4 | 4.4 | 13.4 | 9.0 | | |
| 3 | 0.2 | 5.1 | ~~4.9~~ | 12.4 | 7.3 | | |
| 4 | 0.2 | 5.0 | 4.8 | 12.3 | 7.3 | | |

Averaged Results: % $CO_2$ 4.85 % $O_2$ 7.3

% CO _____ % $N_2$ 87.85

Dry Molecular Weight, MW (dry) =

$$= 0.44 \frac{4.85}{(\% CO_2)} + 0.32 \frac{7.3}{(\% O_2)} + 0.28 \frac{87.85}{(\% CO + \% N_2)}$$

$$= 2.134 + 2.336 + 24.598$$

$$= 29.07 \text{ g/mole}$$

Figure 5-3. Orsat field data sheet.

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> T.J. Campbell

Sampling Location> Inlet Sample Ident.> Cam-1110-TM-IN-01

A02 (1-3) Date 11-10-83 (4:6) (MMDDYY) Time Start 1121 (11:4) (HHMM) Time Finish 1153 (18:4) (HHMM)

Duct Dimensions 6 (25:5) x 7.21 (32:5) ft. or Diameter — ft.

PTCF .84 (46:5) DGMCF 1.0122 (53:5) Test Duration 48 (39:5) min.

A03 (1-3) Nozzle Dia. 2.71 (6:6) inches % CO -0- (11:5) % $N_2$ 81.5 (60:5)

Bar Press. 28.76 (25:5) "Hg % $CO_2$ 4.7 (32:5) % $H_2$ -0 (18:5)

Static Press. -1.20 (46:5) "$H_2O$ (53) % $O_2$ 8.8 (60:5) % $CH_4$ -0 (39:5) (67:5)

A04 (1-3) Initial leak rate .010 (4:5) cfm Condensed Water 137.0 (11:8) gms

Final leak rate .010 (18:5) cfm Filter wt. gain 1.9521 (25:7) gms

Operator initials EPA/TCT (32:7) Probe wash wt. gain 4.6253 (39:7) gms

K = .48

| | 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 | GAS Temp. °F | Last Impinger Temp. °F | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 1-1 | 1121 | 699.976 | .22 | .46 | 270 | 57 | 57 | 250 | 39 | 5.0 |
| A06 | 1-2 | 1124 | 701.20 | .30 | .63 | 306 | 57 | 57 | 250 | 39 | 6.2 |
| A07 | 1-3 | 1127 | 702.58 | .34 | .72 | 330 | 57 | 56 | 250 | 39 | 7.0 |
| A08 | 1-4 | 1130 | 704.02 | .33 | .69 | 332 | 57 | 56 | 250 | 39 | 7.1 |
| A09 | STOP | 1133 | 705.485 | | | | | | | | |
| A10 | 2-1 | 1134 | 705.485 | .23 | .48 | 304 | 56 | 55 | 250 | 39 | 6.0 |
| A11 | 2-2 | 1137 | 706.08 | .26 | .54 | 303 | 56 | 55 | 250 | 39 | 6.6 |
| A12 | 2-3 | 1140 | 707.95 | .26 | .54 | 296 | 57 | 56 | 250 | 42 | 6.6 |
| A13 | 2-4 | 1143 | 709.23 | .29 | .61 | 296 | 57 | 56 | 250 | 42 | 6.5 |
| A14 | STOP | 1146 | 710.572 | | | | | | | | |
| A15 | 3-1 | 1147 | 710.572 | .28 | .60 | 250 | 57 | 57 | 250 | 42 | 7.5 |
| A16 | 3-2 | 1150 | 711.91 | .35 | .73 | 259 | 57 | 56 | 250 | 42 | 9.0 |
| A17 | STOP | 1153 | 713.309 | | | | | | | | |
| 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 D-548 Filter 018 Initial Wt. 0.5270 gms

Sample Analysis Potential for particulate Tare wt = 9.21g

Weather

A23 Remarks H.F. Box 115°F 172°

Inlet

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | 0.1N NaOH | | | Final | 842.7 |
| | | | | Initial | 720.6 |
| | | | | Wt. Gain | 122.1 |
| 2 | 0.1N NaOH | | | Final | 709.1 |
| | | | | Initial | 697.8 |
| | | | | Wt. Gain | 11.3 |
| 3 | Dry | | | Final | 444.0 |
| | | | | Inital | 443.1 |
| | | | | Wt. Gain | .9 |
| 4 | 10% HNO3 | | | Final | 703.1 |
| | | | | Initial | 709.5 |
| | | | | Wt. Gain | -6.4 |
| 5 | Dry | | | Final | 445.1 |
| | | | | Initial | 439.2 |
| | | | | Wt. Gain | 5.9 |
| 6 | Silica Gel | | | Final | 632.4 |
| | | | | Initial | 629.2 |
| | | | | Wt. Gain | 3.2 |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 137.0 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> Campbell Asphalt

Sampling Location> Inlet Sample Ident.> CAM-III-TM-IN-01

A02 (1-3) Date 11-11-88 (MMDDYY) Time Start 0843 (HHMM) Time Finish 0937 (HHMM)

Duct Dimensions 6.0 x 2.7 ft. or Diameter — ft.

PTCF .84 DGMCF 1.0122 Test Duration 48 min.

A03 (1-3) Nozzle Dia. .273 inches N2-119 % CO -0- % $N_2$ 85.1

Bar Press. 28.79 "Hg % $CO_2$ 4.2 % $H_2$ -0-

Static Press. -1.20 "$H_2O$ % $O_2$ 10.7 % $CH_4$ -0-

A04 (1-3) Initial leak rate .012 cfm Condensed Water 142.1 gms

Final leak rate .005 cfm Filter wt. gain 1.5430 gms

Operator initials EPA/ Probe wash wt. gain 2.8321 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 | 0843 | 756.218 | .18 | .38 | 240 | 56 | 56 | 250 | 39 | 5.0 |
| A06 | 1-2 | 0846 | 757.33 | .28 | .58 | 309 | 56 | 56 | 250 | 39 | 6.0 |
| | 1-3 | 0849 | 758.65 | .30 | .63 | 319 | 56 | 56 | 250 | 39 | 6.5 |
| A08 | 1-4 | 0852 | 760.02 | .31 | .65 | 331 | 56 | 55 | 250 | 39 | 6.8 |
| A09 | Stop | 0855 | 761.418 | | | | | | | | |
| A10 | 2-1 | 0857 | 761.418 | .22 | .46 | 304 | 55 | 55 | 250 | 37 | 5.5 |
| A11 | 2-2 | 0900 | 762.58 | .23 | .48 | 304 | 56 | 55 | 250 | 37 | 6.0 |
| A12 | 2-3 | 0903 | 763.82 | .24 | .50 | 313 | 56 | 55 | 255 | 37 | 6.0 |
| A13 | 2-4 | 0906 | 765.07 | .30 | .63 | 303 | 56 | 55 | 250 | 37 | 6.8 |
| A14 | Stop | 0909 | 766.446 | | | | | | | | |
| A15 | 3-1 | 0911 | 766.446 | .32 | .67 | 243 | 57 | 56 | 255 | 37 | 7.1 |
| A16 | 3-2 | 0914 | 767.84 | .32 | .67 | 268 | 57 | 56 | 250 | 38 | 7.1 |
| A17 | 3-3 | 0917 | 769.26 | .26 | .54 | 293 | 58 | 57 | 255 | 39 | 6.5 |
| A18 | 3-4 | 0920 | 770.57 | .26 | .54 | 331 | 58 | 57 | 250 | 39 | 6.5 |
| A19 | Stop | 0923 | 771.874 | | | | | | | | |
| A20 | 4-1 | 0925 | 771.874 | .26 | .54 | 279 | 58 | 58 | 250 | 39 | 6.5 |
| A21 | 4-2 | 0928 | 773.19 | .26 | .54 | 286 | 58 | 58 | 250 | 39 | 6.8 |
| A22 | 4-3 | 0931 | 774.46 | .26 | .54 | 303 | 60 | 59 | 250 | 44 | 7.0 |
| | (4:2) | (11:4) | (16:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console D-548 Filter ~~020~~ 005 Initial Wt. .5207 gms

Sample Analysis

Weather

A23 Remarks Hot Box 168°F, [171°F 0922]



| ΔP | .18 | .2 | .23 | .25 | .28 | .30 | .32 | .35 |
|---|---|---|---|---|---|---|---|---|
| ΔH | .38 | .42 | .48 | .52 | .58 | .63 | .67 | .73 |

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> Cam-III-Tm-IN-01

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 $ft^3$ | 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 | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 4-4 | 0934 | 775.75 | .26 | .54 | 313 | 60 | 59 | 250 | 44 | 7.1 |
| A06 | stop | 0937 | 777.030 | | | | | | | | |
| A08 | | | | | | | | | | | |
| A09 | | | | | | | | | | | |
| A10 | | | | | | | | | | | |
| A11 | | | | | | | | | | | |
| A12 | | | | | | | | | | | |
| 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 | 0.1N NaOH | ~250 | G-S | Final | 828.3 |
| | | | | Initial | 701.5 |
| | | | | Wt. Gain | 126.8 |
| 2 | 0.1N NaOH | ~250 | G-S | Final | 726.0 |
| | | | | Initial | 719.1 |
| | | | | Wt. Gain | 6.9 |
| 3 | Dry | | Mod | Final | 444.0 |
| | | | | Inital | 443.8 |
| | | | | Wt. Gain | .2 |
| 4 | 10% $HNO_3$ | ~250 | G-S | Final | 716.0 |
| | | | | Initial | 716.2 |
| | | | | Wt. Gain | |
| 5 | Dry | | Mod | Final | 440.2 |
| | | | | Initial | 439.9 |
| | | | | Wt. Gain | .3 |
| 6 | Silica Gel | | Mod | Final | 640.5 |
| | | | | Initial | 632.4 |
| | | | | Wt. Gain | 8.1 |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 142.1 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 21.066 $ft^3$

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 517 °R

Total imp. wt. gain, MWC 142.1 grams $H_2O$

Pressure at meter, PM 28.79 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = 24.43$$

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Inlet Sample Ident.> Cam-IIII-~~PAS~~ PAH In-1

A02 (1-3) Date 11-11-83 (MMDDYY) Time Start 1645 (HHMM) Time Finish 1730 (HHMM)

Duct Dimensions 6 x 2.21 ft. or Diameter — ft.

PTCF .84 DGMCF 1.0122 Test Duration 42 min.

A03 (1-3) Nozzle Dia. .273 inches % CO -0- % $N_2$ 86.5

Bar Press. 28.79 "Hg % $CO_2$ 4.7 % $H_2$ -0-

Static Press. -1.20 "$H_2O$ % $O_2$ 8.8 % $CH_4$ -0-

A04 (1-3) Initial leak rate .015 cfm Condensed Water 180.0 gms

Final leak rate .010 cfm Filter wt. gain 2.0998 gms

Operator initials EPA/MBS Probe wash wt. gain 3.1625 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 | 1645 | 788.846 | .18 | .47 | 305 | 76 | 76 | 245 | 48 | 3.5 |
| A06 | 1-2 | 1648 | 790.06 | .24 | .63 | 348 | 74 | 75 | 255 | 48 | 4.0 |
| | 1-3 | 1651 | 791.49 | .24 | .67 | 347 | 75 | 74 | 255 | 48 | 4.2 |
| A08 | 1-4 | 1654 | 792.93 | .24 | .65 | 347 | 75 | 75 | 250 | 48 | 4.4 |
| A09 | STOP | 1657 | 794.367 | | | | | | | | |
| A10 | 2-1 | 1658 | 794.367 | .16 | .42 | 292 | 73 | 73 | 250 | 48 | 3.9 |
| A11 | 2-2 | 1701 | 795.53 | .19 | .50 | 311 | 73 | 73 | 250 | 48 | 4.1 |
| A12 | 2-3 | 1704 | 796.80 | .20 | .52 | 318 | 73 | 72 | 250 | 48 | 4.0 |
| A13 | 2-4 | 1707 | 798.09 | .24 | .66 | 325 | 73 | 72 | 250 | 48 | 4.5 |
| A14 | STOP | 1710 | 799.525 | | | | | | | | |
| A15 | 3-1 | 1711 | 799.525 | .25 | .66 | 268 | 72 | 71 | 260 | 48 | 4.5 |
| A16 | 3-2 | 1714 | 800.00 | .25 | .66 | 300 | 71 | 71 | 250 | 48 | 5.0 |
| A17 | 3-3 | 1717 | 802.44 | .22 | .58 | 318 | 70 | 70 | 250 | 48 | 5.0 |
| A18 | 3-4 | 1720 | 803.96 | .18 | .48 | 320 | 71 | 70 | 250 | 49 | 5.0 |
| A19 | STOP | 1723 | 805.101 | | | | | | | | |
| A20 | 4-1 | 1724 | 805.101 | .26 | .68 | 271 | 70 | 69 | 250 | 49 | 5.6 |
| A21 | 4-2 | 1727 | 806.53 | .22 | .58 | 310 | 70 | 69 | 250 | 49 | 6.0 |
| A22 | STOP | 1730 | 807.96 | | | | | | | | |
| | (4:2) | | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

Console 1)-548 Filter 012 Initial Wt. 0.5369 gms

Sample Analysis

Weather

A23 Remarks Hot Box 1850-1704 ~~After~~ Cyclone Solids finlwt= tarwt= 9.144 sampwt=
Plant Down 1730

.18 | .20 | .25 | .30
.51 | .61 | .79

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) |
|---|---|---|---|---|
| 1 | 0.1 NaOH | 250 ml | | Final 845.6<br>Initial 686.8 g.<br>Wt. Gain 158.8 |
| 2 | 0.1 NaOH | 250 ml | | Final 707.0<br>Initial 698.2 g.<br>Wt. Gain 8.8 |
| 3 | Dry | | | Final 435.3<br>Inital 429.4 g.<br>Wt. Gain 5.9 |
| 4 | Silica Gel | | | Final 699.5<br>Initial 693.0 g<br>Wt. Gain 6.5 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| 7 | | | | Final<br>Initial<br>Wt. Gain |

Total Impingers Weight Gain (MWC)(grams) 180.0 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 19.350 ft³

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 532.5 °R

Total imp. wt. gain, MWC 180.0 grams $H_2O$

Pressure at meter, PM 28.79 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)\ (1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = .3147$$

1/1

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Inlet Sample Ident.> Cam-1112-PAH-IN-01

A02 (1-3) Date 11-12-83 (4:6) (MMDDYY) Time Start 0748 (11:4) (HHMM) Time Finish 0846 (16:4) (HHMM)

Duct Dimensions 6 (29:5) x 2.21 (32:5) ft. or Diameter — (39:5) ft.

PTCF .84 (46:5) DGMCF 1.0122 (53:5) Test Duration 48 (60:5) min.

A03 (1-3) Nozzle Dia. .273 (6:6) inches % CO -0- (11:5) % $N_2$ 87.8 (18:5)

Bar Press. 28.495 (25:5) "Hg % $CO_2$ 4.9 (32:5) % $H_2$ -0- (39:5)

Static Press. -1.20 (46:5) "$H_2O$ (53) % $O_2$ 7.3 (60:5) % $CH_4$ -0- (67:5)

A04 (1-3) Initial leak rate .018 (4:5) cfm Condensed Water 185.6 (11:6) gms

Final leak rate .004 (18:5) cfm Filter wt. gain 1.9990 (25:7) gms

Operator initials EPA/MAC (32:7) Probe wash wt. gain 3.5746 (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 | 1-1 | 0748 | 814.464 | .20 | .51 | 300 | 53 | 54 | 255 | 37 | 3.2 |
| A06 | 1-2 | 0751 | 815.74 | .28 | .72 | 334 | 54 | 54 | 250 | 37 | 4.0 |
| | 1-3 | 0754 | 817.18 | .28 | .72 | 344 | 55 | 54 | 250 | 37 | 4.0 |
| A08 | 1-4 | 0757 | 818.66 | .28 | .72 | 362 | 56 | 54 | 250 | 37 | 4.0 |
| A09 | STOP | 0800 | 820.139 | | | | | | | | |
| A10 | 2-1 | 0801 | 820.139 | .22 | .56 | 290 | 55 | 55 | 250 | 37 | 3.8 |
| A11 | 2-2 | 0804 | 821.43 | .21 | .53 | 304 | 56 | 55 | 250 | 37 | 3.8 |
| A12 | STOP | 0805 | 822.016 | | | | | | | | |
| A13 | 2-3 | 0811 | 822.016 | .21 | .53 | 305 | 56 | 57 | 250 | 37 | 3.8 |
| A14 | 2-3 | 0813 | 822.90 | .23 | .60 | 330 | 57 | 57 | 250 | 37 | 4.0 |
| A15 | 2-4 | 0816 | 824.26 | .27 | .67 | 347 | 57 | 57 | 250 | 37 | 4.3 |
| A16 | STOP | 0819 | 825.685 | | | | | | | | |
| A17 | 3-1 | 0820 | 825.685 | .31 | .80 | 289 | 58 | 57 | 250 | 37 | 4.8 |
| A18 | 3-2 | 0823 | 827.22 | .37 | .83 | 302 | 58 | 57 | 250 | 37 | 5.0 |
| A19 | 3-3 | 0826 | 829.76 | .26 | .66 | 317 | 58 | 57 | 250 | 39 | 5.0 |
| A20 | 3-4 | 0829 | 830.20 | .21 | .66 | 328 | 59 | 58 | 250 | 39 | 5.2 |
| A21 | STOP | 0832 | 831.634 | | | | | | | | |
| A22 | | | | | | | | | | | |
| | | (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 007 Initial Wt. .5292 gms

Sample Analysis

Weather Cold, very windy

A23 Remarks Hot Box 172° @ 0821

| | | |
|---|---|---|
| .2 | .25 | .30 |
| .51 | .64 | .77 |

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> CAM-1112-PAH-IN-#1

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 | 1-1 | 0834 | 831.634 | .39 | .86 | 284 | 59 | 58 | 258 | 39 | 6.2 |
| A06 | 1-2 | 0837 | 833.27 | .26 | .66 | 306 | 59 | 58 | 250 | 39 | 6.0 |
| | 1-3 | 0840 | 834.70 | .25 | .64 | 323 | 59 | 58 | 250 | 39 | 6.2 |
| A08 | 1-4 | 0843 | 836.11 | .28 | .72 | 324 | 60 | 59 | 250 | 39 | 7.5 |
| A09 | stop | 0846 | 837.594 | | | | | | | | |
| A10 | | | | | | | | | | | |
| A11 | | | | | | | | | | | |
| A12 | | | | | | | | | | | |
| 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 _____

Inlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | NaOH | 250ml | | Final | 861.8 |
| | | | | Initial | 699.7 |
| | | | | Wt. Gain | 162.1 |
| 2 | NaOH | 250ml | | Final | 733.4 |
| | | | | Initial | 721.6 |
| | | | | Wt. Gain | 11.8 |
| 3 | Dry | — | | Final | 444.2 |
| | | | | Inital | 444.2 |
| | | | | Wt. Gain | 0 |
| 4 | Silica Gel | — | | Final | 652.1 |
| | | | | Initial | 640.4 g. |
| | | | | Wt. Gain | 11.7 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 185.6 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 23.228 $ft^3$

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 517 °R

Total imp. wt. gain, MWC 185.6 grams $H_2O$

Pressure at meter, PM 28.495 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = .279$$

APPENDIX C.2

RECYCLE OPERATION TESTING

INCLUDES

C.2.1 EPA Reference Methods 2, 3, 4, and 5E
C.2.1.2 Controlled Emissions - EPA Reference Method 2, 3, 4, and 5E Data Sheets

RADIAN CORPORATION

# ORSAT DATA SHEET

Location Campbell Inlet

Date 11/15

Time 1000 hrs RAP

Operator MR7

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 | 7.8 | 7.8 | 11.0 | 3.2 | | |
| 2 | 0 | 7.6 | 7.6 | 10.8 | 3.2 | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Averaged Results: % $CO_2$ 7.7 % $O_2$ 3.2

% CO _____ % $N_2$ _____

Dry Molecular Weight, MW (dry) =

$$= 0.44 \underset{(\%\ CO_2)}{____} + 0.32 \underset{(\%\ O_2)}{____} + 0.28 \underset{(\%\ CO + \%\ N_2)}{____}$$

= _____ + _____ + _____

= _____ g/mole

Figure 5-3. Orsat field data sheet.

1/4

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> T. J. Campbell

Sampling Location> Outlet Sample Ident.> Cam-1110-TM-out-#1

A02 (1-3) Date 111083 (MMDDYY) Time Start 1043 (HHMM) Time Finish 1150 (HHMM)

Duct Dimensions 2.60 x 2.96 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9935 Test Duration 60 min.

A03 (1-3) Nozzle Dia. .243 inches % CO -0- % $N_2$ 85.1

Bar Press. 28.77 "Hg % $CO_2$ 4.2 % $H_2$ -0-

Static Press. +.50 "$H_2O$ % $O_2$ 10.7 % $CH_4$ -0-

A04 (1-3) Initial leak rate .016 cfm Condensed Water 227.1 gms

Final leak rate .020 cfm Filter wt. gain 0.0371 gms

Operator Initials MJR/VLL Probe wash wt. gain 0.0620 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 | 1-4 | 1043 | 988.310 | .60 | 1.01 | 151 | 45 | 45 | 250 | 40 | 4.0 |
| A06 | 1-3 | 1048 | 991.13 | .35 | .59 | 165 | 46 | 44 | 250 | 38 | 3.2 |
| A07 | 1-2 | 1053 | 993.39 | .20 | .34 | 157 | 43 | 43 | 250 | 37 | 3.0 |
| A08 | 1-1 | 1058 | 995.14 | .20 | .34 | 151 | 42 | 42 | 250 | 36 | 3.0 |
| A09 | STOP | 1103 | 996.934 | | | | | | | | |
| A10 | 2-4 | 1105 | 996.934 | .85 | 1.43 | 150 | 44 | 43 | 250 | 38 | 9.8 |
| A11 | 2-3 | 1110 | 1000.24 | .65 | 1.09 | 152 | 44 | 44 | 250 | 36 | 7.9 |
| A12 | 2-2 | 1115 | 1003.24 | .45 | .76 | 154 | 46 | 44 | 250 | 36 | 6.2 |
| A13 | 2-1 | 1120 | 1005.51 | .30 | .50 | 157 | 44 | 44 | 250 | 37 | 5.0 |
| A14 | STOP | 1125 | 1007.845 | | | | | | | | |
| A15 | 3-4 | 1130 | 1007.845 | .85 | 1.43 | 154 | 47 | 46 | 250 | 39 | 6.9 |
| A16 | 3-3 | 1135 | 1011.23 | .75 | 1.26 | 155 | 47 | 46 | 250 | 40 | 6.1 |
| A17 | 3-2 | 1140 | 1014.44 | .55 | .92 | 156 | 47 | 46 | 250 | 39 | 5.1 |
| A18 | 3-1 | 1145 | 1017.36 | .30 | .50 | 165 | 46 | 46 | 250 | 40 | 3.3 |
| A19 | STOP | 1150 | 1019.348 | | | | | | | | |
| 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 4837 Filter 017 Initial Wt. 0.5254 gms

Sample Analysis

Weather

A23 Remarks

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | 0.1N NaOH | ~250 | G-S | Final | 887.5 |
| | | | | Initial | 706.8 |
| | | | | Wt. Gain | 180.7 |
| 2 | 0.1N NaOH | ~250 | G-S | Final | 727.6 |
| | | | | Initial | 690.8 |
| | | | | Wt. Gain | 36.8 |
| 3 | Dry | — | Mod | Final | 448.7 |
| | | | | Inital | 447.5 |
| | | | | Wt. Gain | 1.2 |
| 4 | 10% $HNO_3$ ~~Silica Gel~~ | ~250 | G-S | Final | 726.7 |
| | | | | Initial | 726.2 |
| | | | | Wt. Gain | .5 |
| 5 | ~~10% $HNO_3$~~ | ~~~250~~ | ~~G-S~~ | Final | |
| | | | | Initial | ~~[illegible]~~ |
| | | | | Wt. Gain | |
| 6 | Dry | — | Mod. | Final | 442.3 |
| | | | | Initial | 441.8 |
| | | | | Wt. Gain | .5 |
| 7 | Silica Gel | — | Mod. | Final | 680.4 |
| | | | | Initial | 673.0 |
| | | | | Wt. Gain | 7.4 |

Total Impingers Weight Gain (MWC) (grams) 227.1 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

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

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

1/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> T J Campbell

Sampling Location> Outlet Sample Ident.> CAM-1111-OUTLET

A02 (1-3) Date 11/11/83 (MMDDYY) Time Start 0839 (HHMM) Time Finish 1433 (HHMM)

Duct Dimensions 2.96 x 2.60 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9935 Test Duration 93 min.

A03 (1-3) Nozzle Dia. .243 inches % CO -0- % $N_2$ 85.1

Bar Press. 28.79 "Hg % $CO_2$ 4.2 % $H_2$ -0-

Static Press. +.50 "$H_2O$ % $O_2$ 10.7 % $CH_4$ -0-

A04 (1-3) Initial leak rate .010 cfm Condensed Water 325.7 gms

Final leak rate .006 FROM POINT OF BREAK cfm Filter wt. gain 0.0242 gms

Operator Initials MTK/VLL Probe wash wt. gain 0.0598 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 | 1-4 | 0839 | 38.353 | .25 | .42 | 139 | 47 | 48 | 250 | 39 | 2.2 |
| A06 | 1-3 | 0843 | 39.80 | .20 | .34 | 143 | 45 | 45 | 250 | 40 | 2.0 |
| | 1-2 | 0847 | 41.15 | .40 | .67 | 145 | 44 | 44 | 250 | 41 | 3.0 |
| A8 | 1-1 | 0851 | 42.94 | .55 | .92 | 145 | 43 | 42 | 250 | 41 | 4.0 |
| A09 | STOP | 0855 | 45.259 | | | | | | | | |
| A10 | 2-4 | 0857 | 45.259 | .40 | .67 | 139 | 43 | 42 | 245 | 40 | 3.1 |
| A11 | 2-3 | 0901 | 47.12 | .40 | .67 | 145 | 44 | 43 | 250 | 39 | 3.1 |
| A12 | 2-2 | 0905 | 49.20 | .55 | 1.35 | 143 | 44 | 42 | 250 | 39 | 5.3 |
| A13 | 2-1 | 0909 | 51.74 | .70 | 1.70 | 140 | 45 | 43 | 250 | 40 | 6.6 |
| A14 | STOP | 0913 | 54.713 | | | | | | | | |
| A15 | 3-4 | 0915 | 54.713 | .35 | .86 | 135 | 46 | 44 | 250 | 41 | 3.9 |
| A16 | 3-3 | 0919 | 56.86 | .40 | 1.00 | 136 | 47 | 46 | 250 | 42 | 4.1 |
| A17 | 3-2 | 0923 | 59.18 | .40 | 1.00 | 142 | 47 | 45 | 250 | 42 | 4.1 |
| A18 | 3-1 | 0927 | 61.50 | .40 | 1.30 | 144 | 48 | 45 | 250 | 42 | 5.2 |
| A19 | STOP | 0931 | 64.011 | | | | | | | | |
| A20 | 4-4 | 0955 | 64.011 | .75 | 1.80 | 147 | 55 | 55 | 250 | 43 | 6.9 |
| A21 * | STOP | 0956 | 65.110 | | | | | | | | |
| A22 | 4-4 | 1007 | 65.440 | .75 | 1.80 | 147 | 55 | 55 | 250 | 44 | 6.9 |

Console 4.837 Filter 006 Initial Wt. 0.5236 gms

Sample Analysis

Weather

A23 Remarks * BROKEN GLASSWARE; NEW GLASS LEAK ✓ OK

WET BULB 62.5°C

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> CAIN-1111-OUT-TIN-01

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 $ft^3$ | 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 | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 4-3 | 1010 | 67.68 | .75 | 1.80 | 143 | 47 | 45 | 250 | 40 | 6.9 |
| A06 | STOP | 1012 | 69.428 | | | | | | | | |
| A08 | 4-3 | 1344 | 73.555 | .75 | 1.80 | 145 | 71 | 72 | 250 | 56 | 6.9 |
| | 4-2 | 1346 | 74.98 | .70 | 1.70 | 152 | 74 | 71 | 250 | 54 | 6.6 |
| A09 | 4-1 | 1350 | 78.01 | .55 | 1.32 | 155 | 68 | 68 | 250 | 53 | 5.5 |
| A10 | STOP | 1354 | 80.636 | | | | | | | | |
| A11 | 5-4 | 1356 | 80.636 | .75 | 1.80 | 147 | 62 | 63 | 250 | 50 | 6.9 |
| A12 | 5-3 | 1400 | 83.63 | .75 | 1.80 | 153 | 64 | 65 | 250 | 52 | 6.9 |
| A13 | 5-2 | 1404 | 86.64 | .55 | 1.32 | 156 | 63 | 63 | 245 | 54 | 5.8 |
| A14 | 5-1 | 1408 | 89.50 | .45 | 1.09 | 157 | 61 | 60 | 240 | 54 | 5.0 |
| A15 | STOP | 1412 | 91.881 | | | | | | | | |
| A16 | 6-4 | 1420 | 91.881 | .60 | 1.45 | 146 | 66 | 66 | 250 | 56 | 6.3 |
| A17 | 6-3 | 1424 | 94.58 | .60 | 1.45 | 154 | 65 | 64 | 250 | 57 | 6.3 |
| A18 | 6-2 | 1428 | 97.30 | .55 | 1.32 | 156 | 66 | 65 | 250 | 57 | 5.9 |
| A19 | 6-1 | 1432 | 100.06 | .35 | .86 | 157 | 66 | 64 | 250 | 58 | 3.9 |
| A20 | *** STOP | 1433 | 100.592 | | | | | | | | |
| 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: ** PROBE HEATER MALFUNCTION, CHANGED PROBE LINERS, LEAK CHECK OK



*** STOPPED CROSSOVER BROKE

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | 0.1 N NaOH | 200 | | Final | 859.6 |
| | | | | Initial | 646.7 |
| | | | | Wt. Gain | 212.9 |
| 2 | 0.1 N NaOH | 200 | | Final | 738.2 |
| | | | | Initial | 661.2 |
| | | | | Wt. Gain | 77.0 |
| 3 | Dry | | | Final | 471.2 |
| | | | | Inital | 449.8 |
| | | | | Wt. Gain | 21.4 |
| 4 | 10 % $HNO_3$ | 200 | | Final | 679.7 |
| | | | | Initial | 676.8 |
| | | | | Wt. Gain | 2.9 |
| 5 | Dry | | | Final | 445.5 |
| | | | | Initial | 445.5 |
| | | | | Wt. Gain | 0.0 |
| 6 | S.G. | | | Final | 691.8 |
| | | | | Initial | 680.3 |
| | | | | Wt. Gain | 11.5 |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 325.7 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

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

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

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> Outlet Sample Ident.> Cam-111-PAH-out-02

A02 (1-3) Date 111183 (MMDDYY) Time Start 1515 (HHMM) Time Finish 1704 (HHMM)

Duct Dimensions 2.96 x 2.6 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9935 Test Duration 96 min.

A03 (1-3) Nozzle Dia. .243 inches % CO -0- % $N_2$ 86.5

Bar Press. 28.39 "Hg % $CO_2$ 4.7 % $H_2$ -0-

Static Press. +.50 "$H_2O$ % $O_2$ 8.8 % $CH_4$ -0-

A04 (1-3) Initial leak rate .018 cfm Condensed Water 553.0 gms

Final leak rate .019 cfm Filter wt. gain 0.0240 gms

Operator initials MJR/TWT Probe wash wt. gain 0.0642 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 | 1-4 | 1515 | 100.819 | .25 | .59 | 146 | 70 | 71 | 250 | 52 | 2.2 |
| A06 | 1-3 | 1519 | 102.53 | .20 | .48 | 151 | 66 | 65 | 250 | 54 | 2.0 |
| | 1-2 | 1523 | 104.15 | .20 | .48 | 156 | 66 | 65 | 250 | 53 | 2.0 |
| A08 | 1-1 | 1527 | 105.76 | .15 | .34 | 157 | 64 | 62 | 250 | 52 | 1.0 |
| A09 | STOP | 1531 | 107.168 | | | | | | | | |
| A10 | 2-4 | 1533 | 107.168 | .80 | 1.95 | 147 | 60 | 60 | 250 | 48 | 5.0 |
| A11 | 2-3 | 1537 | 110.35 | .75 | 1.80 | 153 | 61 | 60 | 250 | 48 | 4.9 |
| A12 | 2-2 | 1541 | 113.43 | .75 | 1.80 | 156 | 62 | 60 | 250 | 48 | 4.9 |
| A13 | STOP | 1542 | 114.116 | | | | | | | | |
| A14 | 2-2 | 1545 | 114.116 | .55 | 1.32 | 157 | 62 | 62 | 250 | 49 | 3.9 |
| A15 | 2-1 | 1548 | 116.06 | .30 | .75 | 156 | 64 | 64 | 250 | 49 | 3.0 |
| A16 | STOP | 1552 | 118.127 | | | | | | | | |
| A17 | 3-4 | 1555 | 118.127 | .80 | 1.95 | 147 | 61 | 61 | 245 | 49 | 5.0 |
| A18 | 3-3 | 1559 | 121.22 | .70 | 1.70 | 157 | 64 | 63 | 250 | 48 | 4.6 |
| A19 | 3-2 | 1603 | 124.13 | .60 | 1.48 | 157 | 64 | 63 | 250 | 48 | 4.2 |
| A20 | 3-1 | 1607 | 126.84 | .45 | 1.09 | 158 | 62 | 62 | 250 | 51 | 3.2 |
| A21 | STOP | 1611 | 129.123 | | | | | | | | |
| A22 | 4-4 | 1613 | 129.123 | .80 | 1.95 | 146 | 62 | 61 | 245 | 49 | 5.1 |

Console 4837 Filter 008 Initial Wt. .5069 gms

Sample Analysis

Weather

A23 Remarks

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> OUTLET Sample Ident.> RUN #2 CAm-1111-PAH-OUT-01

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 | 4-3 | 1617 | 132.07 | .70 | 1.70 | 151 | 64 | 63 | 250 | 49 | 4.8 |
| A06 | 4-2 | 1621 | 134.98 | .55 | 1.32 | 154 | 64 | 62 | 250 | 48 | 4.0 |
| | 4-1 | 1625 | 137.51 | .50 | 1.22 | 156 | 61 | 62 | 250 | 47 | 3.9 |
| A08 | STOP | 1629 | 139.950 | ~~.80~~ | ~~1.95~~ | | ~~60~~ | ~~60~~ | | | |
| A09 | 5-4 | 1630 | 139.950 | .80 | 1.95 | 145 | 60 | 60 | 250 | 46 | 5.2 |
| A10 | 5-3 | 1634 | 143.06 | .70 | 1.70 | 151 | 60 | 60 | 250 | 46 | 4.8 |
| A11 | 5-2 | 1638 | 146.04 | .60 | 1.48 | 154 | 61 | 60 | 250 | 45 | 4.3 |
| A12 | 5-1 | 1642 | 148.80 | .50 | 1.22 | 156 | 60 | 60 | 250 | 45 | 4.0 |
| A13 | STOP | 1646 | 151.292 | | | | | | | | |
| A14 | 6-4 | 1648 | 151.292 | .70 | 1.70 | 144 | 60 | 60 | 250 | 48 | 4.9 |
| A15 | 6-3 | 1652 | 154.24 | .60 | 1.48 | 149 | 60 | 60 | 250 | 46 | 4.5 |
| A16 | 6-2 | 1656 | 156.99 | .50 | 1.22 | 153 | 60 | 59 | 250 | 45 | 4.2 |
| A17 | 6-1 | 1700 | 159.50 | .40 | .97 | 155 | 59 | 58 | 250 | 45 | 3.8 |
| A18 | STOP | 1704 | 161.746 | | | | | | | | |
| 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 _____

Outlet.

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) |
|---|---|---|---|---|
| 1 | 0.1 NaOH | 250 ml | | Final 828.5<br>Initial 697.0<br>Wt. Gain 131.5 |
| 2 | 0.1 NaOH | 250 ml | | Final 854.7<br>Initial 705.6<br>Wt. Gain 149.1 g. |
| 3 | Dry | | | Final 704.9<br>Inital 445.0<br>Wt. Gain 259.9 g |
| 4 | Silica Gel | | | Final 714.5<br>Initial 702.0<br>Wt. Gain 12.5 g. |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| 7 | | | | Final<br>Initial<br>Wt. Gain |

Total Impingers Weight Gain (MWC)(grams) 553 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 60.512 $ft^3$

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 522 °R

Total imp. wt. gain, MWC 553 grams $H_2O$

Pressure at meter, PM 28.79 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)(1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = 30.66\%$$

1/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> Campbell

Sampling Location> OUTLET Sample Ident.> CAM-1112-PAH-Out-01

A02 (1-3) Date 11/12/83 (MMDDYY) Time Start 0713 (HHMM) Time Finish 0900 (HHMM)

Duct Dimensions 2.96 x 2.6 ft. or Diameter — ft.

PTCF 0.84 DGMCF .9435 Test Duration 96 min.

A03 (1-3) Nozzle Dia. .243 inches % CO -0- % $N_2$ 87.8

Bar Press. 28.495 "Hg % $CO_2$ 4.9 % $H_2$ -0-

Static Press. -1.35 "$H_2O$ % $O_2$ 7.3 % $CH_4$ -0-

A04 (1-3) Initial leak rate .020 cfm Condensed Water 330.6 gms

Final leak rate .020 cfm Filter wt. gain 0.0240 gms

Operator initials MJR/TWT Probe wash wt. gain 0.0873 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 | 1-4 | 0713 | 178.184 | .25 | .60 | 141 | 43 | 43 | 250 | 40 | 1.0 |
| A06 | 1-3 | 0717 | 179.99 | .25 | .60 | 141 | 42 | 42 | 250 | 40 | 1.0 |
| A08 | 1-2 | 0721 | 181.80 | .20 | .48 | 139 | 42 | 42 | 245 | 39 | 1.0 |
| A09 | 1-1 | 0725 | 183.38 | .20 | .48 | 140 | 42 | 42 | 250 | 38 | 1.0 |
| A10 | STOP | 0729 | 184.902 | | | | | | | | |
| A11 | 2-4 | 0730 | 184.902 | .80 | 1.90 | 141 | 43 | 43 | 250 | 40 | 4.2 |
| A12 | 2-3 | 0734 | 187.97 | .60 | 1.40 | 142 | 44 | 42 | 250 | 40 | 3.7 |
| A13 | 2-2 | 0738 | 190.68 | .50 | 1.20 | 142 | 44 | 42 | 245 | 41 | 3.4 |
| A14 | 2-1 | 0742 | 193.09 | .40 | .98 | 141 | 44 | 43 | 250 | 41 | 3.0 |
| A15 | STOP | 0746 | 195.355 | | | | | | | | |
| A16 | 3-4 | 0750 | 195.355 | .80 | 1.90 | 140 | 45 | 45 | 245 | 42 | 4.9 |
| A17 | 3-3 | 0754 | 198.44 | .70 | 1.65 | 144 | 46 | 45 | 250 | 42 | 4.8 |
| A18 | 3-2 | 0758 | 201.35 | .60 | 1.40 | 141 | 46 | 44 | 250 | 41 | 4.3 |
| A19 | 3-1 | 0802 | 204.05 | .40 | .98 | 141 | 45 | 44 | 250 | 41 | 3.3 |
| A20 | STOP | 0806 | 206.375 | | | | | | | | |
| A21 | 4-4 | 0810 | 206.375 | .80 | 1.90 | 144 | 46 | 45 | 250 | 42 | 5.1 |
| A22 | 4-3 | 0814 | 209.45 | .70 | 1.65 | 145 | 47 | 46 | 245 | 41 | 4.9 |
| | 4-2 | 0818 | 212.37 | .55 | 1.30 | 143 | 46 | 45 | 250 | 41 | 4.0 |

Console 4837 Filter 009 Initial Wt. .5177 gms

Sample Analysis

Weather

A23 Remarks

2/2

# SOURCE SAMPLING FIELD DATA
## EPA METHOD 5

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> CAM-1112-PAH-OUT-Ø1

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 | 4-1 | 0822 | 214.99 | .45 | 1.10 | 141 | 46 | 45 | 245 | 40 | 3.6 |
| A06 | STOP | 0826 | 217.380 | | | | | | | | |
| | 5-4 | 0827 | 217.380 | .80 | 1.90 | 143 | 47 | 46 | 250 | 41 | 5.3 |
| A08 | 5-3 | 0831 | 220.48 | .75 | 1.78 | 141 | 47 | 45 | 250 | 40 | 5.1 |
| A09 | 5-2 | 0835 | 223.47 | .60 | 1.40 | 141 | 48 | 47 | 250 | 40 | 4.6 |
| A10 | 5-1 | 0839 | 226.18 | .50 | 1.20 | 141 | 47 | 46 | 250 | 40 | 4.1 |
| A11 | STOP | 0843 | 228.691 | | | | | | | | |
| A12 | 6-4 | 0844 | 228.691 | .65 | 1.53 | 142 | 47 | 46 | 250 | 41 | 5.0 |
| A13 | 6-3 | 0848 | 231.46 | .60 | 1.40 | 147 | 48 | 47 | 250 | 41 | 5.0 |
| A14 | 6-2 | 0852 | 234.15 | .40 | .98 | 149 | 49 | 47 | 250 | 42 | 4.0 |
| A15 | 6-1 | 0856 | 236.50 | .30 | .75 | 149 | 49 | 47 | 250 | 42 | 3.3 |
| A16 | STOP | 0900 | 238.497 | | | | | | | | |
| 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 _____

Outlet

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | NaOH | 250 ml | | Final | 868.2 |
| | | | | Initial | 697.5 |
| | | | | Wt. Gain | 170.7 |
| 2 | NaOH | 250 ml | | Final | 858.5 |
| | | | | Initial | 710.2 |
| | | | | Wt. Gain | 148.3 |
| 3 | Dry | — | | Final | 450.6 |
| | | — | | Inital | 449.2 |
| | | | | Wt. Gain | 1.4 |
| 4 | SilicaGel | | | Final | 701.8 |
| | | | | Initial | 691.6 |
| | | | | Wt. Gain | 10.2 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) 330.6 Analyst _____

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 59.921 $ft^3$

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 505 °R

Total imp. wt. gain, MWC 330.6 grams $H_2O$

Pressure at meter, PM 29.495 inches Hg

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

$$\text{Moisture Fraction} = \frac{(\quad)\ (1.339)}{\left[(\quad)\ (1.339)\right] + \left[\frac{(\quad)\ (\quad)}{(\quad)}\ (501.7)\right]} = .2070$$

APPENDIX C.2

RECYCLE OPERATION TESTING

INCLUDES

C.2.2 Particle Size Distribution Data Sheets
C.2.2.1 Uncontrolled Emissions Particle Size Data Sheets

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Inlet Sample Ident.> Cam-1111-PSD-In-01

Type of Impactor> Andersen HCSS Impactor Substrate> Thimbal (HCSS)

802 (1-3) Date 11-11-89 (MMDDYY) (4:6) Time Start 1253 (HHMM) (11:4) Time Finish 1330 (HHMM) (18:4)

Duct Dimensions 6 (25:5) x 2.21 (32:5) ft. or Diameter — (39:5) ft.

PTCF .84 (46:5) DGMCF 1.0122 (53:5) Test Duration 37 (60:5) min.

803 (1-3) Bar Press. 28.79 (6:5) "Hg Static Press. -1.20 (11:5) "$H_2O$ (18)

Nozzle Dia. .184 (25:4) inches Condensed Water 144.6 (32:5) gms

Intake leak rate 0.012 (39:5) cfm Operator initials EPA/TWT (46:7)

| | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | 1 | 1253 | 778.969 | .26 | .14 | 312 | 78 | 77 | — | 54 | 2.5 |
| 805 | 1 | 1303 | 781.26 | .26 | .14 | 312 | 75 | 74 | — | 55 | 3.0 |
| 806 | | 1313 | 783.53 | .26 | .14 | 312 | 76 | 74 | — | 52 | 3.0 |
| 807 | | 1323 | 785.73 | .26 | .14 | 312 | 76 | 75 | — | 55 | 3.0 |
| 808 | Stop | 1330 | 787.281 | | | | | | | | |
| 809 | | | | | | | | | | | |
| 810 | | | | | | | | | | | |
| 811 | | | | | | | | | | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:6) |

In Filter = 1.7777
Final = 1.9358

* Dry air purge when sampling wet streams

Console D-548

Weather

Remarks Probe located at side port between vertical ports 1 & 2 Impactor warmed in stack for 45 min.

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | ~250 | G-S | Final 856.0<br>Initial 755.4<br>Wt. gain 100.6 |
| 2 | $H_2O$ | ~250 | G-S | Final 637.4<br>Initial 681.1<br>Wt. gain -43.7 |
| 3 | Dry | — | Mod | Final 447.8<br>Initial 447.5<br>Wt. gain .3 |
| 4 | Silica Gel | — | Mod | Final 644.5<br>Initial 644.5<br>Wt. gain 0 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| | Total wt gain = | | 144.6 g | |
| 6 | | | 57.2 | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams)

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. Cam-111-PSD-01 Date 11-11-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 1.1838 |
| C03 | 2 | | | | 0.2831 |
| C04 | 3 | | | | 0.4340 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | | | .1584 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 4.7 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 86.5 (39:5)

% $O_2$ (dry) 8.8 (46:5) Other (dry) 0 (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

APPENDIX C.2

RECYCLE OPERATION TESTING

INCLUDES

C.2.2 Particle Size Distribution Data Sheets
C.2.2.2 Controlled Emissions - Particle Size Data Sheets

IMPACTOR FIELD DATA

301 (1-3) Plant Name> T.J. Campbell

Sampling Location> Outlet  Sample Ident.> PSD Run 1

Type of Impactor> Anderson  Impactor Substrate>

302 (1-3) Date 11/10 (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.

303 (1-3) Bar Press. (4:5) "Hg  Static Press. (11:5) "$H_2O$ (18)

Nozzle Dia. 0.184 (25:6) inches  Condensed Water (32:6) gms

Intake leak rate (39:5) cfm  Operator initials (46:7)

| | Pt. | Clock Time | Dry Gas Meter Reading ft³ | ΔP In. $H_2O$ | Meter Rate .34 ΔH In. $H_2O$ | Impactor ~~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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 304 | N3 | 1139 | 12.748 | | .45 | 217 | | | | | |
| 305 | | 1146 | 1-29.3 | | .45 | 237 | 47 | 53 | | 40 | 3 |
| 306 | | 1155 | 632.395 | | .45 | 249 | 47 | 54 | | 40 | 3 |
| 307 | | | | | | | | | | | |
| 308 | | | | | | | | | | | |
| 309 | | | | | | | | | | | |
| 310 | | | | | | | | | | | |
| 311 | | | | | | | | | | | |
| 312 | | | | | | | | | | | |
| 313 | | | | | | | | | | | |
| 314 | | | | | | | | | | | |
| 315 | | | | | | | | | | | |
| 316 | | | | | | | | | | | |
| 317 | | | | | | | | | | | |
| 318 | | | | | | | | | | | |
| 319 | | | | | | | | | | | |
| 320 | | | | | | | | | | | |
| 321 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

* Dry air purge when sampling wet streams

Console

Weather

Remarks

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | ~250 | G-S | Final<br>Initial 715.6<br>Wt. gain |
| 2 | $H_2O$ | ~250 | G-S | Final<br>Initial 681.1<br>Wt. gain |
| 3 | Dry | — | Mod. | Final<br>Initial 447.3<br>Wt. gain |
| 4 | Silica Gel | — | Mod. | Final<br>Initial 641.7<br>Wt. gain |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams)

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> T.J. Campbell

Sampling Location> Outlet  Sample Ident.> PSD Run 2

Type of Impactor> Anderson  Impactor Substrate>

802 (1-3) Date 11/11/83 (MMDDYY) (4:6) 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.

803 (1-3) Bar Press. (4:5) "Hg  Static Press. (11:5) "$H_2O$ (18)

Nozzle Dia. 0.185 (25:6) inches  Condensed Water (32:6) gms

Intake leak rate 0.08 (39:5) cfm  Operator initials (46:7)

| | Pt. | Clock Time | Dry Gas Meter Reading $ft^3$ | ΔP in. $H_2O$ | Meter Rate ~~ΔH~~ .44 in. $H_2O$ | Stack Temp. °F | Dry Gas Meter Temperature Inlet °F | Dry Gas Meter Temperature Outlet °F | Impactor ~~Hot Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | M3 | 1136 | 632.502 | 0.8 | | 148 | | | 190 | | |
| 805 | Stop | 1139 | 633.581 | | | | | | | | |
| 806 | Start | 1151 | 633.581 | | | Probably not heated, ~155 | | | | | |
| 807 | Stop | 1156 | 635.557 | | | TC problem & Heat tape problem | | | | | |
| 808 | Start | 1221 | 635.557 | | | | | | | | |
| 809 | | 1224 | 635.810 | | | | | | | | |
| 810 | | | | | | | | | | | |
| 811 | | | | | | | | | | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

* Dry air purge when sampling wet streams

Console

Weather

Remarks

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell

Sampling Location> Outlet  Sample Ident.> CAM-1111-PSD-out-Ø3

Type of Impactor> Anderson Mark III  Impactor Substrate> Reeves Angel

802 (1-3) Date 11-11-83 (MMDDYY) (4:6)  Time Start 1519 (HHMM) (11:4)  Time Finish 1622 (HHMM) (18:4)

Duct Dimensions 2.96 (25:5) x 2.60 (32:5) ft. or Diameter ——— (39:5) ft.

PTCF .84 (46:5)  DGMCF ——— (53:5)  Test Duration 62 (60:5) min.

803 (1-3) Bar Press. 28.79 (4:6) "Hg  Static Press. +.55 (11:5) "$H_2O$ ——— (18)

Nozzle Dia. 0.185 (25:6) inches  Condensed Water 201.3 (32:6) gms

Intake leak rate .016 (39:5) cfm  Operator initials MUF (46:7)

| | Pt. | Clock Time | Dry Gas Meter Reading $ft^3$ | ΔP in. $H_2O$ | Meter Rate .44 ΔH in. $H_2O$ | Stack Temp. °F | Dry Gas Meter Temperature Inlet °F | Dry Gas Meter Temperature Outlet °F | Impactor ~~Hot Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. In. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | M3 | 1519 | 635.912 | 0.8 | .55 | 148 | 67 | 66 | 195 | 50 | 4 |
| 805 | M3 | 1532 | 641.05 | 0.8 | .55 | 148 | 67 | 65 | 225 | 51 | 4 |
| 806 | M3 | 1547 | 647.82 | 0.8 | .55 | 148 | 70 | 68 | 232 | 52 | 4.0 |
| 807 | M3 | 1608 | 657.87 | 0.8 | .55 | 148 | 72 | 68 | 230 | 52 | 5 |
| 808 | STOP | 1622 | 663.345 | 0.8 | .55 | 148 | 71 | 68 | 164 | 52 | 5 |
| 809 | | | | | | | | | | | |
| 810 | | | | | | | | | | | |
| 811 | | | | | | | | | | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (70:5) |

• Dry air purge when sampling wet streams

Console R-31-520

Weather

Remarks

PSD Run 2 & Run 3

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | ~250 | G-S | Final 956.8<br>Initial 726.6<br>Wt. gain 229.4 |
| 2 | $H_2O$ | ~250 | G-S | Final 693.1<br>Initial 704.8<br>Wt. gain -11.7 |
| 3 | Dry | — | Mod. | Final 430.0<br>Initial 429.1<br>Wt. gain .9 |
| 4 | Silica Gel | — | Mod. | Final 584.3<br>Initial 577.3<br>Wt. gain 7.0 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams)

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. Campbell PSD 3 OutHet Date 11/11

Analyst MRF

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16283 | .16284 | |
| C03 | 2 | | .14597 | .14591 | |
| C04 | 3 | | .16324 | .16284 | |
| C05 | 4 | | .14441 | .14410 | |
| C06 | 5 | | .16698 | .16173 | |
| C07 | 6 | | .14693 | .14654 | |
| C08 | 7 | | .16099 | .16108 | |
| C09 | 8 | | .14580 | .14713 | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21833 | .2177 | |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Outlet  Sample Ident.> Cam-1111-PSD-Out-04

Type of Impactor> Andersen MK III  Impactor Substrate> Reeves Angel

802 (1-3) Date 11/11/83 (4:6) (MMDDYY)  Time Start 0715 (11:4) (HHMM)  Time Finish 0738 (18:4) (HHMM)

Duct Dimensions 1.96 (25:5) x 2.60 (32:5) ft. or Diameter — (39:5) ft.

PTCF .84 (46:5)  DGMCF .9749 (53:5)  Test Duration 23 (60:5) min.

803 (1-3) Bar Press. 28.79 (6:5) "Hg  Static Press. +.55 (11:5) "$H_2O$ (18)

Nozzle Dia. .185 (25:6) inches  Condensed Water 34.0 (32:6) gms

Intake leak rate .012 (39:5) cfm  Operator initials MRF (46:7)

| | 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 | Impactor ~~Hot Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | M3 | 0715 | 682.743 | 0.8 | .55 | 152 | 49 | 48 | 223 | 39 | 3.5 |
| 805 | M3 | 0723 | 686.06 | 0.8 | .55 | 152 | 50 | 47 | 220 | 40 | 4 |
| 806 | M3 | 0735 | 691.60 | 0.8 | .55 | 152 | 51 | 47 | 202 | 40 | 4.5 |
| 807 | STOP | 0738 | 692.37 | 0.8 | .55 | 152 | 50 | 46 | 196 | 40 | 4.5 |
| 808 | | | | | | | | | | | |
| 809 | | | | | | | | | | | |
| 810 | | | | | | | | | | | |
| 811 | | | | | | | | | | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

• Dry air purge when sampling wet streams

Console R-31-520

Weather

822 Remarks Had to Stop Due to increasing Pressure Drop

## MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | $H_2O$ | ≈ 250 ml | | Final | 734.6 |
| | | | | Initial | 701.9 |
| | | | | Wt. Gain | 32.7 |
| 2 | $H_2O$ | ≈ 250 ml | | Final | 637.4 |
| | | | | Initial | 637.4 |
| | | | | Wt. Gain | |
| 3 | Dry | | | Final | 447.9 |
| | | | | Inital | 447.7 |
| | | | | Wt. Gain | .2 |
| 4 | Silica Gel | | | Final | 640.0 |
| | | | | Initial | 638.9 |
| | | | | Wt. Gain | |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 7 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

Total Impingers Weight Gain (MWC)(grams) _____ 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

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

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

IMPACTOR FIELD DATA

Sample Ident. CAMPBELL PSD 4 OUTLET Date 11/12

Analyst MJK

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16386 | .16424 | |
| C03 | 2 | | .14400 | .14474 | |
| C04 | 3 | | .16159 | .16160 | |
| C05 | 4 | | .14671 | .14702 | |
| C06 | 5 | | .16513 | .16493 | |
| C07 | 6 | | .14643 | .14586 | |
| C08 | 7 | | .16232 | .16128 | |
| C09 | 8 | | .14721 | .14647 | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21783 | .2175 | |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

# IMPACTOR FIELD DATA

801 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Outlet  Sample Ident.> CAM-1115-PSD-Out-08

Type of Impactor> Andersen MkIII  Impactor Substrate> REEVES ANGEL

802 (1-3) Date 11/15/83 (MMDDYY) (4:6) Time Start 0907 (HHMM) (11:4) Time Finish 0939 (HHMM) (18:4)

Duct Dimensions 2.96 (25:5) x 2.60 (32:5) ft. or Diameter _____ (39:5) ft.

PTCF .84 (46:5) DGMCF .9749 (53:5) Test Duration 32 (60:5) min.

803 (1-3) Bar Press. 28.825 (4:5) "Hg  Static Press. +.55 (11:5) "$H_2O$ _____ (18)

Nozzle Dia. 0.185 (25:6) inches  Condensed Water 192.6 (32:6) gms

Intake leak rate 0.02 (39:5) cfm  Operator initials MRF (46:7)

| | Pt. | Clock Time | Dry Gas Meter Reading ft³ | ΔP in. $H_2O$ | Meter Rate .38 ΔH in. $H_2O$ | Stack Temp. °F | Dry Gas Meter Temperature Inlet °F | Dry Gas Meter Temperature Outlet °F | Impactor ~~Hot Box~~ Temp. °F | Last Impinger Temp. °F | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 804 | M3 | 0907 | 744.914 | 0.8 | .42 | 170 | 57 | 56 | 283 | 46 | 4 |
| 805 | M3 | 0916 | 748.13 | 0.8 | .42 | 170 | 61 | 56 | 288 | 46 | 4 |
| 806 | M3 | 0923 | 750.85 | 0.8 | .42 | 170 | 65 | 59 | 274 | 48 | 5 |
| 807 | M3 | 0930 | 753.60 | 0.8 | .42 | 170 | 69 | 61 | 269 | 48 | 5 |
| 808 | STOP | 0939 | 756.654 | | | | 67 | 64 | 232 | | |
| 809 | | | | | | | | | | | |
| 810 | | | | | | | | | | | |
| 811 | | | | | | | | | | | |
| 812 | | | | | | | | | | | |
| 813 | | | | | | | | | | | |
| 814 | | | | | | | | | | | |
| 815 | | | | | | | | | | | |
| 816 | | | | | | | | | | | |
| 817 | | | | | | | | | | | |
| 818 | | | | | | | | | | | |
| 819 | | | | | | | | | | | |
| 820 | | | | | | | | | | | |
| 821 | | | | | | | | | | | |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (74:5) |

• Dry air purge when sampling wet streams

Console R-31-526

Weather _____

Remarks RAP

IMPINGER CATCH

Sample Ident. Inlet AND- Date

Analyst

| Impinger No. | Solution Used | Amount of Solution (ml) | Imp. Tip Configuration | Weight (grams) |
|---|---|---|---|---|
| 1 | $H_2O$ | 250 ml. | | Final 877.3<br>Initial 688.1<br>Wt. gain 189.2 |
| 2 | $H_2O$ | 250 ml | | Final 565.6<br>Initial 564.9<br>Wt. gain .7 |
| 3 | Dry | — | | Final 448.6<br>Initial 448.6<br>Wt. gain 0.0 |
| 4 | Silica Gel | — | | Final 654.8<br>Initial 652.1<br>Wt. gain 2.7 |
| 5 | | | | Final<br>Initial<br>Wt. gain |
| 6 | | | | Final<br>Initial<br>Wt. gain |
| 7 | | | | Final<br>Initial<br>Wt. gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 192.6

Samples for Further Analysis:

| Sample No. | Description | Species | Results (total mg.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Remarks

IMPACTOR FIELD DATA

Sample Ident. Campbell Outlet PSD 8 Date _____

Analyst MRF

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16245 | .16296 | |
| C03 | 2 | | .14384 | .14404 | |
| C04 | 3 | | .16301 | .16343 | |
| C05 | 4 | | .14600 | .14625 | |
| C06 | 5 | | .16158 | .16230 | |
| C07 | 6 | | .14617 | .14538 | |
| C08 | 7 | | .15632 | .16287 | |
| C09 | 8 | | .14457 | .14632 | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21905 | .2168 | |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

APPENDIX C.2

RECYCLE OPERATION TESTING

INCLUDES

C.2.3 Polynuclear Aromatic Hydrocarbon (PAH) Data Sheets
C.2.3.1 Uncontrolled Emissions - PAH Data Sheets

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

1/2

A01 (1-3) Plant Name> Campbell Asphalt

Sampling Location> Inlet Sample Ident.> CAM-111S-BAP-IN-01

A02 (1-3) Date 11-15-83 (MMDDYY) Time Start 0909 (HHMM) Time Finish 1005 (HHMM)

Duct Dimensions 6 x 2.2 ft. or Diameter — ft.

PTCF .84 DGMCF 1.0122 Test Duration 48 min.

A03 (1-3) Nozzle Dia. .273 inches % CO -0- % $N_2$ 89.1

Bar Press. 28.825 "Hg % $CO_2$ 7.7 % $H_2$ -0-

Static Press. -1.20 "$H_2O$ % $O_2$ 3.2 % $CH_4$ -0-

A04 (1-3) Initial leak rate .018 cfm Condensed Water 316.2 gms

Final leak rate .012 cfm Filter wt. gain gms

Operator initials EPA/CBC/VAL 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 | 1-1 | 0909 | 954.380 | .22 | .28 | 296 | 64 | 64 | 250 | 46 | 5.0 |
| A06 | 1-2 | 0912 | 955.20 | .24 | .32 | 328 | 64 | 64 | 250 | 46 | 5.5 |
| | 1-3 | 0915 | 956.21 | .27 | .35 | 326 | 64 | 64 | 250 | 47 | 5.5 |
| | 1-4 | 0918 | 957.29 | .27 | .35 | 308 | 64 | 63 | 250 | 47 | 5.6 |
| A09 | STOP | 0921 | 958.369 | | | | | | | | |
| A10 | 2-1 | 0922 | 958.369 | .26 | .27 | 289 | 64 | 64 | 250 | 47 | 6.8 |
| A11 | 2-2 | 0925 | 959.28 | .22 | .29 | 303 | 64 | 64 | 250 | 47 | 6.8 |
| A12 | 2-3 | 0928 | 960.24 | .25 | .34 | 324 | 64 | 64 | 250 | 47 | 7.0 |
| A13 | 2-4 | 0931 | 961.27 | .28 | .36 | 362 | 64 | 64 | 250 | 47 | 7.5 |
| A14 | STOP | 0934 | 962-362 | | | | | | | | |
| A15 | 3-1 | 0937 | 962-362 | .30 | .39 | 309 | 65 | 65 | 250 | 47 | 7.8 |
| A16 | 3-2 | 0940 | 963.48 | .31 | .40 | 317 | 65 | 65 | 250 | 53 | 8.0 |
| A17 | 3-3 | 0943 | 964.64 | .26 | .36 | 326 | 66 | 65 | 250 | 53 | 7.8 |
| A18 | 3-4 | 0946 | 965.71 | .25 | .33 | 326 | 66 | 66 | 250 | 53 | 7.8 |
| A19 | STOP | 0949 | 966.767 | | | | | | | | |
| A20 | 4-1 | 0953 | 966.767 | .36 | .45 | 298 | 67 | 67 | 245 | 54 | 9.5 |
| A21 | 4-2 | 0956 | 967.84 | .21 | .27 | 305 | 67 | 67 | 250 | 54 | 9.0 |
| A22 | 4-3 | 0959 | 968.67 | .18 | .24 | 320 | 67 | 67 | 250 | 54 | 8.2 |
| | (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 Initial Wt. gms

Sample Analysis

Weather

A23 Remarks Hot Box 163@ 0916 0936 wet bulb - 3rd port 181°F still 48 %



wet bulb = 83 = 181
Dry Bulb = 156 - 313 = 48%
at start

| .15 | .20 | .25 | .30 | .3 |
|---|---|---|---|---|
| .10 | .26 | .33 | .39 | |

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

2/2

A01 (1-3) Plant Name> _____

Sampling Location> _____ Sample Ident.> CAm-115-BAP-IN-01

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 _____ (53:6) Test Duration _____ (60:5) min.

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

Bar Press. _____ (25:6) "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 _____ (71:6) 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 $ft^3$ | 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 | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 4-4 | 1002 | 969.87 | .22 | .28 | 33 | 67 | 67 | 250 | 54 | 9.0 |
| A06 | STOP | 1005 | 970.829 | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| A09 | | | | | | | | | | | |
| A10 | | | | | | | | | | | |
| A11 | | | | | | | | | | | |
| A12 | | | | | | | | | | | |
| 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 _____

Inlet CAM-1115-BAP-IN-01

MOISTURE AND IMPINGER CATCH DATA SHEET

| Impinger Number | Solution | Solution (mL) | Configuration | Weight (g) | |
|---|---|---|---|---|---|
| 1 | Dry | — | | Final | 674.1 |
| | | | | Initial | 409.6 |
| | | | | Wt. Gain | 264.5 |
| 2 | Dry | — | | Final | 507.2 |
| | | | | Initial | 438.3 |
| | | | | Wt. Gain | 68.9 |
| 3 | SilicaGel | — | | Final | 681.9 |
| | | | | Inital | 648.9 |
| | | | | Wt. Gain | 33.0 |
| 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) 366.4 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

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

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

APPENDIX C.2

RECYCLE OPERATION TESTING

INCLUDES

C.2.3 Polynuclear Aromatic Hydrocarbon (PAH) Data Sheets
C.2.3.2 Controlled Emissions - PAH Data Sheets

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

A01 (1-3) Plant Name> T.J. CAMPBELL

Sampling Location> OUTLET Sample Ident.> CAM-1115-BAP-OUT-01

A02 (1-3) Date 11/15/83 (MMDDYY) (4:6) Time Start 0859 (HHMM) (11:4) Time Finish 1053 (HHMM) (18:4)

Duct Dimensions 2.96 (25:5) x 2.6 (32:5) ft. or Diameter — — ft.

PTCF 0.84 (46:3) DGMCF .9935 (53:5) Test Duration 96 (39:5) (60:5) min.

A03 (1-3) Nozzle Dia. .243 (6:6) inches % CO 0 (11:5) % $N_2$ 89.1 (18:5)

Bar Press. 28.825 (25:6) "Hg % $CO_2$ 7.7 (32:5) % $H_2$ 0 (39:5)

Static Press. +.55 (46:6) "$H_2O$ (53) % $O_2$ 3.2 (60:5) % $CH_4$ 0 (67:5)

A04 (1-3) Initial leak rate .018 (4:5) cfm Condensed Water 811.4 (11:6) gms

Final leak rate .020 (18:6) cfm Filter wt. gain (25:7) gms

Operator initials MJK/TWT (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 | 1-4 | 0859 | 433.416 | .20 | .30 | 170 | 52 | 52 | 250 | 42 | 1.3 |
| A06 | 1-3 | 0903 | 434.68 | .15 | .22 | 172 | 51 | 51 | 250 | 44 | 1.0 |
| | 1-2 | 0907 | 435.75 | .15 | .22 | 171 | 51 | 50 | 250 | 46 | 1.0 |
| A08 | 1-1 | 0911 | 436.80 | .10 | .15 | 175 | 51 | 51 | 250 | 46 | 0.8 |
| A09 | STOP | 0915 | 437.693 | | | | | | | | |
| A10 | 2-4 | 0916 | 437.693 | .65 | .960 | 177 | 51 | 51 | 250 | 45 | 3.4 |
| A11 | 2-3 | 0920 | 440.00 | .55 | .82 | 176 | 52 | 51 | 250 | 60 | 3.1 |
| A12 | 2-2 | 0924 | 442.01 | .45 | .65 | 167 | 52 | 52 | 250 | 61 | 2.4 |
| A13 | 2-1 | 0928 | 443.45 | .45 | .65 | 168 | 52 | 52 | 250 | 62 | 2.4 |
| A14 | STOP | 0932 | 445.596 | | | | | | | | |
| A15 | 3-4 | 0934 | 445.596 | .80 | 1.25 | 169 | 53 | 52 | 245 | 49 | 4.1 |
| A16 | 3-3 | 0938 | 447.96 | .70 | 1.10 | 169 | 52 | 52 | 250 | 52 | 4.0 |
| A17 | 3-2 | 0942 | 450.33 | .55 | .82 | 170 | 53 | 52 | 250 | 54 | 3.2 |
| A18 | 3-1 | 0946 | 452.44 | .45 | .65 | 171 | 52 | 52 | 250 | 55 | 3.0 |
| A19 | STOP | 0950 | 454.258 | | | | | | | | |
| A20 | 4-4 | 0953 | 454.258 | .75 | 1.18 | 172 | 54 | 53 | 250 | 50 | 4.4 |
| A21 | 4-3 | 0957 | 456.80 | .70 | 1.10 | 172 | 53 | 52 | 250 | 49 | 4.4 |
| A22 | 4-2 | 1001 | 459.07 | .60 | .90 | 170 | 52 | 52 | 250 | 52 | 4.0 |
| | (4:2) | (11:4) | (18:7) | (25:5) | (32:5) | (39:5) | (46:5) | (53:5) | (60:5) | (67:5) | (70:5) |

Console 4837 Filter _____ Initial Wt. _____ gms

Sample Analysis _____

Weather _____

A23 Remarks _____



WET BULB 176°F
DRY " 176°F

SOURCE SAMPLING FIELD DATA
EPA METHOD 5

2/2

A01 (1-3) Plant Name> _____

Sampling Location> OUTLET Sample Ident.> CAM-1115-BAP-OUT-Ø1

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 $ft^3$ | 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 | L. Vac. in. Hg Gauge |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A05 | 4-1 | 1005 | 461.20 | .45 | .65 | 172 | 54 | 53 | 250 | 52 | 3.0 |
| A06 | * STOP | 1007 | 462.123 | | | | | | | | |
| | 4-1 | 1017 | 462.182 | .45 | .65 | 172 | 53 | 52 | 250 | 44 | 3.0 |
| A08 | STOP | 1019 | 463.072 | | | | | | | | |
| A09 | 5-4 | 1020 | 463.072 | .75 | 1.18 | 175 | 54 | 52 | 250 | 45 | 4.8 |
| A10 | 5-3 | 1024 | 465.49 | .70 | 1.10 | 177 | 56 | 53 | 250 | 46 | 5.0 |
| A11 | 5-2 | 1028 | 467.80 | .60 | .90 | 179 | 56 | 54 | 250 | 48 | 4.1 |
| A12 | 5-1 | 1032 | 469.86 | .50 | .70 | 174 | 55 | 53 | 250 | 50 | 3.2 |
| A13 | STOP | 1036 | 471.745 | | | | | | | | |
| A14 | 6-4 | 1037 | 471.745 | .55 | .82 | 176 | 55 | 54 | 250 | 48 | 3.8 |
| A15 | 6-3 | 1041 | 473.73 | .50 | .70 | 175 | 55 | 54 | 250 | 51 | 3.5 |
| A16 | 6-2 | 1045 | 475.63 | .45 | .65 | 175 | 55 | 53 | 250 | 50 | 3.2 |
| A17 | 6-1 | 1049 | 477.42 | .35 | .50 | 173 | 54 | 53 | 250 | 49 | 3.0 |
| A18 | STOP | 1053 | 479.013 | | | | | | | | |
| 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 * BROKEN GLASSWARE; REPLACED & LEAK ✓ OK

# APPENDIX D

## SAMPLING LOGS

INCLUDES

D.1 Daily Sampling Log
D.2 Chain of Custody Log
D.3 Sample Identification Log

APPENDIX D.1

DAILY SAMPLING LOGS

# DAILY SUMMARY LOG

November 8, 1983

| Clock Time | Particulate Runs Inlet | Particulate Runs Outlet | Particle Size Distribution Inlet | Particle Size Distribution Outlet | Visible Emissions |
|---|---|---|---|---|---|
| 1405 | | started run C-V[a] | | | |
| 1416 | started run C-V[a] | ↓ | | | |
| 1425 | ↓ | finished 1st port | | | |
| 1428 | finished 1st port | | | | |
| 1431 | started 2nd port | started 2nd port | | | |
| 1443 | finished 2nd port | | | | |
| 1445 | started 3rd port | ↓ | | | |
| 1451 | ↓ | finished 2nd port | | | |
| 1457 | finished 3rd port | | | | |
| 1458 | | started 3rd port | | | |
| 1509 | started 4th port | ↓ | | | |
| 1518 | ↓ | finished 3rd port | | | |
| 1521 | finished run C-V | | | | |
| 1523 | | started 4th port | | | |
| 1530 | | ↓ | | | |
| 1543 | | finished 4th port | | | |
| 1548 | | started 5th port | | | |
| 1600 | | ↓ | | | |
| 1608 | | finished run C-V | | | |

[a]Run void due to high isokinetics

November 10, 1983

| Clock Time | Particulate Runs Inlet | Particulate Runs Outlet | Particle Size Distribution Inlet | Particle Size Distribution Outlet | Visible Emissions |
|---|---|---|---|---|---|
| 1000 | | | | | |
| 1030 | | | | | observations started |
| 1043 | | started run R-V * | | | ↓ |
| 1100 | | ↓ | | | observations stopped |
| 1103 | | finished 1st port | | | |
| 1105 | | started 2nd port | | | |
| 1115 | | ↓ | | | |
| 1121 | started run R-V | | | | |
| 1125 | ↓ | finished 2nd port | | | |
| 1130 | ↓ | start 3rd port | | | |
| 1133 | finished 1st port | ↓ | | | |
| 1134 | started 2nd port | ↓ | | | |
| 1139 | ↓ | ↓ | | started run R-1 | |
| 1140 | ↓ | ↓ | | ↓ | observations continued |
| 1146 | finished 2nd port | ↓ | | ↓ | ↓ |
| 1147 | started 3rd port | ↓ | | ↓ | ↓ |
| 1150 | ↓ | finished 3rd port | | ↓ | ↓ |
| 1153 | finished 3rd port | | | ↓ | ↓ |
| 1155 | | | | stopped run R-1 | ↓ |
| 1157 | | | | | observations stopped |
| 1159 | | | | | |
| 1230 | | | | | |
| 1300 | | | | | |
| 1330 | | | | | |
| 1400 | | | | | observations continued |
| 1430 | | | | | ↓ |
| 1500 | | | | | observations stopped |
| 1505 | | | | | observations continued |
| 1530 | | | | | ↓ |
| 1600 | | | | | observations stopped |
| 1620 | | | | | observations continued |
| 1630 | | | | | observations stopped |

*Run stopped, plant changed to conventional operation mix.

# DAILY SUMMARY LOG (Continued)

November 11, 1983

| Clock time | Particulate Runs Inlet | Particulate Runs Outlet | Particle Size Distribution Inlet | Particle Size Distribution Outlet | Visible Emissions |
|---|---|---|---|---|---|
| 0713 | | | | started run PSD R-2 | |
| 0738 | | | | finished run PSD R-2 | |
| 0800 | | | | | |
| 0819 | | | | | observations started |
| 0830 | | | | | |
| 0839 | | started run R-1 | | | |
| 0843 | started run R-1 | | | | |
| 0855 | finished 1st port | finished 1st port | | | |
| 0857 | started 2nd port | started 2nd port | | | |
| 0909 | finished 2nd port | | | | |
| 0911 | started 3rd port | | | | |
| 0913 | | finished 2nd port | | | |
| 0915 | | started 3rd port | | | |
| 0923 | finished 3rd port | | | | |
| 0925 | started 4th port | | | | |
| 0931 | | finished 3rd port | | | |
| 0937 | finished run R-1 | | | | |
| 0945 | | | | | |
| 0955 | | started 4th port | | | |
| 1003 | | | | | observations stopped |
| 1009 | | | | | observations continued |
| 1015 | | | | | observations stopped |
| 1030 | | | | | |
| 1100 | | | | | |
| 1104 | | | | | observations continued |
| 1115 | | | | | |
| 1136 | | | | started run PSD R-3 | observations stopped |
| 1145 | | | | | |
| 1200 | | | | | |
| 1224 | | | | finished run PSD R-3 | |
| 1230 | | | | | |
| 1245 | | | | | |
| 1253 | | | started run PSD R-1 | | |
| 1308 | | | | | observations continued |
| 1330 | | | finished run PSD R-1 | | |
| 1337 | | | | | observations stopped |
| 1354 | | finished 4th port | | | |
| 1356 | | started 5th port | | | |
| 1400 | | | | | observations continued |
| 1412 | | finished 5th port | | | |
| 1420 | | started 6th port | | | |
| 1430 | | | | | |
| 1433 | | finished run R-1 | | | |
| 1442 | | | | | observations stopped |
| 1500 | | | | | |
| 1515 | | started run R-2 | | | |
| 1519 | | | | started run PSD R-4 | |
| 1530 | | | | | observations continued |
| 1531 | | finished 1st port | | | |
| 1533 | | started 2nd port | | | |
| 1541 | | | | | observation stopped |
| 1542 | | | | | |
| 1545 | | | | | observations continued |
| 1552 | | finished 2nd port | | | |
| 1555 | | started 3rd port | | | |
| 1611 | | finished 3rd port | | | |
| 1613 | | standard 4th port | | | |
| 1622 | | | | finished run PSD R-4 | |
| 1629 | | finished 4th port | | | |
| 1630 | | started 5th port | | | |
| 1645 | started run R-2 | | | | |
| 1646 | | finished 5th port | | | |
| 1648 | | started 6th port | | | |
| 1657 | finished 1st port | | | | |
| 1658 | started 2nd port | | | | |
| 1704 | | finished run R-2 | | | |
| 1710 | finished 2nd port | | | | |
| 1711 | started 3rd port | | | | |
| 1718 | | | | | |
| 1723 | finished 3rd port | | | | observations stopped |
| 1724 | started 4th port | | | | |
| 1730 | finished run R-2 | | | | |

## DAILY SUMMARY LOG (Continued)

November 12, 1983

| Clock Time | Particulate Runs Inlet | Particulate Runs Outlet | Particle Size Distribution Inlet | Particle Size Distribution Outlet | Visible Emissions |
|---|---|---|---|---|---|
| 0713 | | started run R-3 | | | |
| 0722 | | | | | observations started |
| 0729 | | finished 1st port | | | |
| 0730 | | started 2nd port | | | |
| 0746 | | finished 2nd port | | | |
| 0748 | started run R-3 | | | | |
| 0750 | | started 3rd port | | | |
| 0800 | finished 1st port | | | | |
| 0801 | started 2nd port | | | | |
| 0806 | | finished 3rd port | | | observations stopped |
| 0810 | | started 4th port | | | |
| 0812 | | | | | observations continued |
| 0819 | finished 2nd port | | | | |
| 0820 | started 3rd port | | | | |
| 0826 | | finished 4th port | | | |
| 0827 | | started 5th port | | | |
| 0832 | finished 3rd port | | | | |
| 0834 | started 4th port | | | | |
| 0843 | | finished 5th port | | | |
| 0844 | | started 6th port | | | |
| 0846 | finished run R-3 | | | | |
| 0900 | | finished run R-3 | | | |
| 0925 | | | | | observations stopped |
| 1129 | | started run C-1 | | | |
| 1130 | | | | | observations started |
| 1145 | | finished 1st port | | | |
| 1147 | | started 2nd port | | | |
| 1151 | started run C-1 | | | | |
| 1200 | | | | | |
| 1203 | finished 1st port | finished 2nd port | | | |
| 1204 | started 2nd port | started 3rd port | | | |
| 1216 | finished 2nd port | | | | |
| 1218 | started 3rd port | | | | |
| 1220 | | finished 3rd port | | | |
| 1222 | | started 4th port | | | |
| 1230 | finished 3rd port | | | | |
| 1231 | started 4th port | | | | |
| 1232 | | | | started run PSD C-1 | |
| 1238 | | finished 4th port | | | |
| 1239 | | started 5th port | | | |
| 1243 | finished run C-1 | | | | |
| 1302 | | finished 5th port | | | |
| 1303 | | started 6th port | | | |
| 1315 | | | | | |
| 1319 | | finished run C-1 | | | |
| 1330 | | | | | |
| 1345 | | | | | |
| 1400 | | | | | |
| 1415 | | | | | |
| 1418 | | | started run PSD C-1 | | |
| 1430 | | | | | observations stopped |
| 1445 | | | | | |
| 1500 | | | | | |
| 1514 | | | | finished run PSD C-1 | |
| 1520 | | | finished run PSD C-1 | | |

# DAILY SUMMARY LOG (Continued)

November 13, 1983

| Clock Time | Particulate Runs Inlet | Particulate Runs Outlet | Particle Size Distribution Inlet | Particle Size Distribution Outlet | Visible Emissions |
|---|---|---|---|---|---|
| 0800 | | | | | observations started |
| 0830 | | | | | |
| 0845 | | | | | |
| 0853 | | started run C-2 | | | |
| 0900 | | | | | |
| 0909 | | finished 1st port | | | |
| 0912 | | started 2nd port | | | |
| 0915 | | | | | |
| 0928 | | finished 2nd port | | | |
| 0930 | | started 3rd port | | | |
| 0940 | | | | started run PSD C-2 | |
| 0954 | | finished 3rd port | | | |
| 0956 | started run C-2 | | | | |
| 1000 | | started 4th port | | | |
| 1008 | finished 1st port | | | | |
| 1009 | started 2nd port | | | | |
| 1016 | | finished 4th port | | | |
| 1017 | | started 5th port | | | |
| 1021 | finished 2nd port | | | | |
| 1024 | started 3rd port | | | | |
| 1033 | | finished 5th port | | | |
| 1034 | | started 6th port | | | |
| 1036 | finished 3rd port | | | | |
| 1038 | started 4th port | | | | |
| 1045 | | | | | |
| 1050 | finished run C-2 | | | | |
| 1054 | | | | | observations stopped |
| 1100 | | | | | |
| 1103 | | | | | observations continued |
| 1112 | | finished run C-2 | | finished run PSD C-2 | |
| 1130 | | | | | |
| 1145 | | | | | |
| 1154 | | | | | observations stopped |

# DAILY SUMMARY LOG (Continued)

November 14, 1983

| Clock Time | Particulate Runs Inlet | Particulate Runs Outlet | Particle Size Distribution Inlet | Particle Size Distribution Outlet | Visible Emissions |
|---|---|---|---|---|---|
| 0813 | | started run C-3 | | | |
| 0827 | started run C-3 | | | | |
| 0829 | | finished 1st port | | | |
| 0830 | | started 2nd port | | | |
| 0839 | finished 1st port | | | | |
| 0840 | started 2nd port | | | | |
| 0852 | finished 2nd port | | | | |
| 0853 | | finished 2nd port | | | |
| 0854 | started 3rd port | started 3rd port | | | |
| 0900 | | | | | |
| 0906 | finished 3rd port | | | | |
| 0908 | | | | started run PSD C-3 | |
| 0910 | | finished 3rd port | | | |
| 0913 | | started 4th port | | | |
| 0915 | | | | | |
| 0924 | started 4th port | | | | |
| 0929 | | finished 4th port | | | |
| 0930 | | started 5th port | | | |
| 0936 | finished run C-3 | | | | |
| 0946 | | finished 5th port | | | |
| 0947 | | started 6th port | | | |
| 0949 | | | | finished run PSD C-3 | |
| 1000 | | | | | |
| 1003 | | finished run C-3 | | | |
| 1015 | | | | | |
| 1030 | | | | | |
| 1100 | | | | | |
| 1130 | | | | | |
| 1200 | | | | | |
| 1209 | | started run PAH C-1 | | | |
| 1215 | | | | | |
| 1225 | | finished 1st port | | | |
| 1226 | | started 2nd port | | | |
| 1230 | | | | | |
| 1242 | | finished 2nd port | | | |
| 1243 | | started 3rd port | | | |
| 1245 | | | | | |
| 1259 | | finished 3rd port | | | |
| 1301 | started run PAH C-1 | | | | |
| 1306 | | started 4th port | | | |
| 1313 | finished 1st port | | | | |
| 1315 | started 2nd port | | | | |
| 1318 | plant down | plant down | | | |
| 1401 | | resume 4th port | | | |
| 1404 | resume 2nd port | | | | |
| 1405 | | finished 4th port | | | |
| 1406 | | started 5th port | | | |
| 1412 | finished 2nd port | | | | |
| 1413 | started 3rd port | | | | |
| 1415 | | | | | |
| 1422 | | finished 5th port | | | |
| 1423 | | started 6th port | | | |
| 1425 | finished 3rd port | | | | |
| 1426 | started 4th port | | | | |
| 1427 | plant down | plant down | | | |

# DAILY SUMMARY LOG (Continued)

November 15, 1983

| Clock Time | Particulate Runs Inlet | Particulate Runs Outlet | Particle Size Distribution Inlet | Particle Size Distribution Outlet | Visible Emissions |
|---|---|---|---|---|---|
| 0815 | | | | | observations started |
| 0830 | | | | | ↓ |
| 0845 | | | | | observations stopped |
| 0855 | | | | | observations continued |
| 0859 | | started run PAH R-1 | | | ↓ |
| 0900 | | ↓ | | | ↓ |
| 0907 | | ↓ | | started run PSD R-5 | ↓ |
| 0909 | started run PAH R-1 | ↓ | | ↓ | ↓ |
| 0915 | ↓ | finished 1st port | | ↓ | ↓ |
| 0916 | ↓ | started 2nd port | | ↓ | ↓ |
| 0921 | finished 1st port | ↓ | | ↓ | ↓ |
| 0922 | started 2nd port | ↓ | | ↓ | ↓ |
| 0932 | ↓ | finished 2nd port | | ↓ | ↓ |
| 0934 | finished 2nd port | started 3rd port | | ↓ | ↓ |
| 0937 | started 3rd port | ↓ | | ↓ | ↓ |
| 0939 | ↓ | ↓ | | finished run PSD R-5 | ↓ |
| 0949 | finished 3rd port | ↓ | | | ↓ |
| 0950 | | finished 3rd port | | | ↓ |
| 0953 | started 4th port | started 4th port | | | ↓ |
| 1000 | ↓ | ↓ | | | ↓ |
| 1005 | finished run PAH R-1 | ↓ | | | ↓ |
| 1017 | | finished 4th port | | | ↓ |
| 1019 | | started 5th port | | | ↓ |
| 1030 | | ↓ | | | ↓ |
| 1036 | | finished 5th port | | | ↓ |
| 1037 | | started 6th port | | | ↓ |
| 1045 | | ↓ | | | ↓ |
| 1053 | | finished run PAH R-1 | | | observations stopped |
| 1100 | | | | | |
| 1200 | | | | | |
| 1215 | | | | | |
| 1225 | | | started run PSD C-3 | | |
| 1230 | | | ↓ | | |
| 1245 | | | ↓ | | |
| 1300 | | | ↓ | | |
| 1315 | | | ↓ | | |
| 1330 | | | ↓ | | |
| 1345 | | | ↓ | | |
| 1400 | | | finished run PSD C-3 | | |

APPENDIX D.2

CHAIN OF CUSTODY FORMS

CORPORATION

## CHAIN OF CUSTODY REPORT

Name: Eric P Anderson  Company: Radian
Position: Task Leader  Department: Physical Chemistry
Samples Rec'd from: Barry Chapman  Contract No. 222-098 03
Date Samples Rec'd: 11-17-83

Samples Handled (list)

| | | | | |
|---|---|---|---|---|
| C-6 | C-45 | C-83 | C-106 | C-202 |
| C-12 | C-53 | C-84 | C-115 | C-203 |
| C-19 | C-61 | C-90 | C-121 | C-204 |
| C-25 | C-62 | C-91 | C-128 | |
| C-26 | C-70 | C-97 | C-134 | |
| C-44 | C-77 | C-105 | C-141 | |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| Dessicated & Weighed | 11-18-83 thru 12-02-83 | 661 |
| | | |
| | | |
| | | |

Samples Delivered to: Sample Analysis Complete
Date Delivered:

COMMENTS (note any contamination, etc.): Filters and Cyclone Solids

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: 12/02/83
Witness: Barry Chapman



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CORPORATION

## CHAIN OF CUSTODY REPORT

Name Eric Anderson Company Radian
Position Task Leader Department Physical Chemistry
Samples Rec'd from Barry Chapman Contract No. 222-078 03
Date Samples Rec'd 11-17-83

Samples Handled (list)

| | | | | | |
|---|---|---|---|---|---|
| C-1 | C-20 | C-54 | C-168 | C-93 | C-117 |
| C-2 | C-21 | C-55 | C-78 | C-98 | C-122 |
| C-7 | C-37 | C-63 | C-79 | C-99 | C-123 |
| C-8 | C-38 | C-64 | C-85 | C-109 | C-124 |
| C-13 | C-46 | C-71 | C-86 | C-110 | C-130 |
| C-14 | C-47 | C-72 | C-90 | C-116 | C-135 |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| Evaporation of Solvents | 11-18-83 thru 12-02-83 | 661 |
| Residue Weighing | | |
| | | |
| | | |

Samples Delivered to Sample Analysis Complete
Date Delivered

COMMENTS (note any contamination, etc.) Acetone and TCE Probe Rinses

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 12/02/83
Witness Barry Chapman



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**CORPORATION**

## CHAIN OF CUSTODY REPORT

Name Eric P. Anderson Company Radian
Position Task leader Department Physical Chemistry
Samples Rec'd from Barry Chapman Contract No. 222-078 03
Date Samples Rec'd 11-17-83

Samples Handled (list)

| | | | | |
|---|---|---|---|---|
| C-61 | C-54 | C-109 | C-190 | |
| C-62 | C-55 | C-110 | C-191 | |
| C-70 | C-63 | C-182 | C-192 | |
| C-105 | C-64 | C-183 | C 193 | |
| C-106 | C-98 | C-184 | | |
| C-115 | C-99 | C-185 | | |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| ICAPES) | 12-13-83 thru 12-21-83 | |
| | | |
| | | |
| | | |

Samples Delivered to Donnie Heinrich
Date Delivered 12-13-83

COMMENTS (note any contamination, etc.) Filters and Probe washes from Trace metals sampling - Beaker C-64 Broken

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 12/13/83
Witness Barry Chapman



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**CORPORATION**

## CHAIN OF CUSTODY REPORT

Name Eric R. Anderson Company Radian
Position Task Leader Department Physical Chemistry
Samples Rec'd from Barry Chapman Contract No. 222-018-03
Date Samples Rec'd 12-12-83

**Samples Handled (list)**

C-209
C-210
C-215
C-216
C-226
C-230

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| ICAPES | 12-13-83 thru 12-21-83 | |
| | | |
| | | |
| | | |

Samples Delivered to Donnie Heinrich
Date Delivered 12-13-83
COMMENTS (note any contamination, etc.) Scrubber water Samples & Scrubber Solids

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 12/13/83
Witness Barry Chapman



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CORPORATION

## CHAIN OF CUSTODY REPORT

Name: Eric P. Anderson  Company: Radian
Position: Test Leader  Department: Physical Chemistry
Samples Rec'd from: Barry Chapman  Contract No. 222-078-05
Date Samples Rec'd: 11-17-83

**Samples Handled (list)**

| | | | |
|---|---|---|---|
| C-136 | C-167 | C-173 | |
| C-162 | C-168 | | |
| C-163 | C-169 | | |
| C-164 | C-170 | | |
| C-165 | C-171 | | |
| C-166 | C-172 | | |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| Evaporation of Solvent | 11-18-83 thru 12-02-83 | 661 |
| And Residue Weighing | | |
| | | |
| | | |

Samples Delivered to: Sample Analysis Complete
Date Delivered:

COMMENTS (note any contamination, etc.): Acetone and TCE Probe Rinses

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: 12/02/83
Witness: [signature]



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CORPORATION

## CHAIN OF CUSTODY REPORT

Name: Eric Anderson Company: Radian
Position: Scientist (Task Leader) Department: Physical Chemistry
Samples Rec'd from: Barry Chapman Contract No. 222-078 03-
Date Samples Rec'd: 11-17-83

Samples Handled (list)

| | | | | |
|---|---|---|---|---|
| C-174 | C-189 | C-197 | C-214 | C-220 |
| C-175 | C-190 | C-209 | C-215 | C-221 |
| C-182 | C-193 | C-210 | C-216 | C-222 |
| C-186 | C-194 | C-211 | C-217 | C-223 |
| C-187 | C-195 | C-212 | C-218 | C-224 |
| C-188 | C-196 | C-213 | C-219 | C-184 |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| TOC | 12-12-83 thru 12-19-83 | |
| | | |
| | | |
| | | |

Samples Delivered to: Donnie Heinrich
Date Delivered: 12-12-83

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: 12/12/83
Witness: Barry Chapman



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CORPORATION

## CHAIN OF CUSTODY REPORT

Name BARRY CHAPMAN Company RADIAN
Position Technician Department Physical Chemistry
Samples Rec'd from SELF Contract No. 222-078-03
Date Samples Rec'd 11-08-83 thru 11-15-83

Samples Handled (list)

| | | | | |
|---|---|---|---|---|
| C-231 | C-233 | C-237 | C-241 | C-230 |
| C-221 | C-34 | C-159 | C-144 | |
| C-222 | C-234 | C-238 | C-242 | |
| C-223 | C-235 | C-239 | C-243 | |
| C-224 | C-29 | C-154 | C-149 | |
| C-232 | C-236 | C-240 | C-228 | |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| Extraction & GC-MS | 12-05 thru 12-18-83 | |
| Preparation | | |
| | | |
| | | |

Samples Delivered to JERRY PARR
Date Delivered 12-19-83
COMMENTS (note any contamination, etc.) GC-MS Analysis for BAP

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 12/15/83
Witness Ernest R. [illegible]



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CORPORATION

## CHAIN OF CUSTODY REPORT

Name Barry Chapman Company Radian
Position Technician Department Physical Chemistry
Samples Rec'd from SEIC Contract No. 222-078-03
Date Samples Rec'd 11-08-83 thru 11-15-83

Samples Handled (list)

| | | |
|---|---|---|
| C-5 | C-89 | C-131 |
| C-11 | C-96 | C-137 |
| C-59 | C-100 | |
| C-67 | C-111 | |
| C-76 | C-118 | |
| C-82 | C-124 | |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| Solvent Evaporation | 12-05-83 thru 12-15-83 | 666 |
| and Residue weight determination | | |
| | | |
| | | |

Samples Delivered to Sample Analysis Complete
Date Delivered

COMMENTS (note any contamination, etc.) TCE Impinger Rinses

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 12/15/83
Witness Eric [illegible]



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CORPORATION

## CHAIN OF CUSTODY REPORT

Name: BARRY CHAPMAN Company: RADIAN

Position: Technician Department: Physical Chemistry

Samples Rec'd from: SCIS Contract No. 222-078-03

Date Samples Rec'd: 11-08-83 thru 11-05-83

Samples Handled (list)

| | | |
|---|---|---|
| C-174 | C-188 | C-195 |
| C-175 | C-189 | C-196 |
| C-182 | C-190 | C-197 |
| C-184 | C-191 | |
| C-186 | C-193 | |
| C-187 | C-194 | |

| Analyses Performed | Date | Recorded (Lab Book No.) |
|---|---|---|
| Extractable Condensed Hydrocarbons | 12-05-83 thru 12-15-83 | 666 |

Samples Delivered to: Sample Analysis Complete

Date Delivered:

COMMENTS (note any contamination, etc.) NaOH Impinger Catches Chloroform/Ether Extraction for Condensible Hydrocarbons

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: 12/15/83

Witness: [illegible]



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APPENDIX D.3

SAMPLE IDENTIFICATION LOG

# T.J. CAMPBELL ASPHALT PLANT - SAMPLE LOG

| Sample Number | Date | Sample ID | Time | Sampling Location | Sample Type |
|---|---|---|---|---|---|
| | 11-8-83 | CAM-1108-IN-M5-Blank | 1000 | -- | PCH acetone probe rinse |
| C-2 | | | | | PCH TCE probe rinse |
| C-3 | | | | | PCH NaOH 1st imp rinse |
| C-4 { C-174 | | | | | Impirinse 2nd rinse |
| C-5 | | | | | PCH TCE imp rinse |
| C-6 | | | | | Filter 001 |
| C-7 | | CAM-1108-OUT-M5-Blank | 1200 | -- | PCH acetone probe rinse |
| C-8 | | | | | PCH TCE probe rinse |
| C-9 | | | | | PCH NaOH 1st imp rinse |
| C-10 { C-175 | | | | | NaOH imp rinse 2nd rinse |
| C-11 | | | | | PCH TCE imp rinse |
| C-12 | | | | | Filter 002 |
| C-13 | | CAM-1108-OUT-M5-01 | 1405 | Outlet | PCH acetone probe rinse |
| C-14 | | | | | PCH TCE probe rinse |
| C-15 | | | | | PCH NaOH 1st imp rinse |
| C-16 { C-176 | | | | | PCH NaOH imp rinse 2nd rinse |
| C-17 | | | | | PCH NaOH imp rinse 3rd |
| C-18 | | | | | PCH TCE imp rinse |
| C-19 | | | | | Filter 004 |
| C-20 | | CAM-1108-IN-M5-01 | 1416 | Inlet | PCH acetone probe rinse |
| C-21 | | | | | PCH TCE probe rinse |
| C-22 | | | | | PCH NaOH imp 1st rinse |
| C-23 { C-177 | | | | | PCH NaOH imp 2nd rinse |
| C-24 | | | | | PCH TCE imp rinse |
| C-25 | | | | | Filter 003 |
| C-26 | | | | | Cyclone solids |
| C-27 | | CAM-1109-OUT-BAP-Blank | 1200 | Outlet | PAH $MeCl_2$ probe rinse |
| C-28 | | | | | PAH $MeCl_2$imp rinse before XAD |
| C-29 | | | | | PAH $MeCl_2$imp rinse after XAD |
| C-30 | | | | | PAH $MeCl_2$XAD-2 |
| C-31 | | | | | PAH filter 023 |
| C-32 | | CAM-1109-IN-BAP-Blank | 1300 | Inlet | PAH $MeCl_2$ probe rinse |
| C-33 | | | | | PAH $MeCl_2$imp rinse before XAD |
| C-34 | | | | | PAH $MeCl_2$ imp rinse after XAD |
| C-35 | | | | | PAH $MeCl_2$ XAD-2 |
| C-36 | | | | | PAH filter 024 |
| C-37 | 11-10-83 | CAM-1110-TM-IN-01 | 1121 | Inlet | Acetone probe rinse |
| C-38 | | | | | TCE probe rinse |
| C-39 | | | | | 1st NaOH imp rinse |
| C-40 | | | | | 2nd NaOH imp rinse |
| C-41 | | | | | TCE imp rinse |
| C-42 | | | | | $HNO_3$ 1st imp rinse |
| C-43 | | | | | $HNO_3$ 2nd imp rinse |
| C-44 | | | | | 018 Filter |
| C-45 | | | | | Cyclone solids |
| C-46 | | CAM-1110-TM-OUT-01 | 1043 | Outlet | Acetone probe rinse |
| C-47 | | | | | TCE probe rinse |
| C-48 | | | | | 1st NaOH imp rinse |
| C-49 | | | | | 2nd NaOH imp rinse |
| C-50 | | | | | TCE imp rinse |
| C-51 | | | | | 1st $HNO_3$ imp rinse |
| C-52 | | | | | 2nd $HNO_3$ imp rinse |
| C-53 | | | | | Filter 017 |

## T.J. CAMPBELL ASPHALT PLANT - SAMPLE LOG

(Continued)

| Sample Number | Date | Sample ID | Time | Sampling Location | Sample Type |
|---|---|---|---|---|---|
| C-54 | 11-11-83 | CAM-1111-TM-IN-01 | 0843 | Inlet | Acetone probe rinse |
| C-55 | | | | | TCE probe rinse |
| C-56 | | | | | 1st NaOH imp rinse |
| C-57 | | | | | 2nd NaOH imp rinse |
| C-59 | | | | | TCE imp rinse |
| C-60 | | | | | 1st $HNO_3$ imp rinse |
| C-61 | | | | | 2nd $HNO_3$ imp rinse |
| C-61 | | | | | Filter 005 |
| C-62 | | | | | Cyclone solids |
| C-63 | 11-11-83 | CAM-1111-TM-OUT-01 | 0839 | Outlet | Acetone probe rinse |
| C-64 | | | | | TCE probe rinse |
| C-65 | | | | | 1st NaOH imp rinse |
| C-66 | | | | | 2nd NaOH imp rinse |
| C-67 | | | | | TCE imp rinse |
| C-68 | | | | | 1st $HNO_3$ imp rinse |
| C-69 | | | | | 2nd $HNO_3$ imp rinse |
| C-70 | | | | | Filter 006 |
| C-71 | | CAM-1111-PAH-OUT-02 | 1515 | Outlet | Acetone probe rinse |
| C-72 | | | | | TCE probe rinse |
| C-73 | | | | | 1st NaOH imp rinse |
| C-74 | | | | | 2nd NaOH imp rinse |
| C-75 | | | | | 3rd NaOH imp rinse |
| C-76 | | | | | TCE imp rinse |
| C-77 | | | | | Filter 008 |
| C-168 | | CAM-1111-PSD-OUT-03 | 1519 | Outlet | Acetone rinse - nozzle cone, plate |
| C-78 | | CAM-1111-PAH-IN-02 | 1645 | Inlet | Acetone probe rinse |
| C-79 | | | | | TCE probe rinse |
| C-80 | | | | | 1st NaOH imp rinse |
| C-81 | | | | | 2nd NaOH imp rinse |
| C-82 | | | | | TCE imp rinse |
| C-83 | | | | | Cyclone solids |
| C-84 | | | | | Filter 012 |
| C-85 | 11-12-83 | CAM-1112-PAH-IN-01 | 0748 | Inlet | Acetone probe rinse |
| C-86 | | | | | TCE probe rinse |
| C-87 | | | | | 1st NaOH imp rinse |
| C-88 | | | | | 2nd NaOH imp rinse |
| C-89 | | | | | TCE imp rinse |
| C-90 | | | | | Cyclone solids |
| C-91 | | | | | Filter 007 |
| C-90 | | CAM-1112-PAH-OUT-01 | 0713 | Outlet | Acetone probe rinse |
| C-93 | | | | | TCE probe rinse |
| C-94 | | | | | 1st NaOH imp rinse |
| C-95 | | | | | 2nd NaOH imp rinse |
| C-96 | | | | | TCE imp rinse |
| C-97 | | | | | Filter 009 |
| C-98 | | CAM-1112-TM-IN-02 | 1151 | Inlet | Acetone probe rinse |
| C-99 | | | | | TCE probe rinse |
| C-100 | | | | | TCE imp rinse |
| C-101 | | | | | 1st NaOH imp rinse |
| C-102 | | | | | 2nd NaOH imp rinse |
| C-103 | | | | | 1st $HNO_3$ imp rinse |
| C-104 | | | | | 2nd $HNO_3$ imp rinse |
| C-105 | | CAM-1112-TM-IN-02 | 1151 | Inlet | Cyclone solids |
| C-107 | | CAM-1112-TM-OUT-02 | 1129 | Outlet | 1st $HNO_3$ imp rinse |
| C-108 | | | | | 2nd $HNO_3$ imp rinse |
| C-109 | | | | | Acetone probe rinse |
| C-110 | | | | | TCE probe rinse |
| C-112 | | | | | 1st NaOH imp rinse |
| C-113 | | | | | 2nd NaOH imp rinse |
| C-114 | | | | | 3rd NaOH imp rinse |
| C-111 | | | | | TCE imp rinse |

## T.J. CAMPBELL ASPHALT PLANT - SAMPLE LOG

(Continued)

| Sample Number | Date | Sample ID | Time | Sampling Location | Sample Type |
|---|---|---|---|---|---|
| C-116 | 11-13-83 | CAM-1113-PAH-IN-01 | 0956 | Inlet | Acetone probe rinse |
| C-117 | | | | | TCE probe rinse |
| C-118 | | | | | CE imp rinse |
| C-119 | | | | | 1st NaOH imp rinse |
| C-120 | | | | | 2nd NaOH imp rinse |
| C-122 | | CAM-1113-PAH-OUT-01 | 0853 | Outlet | Acetone probe rinse |
| C-123 | | | | | TCE probe rinse |
| C-124 | | | | | TCE imp rinse |
| C-125 | | | | | 1st NaOH imp rinse |
| C-126 | | | | | 2nd NaOH imp rinse |
| C-127 | | | | | 3rd NaOH imp rinse |
| C-129 | 11-14-83 | CAM-1114-PAH-IN-01 | 0827 | Inlet | Acetone probe rinse |
| C-130 | | | | | TCE probe rinse |
| C-131 | | | | | TCE imp rinse |
| C-132 | | | | | 1st NaOH imp rinse |
| C-133 | | | | | 2nd NaOH imp rinse |
| C-135 | | CAM-1114-PAH-OUT-01 | 0813 | Outlet | Acetone probe rinse |
| C-136 | | | | | TCE probe rinse |
| C-137 | | | | | TCE imp rinse |
| C-138 | | | | | 1st NaOH imp rinse |
| C-139 | | | | | 2nd NaOH imp rinse |
| C-140 | | | | | 3rd NaOH imp rinse |
| C-141 | | | | | Filter 014 |
| C-106 | 11-12-83 | CAM-1112-TM-IN-02 | 1151 | Inlet | Filter 010 |
| C-121 | 11-13-83 | CAM-1113-PAH-IN-01 | 0956 | Inlet | Filter 030 |
| C-134 | 11-14-83 | CAM-1114-PAH-IN-01 | 0827 | Inlet | Filter 019 |
| C-115 | 11-12-83 | CAM-1112-TM-OUT-02 | 1129 | Outlet | Filter 013 |
| C-128 | 11-13-83 | CAM-1113-PAH-OUT-01 | 0853 | Outlet | Filter 029 |
| C-141 | 11-14-83 | CAM-1114-PAH-OUT-01 | 0813 | Outlet | Filter 014 |
| C-142 | 11-14-83 | CAM-1114-BAP-OUT-01 | 1209 | Outlet | BAP $MeCl_2$ probe rinse |
| C-143 | | | | | BAP $MeCl_2$ imp rinse before XAD |
| C-144 | | | | | BAP $MeCl_2$ imp rinse after XAD |
| C-145 | | | | | BAP $MeCl_2$ XAD-2 |
| C-146 | | | | | Filter 028 |
| C-147 | 11-14-83 | CAM-1114-BAP-IN-01 | 1301 | Inlet | BAP $MeCl_2$ probe rinse |
| C-148 | | | | | BAP $MeCl_2$ imp rinse before XAD |
| C-149 | | | | | BAP $MeCl_2$ imp rinse after XAD |
| C-150 | | | | | BAP $MeCl_2$ XAD-2 |
| C-151 | | | | | Filter 027 |
| C-152 | 11-15-83 | CAM-1115-BAP-OUT-01 | 0859 | Outlet | BAP $MeCl_2$ probe rinse |
| C-153 | | | | | BAP $MeCl_2$ imp rinse before XAD |
| C-154 | | | | | BAP $MeCl_2$ imp rinse after XAD |
| C-155 | | | | | BAP $MeCl_2$ XAD-2 |
| C-156 | | | | | Filter 025 |
| C-157 | | CAM-1115-BAP-IN-01 | 0909 | Inlet | BAP $MeCl_2$ probe rinse |
| C-158 | | | | | BAP $MeCl_2$ imp rinse before XAD |
| C-159 | | | | | BAP $MeCl_2$ imp rinse after XAD |
| C-160 | | | | | BAP $MeCl_2$ XAD-2 |
| C-161 | 11-15-83 | CAM-1115-BAP-IN-01 | 0909 | Inlet | Filter 026 |
| C-162 | 11-10-83 | 5 ft. stainless steel probe | | Blank | Acetone rinse |
| C-163 | 11-10-83 | 5 ft. stainless steel probe | | Blank | TCE |
| C-164 | | PSD-1-IN | 1253 | Inlet | Acetone nozzle rinse |

## T.J. CAMPBELL ASPHALT PLANT - SAMPLE LOG

(Continued)

| Sample Number | Date | Sample ID | Time | Sampling Location | Sample Type |
|---|---|---|---|---|---|
| C-165 | | PSD-2-IN | 1418 | Inlet | Acetone nozzle rinse |
| C-166 | | PSD-3-IN | 1014 | Inlet | Acetone nozzle rinse |
| C-167 | | PSD-4-IN | 1225 | Inlet | Acetone nozzle rinse |
| C-168 | | CAM-1111-PSD-OUT-3 | 1519 | Outlet | Acetone rinse |
| C-169 | | CAM-1112-PSD-OUT-4 | 0715 | Outlet | Acetone Rinse |
| C-170 | | CAM-1112-PSD-OUT-5 | 1232 | Outlet | Acetone rinse |
| C-171 | | CAM-1113-PSD-OUT-6 | 0940 | Outlet | Acetone rinse |
| C-172 | | CAM-1114-PSD-OUT-7 | 0908 | Outlet | Acetone rinse |
| C-173 | | CAM-1115-PSD-OUT-8 | 0907 | Outlet | Acetone rinse |
| C-174 | | Composite of C-3, C-4 | | Blank | NaOH impingers |
| C-175 | | Composite of C-9, C-10 | | Blank | NaOH impingers |
| C-176 | | Composite of C-15,C-16, C-17 | | Outlet | NaOH impingers |
| C-177 | | Composite of C-22,C-23 | | Inlet | NaOH impingers |
| C-178 | | Composite of C-39, C-40 | | Inlet | NaOH impingers |
| C-179 | | Composite of C-42,C-43 | | Inlet | $HNO_3$ impingers |
| C-180 | | Composite of C-48,C-49 | | Outlet | NaOH impingers |
| C-181 | | Composite of C-51,C-52 | | Outlet | $HNO_3$ impingers |
| C-182 | | Composite of C-56,C-57 | | Inlet | NaHO impingers |
| C-183 | | Composite of C-59,C-60 | | Inlet | $HNO_3$ impingers |
| C-184 | | Composite of C-65,C-66 | | Outlet | NaOH impingers |
| C-185 | | Composite of C-68,C-69 | | Outlet | $HNO_3$ impingers |
| C-186 | | Composite of C-73,C-74 C-75 | | Outlet | NaOH impingers |
| C-187 | | Composite of C-80,C-81 | | Inlet | NaOH impingers |
| C-188 | | Composite of C-87,C-88 | | Inlet | NaOH impingers |
| C-189 | | Composite of C-94,C-95 | | Outlet | NaOH impingers |
| C-190 | | Composite of C-101,C-102 | | Inlet | NaOH impingers |
| C-191 | | Composite of C-103,C-104 | | Inlet | $HNO_3$ impingers |
| C-192 | | Composite of C-107,C-108 | | Outlet | $HNO_3$ impingers |
| C-193 | | Composite of C-112,C-113. C-114 | | Outlet | NaOH impingers |
| C-194 | | Composite of C-119,C-120 | | Inlet | NaOH impingers |
| C-195 | | Composite of C-125,C-126, C-127 | | Outlet | NaOH impingers |
| C-196 | | Composite of C-132,C-133 | | Inlet | NaOH impingers |
| C-197 | | Composite of C-139,C-140, C-141 | | Outlet | NaOH impingers |
| C-198 | | CAM-1114-BAP-OUT-01 | 1209 | Outlet | Acetone probe rinse |
| C-199 | | CAM-1114-BAP-IN-01 | 1301 | Inlet | Acetone probe rinse |
| C-200 | | CAM-1115-BAP-OUT-01 | 0859 | Outlet | Acetone probe rinse |
| C-201 | | CAM-1115-BAP-IN-01 | 0909 | Inlet | Acetone probe rinse |
| C-202 | | CAM-1113-PAH-IN-01 | | Inlet | Cyclone solids |
| C-203 | | CAM-1114-PAH-IN-01 | | Inlet | Cyclone solids |
| C-204 | | CAM-1114-TM-IN-02 | | Inlet | Cyclone solids |

## T.J. CAMPBELL ASPHALT PLANT - SAMPLE LOG

(Continued)

| Sample Number | Date | Sample ID | Time | Sampling Location | Sample Type |
|---|---|---|---|---|---|
| C-205 | 11-08-83 | Venturi Feed | 1400-1600 | | |
| C-206 | 11-08-83 | Venturi return | 1415-1615 | | |
| C-207 | 11-10-83 | Venturi feed | 1100-1155 | | |
| C-208 | 11-10-83 | Venturi return | 1110 | | |
| C-209 | 11-11-83 | Venturi feed | 0900-1440 | | |
| C-211 | 11-11-83 | Venturi feed | 1605-1650 | | |
| C-212 | 11-11-83 | Venturi return | 1605-1650 | | |
| C-213 | 11-12-83 | Venturi feed | 0830-0900 | | |
| C-214 | 11-12-83 | Venturi return | 0830-0900 | | |
| C-215 | 11-12-83 | Venturi feed | 1140-1340 | | |
| C-216 | 11-12-83 | Venturi return | 1140 1340 | | |
| C-217 | 11-13-83 | Venturi feed | 0920-1020 | | |
| C-218 | 11-13-83 | Venturi return | 0920-1020 | | |
| C-219 | 11-14-83 | Venturi feed | 0850-0945 | | |
| C-220 | 11-14-83 | Venturi return | 0850-0945 | | |
| C-221 | 11-14-83 | Venturi feed | 1230-1400 | | |
| C-222 | 11-14-83 | Venturi return | 1230-1400 | | |
| C-223 | 11-15-83 | Venturi feed | 0915-1050 | | |
| C-224 | 11-15-83 | Venturi return | 0915-1050 | | |
| C-225 | 11-08-83 | Solids from venturi $H_2O$ return | 1400-1615 | | |
| C-226 | 11-12-83 | Solids from venturi return $H_2O$ | 1140-1340 | | |
| C-227 | 11-13-83 | Solids from venturi return $H_2O$ | 0900-1030 | | |
| C-228 | 11-14-83 | Solids from venturi return $H_2O$ | 1230-1430 | | |
| C-229 | 11-14-83 | Solids from venturi return $H_2O$ | 0830-1000 | | |
| C-230 | 11-15-83 | Solids from venturi return $H_2O$ | 0900-1100 | | |

# T.J. CAMPBELL ASPHALT PLANT - SAMPLE LOG

(Continued)

| Sample Number | Date | Sample ID | Time | Sampling Location | Sample Type |
|---|---|---|---|---|---|
| C-54 | 11-11-83 | CAM-1111-TM-IN-01 | 0843 | Inlet | Acetone probe rinse |
| C-55 | | | | | TCE probe rinse |
| C-56 | | | | | 1st NaOH imp rinse |
| C-57 | | | | | 2nd NaOH imp rinse |
| C-59 | | | | | TCE imp rinse |
| C-60 | | | | | 1st $HNO_3$ imp rinse |
| C-61 | | | | | 2nd $HNO_3$ imp rinse |
| C-61 | | | | | Filter 005 |
| C-62 | | | | | Cyclone solids |
| C-63 | 11-11-83 | CAM-1111-TM-OUT-01 | 0839 | Outlet | Acetone probe rinse |
| C-64 | | | | | TCE probe rinse |
| C-65 | | | | | 1st NaOH imp rinse |
| C-66 | | | | | 2nd NaOH imp rinse |
| C-67 | | | | | TCE imp rinse |
| C-68 | | | | | 1st $HNO_3$ imp rinse |
| C-69 | | | | | 2nd $HNO_3$ imp rinse |
| C-70 | | | | | Filter 006 |
| C-71 | | CAM-1111-PAH-OUT-02 | 1515 | Outlet | Acetone probe rinse |
| C-72 | | | | | TCE probe rinse |
| C-73 | | | | | 1st NaOH imp rinse |
| C-74 | | | | | 2nd NaOH imp rinse |
| C-75 | | | | | 3rd NaOH imp rinse |
| C-76 | | | | | TCE imp rinse |
| C-77 | | | | | Filter 008 |
| C-168 | | CAM-1111-PSD-OUT-03 | 1519 | Outlet | Acetone rinse - nozzle cone, plate |
| C-78 | | CAM-1111-PAH-IN-02 | 1645 | Inlet | Acetone probe rinse |
| C-79 | | | | | TCE probe rinse |
| C-80 | | | | | 1st NaOH imp rinse |
| C-81 | | | | | 2nd NaOH imp rinse |
| C-82 | | | | | TCE imp rinse |
| C-83 | | | | | Cyclone solids |
| C-84 | | | | | Filter 012 |
| C-85 | 11-12-83 | CAM-1112-PAH-IN-01 | 0748 | Inlet | Acetone probe rinse |
| C-86 | | | | | TCE probe rinse |
| C-87 | | | | | 1st NaOH imp rinse |
| C-88 | | | | | 2nd NaOH imp rinse |
| C-89 | | | | | TCE imp rinse |
| C-90 | | | | | Cyclone solids |
| C-91 | | | | | Filter 007 |
| C-90 | | CAM-1112-PAH-OUT-01 | 0713 | Outlet | Acetone probe rinse |
| C-93 | | | | | TCE probe rinse |
| C-94 | | | | | 1st NaOH imp rinse |
| C-95 | | | | | 2nd NaOH imp rinse |
| C-96 | | | | | TCE imp rinse |
| C-97 | | | | | Filter 009 |
| C-98 | | CAM-1112-TM-IN-02 | 1151 | Inlet | Acetone probe rinse |
| C-99 | | | | | TCE probe rinse |
| C-100 | | | | | TCE imp rinse |
| C-101 | | | | | 1st NaOH imp rinse |
| C-102 | | | | | 2nd NaOH imp rinse |
| C-103 | | | | | 1st $HNO_3$ imp rinse |
| C-104 | | | | | 2nd $HNO_3$ imp rinse |
| C-105 | | CAM-1112-TM-IN-02 | 1151 | Inlet | Cyclone solids |
| C-107 | | CAM-1112-TM-OUT-02 | 1129 | Outlet | 1st $HNO_3$ imp rinse |
| C-108 | | | | | 2nd $HNO_3$ imp rinse |
| C-109 | | | | | Acetone probe rinse |
| C-110 | | | | | TCE probe rinse |
| C-112 | | | | | 1st NaOH imp rinse |
| C-113 | | | | | 2nd NaOH imp rinse |
| C-114 | | | | | 3rd NaOH imp rinse |
| C-111 | | | | | TCS Imp Rinse |

# APPENDIX E

## LABORATORY 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 Extracted Total Condensed Hydrocarbons
- E.2.1 Sample Fraction Results
- E.2.2 Laboratory Log

E.3 Total Organic Carbon (Air Emissions Only)
- E.3.1 Sample Fraction Results
- E.3.2 Laboratory Data Computer Printouts

E.4 Trace Metals (Air Emissions Only)
- E.4.1 Sample Fraction Results
- E.4.2 Computer Printout of Laboratory Data

E.5 Particle Size Distribution
- E.5.1 Sample Fraction Results
- E.5.2 Impactor Substrate Weighing Data Sheets
  - E.5.2.1 Andersen High Capacity Stack Sampler Impactor Stage Weighing Data Sheets
  - E.5.2.2 Andersen Mark III Impactor Substrate Weighing Data Sheets

E.6 Polynuclear Aromatic Hydrocarbons (Air Emissions Only)
- E.6.1 Sample Fraction Results

E.7 Analytical Sample Matrices
- E.7.1 Conventional Test Series Matrices
- E.7.2 Recycle Test Series Matrices

# APPENDIX E.1

## PARTICULATE MASS (EPA METHOD 5E) RESULTS

INCLUDES

E.1.1 Sample Fraction Results

Table E.1.1 FRONT HALF LOADINGS--ACETONE-TCE COMPARISONS

| Date | Time | Sample Description | Controlled Air Emissions Fraction 1 Filter & Cyclone (g) | 2 Acetone Probe Rinse[1] (g) | 3 TCE Probe Rinse[1] (g) | 4 Total (g) |
|---|---|---|---|---|---|---|
| 1111 | 0839-1433 | T.M.-Part/cond Hyd R-1 | 0.0242 | 0.0598 | 0 | 0.0840 |
| 1111 | 1515-1704 | Part/cond Hyd R-2 | 0.0240 | 0.0635 | 0.0007 | 0.0882 |
| 1112 | 0713-0900 | Part/cond Hyd R-3 | 0.0240 | 0.0755 | 0.0118 | 0.1113 |
| 1112 | 1129-1319 | T.M.-Part/cond Hyd C-1 | 0.0344 | 0.1313 | 0.0060 | 0.1717 |
| 1113 | 1853-1112 | Part/cond Hyd C-2 | 0.0862 | 0.1451 | 0.0122 | 0.2435 |
| 1114 | 0813-1003 | Part/cond Hyd C-3 | 0.0296 | 0.0748 | 0 | 0.1044 |
| | | | Uncontrolled Air Emissions Fraction | | | |
| 1111 | 0843-0937 | T.M.-Part/cond Hyd R-1 | 3.0700 | 1.2973 | 0.0078 | 4.3751 |
| 1111 | 1645-1730 | Part/cond Hyd R-2 | 4.4147 | 0.8450 | 0.0026 | 5.2623 |
| 1112 | 0748-0846 | Part/cond Hyd R-3 | 3.5398 | 2.0279 | 0.0059 | 5.5736 |
| 1112 | 1151-1243 | T.M.-Part/cond Hyd C-1 | 7.0770 | 2.2760 | 0.0066 | 9.3596 |
| 1113 | 0956-1050 | Part/cond Hyd C-2 | 8.9177 | 1.8803 | 0.0124 | 10.8104 |
| 1114 | 0827-0936 | Part/cond Hyd C-3 | 4.9096 | 2.0052 | 0.0376 | 6.9524 |

[1] Weights gains have been corrected for the blanks

Table E.1.2

## BREAKDOWN OF SAMPLING RUN WEIGHT GAINS

| Date | Time | Sample Description | Filter Wt. Gain (g) | Cyclone Wt. Gain (g) | Acetone Wash Residue (g) | Blank Corr[1] Acetone Residue (g) | TCE Wash Residue (g) | Blank Corr[1] TCE Residue (g) | Filter & Cyclone Wt. (g) | Total Wash Wt. (g) | Acetone Wash Volume (mL) | TCE Wash Volume (mL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Controlled Air Emissions** | | | | | | | | | |
| 1111[3] | 0839-1433 | T.M. Par/cond Hyd R-1 | 0.0242 | | 0.0688 | 0.0598 | 0.0027 | 0 | | 0.0598 | 385 | 170 |
| 1111[3] | 1515-1704 | Part/cond Hyd R-2 | 0.0240 | | 0.0720 | 0.0635 | 0.0052 | 0.0007 | | 0.0642 | 140 | 70 |
| 1112[2] | 0713-0900 | Part/cond Hyd R-3 | 0.0240 | | 0.0840 | 0.0755 | 0.0163 | 0.0118 | | 0.0873 | 131 | 75 |
| 1112[2] | 1129-1319 | T.M. Part/cond Hyd C-1 | 0.0344 | | 0.1397 | 0.1313 | 0.0105 | 0.0060 | | 0.1373 | 101 | 67 |
| 1113[2] | 0853-1112 | Part/cond Hyd C-2 | 0.0862 | | 0.1538 | 0.1451 | 0.0174 | 0.0122 | | 0.1573 | 231 | 136 |
| 1114[2] | 0813-1003 | Part/cond Hyd C-3 | 0.0296 | | 0.0834 | 0.0748 | 0.0018 | 0 | | 0.0748 | 198 | 155 |
| | | | **Uncontrolled Air Emissions** | | | | | | | | | |
| 1111[3] | 0843-0937 | T.M. Part/cond Hyd R-1 | 1.5430 | 1.5270 | 1.3065 | 1.2973 | 0.0155 | 0.0078 | 3.0700 | 1.3051 | 502 | 354 |
| 1111[2] | 1645-1730 | Part/cond Hyd R-2 | 2.0998 | 2.3149 | 0.8539 | 0.8450 | 0.0082 | 0.0026 | 4.4147 | 0.8476 | 326 | 166 |
| 1112[2] | 0748-0846 | Part/cond Hyd R-3 | 1.9990 | 1.5408 | 2.0371 | 2.0279 | 0.0111 | 0.0059 | 3.5398 | 2.0338 | 498 | 130 |
| 1112[2] | 1151-1243 | T.M. Part/cond Hyd C-1 | 4.8540 | 2.2230 | 2.2850 | 2.2760 | 0.0117 | 0.0066 | 7.0770 | 2.2826 | 421 | 126 |
| 1113[2] | 0956-1050 | Part/cond Hyd C-2 | 4.3309 | 4.5868 | 1.8958 | 1.8803 | 0.0199 | 0.0124 | 8.9177 | 1.8927 | 455 | 180 |
| 1114[2] | 0827-0936 | Part/cond Hyd C-3 | 2.9104 | 1.9992 | 2.0208 | 2.0052 | 0.0444 | 0.0376 | 4.9096 | 2.0428 | 494 | 113 |
| | | Acetone blank | - | - | 0.0003 | - | - | - | - | - | 150 | - |
| | | TCE blank | - | - | - | - | 0.0017 | - | - | - | - | 150 |
| | | Outlet glass probe acetone blank | - | - | 0.0089 | 0.0082 | - | - | - | 0.0082 | 366 | - |
| | | Outlet glass probe TCE blank | - | - | - | - | 0.0049 | 0.0037 | - | 0.0037 | - | 102 |
| | | Inlet stainless steel probe acetone blank | - | - | 0.0149 | 0.0146 | - | - | - | 0.0146 | 167 | - |
| | | Inlet stainless steel probe TCE blank | - | - | - | - | 0.0066 | 0.0055 | - | 0.0055 | - | 98 |
| | | Inlet glass probe acetone blank | - | - | 0.0109 | 0.0105 | - | - | - | 0.0105 | 209 | - |
| | | Inlet glass probe TCE blank | - | - | - | - | 0.0230 | 0.0212 | - | 0.0212 | - | 157 |

[1]Blank calculation
Corrected Wash Weight = residue wt. gain - [(vol. of solvent)·(solvent blank g/mL)+probe blank residue]

[2]Stainless steel blank correction used.

[3]Outlet glass probe blank correction used.

APPENDIX E.1

PARTICULATE MASS (EPA METHOD 5E) RESULTS

INCLUDES

E.1.2 Laboratory Notebook Data

Project No._____

TITLE Method 5 Results

Book No._____



| From Page No. | R | ID | Filter wt (mg) | Acetone wt (mg) | TCE wt | Cyclohex wt | Acetone wt (corr) | +CE wt (corr) | +CE vol (ml) | ACE vol (ml) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | uncorrected wts | | | | | | |
| (005) | C | 1108-PAH-IN-Ø1 | 1.5145 | 4.4994 | 0.0129 | 3.1642 | 4.4903 | .0073 | 172 | 494 |
| | R | 1110-TM-IN-Ø1 | 1.9521 | 2.3445 | 0.0158 | 1.8800 | 2.7355 | .0098 | 205 | 410 |
| | R | 1111-TM-IN-Ø1 | 1.5430 | 1.3065 | 0.0155 | 1.5270 | 1.2973 | .0078 | 354 | 502 |
| | R | 1111-PAH-IN-Ø2 | 2.0998 | 0.8539 | 0.0082 | 2.3149 | .8450 | .0026 | 166 | 326 |
| | R | 1112-PAH-IN-Ø1 | 1.9990 | 2.0371 | 0.0111 | 1.5408 | 2.0279 | .0059 | 130 | 498 |
| | C | 1112-TM-IN-Ø2 | 4.8540 | 2.2850 | 0.0117 | 2.2230 | 2.2360 | .0066 | 126 | 421 |
| | C | 1113-PAH-IN-Ø1 | 4.3309 | 1.6956 | 0.0199 | 4.5868 | 1.8803 | .0124 | 120 | 455 |
| | C | 1114-PAH-IN-Ø1 | 2.9104 | 2.0208 | 0.0444 | 1.9992 | 2.0052 | .0376 | 113 | 494 |
| | C | 1114-BAP-IN-Ø1 | — | — | — | — | — | | | |
| | R | 1115-BAP-IN-Ø1 | — | — | — | — | — | | | |
| | | | | blank | blank | Rinse | | | | |
| | C | 1108-PAH-Out-Ø1 | .0246 | 0.0527 | 0.0089 | .0482 | .0440 | .0042 | 88 | 240 |
| | R | 1110-TM-Out-Ø1 | .0371 | 0.0690 | 0.0066 | .0620 | .0602 | .0018 | 96 | 287 |
| | R | 1111-TM-Out-Ø1 | .0242 | 0.0688 | 0.0027 | .0598 | .0598 | 0 | 170 | 385 |
| | R | 1111-PAH-Out-Ø2 | .0240 | 0.0720 | 0.0052 | .0642 | .0635 | .0007 | 70 | 140 |
| | R | 1112-PAH-Out-Ø1 | .0240 | 0.0840 | 0.0163 | .0873 | .0755 | .0118 | 75 | 131 |
| | C | 1112-TM-Out-Ø2 | .0344 | 0.0397 | 0.0105 | .1373 | .1313 | .0060 | 67 | 101 |
| | C | 1113-PAH-Out-Ø1 | .0862 | 0.1538 | 0.0174 | .1573 | .1451 | .0122 | 136 | 231 |
| | C | 1114-PAH-Out-Ø1 | .0296 | 0.0834 | 0.0018 | .0748 | .0748 | - 0 | 155 | 198 |
| | C | 1114-BAP-Out-Ø2 | — | — | — | | — | | | |
| | R | 1115-BAP-Out-Ø1 | — | — | — | | — | | | |
| | | Total | total Probe | | | | | | | |
| | | 1108-PAH-IN-Ø1 | 7.6618 | | | | | | | |
| | | 1110-TM-IN-Ø1 | 4.6253 | | | | | | | |
| | | 1111-TM-IN-Ø1 | 2.8321 | | | | | | | |
| | | 1111-PAH-IN-Ø2 | 3.1625 | | | | | | | |
| | | 1112-PAH-IN-Ø1 | 3.5746 | | | | | | | |
| | | 1112-TM-IN-Ø2 | 4.5056 | | | | | | | |
| | | 1113-PAH-IN-Ø1 | 6.4755 | | | | | | | |
| | | 1114-PAH-IN-Ø1 | 4.0420 | | | | | | | |

To Page No._____

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by

TITLE Filter Wts

Project No.

Book No.

From Page No.

| Filter # | tare wt | Final wt 1st | 2nd | 3rd | 4th | Final | wt Gain | |
|---|---|---|---|---|---|---|---|---|
| 001 | .5266 | .5270 | | | | | — | Inlet Blank |
| 002 | .5185 | .5186 | | | | | — | Outlet Bl |
| 003 | .5250 | 2.0410 | 2.0395 | | | | 1.5145 | |
| 004 | .5241 | .5484 | .5487 | | | | .0246 | |
| 005 | .5207 | 2.0630 | 2.0637 | | | | 1.5430 | * - 1111 - TM |
| 006 | .5236 | .5482 | 5478 | | | | .0242 | * - 1111 - TM out |
| 007 | .5292 | 2.5336 | 2.5262 | 2.5282 | | | 1.9990 | |
| * 008 | .5069 | .5403 | .5309 | .5307 | | | .0246 | |
| 009 | .5177 | .5420 | .5417 | | | | .0240 | |
| 010 | .5072 | 5.3940 | 5.3662 | 5.3612 | | | 4.8540 | * - 1112 - TM - In |
| 011 | .5318 | | | | | | — | |
| 012 | .5369 | 2.6373 | 2.6367 | | | | 2.0998 | |
| 013 | .5052 | .5413 | .5392 | .5396 | | | .0344 | * - 1112 - TM - out |
| 014 | .5086 | .5384 | .5369 | .5372 | | | .0296 | |
| 015 | .5330 | | | | | | — | |
| 016 | .5348 | | | | | | — | |
| 017 | .5254 | .5621 | .5625 | | | | .0371 | |
| 018 | .5276 | 2.4777 | 2.4799 | | | | 1.9521 | |
| 019 | .5245 | 3.4509 | 3.4335 | 3.4349 | | | 2.9104 | |
| 020 | .5295 | | | | | | — | |
| 021 | .5342 | | | | | | — | |
| 022 | .5394 | | | | | | — | |
| 023 | .5225 | PAH Outlet Blank | | | | | — | |
| 024 | .5151 | PAH Inlet Blank | | | | | — | |
| 025 | .5203 | | | | | | — | |
| 026 | .5223 | | | | | | — | |
| 027 | .5273 | | | | | | — | |
| 028 | .5221 | | | | | | — | |
| * 029 | .5090 | .5981 | .5952* | .5962 | .5968 | .5952* | .0862 | |
| 030 | .4988 | 4.8491 | 4.8273 | 4.8297 | | | 4.3309 | |
| 031 | .5111 | | | | | | — | |
| PSD 4 - Inlet | | 4.5550 | | | | | | |
| 1112 - TM - In - 02 Cyclone Solids | 1.9224 | 4.1454 | | | | | | |

To Page

Witnessed & Understood by me, Date Invented by Date

Recorded by

| | |

ACETONE = .7857

Project No._____ TCE = 1.33909

TITLE Probe Rinses Book No._____

| From Page No. | | | Acetone or TCE | Beaker tare wt | 1st wt | 2nd wt | 3rd wt | Final wt | Sample wt (g) |
|---|---|---|---|---|---|---|---|---|---|
| Beaker # | Sample ID | | | | | | | | |
| 001 | 1108-PAH-IN-Ø1 | | ACE | 102.4321 | 106.9312 | 106.9315 | | 4.4994 | 372.2 |
| 002 | 1108-PAH-IN-Ø1 | | TCE | 105.1650 | 105.6775 | 105.6787 | 105.6779 | 0.0129 | 230.8 |
| 003 | 1108-PAH-Out-Ø1 | | Ace | 101.3988 | 101.4516 | 101.4510 | 101.4515 | 0.0527 | 188.7 |
| 004 | 1108-PAH-Out-Ø1 | | TCE | 105.1476 | 105.1575 | 105.1569 | 105.1565 | 0.0089 | 117.8 |
| 005 | 1110-~~PAH~~ TM-IN-Ø1 | * | Ace | 105.3129 | 108.0558 | 108.0578 | 108.0574 | 2.7445 | 322.9 |
| 006 | 1110-TM-IN-Ø1 | * | TCE | 105.9376 | 105.9543 | 105.9531 | 105.9534 | 0.0158 | 273.9 |
| 007 | 1110-TM-Out-Ø1 | * | Ace | 107.0916 | 107.1625 | 107.1602 | 107.1606 | 0.0690 | 223.5 |
| 008 | 1110-TM-Out-Ø1 | * | TCE | 104.5532 | 104.5602 | 104.5598 | | .0066 | 129.1 |
| 009 | 1111-TM-IN-Ø1 | * | Ace | 99.6481 | 100.9547 | 100.9554 | 100.9546 | 1.3065 | 394.7 |
| 010 | 1111-TM-IN-Ø1 | * | TCE | 102.9960 | 103.0117 | 103.0115 | | .0155 | 474.2 |
| 011 | 1111-TM-Out-Ø1 | * | ACE | 103.9125 | 103.9808 | 103.9818 | 103.9813 | 0.0688 | 302.4 |
| 012 | 1111-TM-Out-Ø1 | * | TCE | 102.5018 | 102.5045 | — | -Broke- | .0027 | 228.4 |
| 013 | 1111-PAH-IN-Ø2 | | Ace | 102.0370 | 102.8906 | 102.8909 | | .8539 | 256.6 |
| 014 | 1111-PAH-IN-Ø2 | | TCE | 106.6649 | 106.6729 | 106.6731 | | .0082 | 222.9 |
| 015 | 1111-PAH-Out-Ø2 | | Ace | 105.7150 | 105.7871 | 105.7870 | | .0720 | 110.4 |
| 016 | 1111-PAH-Out-Ø2 | | TCE | 108.2745 | 108.2772 | 108.2793 | 108.2797 | 0.0052 | 440 |
| 017 | 1112-PAH-IN-Ø1 | | Ace | 106.6431 | 108.6805 | 108.6802 | | 2.0371 | 391.3 |
| 018 | 1112-PAH-IN-Ø1 | | TCE | 101.9067 | 101.9175 | 101.9178 | | 0.0111 | 174.3 |
| ~~019~~ 021 | 1112-PAH-Out-Ø1 | | Ace | 106.8375 | 106.9248 | 106.9218 | 106.9215 | 0.0840 | 103.1 |
| ~~020~~ 022 | 1112-PAH-Out-Ø1 | | TCE | 98.7536 | 98.7381 | 98.7370 | 98.7374 | -0.0162 | 100.3 |
| ~~021~~ 019 | 1112-TM-IN-Ø2 | * | Ace | 103.8635 | 106.1482 | 106.1485 | | 2.2850 | 331.1 |
| ~~022~~ 020 | 1112-TM-IN-Ø2 | * | TCE | 104.9074 | 104.9194 | 104.9191 | | 0.0117 | 168.8 |
| 023 | 1112-TM-Out-Ø2 | * | Ace | 106.7496 | 106.8890 | 106.8893 | | .1397 | 79.5 |
| 024 | 1112-TM-Out-Ø2 | * | TCE | 106.9879 | 106.9993 | 106.9980 | 106.9984 | 0.0105 | 90.1 |
| 025 | 1113-PAH-IN-Ø1 | | Ace | 105.6278 | 107.5272 | 107.5234 | 107.5236 | 1.8958 | 357.8 |
| 026 | 1113-PAH-IN-Ø1 | | TCE | 107.9952 | 108.0118 | 108.0147 | 108.0151 | 0.0199 | 241.1 |
| 027 | 1113-PAH-Out-Ø1 | | Ace | 103.1033 | 103.2587 | 103.2568 | 103.2571 | 0.1538 | 181.2 |
| 028 | 1113-PAH-Out-Ø1 | | TCE | 102.4245 | 102.4240 | 102.4238 | 102.4242 | -0.0003 | 182.7 |
| 029 | 1114-PAH-IN-Ø1 | | Ace | 106.6275 | 108.6470 | 108.6488 | 108.6483 | 2.0208 | 388.3 |
| 030 | 1114-PAH-IN-Ø1 | | TCE | 105.4040 | 105.4474 | 105.4481 | 105.4484 | 0.0444 | 151.7 |
| 031 | 1114-PAH-Out-Ø1 | | ACE | 107.6176 | 107.6989 | 107.7013 | 107.7010 | 0.0834 | 155.3 |
| 032 | 1114-PAH-Out-Ø1 | | TCE | 107.8054 | 107.8063 | 107.8070 | 107.8072 | 0.0018 | 207.9 |
| 033 | Inlet Probe Acetone Blank | | Ace | 106.7957 | 106.8031 | 106.8070 | 106.8066 | 0.0109 | 164.2 |
| 034 | Inlet Probe TCE BLANK | | TCE | 102.0234 | 105.0335 | 105.0339 | — | 2.0105 | 209.6 |
| 035 | Outlet Probe Acetone Blank | | Ace | 100.7172 | 100.7245 | 100.7257 | 100.7261 | 0.0089 | 287.7 |
| 036 | Outlet Probe TCE BLANK | | TCE | 107.5005 | 107.4963 | 107.4980 | 107.4976 | -0.0029 | 246.6 |

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Witnessed & Understood by me, Date Witnessed by * Final wt Date



Recorded by

Project No._____

Book No._____ TITLE Probe Rinses Cont'd

| Page No. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BEAKER # | Run ID | Acetone or TCE | Beaker tare wt | | | | | Sample wt (g) |
| 337 | S.S. Probe Acetone Blank | Ace | 107.9363 | 107.9513 | 107.9538 | 107.9512 | 0.0149 | 131.0 |
| 338 | SS. Probe TCE Blank | TCE | 107.5983 | 107.6051 | 107.6062 | 107.6049 | 0.0066 | 130.6 |
| 339 | 1111-PSD-IN-Ø1 | Ace | 107.2502 | 107.2902 | 107.2916 | 107.2901 | 0.0399 | 15.1 |
| 340 | 1112-PSD-IN-Ø2 | Ace | 108.0044 | 108.3148 | 108.3161 | 108.3144 | 0.3100 | 40.1 |
| 341 | 1114-PSD-IN-Ø3 | Ace | 106.9683 | 107.0506 | 107.0522 | 107.0502 | 0.0819 | 22.8 |
| 342 | 1115-PSD-IN-Ø4 | Ace | 107.9168 | 108.1326 | 108.1341 | 108.1321 | 0.2153 | 23.4 |
| 343 | 1111-PSD-out-Ø3 (3) | Ace | 105.9411 | 105.9461 | 105.9474 | 105.9455 | 0.0044 | 36.4 |
| 344 | 1112-PSD-out-Ø4 (4) | Ace | 106.7365 | 106.7469 | 106.7472 | | 0.0107 | 34.6 |
| 345 | 1112-PSD-out-Ø5 (5) | Ace | 112.7127 | 112.7374 | 112.7377 | | 0.0250 | 46.4 |
| 346 | 1113-PSD-out-Ø6 (6) | Ace | 110.2331 | 110.2470 | 110.2485 | 110.2477 | 0.0146 | 56.3 |
| 347 | 1114-PSD-out-Ø7 (7) | Ace | 107.4392 | 107.4417 | 107.4426 | 107.4418 | 0.0026 | 99.5 |
| 348 | 1115-PSD-out-Ø8 | Ace | 114.3085 | 114.3143 | 114.3144 | | 0.0059 | 84.1 |
| 349 | ACETONE | Ace | 105.6318 | 105.6319 | 105.6321 | | 0.0003 | 150 mls |
| 050 | TCE | TCE | 107.8644 | 107.8657 | 107.8661 | | 0.0017 | 150 mls |
| 034 | - Reweigh | | 105.0109 | 105.0339 | | | 0.0230 | |
| 028 | - Reweigh | | 102.4068 | 102.4242 | | | 0.0174 | |
| 022 | - Reweigh | | 98.7211 | 98.7374 | | | 0.0163 | |
| 36 | " | | 107.4927 | 107.4976 | | | 0.0049 | |

TCE = .0000139/ml residue

Acetone = .0000029/ml

To Page No._____

Witnessed & Understood by me, | Date | Presented by | Date

Recorded by

APPENDIX E.2

EXTRACTED TOTAL CONDENSED HYDROCARBONS

INCLUDES

E.2.1 Sample Fraction Results

Table E.2.1

T. J. CAMPBELL CONSTRUCTION CO. EXTRACTED TOTAL CONDENSIBLE HYDROCARBONS LOADING RESULTS (83-ASP-4)

| Date | Time | Run Description | Correct TCE Rinse Wt (g) | Correct NaOH Extra. Wt (g) | Total Condensibles (g) | DSCF Sampled | Total Condensibles gr/DSCF | Total Condensibles mg/DSCM |
|---|---|---|---|---|---|---|---|---|
| | | **Controlled Emissions** | | | | | | |
| 1111 | 0839-1433 | T.M.-Part/Cond Hyd R-1 | 0.0421 | 0.0447 | 0.0868 | 57.110 | 0.0235 | 53.7 |
| 1111 | 1515-1704 | Part/Cond Hyd R-2 | 0.1195 | 0.1099 | 0.2294 | 59.363 | 0.0596 | 136.5 |
| 1112 | 0713-0900 | Part/Cond Hyd R-3 | 0.0673 | 0.0630 | 0.1303 | 60.107 | 0.0334 | 76.6 |
| 1112 | 1129-1319 | T.M.-Part/Cond Hyd C-1 | 0.1743 | 0.0710 | 0.2453 | 48.162 | 0.0786 | 179.9 |
| 1113 | 0853-1112 | Part/Cond Hyd C-2 | 0.0418 | 0.0393 | 0.0811 | 46.177 | 0.0271 | 62.0 |
| 1114 | 0813-1003 | Part/Cond Hyd C-3 | 0.0270 | 0.0607 | 0.0877 | 48.540 | 0.0279 | 63.8 |
| | | **Uncontrolled Emissions** | | | | | | |
| 1111 | 0843-0937 | T.M.-Part/Cond Hyd R-1 | 0.1829 | 0.0251 | 0.2080 | 20.828 | 0.1541 | 352.7 |
| 1111 | 1645-1730 | Part/Cond Hyd R-2 | 0.1596 | 0.0093 | 0.1689 | 18.568 | 0.1404 | 321.2 |
| 1112 | 0748-0846 | Part/Cond Hyd R-3 | 0.0919 | 0.0208 | 0.1127 | 22.919 | 0.0759 | 173.7 |
| 1112 | 1151-1243 | T.M.-Part/Cond Hyd C-1 | 0.2134 | 0.0040 | 0.2174 | 19.014 | 0.1764 | 403.8 |
| 1113 | 0956-1050 | Part/Cond Hyd C-2 | 0.0582 | 0.0141 | 0.0723 | 19.649 | 0.0568 | 129.9 |
| 1114 | 0827-0916 | Part/Cond Hyd C-3 | 0.1415 | 0.0211 | 0.1626 | 19.215 | 0.1306 | 298.8 |

APPENDIX E.2

EXTRACTED TOTAL CONDENSED HYDROCARBONS

INCLUDES

E.2.2 Laboratory Log

TITLE Sample Extracts

Project No.

Book No.

From Page No.

| Beaker # | Sample ID | Chloroform Ether or TCE | Beaker tare wt. | 1st wt | 2nd wt. | 3rd wt. | Final wt. Gain | Sam wt Ga |
|---|---|---|---|---|---|---|---|---|
| 051 | CAM-1108-PAH-IN-Blank | TCE C-5 | 108.9805 | 108.9831 | 108.9835 | | .0030 | |
| 052 | CAM-1108-PAH-Out-Blank | TCE C-11 | 108.4574 | 108.4603 | 108.4608 | | .0034 | |
| 053 | CAM-1111-PAH-IN-Q2 | TCE C-82 | 105.8389 | 106.0018 | 106.0019 | | .1630 | |
| 054 | CAM-1111-PAH-Out-Q2 | TCE C-76 | 106.3592 | 106.4827 | 106.4824 | | .1232 | |
| 055 | CAM-1111-TM-IN-Q1 | TCE C-58 | 108.3974 | 108.5844 | 108.5839 | | .1865 | |
| 056 | CAM-1111-TM-Out-Q1 | TCE - C-67 | 107.0785 | 107.1244 | 107.1241 | | .0456 | |
| 057 | CAM-1112-PAH-IN-Q1 | TCE - C-89 | 105.8198 | 105.9155 | 105.9156 | | .0958 | |
| 058 | CAM-1112-PAH-Out-Q1 | TCE C-96 | 108.4505 | 108.5217 | 108.5218 | | .0713 | |
| 059 | CAM-1112-TM-IN-Q2 | TCE - C-100 | 106.9766 | 107.1942 | 107.1937 | | .2171 | |
| 060 | CAM-1112-TM-Out-Q2 | TCE C-111 | 105.3330 | 105.5117 | 105.5111 | | .1781 | |
| 061 | CAM-1113-PAH-IN-Q1 | TCE C-118 | 108.9658 | 109.0275 | 109.0276 | | .0618 | |
| 062 | CAM-1113-PAH-Out-Q1 | TCE C-124 | 106.0232 | 106.0690 | 106.0688 | | .0456 | |
| 063 | CAM-1114-PAH-IN-Q1 | TCE C-131 | 105.3181 | 105.4630 | 105.4633 | | .1453 | |
| 064 | CAM-1114-PAH-Out-Q1 | TCE - C-137 | 108.2820 | 108.3125 | 108.3127 | | .0307 | |
| 065 | Chloroform Ether Blank | C.E.-200ml | 103.3177 | 103.3231 | 103.3235 | | .0058 | |
| 066 | NaOH Blank | C.E.-200ml | 110.2197 | 110.2206 | 110.2208 | | .0011 | |
| 067 | CAM-1108-PAH-IN-Blank | C.E. C-174 | 108.3354 | 108.3375 | 108.3376 | | .0022 | |
| 068 | CAM-1108-PAH-Out-Blank | C.E C-175 | 114.0590 | 114.0595 | 114.0598 | | .0008 | |
| 069 | CAM-1111-PAH-Out-Q2 | CE C-186 | 109.7774 | 109.8139 | 109.8140 | | .0366 | |
| 070 | CAM-1111-PAH-IN-Q2 | C.E. C-187 | 107.6554 | 107.6608 | 107.6610 | | .0056 | |
| 071 | CAM-1112-PAH-IN-Q1 | C.E. C-188 | 104.8158 | 104.8265 | 104.8268 | | .0110 | |
| 072 | CAM-1112-PAH-Out-Q1 | C.E. C-189 | 109.3880 | 109.4138 | 109.4139 | | .0259 | |
| 073 | CAM-1113-PAH-IN-Q1 | C.E. C-194 | 107.3004 | 107.3077 | 107.3079 | | .0075 | |
| 074 | CAM-1113-PAH-Out-Q1 | C.E. C-195 | 107.6915 | 107.7065 | 107.7065 | | .0150 | |
| 075 | CAM-1114-PAH-IN-Q1 | C.E. C-196 | 106.7704 | 106.7813 | 106.7814 | | .0110 | |
| 076 | CAM-1114-PAH-Out-Q1 | C.E. C-197 | 103.0449 | 103.0681 | 103.0682 | | .0233 | |
| 077 | CAM-1111-TM-IN-Q1 | C.E. C-182 | 108.2048 | 108.2218 | 108.2191 | 108.2185 | .0137 | |
| 078 | CAM-1111-TM-Out-Q1 | CE C-184 | 107.3844 | 109.4045 | 107.4029 | 107.4046 | .0202 | |
| 079 | CAM-1112-TM-IN-Q2 | CE C-190 | 110.2094 | 110.2180 | 110.2130 | 110.2126 | .0034 | |
| 080 | CAM-1112-TM-Out-Q2 | C.E. C-193 | 106.9642 | 106.9890 | 106.9882 | 106.9878 | .0236 | |
| 081 | 200ml TCE Blank | TCE-200ml | 111.5617 | 111.5625 | 111.5624 | | .0007 | |
| 082 | Chloroform Ether Blank | C.E.-200ml | 109.9920 | 109.9937 | 109.9936 | | .0016 | |
| 083 | | | 105.0329 | | | | | |
| 084 | | | 109.6901 | | | | | |
| 085 | | | 106.9085 | | | | | |
| 086 | | | 111.7206 | | | | | |

To Page No.

Witnessed & Understood by me, Barry Chapman

Date 12/5/83

Invented by Eric Anderson

E-16

Recorded by

Date

APPENDIX E.3

TOTAL ORGANIC CARBON (AIR EMISSIONS ONLY)

INCLUDES

E.3.1 Sample Fraction Results

Table E.3.1

## T. J. CAMPBELL CONSTRUCTION CO. TOTAL ORGANIC CARBON (AS C) LOADING RESULTS (83-ASP-4)

| Radian Code | Date | Time | Run Description | TOC mg/l as C | Sample Vol. (ml) | Total mg | DSCF Sampled | TOC gr/DSCF | TOC mg/DSCM |
|---|---|---|---|---|---|---|---|---|---|
| **Controlled Emissions** | | | | | | | | | |
| C-175 | 1108 | -- | NaOH Blank | 2 | 635 | 1.3 | -- | -- | -- |
| C-184 | 1111 | 0839-1433 | T.M.-Part/Cond Hyd R-1 | 230 | 952 | 219 | 57.110 | 0.0592 | 135 |
| C-186 | 1111 | 1515-1704 | Part/Cond Hyd R-2 | 300 | 1250 | 375 | 59.363 | 0.0975 | 223 |
| C-189 | 1112 | 0713-0900 | Part/Cond Hyd R-3 | 600 | 1030 | 618 | 60.107 | 0.1586 | 363 |
| C-193 | 1112 | 1129-1319 | T.M.-Part/Cond Hyd C-1 | 130 | 1230 | 166 | 48.162 | 0.0532 | 122 |
| C-195 | 1113 | 0853-1112 | Part/Cond Hyd C-2 | 360 | 1158 | 417 | 46.177 | 0.1393 | 319 |
| C-197 | 1114 | 0813-1003 | Part/Cond Hyd C-3 | 365 | 1110 | 405 | 48.540 | 0.1287 | 295 |
| **Uncontrolled Emissions** | | | | | | | | | |
| C-174 | 1108 | -- | NaOH Blank | <1 | 705 | <1 | -- | -- | -- |
| C-182 | 1111 | 0843-0937 | T.M.-Part/Cond Hyd R-1 | 740 | 818 | 605 | 20.828 | 0.4482 | 1026 |
| C-187 | 1111 | 1645-1730 | Part/Cond Hyd R-2 | 880 | 895 | 788 | 18.568 | 0.6548 | 1499 |
| C-188 | 1112 | 0748-0846 | Part/Cond Hyd R-3 | 860 | 870 | 748 | 22.919 | 0.5036 | 1152 |
| C-190 | 1112 | 1151-1243 | T.M.-Part/Cond Hyd C-1 | 280 | 905 | 253 | 19.014 | 0.2053 | 468 |
| C-194 | 1113 | 0956-1050 | Part/Cond Hyd C-2 | 595 | 929 | 553 | 19.649 | 0.4343 | 994 |
| C-196 | 1114 | 0827-0936 | Part-Cond Hyd C-3 | 420 | 880 | 370 | 19.215 | 0.2971 | 680 |

APPENDIX E.3

TOTAL ORGANIC CARBON (AIR EMISSIONS ONLY)

INCLUDES

E.3.2 Laboratory Data Computer Printouts

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 83-12-108

RECEIVED: 12/12/83 02/16/84 11:00:10

REPORT TO: Radian Corporation
Austin
B1 3

ATTEN: Eric Anderson

CLIENT: EPA EMB SAMPLES: 36
COMPANY: EPA-EMB
FACILITY:

WORK ID: TOC
TAKEN:
TRANS TYPE: hand
P.O. #: 222-078-03-25
INV. #: 2336

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY

CONTACT: KAMAS

E-20

## SAMPLE IDENTIFICATION

| | |
|---|---|
| 01 | C-174 |
| 02 | C-175 |
| 03 | C-182 |
| 04 | C-184 |
| 05 | C-186 |
| 06 | C-187 |
| 07 | C-188 |
| 08 | C-189 |
| 09 | C-190 |
| 10 | C-193 |
| 11 | C-194 |
| 12 | C-195 |
| 13 | C-196 |
| 14 | C-197 |
| 15 | C-209 |
| 16 | C-210 |
| 17 | C-211 |
| 18 | C-212 |
| 19 | C-213 |
| 20 | C-214 |
| 21 | C-215 |

## Analytical Serv TEST CODES and NAMES used on this report

TOC Total Organic Carbon

RECEIVED: 12/12/83 02/16/84 11:00:10

SAMPLE IDENTIFICATION

22 C-216
23 C-217
24 C-218
25 C-219
26 C-220
27 C-221
28 C-222
29 C-223
30 C-224
31 C-300
32 C-301
33 C-302
34 C-303
35 C-325
36 C-326

CORPORATION

 Analytical Serv REPORT LAB # 83-12-108

RECEIVED: 12/12/83 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 | <1 | 2 | 740 | 230 | 300 |

| 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 | 880 | 860 | 590 | 280 | 130 |

| TEST CODE default units | Sample 11 (entered units) | Sample 12 (entered units) | Sample 13 (entered units) | Sample 14 (entered units) | Sample 15 (entered units) |
|---|---|---|---|---|---|
| TOC mg/L | 595 | 360 | 420 | 365 | 170 |

| TEST CODE default units | Sample 16 (entered units) | Sample 17 (entered units) | Sample 18 (entered units) | Sample 19 (entered units) | Sample 20 (entered units) |
|---|---|---|---|---|---|
| TOC mg/L | 170 | 180 | 190 | 170 | 170 |

| TEST CODE default units | Sample 21 (entered units) | Sample 22 (entered units) | Sample 23 (entered units) | Sample 24 (entered units) | Sample 25 (entered units) |
|---|---|---|---|---|---|
| TOC mg/L | 160 | 160 | 180 | 250 | 186 |

CORPORATION



Analytical Serv REPORT LAB # 83-12-108

RECEIVED: 12/12/83

RESULTS BY TEST

| TEST CODE default units | Sample 26 (entered units) | Sample 27 (entered units) | Sample 28 (entered units) | Sample 29 (entered units) | Sample 30 (entered units) |
|---|---|---|---|---|---|
| TOC mg/L | 230 | 180 | 200 | 190 | 190 |

| TEST CODE default units | Sample 31 (entered units) | Sample 32 (entered units) | Sample 33 (entered units) | Sample 34 (entered units) | Sample 35 (entered units) |
|---|---|---|---|---|---|
| TOC mg/L | 85 | 21 | 19 | 84 | 77 |

| TEST CODE default units | Sample 36 (entered units) |
|---|---|
| TOC mg/L | 21 |

APPENDIX E.4

TRACE METALS (AIR EMISSIONS ONLY)

INCLUDES

E.4.1 Sample Fraction Results

Table E.4.1

RESULT SUMMARY OF TRACE METALS MASS EMISSION RATES
AT THE T.J. CAMPBELL ASPHALT CONCRETE PLANT

| Date | Time | Run Description | Al µg/DSCM | Be µg/DSCM | Ca µg/DSCM | Cd µg/DSCM | Cr µg/DSCM | Fe µg/DSCM | Hg µg/DSCM | Mg µg/DSCM | Mn µg/DSCM | Ni µg/DSCM | Pb µg/DSCM | V µg/DSCM | Zn µg/DSCM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CONTROLLED EMISSIONS | | | | | | | | | | | | | |
| 11-11 | 0839-1433 | T.M.Part/ Cond Hyd R-2[a] | 124 | .14 | 11,800 | 3.6 | 5.2 | 204 | <62 | 309 | 11 | 10 | 2.6 | <126 | 46 |
| 11-12 | 1129-1319 | T.M.Part/ Cond Hyd C-1[b] | 404 | 2.0 | 31,000 | 30 | 14 | 521 | <107 | 1070 | 35 | 12 | 3.4 | <167 | 38 |
| | | UNCONTROLLED EMISSIONS | | | | | | | | | | | | | |
| 11-11 | 0843-0937 | T.M.Part/ Cond Hyd R-2[a] | 22,500 | 3.9 | 1,960,000 | 34 | 199 | 41,800 | <298 | 38,500 | 620 | 112 | 150 | <378 | 414 |
| 11-12 | 1151-1243 | T.M.Part/ Cond Hyd C-1[b] | 55,000 | 6.0 | 4,930,000 | 37 | 255 | 107,000 | <544 | 79,600 | 1700 | 193 | 219 | <1170 | 385 |

[a]Recycle operation

[b]Conventional operation

Table E.4.2

TRACE METAL ANALYSIS, CONTROLLED EMISSIONS

| Radian No. | Date | Sample Description | Al total µg | Be total µg | Ca total µg | Cd total µg | Cr total µg | Fe total µg | Hg total µg | Mg total µg | Mn total µg | Ni total µg | Pb total µg | V total µg | Zn total µg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 006 | 11-11 | Filter | 41 | <.096 | 4,400 | <.40 | <.20 | 150 | <30 | 120 | 2.1 | <.6 | <17 | <.60 | 5.3 |
| B-011 | | Acetone residue | 160 | 0.22 | 14,000 | 5.8 | 8.4 | 170 | <30 | 380 | 16 | 12 | 4.2 | <60 | 62 |
| C-184 | | NaOH catch | <48 | .48 | 466 | <1.9 | <.95 | <7.6 | <28 | <32 | <.95 | 4.8 | <80 | <57 | <2.8 |
| C-185 | | $H_2SO_4$ catch | <22 | .22 | 264 | <.89 | <.45 | 9.8 | <13 | <15 | <.45 | <1.3 | <38 | <27 | 7.6 |
| | | Total µg | 201 | 0.22 | 19,100 | 5.8 | 8.4 | 330 | <101 | 500 | 18.1 | 16.8 | 4.2 | <204 | 74.9 |
| | | µg/DSCM<br>DSCM Sampled 1.6172 | 124 | 0.14 | 11,800 | 3.6 | 5.2 | 204 | <62 | 309 | 11 | 10 | 2.6 | <126 | 46 |
| 013 | | Filter | 160 | <.096 | 7,500 | <.40 | <.20 | 180 | <30 | 330 | 3.4 | <.60 | <17 | <.60 | 6.1 |
| B-023 | | Acetone residue | 260 | .12 | 32,000 | 27 | 4.3 | 280 | <30 | 850 | 3.7 | 15 | 3.4 | <43 | 32 |
| C-193 | | NaOH catch | 98 | 2.6 | 563 | 13 | 12 | 45 | <38 | 230 | 5.1 | <3.8 | <102 | <77 | <3.8 |
| C-192 | | $HNO_3$ catch | 30 | <.30 | 720 | <1.2 | <.60 | 16 | <18 | <20 | <.60 | <1.8 | <50 | <36 | 9.6 |
| B-024 | | TCE residue | 33 | .067 | 1,500 | 1.4 | 2.9 | 190 | <30 | 54 | 2.3 | 1.4 | 1.3 | <71 | 4.1 |
| | | Total µg | 551 | 2.8 | 42,300 | 41 | 19 | 711 | <146 | 1,460 | 48 | 16 | 4.7 | <228 | 52 |
| | | µg/DSCM<br>DSCM Sampled 1.3638 | 404 | 2.0 | 31,000 | 30 | 14 | 521 | <107 | 1,070 | 35 | 12 | 3.4 | <167 | 38 |

Table E.4.3

TRACE METAL ANALYSIS, UNCONTROLLED EMISSIONS

| Radian No. | Date | Sample Description | Al total µg | Be total µg | Ca total µg | Cd total µg | Cr total µg | Fe total µg | Hg total µg | Mg total µg | Mn total µg | Ni total µg | Pb total µg | V total µg | Zn total µg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 005 | 11-11 | Inlet filter | 5,700 | 0.45 | 450,000 | 2.2 | 50 | 11,000 | <30 | 8,500 | 150 | 32 | 10 | 400 | 39 |
| 005-A | | Cyclone solids | 4,100 | 0.32 | 340,000 | 2.4 | 21 | 7,200 | <46 | 7,500 | 110 | 11 | 15 | 35 | 23 |
| B-009 | | Acetone residue | 3,400 | 0.14 | 360,000 | 7.4 | 18 | 6,300 | <30 | 6,500 | 100 | 19 | 89 | 60 | 150 |
| B-010 | | T.C.E. residue | 68 | .048 | 4,200 | 1.7 | 22 | 81 | 30 | 93 | 2.3 | 1.6 | 8.4 | 6.4 | 18 |
| C-182 | | NaOH catch | 41 | 0.82 | 515 | 3.3 | 5.7 | 16 | <24 | 90 | 1.6 | <2.4 | <69 | 49 | 2.4 |
| C-183 | | $HNO_3$ catch | <28 | 0.55 | 236 | 3.3 | 0.55 | 48 | 16 | 31 | 1.6 | 2.8 | <44 | 33 | 14 |
| | | Total µg | 13,300 | 2.28 | 1,150,000 | 20.3 | 117 | 24,600 | <176 | 22,700 | 366 | 66 | 89 | <223 | 244 |
| | | Loading µg/DSCM .5898 DSCM Sampled | 22,500 | 3.9 | 1,960,000 | 34 | 119 | 41,800 | <298 | 38,500 | 620 | 112 | 150 | <378 | 414 |
| 010 | 11-12 | Filter | 20,000 | 1.4 | 1,400,000 | 4.4 | 68 | 36,000 | <146 | 24,000 | 530 | 58 | 78 | 290 | 87 |
| 010-A | | Cyclone solids | 5,100 | 0.49 | 600,000 | 2.1 | 29 | 10,700 | <67 | 10,000 | 189 | 16 | 36 | 130 | 27 |
| B-019 | | Acetone residue | 4,400 | 0.30 | 650,000 | 5.3 | 38 | 11,000 | <30 | 8,800 | 190 | 28 | 2.1 | 60 | 71 |
| B-020 | | T.C.E. residue | 38 | 0.14 | 4,000 | 2.9 | 2.5 | 48 | <30 | 84 | 2.4 | 1.7 | 1.7 | 60 | 9.2 |
| C-190 | | NaOH catch | 66 | 0.90 | 460 | 5.4 | <0.9 | 27 | <2.7 | <31 | 1.8 | <2.7 | <72 | <54 | <2.7 |
| C-191 | | $HNO_3$ catch | <28 | <0.28 | 800 | <1.1 | <0.57 | 26 | <17 | <19 | <46 | <1.7 | <46 | <34 | 13 |
| | | Total µg | 29,600 | 3.23 | 2,660,000 | 20.1 | 138 | 57,800 | <293 | 43,000 | 913 | 104 | 118 | <628 | 207 |
| | | Loading µg/DSCM .5384 DSCM Samples | 55,000 | 6.0 | 4,930,000 | 37 | 255 | 107,000 | <544 | 79,600 | 1,700 | 193 | 219 | <1,170 | 385 |

APPENDIX E.4

TRACE METALS (AIR EMISSIONS ONLY)

INCLUDES

E.4.2 Computer Printouts of Laboratory Data

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 84-01-043

RECEIVED: 01/10/84 02/17/84 13:22:58

REPORT TO: Radian Corporation
Austin
D1 3

ATTEN: Eric P. Anderson

CLIENT: EPA EMB SAMPLES: 4
COMPANY: EPA-EMB
FACILITY:

WORK ID: Trace Metals
TAKEN:
TRANS TYPE: hand delivered
P.O. #: 222-078-02-25
INV. #: 2502

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 C-170
02 C-170
03 filter a
04 filter b

## Analytical Serv TEST CODES and NAMES used on this report

| | |
|---|---|
| AL E | Aluminum, ICPES |
| BE E | Beryllium, ICPES |
| CA E | Calcium, ICPES |
| CD E | Cadmium, ICPES |
| CR E | Chromium, ICPES |
| FE E | Iron, ICPES |
| HG E | Mercury, ICPES |
| MG E | Magnesium, ICPES |
| MN E | Manganese, ICPES |
| NI E | Nickel, ICPES |
| PB E | Lead, ICPES |
| U E | Uranium, ICPES |
| ZN E | Zinc, ICPES |

CORPORATION



Analytical Serv REPORT LAB # 84-01-043

RECEIVED: 01/10/84

RESULTS BY TEST

| TEST CODE default units | Sample 01 (entered units) | Sample 02 (entered units) | Sample 03 (entered units) | Sample 04 (entered units) |
|---|---|---|---|---|
| AL_E ug/ml | <.05 | <.05 | <5 ug/filter | <5 ug/filter |
| BE_E ug/ml | 0.0005 | <.0005 | <.5 ug/filter | <.5 ug/filter |
| CA_E ug/ml | <.04 | <.04 | <3 ug/filter | <3 ug/filter |
| CD_E ug/ml | <.002 | <.002 | <.2 ug/filter | <.2 ug/filter |
| CR_E ug/ml | <.001 | <.001 | <.1 ug/filter | <.1 ug/filter |
| FE_E ug/ml | 0.010 | <.008 | <.8 ug/filter | <.8 ug/filter |
| HG_E ug/ml | <.030 | <.03 | <3 ug/filter | <3 ug/filter |
| MG_E ug/ml | <.03 | <.034 | <3 ug/filter | <3 ug/filter |
| MN_E ug/ml | <.001 | <.001 | <.1 ug/filter | <.1 ug/filter |
| NI_E ug/ml | <.003 | <.003 | <.3 ug/filter | <.3 ug/filter |
| PB_E ug/ml | <.08 | <.084 | <8 ug/filter | <8 ug/filter |
| U_E ug/ml | <.06 | <.06 | <6 ug/filter | <6 ug/filter |
| ZN_E ug/ml | <.003 | <.003 | <.3 ug/filter | <.3 ug/filter |

RADIAN CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 83-12-117

RECEIVED 12/13/83 02/16/84 11:03:13

REPORT TO: Radian Corporation
Austin
B1 3

ATTEN: Eric Anderson

CLIENT: EPA ENB SAMPLES: 29
COMPANY: EPA-ENB
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: trace metals
TAKEN:
TRANS: hand
TYPE:
P.O. #: 202-078-03-24
INV. #: 2376

## SAMPLE IDENTIFICATION

| | |
|---|---|
| 01 | 005 |
| 02 | 005-A |
| 03 | 006 |
| 04 | 010 |
| 05 | 010-A |
| 06 | 013 |
| 07 | C-226 |
| 08 | C-230 |
| 09 | B-009 |
| 10 | B-010 |
| 11 | B-011 |
| 12 | B-012 |
| 13 | B-019 |
| 14 | B-020 |
| 15 | B-023 |
| 16 | B-024 |
| 17 | C-182 |
| 18 | C-183 |
| 19 | C-184 |
| 20 | C-185 |
| 21 | C-190 |

## Analytical Serv TEST CODES and NAMES used on this report

| | |
|---|---|
| AL E | Aluminum, ICPES |
| BE E | Beryllium, ICPES |
| CA E | Calcium, ICPES |
| CD E | Cadmium, ICPES |
| CR E | Chromium, ICPES |
| FE E | Iron, ICPES |
| HG E | Mercury, ICPES |
| MG E | Magnesium, ICPES |
| MN E | Manganese, ICPES |
| NI E | Nickel, ICPES |
| PB E | Lead, ICPES |
| PREP X | Special Digestion Method |
| U E | Uranium, ICPES |
| ZN E | Zinc, ICPES |

CORPORATION

 Analytical Serv REPORT LAB # 83-12-117

RECEIVED: 12/13/83 02/16/84 11:03:13

SAMPLE IDENTIFICATION

22 C-191
23 C-192
24 C-193
25 C-209
26 C-210
27 C-215
28 C-216
29 blank

CORPORATION



RECEIVED: 12/13/83

Analytical Serv REPORT

RESULTS BY TEST

LAB # 83-12-117

| TEST CODE default units | Sample 01 (entered units) | Sample 02 (entered units) | Sample 03 (entered units) | Sample 04 (entered units) | Sample 05 (entered units) |
|---|---|---|---|---|---|
| AL_E ug/ml | 5700 ug/filter | 2700 ug/g | 41 ug/filter | 4200 ug/g | 2300 ug/g |
| BE_E ug/ml | 0.45 ug/filter | 0.21 ug/g | <.096 ug/filter | 0.29 ug/g | 0.22 ug/g |
| CA_E ug/ml | 450,000 ug/filter | 220,000 ug/g | 4400 ug/filter | 280,000 ug/g | 270,000 ug/g |
| CD_E ug/ml | 2.2 ug/filter | 1.6 ug/g | <.40 ug/filter | 0.90 ug/g | 0.94 ug/g |
| CR_E ug/ml | 50 ug/filter | 14 ug/g | <.20 ug/filter | 14 ug/g | 13 ug/g |
| FE_E ug/ml | 11,000 ug/filter | 4700 ug/g | 150 ug/filter | 7500 ug/g | 4800 ug/g |
| HG_E ug/ml | <30 ug/filter | <30 ug/g | <30 ug/filter | <30 ug/g | <30 ug/g |
| MG_E ug/ml | 8500 ug/filter | 4900 ug/g | 120 ug/filter | 5000 ug/g | 4500 ug/g |
| MN_E ug/ml | 150 ug/filter | 72 ug/g | 2.1 ug/filter | 110 ug/g | 85 ug/g |
| NI_E ug/ml | 32 ug/filter | 7.2 ug/g | <.6 ug/filter | 12 ug/g | 7.4 ug/g |
| PB_E ug/ml | <10 ug/filter | <10 ug/g | <17 ug/filter | 16 ug/g | 16 ug/g |
| PREP_X date complete | 12/06/83 | 12/06/83 | 12/06/83 | 12/06/83 | 12/06/83 |
| U_E ug/ml | <40.0 ug/filter | <23.0 ug/g | <.60 ug/filter | <60 ug/g | <60 ug/g |
| ZN_E ug/ml | 39 ug/filter | 15 ug/g | 5.3 ug/filter | 18 ug/g | 12 ug/g |

Analytical Serv REPORT LAB # 83-12-117

RECEIVED: 12/13/83

RESULTS BY TEST

| TEST CODE default units | Sample 06 (entered units) | Sample 07 (entered units) | Sample 08 (entered units) | Sample 09 (entered units) | Sample 10 (entered units) |
|---|---|---|---|---|---|
| AL_E ug/ml | 160 ug/filter | 3600 ug/g | 4800 ug/g | 3400 total ug | 68 total ug |
| BE_E ug/ml | <.096 ug/filter | 0.30 ug/g | 0.85 ug/g | 0.14 total ug | <.048 total ug |
| CA_E ug/ml | 7500 ug/filter | 330,000 ug/g | 200,000 ug/g | 360,000 total ug | 4200 total ug |
| CD_E ug/ml | <.40 ug/filter | 0.92 ug/g | 3.3 ug/g | 7.4 total ug | 1.7 total ug |
| CR_E ug/ml | <.20 ug/filter | 15 ug/g | 18 ug/g | 18 total ug | 2.2 total ug |
| FE_E ug/ml | 180 ug/filter | 6000 ug/g | 7700 ug/g | 6300 total ug | 81 total ug |
| HG_E ug/ml | <30 ug/filter | <30 ug/g | <30 ug/g | <30 total ug | <30 total ug |
| MG_E ug/ml | 330 ug/filter | 4600 ug/g | 5600 ug/g | 6500 total ug | 93 total ug |
| MN_E ug/ml | 3.4 ug/filter | 110 ug/g | 220 ug/g | 100 total ug | 2.3 total ug |
| NI_E ug/ml | <.60 ug/filter | 9.9 ug/g | 12 ug/g | 19 total ug | 1.6 total ug |
| PB_E ug/ml | <17 ug/filter | 1.6 ug/g | 7.8 ug/g | 89 total ug | <8.4 total ug |
| PREP_X date complete | 12/06/83 | 12/06/83 | 12/06/83 | 12/06/83 | 12/06/83 |
| U_E ug/ml | <.60 ug/filter | <60 ug/g | <60 ug/g | <60 total ug | <6.4 total ug |
| ZN_E ug/ml | 6.1 ug/filter | 15 ug/g | 20 ug/g | 150 total ug | 18 total ug |

CORPORATION



RECEIVED: 12/13/83

Analytical Serv REPORT

RESULTS BY TEST

LAB # 83-12-117

| TEST CODE default units | Sample 11 (entered units) | Sample 13 (entered units) | Sample 14 (entered units) | Sample 15 (entered units) | Sample 16 (entered units) |
|---|---|---|---|---|---|
| AL_E ug/ml | 160 total ug | 4400 total ug | 38 total ug | 260 total ug | 33 total ug |
| BE_E ug/ml | 0.22 total ug | 0.30 total ug | 0.14 total ug | 0.12 total ug | 0.067 total ug |
| CA_E ug/ml | 14,000 total ug | 650,000 total ug | 4000 total ug | 32,000 total ug | 1500 total ug |
| CD_E ug/ml | 5.8 total ug | 5.3 total ug | 2.9 total ug | 27 total ug | 1.4 total ug |
| CR_E ug/ml | 8.4 total ug | 38 total ug | 2.5 total ug | 4.3 total ug | 2.9 total ug |
| FE_E ug/ml | 170 total ug | 11,000 total ug | 48 total ug | 280 total ug | 190 total ug |
| HG_E ug/ml | <30 total ug | <30 total ug | <30 total ug | <30 total ug | <30 total ug |
| MG_E ug/ml | 380 total ug | 8800 total ug | 84 total ug | 850 total ug | 54 total ug |
| MN_E ug/ml | 16 total ug | 190 total ug | 2.4 total ug | 37 total ug | 2.3 total ug |
| NI_E ug/ml | 12 total ug | 28 total ug | 1.7 total ug | 15 total ug | 1.4 total ug |
| PB_E ug/ml | 4.2 total ug | 2.1 total ug | 1.7 total ug | 3.4 total ug | 1.3 total ug |
| PREP_X date complete | 12/06/83 | 12/06/83 | 12/06/83 | 12/06/83 | 12/06/83 |
| U_E ug/ml | <60 total ug | <60 total ug | <60 total ug | <43 total ug | <71 total ug |
| ZN_E ug/ml | 62 total ug | 71 total ug | 9.2 total ug | 32 total ug | 4.1 total ug |

CORPORATION



Analytical Serv REPORT LAB # 83-12-117

RECEIVED: 12/13/83

RESULTS BY TEST

| TEST CODE default units | Sample 17 (entered units) | Sample 18 (entered units) | Sample 19 (entered units) | Sample 20 (entered units) | Sample 21 (entered units) |
|---|---|---|---|---|---|
| AL_E ug/ml | <.05 | <.05 | <.050 | <.050 | 0.073 |
| BE_E ug/ml | 0.001 | 0.001 | <.0005 | <.0005 | 0.001 |
| CA_E ug/ml | 0.63 | 0.43 | 0.49 | 0.59 | 0.51 |
| CD_E ug/ml | 0.004 | 0.006 | <.002 | <.002 | 0.006 |
| CR_E ug/ml | 0.007 | 0.001 | <.001 | <.001 | <.001 |
| FE_E ug/ml | 0.019 | 0.087 | <.008 | 0.022 | 0.030 |
| HG_E ug/ml | <.03 | <.03 | <.03 | <.03 | <.003 |
| MG_E ug/ml | 0.11 | 0.056 | <.034 | <.034 | <.034 |
| MN_E ug/ml | 0.002 | 0.003 | <.001 | <.001 | 0.002 |
| NI_E ug/ml | <.003 | 0.005 | 0.005 | <.003 | <.003 |
| PB_E ug/ml | <.084 | <.08 | <.084 | <.084 | <.08 |
| U_E ug/ml | <.06 | <.06 | <.06 | <.06 | <.06 |
| ZN_E ug/ml | <.003 | 0.025 | <.003 | 0.017 | <.003 |

CORPORATION



Analytical Serv REPORT LAB # 83-12-117

RECEIVED: 12/13/83

RESULTS BY TEST

| TEST CODE default units | Sample 22 (entered units) | Sample 23 (entered units) | Sample 24 (entered units) | Sample 25 (entered units) | Sample 26 (entered units) |
|---|---|---|---|---|---|
| AL_E ug/ml | <.050 | <.050 | 0.077 | <.050 | <.050 |
| BE_E ug/ml | <.0005 | <.0005 | 0.002 | <.0005 | <.0005 |
| CA_E ug/ml | 1.4 | 1.2 | 0.44 | 300 | 300 |
| CD_E ug/ml | <.002 | <.002 | 0.010 | <.002 | <.002 |
| CR_E ug/ml | <.001 | <.001 | 0.009 | <.001 | <.001 |
| FE_E ug/ml | 0.046 | 0.027 | 0.035 | <.008 | <.008 |
| HG_E ug/ml | <.03 | <.03 | <.03 | <.03 | <.03 |
| MG_E ug/ml | <.034 | <.034 | 0.18 | 54 | 53 |
| MN_E ug/ml | <.001 | <.001 | 0.004 | 0.060 | 0.061 |
| NI_E ug/ml | <.003 | <.003 | <.003 | 0.003 | <.003 |
| PB_E ug/ml | <.08 | <.084 | <.08 | <.084 | <.084 |
| U_E ug/ml | <.06 | <.06 | <.06 | <.003 | <.003 |
| ZN_E ug/ml | 0.023 | 0.016 | <.003 | <.003 | <.003 |

RECEIVED: 12/13/83

RESULTS BY TEST

| TEST CODE default units | Sample 27 (entered units) | Sample 28 (entered units) | Sample 29 (entered units) |
|---|---|---|---|
| AL_E ug/ml | <.050 | <.050 | <.050 |
| BE_E ug/ml | 0.001 | <.0005 | <.0005 |
| CA_E ug/ml | 290 | 300 | <.04 |
| CD_E ug/ml | 0.007 | <.002 | <.002 |
| CR_E ug/ml | 0.004 | <.001 | <.001 |
| FE_E ug/ml | 0.026 | <.008 | <.008 |
| HG_E ug/ml | <.03 | <.03 | <.03 |
| MG_E ug/ml | 54 | 54 | <.034 |
| MN_E ug/ml | 0.047 | 0.053 | <.001 |
| NI_E ug/ml | <.003 | 0.005 | <.003 |
| PB_E ug/ml | <.08 | <.084 | <.084 |
| U_E ug/ml | 0.069 | <.003 | <.003 |
| ZN_E ug/ml | <.003 | <.003 | <.003 |

APPENDIX E.5

PARTICLE SIZE DISTRIBUTION

INCLUDES

E.5.1 Sample Fraction Results

Table E.5.1

## IMPACTOR SAMPLING RESULTS--UNCONTROLLED AIR EMISSIONS

| Date | Time | Run ID | Flow Rate (ACFM[1]) | Stage | Mass Collected (g) | % in Size Range | Cumulative % Less than Size Range | Size Range µm | $DP_{50}$ µm | % Isokinetic |
|---|---|---|---|---|---|---|---|---|---|---|
| 1111 | 1253-1330 | PSD-B-1 | 0.439 | 1 | 1.1838 | 57.5 | 42.6 | >13.3 | 13.3 | 108 |
| | | | 0.439 | 2 | 0.2831 | 13.8 | 28.8 | 7.2-13.3 | 7.2 | |
| | | | 0.439 | Cyclone | 0.4340 | 21.1 | 7.7 | 2.1-7.2 | 2.1 | |
| | | | 0.439 | Filter | 0.1581 | 7.7 | 0 | <0-2.1 | - | |
| 1112 | 1418-1520 | PSD-C-1 | 0.430 | 1 | 2.9926 | 41.0 | 58.9 | >13.3 | 13.3 | 103 |
| | | | 0.430 | 2 | 1.2359 | 16.9 | 42.0 | 7.2-13.3 | 7.2 | |
| | | | 0.430 | Cyclone | 1.0506 | 14.4 | 27.6 | 2.2-7.2 | 2.2 | |
| | | | 0.430 | Filter | 2.0152 | 27.6 | 0 | <0-2.2 | - | |
| 1114 | 1014-1143 | PSD-C-2 | 0.442 | 1 | 1.5725 | 27.3 | 72.7 | >13.3 | 13.3 | 103 |
| | | | 0.442 | 2 | 1.0991 | 19.1 | 53.6 | 7.2-13.3 | 7.2 | |
| | | | 0.442 | Cyclone | 0.8769 | 15.2 | 38.4 | 2.1-7.2 | 2.1 | |
| | | | 0.442 | Filter | 2.2131 | 38.4 | 0 | <0-2.1 | - | |
| 1115 | 1225-1400 | PSD-C-3 | 0.456 | 1 | 3.2178 | 32.2 | 67.8 | >13.0 | 13.0 | 112[2] |
| | | | 0.456 | 2 | 2.3035 | 23.1 | 44.7 | 6.9-13.0 | 6.9 | |
| | | | 0.456 | Cyclone | 1.3990 | 14.0 | 30.7 | 1.9-6.9 | 1.9 | |
| | | | 0.456 | Filter | 3.0625 | 30.7 | 0 | <0-1.9 | - | |

[1]ACFM = actual cubic feet per minute

[2]Wet bulb/dry bulb indicated 35% moisture; 42.5% moisture measured which caused super isokinetic run

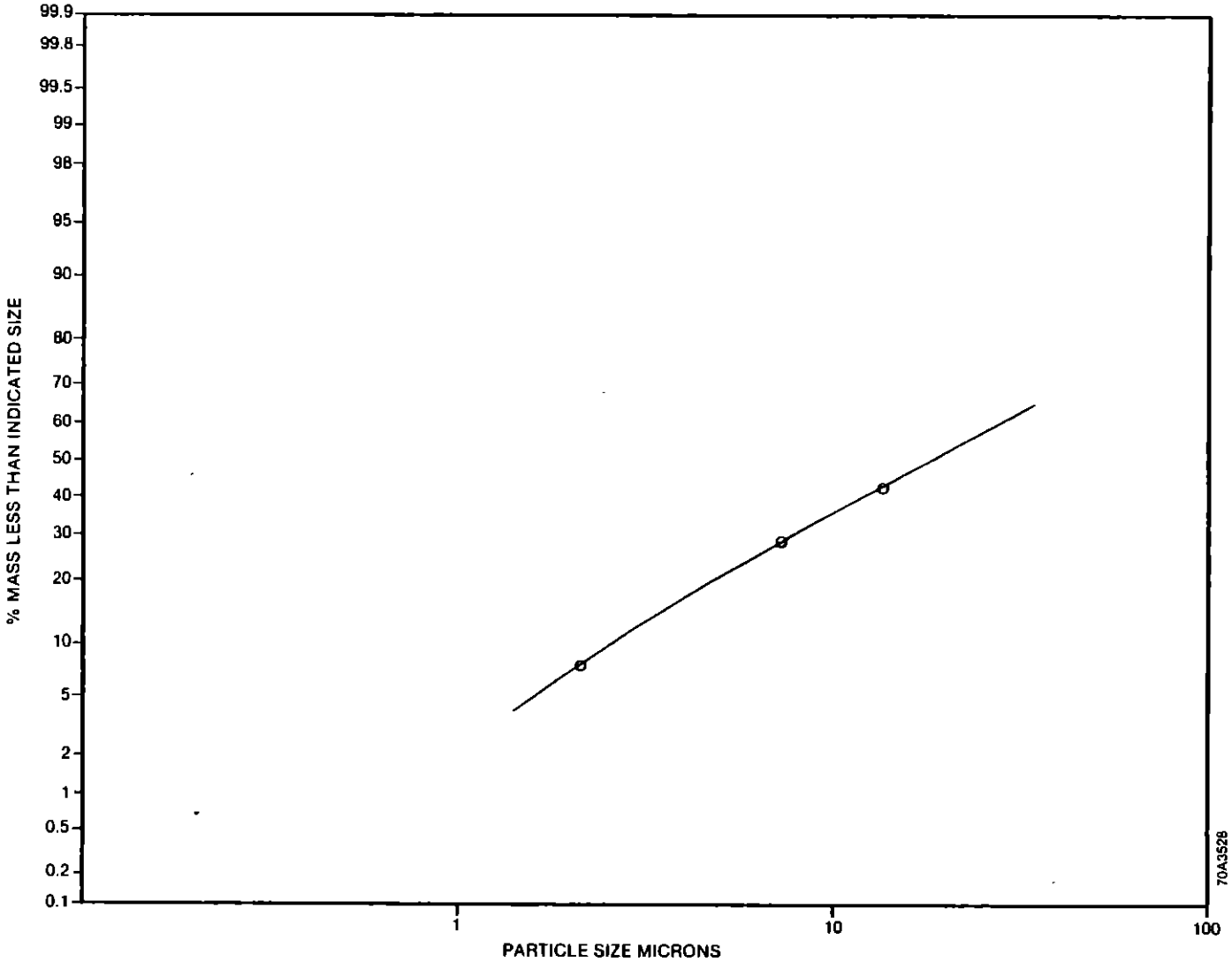


Figure E.5.1 Particle size distribution curves for recycle operation.

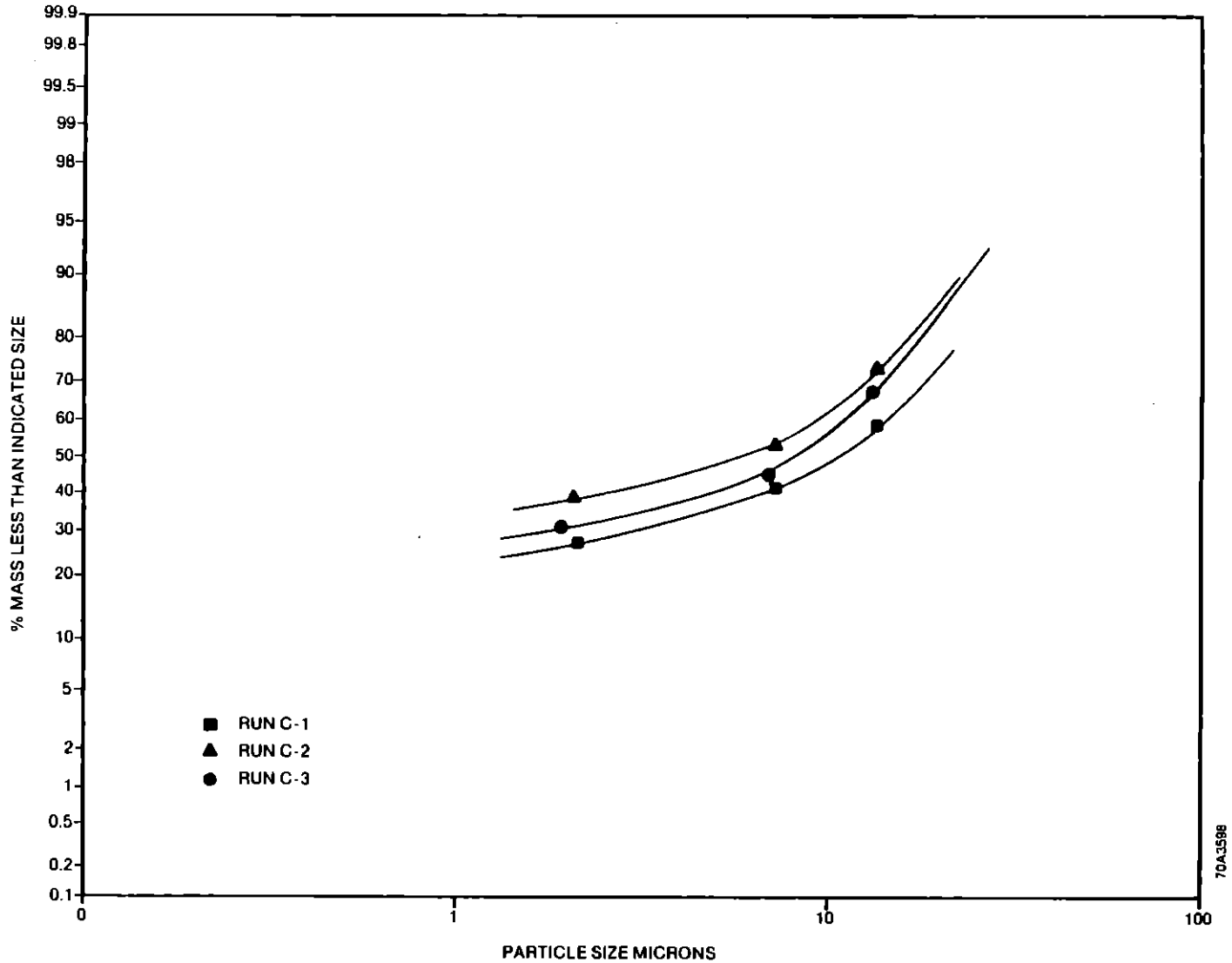


Figure E.5.2 Particle size distribution curves for conventional operation.

APPENDIX E.5

PARTICLE SIZE DISTRIBUTION

INCLUDES

E.5.2 Impactor Substrate Weighing Data Sheets

E.5.2.1 Andersen High Capacity Stack Sampler Impactor Stage Weighing Data Sheets

IMPACTOR FIELD DATA

Sample Ident. Cam-1111-PSD-01 Date 11-11-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 1.1838 |
| C03 | 2 | | | | 0.2831 |
| C04 | 3 | | | | 0.4340 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | 1.9358 | 1.7777 | .1584 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 4.7 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 86.5 (39:5)

% $O_2$ (dry) 8.8 (46:5) Other (dry) 0 (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. Cam-1112-PSD-IN-01 Date 11-12-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 1.2359 |
| C03 | 2 | | | | 1.0506 |
| C04 | 3 | | | | 2.0152 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | 3.8780 | 1.8628 | 2.9926 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 6.2 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 88.8 (39:5)

% $O_2$ (dry) 5.0 (46:5) Other (dry) 0 (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. Cam-1114-PSD Date 11-14-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 1.5725 |
| C03 | 2 | | | | 1.0991 |
| C04 | 3 | | | | 0.8769 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | 4.0058 | 1.7927 | 2.2131 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 6.1 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 89.2 (39:5)

% $O_2$ (dry) 4.7 (46:5) Other (dry) _____ (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. Cam-1115-PSD-IN-01 Date 11-5-83

Analyst EPA

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | | | 3.2178 |
| C03 | 2 | | | | 2.3035 |
| C04 | 3 | | | | 1.3990 |
| C05 | 4 | | | | |
| C06 | 5 | | | | |
| C07 | 6 | | | | |
| C08 | 7 | | | | |
| C09 | 8 | | | | |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | 4.9590 | 1.8965 | 3.0625 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 0 (11:5)

% $CO_2$ (dry) 6.3 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 88.2 (39:5)

% $O_2$ (dry) 5.5 (46:5) Other (dry) _____ (53:5)

Assumed particle density 1.0 (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

APPENDIX E.5

PARTICLE SIZE DISTRIBUTION

INCLUDES

E.5.2 Impactor Substrate Weighing Data Sheets
E.5.2.2 Andersen Mark III Impactor Substrate Weighing Data Sheet

IMPACTOR FIELD DATA

Sample Ident. Campbell PSD 3 OuHet Date 11/11

Analyst MRZ

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16283 | .16281 | +.00002 |
| C03 | 2 | | .14597 | .14591 | +.00006 |
| C04 | 3 | | .16324 | .16284 | +.00040 |
| C05 | 4 | | .14441 | .14410 | +.00031 |
| C06 | 5 | | .16698 | .16173 | +.00525 |
| C07 | 6 | | .14693 | .14654 | +.00039 |
| C08 | 7 | | .16099 | .16108 | -.00009 |
| C09 | 8 | | .14580 | .14713 | -.00133 |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21833 | .2177 | .00063 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 86.6 (11:5)

% $CO_2$ (dry) 4.65 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 0 (39:5)

% $O_2$ (dry) 8.75 (46:5) Other (dry) 0 (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. CAMPBELL PSD 4 OUTLET Date 11/12

Analyst MJK

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16386 | .16424 | -.00038 |
| C03 | 2 | | .14400 | .14474 | -.00074 |
| C04 | 3 | | .16159 | .16160 | -.00001 |
| C05 | 4 | | .14672 | .14702 | -.00030 |
| C06 | 5 | | .16513 | .16493 | +.00020 |
| C07 | 6 | | .14643 | .14586 | +.00057 |
| C08 | 7 | | .16232 | .16128 | +.00104 |
| C09 | 8 | | .14721 | .14647 | +.00074 |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21783 | .2175 | .00033 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. Campbell Outlet PSD 5 Date 11/12

Analyst MRF

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16502 | .16513 | -.00011 |
| C03 | 2 | | .14380 | .14380 | 0 |
| C04 | 3 | | .16285 | .16249 | +.00036 |
| C05 | 4 | | .14489 | .14450 | +.00039 |
| C06 | 5 | | .16418 | .16289 | +.00129 |
| C07 | 6 | | .14743 | .14538 | +.00205 |
| C08 | 7 | | .16329 | .16292 | +.00037 |
| C09 | 8 | | .14185 | .14359 | -.00174 |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21986 | .2173 | +.00256 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) 88.8 (11:5)

% $CO_2$ (dry) 6.2 (18:5) % $CH_4$ (dry) 0 (25:5)

% CO (dry) 0 (32:5) % $N_2$ (dry) 0 (39:5)

% $O_2$ (dry) 5.0 (46:5) Other (dry) 0 (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. CAMPBELL OUTLET PSD6 Date 11/13

Analyst MJK

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16062 | .16417 | -.00355 |
| C03 | 2 | | .14535 | .14645 | -.00110 |
| C04 | 3 | | .16015 | .16101 | -.00086 |
| C05 | 4 | | .14297 | .14480 | -.00183 |
| C06 | 5 | | .16265 | .16363 | -.00098 |
| C07 | 6 | | .14454 | .14438 | -.00084 |
| C08 | 7 | | .16119 | .16309 | -.00190 |
| C09 | 8 | | .14522 | .14749 | -.00227 |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21839 | .2181 | |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. Campbell Outlet PSD 7 Date 11/14

Analyst MR7

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16195 | .16240 | -.00045 |
| C03 | 2 | | .14515 | .14546 ~~.16280~~ | -.00031 |
| C04 | 3 | | .16288 | .16250 | +.00038 |
| C05 | 4 | | .14539 | .14489 | +.00050 |
| C06 | 5 | | .16510 | .16213 | +.00297 |
| C07 | 6 | | .14498 | .14527 | -.00029 |
| C08 | 7 | | .16398 | .16504 | -.00106 |
| C09 | 8 | | .14400 | .14596 | -.00196 |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .22041 | .2203 | +.00011 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

IMPACTOR FIELD DATA

Sample Ident. Campbell Outlet PSD 8 Date _____

Analyst MRF

| | Stage # | Substrates I.D. | Final Wt. (gm) | Tare Wt. (gm) | Net Wt. (gm) |
|---|---|---|---|---|---|
| C01 | Cyclone | | | | |
| C02 | 1 | | .16245 | .16296 | -.00051 |
| C03 | 2 | | .14384 | .14404 | -.00020 |
| C04 | 3 | | .16301 | .16343 | -.00042 |
| C05 | 4 | | .14600 | .14625 | -.00025 |
| C06 | 5 | | .16158 | .16230 | -.00072 |
| C07 | 6 | | .14617 | .14538 | +.00079 |
| C08 | 7 | | .15632 | .16287 | -.00655 |
| C09 | 8 | | .14457 | .14632 | -.00175 |
| C10 | 9 | | | | |
| C11 | 10 | | | | |
| C12 | 11 | | | | |
| C13 | 12 | | | | |
| C14 | Final Filter | | .21905 | .2168 | +.00225 |
| | | (4:7) | (11:7) | (18:7) | (25:7) |

Stack Gas Composition:

C15 % Moisture _____ (4:5) % $H_2$ (dry) _____ (11:5)

% $CO_2$ (dry) _____ (18:5) % $CH_4$ (dry) _____ (25:5)

% CO (dry) _____ (32:5) % $N_2$ (dry) _____ (39:5)

% $O_2$ (dry) _____ (46:5) Other (dry) _____ (53:5)

Assumed particle density _____ (60:5) gm/cc

Assumed maximum particle diameter _____ (67:5) µm

Assumed minimum particle diameter _____ (74:5) µm

C16 Remarks _____

APPENDIX E.6

POLYNUCLEAR AROMATIC HYDROCARBONS

INCLUDES

E.6.1 Sample Fraction Results

AMOUNT OF BENZO(A)PYRENE AND RELATED PAHs IN OUTLET
EMISSION SAMPLES COLLECTED 11-14-83

| Compounds | Isomer Group | Amount Found | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | C-240 Front | | C-241 XAD | | C-144 Back | | Total | |
| | | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM |
| Phenanthrene | $C_{14}H_{10}$ | 0.8 | 0.585 | 124 | 103 | 0.6 | 0.485 | 125 | 104 |
| Anthracene | $C_{14}H_{10}$ | ND | 0 | 8.5 | 7.10 | ND | 0 | 8.5 | 7.10 |
| Fluoranthene | $C_{16}H_{10}$ | 0.4 | 0.284 | 3.4 | 2.54 | <0.1 | <0.050 | 3.8 | 2.79 |
| Pyrene | $C_{16}H_{10}$ | 1.3 | 0.928 | 8.4 | 6.40 | 0.2 | 0.084 | 9.9 | 7.41 |
| Benz(a)anthracene | $C_{18}H_{12}$ | <0.1 | <0.084 | 0.3 | 0.217 | <0.1 | <0.084 | 0.3 | 0.217 |
| Chrysene | $C_{18}H_{12}$ | 0.2 | 0.167 | 1.3 | 0.995 | <0.1 | <0.084 | 1.5 | 1.16 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | 0.6 | 0.502 | ND | 0 | ND | 0 | 0.6 | 0.502 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | 0.6 | 0.502 | ND | 0 | ND | 0 | 0.6 | 0.502 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Benzo(e)pyrene | $C_{20}H_{12}$ | 0.2 | 0.167 | <0.1 | <0.084 | ND | 0 | 0.2 | 0.167 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Perylene | $C_{20}H_{12}$ | 0.2 | 0.167 | ND | 0 | ND | 0 | 0.2 | 0.167 |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | 0.1 | 0.084 | ND | 0 | ND | 0 | 0.1 | 0.084 |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Benzo(a)pyrene-$d_{12}$ | | 32.8 (82%) | | 25.7 (64%) | | 37.8 (94.6%) | | | |

ND = Not Detected

AMOUNT OF BENZO(A)PYRENE AND RELATED PAHs IN OUTLET
EMISSION SAMPLES COLLECTED 11-15-83

| Compounds | Isomer Group | Amount Found | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | C-238 Front | | C-239 XAD | | C-154 Back | | Total | |
| | | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM |
| Phenanthrene | $C_{14}H_{10}$ | 1.3 | 0.938 | 110 | 85.4 | 0.2 | 0.141 | 110 | 86.5 |
| Anthracene | $C_{14}H_{10}$ | ND | 0 | 23 | 18.0 | ND | 0 | 23 | 18.0 |
| Fluoranthene | $C_{16}H_{10}$ | 0.4 | 0.266 | 17 | 13.0 | <0.1 | <0.047 | 17 | 13.0 |
| Pyrene | $C_{16}H_{10}$ | 1.1 | 0.712 | 33 | 25.2 | 0.2 | 0.078 | 34 | 25.8 |
| Benz(a)anthracene | $C_{18}H_{12}$ | <0.1 | <0.078 | 1.0 | 0.751 | ND | 0 | 1.0 | 0.751 |
| Chrysene | $C_{18}H_{12}$ | 0.2 | 0.156 | 3.2 | 2.42 | ND | 0 | 3.4 | 2.57 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | <0.1 | <0.078 | 0.3 | 0.235 | ND | 0 | 0.3 | 0.235 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | <0.1 | <0.078 | 0.3 | 0.235 | ND | 0 | 0.3 | 0.235 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Benzo(e)pyrene | $C_{20}H_{12}$ | 0.1 | 0.078 | 0.6 | 0.469 | ND | 0 | 0.7 | 0.547 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND | 0 | 0.3 | 0.235 | 0.1 | 0.078 | 0.4 | 0.313 |
| Perylene | $C_{20}H_{12}$ | 0.1 | 0.078 | 0.1 | 0.078 | ND | 0 | 0.2 | 0.156 |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND | 0 | 0.4 | 0.313 | ND | 0 | 0.4 | 0.313 |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | | |
| Benzo(a)pyrene-$d_{12}$ | | 31 (77%) | | 24 (60%) | | 33 (82%) | | | |

ND = Not Detected

AMOUNT OF BENZO(A)PYRENE AND RELATED PAHs IN INLET
EMISSION SAMPLES COLLECTED 11-14-83

| Compounds | Isomer Group | Amount Found | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | C-242 Front | | C-243 XAD | | C-149 Back | | Total | |
| | | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM |
| Phenanthrene | $C_{14}H_{10}$ | 7.2 | 20.5 | 40 | 113 | 0.4 | 0.979 | 48 | 136 |
| Anthracene | $C_{14}H_{10}$ | 0.9 | 2.59 | 5.9 | 17.0 | ND | 0 | 6.8 | 19.6 |
| Fluoranthene | $C_{16}H_{10}$ | 2.0 | 5.67 | 2.5 | 6.68 | 0.2 | 0.403 | 4.7 | 12.8 |
| Pyrene | $C_{16}H_{10}$ | 5.7 | 16.2 | 6.8 | 18.7 | 0.6 | 1.21 | 13 | 35.8 |
| Benz(a)anthracene | $C_{18}H_{12}$ | 0.4 | 1.15 | 0.1 | 0.230 | <0.1 | <0.288 | 0.5 | 1.38 |
| Chrysene | $C_{18}H_{12}$ | 2.2 | 6.34 | 0.4 | 1.01 | <0.1 | <0.288 | 2.6 | 7.34 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | 0.2 | 0.576 | <0.1 | <0.288 | <0.1 | <0.288 | 0.2 | 0.576 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | 0.2 | 0.576 | <0.1 | <0.288 | ND | 0 | 0.2 | 0.576 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Benzo(e)pyrene | $C_{20}H_{12}$ | 0.9 | 2.59 | 0.1 | 0.288 | 0.2 | 0.576 | 1.2 | 3.46 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | 0.5 | 1.44 | ND | 0 | ND | 0 | 0.5 | 1.44 |
| Perylene | $C_{20}H_{12}$ | 0.1 | 0.288 | 0.1 | 0.288 | <0.1 | <0.288 | 0.576 | |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | 0.5 | 1.44 | 0.2 | 0.288 | <0.1 | <0.288 | 0.6 | 1.73 |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Benzo(a)pyrene-$d_{12}$ | | 31.8 (79%) | | 25.7 (64%) | | 35.2 (88%) | | | |

ND = Not Detected

AMOUNT OF BENZO(A)PYRENE AND RELATED PAHs IN INLET
EMISSION SAMPLES COLLECTED 11-15-83

| Compounds | Isomer Group | Amount Found | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | C-236 Front | | C-237 XAD | | C-159 Back | | Total | |
| | | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM | ug | ug/DSCM |
| Phenanthrene | $C_{14}H_{10}$ | 4.0 | 8.63 | 100 | 216 | 0.35 | 0.632 | 104 | 226 |
| Anthracene | $C_{14}H_{10}$ | 0.67 | 1.46 | 6.7 | 14.6 | 0.03 | 0.065 | 7.4 | 16.1 |
| Fluoranthene | $C_{16}H_{10}$ | 0.88 | 1.85 | 8.2 | 17.5 | 0.27 | 0.458 | 9.3 | 19.7 |
| Pyrene | $C_{16}H_{10}$ | 1.6 | 3.33 | 15 | 32.0 | 0.76 | 1.26 | 17.4 | 36.7 |
| Benz(a)anthracene | $C_{18}H_{12}$ | 0.30 | 0.654 | 0.50 | 1.05 | 0.02 | 0.044 | 0.82 | 1.74 |
| Chrysene | $C_{18}H_{12}$ | 1.7 | 3.70 | 2.2 | 4.68 | 0.05 | 0.109 | 3.9 | 8.39 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND | 0 | ND | 0 | 0.04 | 0.087 | 0.04 | 0.087 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND | 0 | ND | 0 | 0.05 | 0.109 | 0.05 | 0.109 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Benzo(e)pyrene | $C_{20}H_{12}$ | 0.58 | 1.26 | 0.16 | 0.349 | 0.10 | 0.218 | 0.84 | 1.83 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | 0.19 | 0.414 | ND | 0 | 0.04 | 0.087 | 0.23 | 0.501 |
| Perylene | $C_{20}H_{12}$ | ND | 0 | 0.08 | 0.174 | 0.07 | 0.153 | 0.15 | 0.327 |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND | 0 | ND | 0 | 0.07 | 0.153 | 0.07 | 0.153 |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | 0 | ND | 0 | ND | 0 | ND | 0 |
| Benzo(a)pyrene-$d_{12}$ | | 42 (105%) | | 21 (53%) | | 33 (82%) | | | |

ND = Not Detected

Table E.6.1 MASS LOADINGS OF BENZO(A)PYRENE AND RELATED PAHs IN UNCONTROLLED AIR EMISSIONS AT THE T.J. CAMPBELL ASPHALT CONCRETE PLANT

| Compounds | Isomer Group | Uncontrolled Emission Blank total μg[a] | BaP/Org. C-1[d] 11-14 1301-1426 | | BaP/Org. R-1[e] 11-15 0909-1005 | |
|---|---|---|---|---|---|---|
| | | | total μg | μg/DSCM[b] | total μg | μg/DSCM[c] |
| Phenanthrene | $C_{14}H_{10}$ | 0.72 | 48 | 136 | 100 | 220 |
| Anthracene | $C_{14}H_{10}$ | ND | 6.8 | 19.6 | 7.4 | 16.1 |
| Fluoranthene | $C_{16}H_{10}$ | 0.27 | 4.7 | 12.8 | 9.3 | 19.7 |
| Pyrene | $C_{16}H_{10}$ | 0.56 | 13.0 | 35.8 | 17.4 | 36.4 |
| Benz(a)anthracene | $C_{18}H_{12}$ | 0.02 | 0.5 | 1.38 | 0.82 | 1.80 |
| Chrysene | $C_{18}H_{12}$ | 0.05 | 2.6 | 7.34 | 3.9 | 8.39 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND | 0.2 | 0.576 | 0.04 | 0.087 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND | 0.2 | 0.576 | 0.05 | 0.109 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | ND | 0 | ND | 0 |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND | 1.2 | 3.46 | 0.84 | 1.90 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND | 0.5 | 1.44 | 0.23 | 0.501 |
| Perylene | $C_{20}H_{12}$ | ND | 0.2 | 0.576 | 0.15 | 0.327 |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND | 0.6 | 1.73 | 0.07 | 0.153 |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | ND | 0 | ND | 0 |

ND = Not Detected

[a] The blank is subtracted for the μg/DSCM calculation

[b] 0.3472 DSCM sampled

[c] 0.4590 DSCM sampled

[d] Conventional operation

[e] Recycle operation

Table E.6.2 MASS LOADINGS OF BENZO(A)PYRENE AND RELATED PAHs IN CONTROLLED AIR EMISSIONS AT THE T.J. CAMPBELL ASPHALT CONCRETE PLANT

| Compounds | Isomer Group | Controlled Emission Blank total µg[a] | BaP/Org. C-1[d] 11-14 1209-1426 | | BaP/Org. R-1[e] 11-15 0859-1053 | |
|---|---|---|---|---|---|---|
| | | | total µg | µg/DSCM[b] | total µg | µg/DSCM[c] |
| Phenanthrene | $C_{14}H_{10}$ | 0.89 | 125 | 104 | 110 | 86.5 |
| Anthracene | $C_{14}H_{10}$ | ND | 8.5 | 7.10 | 23 | 18.0 |
| Fluoranthene | $C_{16}H_{10}$ | 0.46 | 3.8 | 2.50 | 17 | 13.0 |
| Pyrene | $C_{16}H_{10}$ | 1.04 | 9.9 | 6.4 | 34 | 25.8 |
| Benz(a)anthracene | $C_{18}H_{12}$ | 0.04 | 0.3 | 0.217 | 1.0 | 0.751 |
| Chrysene | $C_{18}H_{12}$ | 0.11 | 1.5 | 1.16 | 3.4 | 2.57 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND | 0.6 | 0.502 | 0.3 | 0.235 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND | 0.6 | 0.502 | 0.3 | 0.235 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | ND | 0 | ND | 0 |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND | 0.2 | 0.167 | 0.7 | 0.547 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND | ND | 0 | 0.4 | 0.313 |
| Perylene | $C_{20}H_{12}$ | ND | 0.2 | 0.167 | 0.2 | 0.156 |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND | 0.1 | 0.084 | 0.4 | 0.313 |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | ND | 0 | ND | 0 |

ND = Not Detected

[a]The blank is subtracted for the µg/DSCM calculation

[b]1.1963 DSCM sampled

[c]1.2789 DSCM sampled

[d]Conventional operation

[e]Recycle operation

APPENDIX E.7

ANALYTICAL SAMPLE MATRICES

INCLUDES

E.7.1 Conventional Test Series Matrices

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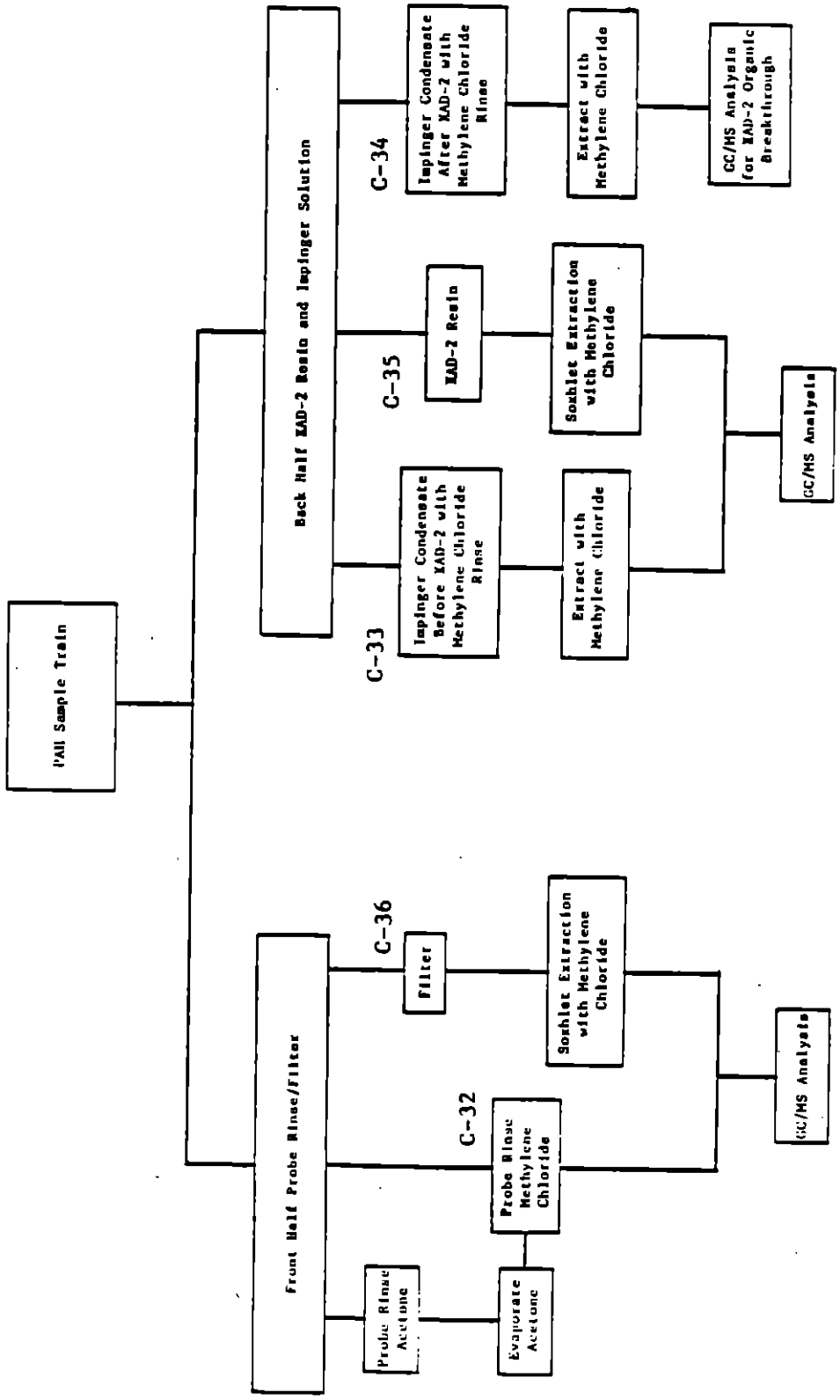
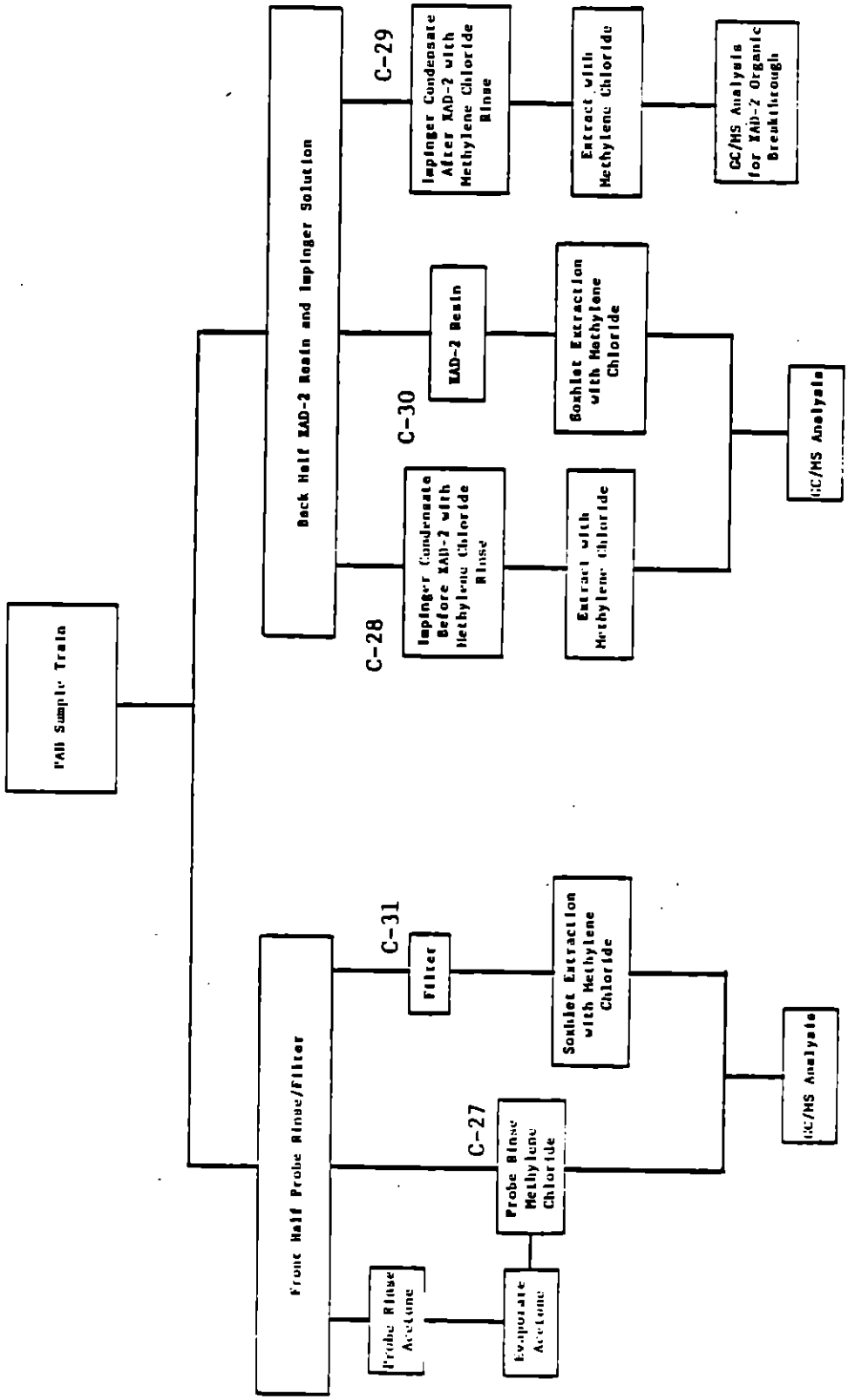


RADIAN CORPORATION

CAM-1109-BAP-Out-Blank



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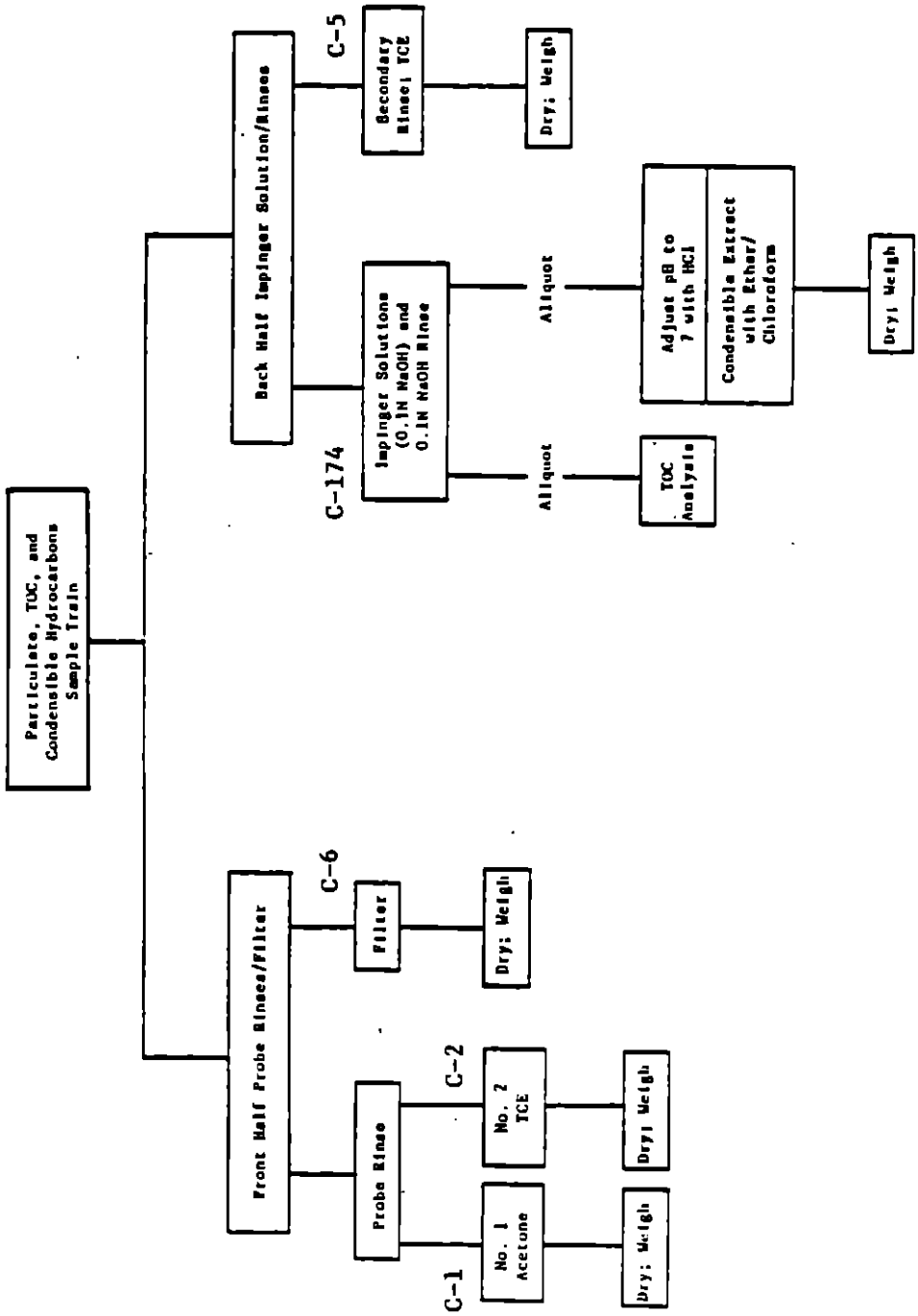
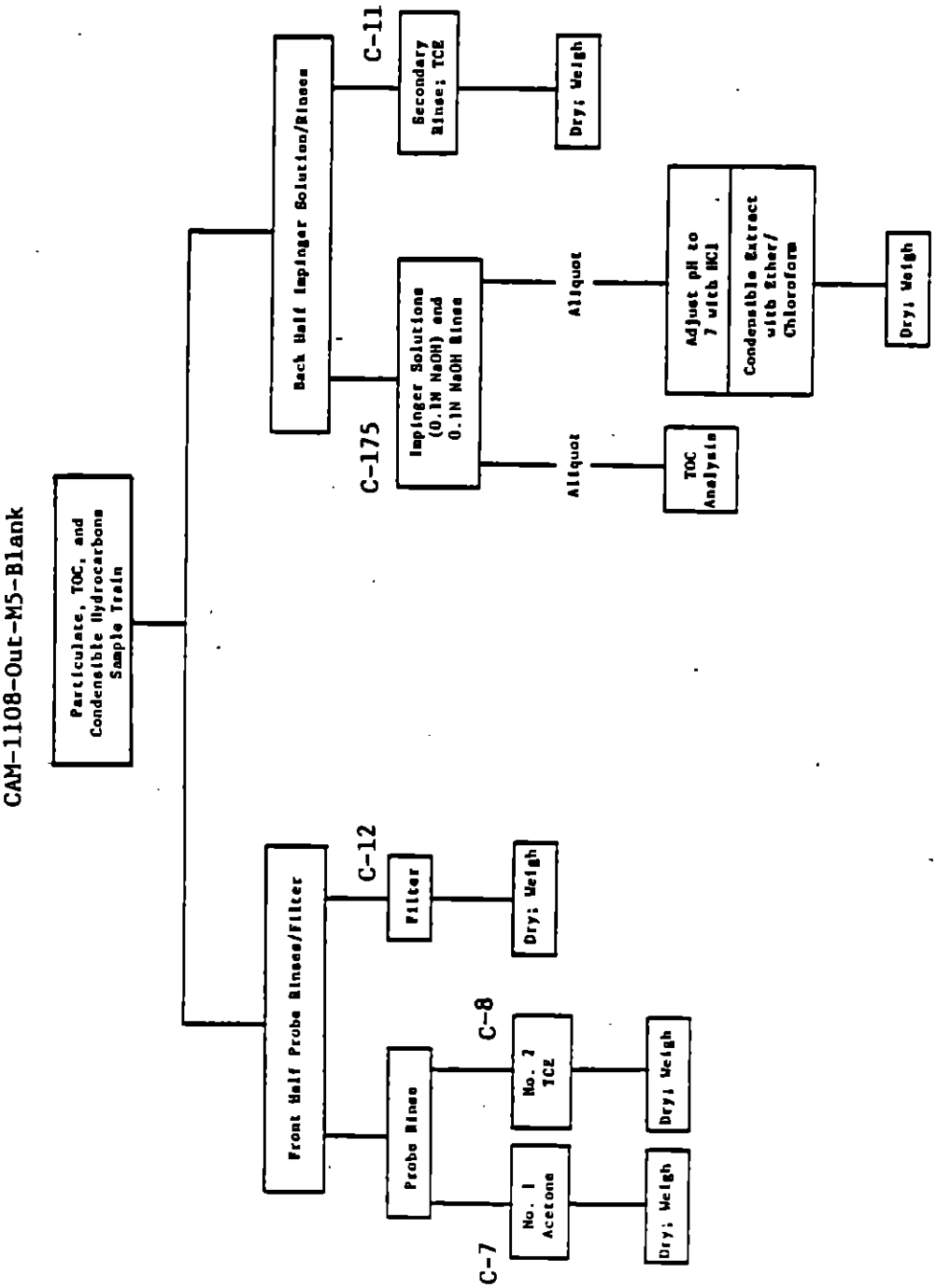


RADIAN
CORPORATION

CAM-1108-Out-M5-Blank



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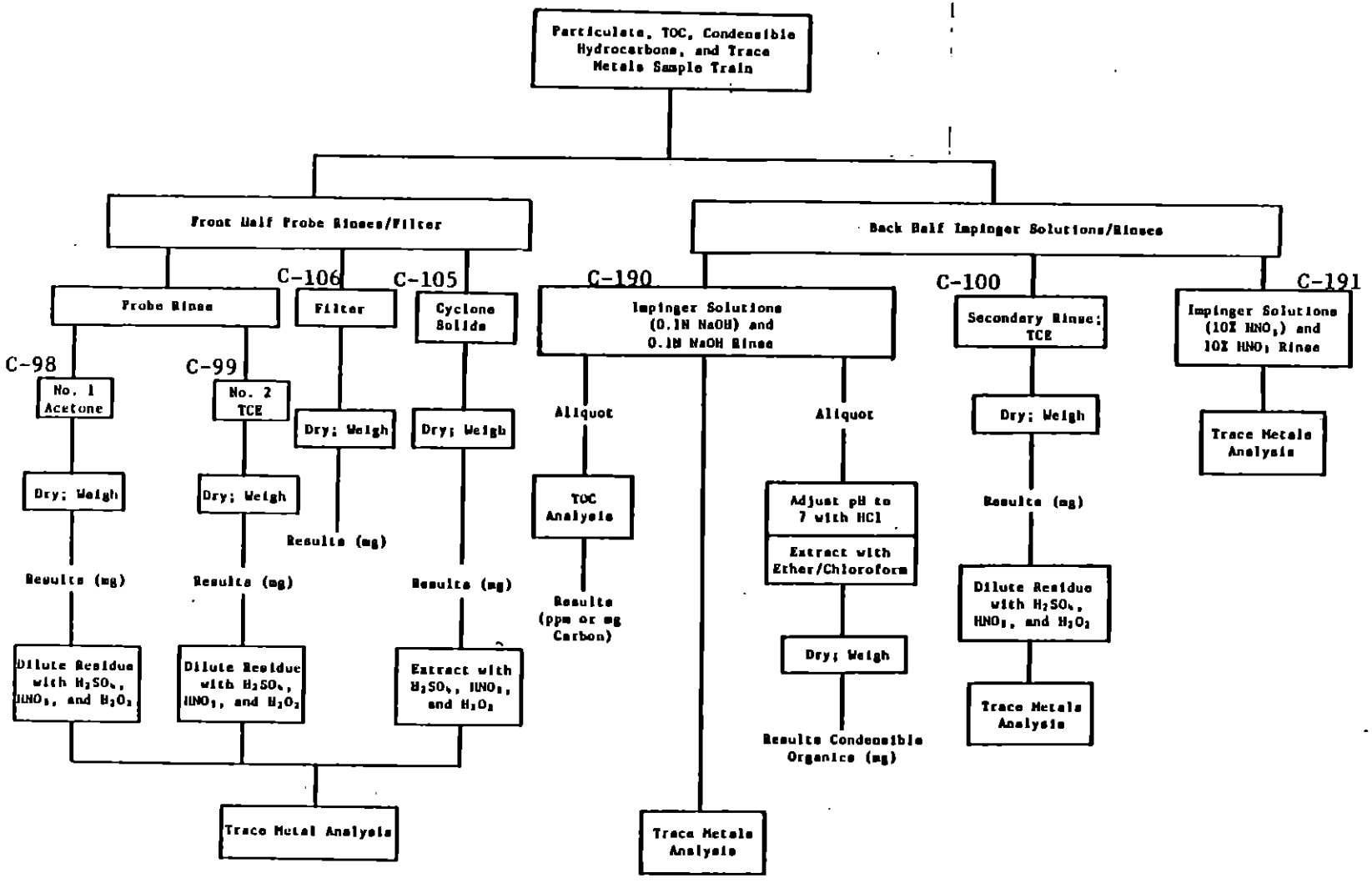

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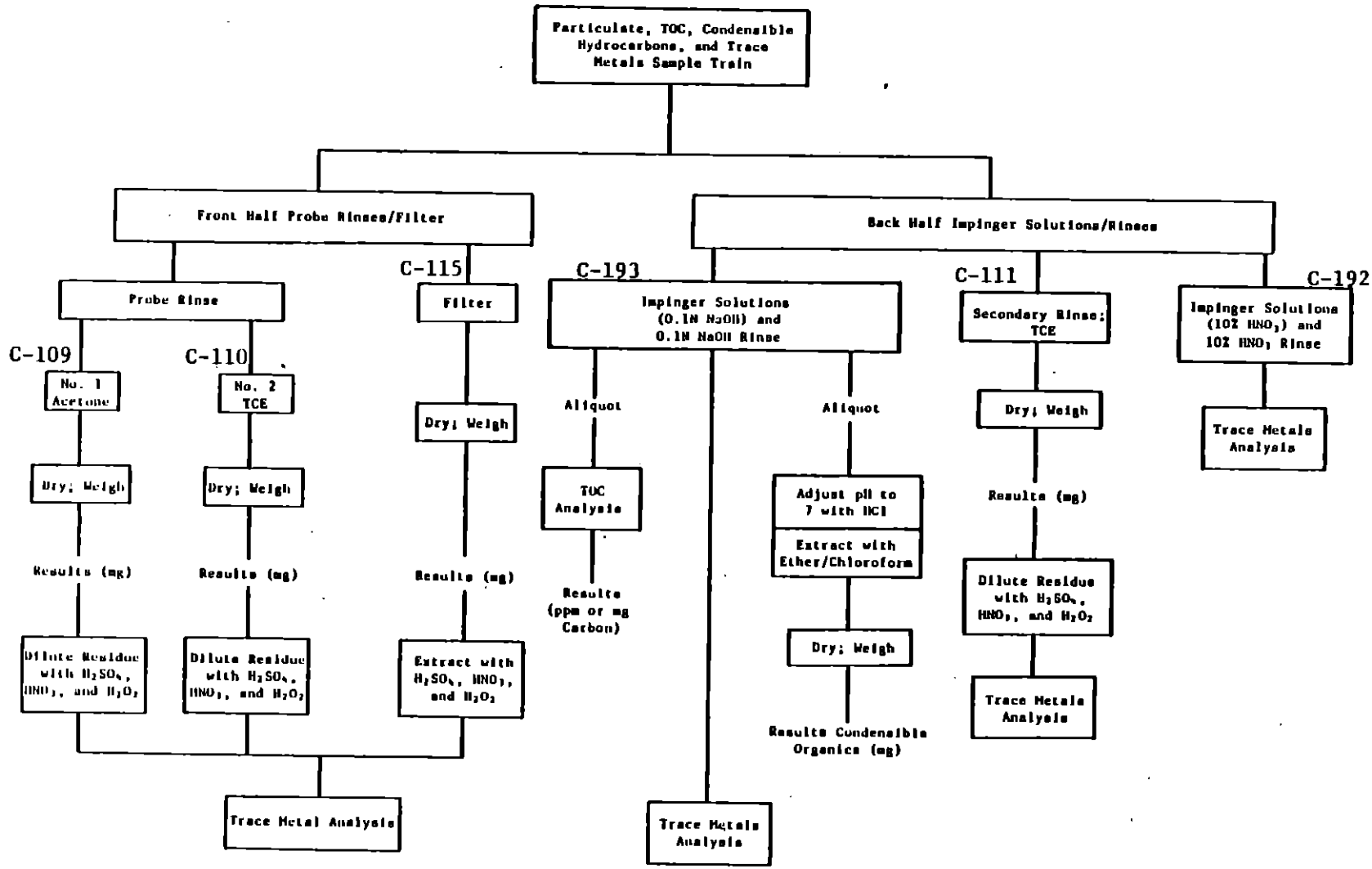

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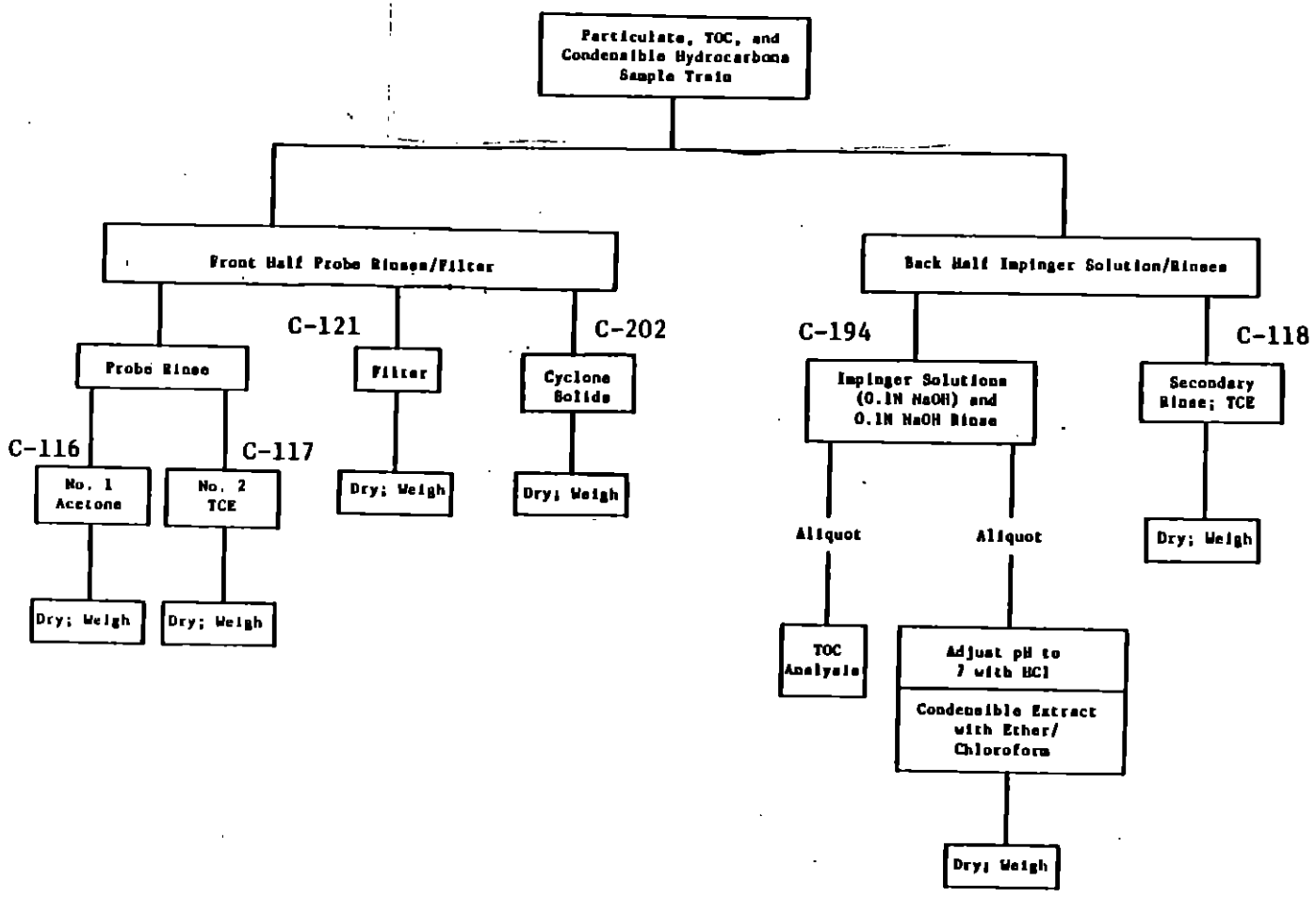
CAM-1113-PAH-In-01



RADIAN
CORPORATION

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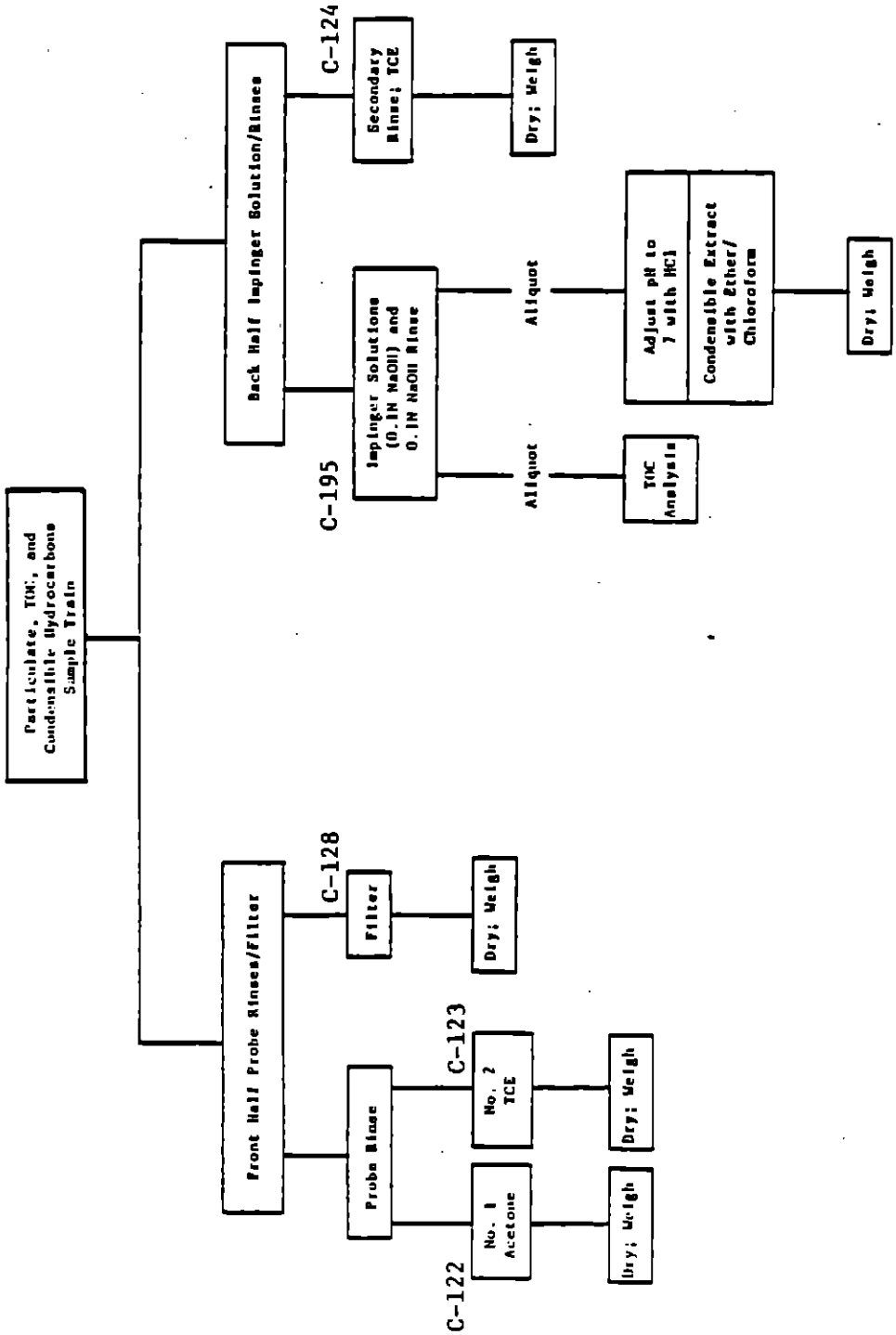

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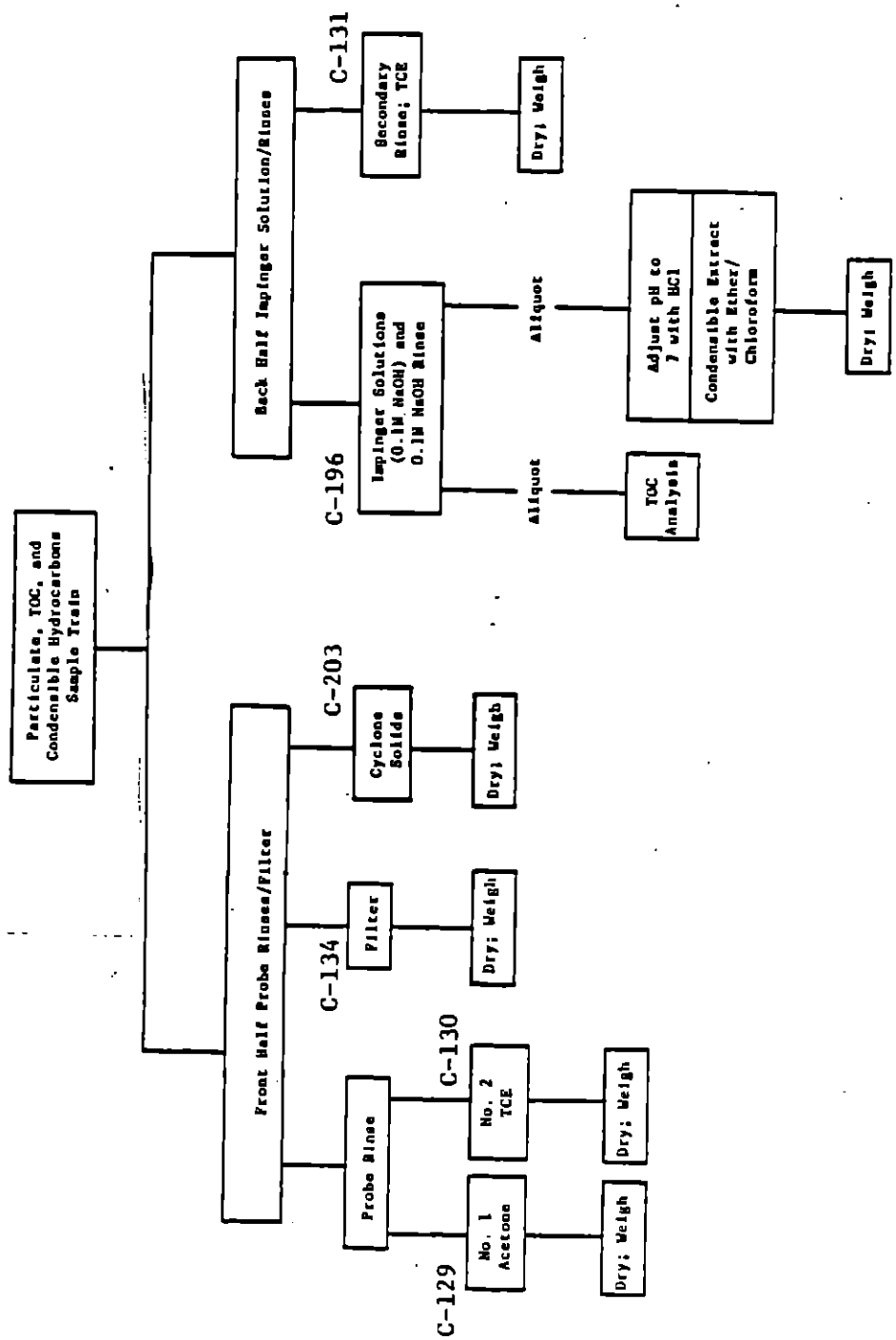

RADIAN CORPORATION

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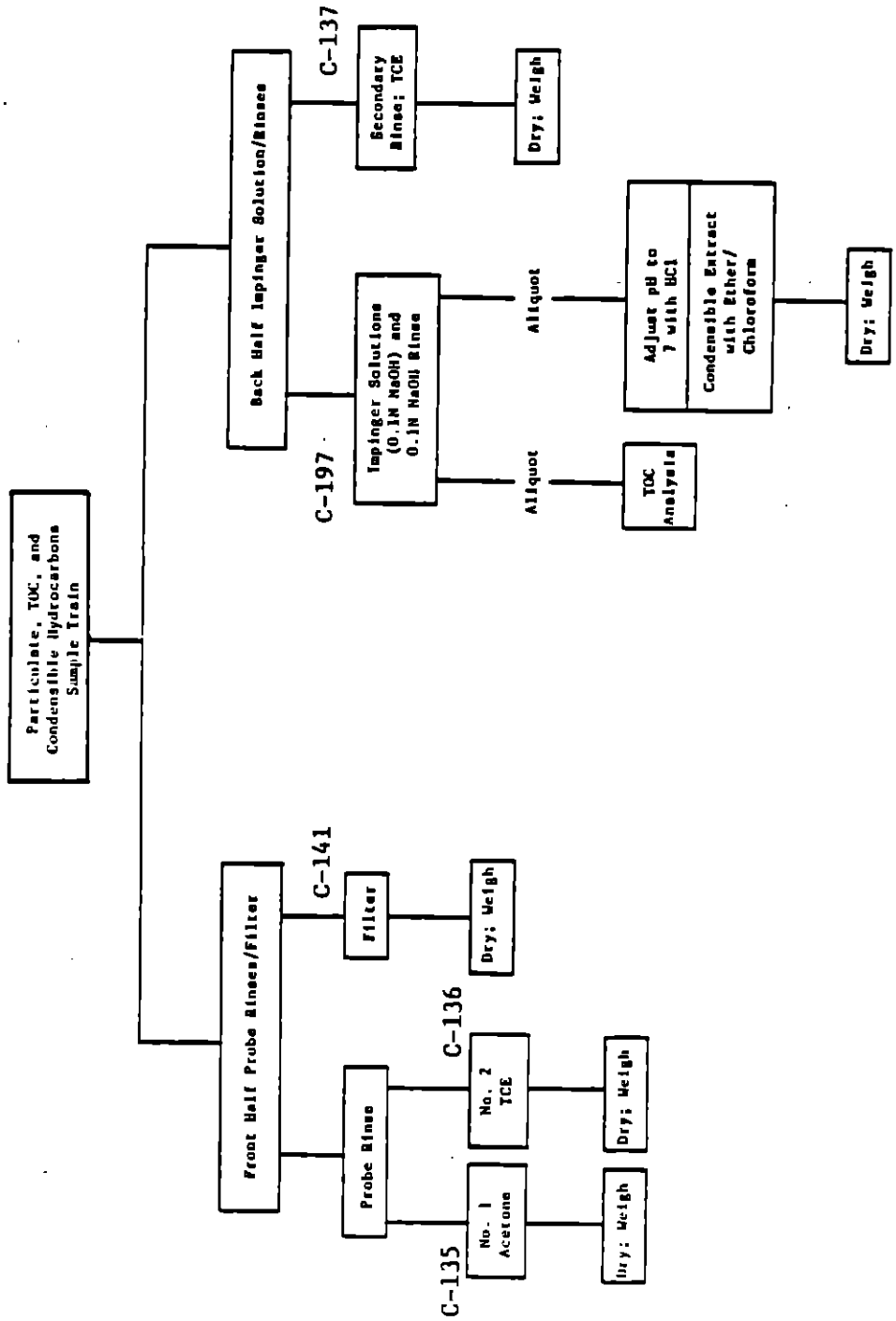

APPENDIX E.7

ANALYTICAL SAMPLE MATRICES

INCLUDES

E.7.2 Recycle Test Series Matrices

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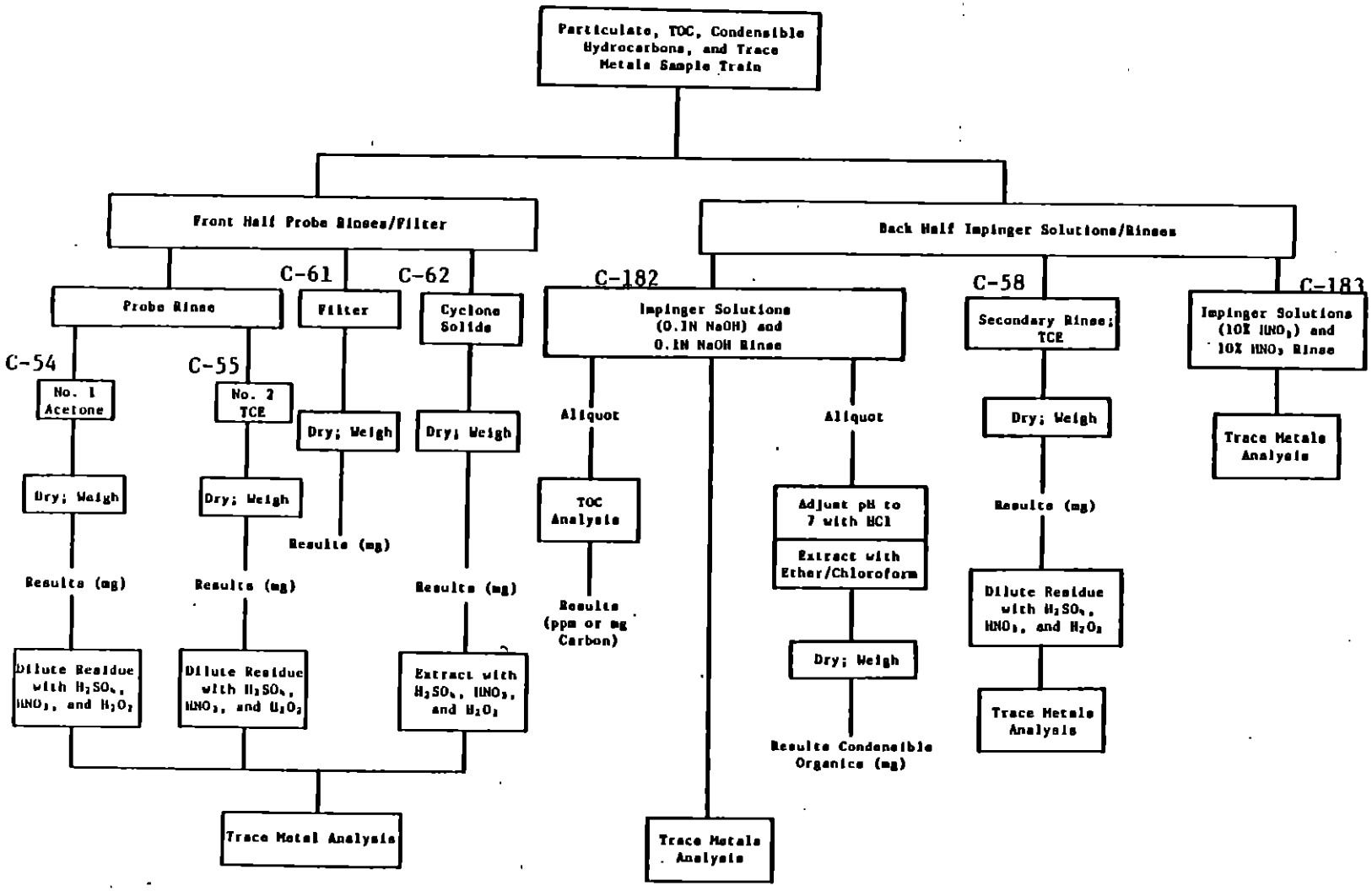
CAM-1111-TM-In-01



RADIAN CORPORATION

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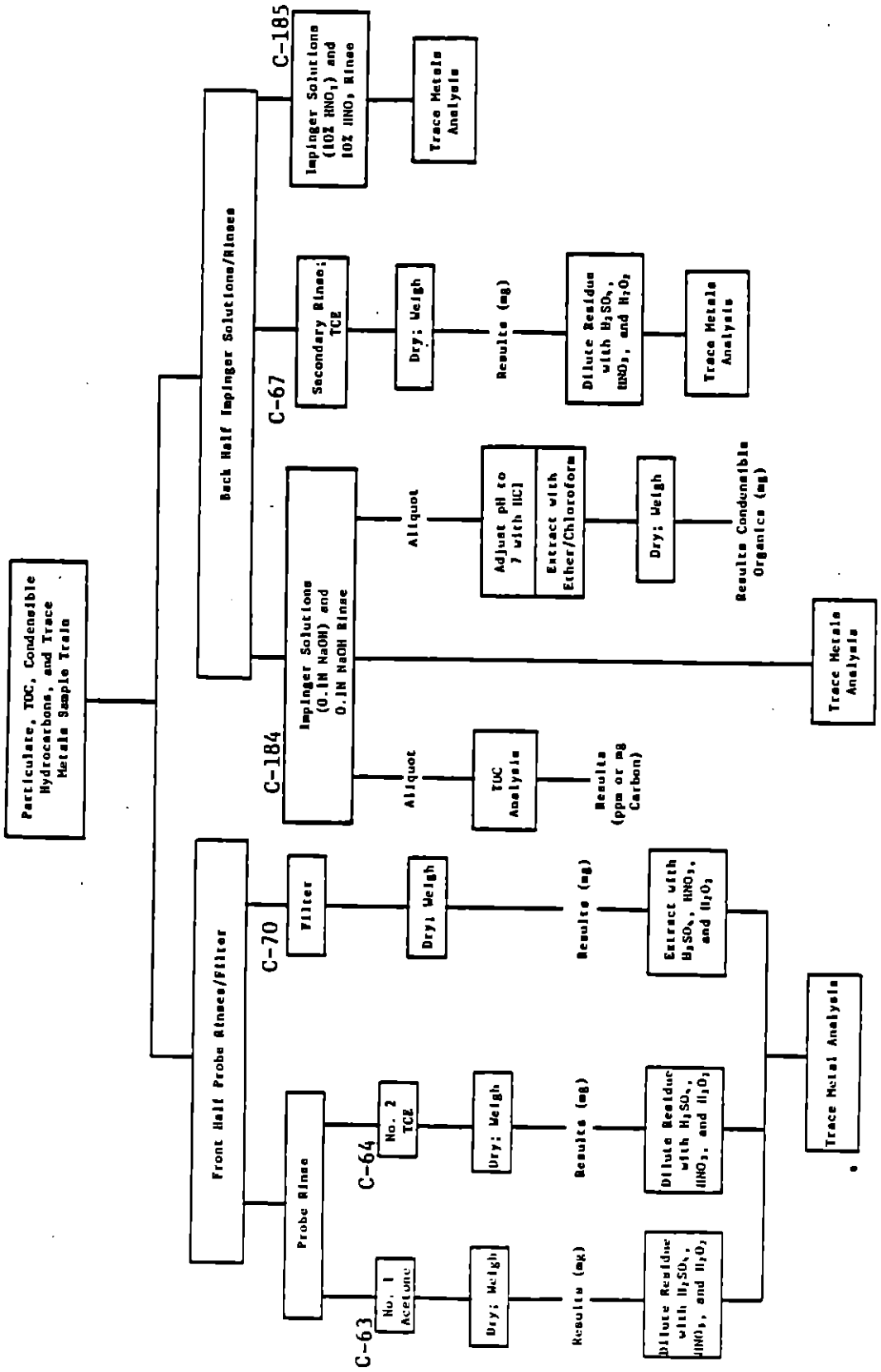

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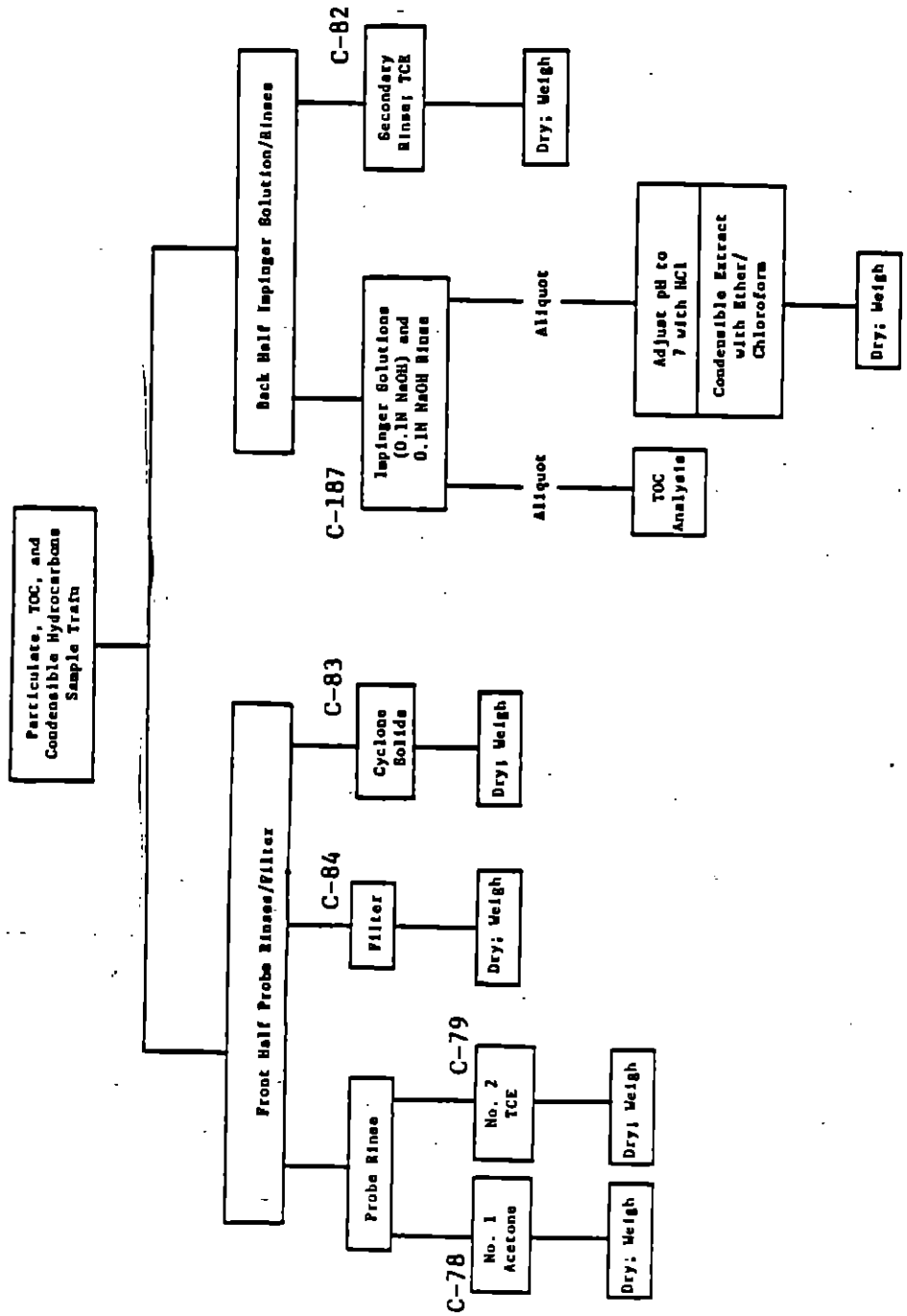

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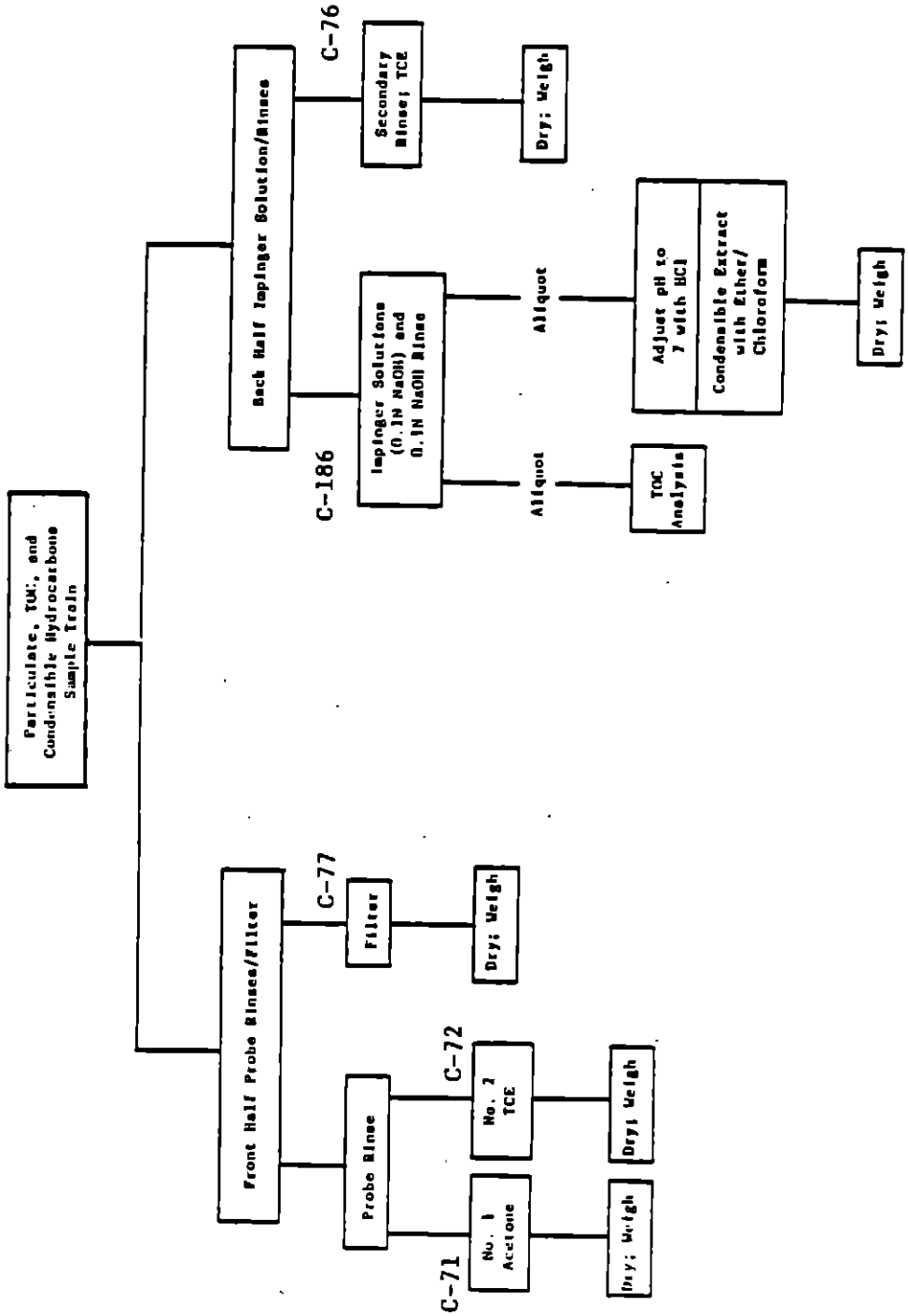

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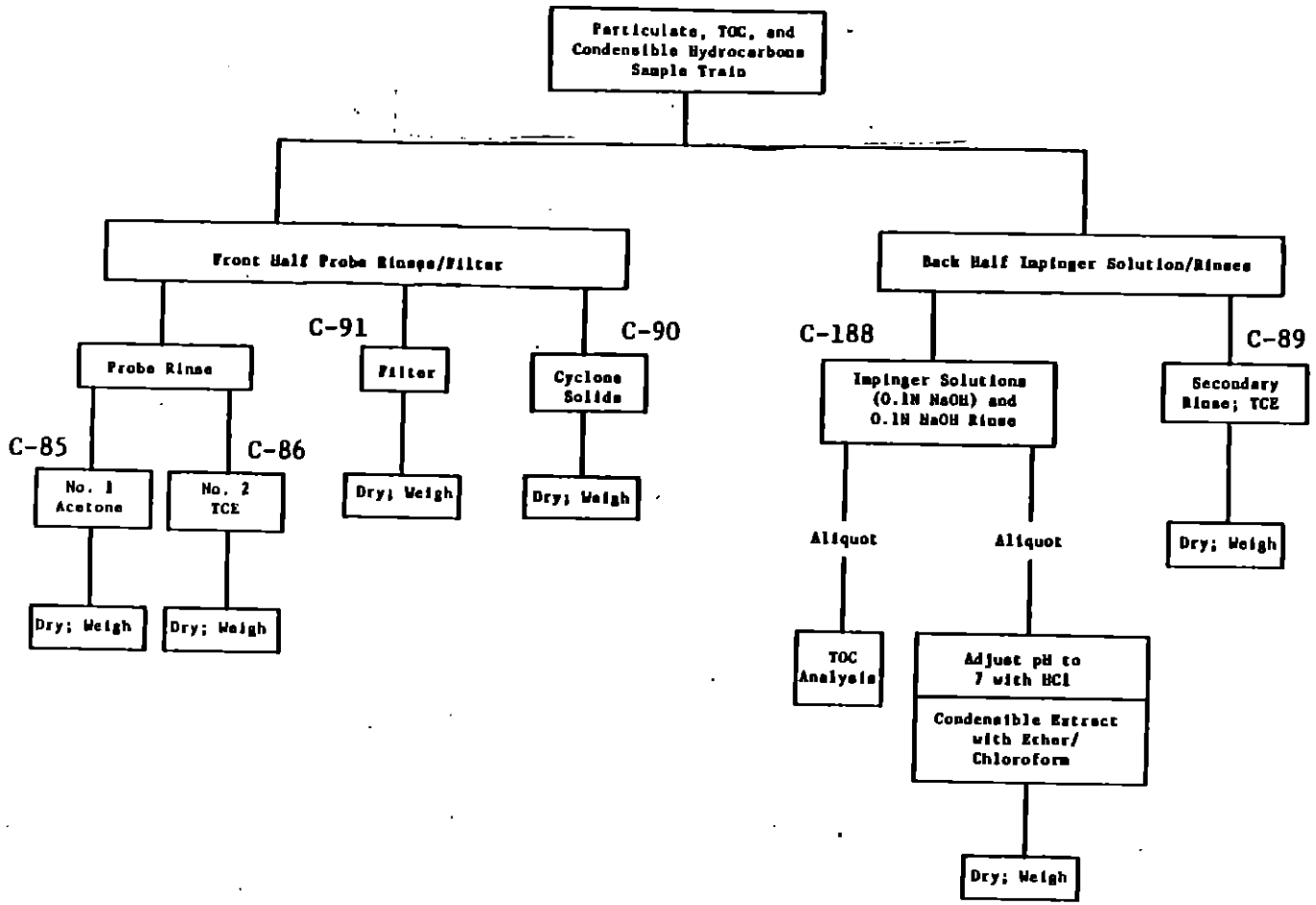

RADIAN
CORPORATION

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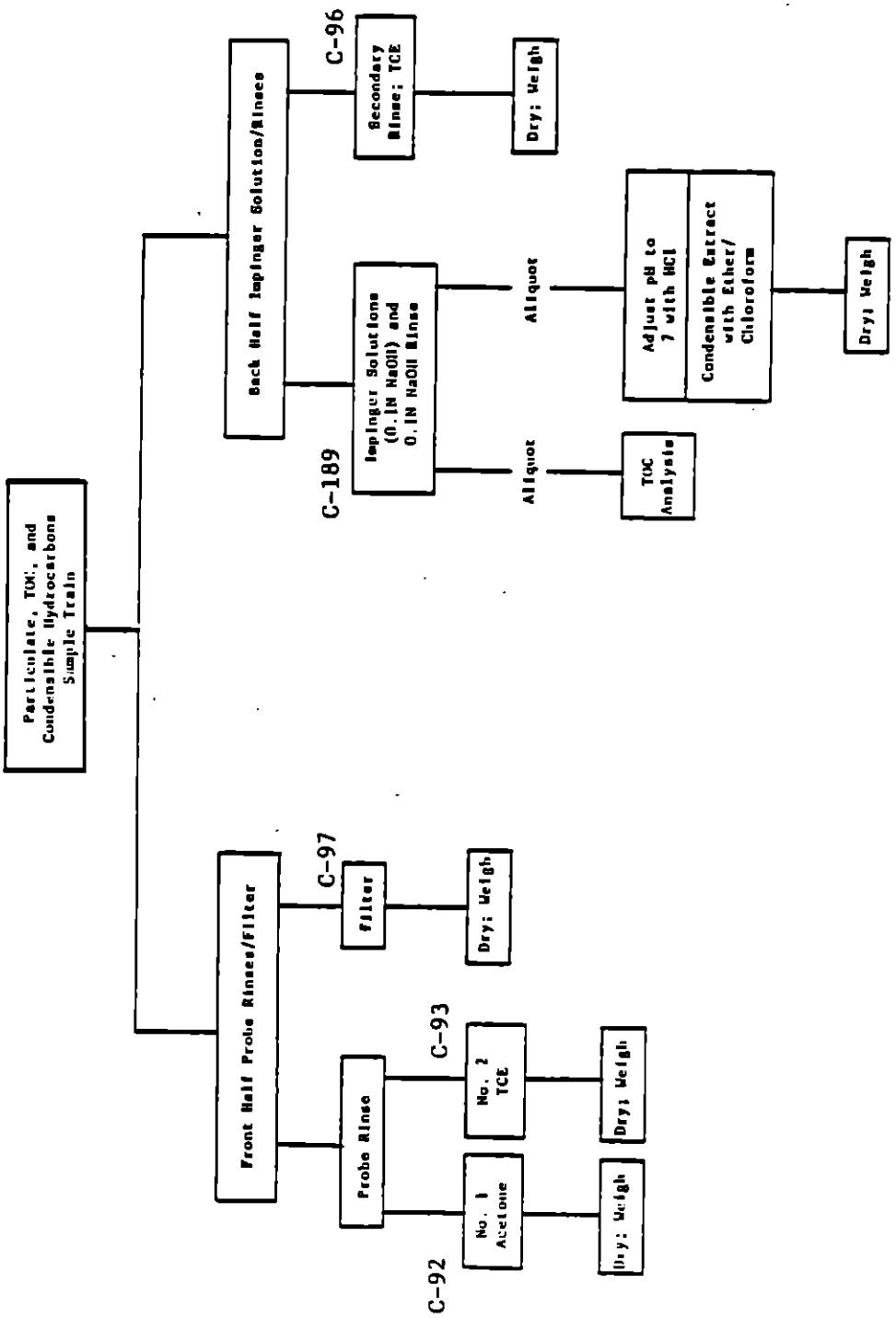

RADIAN CORPORATION

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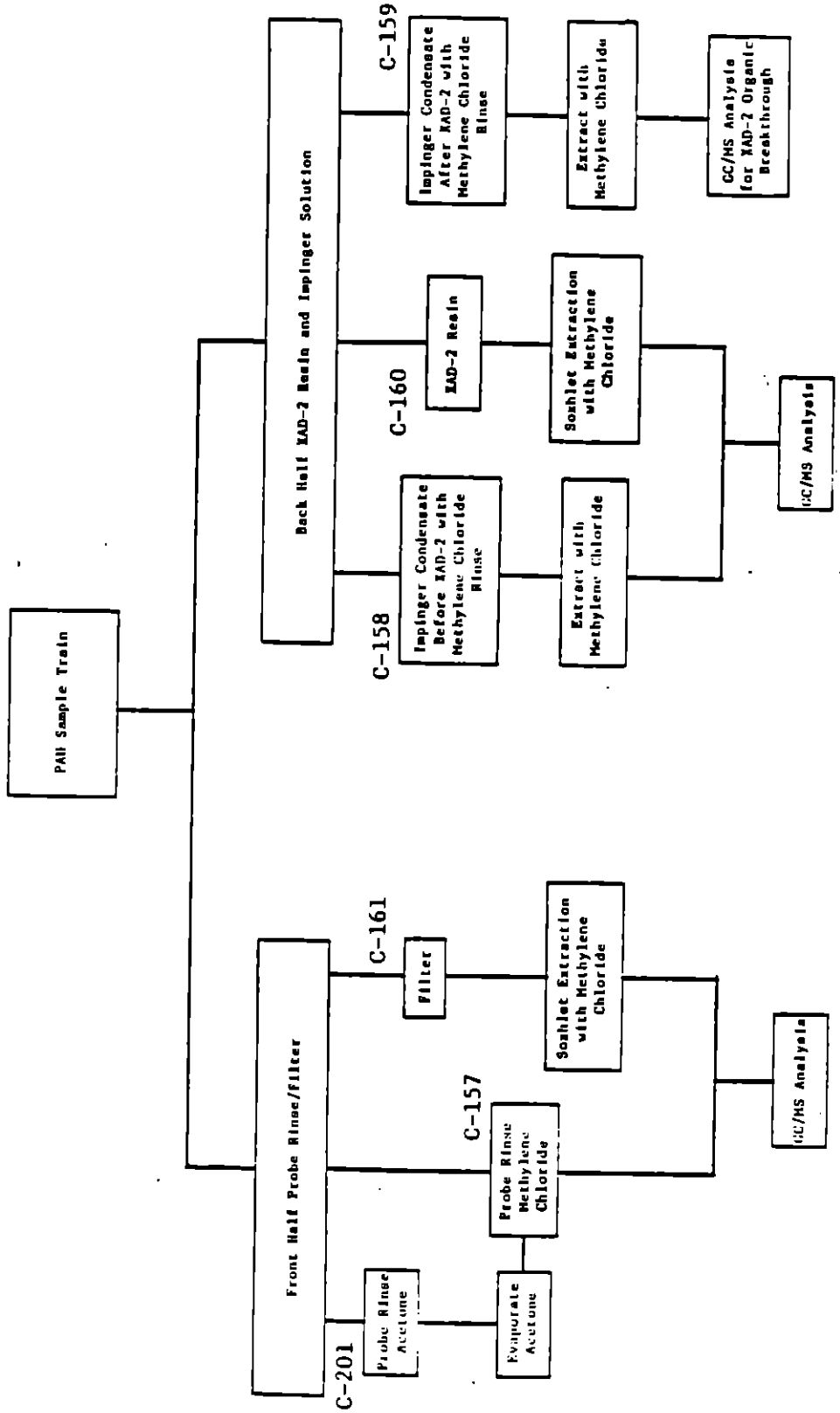

RADIAN CORPORATION

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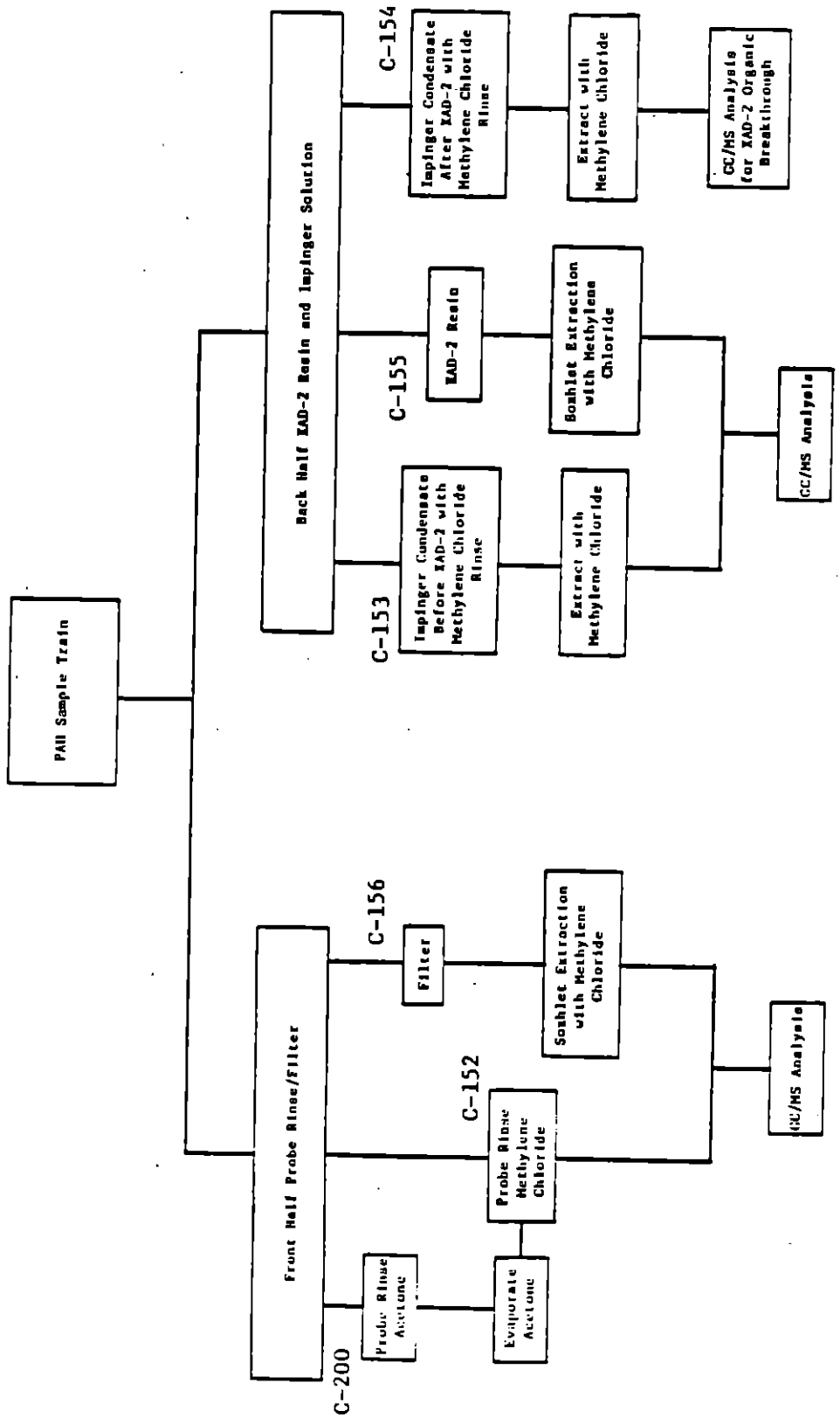

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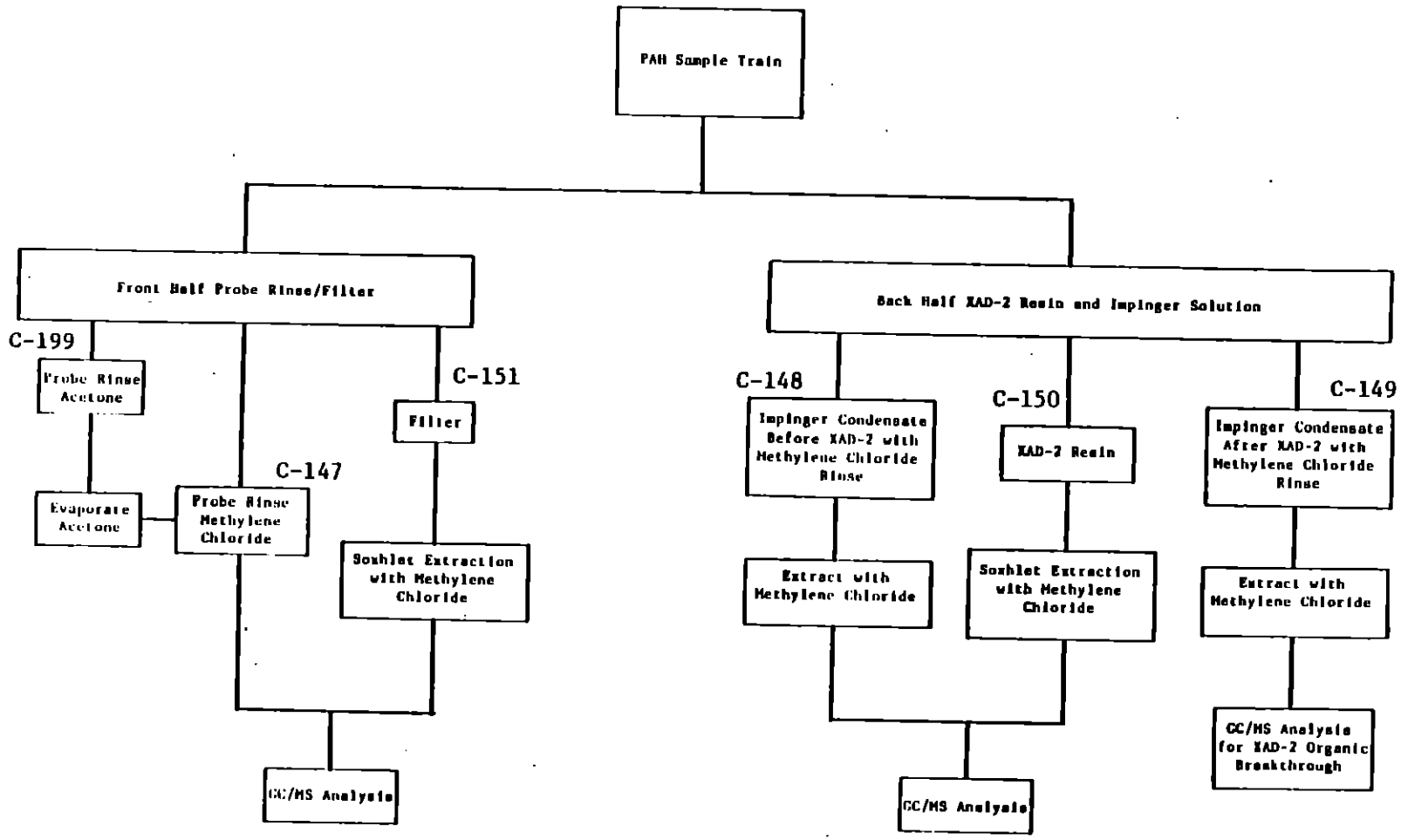

RADIAN CORPORATION

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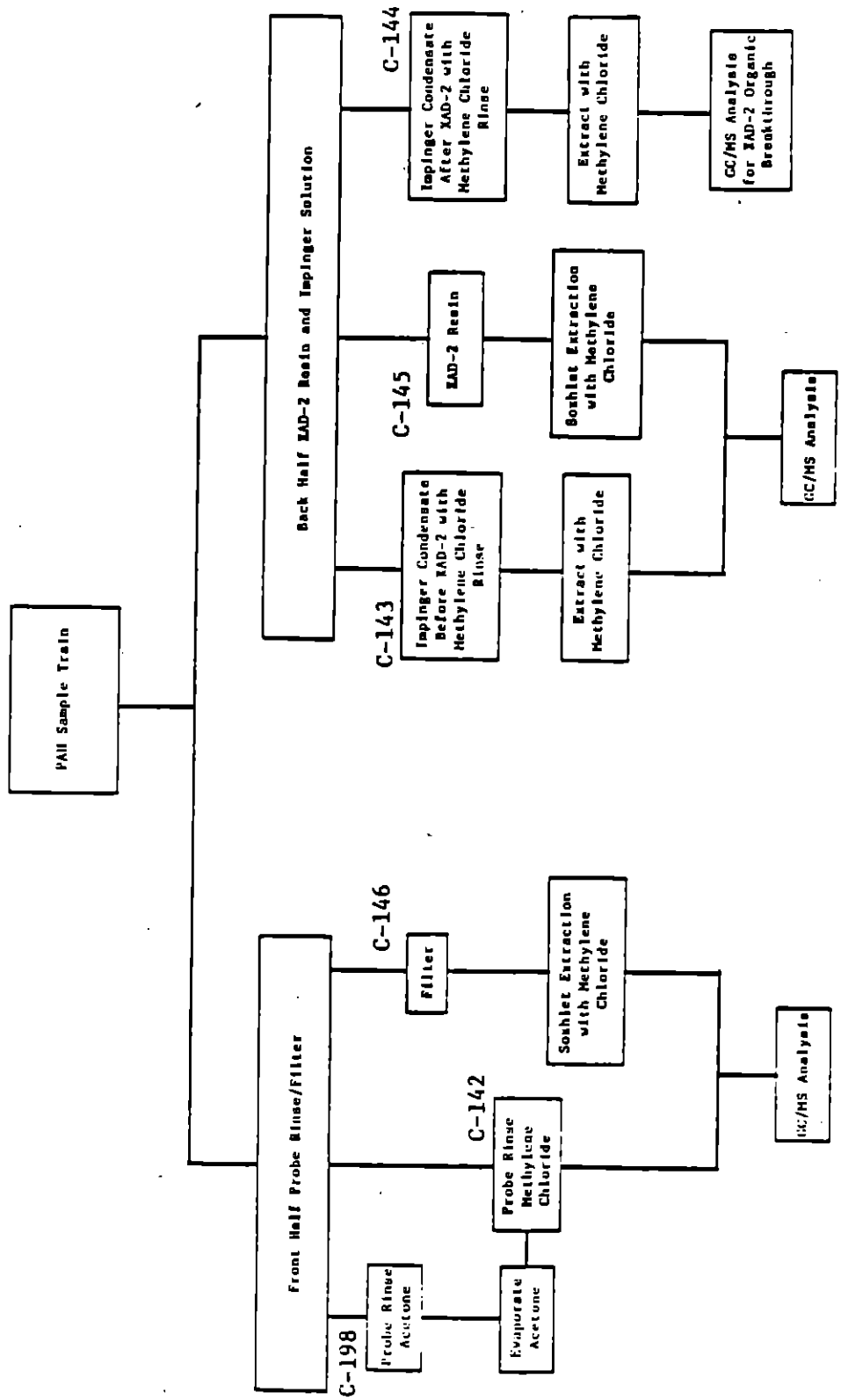

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

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May 1984

Air

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Ref 37(d)

EPA

# Asphalt Concrete Industry

# Emission Test Report T.J. Campbell Company Oklahoma City, Oklahoma

## Volume 3

DCN 222-078-03-12

# EMISSION TEST REPORT

# T.J. CAMPBELL ASPHALT CONCRETE PLANT

# OKLAHOMA CITY, OKLAHOMA

Final Report
Appendices F through L
Volume 3

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APPENDIX F

PROCESS SAMPLING AND MONITORING INFORMATION

INCLUDES

F.1 Conventional Operation Data
- F.1.1 Virgin Aggregate Percent Moisture
  - F.1.1.1 Summary of Results
  - F.1.1.2 Laboratory Notebook Data
- F.1.2 Uncontrolled Emissions Wet Bulb/Dry Bulb Measurements
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- F.1.4 Water Flow Rates

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- F.2.4 Water Flow Measurements

F.3 Liquid Asphalt Cement Data
- F.3.1 Sample Collection Data

F.4 T.J. Campbell Solids Balance
- F.4.1 Solids Balance Data Summary

APPENDIX F.1

CONVENTIONAL OPERATIONS DATA

INCLUDES

F.1.1 Virgin Aggregate Data
F.1.1.1 Summary of Results

F.1.1.1 Summary of Results

Table F.1.1.1 Virgin Aggregate Percent Moisture

| Date | Time | % Moisture |
|---|---|---|
| 11-08-83 | 1400 | 2.34 |
| ↓ | 1512 | 2.70 |
| ↓ | 1605 | 3.05 |
| 11-12-83 | 1345 | 2.68 |
| 11-13-83 | 0920 | 2.32 |
| 11-14-83 | 0850 | 2.64 |
| ↓ | 1235 | 2.62 |

APPENDIX F.1

CONVENTIONAL OPERATION DATA

INCLUDES

F.1.1 Virgin Aggregate Percent Moisture
F.1.1.2 Laboratory Notebook Data

TITLE Moisture

Project No.

Book No.

From Page No.

| Date | Sample ID | | Initial weight | Tare weight | Sample weight | final weight | weight loss | % |
|---|---|---|---|---|---|---|---|---|
| 11-10 | U.A | 1400 | 174.96 | 69.81 | 105.15 | 172.50 | 2.46 | 2.3 |
| | " | 1512 | 181.73 | 73.51 | 108.22 | 178.81 | 2.92 | 2.7 |
| | " | 1605 | 163.05 | 55.27 | 107.78 | 159.76 | 3.29 | 3.05 |
| 11-10 | U.A. | 1100 | 920.9 | 16.97 | 903.93 | 902.2 | 18.70 | 2.0 |
| | " | " | 246.74 | 69.82 | 176.92 | 243.35 | 3.39 | 1.92 |
| 11-11 | U.A. | 0900 | 607.4 | 17.09 | 590.31 | 598.8 | 8.60 | 1.4 |
| | R.A.P. | 0900 | 456.3 | 17.19 | 439.11 | 449.8 | 6.50 | 1.48 |
| | U.A. | 1440 | 923.5 | 16.48 | 907.01 | 906.9 | 16.60 | 1.8 |
| | RAP. | 1440 | 845.6 | 16.53 | 829.07 | 834.0 | 11.60 | 1.4 |
| 11-12 | U.A | 0835 | 733.9 | 17.05 | 716.85 | 725.3 | 8.60 | 1.20 |
| | RAP | 0835 | 516.6 | 17.40 | 499.20 | 506.0 | 10.60 | 2.1 |
| | U.A. | 1315 | 666.0 | 16.98 | 649.02 | 648.6 | 17.40 | 2.68 |
| 11-13 | U.A. | 0920 | 675.6 | 17.01 | 658.59 | 660.3 | 15.30 | 2.3 |
| 11-14 | U.A | 0850 | 668.8 | 17.00 | 651.8 | 651.6 | 17.20 | 2.64 |
| | U.A. | 1235 | 716.9 | 17.26 | 699.64 | 698.6 | 18.30 | 2.6 |
| 11-15 | U.A. | 0915 | 637.7 | 16.97 | 620.73 | 595.0 | 42.70 | 6.8 |
| | RA.P. | 0915 | 573.1 | 17.25 | 555.85 | 546.0 | 27.10 | 4.8 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by

APPENDIX F.1

CONVENTIONAL OPERATION DATA

INCLUDES

F.1.2 Uncontrolled Emissions Wet Bulb/Dry Bulb Measurements

Table F.1.2 Uncontrolled Emissions Wet Bulb/Dry Bulb Measurements

| Date | Time | Wet Bulb | Dry Bulb | % Moisture |
|---|---|---|---|---|
| 11-08-83 | 1416-1521 | 162 | 297 | 31% |
| 11-12-83 | 1151-1243 | 172 | 313 | 40% |
| 11-12-83 | 1418-1520 | 172 | 309 | 40% |
| 11-13-83 | 0956-1050 | 163 | 289 | 32% |
| 11-14-83 | 0827-0936 | 174 | 315 | 42% |
| 11-14-83 | 1014-1143 | 169 | 313 | 37% |
| 11-14-83 | 1301-1426 | 176 | 309 | 44% |
| 11-15-83 | 1225-1400 | 176 | 298 | 44% |

APPENDIX F.1

CONVENTIONAL OPERATION DATA

INCLUDES

F.1.3 Pressure Drop Measurements

Table F.1.3 Pressure Drop Measurements

| Date | Time | ΔP Inches W.C. |
|---|---|---|
| 11-12-83 | 1100 | 13.5 |
| | 1200 | 13.5 |
| | 1320 | 13.5 |
| | 1301 | 13.5 |
| | 1330 | 13.5 |
| | 1400 | 13.5 |
| | 1430 | 13.5 |
| | 1501 | 13.5 |
| 11-13-83 | 0801 | 13.5 |
| | 0829 | 13.5 |
| | 0858 | 13.5 |
| | 0929 | 13.5 |
| | 0959 | 13.5 |
| | 1030 | 13.5 |
| | 1105 | 13.5 |
| | 1129 | 13.0 |
| 11-14-83 | 0803 | 13.5 |
| | 0830 | 13.5 |
| | 0900 | 13.5 |
| | 0930 | 13.5 |
| | 1000 | 13.5 |
| | 1030 | 13.5 |
| | 1108 | 13.5 |
| | 1130 | 13.5 |
| | 1200 | 13.5 |
| | 1230 | 13.5 |
| | 1300 | 13.5 |
| | 1406 | 13.0 |
| 11-15-83 | 1207 | 13.0 |
| | 1230 | 13.0 |
| | 1300 | 13.0 |
| | 1355 | 13.0 |

APPENDIX F.1

CONVENTIONAL OPERATION DATA

INCLUDES

F.1.4 Water Flow Measurements

Table F.1.4 Water Flow Rates

| Date | Time | Water Flow Rates Total gpm | Venturi gpm |
|---|---|---|---|
| 11-12-83 | 1100 | 215 | 41 |
| | 1130 | 215 | 41 |
| | 1200 | 220 | 41 |
| | 1230 | 220 | 41 |
| | 1301 | 220 | 42 |
| | 1330 | 220 | 42 |
| | 1400 | 220 | 42 |
| | 1430 | 220 | 42 |
| | 1501 | 220 | 42 |
| 11-13-83 | 0801 | 215 | 41 |
| | 0829 | 220 | 42 |
| | 0858 | 215 | 42 |
| | 0929 | 220 | 42 |
| | 0959 | 220 | 42 |
| | 1030 | 220 | 42 |
| | 1105 | 220 | 42 |
| | 1129 | 220 | 42 |
| 11-14-83 | 0803 | 215 | 42 |
| | 0830 | 215 | 42 |
| | 0900 | 215 | 41 |
| | 0930 | 215 | 41 |
| | 1000 | 215 | 42 |
| | 1030 | 215 | 42 |
| | 1108 | 220 | 42 |
| | 1130 | 220 | 42 |
| | 1200 | 220 | 43 |
| | 1230 | 220 | 42 |
| | 1300 | 220 | 42 |
| | 1406 | 220 | 42 |
| 11-15-83 | 1207 | 210 | 30 |
| | 1230 | 210 | 30 |
| | 1300 | 220 | 30 |

APPENDIX F.2

RECYCLE OPERATIONS DATA

INCLUDES

F.2.1 Virgin Aggregate and Recycle Asphalt Pavement Percent Moisture

F.2.1.1 Summary of Results

F.2.1.1 Summary of Results

Table 2.1.1 Virgin Aggregate Percent Moisture

| Date | Time | % Moisture |
|---|---|---|
| 11-10-83 | 1100 | 2.07 |
| ↓ | 1100 | 1.92 |
| 11-11-83 | 0900 | 1.46 |
| ↓ | 1400 | 1.83 |
| 12-12-83 | 0835 | 1.20 |
| 11-15-83 | 0915 | 6.88 |

Table 2.1.2 Recycle Asphalt Pavement Percent Moisture

| Date | Time | % Moisture |
|---|---|---|
| 11-11-83 | 0900 | 1.48 |
| ↓ | 1440 | 1.40 |
| 11-12-83 | 0835 | 2.12 |
| 11-15-83 | 0915 | 4.88 |

APPENDIX F.2

RECYCLE OPERATION DATA

INCLUDES

F.2.1 Virgin Aggregate and Recycle Asphalt Pavement Percent Moisture
F.2.1.2 Laboratory Notebook Data

TITLE Moisture

Project No.

Book No.

From Page No.

| Date | Sample ID | | Initial weight | Tare weight | Sample weight | Final weight | weight loss | % |
|---|---|---|---|---|---|---|---|---|
| 11-8 | U.A | 1400 | 174.96 | 69.81 | 105.15 | 172.50 | 2.46 | 2.3 |
| | " | 1512 | 181.73 | 73.51 | 108.22 | 178.81 | 2.92 | 2.7 |
| | " | 1605 | 163.05 | 55.27 | 107.78 | 159.76 | 3.29 | 3.0 |
| 11-10 | U.A. | 1100 | 920.9 | 16.97 | 903.93 | 902.2 | 18.70 | 2.07 |
| | " | " | 246.74 | 69.82 | 176.92 | 243.35 | 3.39 | 1.92 |
| 11-11 | U.A. | 0900 | 607.4 | 17.09 | 590.31 | 598.8 | 8.60 | 1.46 |
| | R.A.P. | 0900 | 456.3 | 17.19 | 439.11 | 449.8 | 6.50 | 1.48 |
| | U.A. | 1440 | 923.5 | 16.48 | 907.01 | 906.9 | 16.60 | 1.83 |
| | RAP. | 1440 | 845.6 | 16.53 | 829.07 | 834.0 | 11.60 | 1.40 |
| 11-12 | U.A | 0835 | 733.9 | 17.05 | 716.85 | 725.3 | 8.60 | 1.20 |
| | RAP | 0835 | 516.6 | 17.40 | 499.20 | 506.0 | 10.60 | 2.12 |
| | V.A. | 1345 | 666.0 | 16.98 | 649.02 | 648.6 | 17.40 | 2.68 |
| 11-13 | UA. | 0920 | 675.6 | 17.01 | 658.59 | 660.3 | 15.30 | 2.32 |
| 11-14 | V.A | 0850 | 668.8 | 17.00 | 651.8 | 651.6 | 17.20 | 2.64 |
| | V.A. | 1235 | 716.9 | 17.26 | 699.64 | 698.6 | 18.30 | 2.62 |
| 11-15 | U.A. | 0915 | 637.7 | 16.97 | 620.73 | 595.0 | 42.70 | 6.88 |
| | RAP. | 0915 | 573.1 | 17.25 | 555.85 | 546.0 | 27.10 | 4.88 |

To Page No.

Witnessed & Understood by me, | Date | Invented by | Date

APPENDIX F.2

RECYCLE OPERATION DATA

INCLUDES

F.2.2 Uncontrolled Emissions Wet Bulb/Dry Bulb Measurements

Table F.2.2 Uncontrolled Emissions Wet Bulb/Dry Bulb

| Date | Time | Wet Bulb | Dry Bulb | % Moisture |
|---|---|---|---|---|
| 11-15-83 | 0909-1005 | 181 | 313 | 50 |

APPENDIX F.2

RECYCLE OPERATION DATA

INCLUDES

F.2.3 Pressure Drop Measurements

Table F.2.3 Pressure Drop Measurements

| Date | Time | ΔP Inches W.C. |
|---|---|---|
| 11-10-83 | 0930 | 13.5 |
| | 1000 | 13.5 |
| | 1033 | 13.5 |
| | 1100 | 13.5 |
| | 1130 | 13.5 |
| | 1401 | 14.0 |
| | 1431 | 14.0 |
| | 1457 | 13.5 |
| | 1531 | 14.0 |
| | 1552 | 14.0 |
| | 1612 | 14.0 |
| 11-11-83 | 0837 | 12.5 |
| | 0901 | 12.5 |
| | 0930 | 12.5 |
| | 1001 | 14.5 |
| | 1030 | 14.5 |
| | 1100 | 14.5 |
| | 1130 | 14.5 |
| | 1210 | 14.0 |
| | 1230 | 14.0 |
| | 1300 | 14.0 |
| | 1332 | 14.0 |
| | 1400 | 14.0 |
| | 1430 | 14.0 |
| | 1501 | 14.0 |
| | 1531 | 13.5 |
| | 1602 | 13.5 |
| | 1630 | 14.0 |
| | 1700 | 14.0 |
| | 1726 | 14.0 |
| 11-12-83 | 0700 | 14.0 |
| | 0730 | 14.0 |
| | 0801 | 14.0 |
| | 0830 | 14.0 |
| | 0900 | 13.5 |
| 11-15-83 | 0738 | 13.0 |
| | 0800 | 13.0 |
| | 0830 | 13.0 |
| | 0903 | 13.0 |
| | 0930 | 13.0 |
| | 0957 | 12.5 |
| | 1030 | 12.5 |
| | 1055 | 12.5 |

APPENDIX F.2

RECYCLE OPERATION DATA

INCLUDES

F.2.4 Water Flow Measurements

Table F.2.4 Water Flow Measurements

| Date | Time | Water Flow Rates Total gpm | Ventori gpm |
|---|---|---|---|
| 11-10-83 | 1000 | 250 | 40 |
| | 1033 | 250 | 50 |
| | 1100 | 250 | 40 |
| | 1130 | 260 | 41 |
| | 1401 | 230 | 40 |
| | 1431 | 230 | 40 |
| | 1457 | 44[1] | 44 |
| | 1531 | 44[1] | 44 |
| | 1552 | 220 | 40 |
| | 1612 | 230 | 42 |
| 11-11-83 | 0837 | 235 | 40 |
| | 0901 | 235 | 40 |
| | 0930 | 225 | 40 |
| | 1001 | 220 | 38 |
| | 1030 | 220 | 41 |
| | 1100 | 220 | 41 |
| | 1130 | 220 | 41 |
| | 1210 | 220 | 41 |
| | 1230 | 220 | 42 |
| | 1300 | 220 | 41 |
| | 1332 | 220 | 42 |
| | 1400 | 220 | 42 |
| | 1430 | 220 | 41 |
| | 1501 | 220 | 41 |
| | 1531 | 220 | 41 |
| | 1602 | 220 | 41 |
| | 1630 | 220 | 42 |
| | 1700 | 220 | 41 |
| | 1726 | 220 | 41 |
| 11-12-83 | 0700 | 215 | 42 |
| | 0730 | 220 | 42 |
| | 0801 | 220 | 41 |
| | 0830 | 220 | 42 |
| | 0900 | 220 | 41 |
| 11-15-83 | 0738 | 210 | 30 |
| | 0800 | 205 | 30 |
| | 0830 | 205 | 30 |
| | 0903 | 225 | 30 |
| | 0930 | 210 | 30 |
| | 0957 | 215 | 30 |
| | 1030 | 210 | 30 |
| | 1055 | 210 | 30 |

[1] water flow to presprays and settling chamber washout was turned off.

APPENDIX F.3

LIQUID ASPHALT CEMENT DATA

INCLUDES

F.3.1 Sample Collection Data

Table F.3.1 Collection Data

| Date | Time | Processing Co. |
|---|---|---|
| 11-08-83 | 1315 | Kerr-McGee, Wynnewood, OK |
| 11-12-83 | -- | Allied Chemical, Strod, OK |

APPENDIX F.4

T.J. CAMPBELL SOLIDS BALANCE DATA

INCLUDES

F.4.1 Solids Balance Data Summary

## Table F.4.1 T.J. Campbell Solids Balance Data

| | | | Controlled Air Emissions | | | Water from Venturi | | | Solids | Uncontrolled Air Emissions | | | Water to Venturi | | | Solids | Solids |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Sampling Period | Plant Mode | Loading (gr/DSCF) | Flowrate (DSCFM) | Solids (lbs/hr) | TSS (mg/ml) | Flowrate (GPM)[1] | Solids (lbs/hr) | Out (lbs/hr) | Loading (gr/DSCF) | Flowrate (DSCFM) | Solids (lbs/hr) | TSS (mg/ml) | Flowrate (GPM) | Solids (lbs/hr) | In (lbs/hr) | Out/In Ratio |
| 11/11 | 0839-1433 | R | 0.0227 | 14,000 | 2.73 | 3.09 | 225 | 348 | 351 | 3.24 | 14,800 | 412 | 0.0778 | 225 | 8.76 | 421 | 0.83 |
| 11/11 | 1515-1730 | R | 0.0229 | 12,600 | 2.48 | 4.69 | 220 | 516 | 518 | 4.37 | 12,300 | 461 | 0.144 | 220 | 15.8 | 477 | 1.09 |
| 11/12 | 0713-0900 | R | 0.0286 | 14,000 | 3.44 | 3.01 | 220 | 331 | 334 | 3.75 | 14,000 | 451 | 0.179 | 220 | 19.7 | 471 | 0.71 |
| Avg | | R | 0.0247 | 13,500 | 2.86 | 3.60 | 222 | 400 | 403 | 3.79 | 13,700 | 446 | 0.134 | 222 | 14.9 | 461 | 0.87 |
| 11/12 | 1129-1319 | C | 0.0550 | 11,400 | 5.38 | 6.71 | 220 | 738 | 743 | 7.60 | 11,700 | 761 | 0.161 | 220 | 17.7 | 781 | 0.95 |
| 11/13 | 0853-1112 | C | 0.0814 | 11,400 | 7.96 | 6.53 | 220 | 719 | 727 | 8.49 | 11,700 | 852 | 0.0239 | 220 | 2.63 | 855 | 0.85 |
| 11/14 | 0813-1003 | C | 0.0332 | 11,800 | 3.36 | 5.18 | 215 | 557 | 560 | 5.58 | 12,500 | 599 | 0.0235 | 215 | 2.53 | 602 | 0.93 |
| Avg | | C | 0.0565 | 11,500 | 5.58 | 6.14 | 218 | 670 | 676 | 7.22 | 12,000 | 744 | 0.0695 | 218 | 7.58 | 752 | 0.90 |

[1] These values are 1-2 percent low; some moisture is removed from the fluegases (temperature delta) which is not included here.

# APPENDIX G

## VISIBLE EMISSIONS RESULTS

INCLUDES

G.1 Conventional Operation Data
- G.1.1 Summary of Visible Emissions
- G.1.2 Visible Emissions Field Data Sheets
- G.1.3 Summary Log of Visible Emissions
- G.1.4 Visible Emissions Observation Locations

G.2 Recycle Operation Data
- G.2.1 Summary of Visible Emissions
- G.2.2 Visible Emissions Field Data Sheets
- G.2.3 Summary Log of Visible Emissions
- G.2.4 Visible Emissions Observation Locations

G.3 Visible Emissions Observer Certification Certificate

G.4 EPA Method 9 Guidelines

APPENDIX G.1

CONVENTIONAL OPERATION DATA

INCLUDES

G.1.1 Summary of Visible Emissions

TABLE 2.11. OPACITY READINGS ON THE VENTURI SCRUBBER OUTLET DURING CONVENTIONAL OPERATION

| Date | Run Description | Time | Average Opacity for 6 Minutes |
|---|---|---|---|
| 11-12-83 | T.M.-Part/cond hyd C-1 | 1130-1135 | 0 |
| | | 1136-1141 | 0 |
| | | 1142-1147 | 0 |
| | | 1148-1153 | 0 |
| | | 1154-1159 | 0 |
| | | 1200-1205 | 0 |
| | | 1206-1211 | 0 |
| | | 1212-1217 | 0 |
| | | 1218-1223 | 0 |
| | | 1224-1229 | 0 |
| | | 1230-1235 | 0 |
| | | 1236-1241 | 0 |
| | | 1242-1247 | 0 |
| | | 1248-1253 | 0 |
| | | 1254-1259 | 0 |
| | | 1300-1305 | 0 |
| | | 1306-1311 | 0 |
| | | 1312-1317 | 0 |
| | | 1318-1323 | 0 |
| | | 1324-1329 | 0 |
| | | 1330-1335 | 0 |
| | | 1336-1341 | 0 |
| | | 1342-1347 | 0 |
| | | 1348-1353 | 0 |
| | | 1354-1359 | 0 |
| | | 1400-1405 | 0 |
| | | 1406-1411 | .6 |
| | | 1412-1417 | 1.5 |
| | | 1418-1423 | .2 |
| | | 1424-1429 | 0 |
| | | Average | 0.08 |
| 11-13-83 | Part./cond hyd C-1 | 0800-0805 | 0 |
| | | 0806-0811 | 0 |
| | | 0812-0817 | 0 |
| 11-13-83 (continued) | Part./cond hyd C-1 (continued) | 0818-0823 | 0 |
| | | 0824-0829 | 0 |
| | | 0830-0835 | 0 |
| | | 0836-0841 | 0 |
| | | 0842-0847 | 0 |
| | | 0848-0853 | 0 |
| | | 0854-0859 | 0 |
| | | 0900-0905 | 0 |
| | | 0906-0911 | 0 |
| | | 0912-0917 | 0 |
| | | 0918-0923 | 0 |
| | | 0924-0929 | 0 |
| | | 0930-0935 | 0 |
| | | 0936-0941 | 0 |
| | | 0942-0947 | 0 |
| | | 0948-0953 | 0 |
| | | 0954-0959 | 0 |
| | | 1000-1005 | 0 |
| | | 1006-1011 | 0 |
| | | 1012-1017 | 0 |
| | | 1018-1023 | 0 |
| | | 1024-1029 | 0 |
| | | 1030-1035 | 0 |
| | | 1036-1041 | 0 |
| | | 1042-1047 | 0 |
| | | 1048-1053 | 0 |
| | | 1103-1108 | 0 |
| | | 1109-1114 | 0 |
| | | 1115-1120 | 0 |
| | | 1121-1126 | 0 |
| | | 1127-1132 | 0 |
| | | 1133-1138 | 0 |
| | | 1139-1144 | 0 |
| | | 1145-1150 | 0 |
| | | Average | 0 |

APPENDIX G.1

CONVENTIONAL OPERATION DATA

INCLUDES

G.1.2 Visible Emissions Field Data Sheets

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: 11/12/83

Type of Plant: Asphalt Concrete

Type of Discharge: stack

Distance from Observer to Discharge Point: 100'

Location of Discharge: scrubber outlet

Height of Observation Point: 0'

Height of Point of Discharge: 30'

Direction of Observer from Discharge Point: E

Description of Background: clear - scattered clouds

Description of Sky: blue

Wind Direction: SE

Wind Velocity: 10-20

Color of Plume: white

Detached Plume: 150'

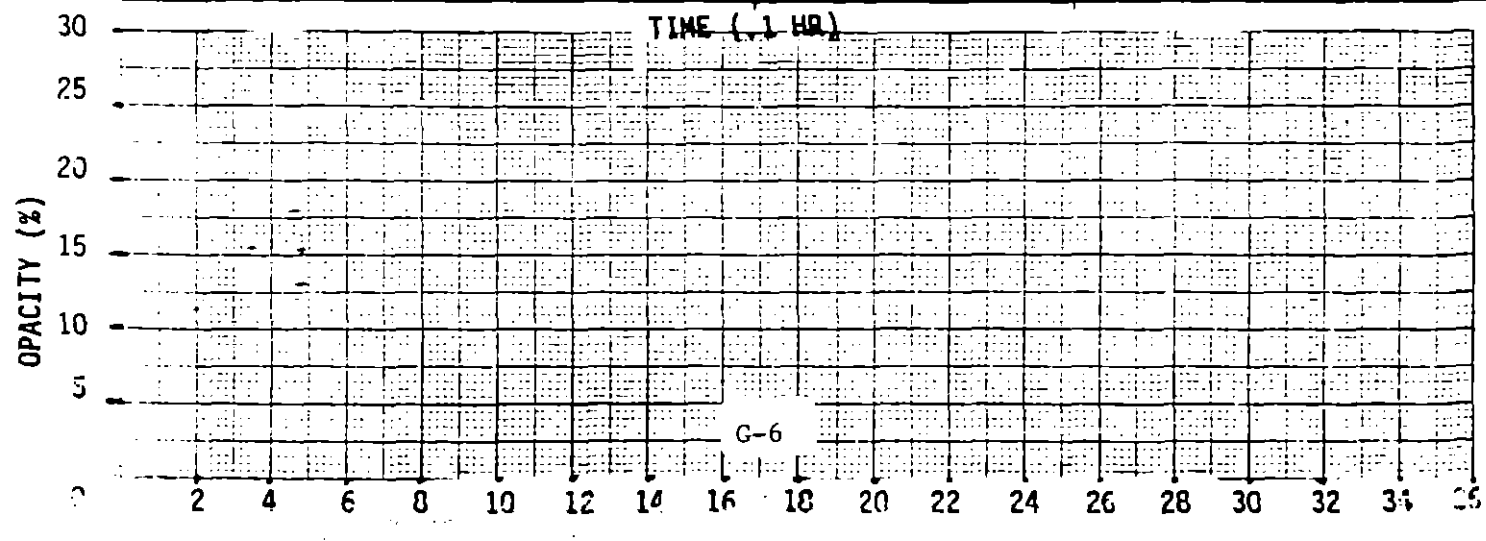
Duration of Observation: 3hr 35min

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 1 | 0722 | 0727 | 0 | 0 |
| 2 | 0728 | 0733 | 0 | 0 |
| 3 | 0734 | 0739 | 0 | 0 |
| 4 | 0740 | 0745 | 0 | 0 |
| 5 | 0746 | 0751 | 0 | 0 |
| 6 | 0752 | 0757 | 0 | 0 |
| 7 | 0758 | 0803 | 0 | 0 |
| 8 | 0812 | 0817 | 0 | 0 |
| 9 | 0818 | 0823 | 0 | 0 |
| 10 | 0824 | 0829 | 0 | 0 |
| 11 | 0830 | 0835 | 0 | 0 |
| 12 | 0836 | 0841 | 0 | 0 |
| 13 | 0842 | 0847 | 0 | 0 |
| 14 | 0848 | 0853 | 0 | 0 |
| 15 | 0854 | 0859 | 0 | 0 |
| 16 | 090 | 0905 | 0 | 0 |
| 17 | 0906 | 0911 | 0 | 0 |
| 18 | 0912 | 0917 | 0 | 0 |
| 19 | 0918 | 1923 | 0 | 0 |
| 20 | 1130 | 1135 | 0 | 0 |

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 21 | 1136 | 1141 | 0 | 0 |
| 22 | 1142 | 1147 | 0 | 0 |
| 23 | 1148 | 1153 | 0 | 0 |
| 24 | 1154 | 1159 | 0 | 0 |
| 25 | 1200 | 1205 | 0 | 0 |
| 26 | 1206 | 1211 | 0 | 0 |
| 27 | 1212 | 1217 | 0 | 0 |
| 28 | 1218 | 1223 | 0 | 0 |
| 29 | 1224 | 1229 | 0 | 0 |
| 30 | 1230 | 1235 | 0 | 0 |
| 31 | 1236 | 1241 | 0 | 0 |
| 32 | 1242 | 1247 | 0 | 0 |
| 33 | 1248 | 1253 | 0 | 0 |
| 34 | 1254 | 1259 | 0 | 0 |
| 35 | 1300 | 1305 | 0 | 0 |
| 36 | 1306 | 1311 | 0 | 0 |
| 37 | | | | |
| 38 | | | | |
| 39 | | | | |
| 40 | | | | |



FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: 11/12/83

Type of Plant: Asphalt Concrete

Type of Discharge: stack

Location of Discharge: scrubber outlet

Height of Point of Discharge: 30'

Description of Background: Scattered Clouds

Description of Sky: blue

Wind Direction: SE

Color of Plume: white

Duration of Observation: 1 hr 20 min

Distance from Observer to Discharge Point: 150'

Height of Observation Point: 0'

Direction of Observer from Discharge Point: E

Wind Velocity:

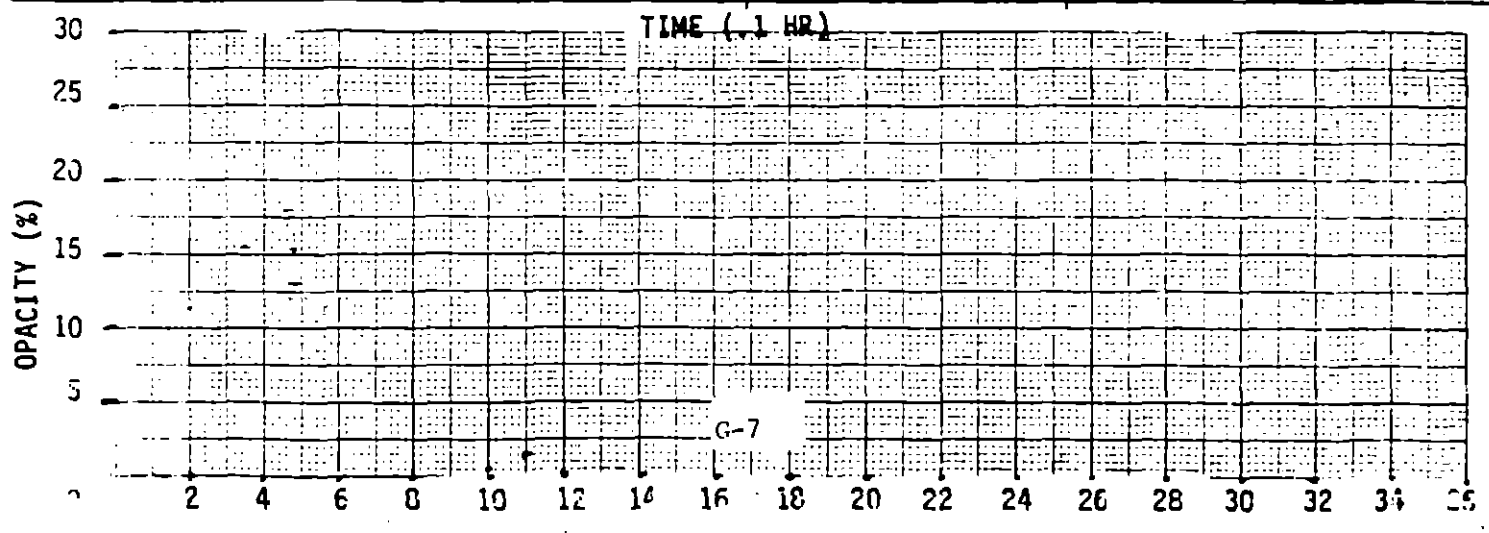
Detached Plume:

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 1 | 1312 | 1317 | 0 | 0 |
| 2 | 1318 | 1323 | 0 | 0 |
| 3 | 1324 | 1329 | 0 | 0 |
| 4 | 1330 | 1335 | 0 | 0 |
| 5 | 1336 | 1341 | 0 | 0 |
| 6 | 1342 | 1347 | 0 | 0 |
| 7 | 1348 | 1353 | 0 | 0 |
| 8 | 1354 | 1359 | 0 | 0 |
| 9 | 1400 | 1405 | 0 | 0 |
| 10 | 1406 | 1411 | 15 | .6 |
| 11 | 1412 | 1417 | 35 | 1.5 |
| 12 | 1418 | 1423 | 5 | .2 |
| 13 | 1424 | 1429 | 0 | 0 |
| 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 | | | | |



| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/12/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 180 Ft.

Wind Speed 15 Direct SE

Sky Condition Partly Cloudy

Plume Color White

Plume Background blue

Plume Behavior ~~Horizontal~~ looping

Steam Plume

detached 0 Ft. from stack

attached 150 Ft. dissipated

Start Time 1130

Ending Time 1159

Ending Weather Clear 48°

Wind Speed 10 Direct SE

Sky Condition clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source TJ Cambell Const. Co.

Address _____

Oklahoma City, OK

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

REV. AQ-23 6/1/78

DATA VALIDATION
BY _____
DATE _____

## Plume Observation Record Form

Date 11/12/83
Observer L Garcia
Checked By _____
Type of installation Asphalt Concrete Plant
Fuel GAS Stack Ht. 30
Observers Distance from Stack 150 Ft.
Wind Speed 15 Direct SE
Sky Condition ~~Clear~~ Part. Cloudy
Plume Color White
Plume Background blue
Plume Behavior looping
Steam Plume
detached 0 Ft. from stack
attached 150 Ft. dissipated
Start Time 1200
Ending Time 1259
Ending Weather Part Cloudy
Wind Speed 15 Direct SE
Sky Condition Part Cldy

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Remarks:

Source T J Cambell Const. Co
Address Oklahoma City

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

REV. AQ-23 6/1/78

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/12/83

Observer L Garcia

Checked By

Type of installation

Source TJ Cambell Const. Co.

Address Oklahoma City Ok

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 150 Ft.

Wind Speed 5-10 Direct SE

Sky Condition Part Cloudy

Plume Color White

Plume Background Blue

Plume Behavior looping

Steam Plume

detached 0 Ft. from stack

attached 150 Ft. dissipated

Start Time 1300

Ending Time 1359

Ending Weather Pt. Cldy

Wind Speed 3-5 Direct SE

Sky Condition Pt. Cldy

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

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

REV. AQ-23 6/1/78

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| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/12/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 130 ~~100~~ Ft.

Wind Speed 3-5 Direct SE

Sky Condition Pt. Cldy

Plume Color white

Plume Background Blue

Plume Behavior looping

Steam Plume

detached 0 Ft. from stack

attached 75 Ft. dissipated

Start Time 1400

Ending Time 1430

Ending Weather Pt Cldy 55°

Wind Speed 1-3 Direct SE

Sky Condition Pt Cldy

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source T J Campbell Const. Co.

Address Oklahoma City OK

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

REV. AQ-23 6/1/78

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: 11/13/83

Type of Plant: Asphalt Concrete

Type of Discharge: stack

Location of Discharge: scrubber outlet

Height of Point of Discharge: 30'

Description of Background: clear

Description of Sky: blue

Wind Direction: W-S

Color of Plume: white

Duration of Observation: 3 hr 40 min

Distance from Observer to Discharge Point: 80-[illegible]

Height of Observation Point: 0'

Direction of Observer from Discharge Point: S [illegible]

Wind Velocity: 1-5

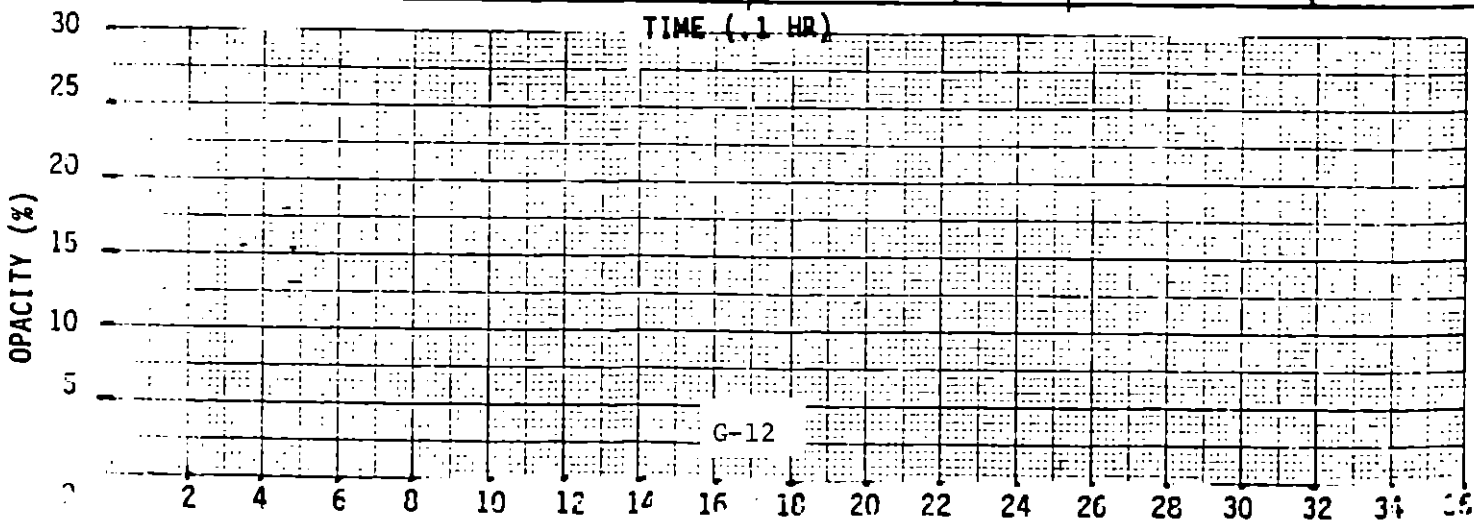
Detached Plume: 150'-175'

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 1 | 0800 | 0805 | 0 | 0 |
| 2 | 0806 | 0811 | 0 | 0 |
| 3 | 0812 | 0817 | 0 | 0 |
| 4 | 0818 | 0823 | 0 | 0 |
| 5 | 0824 | 0829 | 0 | 0 |
| 6 | 0830 | 0835 | 0 | 0 |
| 7 | 0836 | 0841 | 0 | 0 |
| 8 | 0842 | 0847 | 0 | 0 |
| 9 | 0848 | 0853 | 0 | 0 |
| 10 | 0854 | 0859 | 0 | 0 |
| 11 | 0900 | 0905 | 0 | 0 |
| 12 | 0906 | 0911 | 0 | 0 |
| 13 | 0912 | 0917 | 0 | 0 |
| 14 | 0918 | 0923 | 0 | 0 |
| 15 | 0924 | 0929 | 0 | 0 |
| 16 | 0930 | 0935 | 0 | 0 |
| 17 | 0936 | 0941 | 0 | 0 |
| 18 | 0942 | 0947 | 0 | 0 |
| 19 | 0948 | 0953 | 0 | 0 |
| 20 | 0954 | 0959 | 0 | 0 |

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 21 | 1000 | 1005 | 0 | 0 |
| 22 | 1006 | 1011 | 0 | 0 |
| 23 | 1012 | 1017 | 0 | 0 |
| 24 | 1018 | 1023 | 0 | 0 |
| 25 | 1024 | 1029 | 0 | 0 |
| 26 | 1030 | 1035 | 0 | 0 |
| 27 | 1036 | 1041 | 0 | 0 |
| 28 | 1042 | 1047 | 0 | 0 |
| 29 | 1048 | 1053 | 0 | 0 |
| 30 | 1103 | 1108 | 0 | 0 |
| 31 | 1109 | 1114 | 0 | 0 |
| 32 | 1115 | 1120 | 0 | 0 |
| 33 | 1121 | 1126 | 0 | 0 |
| 34 | 1127 | 1132 | 0 | 0 |
| 35 | 1133 | 1138 | 0 | 0 |
| 36 | 1139 | 1144 | 0 | 0 |
| 37 | 1145 | 1150 | 0 | 0 |
| 38 | | | | |
| 39 | | | | |
| 40 | | | | |



| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/13/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 100 Ft.

Wind Speed 1-3 Direct W

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior looping

Steam Plume

detached 0 Ft. from stack

attached 150 Ft. dissipated

Start Time 0800

Ending Time 0859

Ending Weather clear 50°

Wind Speed 1-3 Direct SW

Sky Condition clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source TJ Campbell Const. Co.

Address Oklahoma City, OK

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

REV. AQ-23 6/1/78

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/13/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 100 Ft.

Wind Speed 2-4 Direct SW

Sky Condition clear

Plume Color white

Plume Background Blue

Plume Behavior looping

Steam Plume

detached 0 Ft. from stack

attached 175 Ft. dissipated

Start Time 0900

Ending Time 0959

Ending Weather clear 50°

Wind Speed 2-4 Direct S

Sky Condition clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source TJ Cambell Const. Co

Address Oklahoma City

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

REV. AQ-23 6/1/78

3

| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/13/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 100 Ft.

Wind Speed 3-5 Direct S

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior looping

Steam Plume

detached 0 Ft. from stack

attached 150 Ft. dissipated

Start Time 1000

Ending Time 1054

Ending Weather clear 50°

Wind Speed 3-5 Direct S

Sky Condition clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source _____

Address _____

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

21 22 23 24 25 26 27 28 29

REV. AQ-23 6/1/78

DATA VALIDATION
BY _____
DATE _____

## Plume Observation Record Form

Date 11/13/83
Observer L Garcia
Checked By _____
Type of installation _____

Source _____
Address _____

Fuel Gas Stack Ht. 30'
Observers Distance from Stack 80 Ft.
Wind Speed 3-5 Direct S
Sky Condition Clear
Plume Color white
Plume Background blue
Plume Behavior looping
Steam Plume
detached 0 Ft. from stack
attached 175 Ft. dissipated
Start Time 1103
Ending Time 1159
Ending Weather clear 50°
Wind Speed 3-5 Direct SE
Sky Condition clear
No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

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

30 31 32 33 34 35 36 37

REV. AQ-23 6/1/78

APPENDIX G.1

CONVENTIONAL OPERATION DATA

INCLUDES

G.1.3 Summary Log of Visible Emissions

Conventional Operation Observations

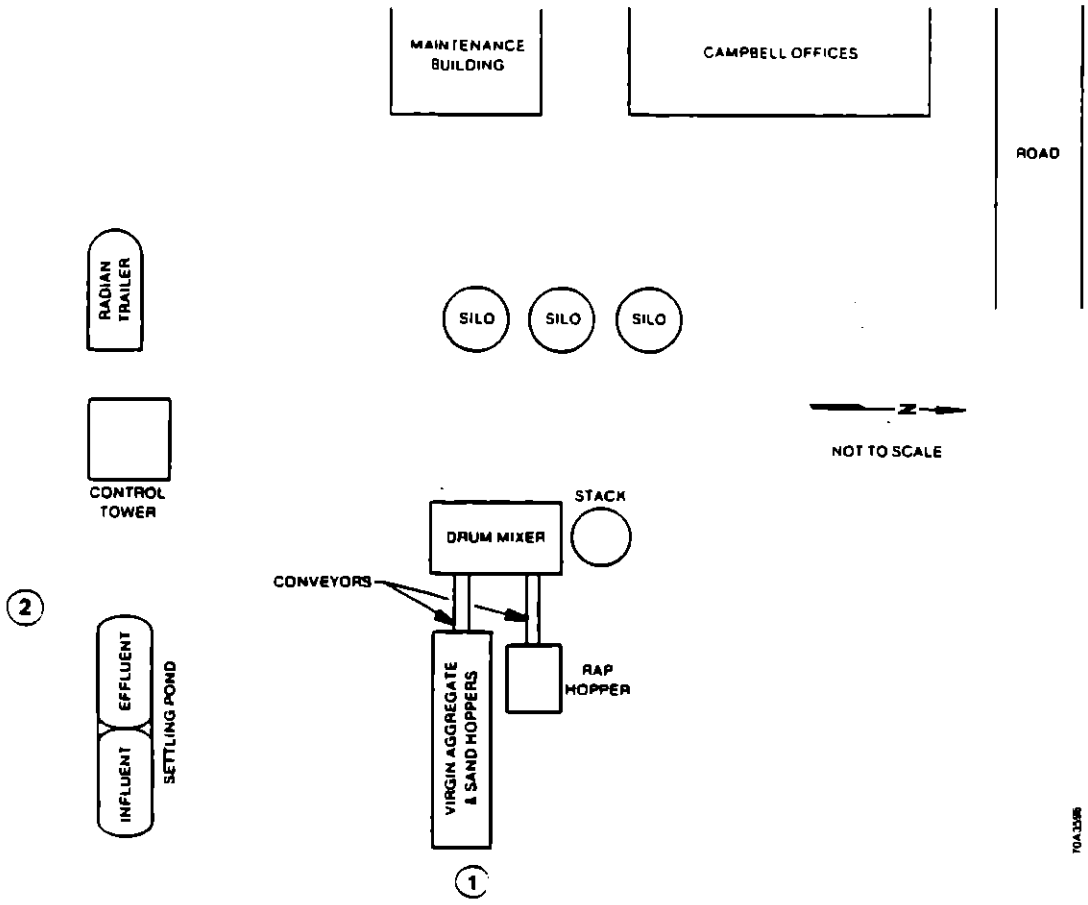
| Date | Start | Stop | Time (min) |
|---|---|---|---|
| 11/12 | 1130 | 1430 | 180 |
| 11/13 | 0800 | 1054 | 175 |
| | 1103 | 1154 | 52 |

APPENDIX G.1

CONVENTIONAL OPERATION DATA

INCLUDES

G.1.4 Visible Emissions Observation Locations




| Position No. | Date | Time | Approximate Distance from Stack (ft) | Direction of Observer from Discharge Point |
|---|---|---|---|---|
| 1 | 11-12-83 | 0722-1429 | 100-150 | E |
| 2 | 11-13-83 | 0800-1150 | 80-100 | S-SE |

Figure 1-2. Locations of visible emissions observations during conventional operation.

APPENDIX G.2

RECYCLE OPERATION DATA

INCLUDES

G.2.1 Summary of Visible Emissions

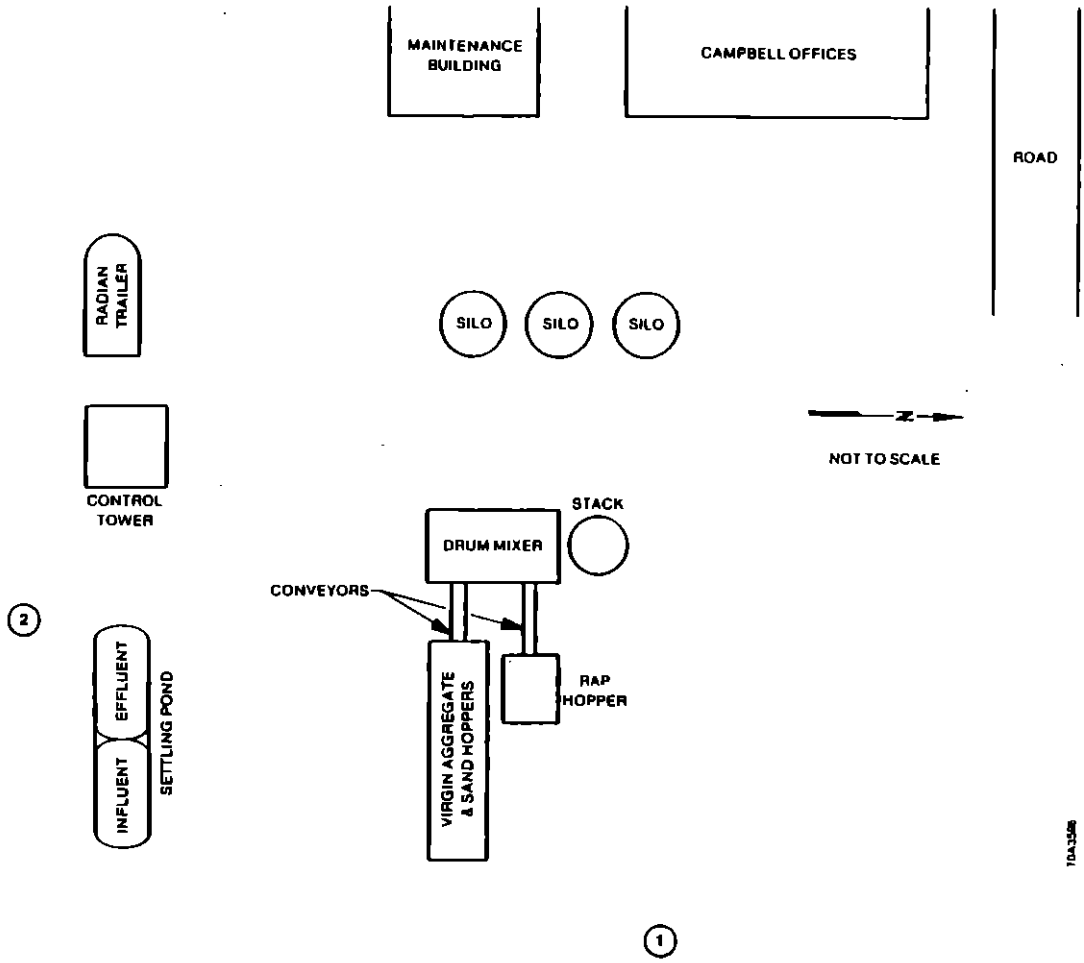
TABLE 2.10. OPACITY READINGS OF THE VENTURI SCRUBBER OUTLET DURING RECYCLE OPERATION

| Date | Run Description | Time | Average Opacity for 6 Minutes |
|---|---|---|---|
| 11-10-83 | | 1000-1005 | 1.5 |
| | | 1006-1011 | 1.5 |
| | | 1012-1017 | 2.7 |
| | | 1018-1023 | 2.6 |
| | | 1024-1029 | 1.9 |
| | | 1030-1035 | 1.7 |
| | | 1036-1041 | 1.7 |
| | | 1042-1047 | 1.9 |
| | | 1048-1053 | 1.0 |
| | | 1054-1059 | 2.1 |
| | | 1140-1145 | .4 |
| | | 1146-1151 | .6 |
| | | 1152-1157 | 1.0 |
| | | 1400-1405 | .2 |
| | | 1406-1411 | 0 |
| | | 1412-1417 | .4 |
| | | 1418-1423 | 0 |
| | | 1424-1429 | 0 |
| | | 1430-1435 | .2 |
| | | 1436-1441 | .2 |
| | | 1442-1447 | .2 |
| | | 1448-1453 | .6 |
| | | 1454-1459 | 1.7 |
| | | 1506-1511 | 1.5 |
| | | 1512-1517 | .8 |
| | | 1518-1523 | .2 |
| | | 1524-1529 | .4 |
| | | 1530-1535 | .4 |
| | | 1536-1541 | .6 |
| | | 1542-1547 | 0 |
| | | 1548-1553 | 0 |
| | | 1554-1559 | .2 |
| | | 1620-1625 | 0 |

| Date | Run Description | Time | Average Opacity for 6 Minutes |
|---|---|---|---|
| 11-11-83 | | 0819-0824 | .6 |
| | | 0825-0830 | 0 |
| | | 0831-0836 | 0 |
| | | 0837-0842 | 0 |
| | | 0843-0848 | 0 |
| | | 0849-0854 | 0 |
| | | 0855-0900 | .2 |
| | | 0901-0906 | 0 |
| | | 0907-0912 | 0 |
| | | 0913-0918 | 0 |
| | | 0919-0924 | 0 |
| | | 0925-0930 | 0 |
| | | 0931-0936 | 0 |
| | | 0937-0942 | 0 |
| | | 0943-0948 | 0 |
| | | 0949-0954 | 0 |
| | | 0955-1000 | .8 |
| | | 1009-1014 | .8 |
| | | 1104-1109 | .4 |
| | | 1110-1115 | 0 |
| | | 1116-1121 | .6 |
| | | 1122-1127 | 0 |
| | | 1128-1133 | 0 |
| | | 1308-1313 | 5.8 |
| | | 1314-1319 | 2.3 |
| | | 1320-1325 | 2.3 |
| | | 1326-1331 | 4.6 |
| | | 1332-1337 | 4.0 |
| | | 1400-1405 | 1.5 |
| | | 1406-1411 | 2.3 |
| | | 1412-1417 | 5.0 |
| | | 1418-1423 | 3.5 |

TABLE 2.10. OPACITY READINGS OF THE VENTURI SCRUBBER OUTLET DURING RECYCLE OPERATION (Continued)

| Date | Run Description | Time | Average Opacity for 6 Minutes |
|---|---|---|---|
| 11-11-83 (continued) | | 1424-1429 | 2.3 |
| | | 1430-1435 | 2.1 |
| | | 1436-1441 | 5.2 |
| | | 1530-1535 | 0 |
| | | 1536-1541 | 0 |
| | | 1545-1550 | 1.7 |
| | | 1551-1556 | .4 |
| | | 1557-1602 | 0 |
| | | 1603-1608 | 1.3 |
| | | 1609-1614 | 1.0 |
| | | 1615-1620 | 0 |
| | | 1621-1626 | 0 |
| | | 1627-1632 | 0 |
| | | 1633-1638 | 0 |
| | | 1639-1644 | 0 |
| | | 1645-1650 | 0 |
| | | 1651-1656 | 0 |
| | | 1657-1702 | 0 |
| | | 1703-1708 | 0 |
| | | 1709-1714 | 0 |
| 11-12-83 | Part./cond hyd R-2 | 0722-0727 | 0 |
| | | 0728-0733 | 0 |
| | | 0734-0739 | 0 |
| | | 0740-0745 | 0 |
| | | 0746-0751 | 0 |
| | | 0752-0757 | 0 |
| | | 0758-0803 | 0 |
| | | 0812-0817 | 0 |
| | | 0818-0823 | 0 |
| | | 0824-0829 | 0 |
| | | 0830-0835 | 0 |
| | | 0836-0841 | 0 |
| | | 0842-0847 | 0 |
| 11-11-83 (continued) | Part./cond hyd R-2 (continued) | 0848-0853 | 0 |
| | | 0854-0859 | 0 |
| | | 0900-0905 | 0 |
| | | 0906-0911 | 0 |
| | | 0912-0917 | 0 |
| | | 0918-0923 | 0 |
| | | Average | 0 |
| 11-15-83 | BaP/org. R-1 | 0815-0820 | 0 |
| | | 0821-0826 | 0 |
| | | 0827-0832 | 0 |
| | | 0833-0838 | 0 |
| | | 0839-0844 | 0 |
| | | 0855-0900 | 0 |
| | | 0901-0906 | 0 |
| | | 0907-0912 | 0 |
| | | 0913-0918 | 0 |
| | | 0919-0924 | 0 |
| | | 0925-0930 | 0 |
| | | 0931-0936 | 0 |
| | | 0937-0942 | 0 |
| | | 0943-0948 | 0 |
| | | 0949-0954 | 0 |
| | | 0955-1000 | 0 |
| | | 1001-1006 | 0 |
| | | 1007-1012 | 0 |
| | | 1013-1018 | 0 |
| | | 1019-1024 | 0 |
| | | 1025-1030 | 0 |
| | | 1031-1036 | 0 |
| | | 1037-1042 | 0 |
| | | 1043-1048 | 0 |
| | | 1049-1054 | 0 |
| | | Average | 0 |




| Position No. | Date | Time | Approximate Distance from Stack (ft) | Direction of Observer from Discharge Point |
|---|---|---|---|---|
| 1 | 11-12-83 | 0722–0925 | 200 | E |
| 2 | 11-13-83 | 0800-1150 | 80-100 | S-SE |

Figure 1-2. Locations of visible emissions observations during conventional operation.

APPENDIX G.2

RECYCLE OPERATION DATA

INCLUDES

G.2.2 Visible Emissions Field Data Sheets

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: 11/10/83

Type of Plant: Asphalt Concrete

Type of Discharge: Stack

Location of Discharge: Scrubber outlet

Height of Point of Discharge: 30 ft

Description of Background: clear sky

Description of Sky: blue

Wind Direction: N

Color of Plume: white

Duration of Observation: 3 hr 25 min

Distance from Observer to Discharge Point: 300

Height of Observation Point: 0'

Direction of Observer from Discharge Point: S

Wind Velocity: 15-20 mph

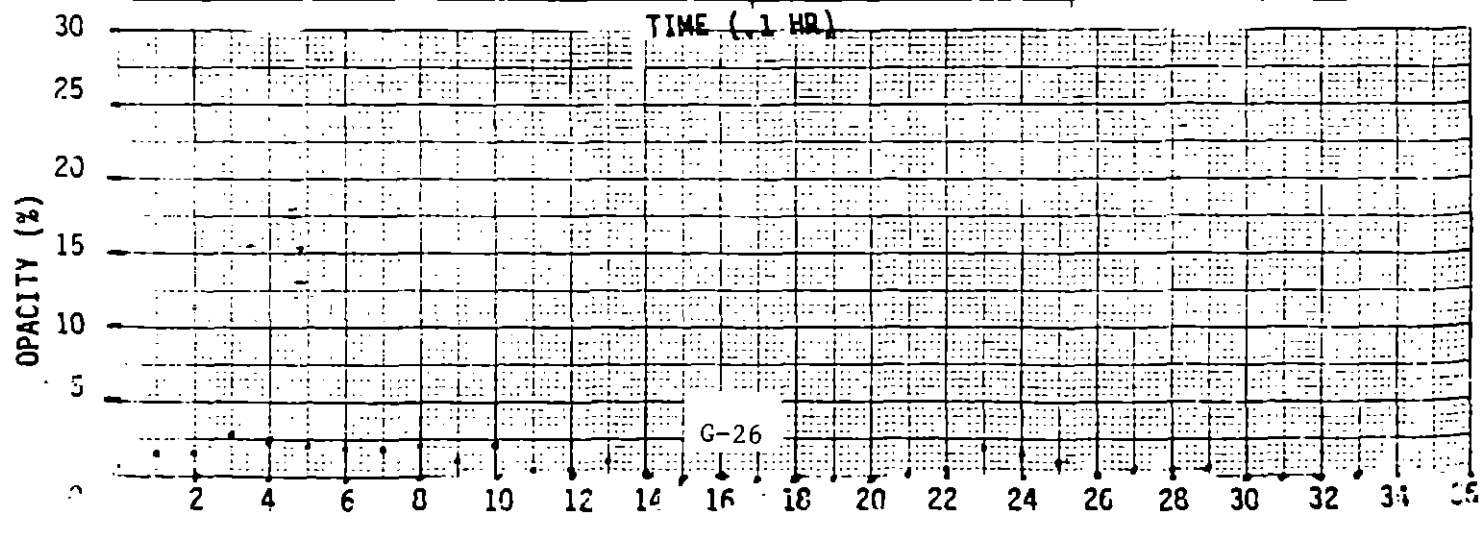
Detached Plume: 350'

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 1 | 1000 | 1005 | 35 | 1.5 |
| 2 | 1006 | 1011 | 35 | 1.5 |
| 3 | 1012 | 1017 | 65 | 2.7 |
| 4 | 1018 | 1023 | 60 | 2.5 |
| 5 | 1024 | 1029 | 45 | 1.9 |
| 6 | 1030 | 1035 | 40 | 1.7 |
| 7 | 1036 | 1041 | 40 | 1.7 |
| 8 | 1042 | 1047 | 45 | 1.9 |
| 9 | 1048 | 1053 | 25 | 1.0 |
| 10 | 1054 | 1059 | 50 | 2.1 |
| 11 | 1140 | 1145 | 10 | .4 |
| 12 | 1146 | 1151 | 15 | .6 |
| 13 | 1152 | 1157 | 25 | 1.0 |
| 14 | 1400 | 1405 | 5 | .2 |
| 15 | 1406 | 1411 | 0 | 0 |
| 16 | 1412 | 1417 | 10 | .4 |
| 17 | 1418 | 1423 | 0 | 0 |
| 18 | 1424 | 1429 | 0 | 0 |
| 19 | 1430 | 1435 | 5 | .2 |
| 20 | 1436 | 1441 | 5 | .2 |

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 21 | 1442 | 1447 | 5 | .2 |
| 22 | 1448 | 1453 | 15 | .6 |
| 23 | 1454 | 1459 | 40 | 1.7 |
| 24 | 1506 | 1511 | 35 | 1.5 |
| 25 | 1512 | 1517 | 20 | .8 |
| 26 | 1518 | 1523 | 5 | .2 |
| 27 | 1524 | 1529 | 10 | .4 |
| 28 | 1530 | 1535 | 10 | .4 |
| 29 | 1536 | 1541 | 15 | .6 |
| 30 | 1542 | 1547 | 0 | 0 |
| 31 | 1548 | 1553 | 0 | 0 |
| 32 | 1554 | 1559 | 5 | .2 |
| 33 | 1620 | 1625 | 0 | 0 |
| 34 | | | | |
| 35 | | | | |
| 36 | | | | |
| 37 | | | | |
| 38 | | | | |
| 39 | | | | |
| 40 | | | | |



| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/10/83

Observer Lee Davis

Checked By

Type of installation Concrete Asphalt Plant

Fuel Nat. Gas Stack Ht. 30'

Observers Distance from Stack 300 Ft. 20

Wind Speed [illegible] Direct N

Sky Condition ~~Blue~~ Clear

Plume Color White

Plume Background Blue-~~[illegible]~~

Plume Behavior ~~Turbulent~~

Steam ~~[illegible]~~ Fumigation

detached 800 Ft. from stack
attached 350 Ft. dissipated

Start Time 1000

Ending Time 1100

Ending Weather Clear

Wind Speed 20 Direct N

Sky Condition Blue-Clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source T.J. Cambell's Asphalt Co

Address Oklahoma City, OK

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

REV. AQ-23 6/1/78

2

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/10/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Nat Gas Stack Ht. 30'

Observers Distance from Stack 250 Ft.

Wind Speed 20 Direct N

Sky Condition clear

Plume Color White

Plume Background Blue

Plume Behavior ~~turbulent~~ Fumigation

Steam Plume

detached 0 Ft. from stack

attached 300 Ft. dissipated

Start Time 1140

Ending Time 1158

Ending Weather Clear

Wind Speed 20 Direct N

Sky Condition clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source TT & Cambell Const Co

Address

Oklahoma City

| 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 | | | | | 40 | 0 | 0 | 0 | 0 |
| 11 | | | | | 41 | 0 | 5 | 0 | 0 |
| 12 | | | | | 42 | 0 | 0 | 0 | 0 |
| 13 | | | | | 43 | 0 | 0 | 5 | 0 |
| 14 | | | | | 44 | 0 | 0 | 0 | 0 |
| 15 | | | | | 45 | 0 | 0 | 0 | 0 |
| 16 | | | | | 46 | 0 | 5 | 0 | 0 |
| 17 | | | | | 47 | 0 | 0 | 0 | 0 |
| 18 | | | | | 48 | 0 | 0 | 5 | 0 |
| 19 | | | | | 49 | 0 | 0 | 0 | 0 |
| 20 | | | | | 50 | 5 | 0 | 0 | 0 |
| 21 | | | | | 51 | 0 | 0 | 0 | 0 |
| 22 | | | | | 52 | 0 | 5 | 0 | 0 |
| 23 | | | | | 53 | 0 | 0 | 0 | 0 |
| 24 | | | | | 54 | 0 | 0 | 5 | 0 |
| 25 | | | | | 55 | 0 | 0 | 0 | 0 |
| 26 | | | | | 56 | 0 | 5 | 0 | 0 |
| 27 | | | | | 57 | 0 | 5 | 5 | 0 |
| 28 | | | | | 58 | 0 | 0 | 0 | 0 |
| 29 | | | | | 59 | | | | |

REV. AQ-23 6/1/78

DATA VALIDATION
BY: _____
DATE _____

# Plume Observation Record Form

Date 11/10/83
Observer L Garcia
Checked By _____
Type of installation Asphalt Concrete Plant
Fuel Nat Gas Stack Ht. _____
Observers Distance from Stack 125 Ft.
Wind Speed 20 Direct NW
Sky Condition Clear
Plume Color White
Plume Background Blue
Plume Behavior ~~turbulent~~
Steam Plume ~~horizontal~~ fumigation
detached 0 Ft. from stack
attached 125 Ft. dissipated
Start Time 1400
Ending Time 1500
Ending Weather clear
Wind Speed 20 Direct NW
Sky Condition clear

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Remarks:
*cut water sprays off

Source TJ Cambell Const. Co
Address
Oklahoma City OK

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

REV. AQ-23 6/1/78

4

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/10/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 3

Observers Distance from Stack 100 Ft.

Wind Speed 20 Direct NW

Sky Condition clear

Plume Color white

Plume Background Blue

Plume Behavior ~~turbulant~~ Fumigation

Steam Plume

detached 0 Ft. from stack
attached 150 Ft. dissipated

Start Time 1505

Ending Time 1600

Ending Weather Clear

Wind Speed 20 Direct NW

Sky Condition clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

water trays back on

Source T.J. Campbell Const. Co.

Address Oklahoma City

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

REV. AQ-23 6/1/78

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/10/83

Observer L. Garcia

Checked By

Type of installation Asphalt Concrete plant

Fuel Nat. Gas Stack Ht. 30'

Observers Distance from Stack 150 Ft.

Wind Speed 20 Direct NW

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior ~~fugitant~~ Fumigation

Steam Plume

detached 0 Ft. from stack

attached 125 Ft. dissipated

Start Time ~~1640~~ 1621

Ending Time 1631

Ending Weather clear

Wind Speed 20 ~~NW~~ Direct NW

Sky Condition clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source I.J. Campel Const Co

Address Oklahoma City

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

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: 11/11/83

Type of Plant: Asphalt Concrete

Type of Discharge: stack

Location of Discharge: scrubber outlet

Height of Point of Discharge: 30'

Description of Background: clear sky

Description of Sky: blue

Wind Direction: 0819 - 1136 N ; 1308 - 1718 S

Color of Plume: white

Duration of Observation: 3hr 35min

Distance from Observer to Discharge Point: 50'

Height of Observation Point: 0'

Direction of Observer from Discharge Point: NE - SW

Wind Velocity: 1-5

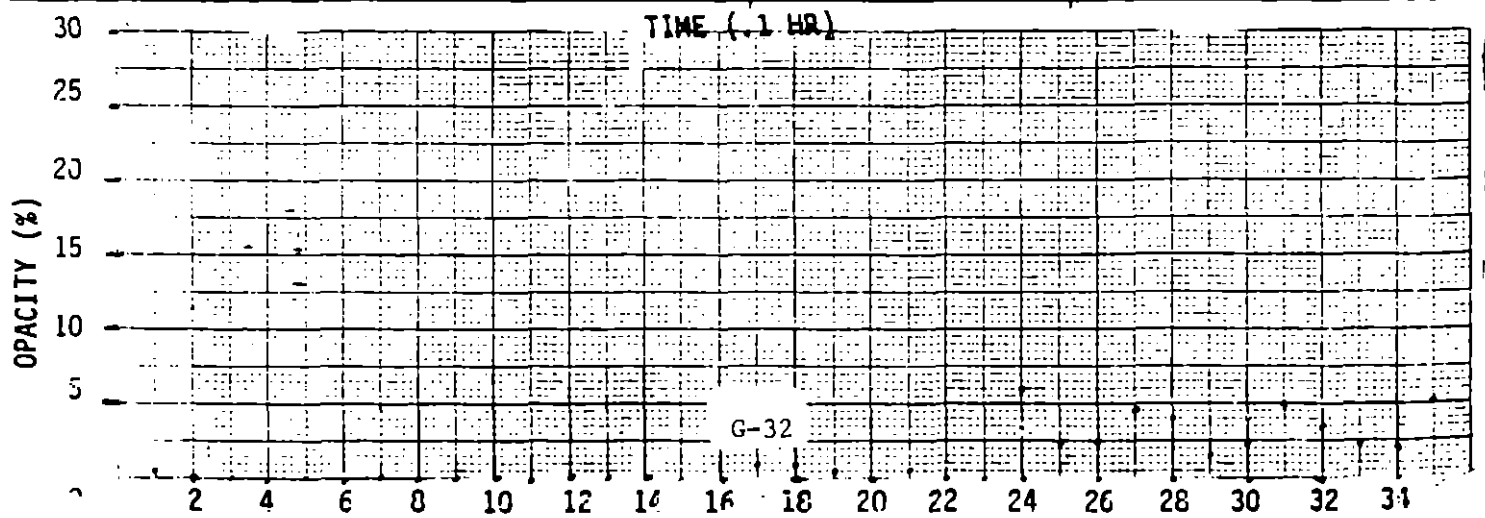
Detached Plume: 60 - 200'

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 1 | 0819 | 0824 | 15 | .6 |
| 2 | 0825 | 0830 | 0 | 0 |
| 3 | 0831 | 0836 | 0 | 0 |
| 4 | 0837 | 0842 | 0 | 0 |
| 5 | 0843 | 0848 | 0 | 0 |
| 6 | 0849 | 0854 | 0 | 0 |
| 7 | 0855 | 0900 | 5 | .2 |
| 8 | 0901 | 0906 | 0 | 0 |
| 9 | 0907 | 0912 | 0 | 0 |
| 10 | 0913 | 0918 | 0 | 0 |
| 11 | 0919 | 0924 | 0 | 0 |
| 12 | 0925 | 0930 | 0 | 0 |
| 13 | 0931 | 0936 | 0 | 0 |
| 14 | 0937 | 0942 | 0 | 0 |
| 15 | 0943 | 0948 | 0 | 0 |
| 16 | 0949 | 0954 | 0 | 0 |
| 17 | 0955 | 1000 | 20 | .8 |
| 18 | 1009 | 1014 | 20 | .8 |
| 19 | 1104 | 1109 | 10 | .4 |
| 20 | 1110 | 1115 | 0 | 0 |

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 21 | 1116 | 1121 | 15 | .6 |
| 22 | 1122 | 1127 | 0 | 0 |
| 23 | 1128 | 1133 | 0 | 0 |
| 24 | 1308 | 1313 | 140 | 5.8 |
| 25 | 1314 | 1319 | 55 | 2.3 |
| 26 | 1320 | 1325 | 55 | 2.3 |
| 27 | 1326 | 1331 | 110 | 4.6 |
| 28 | 1332 | 1337 | 95 | 4.0 |
| 29 | 1400 | 1405 | 35 | 1.5 |
| 30 | 1406 | 1411 | 55 | 2.3 |
| 31 | 1412 | 1417 | 120 | 5.0 |
| 32 | 1418 | 1423 | 85 | 3.5 |
| 33 | 1424 | 1429 | 55 | 2.3 |
| 34 | 1430 | 1435 | 50 | 2.1 |
| 35 | 1436 | 1441 | 125 | 5.2 |
| 36 | 1530 | 1535 | 0 | 0 |
| 37 | | | | |
| 38 | | | | |
| 39 | | | | |
| 40 | | | | |



DATA VALIDATION
BY
DATE

## Plume Observation Record Form

Date 11/11/83
Observer L Garcia
Checked By
Type of installation Asphalt Concrete Plant
Fuel Nat. Gas Stack Ht. 30'
Observers Distance from Stack 125 Ft.
Wind Speed 5 Direct N
Sky Condition Clear
Plume Color White
Plume Background Blue
Plume Behavior ~~horizontal~~ looping
Steam Plume
detached 0 Ft. from stack
attached 125 Ft. dissipated
Start Time 0819
Ending Time 0859
Ending Weather Clear 40°
Wind Speed 10 Direct N
Sky Condition clear
No. Units in Excess of standard
5 min/hr. allow 20
No. Units of VIO.
Remarks:
* ~~unsettled condition~~
plant went down

Source TJ Cambell
Address
Oklahoma City OK

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

REV. AQ-23 6/1/78



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2

| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/11/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30

Observers Distance from Stack 125 Ft.

Wind Speed 5+ Direct N

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior ~~horizontal~~ looping

Steam Plume

detached 0 Ft. from stack

attached 200 Ft. dissipated

Start Time 0900

Ending Time 0959

Ending Weather clear 40°

Wind Speed 5 Direct N

Sky Condition Clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source Ed Cambell Const. Co

Address _____

Oklahoma City OK

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

REV. AQ-23 6/1/78

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/11/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 125 Ft.

Wind Speed 3-5 Direct N

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior ~~horizontal~~ looping

Steam Plume

detached 0 Ft. from stack

attached 200 Ft. dissipated

Start Time 1000 - 1009

Ending Time 1003 - 1015

Ending Weather clear 45°

Wind Speed 3-5 Direct N

Sky Condition clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source T J Cambell Const. Co.

Address Oklahoma City OK

| Min. \ Sec. | 0 | 15 | 30 | 45 | Min. \ Sec. | 0 | 15 | 30 | 45 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 5 | 5 | 0 | 0 | 30 | | | | |
| 1 | 5 | 0 | 5 | 0 | 31 | | | | |
| 2 | 0 | 0 | 0 | 0 | 32 | | | | |
| 3 | 0 | 5 | 0 | 0 | 33 | | | | |
| 4 | | | | | 34 | | | | |
| 5 | | | | | 35 | | | | |
| 6 | | | | | 36 | | | | |
| 7 | | | | | 37 | | | | |
| 8 | | | | | 38 | | | | |
| 9 | 0 | 0 | 0 | 0 | 39 | | | | |
| 10 | 0 | 0 | 0 | 0 | 40 | | | | |
| 11 | 0 | 0 | 0 | 0 | 41 | | | | |
| 12 | 5 | 5 | 0 | 0 | 42 | | | | |
| 13 | 5 | 5 | 0 | 0 | 43 | | | | |
| 14 | 0 | 0 | 0 | 0 | 44 | | | | |
| 15 | 0 | 0 | 0 | 0 | 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 | | | | |

4

| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/11/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 125 Ft.

Wind Speed 3-5 Direct N

Sky Condition clear

Plume Color white

Plume Background Blue

Plume Behavior ~~Horizontal~~ looping

Steam Plume

detached 0 Ft. from stack

attached 200 Ft. dissipated

Start Time 1104

Ending Time 1 :7

Ending Weather clear 45°

Wind Speed 3-5 Direct N

Sky Condition clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source _____

Address _____

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

19 20 21 22 23

REV. AQ-23 6/1/78

DATA VALIDATION
BY _____
DATE _____

## Plume Observation Record Form

Date 11/11/83
Observer L Garcia
Checked By _____
Type of installation Asphalt Concrete
Fuel gas Stack Ht. 30
Observers Distance from Stack 50 Ft.
Wind Speed 1-3 Direct S
Sky Condition Clear
Plume Color White
Plume Background Blue
Plume Behavior ~~wide vertical~~ looping
Steam Plume
detached 0 Ft. from stack
attached 100 Ft. dissipated
Start Time 1308
Ending Time 1337
Ending Weather clear 60°F
Wind Speed 0-3 Direct S
Sky Condition clear
No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____ 25

Remarks:

Source T.J. Campbell Const. Co.
Address
Oklahoma City OK

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

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26

27

REV. AQ-23 6/1/78

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 1/11/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 50 Ft.

Wind Speed 0-3 Direct 5

Sky Condition Clear

Plume Color White

Plume Background Blue

Plume Behavior Vertical

Steam Plume

detached 0 Ft. from stack

attached 25 Ft. dissipated

Start Time 1400

Ending Time 1442

Ending Weather Clear 60°F

Wind Speed 0-3 Direct 5

Sky Condition Clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source T.J Cambell Const. Co.

Address Oklahoma City OK

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

REV. AQ-23 6/1/78

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| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/11/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. ____

Observers Distance from Stack 50 Ft.

Wind Speed 0-3 Direct S

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior vertical

Steam Plume

detached 0 Ft. from stack

attached 80 Ft. dissipated

Start Time 1530

Ending Time 1559

Ending Weather clear-60°

Wind Speed 0-3 Direct S

Sky Condition clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source TJ Cambell Const. Co.

Address _____

Oklahoma City OK

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

36

1

~~15~~

2

3

4

REV. AQ-23 6/1/78

8

| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/11/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. _____

Observers Distance from Stack 50 Ft.

Wind Speed 1-3 Direct S

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior vertical - looping

Steam Plume ~~Horizontal~~

detached 0 Ft. from stack

attached 80 Ft. dissipated

Start Time 1600

Ending Time 1659

Ending Weather clear 55°

Wind Speed 3-5 Direct S

Sky Condition clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source TJ Cambell Const. Co

Address _____

Oklahoma City OK

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

REV. AQ-23 6/1/78

9

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/11/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Natural Gas Stack Ht.

Observers Distance from Stack 50 Ft.

Wind Speed 3-5 Direct S

Sky Condition clear

Plume Color white

Plume Background blue

Plume Behavior ~~Horizontal~~ looping

Steam Plume

detached 0 Ft. from stack

attached 80 Ft. dissipated

Start Time 1700

Ending Time 1718

Ending Weather clear-50

Wind Speed 3-5 Direct S

Sky Condition clear

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Source T.J. Cambell Const. Co

Address Oklahoma City

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

15

16

Remarks:

REV. AQ-23 6/1/78

| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/12/83

Observer L Garcia

Checked By _____

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 150 Ft. 8-10

Wind Speed ~~[illegible]~~ Direct SE

Sky Condition clear

Plume Color White

Plume Background blue

Plume Behavior ~~Horizontal~~

Steam Plume ~~[illegible]~~ coning

detached 0 Ft. from stack

attached 150 Ft. dissipated

Start Time ~~[illegible]~~ 0722

Ending Time 0729

Ending Weather clear 40°

Wind Speed 10-15 Direct SE

Sky Condition clear

No. Units in Excess of standard _____

5 min/hr. allow 20

No. Units of VIO. _____

Remarks:

Source TJ Cambell Const. Co

Address _____

Oklahoma City OK.

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

REV. AQ-23 5/2/78

2

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/12/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 100 Ft.

Wind Speed 10-15 Direct SE

Sky Condition Partly Cloudy

Plume Color white

Plume Background Blue

Plume Behavior ~~[illegible]~~ looping

Steam Plume

detached 0 Ft. from stack

attached 150 Ft. dissipated

Start Time 0800

Ending Time 0859

Ending Weather Partly Cloudy

Wind Speed 10-15 Direct SW

Sky Condition Partly Cloudy

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source

Address

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

8 9 10 11 12 13 14 15

REV. AQ-23 6/1/78

3

| DATA VALIDATION |
|---|
| BY |
| DATE |

## Plume Observation Record Form

Date 11/12/83

Observer L Garcia

Checked By

Type of installation Asphalt Concrete Plant

Fuel Gas Stack Ht. 30'

Observers Distance from Stack 100 Ft.

Wind Speed 15-20 Direct SW

Sky Condition Partly Cloudy

Plume Color white

Plume Background blue

Plume Behavior ~~dispersing~~ looping

Steam Plume

detached 0 Ft. from stack

attached 150 Ft. dissipated

Start Time 0900

Ending Time ~~0950~~ 1125

Ending Weather Partly Cloudy

Wind Speed ~~5-10~~ 20+ Direct SW 40°

Sky Condition Partly Cloudy

No. Units in Excess of standard

5 min/hr. allow 20

No. Units of VIO.

Remarks:

Source TJ Campbell

Address

Oklahoma City OK

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

REV. AQ-23 6/1/78

FACILITY

SUMMARY OF VISIBLE EMISSIONS

Date: 11/15/83

Type of Plant: Asphalt Concrete

Type of Discharge: Stack

Location of Discharge: scrubber outlet

Height of Point of Discharge: 30'

Description of Background: clear

Description of Sky: blue

Wind Direction: N-NW

Color of Plume: white

Duration of Observation: 2hr 35min

Distance from Observer to Discharge Point: 250'

Height of Observation Point: 0-15'

Direction of Observer from Discharge Point: E-SE

Wind Velocity: 10-15

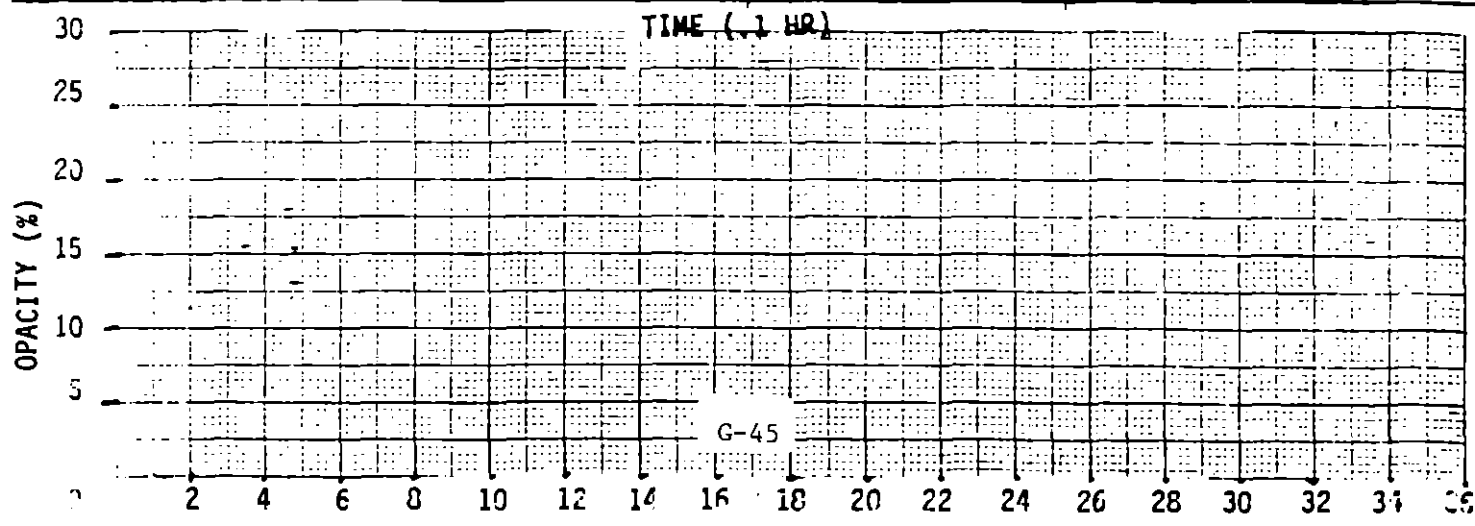
Detached Plume: 200-250'

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 1 | 0815 | 0820 | 0 | 0 |
| 2 | 0821 | 0826 | 0 | 0 |
| 3 | 0827 | 0832 | 0 | 0 |
| 4 | 0833 | 0838 | 0 | 0 |
| 5 | 0839 | 0844 | 0 | 0 |
| 6 | 0855 | 0900 | 0 | 0 |
| 7 | 0901 | 0906 | 0 | 0 |
| 8 | 0907 | 0912 | 0 | 0 |
| 9 | 0913 | 0918 | 0 | 0 |
| 10 | 0919 | 0924 | 0 | 0 |
| 11 | 0925 | 0930 | 0 | 0 |
| 12 | 0931 | 0936 | 0 | 0 |
| 13 | 0937 | 0942 | 0 | 0 |
| 14 | 0943 | 0948 | 0 | 0 |
| 15 | 0949 | 0954 | 0 | 0 |
| 16 | 0955 | 1000 | 0 | 0 |
| 17 | 1001 | 1006 | 0 | 0 |
| 18 | 1007 | 1012 | 0 | 0 |
| 19 | 1013 | 1018 | 0 | 0 |
| 20 | 1019 | 1024 | 0 | 0 |

SUMMARY OF AVERAGE OPACITY

| Set Number | Start | End | Sum | Average |
|---|---|---|---|---|
| 21 | 1025 | 1030 | 0 | 0 |
| 22 | 1031 | 1036 | 0 | 0 |
| 23 | 1037 | 1042 | 0 | 0 |
| 24 | 1043 | 1048 | 0 | 0 |
| 25 | 1049 | 1054 | 0 | 0 |
| 26 | | | | |
| 27 | | | | |
| 28 | | | | |
| 29 | | | | |
| 30 | | | | |
| 31 | | | | |
| 32 | | | | |
| 33 | | | | |
| 34 | | | | |
| 35 | | | | |
| 36 | | | | |
| 37 | | | | |
| 38 | | | | |
| 39 | | | | |
| 40 | | | | |



DATA VALIDATION
BY _____
DATE _____

## Plume Observation Record Form

Date 11/15/83
Observer L Garcia
Checked By _____
Type of installation _____

Source TJ Cambell Constr Co
Address _____
Oklahoma City

Fuel _____ Stack Ht. 30'
Observers Distance from Stack 250 Ft.
Wind Speed 10-15 Direct N
Sky Condition clear
Plume Color white
Plume Background blue
Plume Behavior ~~discharging~~ looping
Steam Plume
detached 0 Ft. from stack
attached 200 Ft. dissipated
Start Time 0815-0855
Ending Time 0845-0859
Ending Weather clear 45°
Wind Speed 10-15 Direct N
Sky Condition clear

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____

Remarks:
*Start RAP

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

REV. AQ-23 6/1/78

DATA VALIDATION
BY _____
DATE _____

## Plume Observation Record Form

Date 11/15/83
Observer L Garcia
Checked By _____
Type of installation _____

Source I.J. Cambell Const Co.
Address _____
Oklahoma City

Fuel _____ Stack Ht. _____
Observers Distance from Stack 250 Ft.
Wind Speed 10-15 Direct NW
Sky Condition Clear
Plume Color white
Plume Background blue
Plume Behavior ~~fanning~~ looping
Steam Plume
detached 0 Ft. from stack
attached 225 Ft. dissipated
Start Time 0900
Ending Time 0959
Ending Weather clear 47°
Wind Speed 10-15 Direct NW
Sky Condition clear

No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

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

REV. AQ-23 6/1/78

3

| DATA VALIDATION |
|---|
| BY _____ |
| DATE _____ |

## Plume Observation Record Form

Date 11/15/83
Observer L Garcia
Checked By _____
Type of installation _____

Source Cambell Asphalt Co
Address _____
Oklahoma City OK

Fuel _____ Stack Ht. _____
Observers Distance from Stack 250 Ft.
Wind Speed 10-15 Direct NW
Sky Condition clear
Plume Color _____
Plume Background blue
Plume Behavior ~~dispersing~~ looping
Steam Plume
detached 0 Ft. from stack
attached 250 Ft. dissipated
Start Time 1000
Ending Time 1059
Ending Weather clear 55°
Wind Speed 10-15 Direct NW
Sky Condition clear
No. Units in Excess of standard _____
5 min/hr. allow 20
No. Units of VIO. _____
Remarks:

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

REV. AQ-23 6/1/78

APPENDIX G.2

RECYCLE OPERATION DATA

INCLUDES

G.2.3 Summary Log of Visible Emissions

Recycle Operation Observations

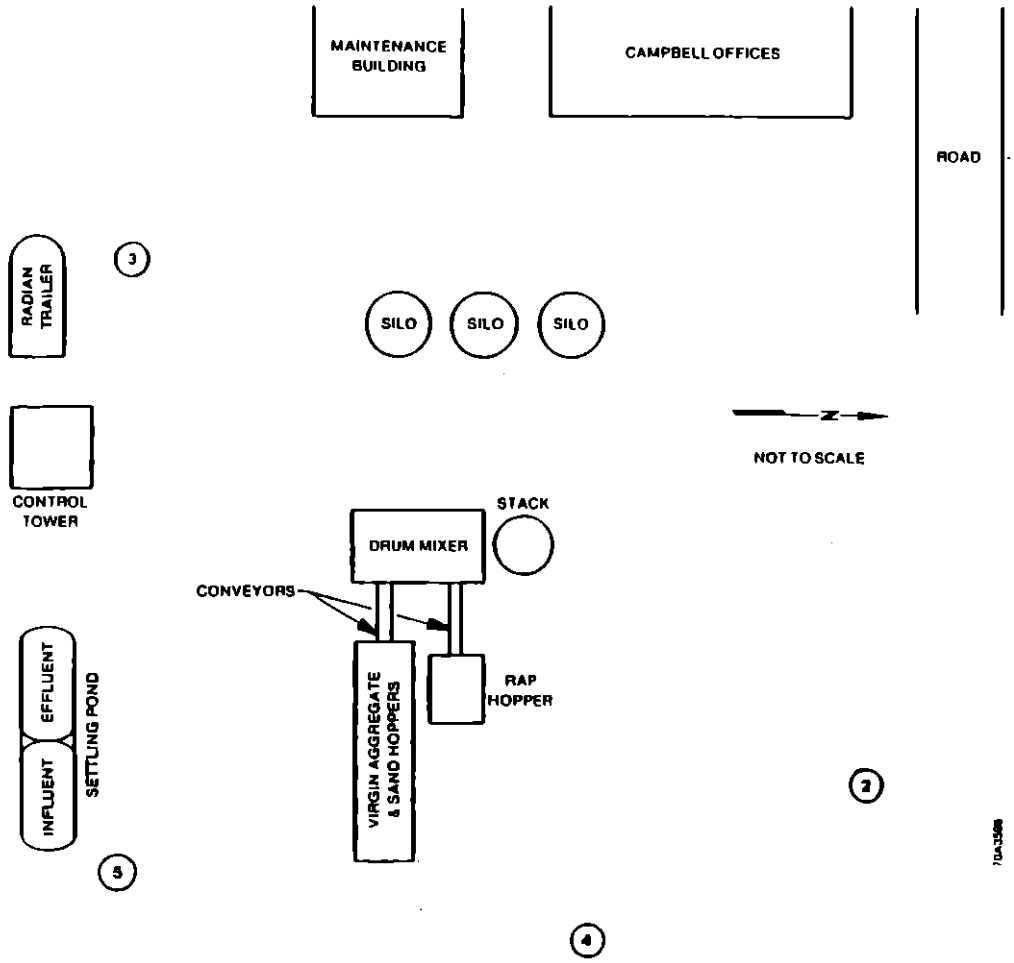
| Date | Start | Stop | Time (min) |
|---|---|---|---|
| 11/10 | 1000 | 1100 | 60 |
| | 1140 | 1159 | 19 |
| | 1400 | 1500 | 60 |
| | 1505 | 1600 | 55 |
| | 1620 | 1630 | 11 |
| 11/11 | 0819 | 1003 | 105 |
| | 1009 | 1015 | 7 |
| | 1104 | 1136 | 33 |
| | 1308 | 1337 | 30 |
| | 1400 | 1442 | 43 |
| | 1530 | 1541 | 12 |
| | 1545 | 1718 | 94 |
| 11/12 | 0722 | 0806 | 45 |
| | 0812 | 0925 | 74 |
| 11/15 | 0815 | 0845 | 30 |
| | 0855 | 1100 | 125 |

APPENDIX G.2

RECYCLE OPERATION DATA

INCLUDES

G.2.4 Visible Emissions Observation Locations




1

| Position No. | Date | Time | Approximate Distance from Stack (ft) | Direction of Observer from Discharge Point |
|---|---|---|---|---|
| 1 | 11-10-83 | 1000-1625 | 1000 | SE |
| 2 | 11-11-83 | 0819-1136 | 125 | NE |
| 3 | 11-11-83 | 1308-1718 | 100 | SW |
| 4 | 11-12-83 | 0722-0925 | 200 | E |
| 5 | 11-15-83 | 0815-1054 | 250 | E-SE |

C - conventional operation
R - recycle operation

Figure 2-2. Locations of visible emissions observations during recycle operation.

APPENDIX G.3

VISIBLE EMISSIONS OBSERVER CERTIFICATION CERTIFICATE

STATE OF NORTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES & COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT

"NOTICE"

This is to advise Fernando Garcia that on 9/13/83 you sucessfully completed requirements for:

✓ Renewal of "Certificate of Competency to Determine Visible Emissions" and thereby will require renewal on 9/13/84. Please attach this notice to your certificate as it is the official notice of recertification.

____ Certification to determine visible emissions, by completion of a cource 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 4.2

"P. O. E." For White Smoke 3.6

____ Did not meet requirements for visible emissions certification.

NAME Fernando L Garcia AFFILIATION TRW

COURSE LOCATION Wate tech Col DISTANCE AND DIRECTION TO STACK

DATE 9/10/83 SKY WIND (DIRECTION) (SPEED)

READING NUMBER 1-B CHECKED BY

| | | | | | | | | | | | | | | | | | | | | | | ERROR PLUS MINUS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 1 5 |
| 2 | 0 | 5 | 10 | (15) | 20 | 25 | ~~30~~ | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 2 15 |
| 3 | 0 | 5 | 10 | 15 | 20 | (25) | 30 | ~~35~~ | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 3 10 |
| 4 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | (35) | ~~40~~ | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 4 5 40 |
| 5 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 5 5 |
| 6 | 0 | 5 | 10 | ~~15~~ | (20) | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 6 5 |
| 7 | 0 | 5 | ~~10~~ | (15) | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | ~~80~~ | 85 | ~~90~~ | 95 | 100 | 7 5 |
| 8 | 0 | ~~5~~ | (10) | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | (80) | ~~85~~ | ~~90~~ | 95 | 100 | 8 5 45 |
| 9 | 0 | 5 | 10 | 15 | 20 | ~~20~~ | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 9 15 |
| 10 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | ~~40~~ | 45 | 50 | (55) | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 10 15 |
| 11 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 11 5 |
| 12 | 0 | 5 | 10 | ~~15~~ | 20 | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 12 10 40 |
| 13 | 0 | 5 | ~~10~~ | 15 | (20) | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 13 10 |
| 14 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 14 5 |
| 15 | 0 | 5 | 10 | 15 | 20 | 25 | ~~30~~ | 35 | (40) | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 15 10 |
| 16 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | ~~40~~ | (45) | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 16 5 |
| 17 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | ~~50~~ | (55) | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 17 5 |
| 18 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | ~~60~~ | (65) | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 18 5 25 |
| 19 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | ~~70~~ | (75) | 80 | 85 | 90 | 95 | 100 | 19 5 |
| 20 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | (75) | ~~80~~ | 85 | 90 | 95 | 100 | 20 5 |
| 21 | 0 | 5 | 10 | 15 | 20 | ~~25~~ | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 21 |
| 22 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | ~~30~~ | 40 | (45) | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 22 10 |
| 23 | 0 | 5 | ~~10~~ | (15) | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 23 5 25 |
| 24 | 0 | ~~5~~ | (10) | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 24 5 |
| 25 | ~~0~~ | (5) | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 25 5 |

SUM OF PLUS DEVIATIONS 140 TOTAL BLACK DEVIATION 175 AVERAGE DEVIATION 7.0

SUM OF MINUS DEVIATION 35 BLACK P.O.E. 4.2

1-W

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 1 5 |
| 2 | 0 | 5 | 10 | 15 | 20 | 25 | ~~30~~ | (35) | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 2 5 |
| 3 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | ~~40~~ | (45) | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 3 5 3 |
| 4 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | ~~50~~ | (55) | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 4 5 |
| 5 | 0 | 5 | 10 | 15 | 20 | ~~25~~ | 30 | (35) | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 5 10 |
| 6 | 0 | 5 | 10 | 15 | 20 | (25) | (30) | ~~35~~ | 40 | (45) | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 6 5 |
| 7 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | ~~35~~ | 40 | (45) | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 7 |
| 8 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 8 5 25 |
| 9 | 0 | 5 | 10 | ~~15~~ | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 9 |
| 10 | 0 | 5 | ~~10~~ | (15) | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 10 5 |
| 11 | 0 | 5 | 10 | 15 | 20 | ~~25~~ | 30 | (35) | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 11 10 |
| 12 | 0 | 5 | 10 | ~~15~~ | 20 | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 12 10 4 |
| 13 | 0 | ~~5~~ | 10 | (15) | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 13 10 |
| 14 | 0 | 5 | 10 | 15 | 20 | ~~25~~ | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 14 |
| 15 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | ~~35~~ | 40 | (45) | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 15 10 |
| 16 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 16 5 |
| 17 | 0 | 5 | 10 | 15 | 20 | 25 | ~~30~~ | (35) | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 17 5 7 |
| 18 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | ~~40~~ | 45 | 50 | (55) | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 18 15 |
| 19 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | ~~50~~ | (55) | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 19 5 |
| 20 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | ~~60~~ | (65) | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 20 5 |
| 21 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | (55) | 60 | 65 | ~~70~~ | 75 | 80 | 85 | 90 | 95 | 100 | 21 15 |
| 22 | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | (65) | 70 | 75 | ~~80~~ | 85 | 90 | 95 | 100 | 22 15 |
| 23 | 0 | 5 | 10 | 15 | ~~20~~ | (25) | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 23 5 4 |
| 24 | 0 | ~~5~~ | (10) | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 24 5 |
| 25 | ~~0~~ | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 25 |

SUM OF PLUS DEVIATIONS 125 TOTAL WHITE DEVIATION 160 AVERAGE DEVIATION 6.4

SUM OF MINUS DEVIATION 35 WHITE P.O.E. 3.6

APPENDIX G.4

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

6.8 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*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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. *Procedures.* 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 observa-

*Continued*

Footnote continued

tions—average opacity determined from transmissometer's 25 recordings.

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 $\theta$=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 $\theta$= 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),

$\phi$=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 $R_2$ [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 $S_v$ 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

SCRUBBER PROCESS MONITORING INFORMATION

INCLUDES


H.1 Conventional Operation Data
- H.1.1 Temperature and pH Measurements of Venturi Scrubber Water
- H.1.2 Total Organic Carbon (TOC) Measurements of Scrubber Water
- H.1.3 Trace Metal Measurements of Scrubber Water
- H.1.4 Polynuclear Aromatic Hydrocarbon Measurements of Scrubber Water and Effluent Scrubber Solids
- H.1.5 Total Solids Measurement of Scrubber Liquor During Conventional Operation

H.2 Recycle Operation Data
- H.2.1 Temperature and pH Measurements of Venturi Scrubber Water
- H.2.2 Total Organic Carbon (TOC) Measurements of Scrubber Water
- H.2.3 Trace Metal Measurements of Scrubber Water
- H.2.4 Polynuclear Aromatic Hydrocarbon Measurements of Scrubber Water and Effluent Scrubber Solids
- H.2.5 Total Solids Measurement of Scrubber Water

H.3 Copies of Field Laboratory Notebook Support Data for Conventional and Recycle Operation

H.4 Analytical Test Matrices
- H.4.1 Conventional Operation Analytical Test Series Matrices
- H.4.2 Recycle Operation Analytical Test Series Matrices

H.5 Sample Identification and Sample Logs

H.6 Calibration Verification of Signet Flosensors

APPENDIX H.1

CONVENTIONAL OPERATION DATA

INCLUDES

H.1.1 Temperature and pH Measurements of Venturi Scrubber Water
- H.1.1.1 Inlet Venturi Scrubber Water
- H.1.1.2 Effluent Venturi Scrubber Water

H.1.1 Temperature and pH Measurements of Venturi Scrubber Water

H.1.1.1 Inlet Venturi Scrubber Water

| Date | Time | Temperature °C | pH |
|---|---|---|---|
| 11-08-83 | 1400 | 54 | 7.53 |
| 11-08-83 | 1510 | 54 | 7.43 |
| 11-08-83 | 1600 | 54 | 7.24 |
| 11-12-83 | 1140 | 53 | 7.28 |
| 11-12-83 | 1240 | 56 | 7.30 |
| 11-12-83 | 1340 | 58 | 7.31 |
| 11-13-83 | 0920 | 51 | 7.31 |
| 11-13-83 | 1020 | 54 | 7.29 |
| 11-14-83 | 0850 | 37 | 7.43 |
| 11-14-83 | 0945 | 46 | 7.36 |
| 11-14-83 | 1230 | 53 | 7.31 |
| 11-14-83 | 1400 | 54 | 7.34 |

H.1.1.2 Effluent Venturi Scrubber Water

| Date | Time | Temperature °C | pH |
|---|---|---|---|
| 11-08-83 | 1415 | 66 | 7.30 |
| 11-08-83 | 1515 | 67 | 7.13 |
| 11-08-83 | 1605 | 68 | 6.89 |
| 11-12-83 | 1140 | 67 | 7.18 |
| 11-12-83 | 1240 | 68 | 7.15 |
| 11-12-83 | 1340 | 71 | 7.18 |
| 11-13-83 | 0920 | 65 | 7.24 |
| 11-13-83 | 1020 | 67 | 7.12 |
| 11-14-83 | 0850 | 63 | 7.12 |
| 11-14-83 | 0945 | 64 | 7.18 |
| 11-14-83 | 1230 | 69 | 7.15 |
| 11-14-83 | 1400 | 71 | 7.22 |

APPENDIX H.1

CONVENTIONAL OPERATION DATA

INCLUDES

H.1.2 Total Organic Carbon (TOC) Measurements of Scrubber Water
- H.1.2.1 Inlet Venturi Scrubber Water
- H.1.2.2 Effluent Venturi Scrubber Water

H.1.2 Total Organic Carbon (TOC) Measurements of Scrubber Water

H.1.2.1 Inlet Venturi Scrubber Water

| Date | Time | TOC mg/ℓ | Sample Vol. (ml) | TOC Total (mg) |
|---|---|---|---|---|
| 11-12-83 | 1140-1340 | 160 | 996 | 159 |
| 11-13-83 | 0920-1020 | 180 | 700 | 126 |
| 11-14-83 | 0850-0945 | 186 | 705 | 131 |
| 11-14-83 | 1230-1400 | 180 | 635 | 114 |

H.1.2.2 Effluent Venturi Scrubber Water

| Date | Time | TOC mg/ℓ | Sample Vol. (ml) | TOC Total (mg) |
|---|---|---|---|---|
| 11-12-83 | 1140-1340 | 160 | 995 | 159 |
| 11-13-83 | 0920-1020 | 250 | 715 | 179 |
| 11-14-83 | 0850-0945 | 230 | 715 | 164 |
| 11-14-83 | 1230-1400 | 200 | 755 | 151 |

APPENDIX H.1

CONVENTIONAL OPERATION DATA

INCLUDES

H.1.3 Trace Metal Measurements of Scrubber Water
- H.1.3.1 Inlet Venturi Scrubber Water Trace Metal Content
- H.1.3.2 Effluent Venturi Scrubber Water Trace Metal Content
- H.1.3.3 Effluent Venturi Scrubber Water Suspended Solids Trace Metal Content

## H.1.3 Trace Metals Measurements of Scrubber Water

### H.1.3.1 Inlet Venturi Scrubber Water Trace Metal Content

| Date | Time | Al µg/ml | Be µg/ml | Ca µg/ml | Cd µg/ml | Cr µg/ml | Fe µg/ml | Hg µg/ml | Mg µg/ml | Mn µg/ml | Ni µg/ml | Pb µg/ml | V µg/ml | Zn µg/ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-12-83 | 1140-1340 | <.05 | 0.001 | 290 | 0.007 | 0.004 | 0.026 | <.03 | 54 | 0.047 | <.003 | <.08 | 0.069 | <.003 |

### H.1.3.2 Effluent Venturi Scrubber Water Trace Metal Content

| Date | Time | Al µg/ml | Be µg/ml | Ca µg/ml | Cd µg/ml | Cr µg/ml | Fe µg/ml | Hg µg/ml | Mg µg/ml | Mn µg/ml | Ni µg/ml | Pb µg/ml | V µg/ml | Zn µg/ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-12-83 | 1140-1340 | <.05 | <.0005 | 300 | <.002 | <.001 | <.008 | <.03 | 54 | 0.053 | 0.005 | <.084 | <.003 | <.003 |

### H.1.3.3 Effluent Venturi Scrubber Water Suspended Solids Trace Metal Content

| Date | Time | Al µg/g | Be µg/g | Ca µg/g | Cd µg/g | Cr µg/g | Fe µg/g | Hg µg/g | Mg µg/g | Mn µg/g | Ni µg/g | Pb µg/g | V µg/g | Zn µg/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-12-83 | 1140-1340 | 3600 | 0.30 | 330,000 | 0.92 | 15 | 6000 | 30 | 4600 | 110 | 9.9 | 1.6 | 60 | 15 |

APPENDIX H.1

CONVENTIONAL OPERATION DATA

INCLUDES

H.1.4 Polynuclear Aromatic Hydrocarbon Measurements of Scrubber Water

- H.1.4.1 Benzo(a)Pyrene and Related PAHs in Inlet Venturi Scrubber Water Samples
- H.1.4.2 Benzo(a)Pyrene and Related PAHs in Effluent Venturi Scrubber Water Samples
- H.1.4.3 Benzo(a)Pyrene and Related PAHs in Venturi Scrubber Water Solids

H.1.4 Polynuclear Aromatic Hydrocarbon Measurements of Scrubber Water

H.1.4.1 Benzo(a)Pyrene and Related PAHs in Inlet Venturi Scrubber Water Samples Collected 11-14-83

| Compounds | Isomer Group | Concentration, µg/L C-221 (Inlet) |
|---|---|---|
| Phenanthrene | $C_{14}H_{10}$ | 10 |
| Anthracene | $C_{14}H_{10}$ | 0.4 |
| Fluoranthene | $C_{16}H_{10}$ | 0.6 |
| Pyrene | $C_{16}H_{10}$ | 1.4 |
| Benz(a)anthracene | $C_{18}H_{12}$ | < 0.1 |
| Chrysene | $C_{18}H_{12}$ | 0.1 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND |
| Perylene | $C_{20}H_{12}$ | ND |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND |
| Benzo(a)pyrene-$d_{12}$ | | 32(80%) |

H.1.4.2 Benzo(a)Pyrene and Related PAHs in Effluent Venturi Scrubber Water Samples Collected 11-14-83

| Compounds | Isomer Group | Concentration, ug/L C-222 (Effluent) |
|---|---|---|
| Phenanthrene | $C_{14}H_{10}$ | 6.8 |
| Anthracene | $C_{14}H_{10}$ | ND |
| Fluoranthene | $C_{16}H_{10}$ | 0.3 |
| Pyrene | $C_{16}H_{10}$ | 0.6 |
| Benz(a)anthracene | $C_{18}H_{12}$ | < 0.1 |
| Chrysene | $C_{18}H_{12}$ | 0.1 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND |
| Perylene | $C_{20}H_{12}$ | ND |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND |
| Benzo(a)pyrene-$d_{12}$ | | 23(57%) |

H.1.4.3 Amount of Benzo(a)Pyrene and Related PAHs in Venturi Scrubber Water Solids

| Compounds | Isomer Group | Concentration, μg/g 11-14-83 |
|---|---|---|
| Phenanthrene | $C_{14}H_{10}$ | 0.02 |
| Anthracene | $C_{14}H_{10}$ | ND |
| Fluoranthene | $C_{16}H_{10}$ | 0.04 |
| Pyrene | $C_{16}H_{10}$ | 0.02 |
| Benz(a)anthracene | $C_{18}H_{12}$ | ND |
| Chrysene | $C_{18}H_{12}$ | 0.18 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | 0.01 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | 0.01 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | 0.04 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND |
| Perylene | $C_{20}H_{12}$ | ND |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND |
| Benzo(a)pyrene-$d_{12}$ | | 38.8(97%) |

ND - Not Detected

APPENDIX H.1

CONVENTIONAL OPERATION DATA

INCLUDES

H.1.5 Total Solids Measurements of Scrubber Water
- H.1.5.1 Inlet Venturi Scrubber Water
- H.1.5.2 Effluent Venturi Scrubber Water

H.1.5 Total Solids Measurements of Scrubber Water

H.1.5.1 Inlet Venturi Scrubber Water

| Date | Time | % Suspended Solids | Dissolved Solids mg/ℓ |
|---|---|---|---|
| 11-08-83 | 1400-1600 | 0 | 1660 |
| 11-12-83 | 1140-1340 | 0.016 | 1860 |
| 11-13-83 | 0920-1020 | 0.002 | 1780 |
| 11-14-83 | 0850- | 0.002 | 1770 |
| 11-14-83 | 1230-1400 | 0 | 1790 |

H.1.5.2 Effluent Venturi Scrubber Water

| Date | Time | % Suspended Solids | Dissolved Solids mg/ℓ |
|---|---|---|---|
| 11-08-83 | 1400-1600 | 0.720 | 1680 |
| 11-12-83 | 1140-1340 | 0.671 | 1850 |
| 11-13-83 | 0920-1020 | 0.653 | 1760 |
| 11-14-83 | 0850-0945 | 0.518 | 1770 |
| 11-14-83 | 1230-1400 | 0.524 | 1810 |

APPENDIX H.2

RECYCLE OPERATION

INCLUDES

H.2.1 Temperature and pH Measurements of Venturi Scrubber Water
H.2.1.1 Inlet Venturi Scrubber Water
H.2.1.2 Effluent Venturi Scrubber Water

H.2.1 Temperature and pH Measurements of Venturi Scrubber Water

H.2.1.1 Inlet Venturi Scrubber Water

| Date | Time | Temperature °C | pH |
|---|---|---|---|
| 11-10-83 | 1100 | 47 | 7.37 |
| 11-11-83 | 0900 | 33 | 7.46 |
| 11-11-83 | 0945 | 42 | 7.32 |
| 11-11-83 | 1440 | 54 | 7.25 |
| 11-11-83 | 1605 | 55 | 7.28 |
| 11-11-83 | 1650 | 55 | 7.28 |
| 11-12-83 | 0830 | 43 | 7.46 |
| 11-12-83 | 0900 | 44 | 7.40 |
| 11-15-83 | 0915 | 48 | 7.44 |
| 11-15-83 | 1000 | 54 | 7.46 |
| 11-15-83 | 1050 | 57 | 7.49 |

H.2.1.2 Effluent Venturi Scrubber Water

| Date | Time | Temperature °C | pH |
|---|---|---|---|
| 11-10-83 | 1110 | 61 | 7.16 |
| 11-11-83 | 0900 | 55 | 7.18 |
| 11-11-83 | 0945 | 55 | 7.10 |
| 11-11-83 | 1440 | 65 | 7.22 |
| 11-11-83 | 1605 | 67 | 7.20 |
| 11-11-83 | 1650 | 68 | 7.22 |
| 11-12-83 | 0830 | 61 | 7.22 |
| 11-12-83 | 0900 | 63 | 7.11 |
| 11-15-83 | 0915 | 80 | 7.11 |
| 11-15-83 | 1000 | 77 | 7.10 |
| 11-15-83 | 1050 | 79 | 7.15 |

APPENDIX H.2

RECYCLE OPERATION DATA

INCLUDES

H.2.2 Total Organic Carbon Measurements
- H.2.2.1 Inlet Venturi Scrubber Water
- H.2.2.2 Effluent Venturi Scrubber Water

H.2.2 Total Organic Carbon Measurements of Scrubber Water

H.2.2.1 Inlet Venturi Scrubber Water

| Date | Time | TOC mg/ℓ | Sample Vol. (ml) | TOC Total (mg) |
|---|---|---|---|---|
| 11-11-83 | 0900-1440 | 170 | 980 | 167 |
| 11-11-83 | 1605-1650 | 180 | 683 | 123 |
| 11-12-83 | 0830-0900 | 170 | 710 | 121 |
| 11-15-83 | 0915-1050 | 190 | 995 | 189 |

H.2.2.2 Effluent Venturi Scrubber Water

| Date | Time | TOC mg/ℓ | Sample Vol. (ml) | TOC Total (mg) |
|---|---|---|---|---|
| 11-11-83 | 0900-1440 | 170 | 1000 | 170 |
| 11-11-83 | 1605-1650 | 190 | 695 | 132 |
| 11-12-83 | 0830-0900 | 170 | 695 | 118 |
| 11-15-83 | 0915-1050 | 190 | 1030 | 196 |

APPENDIX H.2

RECYCLE OPERATION DATA

INCLUDES

H.2.3 Trace Metal Measurements of Scrubber Water
- H.2.3.1 Inlet Venturi Scrubber Water Trace Metal Content
- H.2.3.2 Effluent Venturi Scrubber Water Trace Metal Content
- H.2.3.3 Effluent Venturi Scrubber Water Suspended Solids Trace Metal Content

## H.2.3 Trace Metals Measurements of Scrubber Water

### H.2.3.1 Inlet Venturi Scrubber Water Trace Metal Content

| Date | Time | Al µg/ml | Be µg/ml | Ca µg/ml | Cd µg/ml | Cr µg/ml | Fe µg/ml | Hg µg/ml | Mg µg/ml | Mn µg/ml | Ni µg/ml | Pb µg/ml | V µg/ml | Zn µg/ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-11-83 | 0900-1440 | <.05 | <.0005 | 300 | <.002 | <.001 | <.008 | <.03 | 54 | 0.060 | 0.003 | <0.84 | <.003 | <.003 |

### H.2.3.2 Effluent Venturi Scrubber Water Trace Metal Content

| Date | Time | Al µg/ml | Be µg/ml | Ca µg/ml | Cd µg/ml | Cr µg/ml | Fe µg/ml | Hg µg/ml | Mg µg/ml | Mn µg/ml | Ni µg/ml | Pb µg/ml | V µg/ml | Zn µg/ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-11-83 | 0900-1440 | <.05 | <.0005 | 300 | <.002 | <.001 | <.008 | <.03 | 53 | 0.061 | <.003 | <.084 | <.003 | <.003 |

### H.2.3.3 Effluent Venturi Scrubber Water Suspended Solids Trace Metal Content

| Date | Time | Al µg/g | Be µg/g | Ca µg/g | Cd µg/g | Cr µg/g | Fe µg/g | Hg µg/g | Mg µg/g | Mn µg/g | Ni µg/g | Pb µg/g | V µg/g | Zn µg/g |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-15-83 | 0915-1050 | 4800 | 0.85 | 200,000 | 3.3 | 18 | 7700 | 30 | 5600 | 220 | 12 | 7.8 | 60 | 20 |

APPENDIX H.2

RECYCLE OPERATION DATA

INCLUDES

H.2.4 Polynuclear Aromatic Hydrocarbon Measurements of Scrubber Water
H.2.4.1 Benzo(a)Pyrene and Related PAHs in Inlet Venturi Scrubber Water Samples
H.2.4.2 Benzo(a)Pyrene and Related PAHs in Effluent Venturi Scrubber Water Samples
H.2.4.3 Benzo(a)Pyrene and Related PAHs in Venturi Scrubber Water Solids

H.2.4 Polynuclear Aromatic Hydrocarbon Measurements of Scrubber Water

H.2.4.1 Benzo(a)Pyrene and Related PAHs in Inlet Venturi Scrubber Water Samples Collected 11-15-83

| Compounds | Isomer Group | Concentration, μg/L C-223 (Inlet) |
|---|---|---|
| Phenanthrene | $C_{14}H_{10}$ | 7.0 |
| Anthracene | $C_{14}H_{10}$ | ND |
| Fluoranthene | $C_{16}H_{10}$ | 0.7 |
| Pyrene | $C_{16}H_{10}$ | 1.3 |
| Benz(a)anthracene | $C_{18}H_{12}$ | < 0.1 |
| Chrysene | $C_{18}H_{12}$ | 0.1 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND |
| Perylene | $C_{20}H_{12}$ | ND |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND |
| Benzo(a)pyrene-$d_{12}$ | | 32(80%) |

H.2.4.2 Benzo(a)Pyrene and Related PAHs in Effluent Venturi Scrubber Water Samples Collected 11-15-83

| Compounds | Isomer Group | Concentration, µg/L C-224 (Effluent) |
|---|---|---|
| Phenanthrene | $C_{14}H_{10}$ | 5.0 |
| Anthracene | $C_{14}H_{10}$ | ND |
| Fluoranthene | $C_{16}H_{10}$ | 0.5 |
| Pyrene | $C_{16}H_{10}$ | 0.8 |
| Benz(a)anthracene | $C_{18}H_{12}$ | < 0.1 |
| Chrysene | $C_{18}H_{12}$ | 0.1 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND |
| Benzo(a)pyrene | $C_{20}H_{12}$ | 0.4 |
| Perylene | $C_{20}H_{12}$ | 0.5 |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND |
| Benzo(a)pyrene-$d_{12}$ | | 30(75%) |

H.2.4.3 Benzo(a)Pyrene and Related PAHs in Venturi Scrubber Water Solids

| Compounds | Isomer Group | Concentration, μg/g 11-15-83 |
|---|---|---|
| Phenanthrene | $C_{14}H_{10}$ | 0.98 |
| Anthracene | $C_{14}H_{10}$ | ND |
| Fluoranthene | $C_{16}H_{10}$ | 0.08 |
| Pyrene | $C_{16}H_{10}$ | 0.13 |
| Benz(a)anthracene | $C_{18}H_{12}$ | 0.19 |
| Chrysene | $C_{18}H_{12}$ | 0.79 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | .08 |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | .08 |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | 0.18 |
| Benzo(a)pyrene | $C_{20}H_{12}$ | 0.04 |
| Perylene | $C_{20}H_{12}$ | 0.05 |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND |
| Benzo(a)pyrene-$d_{12}$ | | 28.7(72%) |

ND - Not Detected

APPENDIX H.2

RECYCLE OPERATION DATA

INCLUDES

H.2.5 Total Solids Measurements of Scrubber Water
H.2.5.1 Inlet Venturi Scrubber Water
H.2.5.2 Effluent Venturi Scrubber Water

H.2.5 Total Solids Measurements of Scrubber Water

H.2.5.1 Inlet Venturi Scrubber Water

| Date | Time | % Suspended Solids | Dissolved Solids mg/ℓ |
|---|---|---|---|
| 11-10-83 | 1100-1150 | 0 | 1740 |
| 11-11-83 | 0900-1440 | 0.010 | 1960 |
| 11-11-83 | 1605-1650 | 0.010 | 1970 |
| 11-12-83 | 0830-0900 | 0.018 | 1890 |
| 11-15-83 | 0915-1050 | 0.006 | 1860 |

H.2.5.2 Effluent Venturi Scrubber Water

| Date | Time | % Suspended Solids | Dissolved Solids mg/ℓ |
|---|---|---|---|
| 11-10-83 | 1100-1150 | 0.597 | 1750 |
| 11-11-83 | 0900-1440 | 0.309 | 1950 |
| 11-11-83 | 1605-1650 | 0.469 | 1970 |
| 11-12-83 | 0830-0900 | 0.301 | 1900 |
| 11-15-83 | 0915-1050 | 0.115 | 1820 |

APPENDIX H.3

Copies of Field Laboratory Notebook Support Data for Conventional and Recycle Operation

Project No.

Book No. TITLE Scrubber $H_2O$ pH / Temp °C

| Date/Run | Venturi Feed time | pH / °C | Venturi Return time | pH / °C | |
|---|---|---|---|---|---|
| 11-8-83 | 1400 | 7.53 / 54° | 1415 | 7.30 / 66° | |
| Run 1 | 1510 | 7.43 / 54° | 1515 | 7.13 / 67° | |
| Conventional) | 1600 | 7.24 / 54° | 1605 | 6.89 / 68° | |
| 11-10-83 | 1100 | 7.30 / 47° | 1110 | 7.16 / 61° | |
| 11-11-83 | 0900 | 7.46 / 33° | 0900 | 7.18 / 55° | |
| run 2 | 0945 | 7.32 / 42 | 0945 | 7.10 / 55° | |
| (recycle) | 1440 | 7.25 / 54° | 1440 | 7.22 / 65° | |
| | 1605 | 7.28 / 55° | 1605 | 7.20 / 67° | |
| | 1650 | 7.28 / 55° | 1650 | 7.22 / 68° | |
| 11-12-83 | 0830 | 7.46 / 43° | 0830 | 7.22 / 61° | |
| run 2 | 0900 | 7.40 / 44° | 0900 | 7.11 / 63° | |
| run 1 | 1140 | 7.28 / 53° | 1140 | 7.18 / 67° | |
| | 1240 | 7.30 / 56° | 1240 | 7.15 / 68° | |
| | 1340 | 7.31 / 58° | 1340 | 7.18 / 71° | |
| 11-13-83 | 0920 | 7.31 / 51° | 0920 | 7.24 / 65° | |
| run 1 | 1020 | 7.29 / 54° | 1020 | 7.12 / 67° | |
| 11-14-83 | 0850 | 7.43 / 37° | 0850 | 7.12 / 63° | flocculent |
| run 1 | 0945 | 7.36 / 46° | 0945 | 7.18 / 64° | added to |
| | 1230 | 7.31 / 53° | 1230 | 7.15 / 69° | pond ~1100 |
| | 1400 | 7.34 / 54° | 1400 | 7.22 / 71° | |
| 11-15-83 | 0915 | 7.44 / 48° | 0915 | 7.11 / 80° | |
| run 2 | 1000 | 7.46 / 54° | 1000 | 7.10 / 77° | |
| | 1050 | 7.49 / 57° | 1050 | 7.15 / 79° | |



To Page No.

Witnessed & Understood by me, Date Invented by Date

Recorded by

Project No._____

Book No._____ TITLE Suspended Solids

From Page No.___

| Date | Sample ID | Initial weight | Final weight | Sample weight | filter + solids | filter tare | solids weight | % solids |
|---|---|---|---|---|---|---|---|---|
| -14-83 | Venturi feed 0850 | 721.9 | 290.79 | 431.11 | | | | |
| | 0945 | 710.2 | 291.89 | 418.31 | 3.66 | 3.64 | 0.02 | 0.002 |
| | venturi return 0850 | 706.7 | 290.97 | 415.73 | | | | |
| | 0945 | 716.5 | 296.60 | 420.5 | 7.90 | 3.57 | 4.33 | 0.316 |
| | Venturi feed 1230 | 710.6 | 289.44 | 421.16 | | | | |
| | 1400 | 705.2 | 289.87 | 415.33 | | | | |
| | | | | | 3.68 | 3.68 | — | — |
| | Venturi return 1230 | 703.5 | 290.83 | 412.67 | | | | |
| | 1400 | 723.2 | 290.07 | 433.13 | | | | |
| | | | | | 8.09 | 3.66 | 4.43 | 0.524 |
| 15 | Venturi feed 0915 | 712.0 | 291.50 | | | | | |
| | 1000 | 709.2 | 292.03 | | | | | |
| | 1050 | 719.7 | 295.41 | | 3.66 | 3.61 | .05 | .006 |
| | Venturi return 0915 | 699.5 | 291.29 | | | | | |
| | 1000 | 722.5 | 295.79 | | | | | |
| | 1050 | 705.6 | 289.97 | | 4.63 | 3.62 | 1.02 | .115 |
| | | | | | 5.62 | | | |
| | | | | | 1.02 | | | |



To Page No.___

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by

Dissolved Solids

Project No. 1C1508

Book No.



| Page No. Sample ID | Sample ml | Final weight | Initial + tare weight | Solids weight | g/ml |
|---|---|---|---|---|---|
| 3 Venturi feed 0850 | | | ~~49.1317~~ | | |
| 0945 | | | | | |
| | | 49.1961 | 49.1078 | 0.0883 | .00177 |
| Venturi return 0850 | | | | | |
| 0945 | | | | | |
| | | 49.1889 | 49.1004 | 0.0885 | .00177 |
| Venturi feed 1230 | | | | | |
| 1400 | | | | | |
| | | 51.7237 | 51.6341 | 0.0896 | .00179 |
| Venturi return 1230 | | | | | |
| 1400 | | | | | |
| | | 51.5707 | 51.4804 | 0.0903 | .00181 |
| | | 49.9314 | 49.8363 | 0.0931 | .00186 |
| | | 51.6224 | 51.5312 | 0.0912 | .00182 |



To Page No.

ed & Understood by me, Date Im...ed by Date

Recorded by

TITLE Dissolved Solids

Project No.

Book No.

From Page No.

| Date | Sample ID | | Sample ml | Final weight | Initial weight | Solids weight | S/ml | |
|---|---|---|---|---|---|---|---|---|
| 11-8-83 | Venturi feed | 1400 | 50 | | 51.4553 | | | |
| | | 1510 | | | ~~51.3219~~ | .0832 | | |
| | | 1600 | | 51.5425 | 51.4553 | 51.5425 | .00166 | .001664 |
| | Venturi return | 1415 | | | | | | |
| | | 515 | | | | .0838 | | |
| | | 605 | | 51.4057 | 51.3219 | 51.4057 | .00168 | .001676 |
| 11-10-83 | Venturi feed | 1100 | | | | .0869 | | |
| | | 1155 | | | 51.4069 | 51.3200 | .00174 | .001738 |
| | Venturi return | 1110 | | | 51.7310 | .0874 51.6436 | .00175 | .001748 |
| 11-11-83 | Venturi feed | 0900 | | | | | | |
| | | 0945 | | | | | | |
| | | 1440 | | 49.1749 | 49.0768 | .0981 ~~49.0768~~ | .00196 | |
| | Venturi return | 0900 | | | | | | |
| | | 0945 | | | | | | |
| | | 1440 | | 50.8908 | 50.7935 | .0973 ~~50.7935~~ | .00195 | |
| | Venturi feed | 1605 | | | | | | |
| | | 1650 | | 49.0558 | 48.9575 | .0983 ~~48.9575~~ | .00197 | |
| | Venturi return | 1605 | | | | | | |
| | | 1650 | | 50.9144 | 50.8158 | .0986 ~~50.8158~~ | .00197 | |
| 11-12-83 | Venturi feed | 0830 | | | | | | |
| | | 0900 | | 49.2487 | 49.1542 | .0945 | .00189 | |
| | Venturi return | 0830 | | | | | | |
| | | 0900 | | 50.9123 | 50.8173 | .0950 | .00190 | |
| | Venturi feed | 1140 | | | | | | |
| | | 1240 | | | | | | |
| | | 1340 | | 50.7561 | 50.6633 | .0928 | .00186 | |
| | Venturi return | 140 | | | | | | |
| | | 1240 | | | | | | |
| | | 1340 | | 49.2575 | 49.1649 | .0926 | .00185 | |
| 11-13-83 | Venturi feed | 0920 | | | | | | |
| | | 1020 | | 49.0476 | 48.9589 | .0889 | .00178 | |
| | Venturi return | 0920 | | | ~~48.9566~~ | | | |
| | | 1020 | | 49.2197 | 49.1317 | .0880 | .00176 | |



To Page No.

Witnessed & Understood by me, Date

Invented by Date

Recorded by

Project No._____
Book No._____ TITLE Suspended Solids

From Page No.__

| Date | Sample ID | | Initial Filter weight | Final Filter weight | Sample weight | Filter + solids | Filter Tare | Solid weight | % Solids |
|---|---|---|---|---|---|---|---|---|---|
| 11-8-83 | Venturi feed | 1400 | 622.1 | 289.13 | 332.97 | 1145.41 | ~~3021~~ | | |
| | | 1510 | 695.4 | 291.50 | 403.6 | | ~~3074~~ | | |
| | | 1600 | 703.8 | 294.56 | 408.84 | 3.32 | 3.39 | ~~3.32~~ | — |
| | Venturi return | 1415 | 735.3 | 295.50 | 439.8 | 263.95 | | | |
| | | 1515 | 709.5 | 290.81 | 418.69 | | | | |
| | | 1605 | 696.6 | 291.14 | 405.46 | 12.56 | 3.42 | 12 | 0.72 |
| 11-10-83 | Venturi feed | 1100 | 726.3 | 290.65 | 435.65 | | | | |
| | | 1155 | 777.5 | 291.85 | 485.65 | 3.13 | 3.13 | — | — |
| | Venturi return | 1110 | 700.8 | 290.42 | 410.38 | 5.56 | 3.11 | 2.45 | 0.29 |
| 11-11-83 | Venturi feed | 0900 | 731.8 | 290.74 | 441.06 | 3.03 | 2.93 | 0.10 | 0.01 |
| | | 0945 | 712.1 | 292.09 | 420.01 | | | | |
| | | 1440 | 718.2 | 294.44 | 423.76 | | | | |
| | Venturi return | 0900 | 705.7 | 290.83 | 414.87 | 6.81 | 2.89 | 3.92 | 0.31 |
| | | 0945 | 725.6 | 295.86 | 429.74 | | | | |
| | | 1440 | 712.4 | 289.59 | 422.81 | | | | |
| | Venturi feed | 1605 | 706.5 | 289.37 | 417.13 | 2.99 | 2.87 | 0.12 | 0.01 |
| | | 1650 | 707.0 | 289.47 | 417.53 | | | | |
| | Venturi return | 1605 | 705.7 | 290.93 | 414.77 | 6.79 | 2.93 | 3.86 | 0.47 |
| | | 1650 | 697.5 | 289.50 | 408.00 | | | | |
| 11-12- | Venturi feed | 0630 | 720.8 | 290.78 | 430.02 | | | | |
| | | 0900 | 701.7 | 292.01 | 409.69 | 3.29 | 3.14 | 0.15 | 0.018 |
| | Venturi return | 0630 | 697.9 | 291.24 | 406.66 | | | | |
| | | 0900 | 716.2 | 296.04 | 420.16 | 5.61 | 3.12 | 2.49 | 0.301 |
| | Venturi feed | 1140 | 713.4 | 289.73 | 423.67 | | | | |
| | | 1240 | 704.3 | 289.48 | 414.82 | | | | |
| | | 1340 | 693.8 | 289.32 | 404.48 | 3.32 | 3.12 | 0.20 | 0.016 |
| | Venturi return | 1140 | 707.8 | 290.82 | 416.98 | | | | |
| | | 1240 | 702.0 | 289.65 | 412.35 | | | | |
| | | 1340 | 705.0 | 290.99 | 414.00 | 11.49 | 3.15 | 8.34 | 0.671 |
| 11-13 | Venturi feed | 0920 | 713.7 | 290.97 | 422.73 | | | | |
| | | 1020 | 707.9 | 292.24 | 415.66 | 3.68 | 3.63 | | 0.002 |
| | Venturi return | 0920 | 709.5 | 290.96 | 418.54 | | | | |
| | | 1020 | 725.2 | 295.60 | 429.60 | 9.12 | 3.58 | 5.54 | 0.653 |

To Page No.__



Witnessed & Understood by me, | Date | Invented by | Date
Recorded by

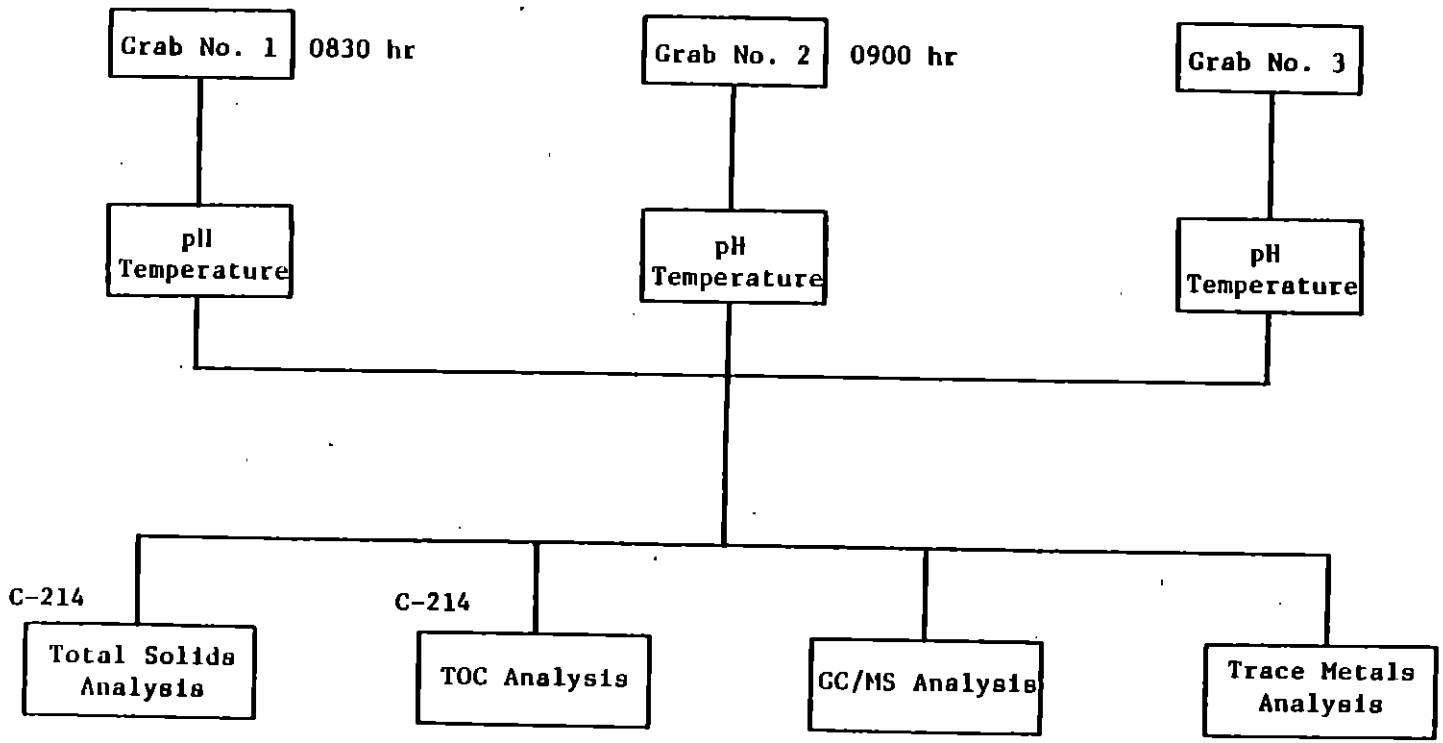
APPENDIX H.4

ANALYTICAL TEST MATRICES

INCLUDES

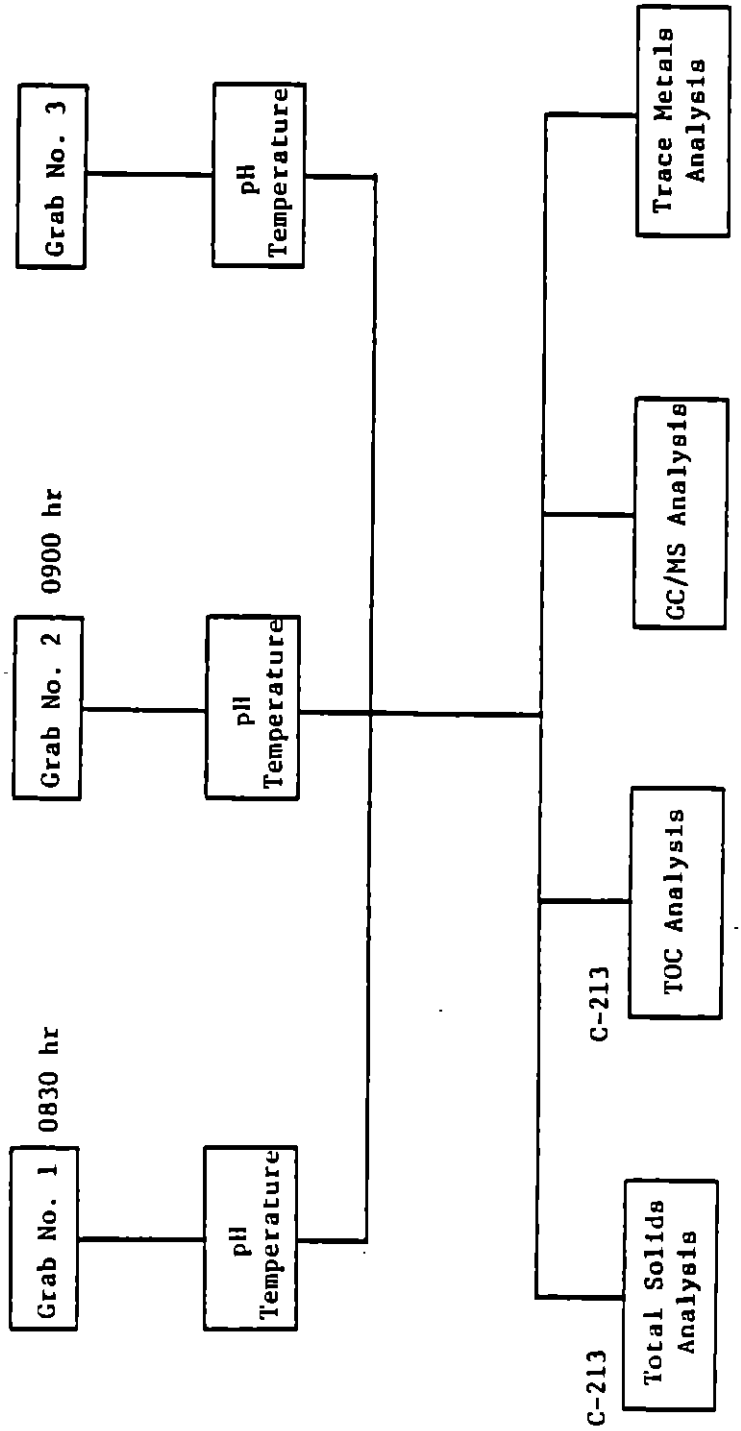
H.4.1 Conventional Operation Analytical Test Series Matrices

Venturi Return 11/12/83 (R)

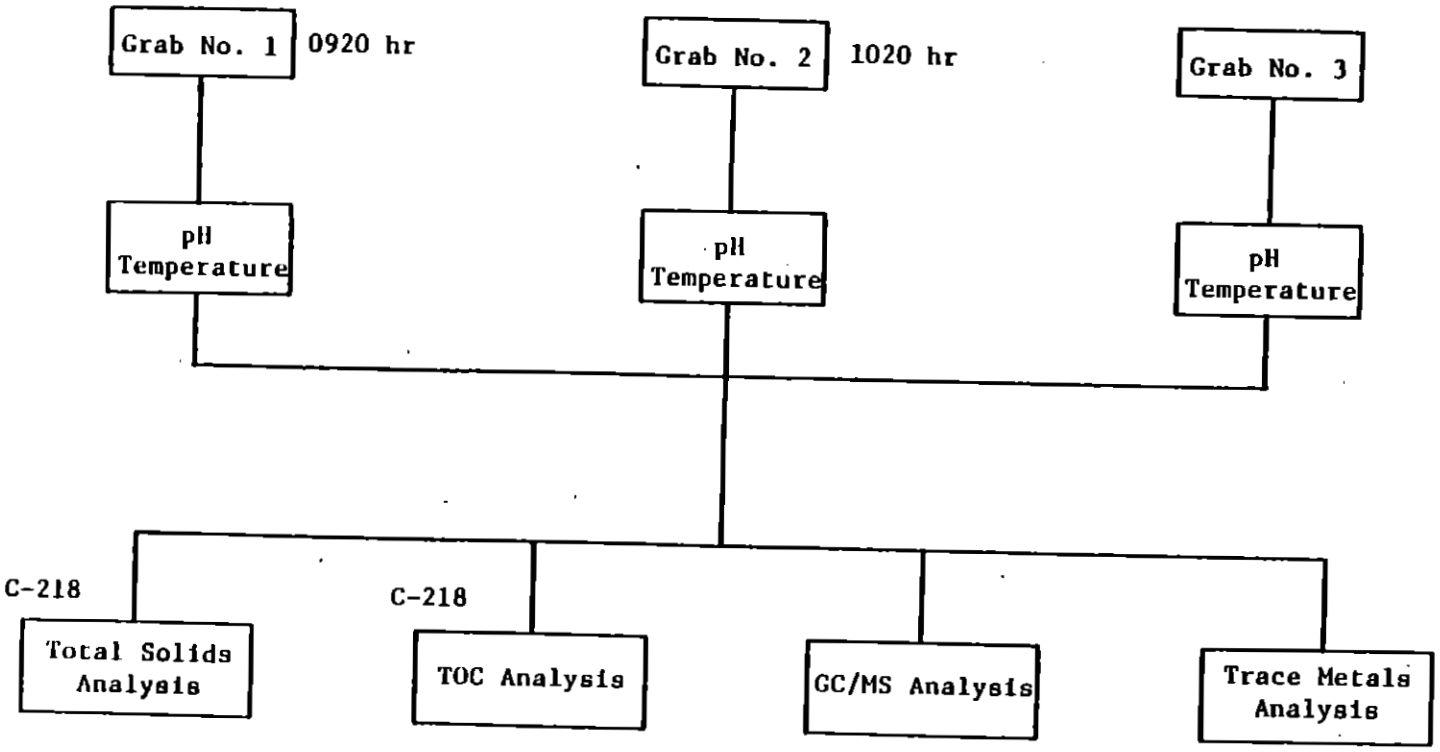


RADIAN CORPORATION

Venturi Feed 11/12/83 (R)

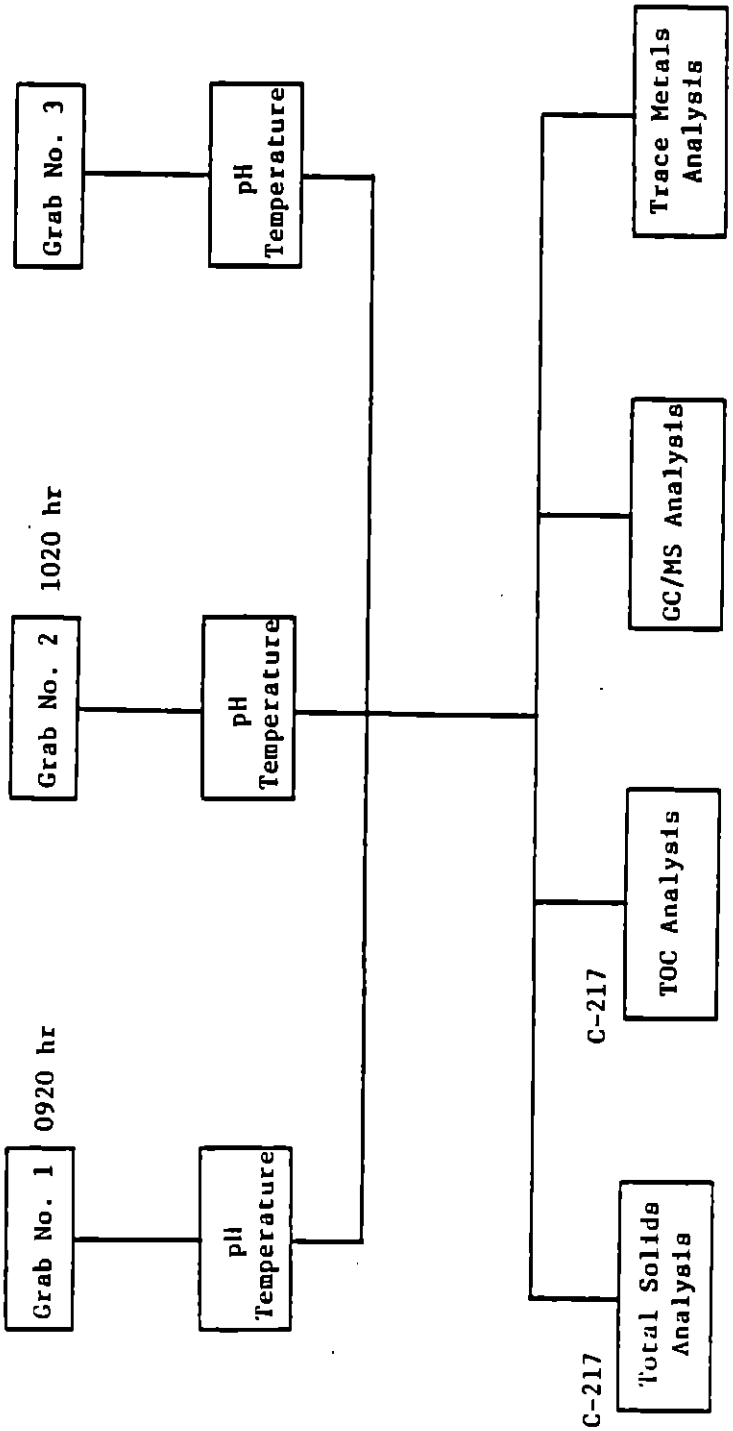


Venturi Return 11/13/83 (C)

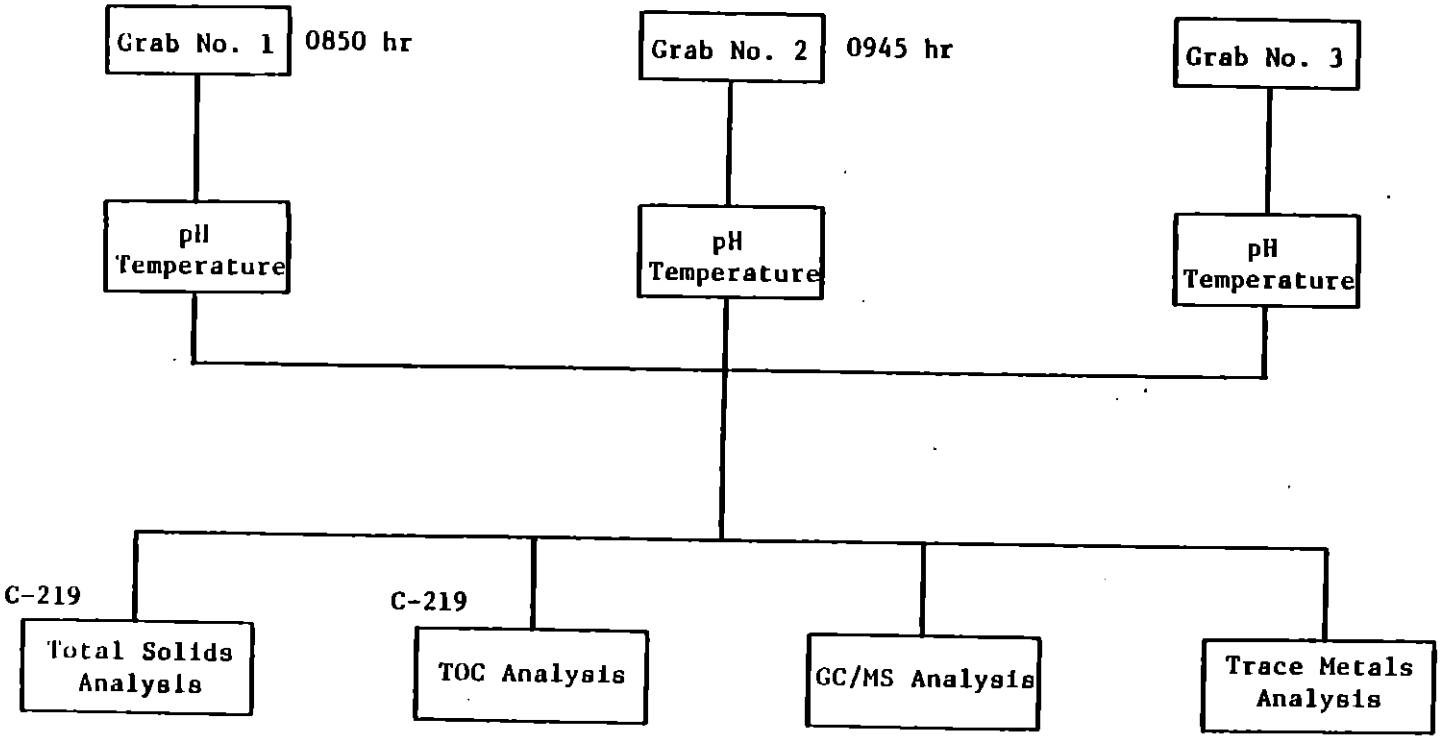


RADIAN CORPORATION

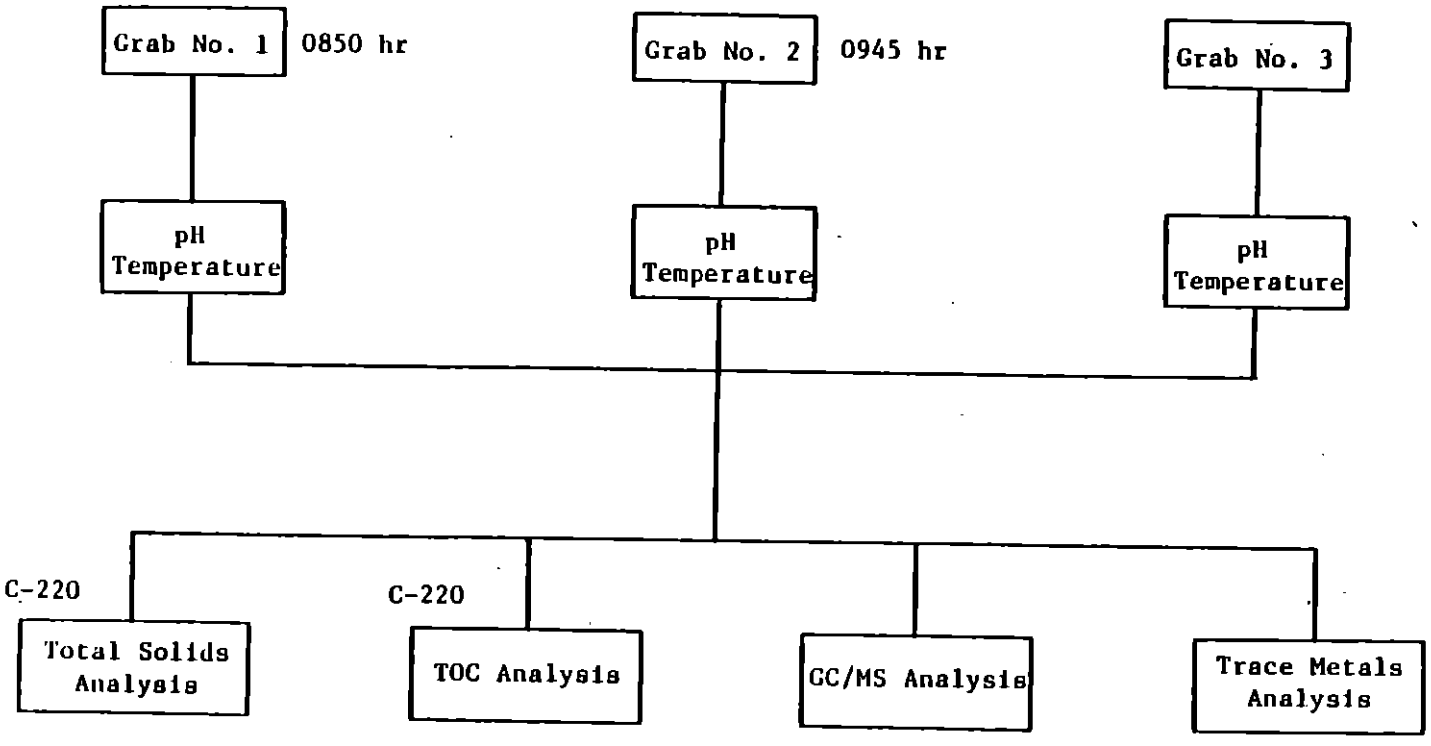
Venturi Feed 11/13/83 (C)



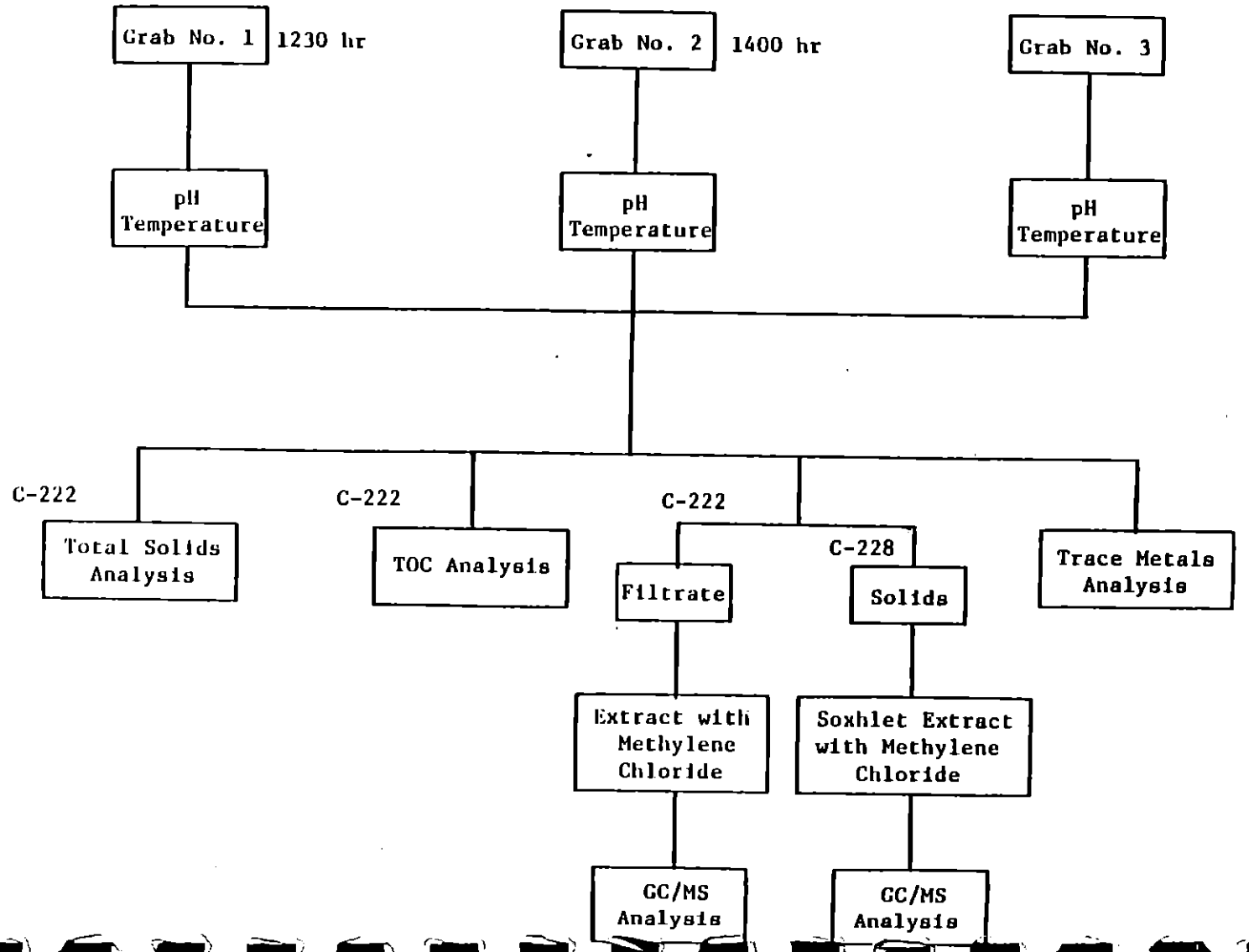
Venturi Feed 11/14/83 (C)



Venturi Return 11/14/83 (C)

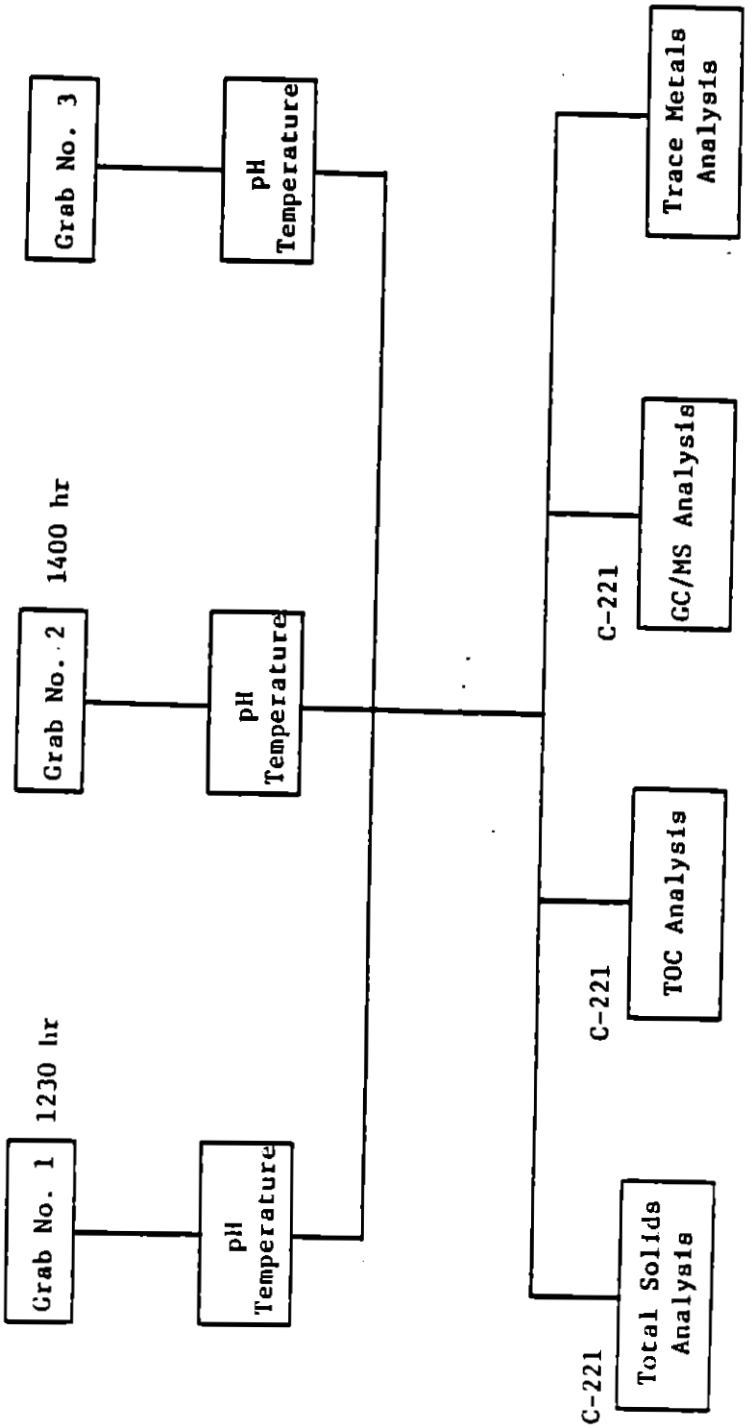


Venturi Return 11/14/83 (C)



RADIAN CORPORATION

Venturi Feed 11/14/83 (C)



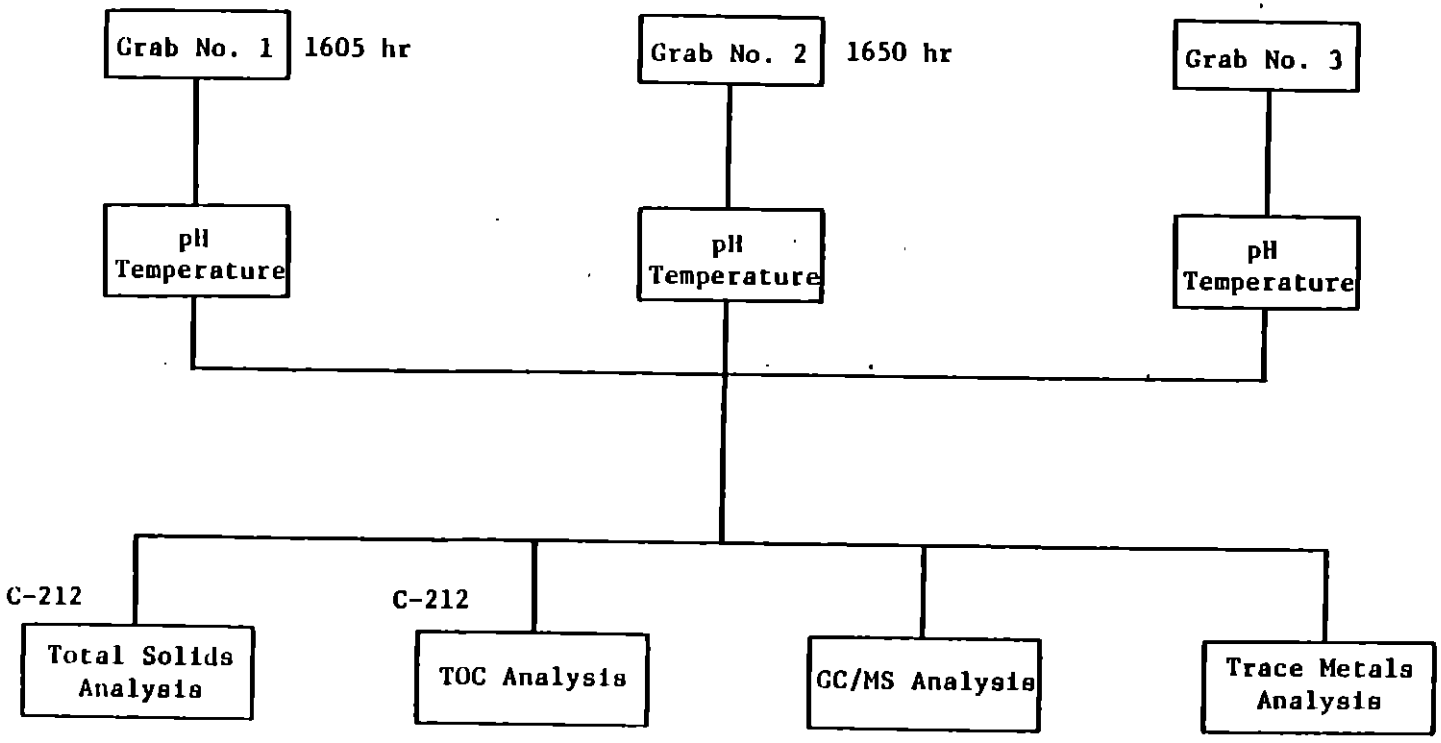
APPENDIX H.4

ANALYTICAL TEST MATRICES

INCLUDES

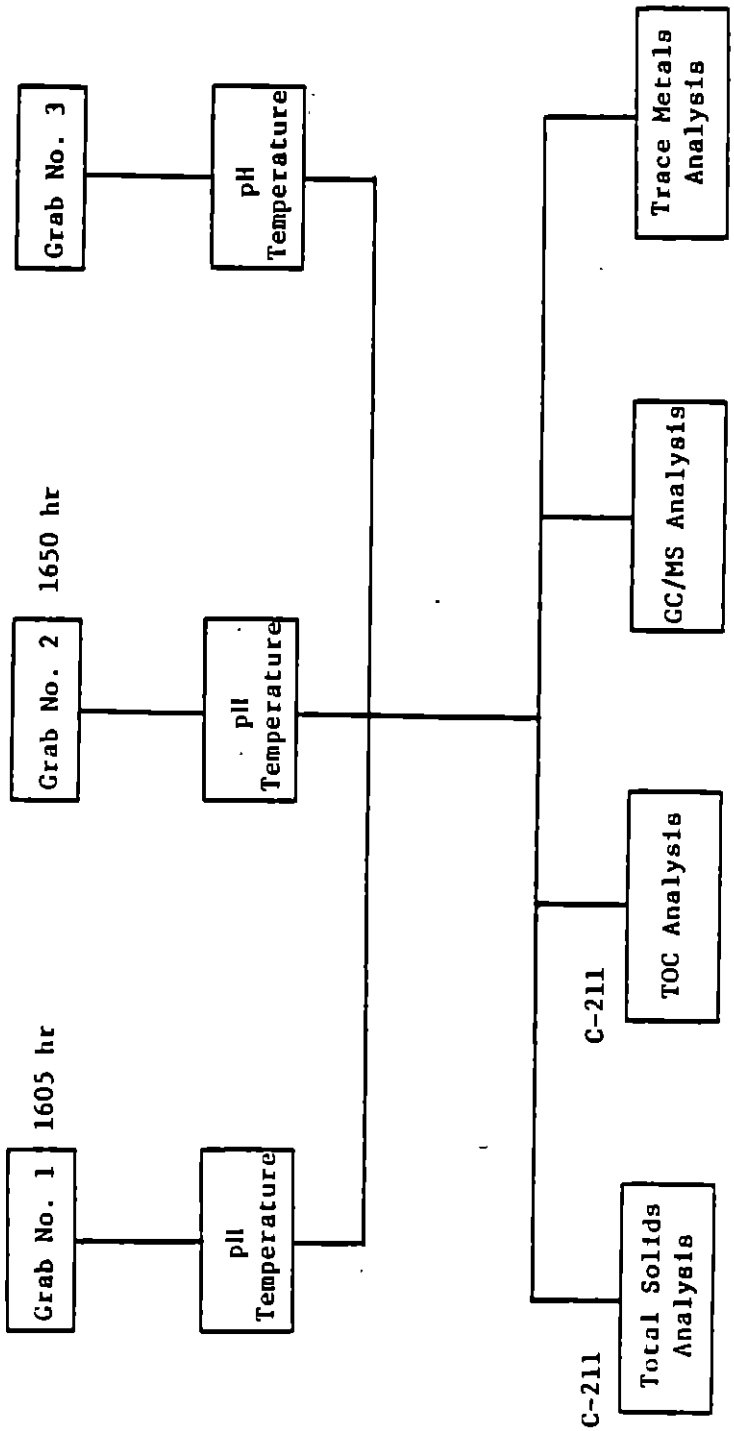
H.4.2 Recycle Operation Analytical Test Series Matrices

Venturi Return 11/11/83 (R)

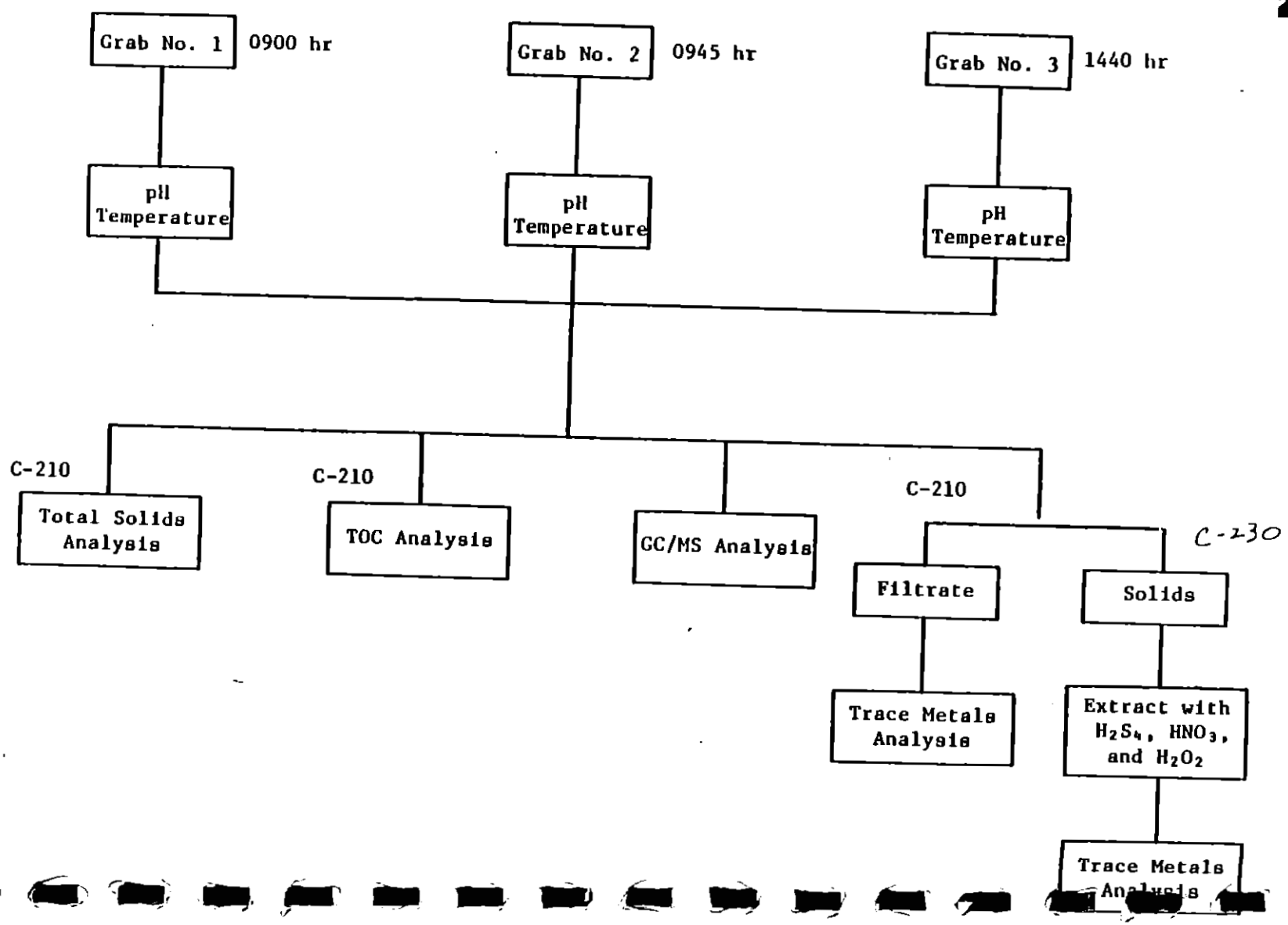


RADIAN CORPORATION

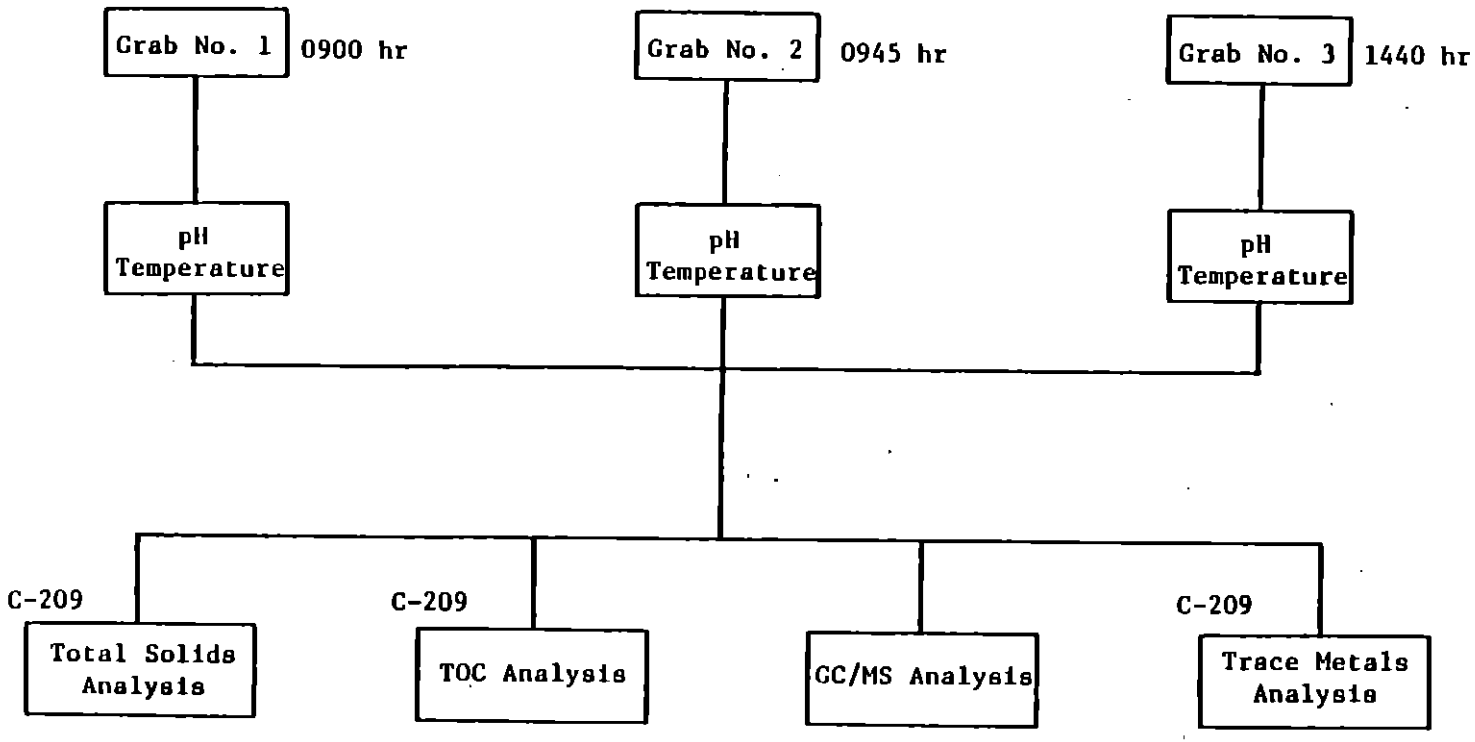
Venturi Feed 11/11/83 (R)



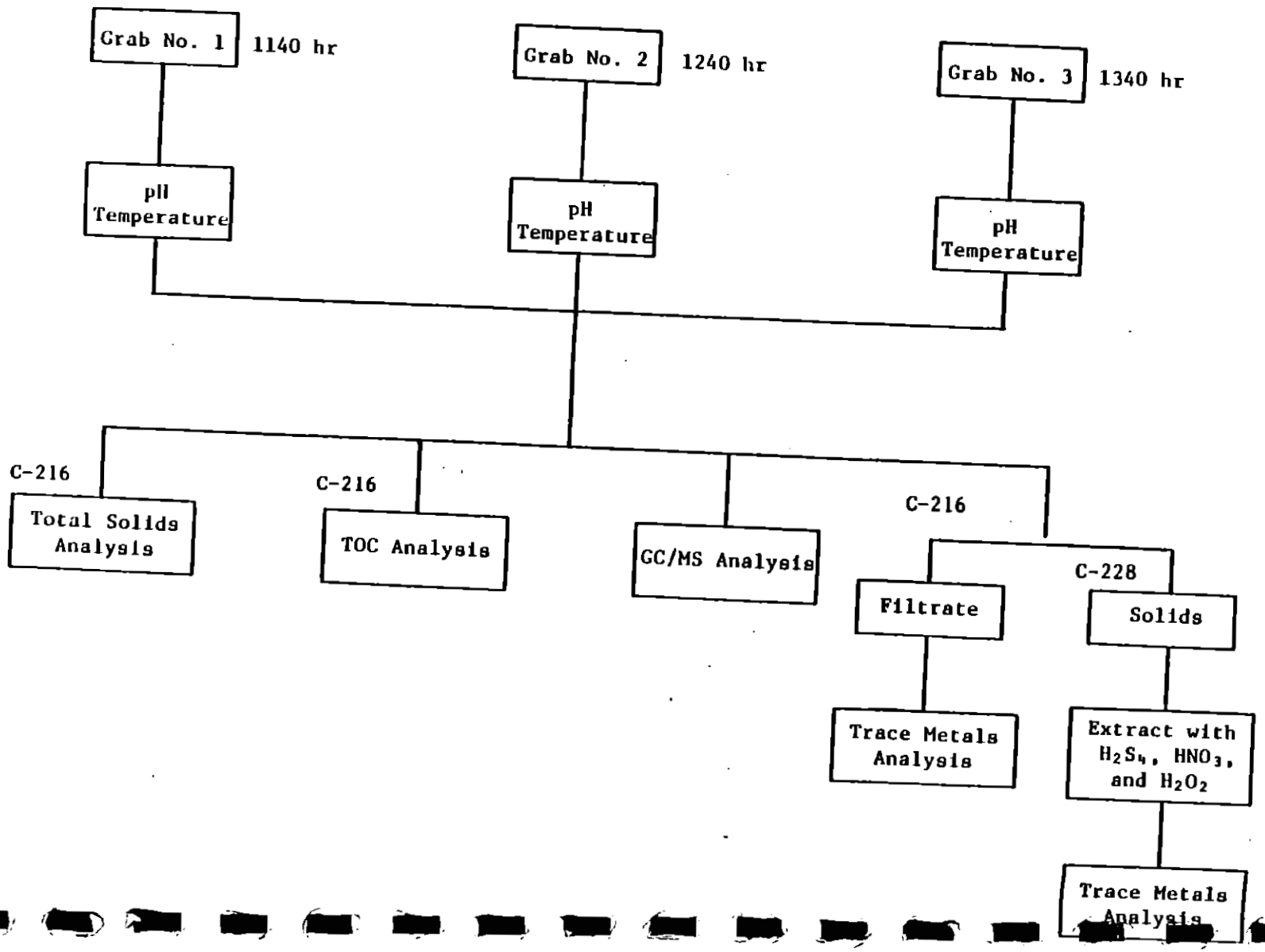
Venturi Return 11/11/83 (R)



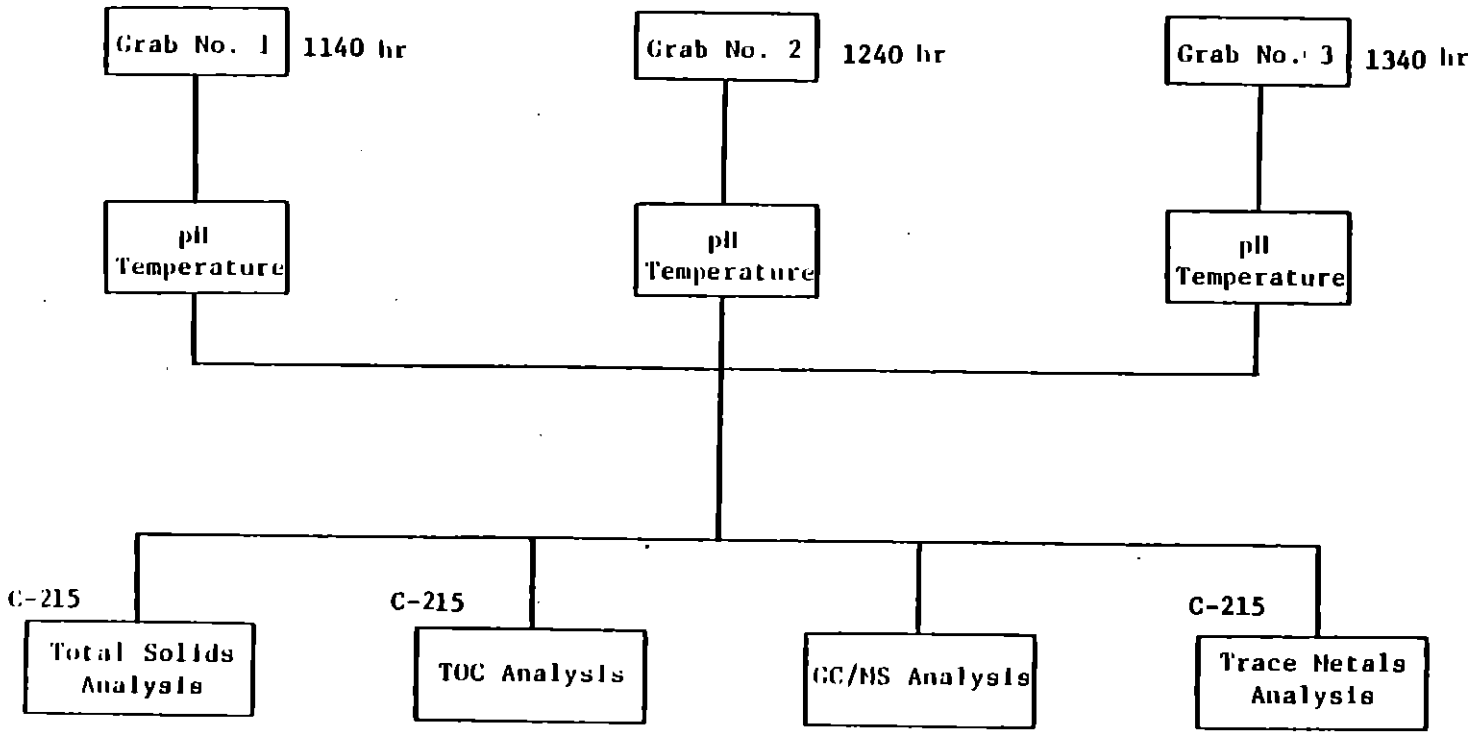
Venturi Feed 11/11/83 (R)



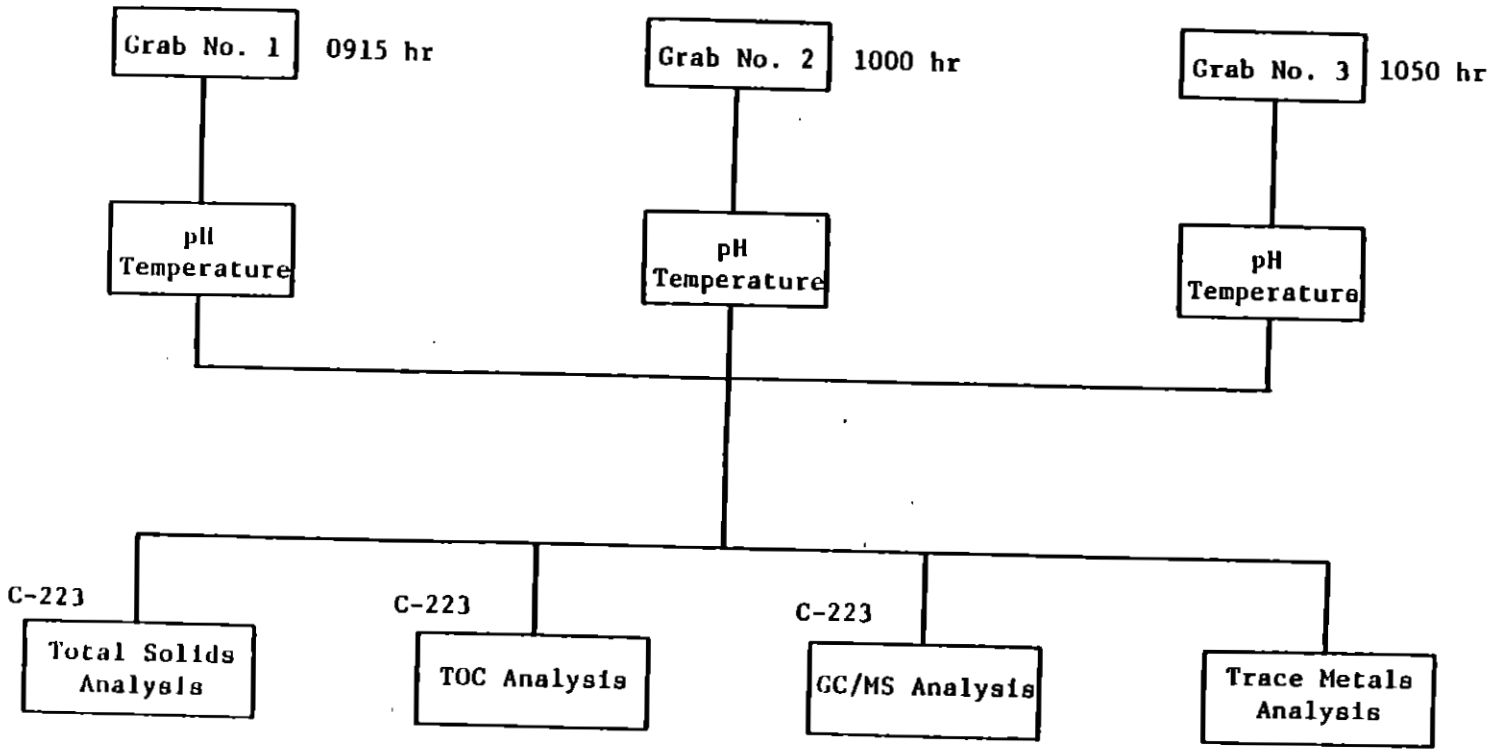
Venturi Return 11/12/83 (C)



Venturi Feed 11/12/83 (C)

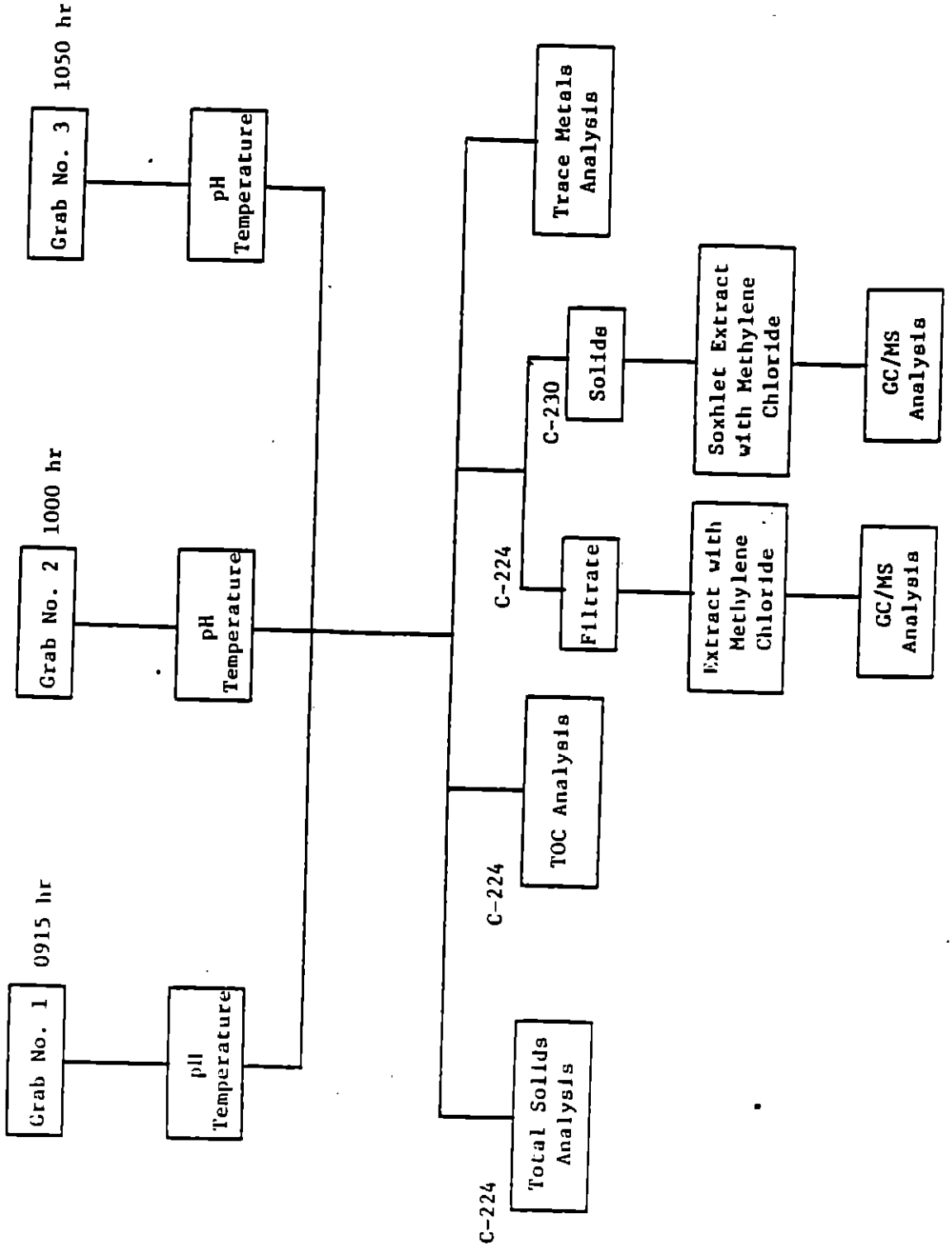


Venturi Feed 11/15/83 (R)



RADIAN CORPORATION

Venturi Return 11/15/83 (R)



APPENDIX H.5

SAMPLE IDENTIFICATION AND SAMPLE LOGS

INCLUDES

H.5.1 Sampling Log
H.5.2 Sample Identification

H.5.1 Sampling Log

| Scrubber Waters[1] | | | | | Solids[2] | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Water to Venturi | | Plant Mode | Water from Venturi | | Virgin Aggregate | | Plant Mode | Recycled Asphalt Pavement | |
| Date | Time | | Date | Time | Date | Time | | Date | Time |
| 11/08 | 1400*[3] | C | 11/08 | 1415* | 11/08 | 1400 | C | 11/08 | |
| | 1510* | C | | 1515* | | 1512 | C | | |
| | 1600* | C | | 1605* | | 1605 | C | | |
| 11/10 | 1100† | R | 11/10 | 1110† | 11/10 | 1100 | R | 11/10 | |
| | 1155† | R | | | | 1100 | R | | |
| 11/11 | 0900* | R | 11/11 | 0900* | 11/11 | 0900 | R | 11/11 | 0900 |
| | 0945* | R | | 0945* | | | | | |
| | 1440* | R | | 1440* | | 1440 | R | | 1440 |
| | 1605† | R | | 1605† | | | | | |
| | 1605† | R | | 1650† | | | | | |
| 11/12 | 0830* | R | 11/12 | 0830* | 11/12 | 0835 | R | 11/12 | 0835 |
| | 0900* | R | | 0900* | | | | | |
| | 1140† | C | | 1140† | | | | | |
| | 1240† | C | | 1240† | | | | | |
| | 1340† | C | | 1340† | | 1345 | C | | |
| 11/13 | 0920* | C | 11/13 | 0920* | 11/13 | 0920 | C | 11/13 | |
| | 1020* | C | | 1020* | | | | | |
| 11/14 | 0850† | C | 11/14 | 0850† | 11/14 | 0850 | C | 11/14 | |
| | 0945† | C | | 0945† | | 1235 | C | | |
| | 1230* | C | | 1230* | | | | | |
| | 1400* | C | | 1400* | | | | | |
| 11/15 | 0915† | R | 11/15 | 0915† | 11/15 | 0915 | R | 11/15 | 0915 |
| | 1000† | R | | 1000† | | | | | |
| | 1050† | R | | 1050† | | | | | |

[1]Analysis includes pH, temperature, TSS, TDS, TOC, trace metals, and BaP/organics.

[2]Analyzed for moisture content only.

[3]Alternating * and † symbols indicate samples composited.

Figure H.5.1 Water and Solids Sampling Performed at the T. J. Campbell Asphalt Plant

## H.5.2 Sample Identification

### T.J. CAMPBELL ASPHALT PLANT - SAMPLE LOG

| Sample Number | Date | Sample ID | Time | Sampling Location | Sample Type |
|---|---|---|---|---|---|
| C-205 | 11-08-83 | Venturi Feed | 1400-1600 | | |
| C-206 | 11-08-83 | Venturi return | 1415-1615 | | |
| C-207 | 11-10-83 | Venturi feed | 1100-1155 | | |
| C-208 | 11-10-83 | Venturi return | 1110 | | |
| C-209 | 11-11-83 | Venturi feed | 0900-1440 | | |
| C-211 | 11-11-83 | Venturi feed | 1605-1650 | | |
| C-212 | 11-11-83 | Venturi return | 1605-1650 | | |
| C-213 | 11-12-83 | Venturi feed | 0830-0900 | | |
| C-214 | 11-12-83 | Venturi return | 0830-0900 | | |
| C-215 | 11-12-83 | Venturi feed | 1140-1340 | | |
| C-216 | 11-12-83 | Venturi return | 1140 1340 | | |
| C-217 | 11-13-83 | Venturi feed | 0920-1020 | | |
| C-218 | 11-13-83 | Venturi return | 0920-1020 | | |
| C-219 | 11-14-83 | Venturi feed | 0850-0945 | | |
| C-220 | 11-14-83 | Venturi return | 0850-0945 | | |
| C-221 | 11-14-83 | Venturi feed | 1230-1400 | | |
| C-222 | 11-14-83 | Venturi return | 1230-1400 | | |
| C-223 | 11-15-83 | Venturi feed | 0915-1050 | | |
| C-224 | 11-15-83 | Venturi return | 0915-1050 | | |
| C-225 | 11-08-83 | Solids from venturi $H_2O$ return | 1400-1615 | | |
| C-226 | 11-12-83 | Solids from venturi return $H_2O$ | 1140-1340 | | |
| C-227 | 11-13-83 | Solids from venturi return $H_2O$ | 0900-1030 | | |
| C-228 | 11-14-83 | Solids from venturi return $H_2O$ | 1230-1430 | | |
| C-229 | 11-14-83 | Solids from venturi return $H_2O$ | 0830-1000 | | |
| C-230 | 11-15-83 | Solids from venturi return $H_2O$ | 0900-1100 | | |

APPENDIX H.6

CALIBRATION VERIFICATION OF SIGNET FLOSENSOR

TABLE H.6.1. RESULTS OF FLOSENSOR CALIBRATION

| Test No. | Flosensor Reading, gpm | Measured gpm | Equivalent gpm* | % Difference $\frac{\text{Instrument} - \text{Equivalent}}{\text{Equivalent}} \times 100$ | Comments |
|---|---|---|---|---|---|
| 1 | 183 | 50.0 | 181 | +1.1 | |
| 2 | 180 | 48.5 | 176 | +2.2 | |
| 3 | 145 | 40.8 | 148 | -2.0 | |
| 4 | 140 | 38.8 | 141 | -0.7 | |
| 5 | 130 | 36.7 | 133 | -2.3 | |
| 6 | 125 | 35.5 | 129 | -3.1 | |
| 7 | 100 | 26.4 | 96 | +4.2 | |
| 8 | 92 | 24.1 | 87 | +5.8 | |
| 9 | 40 | 12.6 | 46 | -13.0 | Difficult to read scale at low flow |

*Equivalent rate derived from the ratio of the cross-sectional area of the 2-inch to 4-inch pipe times the measured gpm.

# APPENDIX I

## QUALITY ASSURANCE INFORMATION

INCLUDES


I.1 Total Organic Carbon (TOC) Audit Sample Results
- I.1.1 Summary of EPA Supplied TOC Audit Sample Analysis
- I.1.2 Summary of Radian Supplied TOC Audit Sample Analysis
- I.1.3 Summary of Radian Analytical Services Laboratory Internal Quality Assurance Samples

I.2 Sample Blank Cleanup Evaluation Data
- I.2.1 EPA Method 5E Particulate Mass Blank Cleanup Data Summary
- I.2.2 Extracted Total Condensible Hydrocarbon Blank Cleanup Data Summary
- I.2.3 Total Organic Carbon Blank Cleanup Data Summary
- I.2.4 Trace Metals Blank Cleanup Data Summary
- I.2.5 Polynuclear Aromatic Hydrocarbon Blank Cleanup Data Summary (Inlet and Outlet)
- I.2.6 Analytical Sample Matrices

I.3 Sampling Equipment and Procedures Quality Control
- I.3.1 Sampling Equipment Selection and Preparation
- I.3.2 EPA Reference Methods 2, 3, and 5E Sampling, PAH Sampling, and Particle Size Determinations
- I.3.3 Sample Analysis Quality Control
- I.3.4 Data Reduction

I.4 Process Monitoring and Sampling Quality Assurance Procedures
- I.4.1 Equipment Preparation
- I.4.2 Sampling and Analytical Preparation
- I.4.3 Samplg Analysis
- I.4.4 Data Reduction

APPENDIX I.1

TOTAL ORGANIC CARBON (TOC) AUDIT SAMPLE RESULTS

INCLUDES

I.1.1 Summary of EPA Supplied TOC Audit Sample Analysis
I.1.2 Summary of Radian Supplied TOC Audit Sample Analysis
I.1.3 Summary of Radian Analytical Services Laboratory Internal Quality Assurance Samples

I.1.1 Summary of EPA Supplied TOC Audit Sample Analysis

| EPA Audit Value mg/l | RAS[1] Value mg/l | Absolute Diff. mg/l |
|---|---|---|
| 4.1 | 4.50 | 0.4 |
| 61.2 | 70 | 8.8 |
| 61.2 | 69 | 7.8 |
| 75.8[2] | 14 | 61.8 |
| 4.1 | 3 | -1.1 |

[1] Radian Analytical Services Lab

[2] Sample may have been old and deteriorated

Analytical Serv REPORT LAB # 83-10-162

RECEIVED: 10/28/83

11/02/83 10:27:49

REPORT TO: Radian Corporation
Austin
Bl. 3

ATTEN: Mike Fuchs

CLIENT: EPA EMB SAMPLES: 5
COMPANY: EPA-EMB
FACILITY:

WORK ID: TOC QC samples
TAKEN:
TRANS: hand
TYPE:
P.O. #: 222-078-03-06
INVOICE: under separate cover

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 EPA-1
02 EPA-2
03 EPA-3
04 EPA-4
05 EPA-5

## Analytical Serv TEST CODES and NAMES used on this report

TOC Total Organic Carbon

RECEIVED: 10/28/83

Analytical Serv REPORT LAB # 83-10-162

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 | 4.50 | 70 | 69 | 14 | 3.0 |

I.1.2 Summary of Radian Supplied TOC Audit Sample Analysis

| Set 1 submitted 11/30/83 | | | Set 2 submitted 12/12/83 | | |
|---|---|---|---|---|---|
| Actual Value mg/l | RAS Value mg/l | Absolute Diff. mg/l | Actual Value mg/l | RAS Value mg/l | Absolute Diff. mg/l |
| 80 | 85 | 5 | 80[1] | 85 | 5 |
| 40 | 45 | 5 | 20[2] | 21 | 1 |
| 80 | 84 | 4 | 20[1] | 19 | -1 |
| 4 | 4 | 0 | 80[2] | 84 | 4 |
| 4 | 3 | -1 | 80[1] | 77 | -3 |
| 40 | 41 | 1 | 20[1] | 21 | 1 |

[1] Sample in 0.1 N NaOH matrix
[2] Sample in distilled water

| | |
|---|---|
| TITLE | Project No. / Book No. |

From Page No.

NEW TOC STD MADE 12-12-83

.1N NaOH

8.00g /2l in $CO_2$ free $H_2O$

KHP - DRIED 1hr @ 102°C 3.6717

DESSICATED LAIF 1.5440

2.1277

2.1274 mg/l KHP = 1000 ppm as C

MAKE up Stock in DI to 1l

5 ml /250 = 20 ppm } for DI matrix

20 ml /250 = 80 ppm } for NaOH matrix

| #s | | | Bas Results |
|---|---|---|---|
| | C-300 | 80ppm in .1N NaOH | 85 |
| | C-301 | 20ppm in DI | 21 |
| | C-302 | 20ppm in .1N NaOH | 19 |
| | C-303 | 80ppm in DI | 84 |
| | C-325 | 80ppm in .1N NaOH | 77 |
| | C-326 | 20ppm in .1N NaOH | 21 |



To Page No.

| Witnessed & Understood by me, | Date | Invented by | Date |
|---|---|---|---|
| | | Recorded by | |

TITLE

Project No.

Book No.

From Page No.

11-31-83

# TOC Std from KHP

KHP = 204.23 g/mole
8C = 96 g/mole

1000 mgC/l × 204.23 mg KHP / 96 mg C = mg/l KHP = 2.1277 = 1000 ppm as Stock

20/250 = 80 ppm C

10/250 = 40 ppm C

2/250 = 8 ppm C

1/250 = 4 ppm C

4.2041
+ tare = 2.0764
2.1277

KHP was Dried 2 hrs @ 10
Dessicated and weighed

| Bottle # | Conc |
|---|---|
| 1 | 80 ppm C |
| 2 | 40 ppm C |
| 3 | 80 ppm C |
| 4 | 4 ppm C |
| 5 | 4 ppm C |
| 6 | 40 ppm C |
| 7 | BLANK |



To Page No.

Witnessed & Understood by me, | Date | Invented by | Date

Recorded by

CORPORATION

PAGE 1 Analytical Serv REPORT LAB # 83-12-001

RECEIVED: 11/30/83 12/14/83 16:22:32

REPORT TO: Radian Corporation
Austin
Bl. 3

ATTEN: Eric Anderson

CLIENT: EPA EMB SAMPLES: 7
COMPANY: EPA-EMB
FACILITY:

WORK ID: TOC
TAKEN:
TRANS: hand
TYPE:
P.O. #: 222-078-03-24
INV. #: 2246

PREPARED BY: Radian Analytical Services
8501 MoPac Blvd.
P.O. Box 9948
Austin, Texas 78766

ATTEN:
PHONE: (512) 454-4797

CERTIFIED BY:

CONTACT: KAMAS

I-10

## SAMPLE IDENTIFICATION

01 #1
02 #2
03 #3
04 #4
05 #5
06 #6
07 QC blank

## Analytical Serv TEST CODES and NAMES used on this report

TOC Total Organic Carbon

RECEIVED: 11/30/83 -?

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 | 85 | 45 | 84 | 4 | 3 |

| TEST CODE default units | Sample 06 (entered units) | Sample 07 (entered units) |
|---|---|---|
| TOC mg/L | 41 | <1 |

I.1.3 Summary of Radian Analytical Services Laboratory Internal Quality Assurance Samples

| Actual Value mg/l | Measured Value mg/l | Absolute Diff. mg/l |
|---|---|---|
| 20 | 24.5 | 4.5 |
| 20 | 23.2 | 3.2 |

APPENDIX I.2

SAMPLE BLANK CLEANUP EVALUATION DATA

INCLUDES

I.2.1 EPA Method 5E Particulate Mass Blank Cleanup Data Summary
I.2.2 Extracted Total Condensible Hydrocarbon Blank Cleanup Data Summary
I.2.3 Total Organic Carbon Blank Cleanup Data Summary
I.2.4 Trace Metal Blank Cleanup Data Summary
I.2.5 Polynuclear Aromatic Hydrocarbon Blank Cleanup Data Summary
I.2.5.1 Benzo(a)Pyrene and Related PAHs in Inlet Blank Sample
I.2.5.2 Benzo(a)Pyrene and Related PAHs in Outlet Blank Sample

## I.2 Sample Blank and Cleanup Evaluation Data

### I.2.1 EPA Method 5A Particulate Mass Blank Cleanup Data Summary

| Sample Description | Residue Wt gain (g) | Blank Value Corr. for Solvent |
|---|---|---|
| Trichloroethane solvent residue | .0017/150 ml | -- |
| Acetone solvent residue | .0003/150 ml | -- |
| Inlet glass probe (acetone wash) | 0.0109 | 0.0105 |
| Inlet glass probe (TCE wash) | 0.0230 | 0.0212 |
| Outlet glass probe (acetone wash) | 0.0089 | 0.0082 |
| Outlet glass probe (TCE wash) | 0.0049 | 0.0037 |
| Stainless steel probe (acetone wash) | 0.0149 | 0.0146 |
| Stainless steel probe (TCE wash) | 0.0066 | 0.0055 |

### I.2.2 Extracted Total Condensible Hydrocarbon Blank Cleanup Results

| Sample Description | Solvent Volume m/s | Residue wt (g) |
|---|---|---|
| NaOH blank chloroform/ ether extracted | 200 | 0.0011 |
| Chloroform/ether solvent blank | 200 | 0.0016 |
| Trichloroethane solvent blank | 200 | 0.0007 |
| Inlet impinger blank C/E | 200 | 0.0022 |
| Outlet impinger blank C/E | 200 | 0.0008 |

### I.2.3 Total Organic Carbon Blank Cleanup Results

| Sample Description | mg/l TOC |
|---|---|
| Inlet impinger train blank | <1 |
| Outlet impinger train blank | 2 |

## I.2.4 Trace Metals Blank Cleanup Results

| Description | Al | Be | Ca | Cd | Cr | Fe | Hg | Mg | Mn | Ni | Pb | V | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Filter blank (1) | <5 | <.5 | <3 | <.2 | <.1 | <.8 | <3 | <3 | <.1 | <.3 | <8 | <6 | <.3 |
| Filter blank (2) | <5 | <.5 | <3 | <.2 | <.1 | <.8 | <3 | <3 | <.1 | <.3 | <8 | <6 | <.3 |
| NaOH blank outlet | <.05 | <.0005 | <.04 | <.002 | <.001 | <.008 | <.03 | <.034 | <.001 | <.003 | <.084 | <.003 | <.003 |
| NaOH blank inlet | <.05 | <.0005 | <.04 | <.002 | <.001 | <.008 | <.03 | <.034 | <.001 | <.003 | <.084 | <.003 | <.003 |
| $HNO_3$ blank | <.05 | <.0005 | <.04 | <.002 | <.001 | <.008 | <.03 | <.034 | <.001 | <.003 | <.084 | <.003 | <.003 |

TABLE I.2.5.1 Benzo(a)Pyrene and Related PAHs in Inlet Blank Emission Samples Collected 11-9-83

| Compounds | Isomer Group | Amount Found, μg | | | |
|---|---|---|---|---|---|
| | | C-232 Front | C-233 XAD | C-34 Back | Total |
| Phenanthrene | $C_{14}H_{10}$ | 0.07 | 0.59 | 0.06 | 0.72 |
| Anthracene | $C_{14}H_{10}$ | ND | ND | ND | ND |
| Fluoranthene | $C_{16}H_{10}$ | 0.03 | 0.18 | 0.06 | 0.27 |
| Pyrene | $C_{16}H_{10}$ | 0.07 | 0.31 | 0.18 | 0.56 |
| Benz(a)anthracene | $C_{18}H_{12}$ | ND | 0.02 | ND | 0.02 |
| Chrysene | $C_{18}H_{12}$ | ND | 0.05 | ND | 0.05 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Perylene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | ND | ND | ND |
| Benzo(a)pyrene-$d_{12}$ | | 35.8(89%) | 21.8(54%) | Not Spiked | |

ND - Not Detected

TABLE I.2.5.2 Benzo(a)Pyrene and Related PAHs in Outlet Blank Emission Samples Collected 11-9-83

| Compounds | Isomer Group | Amount Found, μg C-234 Front | C-235 XAD | C-29 Back | Total |
|---|---|---|---|---|---|
| Phenanthrene | $C_{14}H_{10}$ | 0.10 | 0.77 | 0.02 | 0.89 |
| Anthracene | $C_{14}H_{10}$ | ND | ND | ND | ND |
| Fluoranthene | $C_{16}H_{10}$ | 0.06 | 0.36 | 0.04 | 0.46 |
| Pyrene | $C_{16}H_{10}$ | 0.19 | 0.75 | 0.10 | 1.04 |
| Benz(a)anthracene | $C_{18}H_{12}$ | ND | 0.04 | ND | 0.04 |
| Chrysene | $C_{18}H_{12}$ | ND | 0.11 | ND | 0.11 |
| Benzo(b)fluoranthene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(k)fluoranthene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(j)fluoranthene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(e)pyrene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Benzo(a)pyrene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Perylene | $C_{20}H_{12}$ | ND | ND | ND | ND |
| Indeno(1,2,3-c,d)pyrene | $C_{22}H_{12}$ | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | $C_{22}H_{12}$ | ND | ND | ND | ND |
| Benzo(a)pyrene-$d_{12}$ | | 39(98%) | 36(90%) | Not Spiked | |

ND - Not Detected

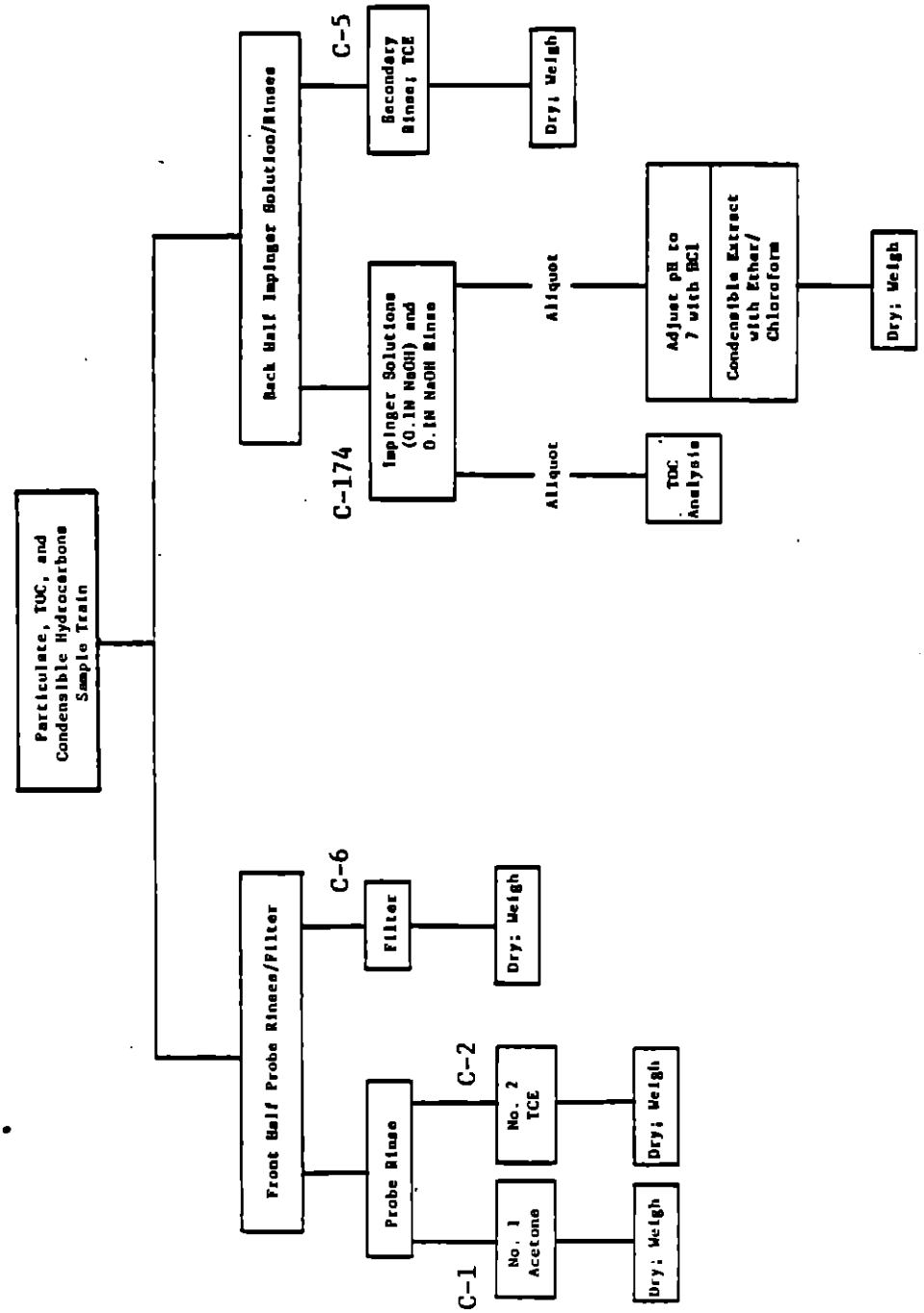
APPENDIX I.2

SAMPLE BLANK CLEANUP EVALUATION DATA

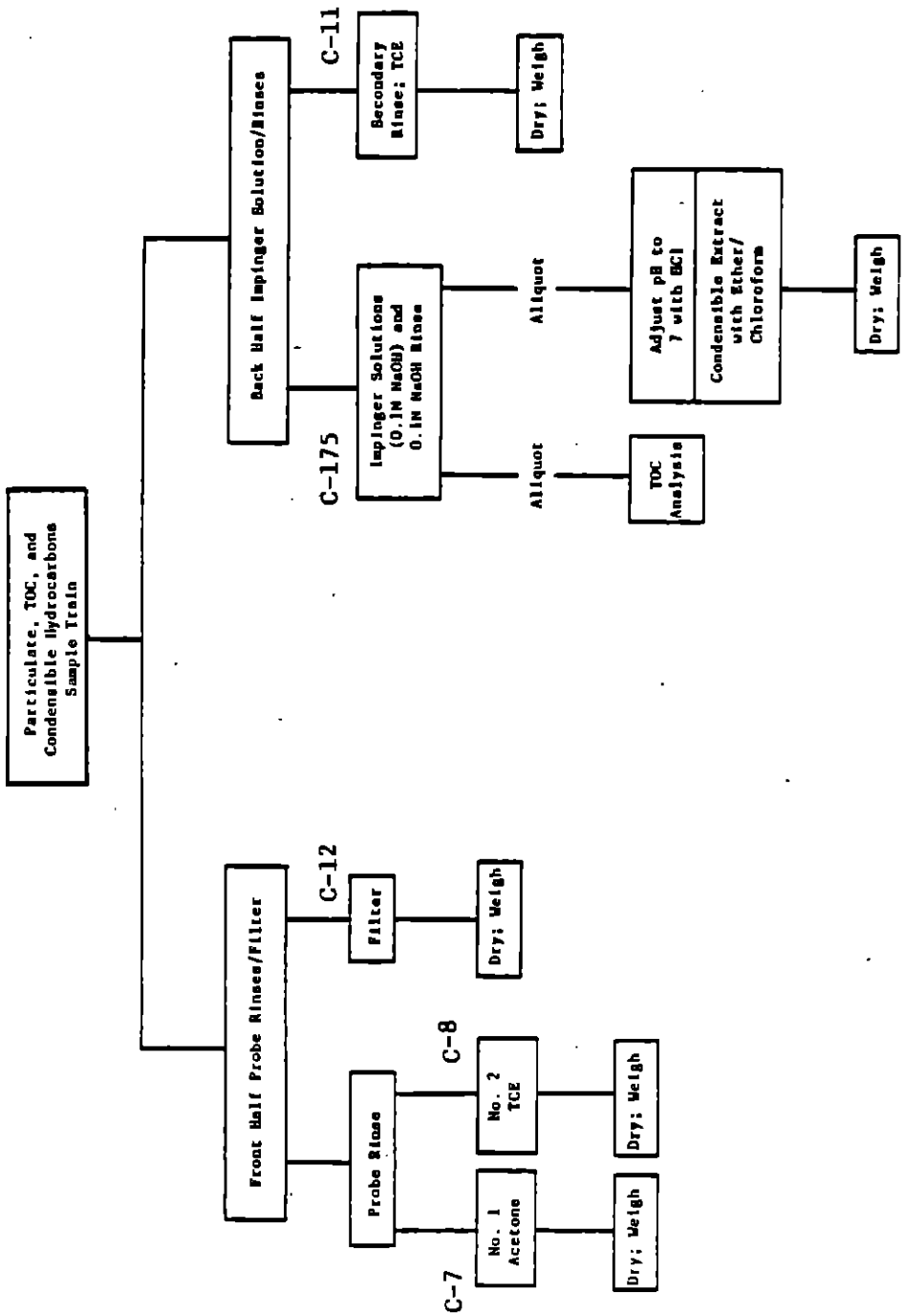
INCLUDES

I.2.6 Analytical Sample Matrices

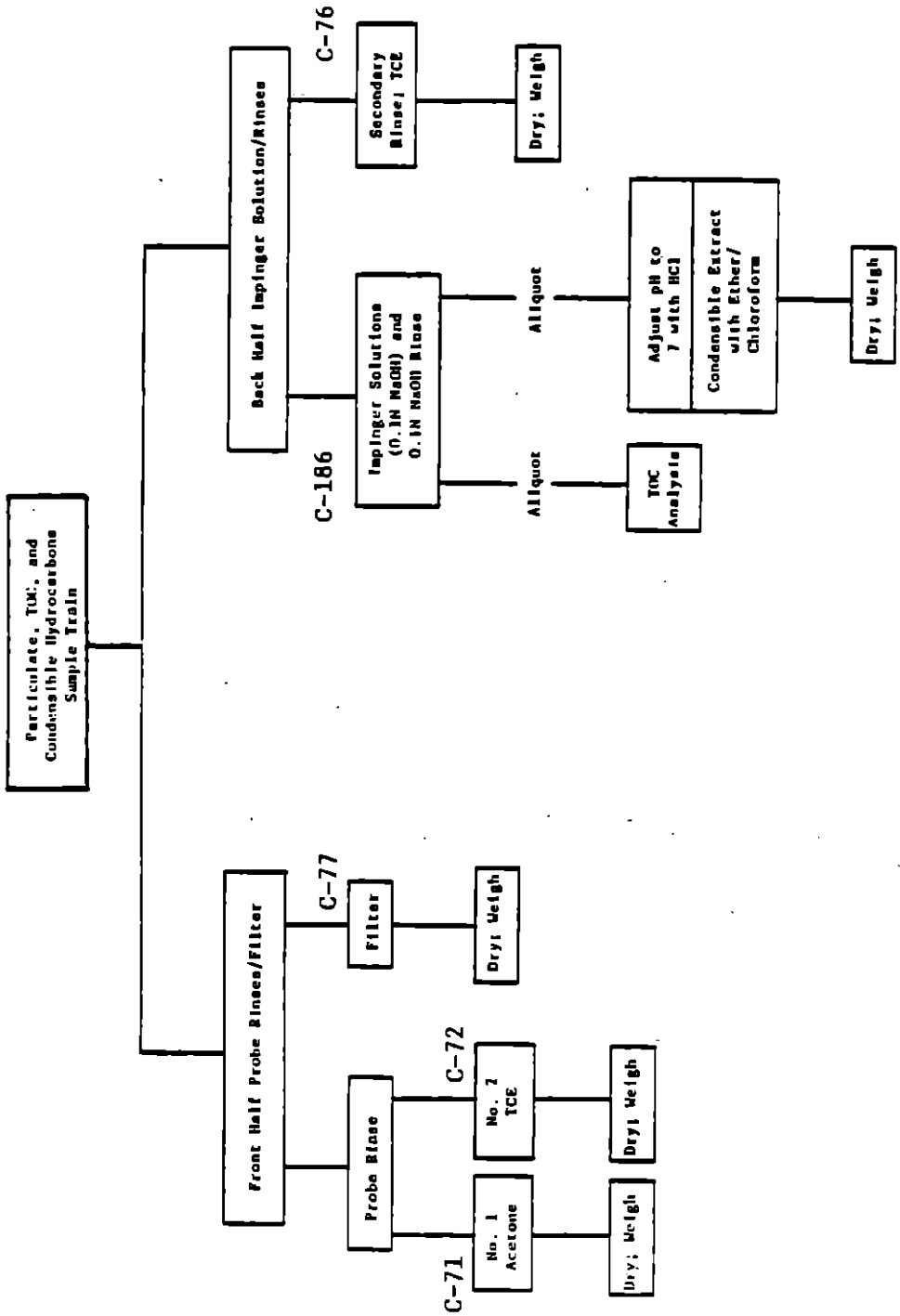
CAM-1108-In-M5-Blank



CAM-1108-Out-M5-Blank

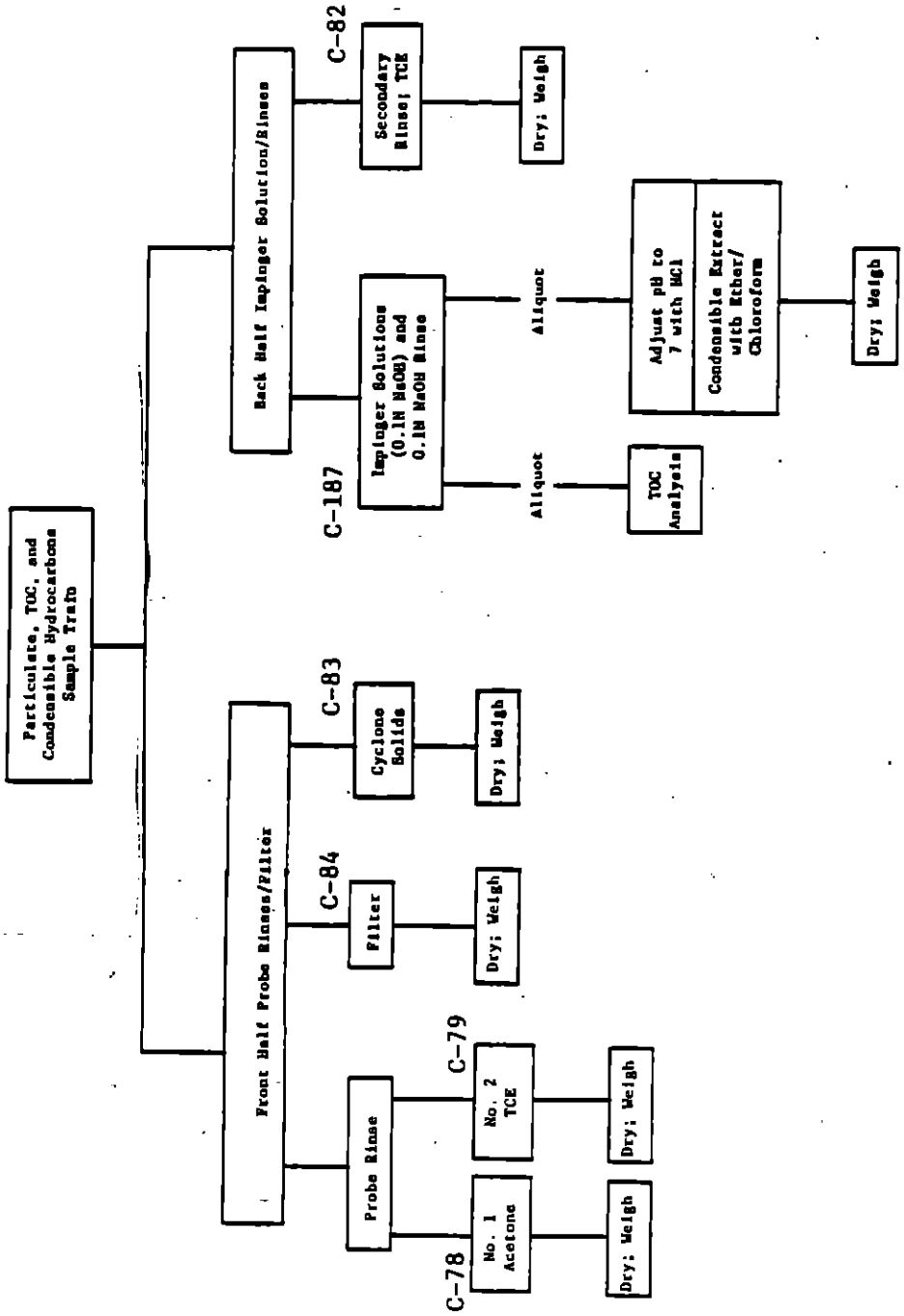


Part./Cond. Hyd. R-1 11/11 1515-1704
CAM-1111-PAH-Out-02

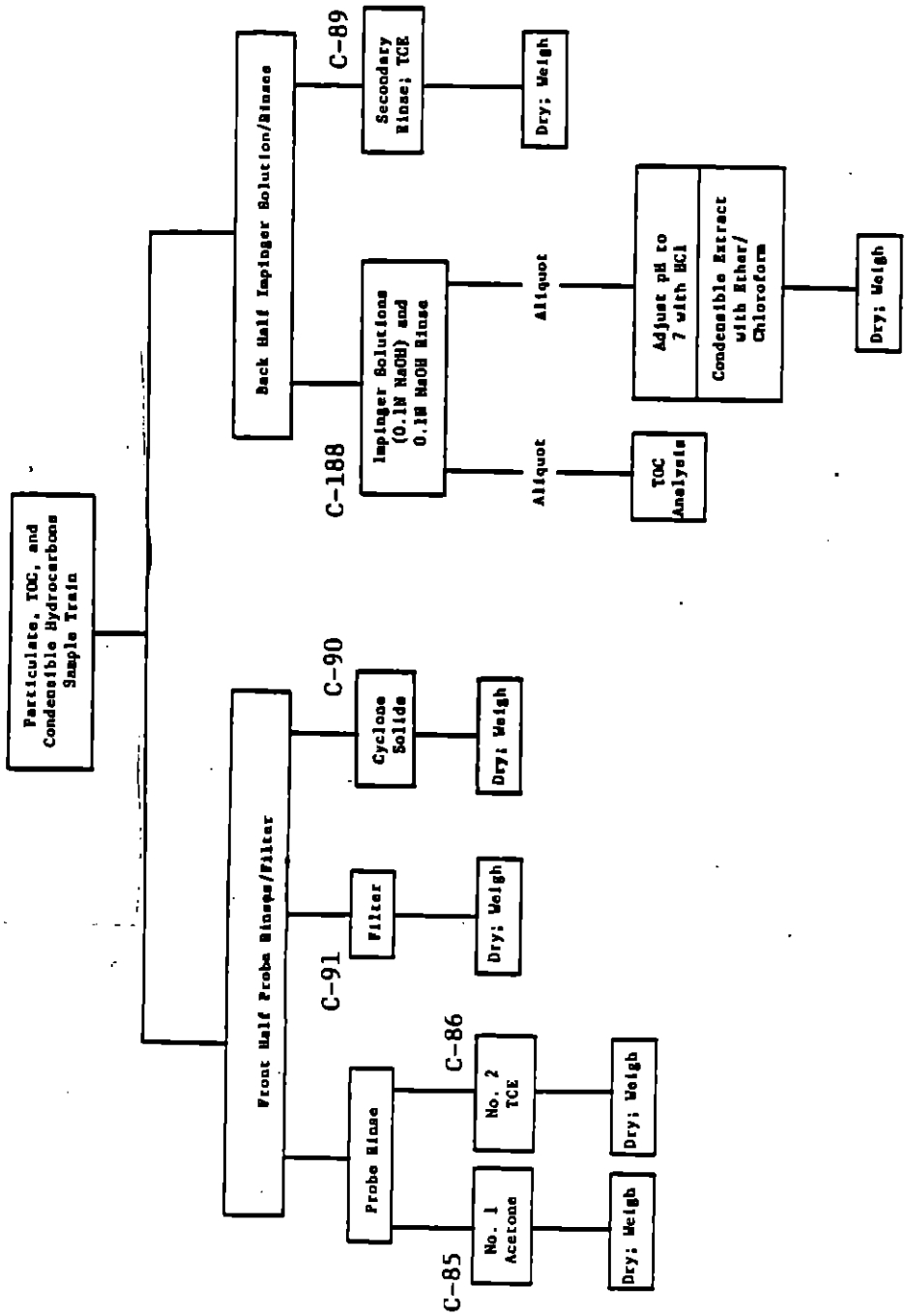


RADIAN CORPORATION

Part./Cond. Hyd. R-1 11/11 1645-1730
CAM-1111-PAH-In-02

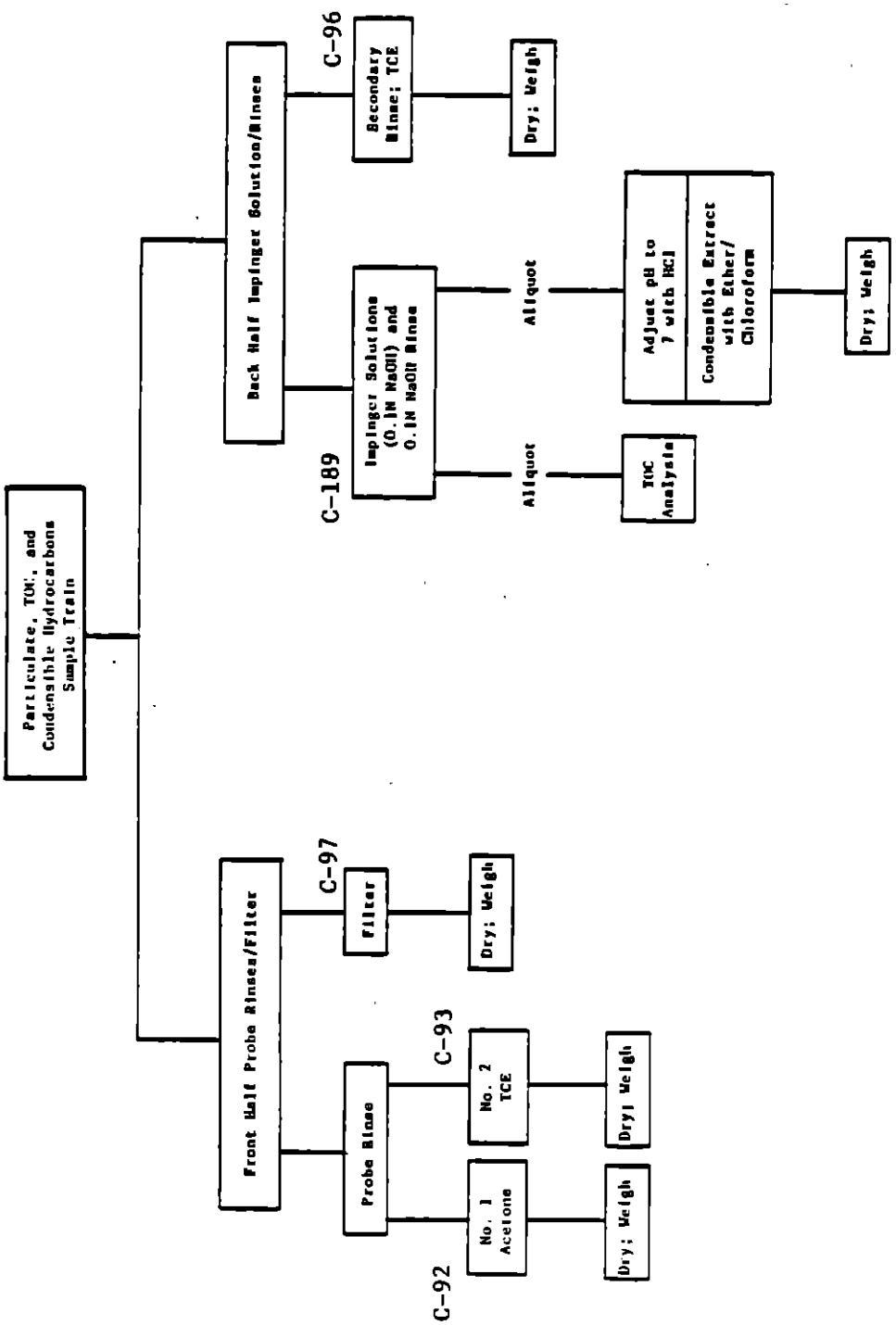


Part./Cond. Hyd. R-2 11/12 0748-0846
CAM-1112-PAH-In-01

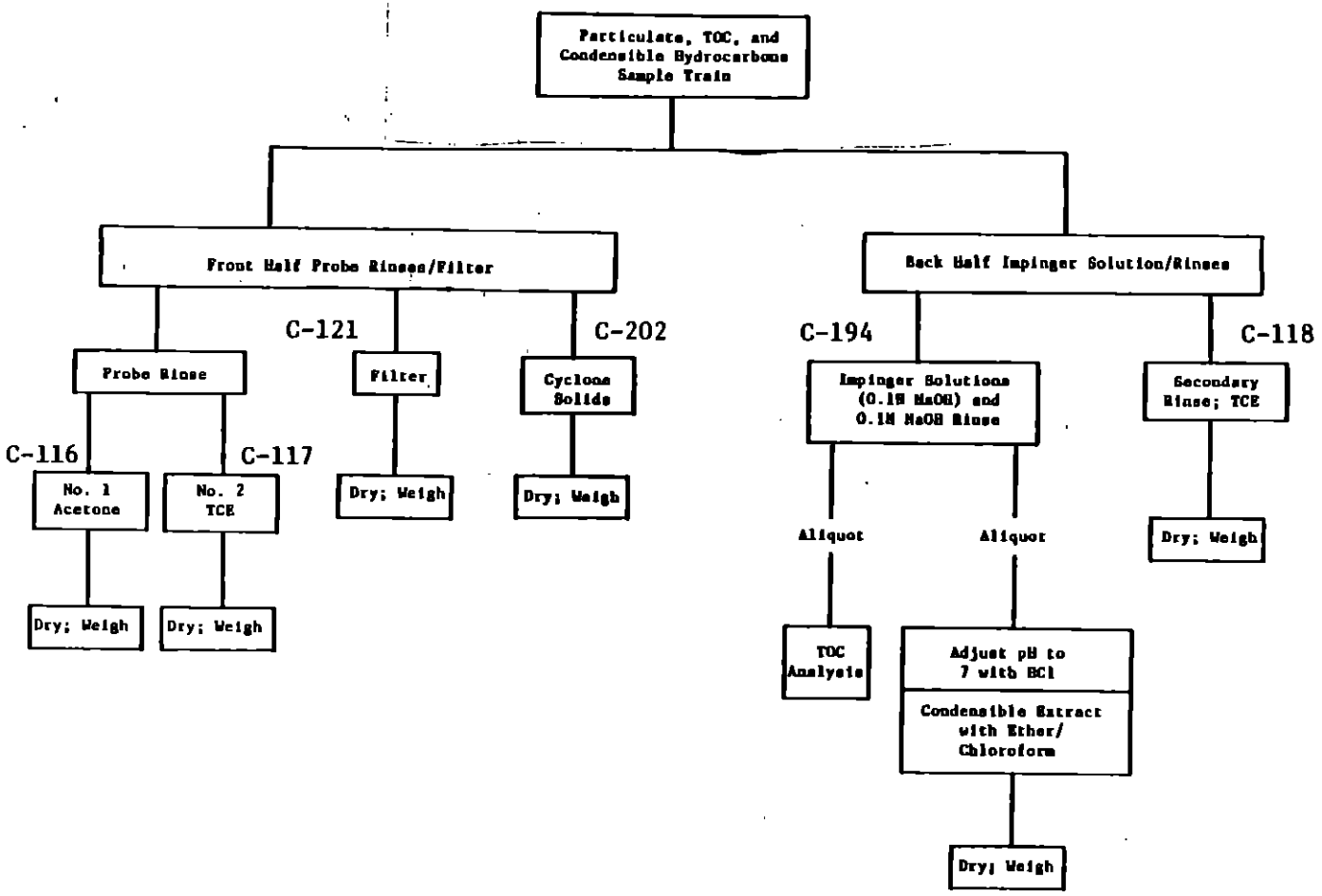


RADIAN CORPORATION

Part./Cond. Hyd. R-2 11/12 0713-0900
CAM-1112-PAH-Out-01

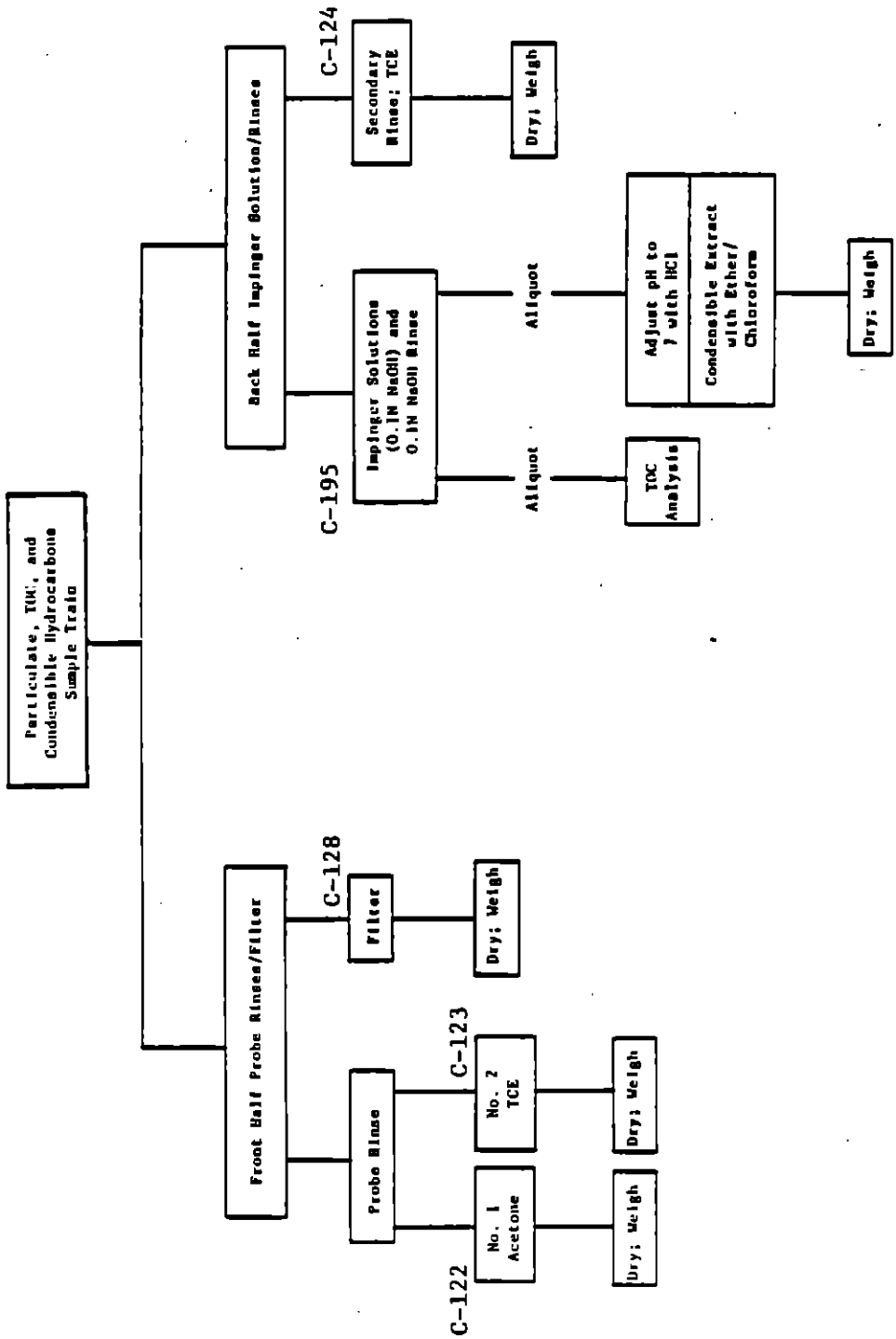


Part./Cond. Hyd. C-1 11/13 0956-1050
CAM-1113-PAH-In-01

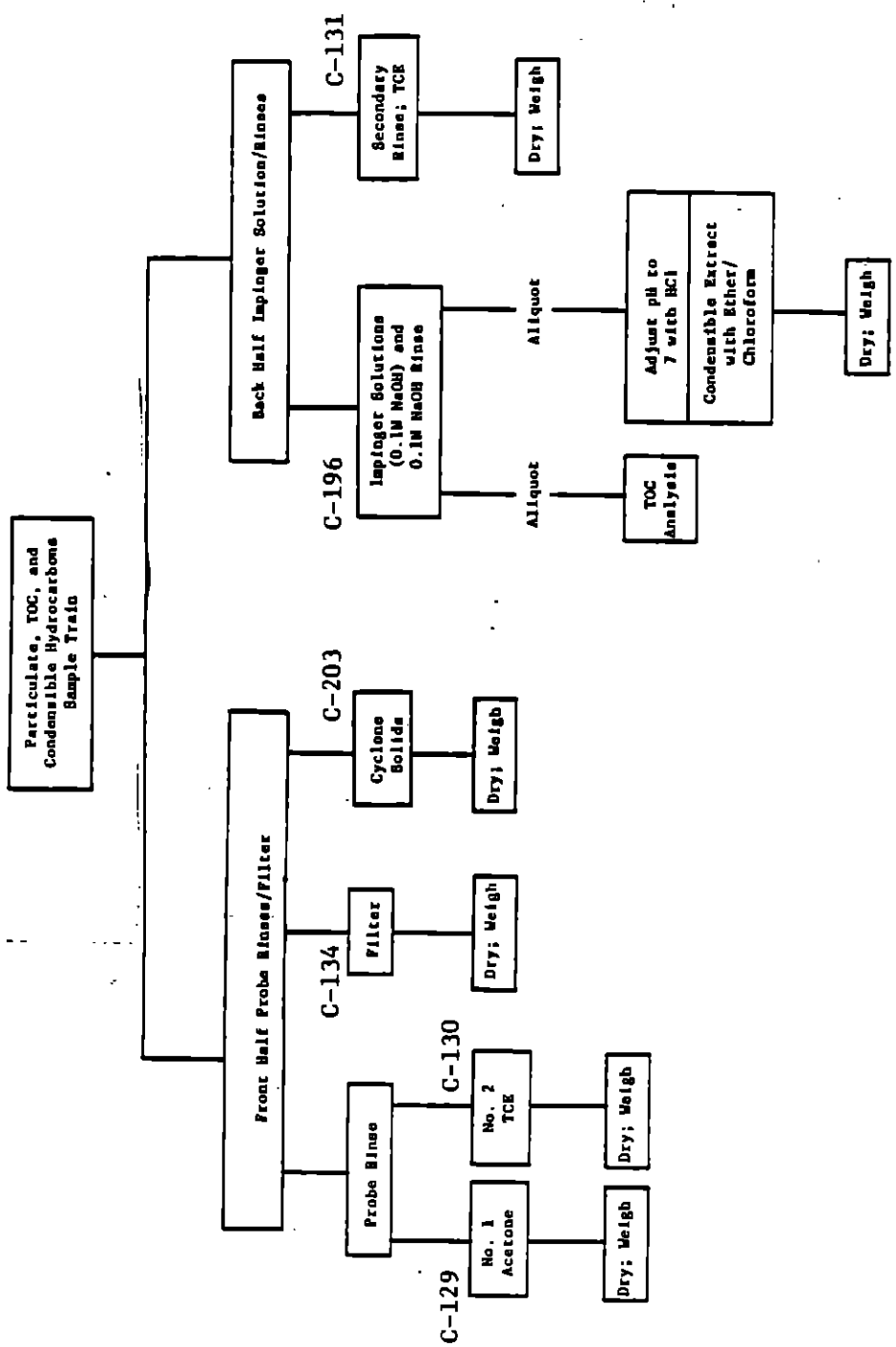


RADIAN CORPORATION

Part./Cond. Hyd. C-1 11/13 0853-1112
CAM-1113-PAH-Out-01

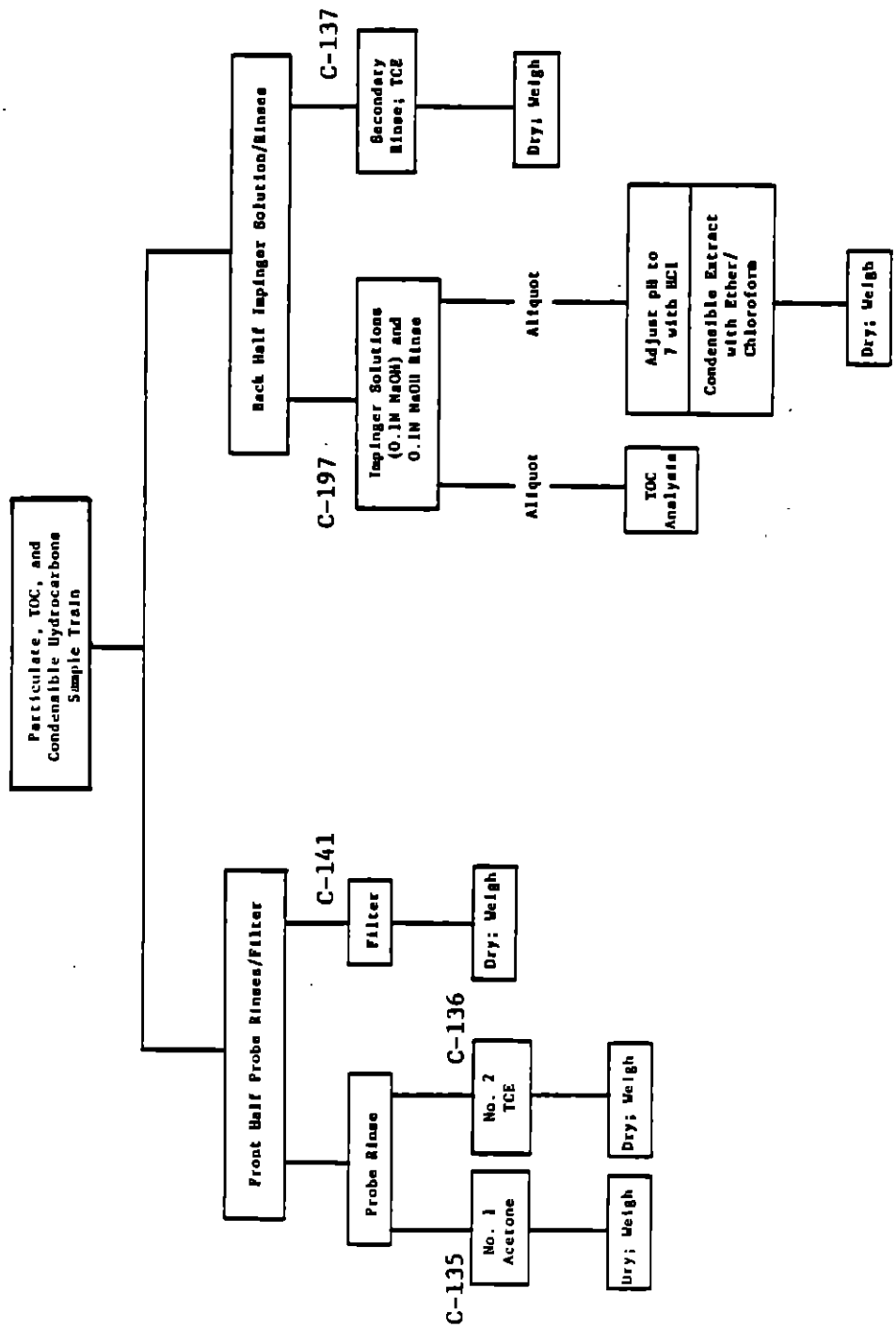


Part./Cond. Hyd. C-2 11/14 0827-0936
CAM-1114-PAH-In-01

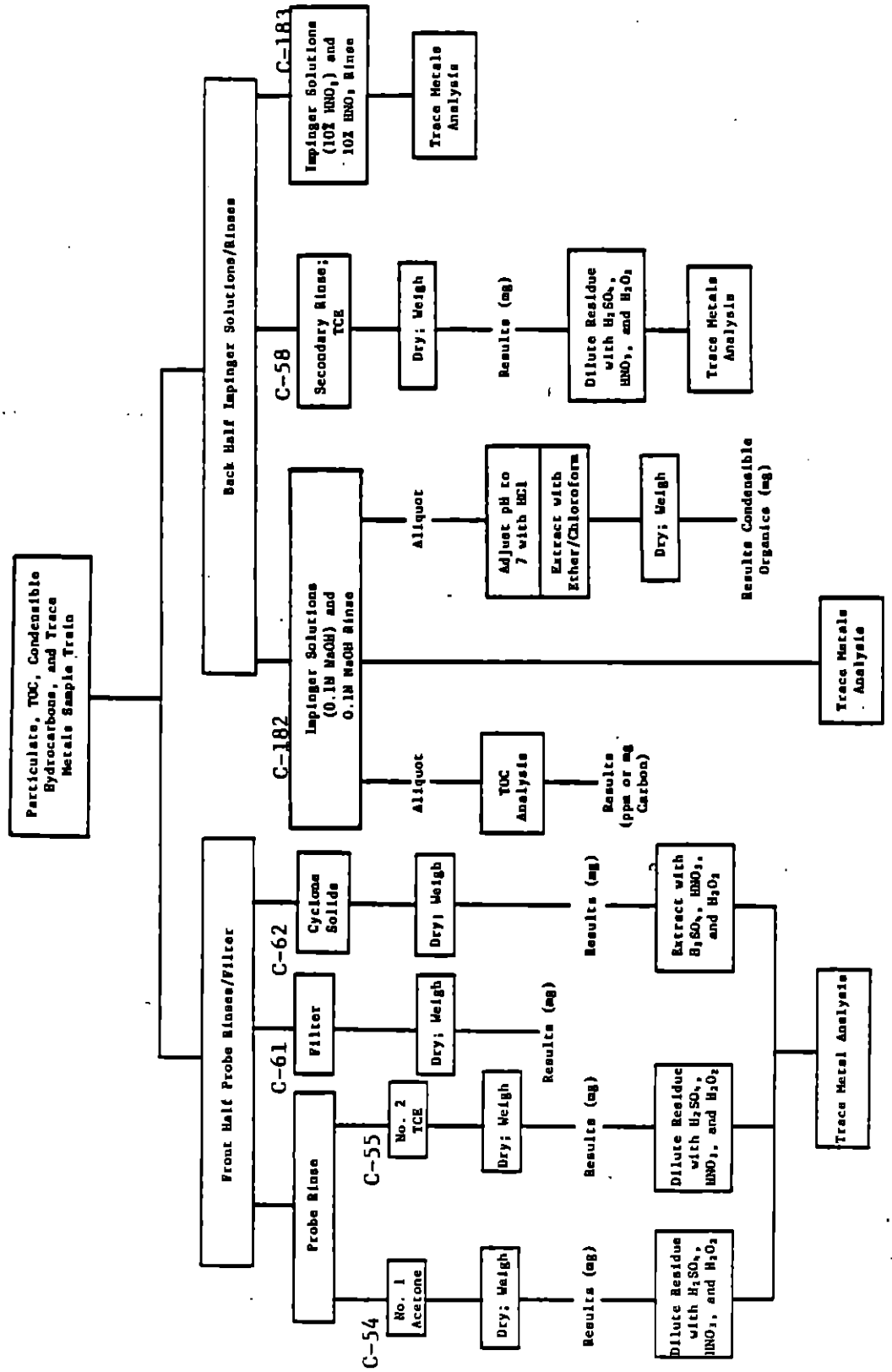


RADIAN CORPORATION

Part./Cond. Hyd. C-2 11/14 0813-1003
CAM-1114-PAH-Out-01

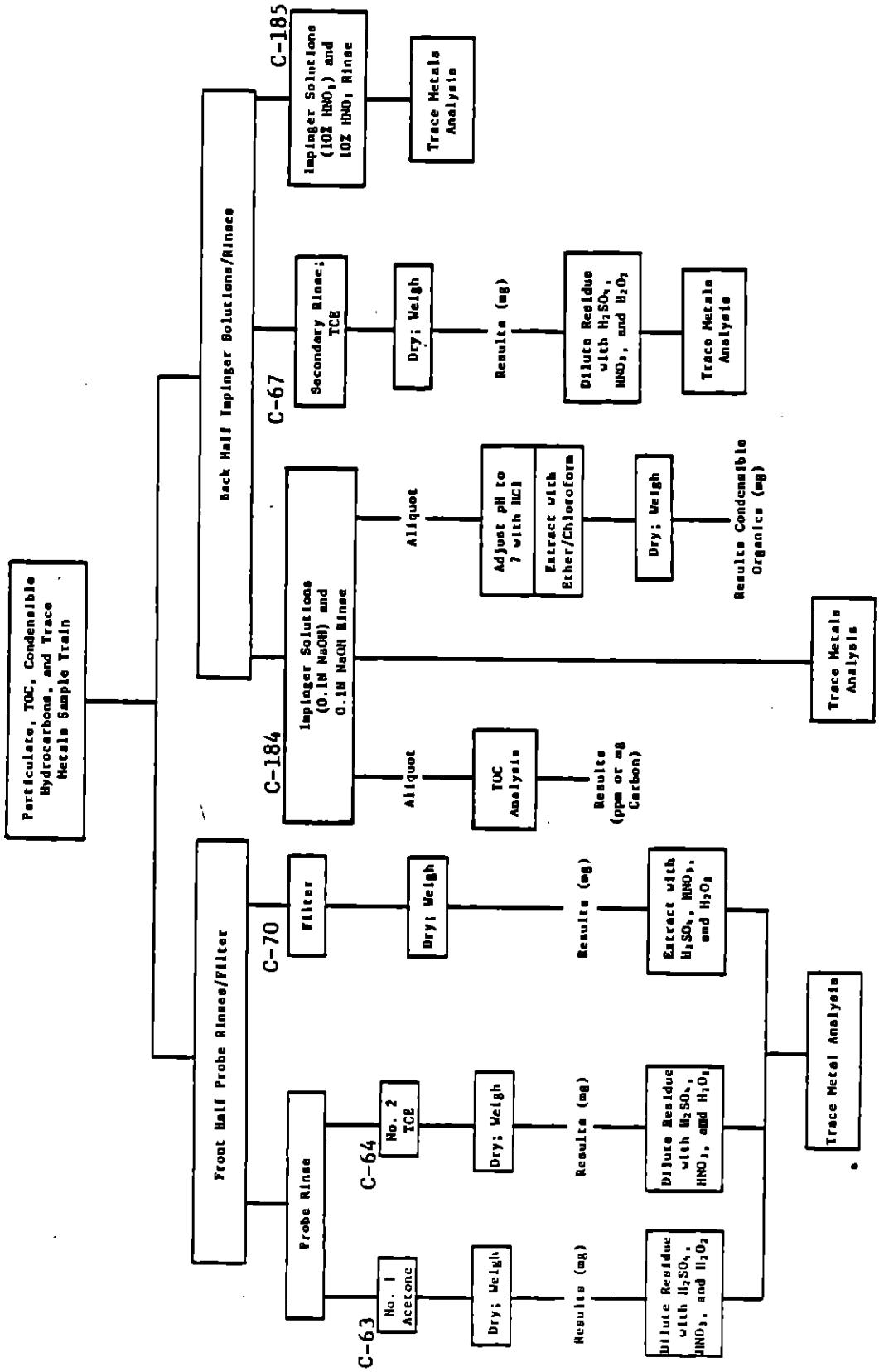


TM-Part./Cond. Hyd. R-2 11/11 0843-0937
CAM-1111-TM-In-01

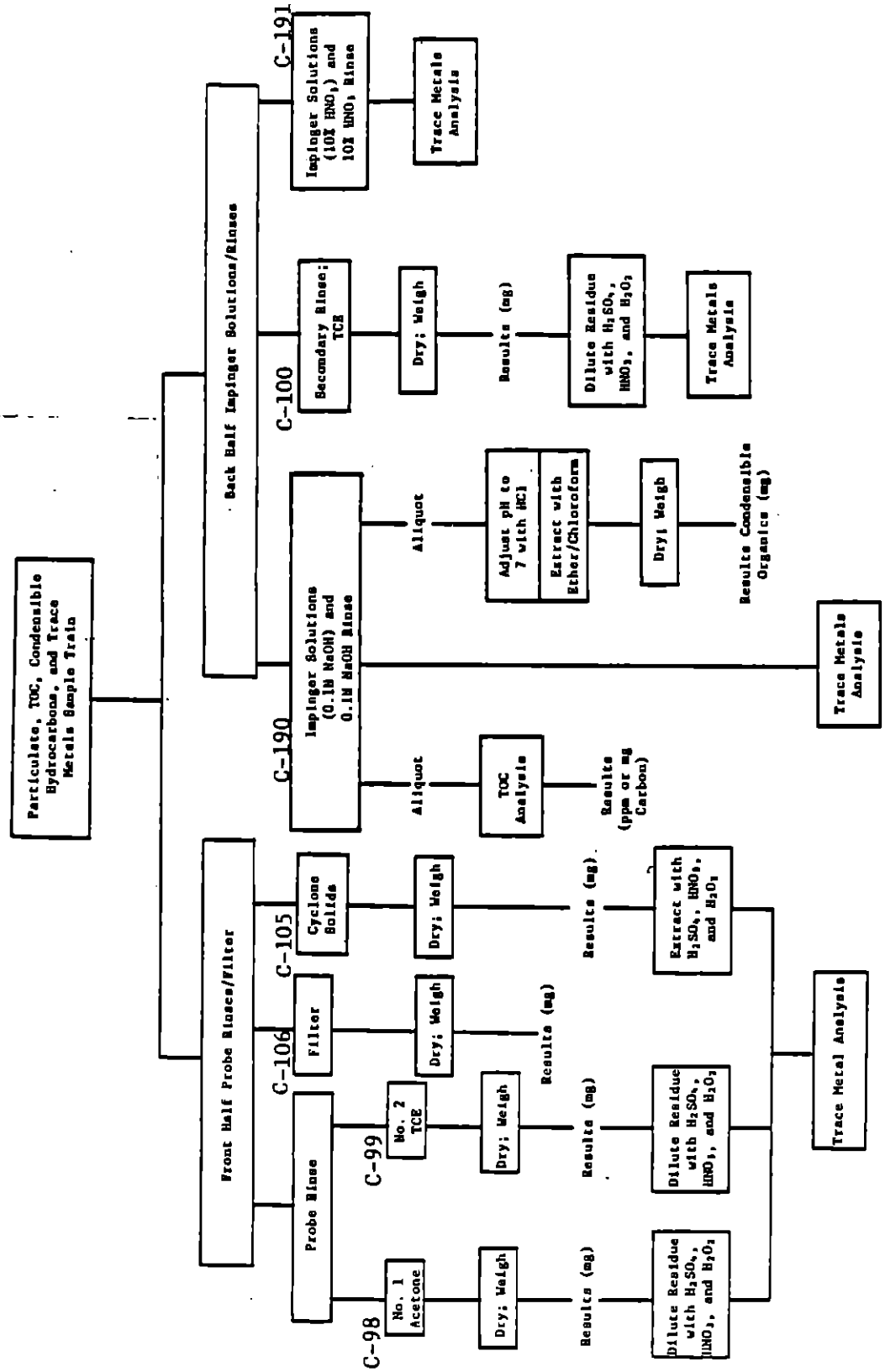


RADIAN CORPORATION

TM-Part./Cond. Hyd. R-2 11/11 0839-1433
CAM-1111-TM-Out-01

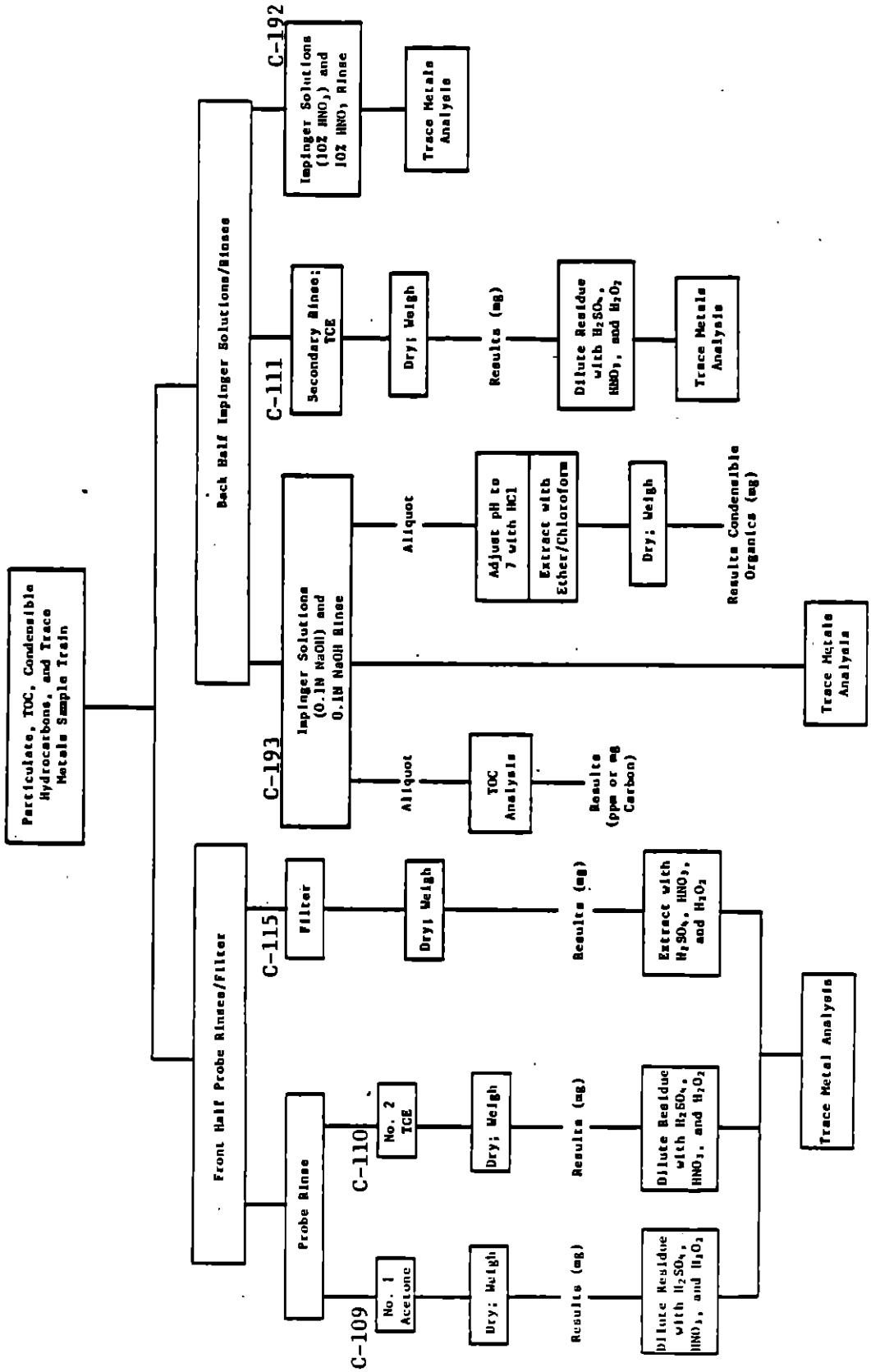


TM-Part./Cond. Hyd. C-1 11/12 1151-1243
CAM-1112-TM-In-02

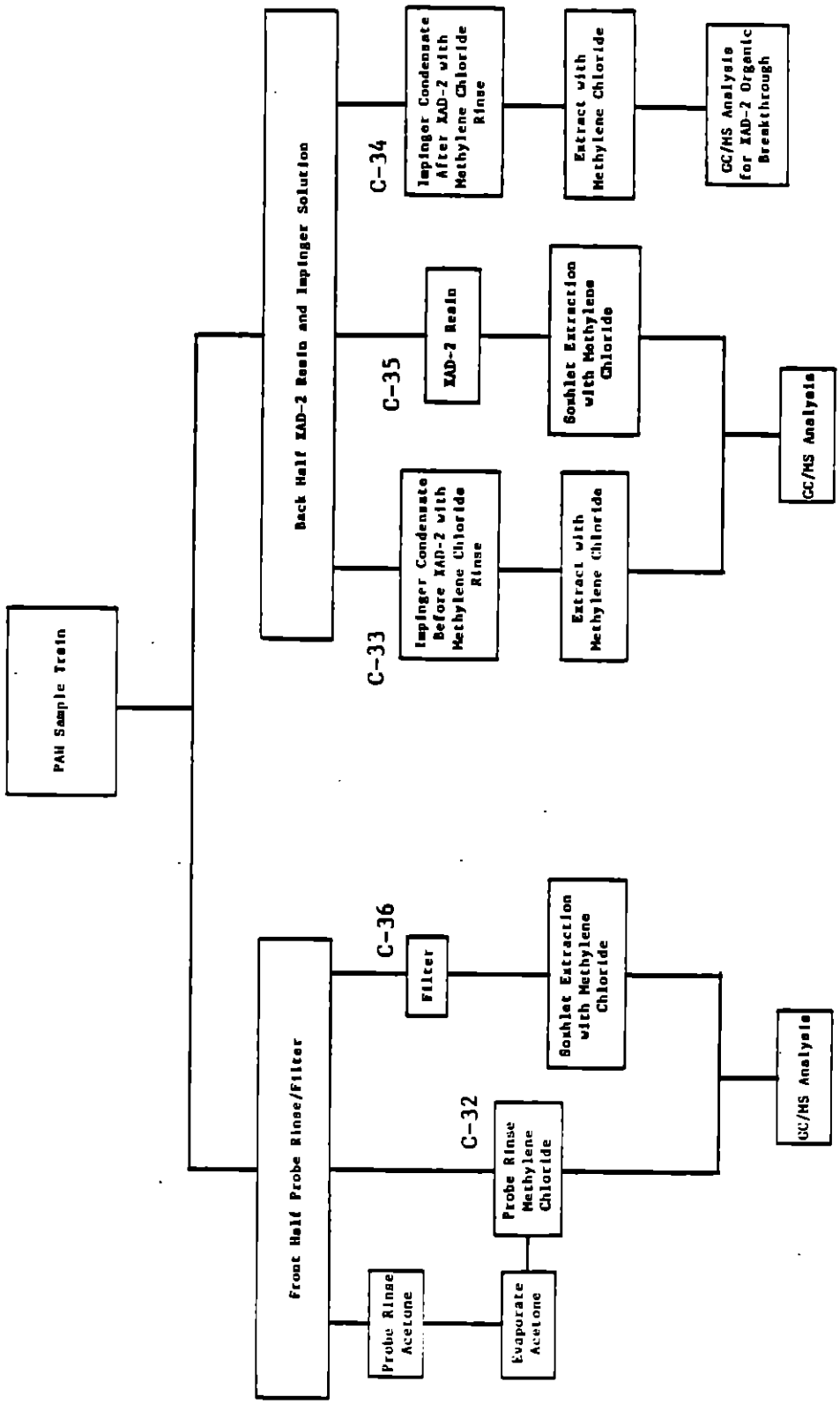


RADIAN

TM-Part./Cond. Hyd. C-1 11/12 1129-1319
CAM-1112-TM-Out-02

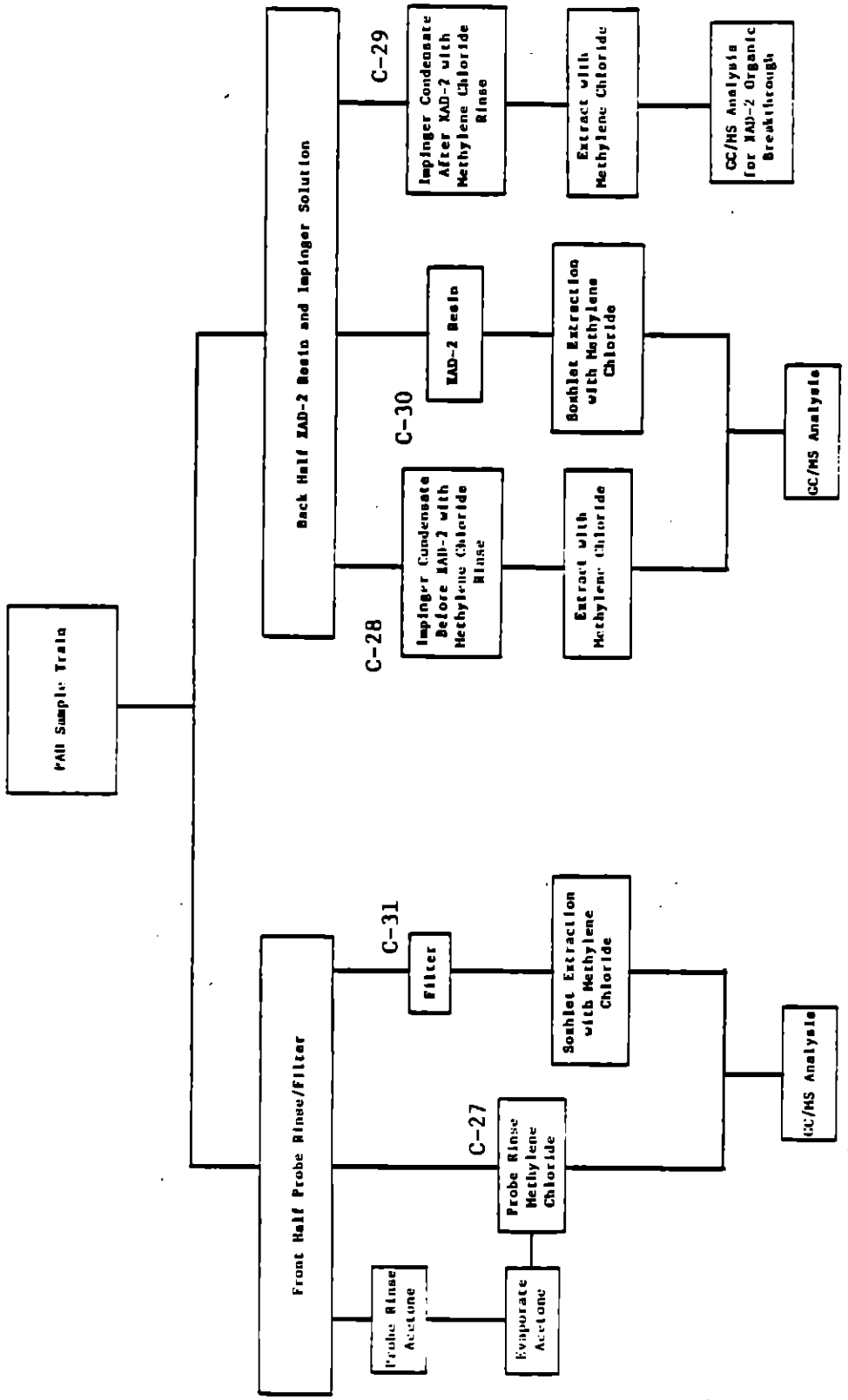


CAM-1109-BAP-In-Blank



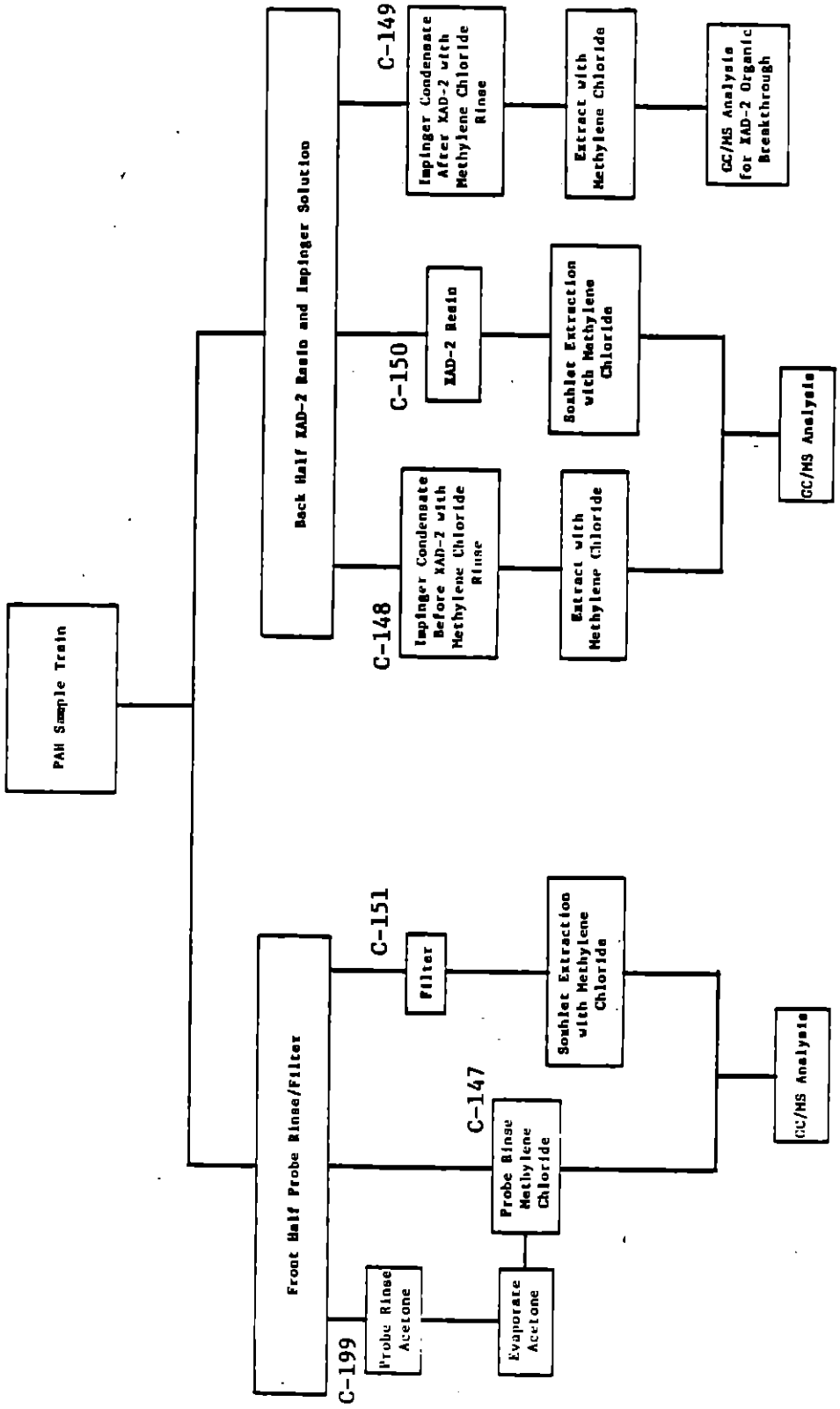
RADIAN CORPORATION

CAM-1109-BAP-Out-Blank



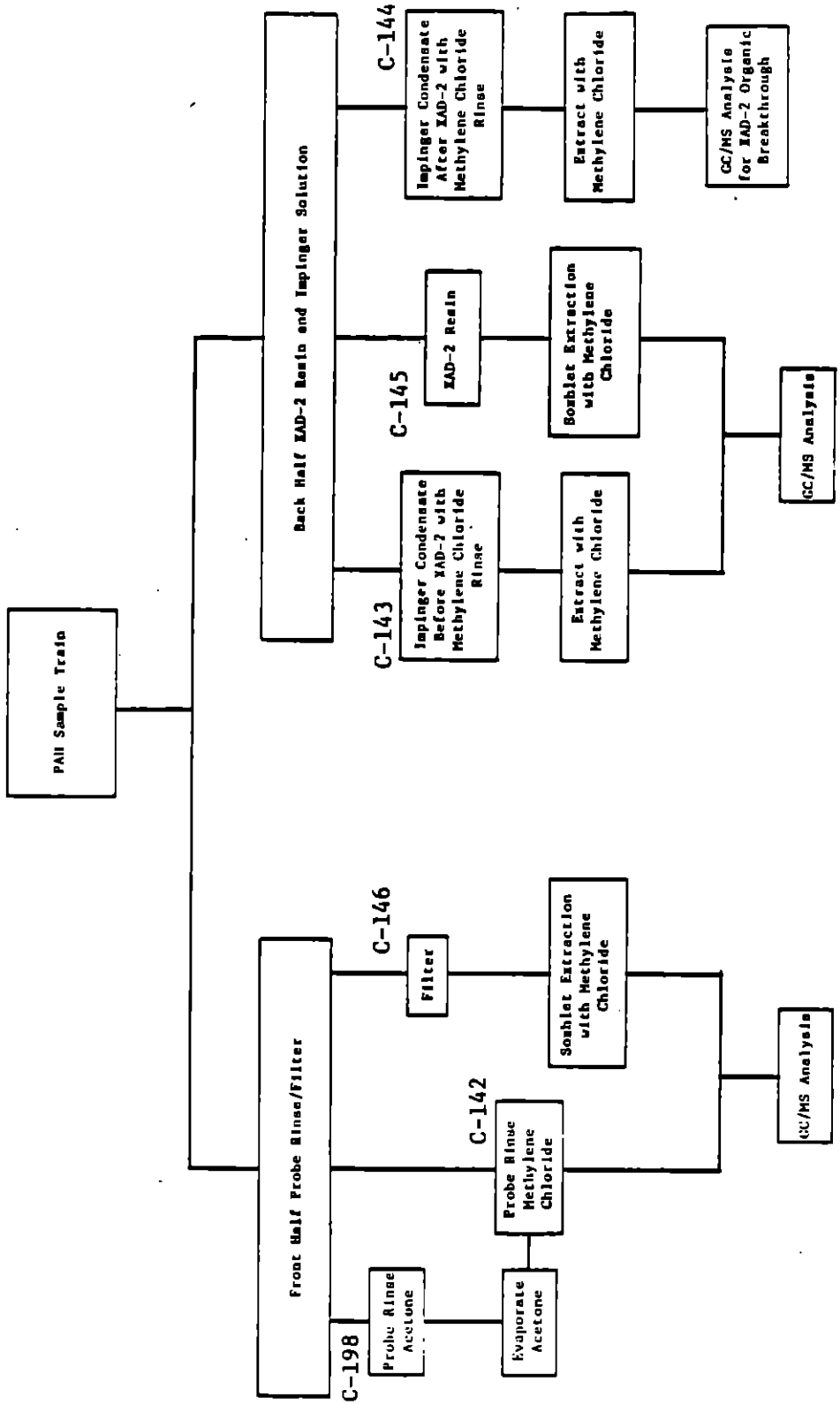
RADIAN CORPORATION

BaP/Org C-1 11/14 1301-1426
CAM-1114-BAP-In-01



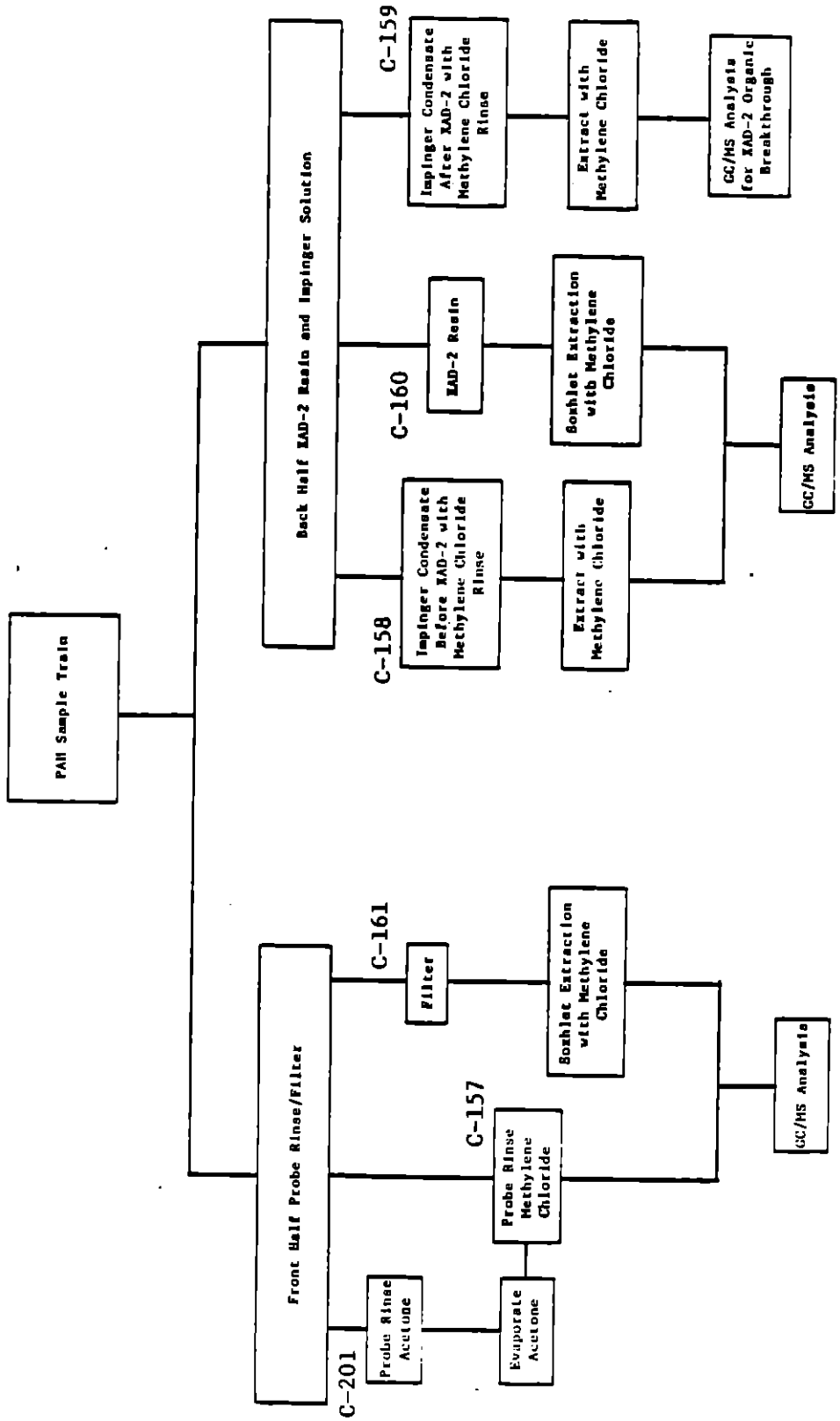
RADIAN CORPORATION

BaP/Org C-1 11/14 1209-1426
CAM-1114-BAP-Out-01



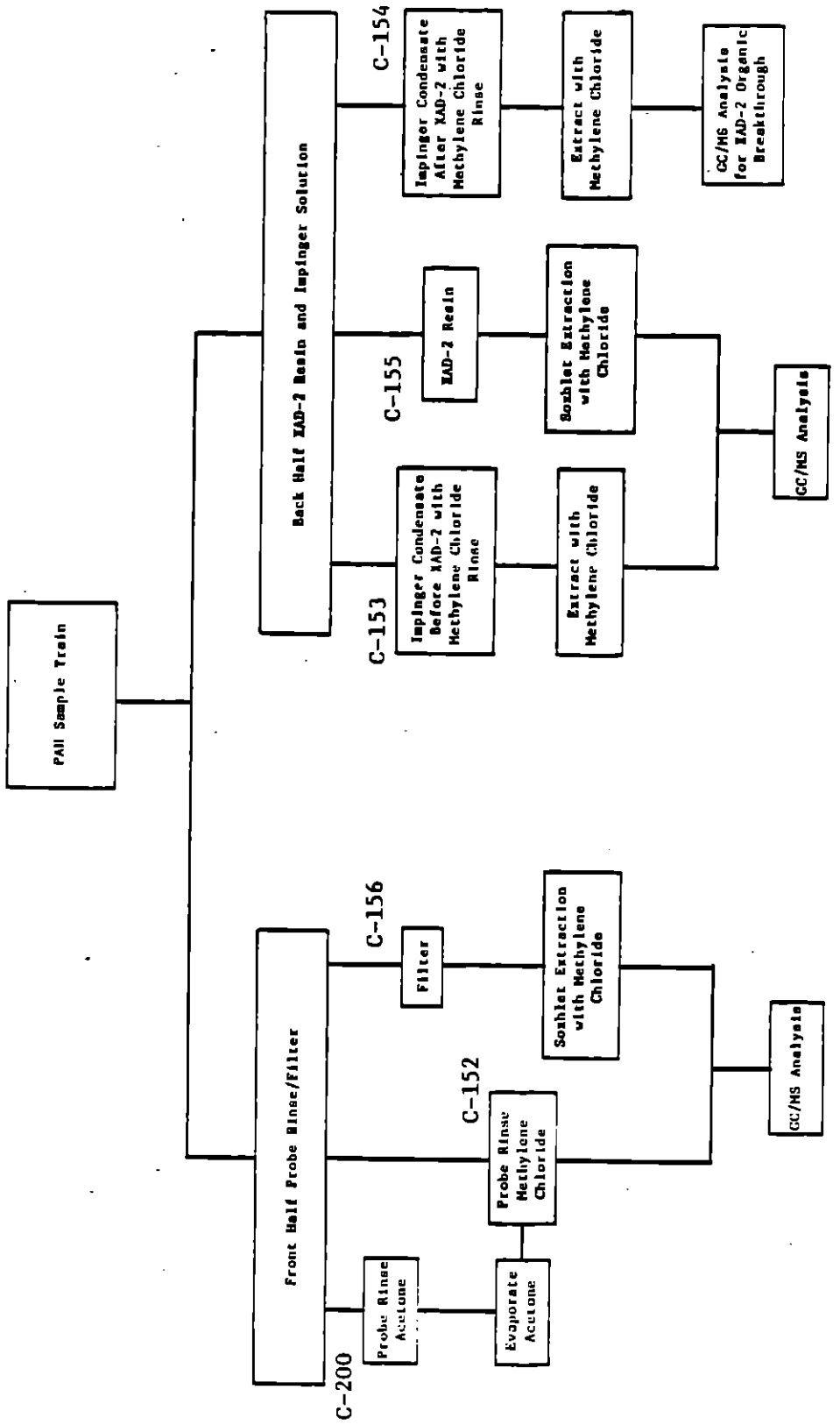
RADIAN CORPORATION

BaP/Org R-1 11/15 0909-1005
CAN-1115-BAP-In-01



RADIAN CORPORATION

BaP/Org R-1 11/15 0859-1053
Cam-1115-BAP-Out-01



APPENDIX I.3

SAMPLING EQUIPMENT AND PROCEDURES QUALITY CONTROL

INCLUDES

I.3.1 Sample Equipment Selection and Preparation
I.3.2 EPA Reference Methods 2, 3, and 5E Sampling, PAH Sampling, and Particle Size Determinations
I.3.3 Sample Analysis Quality Control
I.3.4 Data Reduction

APPENDIX I.3.1

SAMPLING EQUIPMENT SELECTION AND PREPARATION

INCLUDES


I.3.1.1 Prior Cleaning Procedures
- I.3.1.1.1 EPA Method 5E Glassware and Probe Liner Cleaning Procedure
- I.3.1.1.2 PAH Glassware and Probe Liner Cleaning Procedure

I.3.1.2 Calibrated Field Equipment
- I.3.1.2.1 S-Type Pitot Certification
- I.3.1.2.2 Differential Pressure Gauge Certification
- I.3.1.2.3 Temperature Measuring Device Certification
- I.3.1.2.4 Orifice and Gas Meter System Certification
- I.3.1.2.5 Sampling Nozzle Certification

### I.3.1.1 Prior Cleaning Procedures

#### I.3.1.1.1 EPA Method 5E Glassware and Probe Liner Cleaning Procedure

All EPA Method 5E glassware was thoroughly cleaned prior to use in the field using the following procedure.

- First, thoroughly wash with a strong laboratory grade soap (i.e. Alconox) and rinse with deionized water.
- Second, fire in a ceramic kiln for 24 hours at 500°C to remove any remaining organics. After cooling, rinse with methylene chloride to remove kiln residue.
- Third, while wearing latex gloves seal all joints with aluminum foil that has been rinsed with methylene chloride.
- Finally, carefully package in bubble wrap for transportation to the test site.

Each glass and stainless steel probe liner was thoroughly washed using a clean probe brush and acetone. Trichloroethane was used to finally rinse the liners. All probe liners were sealed with aluminum foil until ready for use in the field.

#### I.3.1.1.2 PAH Glassware and Probe Cleaning Procedure

The glassware and probe liner(s) used in collecting PAH samples was cleaned using the procedure in I.3.1.1.1 The PAH glassware was not used for any other sampling to help prevent contamination. A final methylene chloride rinse was performed in the field prior to use in collecting PAH samples.

APPENDIX I.3.1.2

CALIBRATED FIELD EQUIPMENT

INCLUDES

I.3.1.2.1 Type S Pitot Tube Certification

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? ____ yes (explain below) ✓ no

$\alpha_1$ = 0 ° (<10°), $\alpha_2$ = 1 ° (<10°), $\beta_1$ = 1 ° (<5°),

$\beta_2$ = 0 ° (<5°)

$\gamma$ = 1 °, $\theta$ = 1 °, A = .925 ~~cm~~ (in.)

z = A sin $\gamma$ = 0.0161 cm (in.); <0.32 cm (<1/8 in.),

w = A sin $\theta$ = 0.061 cm (in.); <.08 cm (<1/32 in.)

$P_A$ .463 cm (in.) $P_b$ .462 cm (in.)

$D_t$ = .374 cm (in.)

Comments: PITOT LEAK CHECKS (BOTH SIDES @ 30" Hg

Calibration required? ____ yes ✓ no

P-002 11-5-83

Quality Assurance Handbook M2-1.7

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

$\alpha_1$ = 1 ° (<10°), $\alpha_2$ = 1 ° (<10°), $\beta_1$ = 0 ° (<5°),

$\beta_2$ = 1 ° (<5°)

$\gamma$ = 0 °, $\theta$ = 1 °, A = .914 cm (in.)

z = A sin $\gamma$ = 0 ~~cm~~ (in.); <0.32 ~~cm~~ (<1/8 in.),

w = A sin $\theta$ = 0.0160 ~~cm~~ (in.); <.08 cm (<1/32 in.)

$P_A$ .456 ~~cm~~ (in.) $P_b$ .458 ~~cm~~ (in.)

$D_t$ = .374 ~~cm~~ (in.)

Comments: PITOT LEAK CHECKS (BOTH LEGS) @ 30" Hg

Calibration required? _____ yes ✓ no

P-003 11/5/83

Quality Assurance Handbook M2-1.7

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? ✓ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) ✓ no

$\alpha_1$ = 0 ° (<10°), $\alpha_2$ = 1 ° (<10°), $\beta_1$ = 0 ° (<5°),

$\beta_2$ = 0 ° (<5°)

$\gamma$ = 0 °, $\theta$ = 1.5 °, A = .920 cm (in.)

z = A sin $\gamma$ = 0 cm (in.); <0.32 cm (<1/8 in.),

w = A sin $\theta$ = 0.0241 cm (in.); <.08 cm (<1/32 in.)

$P_A$ .460 cm (in.) $P_b$ .460 cm (in.)

$D_t$ = .374 cm (in.)

Comments: PITOT LEAK CHECKS (BOTH SIDES) @ 30" Hg

Calibration required? _____ yes ✓ no

P-001 11-5-83

Quality Assurance Handbook M2-1.7

APPENDIX I.3.1.2

CALIBRATED FIELD EQUIPMENT

INCLUDES

I.3.1.2.2 Differential Pressure Gauge Certification

RADIAN

DATE: 10-21-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. 80906WW75 RANGE: 0-5 " $H_2O$

| | REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|---|
| 1 | 1 | 0.95 | - 1.0 |
| 2 | 2 | 1.7 | - 6.0 |
| 3 | 3 | 2.8 | - 4.0 |
| 4 | 4 | 4.0 | 0 |
| 5 | 5 | 5.0 | 0 |

DATE: 10-21-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP -DS48, ΔH, ~~SPARE~~

MAGNEHELIC I.D. NO. 711168m1 RANGE: 0-.5 " $H_2O$

| | REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|---|
| 1 | .1 | .09 | - 2.0 |
| 2 | .2 | .20 | 0 |
| 3 | .3 | .30 | 0 |
| 4 | .4 | .40 | 0 |
| 5 | .5 | .47 | - 6.0 |

Figure . Magnehelic Calibration Sheet Form I

RADIAN CORPORATION

DATE: 11-2-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP 4837, ΔH, ~~STACK~~

MAGNEHELIC I.D. NO. R00730CF9 RANGE: 0 - 2" " $H_2O$

| | REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|---|
| 1 | .5 | .5 | 0 |
| 2 | .75 | .74 | - .5 |
| 3 | 1.0 | .97 | - 1.5 |
| 4 | 1.25 | 1.21 | - 2.0 |
| 5 | 1.50 | 1.45 | - 2.5 |

DATE: 11-2-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH - [illegible], ~~STACK~~

MAGNEHELIC I.D. NO. 71207M027 RANGE: 0 - 3" " $H_2O$

| | REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|---|
| 1 | .5 | .5 | 0 |
| 2 | 1.0 | 1.0 | 0 |
| 3 | 1.5 | 1.50 | 0 |
| 4 | 2.0 | 1.99 | - .33 |
| 5 | 2.5 | 2.45 | - 1.7 |

Figure . Magnehelic Calibration Sheet Form I

RADIAN

DATE: 11-1-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. 70829 MV 43 RANGE: 0 - .25 " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① .05 | .045 | - 2.0 |
| ② .1 | .11 | + 4.0 |
| ③ .15 | .135 | - 6.0 |
| ④ .2 | .18 | - 6.0 |
| ⑤ .25 | .235 | - 6.0 |

DATE: 11-1-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. 71024 MV15 RANGE: 0 - .25 " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① .05 | .06 | + 4.0 |
| ② .1 | .11 | + 4.0 |
| ③ .15 | .165 | + 6.0 |
| ④ .2 | .225 | + 10.0 |
| ⑤ .25 | .25 | 0 |

Figure . Magnehelic Calibration Sheet Form I

RADIAN CORPORATION

DATE: 11-1-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. 10720C077 RANGE: 0 - .25 " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① .05 | .05 | 0 |
| ② .1 | .105 | + 2.0 |
| ③ .15 | .155 | + 2.0 |
| ④ .2 | .205 | + 2.0 |
| ⑤ .25 | .25 | 0 |

DATE: 11-1-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. 00618MB53 RANGE: 0 - .25 " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① .05 | .055 | + 2.0 |
| ② .1 | .105 | + 2.0 |
| ③ .15 | .145 | − 2.0 |
| ④ .2 | .2 | 0 |
| ⑤ .25 | ~~.26~~ 40 .235 | − 6.0 |

Figure . Magnehelic Calibration Sheet Form I

RADIAN CORPORATION

DATE: 10-31-83 OPERATOR INITIALS: KP

CONSOLE #837

TYPE OF MAGNEHELIC (CIRCLE ONE): ~~ΔP~~, ΔE, SPARE

MAGNEHELIC I.D. NO. 70913GM155 RANGE: 0-5 " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① .5 | .5 | 0 |
| ② 1.0 | 1.0 | 0 |
| ③ 2.0 | 2.0 | 0 |
| ④ 3.0 | 3.0 | 0 |
| ⑤ 4.0 | 4.0 | 0 |

---

DATE: 10-31-83 CONSOLE 4837 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. 70720 RANGE: 0-3 " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① .5 | .5 | 0 |
| ② 1.0 | .95 | - 1.6 |
| ③ 1.5 | 1.45 | - 1.6 |
| ④ 2.0 | 1.95 | - 1.6 |
| ⑤ 2.5 | 2.6 | + 3.3 |

Figure . Magnehelic Calibration Sheet Form I

RADIAN CORPORATION

DATE: 11-2-83 OPERATOR INITIALS: RS

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH D-548, ~~SPARE~~

MAGNEHELIC I.D. NO. R 01118AG37 RANGE: 0-1" " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① .1 | .09 | − 1.0 |
| ② .2 | .19 | − 1.0 |
| ③ .4 | .38 | − 2.0 |
| ④ .6 | .57 | − 3.0 |
| ⑤ .8 | .76 | − 4.0 |

DATE: OPERATOR INITIALS:

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. RANGE: " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % 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

RADIAN CORPORATION

DATE: 10-31-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP (R31-520), ΔH, ~~SPARE~~

MAGNEHELIC I.D. NO. R00728RB18 RANGE: 0 - 3 " $H_2O$

| | REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|---|
| 1 | .5 | .51 | + .3 |
| 2 | 1.0 | 1.02 | + .7 |
| 3 | 1.5 | 1.5 | 0 |
| 4 | 2.0 | 2.05 | + 1.7 |
| 5 | 2.5 | 2.55 | + 1.7 |

DATE: 11-1-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. 10720 A348 RANGE: 0 - .25 " $H_2O$

| | REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|---|
| 1 | .05 | .058 | + 3.2 |
| 2 | .1 | .102 | + .8 |
| 3 | .15 | .152 | + .8 |
| 4 | .2 | KP ~~.152~~ .205 | + 2.0 |
| 5 | .25 | KP ~~.203~~ .245 | − 2.0 |

Figure . Magnehelic Calibration Sheet Form I

RADIAN CORPORATION

DATE: 10-28-83 OPERATOR INITIALS: KP

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP of Venturi, ΔH, ~~SPARE~~

MAGNEHELIC I.D. NO. R30614C54 RANGE: " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % ERROR $\frac{\Delta P_1 - \Delta P_2}{\text{full scale } \Delta P} \times 100$ |
|---|---|---|
| ① 5.0 | 5.0 | 0 |
| ② 10.0 | 10.3 | + 1.0 |
| ③ 15.0 | 15.3 | + 1.0 |
| ④ 20.0 | 20.4 | + 1.3 |
| ⑤ 25.0 | 25.5 | + 1.7 |

DATE: OPERATOR INITIALS:

TYPE OF MAGNEHELIC (CIRCLE ONE): ΔP, ΔH, SPARE

MAGNEHELIC I.D. NO. RANGE: " $H_2O$

| REFERENCE MANOMETER $\Delta P_1$ | MAGNEHELIC $\Delta P_2$ | % 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.3.1.2

CALIBRATED FIELD EQUIPMENT

INCLUDES

I.3.1.2.3 Temperature Measuring Device Calibration

| TEMPERATURE INDICATOR IDENTIFICATION NO. ($T_{Test}$) | NBS THERMOMETER SERIAL NO. ($T_{STD}$) | DATE (MMDDYY) | INITIALS OF CALIBRATOR | CALIBRATION DATA | |
|---|---|---|---|---|---|
| | | | | MEASURED $T_{Test}$ | MEASURED $T_{STD}$ |
| DIGITAL READOUT CONSOLE 4837 | A 04837 | 10-31-83 | KP | 72 | 76 |
| DIGITAL READOUT CONSOLE 4837 | 565139 ~~A 04837~~ LKP | 10-31-83 | | 169 | 172 |
| DIGITAL READOUT CONSOLE 4837 | A 04835 | | | 46 | 49.6 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Figure 7-3. Temperature Calibration Data Sheet Form I



RADIAN

VOLTAGE CALIBRATOR

| 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 $T_{STD}$ |
|---|---|---|---|---|---|
| TR-03 | 33081182 | 11-26-83 | [illegible] | 32°F @ | 0 MV = 32°F |
| | | | | 107°F @ | 1.68 MV = 107°F |
| | | | | 210°F @ | 3.98 MV = 207°F |
| | | | | 408°F @ | 8.47 MV = 407°F |
| | | | | 601°F @ | 12.9 MV = 602°F |
| | | | | 802°F @ | 17.57 MV = 802°F |
| | | | | 1009°F @ | 22.44 MV = 1008° |
| | | | | 1307°F @ | 29.501 MV = 1308° |
| | | | | 1607°F @ | 36.30 MV = 1606° |
| | | | | 1902°F @ | 42.73 MV = 1900° |

Figure 7-3. Temperature Calibration Data Sheet Form I

VOLTAGE CALIBRATOR

| TEMPERATURE INDICATOR IDENTIFICATION NO. ($T_{Test}$) | ~~DRS THERMOMETER~~ SERIAL NO. ($T_{STD}$) | DATE (MMDDYY) | INITIALS OF CALIBRATOR | CALIBRATION DATA MEASURED $T_{Test}$ | CALIBRATION DATA MEASURED $T_{STD}$ | |
|---|---|---|---|---|---|---|
| TR-02 | 33081182 | 4-26-83 | Hanzen | 31°F @ | 0 MV = | 32°F |
| | | | | 106°F @ | 1.68 MV = | 107°F |
| | | | | 206°F @ | 3.98 MV = | 207°F |
| | | | | 407°F @ | 8.47 MV = | 407°F |
| | | | | 601°F @ | 12.9 MV = | 602°F |
| | | | | 801°F @ | 17.57 MV = | 802°F |
| | | | | 1007°F @ | 22.44 MV = | 1008° |
| | | | | 1309°F @ | 29.501 MV = | 1308° |
| | | | | 1608°F @ | 36.30 MV = | 1606°F |
| | | | | 1902°F @ | 42.73 MV = | 1900°F |

Figure 7-3. Temperature Calibration Data Sheet Form I

THERMOCOUPLES

| TEMPERATURE INDICATOR IDENTIFICATION NO. ($T_{Test}$) | NBS THERMOMETER SERIAL NO. ($T_{STD}$) | DATE (MMDDYY) | INITIALS OF CALIBRATOR | CALIBRATION DATA | |
|---|---|---|---|---|---|
| | | | | MEASURED $T_{Test}$ | MEASURED $T_{STD}$ |
| TC1 | 582809 | 11-4-83 | KP | 121° F | 122° F |
| TC1 | 582809 | 11-4-83 | KP | 85° F | 85.4° F |
| TC1 | 02286 | 11-4-83 | KP | 51° F | 50° F |
| TC2 | 582809 | 11-4-83 | KP | 126°F ~~128° F~~ | 125.8°F ~~128° F~~ KP |
| TC2 | 582809 | 11-4-83 | KP | 84° F | 84.7° F |
| TC2 | 02286 | 11-4-83 | KP | 52° F | 52.2° F |
| TC3 | 582809 | 11-4-83 | KP | 125° F | 129° F |
| TC3 | 582809 | 11-4-83 | KP | 87° F | 87.2° F |
| TC3 | 02286 | 11-4-83 | KP | 51° F | 50.4° F |
| TC4 | 582809 | 11-4-83 | KP | 132° F | 131° F |
| TC4 | 582809 | 11-4-83 | KP | 84° F | 84.8° F |
| TC4 | 02286 | 11-4-83 | KP | 52° F | 52° F |

Figure 7-3. Temperature Calibration Data Sheet Form I



RADIAN

THERMOCOUPLES

| 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 5 | 582809 | 11-4-83 | KP | 127°F | 127°F |
| TC 5 | 582809 | 11-4-83 | KP | 86°F | 86.7°F |
| TC 5 | 02286 | 11-4-83 | KP | 52°F | 52.4°F |
| TC 6 | 582809 | 11-4-83 | KP | 122°F | 123.5°F |
| TC 6 | 582809 | 11-4-83 | KP | 85°F | 85.2°F |
| TC 6 | 02286 | 11-4-83 | KP | 51°F | 50.5°F |
| TC 7 | 582809 | 11-4-83 | KP | 122°F | 122°F |
| TC 7 | 582809 | 11-4-83 | KP | 86°F | 86.3°F |
| TC 7 | 02286 | 11-4-83 | KP | 52°F | 51.6°F |
| TC 8 | 582809 | 11-4-83 | KP | 127°F | 126.8 |
| TC 8 | 582809 | 11-4-83 | KP | 86°F | 85.8°F |
| TC 8 | 02286 | 11-4-83 | KP | 53°F | 52.5°F |

Figure 7-3. Temperature Calibration Data Sheet Form I



KAIDAN CORPORATION

THERMOCOUPLES

| TEMPERATURE INDICATOR IDENTIFICATION NO. ($T_{Test}$) | NBS THERMOMETER SERIAL NO. ($T_{STD}$) | DATE (MMDDYY) | INITIALS OF CALIBRATOR | CALIBRATION DATA | |
|---|---|---|---|---|---|
| | | | | MEASURED $T_{Test}$ | MEASURED $T_{STD}$ |
| TC9 | 02286 | 11-4-83 | KP | 71°F | 71.7°F |
| TC9 | 02286 | | KP | 53°F | 52°F |
| TC9 | 582809 | | KP | 104°F | 108°F |
| TC10 | 02286 | | KP | 71°F | 71.7°F |
| TC10 | 02286 | | KP | 53°F | 52°F |
| TC10 | 582809 | | KP | 102°F | 104.5°F |
| TC11 | 02286 | | KP | 72°F | 70.6°F |
| TC11 | 02286 | | KP | 48°F | 49.2°F |
| TC11 | 582809 | | KP | 119°F | 121.4°F |
| TC12 | 02286 | | KP | 71°F | 70.3°F |
| TC12 | 02286 | | KP | 54°F | 52.6°F |
| TC12 | 582809 | 11-4-83 | KP | 110°F | 109°F |

Figure 7-3. Temperature Calibration Data Sheet Form I



RADIAN

THERMOCOUPLES

| 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 13 | 02286 | 11-4-83 | KP | 70° F | 70.4° F |
| TC 13 | 02286 | | KP | 50° F | 50° F |
| TC 13 | 582809 | | KP | 123° F | 122.8° F |
| TC 14 | 02286 | | KP | 71° F | 71.6° F |
| TC 14 | 02286 | | KP | 50° F | 50.0° F |
| TC 14 | 582809 | | KP | 123° F | 122.4° F |
| TC 15 | 02286 | | KP | 69° F | 69° F |
| TC 15 | 02286 | | KP | 52° F | 51.5° F |
| TC 15 | 582809 | 11-4-83 | KP | 114° F | 114° F |
| | | | | | |
| | | | | | |
| | | | | | |

Figure 7-3. Temperature Calibration Data Sheet Form I



RADIAN

APPENDIX I.3.1.2

CALIBRATED FIELD EQUIPMENT

INCLUDES

I.3.1.2.4 Orifice and Gas Metering System Certifications

EMB Rosttest

# DRY GAS METER CALIBRATION DATA

Date 11-22-83 Calibrated by KEN PALMER Meter or Console No. RS 495 N

Barometric pressure, $P_b$ = 29.12 in. Hg Wet Test Meter No. 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 ($T_{test}$) | | |
| .406 | .5 | 0 | 6.022 | 6.022 | 987.200 | 993.315 | 6.095 | 76 | 76 | 76 | 87 | 93 | 85 | 88 | 88.25 | 15 | 2 |
| .406 | .5 | 6.022 | 11.960 | 5.938 | 993.315 | 999.409 | 6.094 | 76.5 | 76.5 | 76.5 | 87 | 95 | 90 | 90 | 90.5 | 15 | 2 |
| .406 | .5 | 11.960 | 18.022 | 6.062 | 999.409 | 5.683 | 6.274 | 76.5 | 76.5 | 76.5 | 90 | 97 | 93 | 92 | 93 | 15 | 2 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .406 | .5 | 1.0093 | 1.7697 |
| .406 | .5 | 0.9986 | 1.8160 |
| .406 | .5 | 0.9947 | 1.7376 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | Y = 0.9967 | ΔH@ = 1.7734 |

**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

# DRY GAS METER CALIBRATION DATA

Date 6-9-83 Calibrated by ZINN Meter or Console No. RS-495 N

Barometric pressure, $P_b$ = 29.39/45 (6-10-83) in. Hg Wet Test Meter No. 5997 (WTM)

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) (in. $H_2O$) | Gas Volumes ($ft^3$) Wet Test Meter Initial | Final | Delta ($V_{std}$) | Dry Gas Meter Initial | Final | Delta ($V_{test}$) | Temperature °F Wet Test Meter Initial | Final | Ave ($T_{std}$) | Dry Gas Meter Inlet Initial | Inlet Final | Outlet Initial | Outlet Final | Ave ($T_{test}$) | Elapsed Time (min) (θ) | Vacuum (2-4 in. Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .215 | .13 | 0 | — | 4.908 | 94.740 | 99.7925 | 5.0925 | — | — | 76 | 89 | 88 | 90 | 89 | 89 | 25 | 3 |
| .215 | .13 | 0 | — | 4.6840 | 40.5000 | 45.1850 | 4.8450 | — | — | 76 | 86 | 87 | 87 | 87 | 86.75 | 25 | 3 |
| .39 | .50 | 0 | — | 6.000 | 20.2000 | 26.7650 | 5.9650 | — | — | 76 | 93 | 93 | 88 | 88 | 90.5 | 16.5 | 3 |
| .39 | .50 | 0 | — | 6.434 | 26.2650 | 33.1490 | 6.2840 | — | — | 76 | 88 | 93 | 89 | 89 | 89.75 | 16.5 | 3 |
| .62 | 1.38 | 0 | — | 6.353 | 11.971 | 18.252 | 6.2810 | — | — | 76 | 92 | 97 | 81 | 88 | 89.5 | 10 | 3 |
| .62 | 1.38 | 0 | — | 6.384 | 5.700 | 11.971 | 6.2750 | — | — | 76 | 90 | 96 | 87 | 87 | 90 | 10 | 3 |
| .80 | 2.5 | 0 | — | 8.568 | 375.6000 | 383.6527 | 8.0527 | — | — | 76 | 82 | 88 | 75 | 78 | 80.75 | 10 | 3 |
| .80 | 2.5 | 0 | — | 8.6430 | 991.7000 | 100.2 860.0 | 8.5860 | — | — | 76 | 90 | 91 | 82 | 86 | 87.25 | 10.25 | 3 |

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .215 | .13 | 0.9868 | 1.9000 |
| .215 | .13 | 0.9858 | 2.0946 |
| .39 | .50 | 1.0318 | 2.1241 |
| .39 | .50 | 1.0324 | 1.8498 |
| .62 | 1.38 | 1.0334 | 1.9242 |
| .62 | 1.38 | 1.0404 | 1.9039 |
| .80 | 2.5 | 1.0668 | 1.9475 |
| .80 | 2.5 | 1.0214 | 1.9869 |
| Average | | Y = | ΔH@ = |

**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 6-9-83 Calibrated by ZINN Meter or Console No. RS-495 N

Barometric pressure, $P_b$ = 29.39 in. Hg Wet Test Meter No. 5997 (WTM)

| 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 ($T_{test}$) | | |
| .95 | 3.0 | 0 | — | 9.4340 | 952.0000 | 961.5720 | 9.5720 | — | — | 77 | 100 | 100 | 92 | 92 | 96 | 10 | 3 |
| .95 | 3.0 | 0 | — | 9.4100 | 961.5720 | 971.0895 | 9.5175 | — | — | 77 | 98 | 100 | 92 | 92 | 95.5 | 10 | 3 |

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .95 | 3.0 | 1.0129 | 1.8857 |
| .95 | 3.0 | 1.0151 | 1.8970 |
| Average | | Y = 1.0227 | ΔH@ = 1.9514 |

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

Y ± 0.0205 High 1.04 High 2.2441 Low 1.6587

EMB POST TEST

# DRY GAS METER CALIBRATION DATA

Date 11-28-83 Calibrated by KEN PALMER Meter or Console No. R31-520

Barometric pressure, $P_b$ = 29.38 in. Hg Wet Test Meter No. 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 ($T_{test}$) | | |
| .413 | .45 | 0 | 5.645 | 5.645 | 787.600 | 787.697 | 6.097 | 66 | 66 | 66 | 78 | 83 | 75 | 79 | 78.75 | 15 | 2 |
| .413 | .45 | 5.645 | 11.260 | 5.615 | 787.697 | 793.804 | 6.107 | 66 | 66 | 66 | 81 | 85 | 80 | 82 | 82 | 15 | 2 |
| .413 | .45 | 0 | 5.645 | 5.645 | 794.200 | 800.330 | 6.130 | 67 | 67 | 67 | 85 | 87 | 85 | 84 | 85.25 | 15 | 2 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .413 | .45 | 0.9472 | 1.7606 |
| .413 | .45 | 0.9463 | 1.7688 |
| .413 | .45 | 0.9517 | 1.7462 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | Y = 0.9484 | ΔH@ = 1.7585 |

**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

DOES ~~NOT~~ MEET METHOD 5 ACCEPTANCE CRITERIA.

# DRY GAS METER CALIBRATION DATA

Date 3-9-83 Calibrated by ZINN Meter or Console No. B31-520

Barometric pressure, $P_b$ = 29.50 in. Hg Wet Test Meter No. Radian 5777 *

| 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 ($T_{test}$) | | |
| .205 | .14 | 0 | 9.975 | 9.930 | 609.2280 | 614.9040 | 5.0761 | — | — | 69 | 77 | 81 | 77 | 80 | 78.75 | 25 | 2 |
| .205 | .14 | 9.930 | 19.420 | 9.9610 | 614.9040 | 619.7830 | 5.6540 | — | — | 70 | 79 | 82 | 80 | 81 | 80.5 | 25 | 2 |
| .42 | .50 | 25.7300 | 30.7936 | 5.5360 | [illegible] | 631.7[illegible] | 5.1015 | — | — | 70 | 79 | 87 | 80 | 80 | 82 | 12.5 | 2 |
| .42 | .50 | 30.7930 | 35.6520 | 4.8590 | 631.7450 | 636.8475 | 5.1025 | — | — | 70 | 81 | 88 | 80 | 81 | 82.5 | 12.5 | 2 |
| .60 | 1.06 | 47.6330 | 53.2330 | 5.6000 | 649.2575 | 655.1208 | 5.8633 | — | — | 66 | 73 | 83 | 72 | 74 | 75.5 | 10 | 2.5 |
| .60 | 1.06 | 53.2330 | 58.3145 | 5.1365 | 655.1208 | 660.7115 | 5.5707 | — | — | 66 | 74 | 84 | 74 | 74 | 76.5 | 10 | 2.5 |
| .82 | 2.12 | 60.2000 | 67.7550 | 7.6550 | 662.5135 | 671.6235 | 9.2100 | — | — | 66 | 82 | 90 | 75 | 76 | 81.75 | 10 | 2.5 |
| .82 | 2.12 | 67.7550 | 75.7870 | 7.9970 | 671.6235 | 680.1180 | 8.5045 | — | — | 66 | 77 | 91 | 76 | 78 | 80.5 | 10 | 2.5 |

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .205 | .14 | 0.9737 | 2.0723 |
| .205 | .14 | 0.9723 | 2.0784 |
| .42 | .50 | 0.9746 | 1.8360 |
| .42 | .50 | 0.9725 | 1.8449 |
| .60 | 1.06 | 0.9706 | 1.8733 |
| .60 | 1.06 | 0.9680 | 1.8822 |
| .82 | 2.12 | 0.9758 | 1.9577 |
| .82 | 2.12 | 0.9754 | 1.9026 |
| Average | | Y = | ΔH@ = |

**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

* WTM 002 USED AT .2 CFM FLOW RATE CORRECTION FACTOR OF .9762 WAS USED TO OBTAIN $Y_i$

# DRY GAS METER CALIBRATION DATA

Date 3-9-83 Calibrated by Zinn Meter or Console No. B31-520

Barometric pressure, $P_b$ = 29.50 in. Hg Wet Test Meter No. 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 ($T_{test}$) | | |
| 1.0 | 3.1 | 76.700 | 86.1670 | 9.4660 | 681.9469 | 690.9070 | 9.8601 | — | — | 66 | 79 | 94 | 78 | 79 | 82.5 | 10 | 3.5 |
| 1.0 | 3.1 | 86.1070 | 95.1234 | 9.5164 | 690.9070 | 700.8275 | 9.9205 | — | — | 66 | 78 | 93 | 78 | 80 | 82.25 | 10 | 3.5 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| 1.0 | 3.1 | 0.9815 | 1.9000 |
| 1.0 | 3.1 | 0.9813 | 1.8768 |
| | | | 1 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | Y = 0.9749 | ΔH@ = 1.9154 |

± .0195 = High 0.9944 ± .1873 = High 2.2027 } ACCEPTANCE CRITERIA MET.

**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

EMB POST TEST

# DRY GAS METER CALIBRATION DATA

Date 11-29-83 Calibrated by KEN PALMER Meter or Console No. D 548

Barometric pressure, $P_b$ = _____ in. Hg Wet Test Meter No. _____

| 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 ($T_{test}$) | | |
| .421 | .5 | 0 | 6.090 | 6.090 | 3.800 | 10.105 | 6.305 | 66 | 66 | 66 | 78 | 83 | 78 | 81 | 80 | 15 | 2 |
| .421 | .5 | 6.090 | 12.187 | 6.097 | 10.105 | 16.450 | 6.345 | 66 | 66 | 66 | 83 | 86 | 85 | 84 | 84.5 | 15 | 2 |
| .421 | .5 | 12.187 | 18.260 | 6.073 | 16.450 | 22.789 | 6.339 | 66 | 66 | 66 | 84 | 86 | 85 | 88 | 85.75 | 15 | 2 |
| | | | | | | | | | | | | | | | | | |
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| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .421 | .5 | 0.9904 | 1.6712 |
| .421 | .5 | 0.9935 | 1.6536 |
| .421 | .5 | 0.9928 | 1.6629 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | Y = 0.9922 | ΔH@ = 1.6626 |

**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

# DRY GAS METER CALIBRATION DATA

Date 3-8-83 Calibrated by ZINN Meter or Console No. D 548

Barometric pressure, $P_b$ = 29.29 in. Hg Wet Test Meter No. * 5997

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) (in. $H_2O$) | Gas Volumes (ft³) Wet Test Meter Initial | Wet Test Meter Final | Wet Test Meter Delta ($V_{std}$) | Dry Gas Meter Initial | Dry Gas Meter Final | Dry Gas Meter Delta ($V_{test}$) | Temperature °F Wet Test Meter Initial | Wet Test Meter Final | Wet Test Meter Ave ($T_{std}$) | Dry Gas Meter Inlet Initial | Dry Gas Meter Inlet Final | Dry Gas Meter Outlet Initial | Dry Gas Meter Outlet Final | Dry Gas Meter Ave ($T_{test}$) | Elapsed Time (min) (θ) | Vacuum (2-4 in. Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .22 | .15 | 51.6914 | 57.0290 | 5.3376 | 555.0675 | 560.3740 | 5.3065 | — | — | 70 | 77 | 79 | 78 | 79 | 78.25 | 25 | 2 |
| .22 | .15 | 57.0290 | 62.4200 | 5.3910 | 560.3740 | 565.6675 | 5.2935 | — | — | 70 | 78 | 82 | 79 | 84 | 80.75 | 25 | 2 |
| .425 | .595 | 5023.2640 | 5027.6590 | 4.3950 | 531.6570 | 535.9692 | 4.3122 | — | — | 75 | 82 | 85 | 83 | 82 | 83 | 10 | 2 |
| .425 | .595 | 5040.7660 | 5046.0950 | 5.3290 | 548.4112 | 554.7669 | 5.3559 | — | — | 70 | 78 | 82 | 78 | 82 | 80 | 12.5 | 2 |
| .595 | 1.1 | 5063.1600 | 5072.5000 | 9.3400 | 567.3000 | 576.7000 | 9.4000 | — | — | 71 | 81 | 86 | 80 | 84 | 82.75 | 16 | 2.5 |
| .595 | 1.1 | 5072.5000 | 5078.3125 | 5.8125 | 576.2000 | 582.0575 | 5.8575 | — | — | 71 | 82 | 86 | 84 | 85 | 84.25 | 10 | 2.5 |
| .80 | 2.11 | 5081.1230 | 5089.0290 | 7.9060 | 585.3860 | 593.3450 | 7.9590 | — | — | 71 | 84 | 89 | 85 | 87 | 86.25 | 10 | 2.5 |
| .80 | 2.11 | 5089.0290 | 5097.1340 | 8.1050 | 593.3450 | 601.5295 | 8.1835 | — | — | 71 | 85 | 90 | 86 | 88 | 87.25 | 10 | 2.5 |

$P_b$ 29.26

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .22 | .15 | 0.9968 | 1.9503 |
| .22 | .15 | 1.0140 | 1.9030 |
| .425 | .595 | 1.0117 | 1.8334 |
| .425 | .595 | 1.0118 | 1.8584 |
| .595 | 1.1 | 1.0128 | 1.8150 |
| .595 | 1.1 | 1.0142 | 1.8256 |
| .80 | 2.11 | 1.0165 | 1.8858 |
| .80 | 2.11 | 1.0153 | 1.7911 |
| Average | | Y = ——— | ΔH@ = ——— |

**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

* WTM002 USED AT .2 CFM FLOW RATE — CORRECTION FACTOR OF .9762 WAS USED TO OBTAIN Yi

# DRY GAS METER CALIBRATION DATA

Date 3-8-83 Calibrated by ZINN Meter or Console No. D 548

Barometric pressure, $P_b$ = 29.29 in. Hg Wet Test Meter No. 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 ($T_{test}$) | | |
| 1.0 | 3.0 | 0011.2340 | 0020.9585 | 9.7245 | 612.9000 | 622.5590 | 9.6590 | — | — | 71 | 83 | 84 | 81 | 87 | 83.75 | 10 | 3.5 |
| 1.0 | 2.7 | 0020.9585 | 0030.0600 | 9.1015 | 622.5590 | 631.7627 | 9.2037 | — | — | 71 | 93 | 89 | 82 | 86 | 85 | 10 | 3.5 |
| | | | | | | | | | | | | | | | | | |
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| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| 1.0 | 3.0 | 1.0332 | 1.7804 |
| 1.0 | 2.7 | 1.0058 | 1.8292 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | Y = 1.0122 | ΔH@ = 1.8472 |

± 0.0202 HIGH 1.0324 [illegible]

**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

EMB - POSTTEST

# DRY GAS METER CALIBRATION DATA

Date 11-21-83 Calibrated by KEN PALMER Meter or Console No. 4837

Barometric pressure, $P_b$ = 29.28 in. Hg Wet Test Meter No. 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 ($T_{test}$) | | |
| .422 | .55 | 0 | 6.172 | 6.172 | 491.200 | 497.593 | 6.393 | 69 | 69 | 69 | 71 | 71 | 71 | 71 | 71 | 15 | 2 |
| .422 | .55 | 6.172 | 12.347 | 6.175 | 497.593 | 503.992 | 6.399 | 69.5 | 69.5 | 69.5 | 70 | 70 | 71 | 71 | 70.5 | 15 | 2 |
| .422 | .55 | 12.347 | 18.520 | 6.173 | 503.992 | 510.380 | 6.388 | 69.5 | 69.5 | 69.5 | 72 | 73 | 71 | 73 | 72.25 | 15 | 2 |
| | | | | | | | | | | | | | | | | | |
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| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .422 | .55 | 0.9677 | 1.8535 |
| .422 | .55 | 0.9655 | 1.8570 |
| .422 | .55 | 0.9700 | 1.8521 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | Y = 0.9677 | ΔH@ = 1.8542 |

**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

# DRY GAS METER CALIBRATION DATA

Date 11-1-83 Calibrated by KEN PALMER Meter or Console No. 4837

Barometric pressure, $P_b$ = 29.56 in. Hg Wet Test Meter No. 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 ($T_{test}$) | | |
| .195 | .15 | 0 | 5.965 | 5.965 | 651.700 | 657.600 | 5.900 | 73.5 | 73.5 | 73.5 | 70 | 71 | 71 | 72 | 71 | 30 | 4 |
| .195 | .15 | 5.965 | 11.925 | 5.960 | 657.600 | 663.550 | 5.950 | 73.5 | 73.5 | 73.5 | 72 | 72 | 73 | 73 | 72.5 | 30 | 4 |
| .406 | .55 | 12.897 | 18.985 | 6.088 | 664.512 | 670.644 | 6.132 | 73.5 | 73.5 | 73.5 | 75 | 75 | 76 | 75 | 75.25 | 15 | 4 |
| .406 | .55 | 18.985 | 25.082 | 6.097 | 670.644 | 676.836 | 6.192 | 74 | 74 | 74 | 78 | 76 | 79 | 77 | 77.5 | 15 | 4 |
| .591 | 1.1 | 33.700 | 39.530 | 5.830 | 685.600 | 691.506 | 5.906 | 74 | 74 | 74 | 76 | 77 | 76 | 77 | 76.5 | 10 | 4 |
| .591 | 1.1 | 39.530 | 45.350 | 5.820 | 691.506 | 697.441 | 5.935 | 75 | 75 | 75 | 80 | 79 | 82 | 79 | 80 | 10 | 4 |
| .8 | 2.15 | 47.585 | 55.657 | 8.072 | 699.700 | 707.860 | 8.160 | 75 | 75 | 75 | 77 | 79 | 78 | 79 | 78.25 | 10 | 4 |
| .8 | 2.15 | 55.657 | 63.725 | 8.068 | 707.860 | 716.004 | 8.144 | 75 | 75 | 75 | 76 | 77 | 76 | 77 | 76.5 | 10 | 4 |

| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| .195 | .15 | 1.0059 | 2.1809 |
| .195 | .15 | 0.9994 | 2.1784 |
| .406 | .55 | 0.9788 | 1.9147 |
| .406 | .55 | 0.9898 | 1.8940 |
| .591 | 1.1 | 0.9890 | 1.8447 |
| .591 | 1.1 | 0.9871 | 1.8459 |
| .8 | 2.15 | 0.9899 | 1.8817 |
| .8 | 2.15 | 0.9882 | 1.8897 |
| Average | | Y = ↓ | ΔH@ = ↓ |

**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 11-1-83 Calibrated by KEN PALMER Meter or Console No. 4837

Barometric pressure, $P_b$ = 29.56 in. Hg Wet Test Meter No. 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 ($T_{test}$) | | |
| 1.0 | 3.35 | 77.410 | 87.410 | 10.000 | 729.500 | 739.588 | 10.088 | 74 | 74 | 74 | 74 | 73 | 74 | 73 | 73.5 | 10 | 4 |
| 1.0 | 3.35 | 87.410 | 97.580 | 10.170 | 739.588 | 749.582 | 9.994 | 74 | 74 | 74 | 71 | 74 | 71 | 73 | 73.25 | 10 | 4 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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| Test DGM Flow Rate (ACFM) | Orifice Setting (ΔH) | $Y_i = \frac{V_{std} P_b (T_{test} + 460)}{V_{test} \left(P_b + \frac{\Delta H}{13.6}\right)(T_{std} + 460)}$ | $\Delta H@_i = \frac{.0317\ \Delta H}{P_b (T_{test} + 460)} \left[\frac{(T_{std} + 460)\theta}{V_{std}}\right]^2$ |
|---|---|---|---|
| 1.0 | 3.35 | 1.0018 | 1.8456 |
| 1.0 | 3.35 | 1.0059 | 1.8609 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Average | | Y = 0.9935 | ΔH@ = 1.9336 |

**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

APPENDIX I.3.1.2

CALIBRATED FIELD EQUIPMENT

INCLUDES

I.3.1.2.5 Sampling Nozzle Calibrations

NOZZLE CALIBRATION FORM

Date (DDMMYY): 11-04-83

Initials of Calibrator: EPA

Impactor Nozzles

| Nozzle Identification No. | $D_1$ (inches) | $D_2$ (inches) | $D_3$ (inches) | Average Diameter (inches) |
|---|---|---|---|---|
| I-003 | .185 | .184 | .185 | .185 |
| I-004 | .183 | .185 | .184 | .184 |

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

NOZZLE CALIBRATION FORM

Date (DDMMYY): 11-5-83

Initials of Calibrator: KZ

| Nozzle Identification No. | $D_1$ (inches) | $D_2$ (inches) | $D_3$ (inches) | Average Diameter (inches) |
|---|---|---|---|---|
| NZ-111 | .182 | .179 | .180 | 0.180 |
| NZ-116 | .170 | .169 | .168 | 0.169 |
| NZ-114 | .175 | .173 | .175 | 0.174 |
| NZ-118 | .244 | .241 | .243 | 0.243 |
| NZ-112 | .365 | .367 | .366 | 0.366 |
| NZ-119 | .270 | .273 | .274 | 0.272 |
| NZ-113 | .365 | .367 | .369 | 0.367 |

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.3.2

EPA REFERENCE METHODS 2, 3, AND 5
SAMPLING, PAH SAMPLING, AND
PARTICLE SIZE DETERMINATIONS -
EQUIPMENT AND PROTOCOL

INCLUDES

I.3.2.1 Summary of Equipment Used During Testing
I.3.2.2 Sampling Protocol

### I.3.2.1 Summary of Equipment Used During Sampling

A summary of the equipment used during sample collection is presented in Tables I.3.2.1.A and I.3.2.1.B.

TABLE I.3.2.1.A. RADIAN EQUIPMENT USED DURING T.J. CAMPBELL CONCRETE ASPHALT TESTING

| Date | Run Description | Location | Console | Probe/ Pitot[1] | Nozzle |
|---|---|---|---|---|---|
| 11/08/83 | Part./Cond.Hyd.C-1 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | RS495N | P-003 | NZ-118 |
| 11/10/83 | T.M.Part/Cond.Hyd.R-1 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-003 | NZ-118 |
| 11/11/83 | T.M.Part./Cond.Hyd.R-2 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-003 | NZ-118 |
| 11/11/83 | Part./Cond.Hyd.B-1 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-003 | NZ-118 |
| 11/12/83 | Part./Cond.Hyd.R-2 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-003 | NZ-118 |
| 11/12/83 | T.M.Part./Cond.Hyd.C-1 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-003 | NZ-118 |
| 11/13/83 | Part./Cond.Hyd.C-1 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-003 | NZ-118 |
| 11/14/83 | Part./Cond.Hyd.C-2 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-001 | NZ-118 |
| 11/14/83 | BaP/Org.C-1 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-001 | NZ-118 |
| 11/15/83 | BaP/Org.R-1 | Inlet | D-548 | P-002 | NZ-119 |
| | | Outlet | 4837 | P-001 | NZ-118 |

[1] The probe and pitot are a single unit, number corresponds to pitot calibration.

TABLE I.3.2.1.B. RADIAN IMPACTOR EQUIPMENT USED DURING T.J. CAMPBELL CONCRETE ASPHALT TESTING

| Date | Run Description | Location | Andersen Type | Console | Nozzle |
|---|---|---|---|---|---|
| 11/10/83 | PSD[1] R-1[2] | Outlet | Mk III | R-31-520 | I-003 |
| 11/11/83 | PSD-R-2 | Outlet | Mk III | R-31-520 | I-003 |
| | PSD-R-1 | Inlet | HCSS | D-548 | I-004 |
| | PSD-R-3 | Outlet | Mk III | R-31-520 | I-003 |
| | PSD-R-4 | Outlet | Mk III | R-31-520 | I-003 |
| 11/12/83 | PSD-C-1[3] | Outlet | Mk III | R-31-520 | I-003 |
| | PSD-C-1 | Inlet | HCSS | D-548 | I-004 |
| 11/13/83 | PSD-C-2 | Outlet | Mk III | R-31-520 | I-003 |
| 11/14/83 | PSD-C-3 | Outlet | Mk III | R-31-520 | I-003 |
| | PSD-C-2 | Inlet | HCSS | D-548 | I-004 |
| 11/15/83 | PSD-R-5 | Outlet | Mk III | R-31-520 | I-003 |
| | PSD-C-3 | Inlet | HCSS | D-548 | I-004 |

[1] PSD--Particle Size Distribution
[2] R-1--Recycle Operation and Sequential Run Number
[3] C-1--Conventional Operation and Sequential Run Number

I.3.2.2 SAMPLING PROTOCOL

EPA METHOD 2

Prior to velocity traverses pitot lines were leak checked, the pitots were visually inspected to determine if they had been damaged. Magnehelic® gauges were checked and zeroed and thermocouples and pyrometers were checked. Each sample point was sampled twice and the average of the $\Delta P$'s and temperatures used for calculations.

Prior to inlet sampling the null angle was determined at each sampling port. The null angle is defined here as the angle of a S-type pitot tube, from perpendicular required to obtain a zero reading on the Magnehelic® attached to the pitot tube. This was accomplished by inserting the S-type pitot tube into the duct at right angles to the duct. The S-type pitot tube was rotated clockwise (+) and counterclockwise (-) until a zero reading was obtained on the Magnehelic® gauge attached to the S-type pitot tube. In all ports the null angle was obtained at 90° from perpendicular for clockwise and counterclockwise rotation of the S-type pitot tube. This indicated the gas flow was parallel to the duct walls.

Another check of whether the gas flow was stratisfied or not was to check the volumetric gas flow rates at the inlet and outlet. If the two (corrected to a constant $O_2$) are within 10% of each other the inlet gas flow determinations would be considered representative of actual conditions. For the six particulate and two BaP runs 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 97% $\pm$ 6%.

EPA METHOD 3

The dry molecular weight of the flue gas was determined using the grab sampling technique described in EPA Method 3.

A small diaphragm pump and a stainless steel probe were used to extract the flue gas which was collected in a Tedlar® bag. Prior to sampling the Tedlar® bag was evacuated and the sampling train was leak checked and purged of several residence volumes. A specific volume of flue gas is transferred to the orsat. The known volume of flue gas is passed through two absorbing solutions designed to selectively remove $CO_2$ and $O_2$. One check used to test these solutions was to pass ambient air through the orsat. The values obtained should be consistent with the actual values of ambient air (e.g. 20.9% $O_2$, 0% $CO_2$). If not the system was leak checked or the absorbing solutions chaneled. Also if more than 6 passes of the flue gas through the absorbing solutions were required to obtain a constant (<0.3% difference, absolute) reading for either $CO_2$ or $O_2$, the appropriate solution was changed. If the system passed the Q-C checks the flue gas sample was analyzed. The analysis was repeated until two separate analysis did not differ by more than 0.3% absolute.

MODIFIED EPA METHOD 5E

Prior to each mass determination sampling run the following protocol was observed. The sampling train was set up and leak checked at 15 inches Hg. If the leak check rate was greater than 0.02 CFM the leak was found and corrected. The Probe heater and hot box heater were turned on and their temperatures monitored. The Magnehelic® gauges were checked and zeroed. The S-type pitot tubes were visually checked for damage and leak checked. When the checklist was complete and the probe and hotbox had reached operating temperature the run commenced.

At the end of the run the sampling train was leak checked at the highest vacuum encountered during the run. All runs met leak check criteria except the BaP sampling on 11/14/83. During that run the XAD-2 cannister was broken while it was being withdrawn from the last port.

Polynuclear Aromatic Hydrocarbon

The protocol used for the polyaromatic hydrocarbon sampling was the same as that used for the Method 5E determinations.

Particle Sizing

Prior to each particle size distribution sampling run performed on the scrubber outlet (controlled emissions) the following protocol was observed. The sample train was set up and leak checked at 15 inches Hg. If the leak rate exceeded 0.02 CFM the leak was found and corrected. The Andersen Mark III impactor was prewarmed for 15-20 minutes before sampling started.

The AHCSS was leak checked at 10 inches Hg. The AHCSS was then allowed to heat in the stack for at least 45 minutes with the nozzle out of the flow.

No final leak checks on any particle size distribution sampling runs were made since pulling a vacuum on the impactor runs the risk of redistributing the particle mass.

APPENDIX I.3.3

SAMPLE ANALYSIS QUALITY CONTROL

INCLUDES

I.3.3.1 EPA Method 5E Particulate Mass
I.3.3.2 Total Condensible Hydrocarbons
I.3.3.3 Total Organic Carbon (TOC)
I.3.3.4 Trace Metal (ICAPES)
I.3.3.5 Particle Size Distribution Determination
I.3.3.6 Polynuclear Aromatic Hydrocarbon (PAH)

### I.3.3.1 MODIFIED EPA METHOD 5E PARTICULATE MASS

Prior to use, the balance used for weighing the particulate filters was calibrated using a National Bureau of Stanrdards Class S-1 weight set. The filters were baked at 500°F, dessicated and weighed. The filters were stored in polyethylene petri dishes until they were used. After sampling the filters were returned to the petri dishes. The filters were dessicated and weighed to a constant weight. The same balance was used for both initial and final filter weighings.

As a quality control check on the effect of handling and transport of the filters final weight determination were made on the two filters used for the particulate train blanks. A weight gain of 0.1 and 0.4 mg was recorded.

### I.3.3.2 EXTRACTED TOTAL CONDENSIBLE HYDROCARBONS

The extracted total condensible hydrocarbon measurements were obtained from two sources, the NaOH extraction and trichloroethane rinse. Blanks were analyzed to determine if there was a significant source of sample contamination from any reagents or solvents used for sampling or sample recovery. The blanks analyzed include: the chloroform-ether solvent, an extraction of the NaOH used, the trichloroethane solvent used for glassware rinse, and inlet and outlet impinger train blanks. No single blank contributed significantly to the sample analysis so a blank value was determined from the average of the blanks.

Care was taken during evaporation of the solvents to make sure no contamination of the samples occurred, and any anomalies were noted. Following evaporation the beakers were dessicated 24 hours and weighed at 24-hour intervals.

### I.3.3.3 TOTAL ORGANIC CARBON (TOC)

The TOC was determined using a Beckman 915-B TOC analyzer according to EPA Method 415-1. The instrument utilizes catalytic combustion to oxidize organic carbon to $CO_2$. A Nitrogen carrier gas is used to sweep the sample through the non-dispersive infrared detector which measures the level of $CO_2$ in the sample.

A calibration curve is constructed using potassium hydrogen phthalate (KHP) as a carbon standard. Standards from 0-100 ppm as C are used to construct the calibration curve. As a sample passes through the detector, the detector produces an electronic signal in proportion to the concentration of the sample. The signal is reproduced as a peak via a strip chart recorder. The sample peak heights are compared to the calibration standards peak heights to calculate the sample concentration.

Prior to field sample analysis 5 EPA audit samples and 6 Radian audit samples were analyzed. In addition six quality assurance (QA) samples were submitted with the field samples. Two internal quality assurance samples were also analyzed at the same time as the field samples. A total of 18 quality assurance samples were analyzed. This excludes one EPA audit sample whose actual concentration was in doubt. A statistical analysis indicates that the 95% confidence interval (C.I.) for the mean error (i.e. bias) is 2.5 $\pm$1.6 mg/l. This indicates the samples are biased slightly positive. The QA sample results indicate a 95% probability that 95% of the field sample data have errors between -6.7 mg/l to 11.7 mg/l (i.e. 2.5 $\pm$9.2 mg/l). This represents the $P = .95$, $\gamma = .95$ tolerance limit based on the QA sample results. Another way of looking at this is, if we measured a TOC value of 200 mg/l we are 95% confident that 95% of the time the maximum error will be less than 6%.

Duplicate analyses were performed on two of the field samples, C-211 and C-212. The duplicate analyses were performed on different days. There was no difference between the two analyses.

I.3.3.4 TRACE METALS (ICAPES)

Several analytical quality assurance checks were performed to verify the quality of the trace metals data. Duplicate analyses and spikes were performed on 10% of the samples. Also an internal quality control sample was analyzed for each element. The duplicate analyses were consistently within ± 10% of each other. The spike recoveries ranged from 95% to 107% and averaged 102%. The internal QC sample recoveries ranged from 95% to 103% and averaged 102%. The results of the analyses are presented in Table I.3.3.4A.

The concentrations of the trace metals were determined using Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES) according to EPA Method 200.7. The technique combines the multielemental capabilities of emission spectroscopy with a radio-frequency generated argon plasma source.

Standards for the elements of interest are aspirated into the Argon plasma and their relative emissions intensities are determined by the photomultiplier tube for that element. These values are stored via the use of a computer which will then calculate sample concentration by comparing the electrical charge generated by the photomultiplier tube during sample aspiration to the current measured during standardization.

Sample information such as analytical dilution factor and weight of solids digested is entered in the instruments computer. The instrument then calculates final sample concentration and prints out the result.

Several analytical quality assurance checks were performed to verify the quality of the trace metals data. Duplicate analyses and spikes were performed on 10% of the samples. An internal quality control sample was analyzed for each element. Also, two sampling train field blanks were analyzed. The duplicate analyses were consistently within ±]0% of each other. The spike recoveries ranged from 95% to 107% and averaged 102%. The internal QC sample recoveries ranged from 95% to 103% and averaged 102%. The results of the analyses are presented in Table I.3.3.4A and Table I.2.4.

TABLE I.3.3.4.A. ICAPES Q-C DATA

| Element | Duplicates | | | | | | Spikes (% Recovery) | | | Q-C Check Recovery (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample B-010 | | C-185 | | C-215 | | Samples | | | |
| | 1 | 2 | 1 | 2 | 1 | 2 | B-010 | C-185 | C-215 | |
| Al | 68 | 68 | .05 | .05 | .05 | .05 | 103 | 95 | 99 | 97 |
| Be | .05 | .05 | .0005 | .0005 | .001 | .001 | 105 | 97 | 98 | 98 |
| Ca | 4200 | 4200 | .59 | .58 | 290 | 285 | 101 | 98 | 99 | 99 |
| Cd | 1.7 | 1.5 | .002 | .002 | .007 | .006 | 107 | 95 | 101 | 99 |
| Cr | 2.2 | 2.3 | .001 | .001 | .004 | .005 | 106 | 99 | 106 | 99 |
| Fe | 81 | 81 | .022 | .025 | .026 | .028 | 103 | 104 | 104 | 103 |
| Hg | 30 | 30 | .03 | .03 | .03 | .03 | 104 | 104 | 101 | 95 |
| Mg | 93 | 94 | .03 | .03 | 54 | 56 | 105 | 105 | 104 | 97 |
| Mn | 2.3 | 2.5 | .001 | .001 | .047 | .049 | 104 | 101 | 105 | 103 |
| Ni | 1.6 | 1.7 | .003 | .003 | .003 | .003 | 98 | 97 | 99 | 101 |
| Pb | 8 | 8 | .08 | .08 | .08 | .08 | 103 | 104 | 104 | 97 |
| V | 6 | 6 | .06 | .06 | .06 | .06 | 107 | 104 | 108 | 99 |
| Zn | 18 | 17 | .017 | .016 | .003 | .003 | 101 | 103 | 103 | 98 |

## I.3.3.5 PARTICLE SIZE DISTRIBUTION DETERMINATION

The Andersen High Capacity Stack Sampler (AHCSS) samples were weighed on a Mettler H-80 analytical balance. Prior to use the balance was calibrated with a set of class S-weights. Sample weights were typically between 1.5 and 20.0 grams. Following are the results of that calibration:

| True Wt (g) | Balance Reading (g) | % Deviation Diff/Actual x 100 |
|---|---|---|
| 0.0500 | 0.0502 | 0.40 |
| 0.200 | 0.2002 | 0.10 |
| 0.500 | 0.5001 | 0.02 |
| 1.0000 | 1.0001 | 0.01 |
| 2.0000 | 2.0002 | 0.01 |
| 3.0000 | 3.0000 | 0 |
| 5.0000 | 4.9999 | -0.002 |
| 10.0000 | 10.0002 | 0.002 |
| 20.0000 | 20.0000 | 0 |
| 30.0000 | 30.0004 | 0.001 |
| 50.0000 | 50.0004 | 0.0008 |
| 75.0000 | 75.0009 | 0.0001 |
| 100.0000 | 100.0009 | 0.0001 |

The samples were transported to the Austin labs in dessicators so they were ready to weigh immediately. The petri dishes and thimbles were weighed to a constant weight defined as a weight change of less than 1% of the total particulate mass.

The Andersen substrates were weighed on a Mettler AE-163 five place analytical balance. Prior to use the balance was calibrated using a set of class S-weights. The filter weights were typically between 0.1 and 0.2 grams. Following are the results of that calibration:

| True Wt (g) | Balance Reading (g) | % Deviation Diff/Actual x 100 |
|---|---|---|
| 0.00200 | 0.00201 | 0.50 |
| 0.00500 | 0.00504 | 0.80 |
| 0.01000 | 0.01006 | 0.60 |
| 0.02000 | 0.01997 | 0.15 |
| 0.05000 | 0.04997 | 0.06 |
| 0.10000 | 0.09996 | 0.04 |
| 0.20000 | 0.20000 | 0 |
| 0.30000 | 0.30006 | 0.04 |
| 0.50000 | 0.50002 | 0.004 |

I.3.3.5 cont'd

The Andersen substrates were recovered in the field, placed in individual petri dishes for transport to Austin laboratories. They were put in desiccators and desiccated 72 hours before the first weighing. Following the first weighing it was found that a majority of the filters weighed less than their original tare weight. Because of the weight losses the filters were not weighed to a constant weight.

I.3.3.6 POLYNUCLEAR AROMATIC HYDROCARBON (PAH)

The sample concentrates were analyzed by GC-MS with operation in the selected ion monitoring mode (SIM). Individual PAHs 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 PAHs 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 corresponding to the molecular weight of the compound ($M^+$); fragments are generally found at $M^+-2$ and $M^+/2$ (corresponding to a double I.3.3.6.A charged ion). The relative intensities of these fragment ions are also examined in order to confirm the identification. Table I.3.3.6.A lists the individual PAHs measured and the key characteristics employed for the identification. The internal standard, phenanthrene-$d_{10}$, served as a marker to verify retention time to within $\pm 0.1$ minutes. A further discussion of PAH sampling and analysis is presented in Section J.4.

Two sample train field blanks were analyzed to determine background contamination levels for the PAHs. The results are presented in Tables I.2.5.1 and I.2.5.2.

Once an individual PAH 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.3.3.6.B.

TABLE I.3.3.6.A. 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.3.3.6.B. 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.3.4

DATA REDUCTION

INCLUDES

I.3.4.1 EPA Method 5E Particulate Mass
I.3.4.2 Total Condensed Hydrocarbons

### I.3.4.1 MODIFIED EPA METHOD 5E PARTICULATE MASS

Raw field data is reduced to engineering units using Radian's Source Sampling Data Reduction Computer Program. Copies of the data reduction print-outs are presented in Appendix A. The program uses the calculations outlined in EPA Method 5 procedure. As a check several runs were hand calculated using the equations presented in Appendix B.

### I.3.4.2 EXTRACTED TOTAL CONDENSED HYDROCARBONS

Total residue weights were determined from the evaporation of the trichloroethane impinger and glassware rinse and the evaporation of the chloroform/ether solvent extraction of the NaOH impinger catches.

The residue weight of the trichloroethane impinger and glassware rinse, corrected for the blank residues was calculated by the following equation:

$$\text{Corrected residue mass(g)} = \text{Total residue wt(g)} - [(\text{solvent blank} \times \text{total sample volume}) + \text{impinger blank(g)}]$$

The solvent blank corrects for the residue fraction from the solvent and the impinger blank acts as a general background correction.

$$\text{Corrected residue mass (g)} = \left[\frac{\text{Residue wt}}{400 \text{ mls}} \times \text{Total NaOH volume (mls)}\right] - \left[\frac{.001425\text{g}}{400 \text{ mls}} \times \text{Total NaOH volume (mls)}\right]$$

Four blanks were analyzed: the chloroform-ether solvent, an extraction of a 400 ml aliquot of the 0.1 N NaOH used in the impingers and two impinger blanks (inlet and outlet) (see Section I.2.2 for fraction results). The blank results indicated the analytical variability of the analysis was larger than actual differences between the different blanks. For this reason an average blank of 1.425 mg/400 mls was used to correct the residue mass.

I.3.4.2 cont'd

The corrected trichloroethane residue mass is added to the corrected residue weight from the chloroform-ether extraction of the NaOH to give a total condensed hydrocarbon weight. The calculations for mg/dscm or gr/dscf are given below:

$$\frac{\text{mg}}{\text{dscm}} = \frac{\text{Total residue mass (g)}}{\text{dscm sampled}} \times \frac{1000\ \text{mg}}{\text{g}}$$

$$\frac{\text{gr}}{\text{dscf}} = \frac{\text{Total residue mass (g)}}{\text{dscf sampled}} \times \frac{15.43\ \text{gr}}{\text{g}}$$

# APPENDIX I.4

## PROCESS MONITORING AND SAMPLING QUALITY ASSURANCE PROCEDURES

INCLUDES

I.4.1 Equipment Preparation
I.4.2 Sampling and Analytical Preparation
I.4.3 Sample Analysis
I.4.4 Data Reduction

### I.4.1 EQUIPMENT PREPARATION

The Magnehelic® gauge used to measure the pressure drop across the venturi scrubber was calibrated prior to use using an incline manometer (for calibration certification, see Section I.3.1.2.2). Two water knockouts were placed in line between the Magnehelic® gauge and the venturi. This removed any moisture which otherwise might have gotten into the Magnehelic gauge and lead to faulty readings.

The percent moisture determinations were made using a Mettler PC 4400 top loader balance. The balance was calibrated prior to use with a set of class P weights. Samples for percent moisture determinations typically ranged from 400-600 grams. The results of that calibration follow:

| Actual wt (g) | Balance Reading (g) | % Deviation Diff/Actual x 100 |
|---|---|---|
| 5.00 | 5.00 | 0 |
| 25.00 | 25.01 | 0.04 |
| 50.00 | 50.00 | 0 |
| 100.00 | 100.02 | 0.02 |
| 200.00 | 199.99 | -0.005 |
| 250.00 | 249.99 | -0.004 |
| 500.0 | 499.9 | -0.02 |
| 750.0 | 749.9 | -0.01 |
| 1000.0 | 999.9 | -0.01 |

The Signet Flosensor was used without any additional postfactory calibration or preparation. However, the flosensor was calibrated after the testing was complete (see Section H.6 for calibration information).

MRI personnel recorded periodic water flow measurements and venturi pressure drop measurements.

### I.4.2 SAMPLING AND ANALYTICAL PREPARATION

Sampling of the virgin aggregate and recycle asphalt pavement presented somewhat of a problem getting a representative sample. To get as representative a sample as possible as approximate 10 pound grab sample was taken and repeatedly riffled to obtain the final 500 g sample used for moisture analysis.

### I.4.3 SAMPLE ANALYSIS

A laboratory oven was used to determine the percent moisture of the virgin aggregate and recycle asphalt payment. The oven was closely controlled to 105°C and monitored using a dial thermometer. This close temperature controlling 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.4.4 DATA REDUCTION

The percent moisture is defined as weight of water per weight of sample. To calculate percent moisture the weight loss after drying (the water fraction) is divided by the sample size and multiplied by 100.

$$\% \text{ moisture} = \frac{\text{weight loss from drying (g)}}{\text{sample weight wet (g)}} \times 100$$

These values were tabulated for data presentation.

# APPENDIX J

## SAMPLING AND ANALYTICAL EQUIPMENT AND PROCEDURES

INCLUDES

J.1 Summary of Standard Sampling Equipment and EPA Reference Methods
J.2 Modified EPA Reference Method 5E Equipment and Procedures
J.3 Particle Size Distribution Equipment and Procedures
J.4 Polynuclear Aromatic Hydrocarbon Equipment and Procedures
J.5 Venturi Scrubber Solution Measurements
J.6 Process Solids Sampling and Analysis

APPENDIX J.1

SUMMARY OF STANDARD SAMPLING
EQUIPMENT AND EPA REFERENCE METHODS

INCLUDES

J.1.1 EPA Reference Methods 1,2,3,4, 5E, and 9
J.1.2 Changes and/or Modifications to EPA Methods during the Test Program

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:

$$R = C_s \times Q_{std} \times \frac{6 \times 10^{-5}\ \text{min-kg}}{\text{h-mg}}$$

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:

$$E = \frac{R}{P_{ave}}$$

where:

E = mass emission level (kg/Mg),

R = mass emission rate (kg/h),

$P_{ave}$ = 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:

Corrected peak height = A − B  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.*

$$m_c = (0.001)(C_t)(V_s) \qquad \text{Eq. 5E-2}$$

Where:

0.001 = Liters per milliliter.

$m_c$ = Mass of condensed particulate material collected in the impingers measured as TOC, mg.

$C_t$ = 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.*

$$C_s = C_a + C_c \qquad \text{Eq. 5E-4}$$

Where:

$C_s$ = Total particulate concentration, dry basis, corrected to standard conditions, g/dscm.

$C_a$ = Concentration of filtered particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm, from Equation 5-8 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.

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BILLING CODE 6560-50-M

J.1.2 Changes and/or Modifications to EPA Methods during the Test Program

- EPA Method 1 - The uncontrolled emissions sampling location did not meet the minimum requirements set forth in EPA Method 1. Alterations to the inlet sampling location was not feasible. A total of 16 sampling points were used to characterize the uncontrolled emissions. A greater number of sampling points was not feasible because of the high particulate concentrations. The gas flow rate determined at the venturi inlet compared favorably with the outlet gas flow rate. This comparison leads credibility to the selection of sampling points on the venturi inlet.

- EPA Method 2 and 3 - No major changes were made to these referenced methods.

- EPA Method 4 - Moisture determinations were performed simultaneously with the collection of particulate and TOC during EPA Method 5E.

- EPA Method 9 - Visible emission readings were only measured during a blue sky background. This modification was performed to minimize interferences that can occur when reading a condensed hydrocarbon plume with a grey background.

- EPA Method 5E - Several modifications were made to the procedure. Acetone and trichloroethane probe and nozzle rinses were used instead of water and acetone. Backhalf glassware was rinsed with trichloroethane and the impinger catches were extracted with chloroform/ether to determine total extracted condensible hydrocarbons in addition to TOC analysis. Inorganic carbon was stripped from the samples prior to total organic carbon analysis.

APPENDIX J.2

MODIFIED EPA REFERENCE METHOD 5E
EQUIPMENT AND PROCEDURES

INCLUDES

J.2.1 Modified EPA Method 5E Equipment Selection and Preparation
J.2.2 EPA Method 5E Modified Sampling Procedure
J.2.3 Modified Sample Recovery Procedures
- J.2.3.1 Particulate Mass
- J.2.3.2 Extracted Condensible Hydrocarbons
- J.2.3.3 Total Organic Carbon
- J.2.3.4 Trace Metals

J.2.4 Modified Sample Analysis Procedures
- J.2.4.1 Particulate
- J.2.4.2 Extracted Condensible Hydrocarbons
- J.2.4.3 Total Organic Carbon
- J.2.4.4 Trace Metals

### J.2.1 Modified EPA Method 5E Equipment Selection and Preparation

A modified version of the sampling procedure specified in EPA Method 5E was used to determine the particulate mass grain loading at the venturi scrubber inlet and outlet. Modifications to the EPA Method 5E equipment consisted of:

- installing a variable transformer to control the probe temperature at 250°F ± 25°F,
- installing a proportional temperature controller to maintain the temperature of the gas stream downstream of the filter holder at 250°F ± 5°F (controlled accuracy ± 1% of full range - 400°F),
- installing additional impingers during trace metal sampling, and
- incorporating a standard Greenburg-Smith impinger in the first impinger position.

The remainder of the sampling equipment is the same as that specified in EPA Method 5E.

### J.2.2 EPA Method 5E Modified Sampling Procedure

Modifications to the EPA Method 5E sampling procedure consisted of using Ultrex nitric acid (10%) in impingers to collect trace metal samples.

### J.2.3 Modified Sample Recovery Procedures

#### J.2.3.1 Particulate Mass

After sampling was complete, the sampling train was disassembled and the ends capped to prevent contamination of the sample. The probe and nozzle were brushed and rinsed three times with acetone and the rinse collected in a pre-weighed glass bottle. The probe and nozzle were then brushed and rinsed with trichloroethane and the rinse collected in a separate glass bottle. All of the glassware upstream of the filter was washed three times with acetone followed by a final trichloroethane rinse. The acetone and trichloroethane glassware rinses were added to the respective probe wash solvent storage containers. The filter was carefully removed from the filter holder with

tweezers, placed in a labeled petri dish and then sealed for transport back to Austin for weighing.

J.2.3.2 Extracted Condensible Hydrocarbons

During EPA Method 5E sampling, hydrocarbons present in the flue gas condensed on the surface of the cooled glassware downstream of the filter holder and in the first two impingers. The first two impingers contained 250 ml of 0.1 N NaOH to help facilitate the collection of condensible hydrocarbons. After sampling, the contents of the first two impingers were combined and stored in a glass bottle with a teflon lid insert. The two impingers were then rinsed with 0.1 N NaOH and the rinse was added to the glass sample storage bottle.

The glassware downstream of filter holder "back half," plus the first two impingers were then rinsed with a known volume of trichloroethane to recover any hydrocarbons condensed on the glassware. The trichloroethane rinse was stored in a separate glass bottle with a teflon lid insert.

J.2.3.3 Total Organic Carbon

Flue gas samples for total organic carbon analysis were collected in the 0.1 N NaOH impingers used during Proposed EPA Reference Method 5E sampling. Sample recovery is the same as described in Section J.2.3.2.

J.2.3.4 Trace Metals

During trace metal sample collection, an impinger containing 250 ml of 10% Ultrex nitric acid was placed downstream of the two NaOH impingers in the EPA Method 5E sampling train. Upon completion of sampling, the filter and NaOH impinger samples were recovered using the procedure described in Section J.2.3.1 and J.2.3.2. The 10% $HNO_3$ impinger solution was recovered by first placing the impinger solution in a 500 ml Nalgene bottle. The $HNO_3$ impinger was then rinsed with a small quantity of 10% Ultrex $HNO_3$ and the rinse added to the Nalgene sample bottle.

### J.2.4 Modified Sample Analysis Procedures

#### J.2.4.1 Particulate Mass

The EPA Method 5E particulate mass sample consisted of the filter, the acetone front-half rinse, and the trichloroethane front-half rinse. Filter analysis consisted of dessicating the filter for 24 hours and then weighing to a constant weight.

The acetone and trichloroethane 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. When the samples were dry they were dessicated for 24 hours and then weighted to a constant weight.

#### J.2.4.2 Extracted Condensible Hydrocarbons

The extracted condensible hydrocarbon sample consisted of the "back half" trichloroethane rinse and the 0.1 N NaOH impinger sample described in Section J.2.3.2.

Analysis of the trichloroethane "back half" rinse consisted of several steps. First, the volume of each rinse sample was determined gravimetrically. Each rinse sample was then transferred to clean and preweighed beakers. The rinse samples were then allowed to evaporate to dryness at room temperature. The beakers were then dessicated for 24 hours and then weighed to a constant weight. A constant weight is defined as two weighings that agree within 0.5 mg or 1 percent of the residue mass.

Each trichloroethane rinse sample was corrected for the solvent blank. The actual magnitude of the solvent blank correction was dependent upon the volume of trichloroethane present in each sample. To determine the magnitude of the trichloroethane blank, a known volume of unused trichloroethane solvent was evaporated using the above procedure. The mg of residue remaining after evaporation was then correlated to the volume of trichloroethane to generate a blank correction factor (mg of blank residue/volume of trichloroethane in the sample).

The condensible hydrocarbon content of the NaOH impinger sample was determined using the following procedure. First, the pH of a 400 ml sample

aliquot was adjusted to pH 7. The sample aliquot was then extracted using 3 portions of a 3:1 ether/chloroform solvent mixture. The solvent extract was then transferred to a clean preweighed beaker. The sample was then allowed to evaporate to dryness at room temperature. After 24 hours of dessication the sample was weighed to a constant weight. The total sample residue was then determined by multiplying by the ratio of total sample volume divided by the sample aliquote volume. An ether/chloroform solvent residue blank was determined and then used to adjust each NaOH impinger sample.

The extracted condensible hydrocarbon sample consisted of the trichloroethane residue plus the sodium hydroxide extracted residue.

### J.2.4.3 Total Organic Carbon (TOC)

The TOC content of the EPA Method 5E sodium hydroxide impinger solution was determined instrumentally during this program. A 20 ml aliquot of the NaOH impinger solution was acidified with $H_2SO_4$ and then sparged with nitrogen gas to remove any inorganic carbon. This procedure differed from the Proposed EPA Reference Method 5E in that Method 5E specifies analyzing the inorganic carbon and subtracting that value from the total carbon to give total organic carbon.

The sample was then analyzed using a Beckman 915B Total Carbon Analyzer. The TOC concentration of the sample was determined by comparing the sample results with the results of standards prepared using potassium hydrogen phthalate. Blank TOC corrections were not required because of insignificant TOC blank values.

### J.2.4.4 Trace Metals

Trace metal samples collected using the EPA Method 5E sampling train were analyzed using Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES). The technique combines the multielemental capacity of emission spectroscopy with a radio-frequency generated argon plasma source.

Prior to analysis, the solids collected in the sampling system were digested in an acidic solution containing $H_2SO_4$, $HNO_3$, and $H_2O_2$. The resulting digestion solution was diluted to a known volume. The NaOH and $HNO_3$ impinger solutions required no special preparation prior to analysis.

An ARL Model 34000B ICAPES was used to analyze the trace metal samples. The aqueous sample was aspirated into the argon plasma, which may reach temperatures of 10,000°K. The emission is focused onto a grating which diffracts the light according to the Pashen Runge theory. The diffracted light bands pass through slits set up for each element of interest. A photomultiplier tube was used to measure the signal passing through each slit.

The system is computer controlled to allow for simultaneous multielement determinations. This is accomplished by means of comparing the electrical charge of each photomultiplier tube during sample analysis, to the electrical charge generated during standardization.

APPENDIX J.3

PARTICLE SIZE DISTRIBUTION EQUIPMENT AND PROCEDURES

INCLUDES

J.3.1 Particle Size Distribution Equipment Selection
J.3.1.1 Andersen High Capacity Stack Sampler
J.3.1.2 Andersen Mark III Cascade Impactor
J.3.2 Sampling
J.3.3 Sample Recovery
J.3.3.1 Andersen High Capacity Stack Sampler
J.3.3.2 Andersen Mark III Cascade Impactor
J.3.4 Sample Analysis
J.3.5 Data Reduction

## J.3 Particle Sizing Equipment

### J.3.1 Equipment Selection

#### J.3.1.1 Andersen High Capacity Stack Sampler

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 grainloading 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.1) 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 in soap and water and then 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. Figure J-1 graphically depicts the AHCSS sampling train.

#### J.3.1.2 Andersen Mark III Cascade Impactor

The particle size distribution at the scrubber outlet was unsuccessfully attempted using an Andersen Mark III Cascade Impactor. The impactor acrodynamically classifies aerosols into nine size fractions. Glass fiber impactor substrates were used to facilitate the collection of the particulate. The substrates were pretreated by baking them at 500°F for four hours. The substrates were then dessicated and weighed to the nearest 0.01 milligram. Preweighed sets of substrates were stored in polyethylene petri dishes until they were used.

A right-angle probe and straight-neck isokinetic sampling nozzle was used to properly orientate the Mark III impactor into the gas stream. Due to the high moisture content at the outlet flue gas an auxiliary heating system (heating tape and insulation) was necessary to elevate the operating

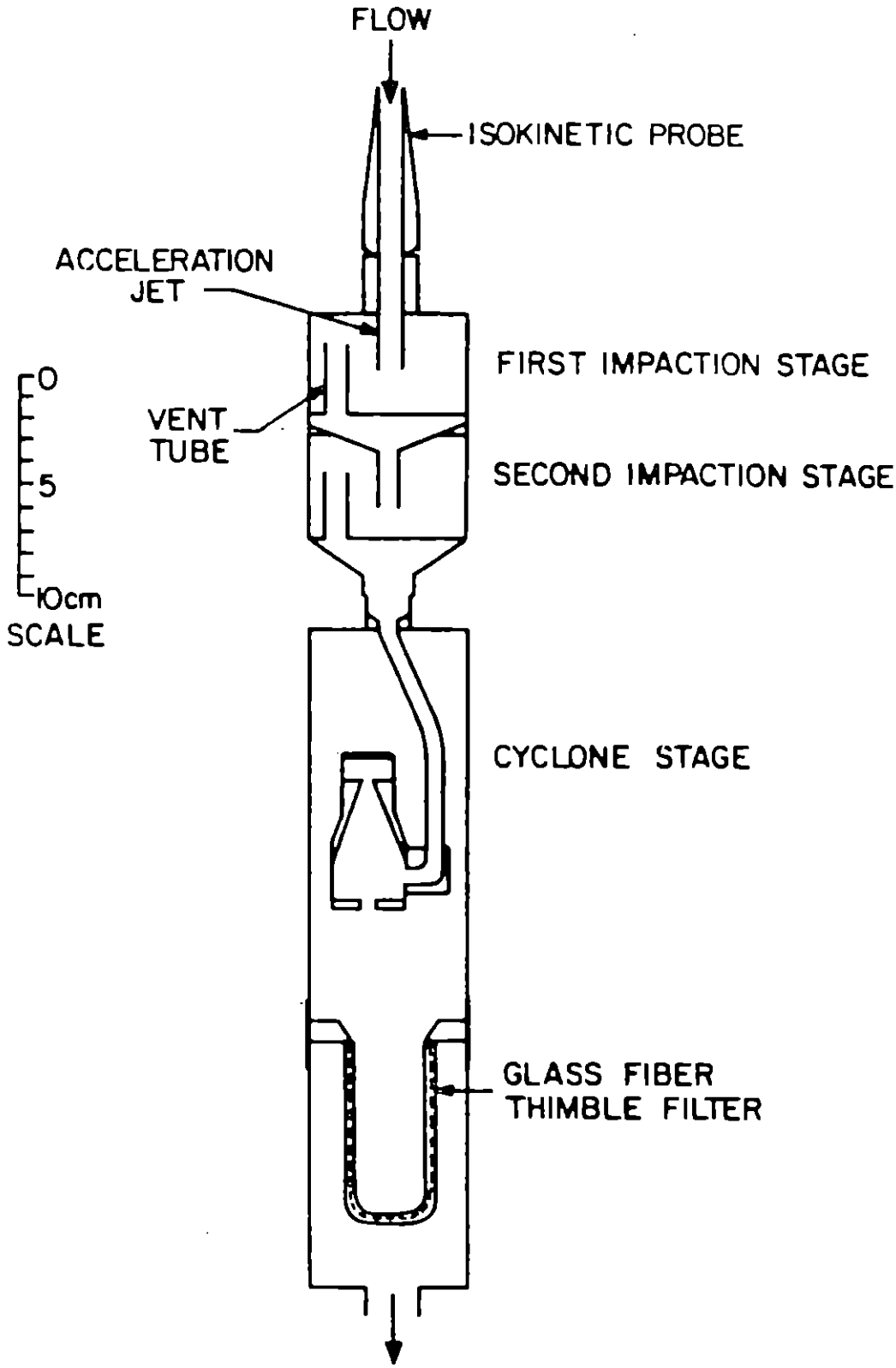


Figure J.1. Schematic of the Andersen Model HCSS High Grain-Loading Impactor

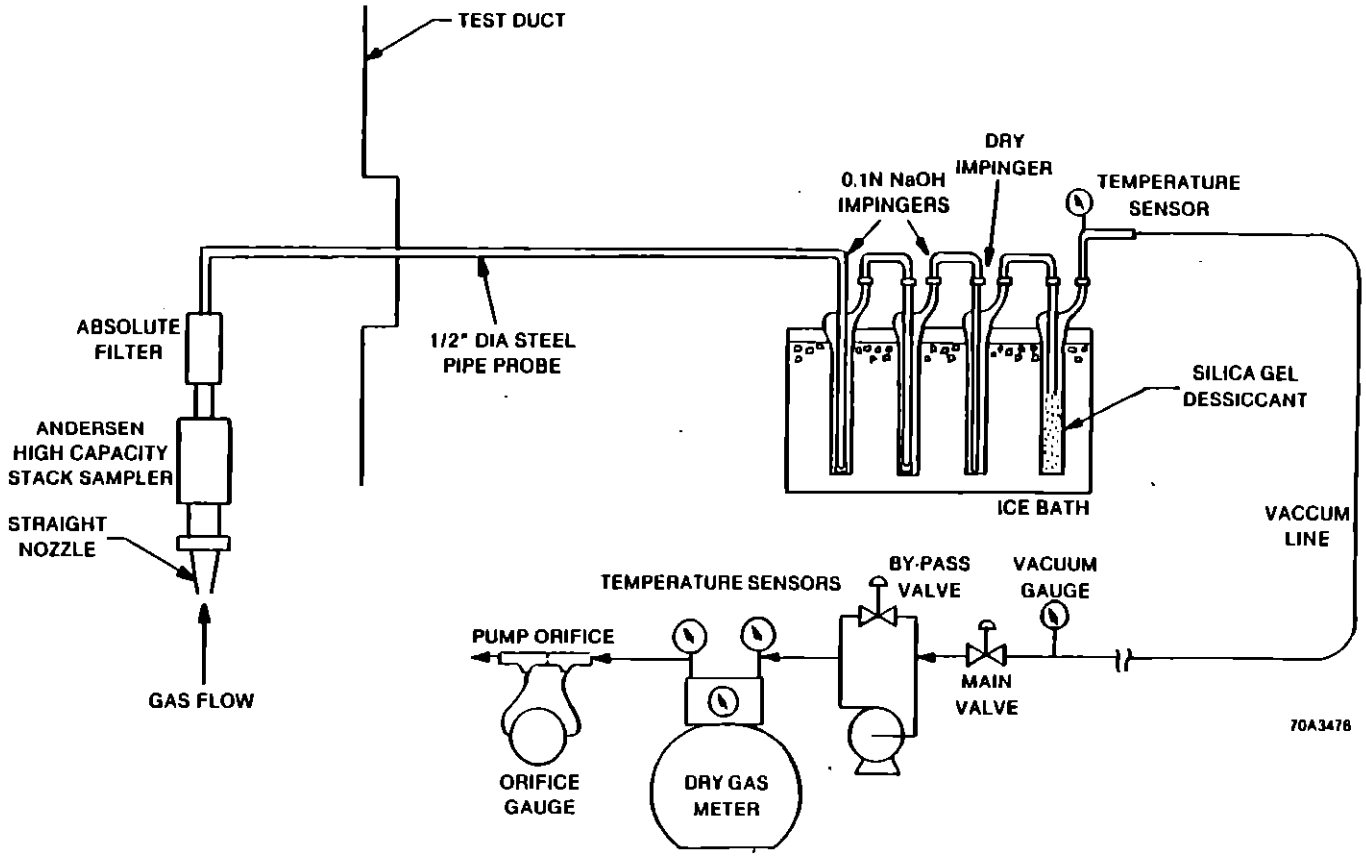


Figure J-2. In-stack Andersen high capacity sampling train used to determine the particle size distribution at the scrubber inlet.

temperature of the impactor to vaporize moisture in the sample gas and to prevent moisture condensation in the sampler. To provide additional residence time to evaporate moisture, a heated 6-inch run of 0.5 inch I.D. pipe was used between the nozzle and the impactor. A thermocouple mounted in the gas stream directly behind the impactor was used to monitor the impactor gas temperature. Figure J-3 depicts the Andersen Mark III impactor sampling train.

### J.3.2 Sampling

Particle size distribution sampling was performed at a single point of average velocity in the flue gas stream at both the venturi inlet and outlet location. This sampling point was selected from previous velocity traverse data. Isokinetic sampling flow rates at the impactor nozzle were precalculated based on velocity data obtained during earlier sampling (modified EPA Method 5E). Operation of both the AHCSS and Andersen Mark III 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 at the inlet, 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.

Special sampling problems were encountered at the venturi outlet due to the high moisture content and entrained water droplets present in the gas stream. An attempt was made to eliminate the excess moisture problem by preheating the sample gas and evaporating the water droplets prior to entering the Andersen Impactor. To help accomplish this, the sampling nozzle and impactor extension tube were heat traced and insulated. The heat traced impactor was then heated for one hour prior to insertion into the sample gas stream.

During sampling, the heat traced Andersen impactor was unable to maintain the flue gas above the moisture due point temperature. As a result, the impactor substrates became wet during sampling and a particle size distribution sample could not be successfully obtained at the venturi scrubber outlet.

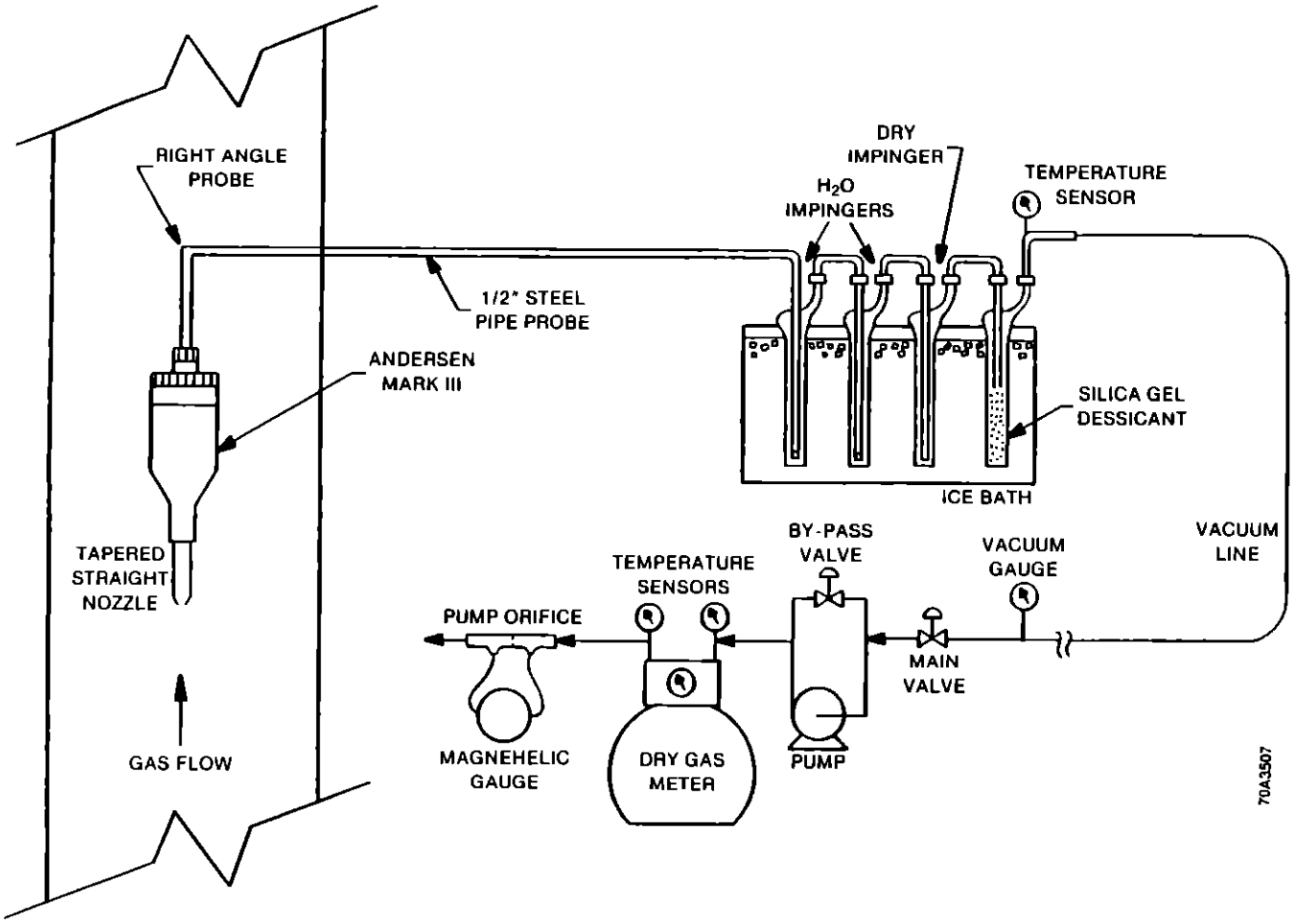


Figure J-3. In-stack Andersen Mark III Cascade impactor sampling train used to determine the particle size distribution at the venturi scrubber outlet.

### J.3.3 Sample Recovery

#### J.3.3.1 Andersen High Capacity Stack Sampler

After sampling the AHCSS was brought back to the lab and allowed to cool. Each stage was carefully removed, one at a time, and the particulate brushed into a tared petri dish. The backup absolute thimble was removed and placed in a glass jar and kept upright. The petri dishes and thimble were stored in a dessicator for shipment back to Austin.

#### J.3.3.2 Andersen Mark III Cascade Impactor

The Andersen Mark III impactor was brought back to the lab and dried in an oven overnight at 250°F. When cool the nozzle, extension tube, and impactor top were rinsed with acetone to remove any particulate adhering to the walls. The substrates were then recovered taking care to remove any filter or particulate adhering to the stage, crosshair or spacer and returning it to its original petri dish. The dishes were sealed and packed for shipment back to Austin.

### J.3.4 Sample Analysis

Upon returning to the Radian laboratories in Austin, the AHCSS and the Andersen Mark III impactor samples were dessicated for a minimum of 24 hours and then weighed to a constant weight. A majority of the Andersen Mark III impactor substrates experienced a negative weight gain. The weight loss can be attributed to the high moisture content and subsequent loss of substrate material during sample recovery.

### J.3.5 Data Reduction

A detailed discussion of the data reduction procedure used to interpret the AHCSS data is presented in Appendix B.4.

APPENDIX J.4

POLYNUCLEAR AROMATIC HYDROCARBON (PAH)
EQUIPMENT AND PROCEDURES

INCLUDES

J.4.1 PAH Equipment Selection and Preparation
J.4.1.1 Sampling Train Components
J.4.1.2 Preparation for Sampling
J.4.1.3 Sample Container Preparation
J.4.2 PAH Sampling Procedure
J.4.3 PAH Sample Recovery and Analysis Preparation
J.4.3.1 Sample Recovery
J.4.3.2 Preparation for Analysis
J.4.4 PAH Sample Analysis
J.4.5 PAH Data Reduction

## J.4 Polynuclear Aromatic Hydrocarbon Equipment and Procedures

### J.4.1 Equipment Selection and Preparation

#### J.4.1.1 Sampling Train Components

Figure J.4 graphically illustrates the sampling train used to collect flue gas for polynuclear aromatic hydrocarbon (PAH) analysis. The PAH sampling train is similar to the EPA Method 5E sampling train described in Section J.2.1. The major difference between the two sampling trains is the impinger configuration.

The PAH impinger train consists of a dry impinger for cooling the gas before entering a glass cannister containing XAD-2 resin for PAH absorption. Following the XAD-2 resin cannister is a second dry impinger used to collect any condensate forming downstream of the XAD-2 resin. An in-line thermocouple was used to help monitor the gas stream temperature as it entered the XAD-2 cannister. Aluminum foil was wrapped around all the glassware in the hot box, the two dry impingers and the XAD-2 resin cannister. This was done to help minimize any possible PAH photodegradation that might otherwise occur during sampling.

#### J.4.1.2 Preparation for Sampling

Prior to sampling, the EPA Method 5E filters used during PAH sample collection were extracted with methylene chloride, baked at 500°F for two hours, and then dessicated and weighed. The filters were stored in glass petri dishes that were previously rinsed with methylene chloride.

The XAD-2 resin was prepared for use by extracting the resin in a soxlet extractor using three solvents. Methanol, ether, and pyridine were individually used to extract the XAD-2 resin for 24 hours. Following extraction, the resin was stored in methanol until ready for use.

#### J.4.1.3 Sample Containers Preparation

All of the sample containers used to store PAH samples were prepared for use by means of rinsing with methylene chloride.

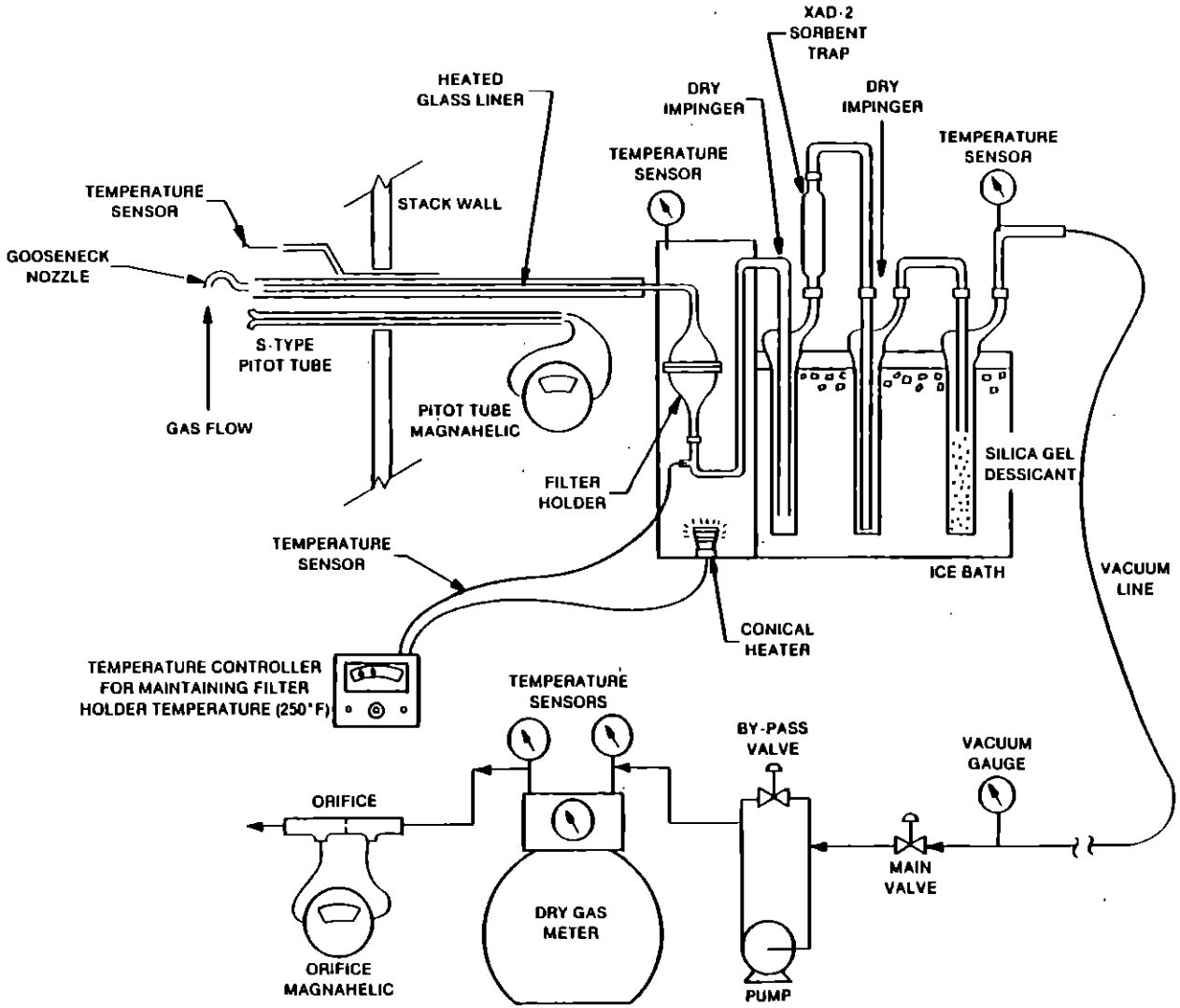


Figure J.4. Sampling train designed to collect polynuclear aromatic hydrocarbon samples at the scrubber inlet and outlet.

### J.4.2 Sampling Procedure

The sampling procedure used to collect PAH samples is similar to the procedure used to collect EPA Method 5E samples (described in Section J.2).

### J.4.3 Sample Recovery and Analysis Preparation

#### J.4.3.1 Sample Recovery

When sampling had been completed, the PAH sampling train was returned to the mobile laboratory for sample recovery. The recovery of each sampling train produced five distinct samples. They were:

- the methylene chloride nozzle and probe liner rinse,
- the filter,
- the combined condensate trapped in the first impinger and the methylene chloride rinse of all glassware between the filter and the XAD-2 resin canister,
- the XAD-2 resin, and
- the methylene chloride rinse of the glassware downstream of the XAD-2 resin canister and prior to the silica gel impinger.

Particulate matter collected during the PAH inlet scrubber sample on 11-14-83 could not be retrieved using methylene chloride. For this sample, a final acetone wash was used to recover the particulate matter. The XAD-2 resin was washed from the resin canister into a pint Ball® jar using methylene chloride and sealed with a teflon lined lid. The filter was carefully removed from the filter holder and placed in its original labeled glass petri dish. The Ball jar and petri dish were individually wrapped with aluminum foil for transport back to Radian's Austin laboratories. The glassware and probe rinses were washed into clean amber glass bottles for storage and sealed with teflon lined caps. During sample recovery, incandescent lighting was used to minimize sample exposure to ultraviolet light which photodegrades benzo(a)pyrene.

J.4.3.2 Preparation for Analysis

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,
- the 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 were:

- the front-half (nozzle rinse, probe rinse, and filter catch), and
- the XAD-2 resin.

The methylene chloride rinses associated with the solid sample fractions were included in the soxhlet extractions.

In addition to the above sample fractions, the sample collected at the venturi scrubber inlet on 11-14-83 included an acetone probe and nozzle rinse. The solids were filtered andthe acetone filtrate was concentrated to approximately one milliliter and added along with the filtered solids to the methylene chloride nozzle and probe rinse soxhlet extraction.

The aqueous and non-aqueous solvent phases of the liquid samples were separated using a superatory funnel. The methylene chloride fraction was then dried using anhydrous sodium sulfate. The liquid samples included:

- the stack condensate and methylene chloride rinse of the glassware downstream of the filter and upstream of the XAD-2 resin canister, and

- the methylene chloride rinse of the glassware downstream of the XAD-2 resin canister and prior to the silica gel impinger.

The resulting methylene chloride sample fraction was retained for PAH analysis.

Prior to sample extraction, samples were isotopically labeled using benzo(a)pyrene-$d_{12}$ to serve as a QC recovery check compound.

All extracts were concentrated to one milliliter by means of a Kuderna-Danish evaporation apparatus.

J.4.4 PAH Sample Analysis

The sample concentrates described in J.4.3.2 above 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 J-1. 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 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 corresponding to the molecular weight of the compound ($M^+$); 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-2 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.

TABLE J-1. GC-MS CONDITIONS FOR EXTRACTABLES

| | |
|---|---|
| Instrument | Hewlett Packard 5985A |
| Ionization voltage | 70eV |
| Column | SE54 fused silica capillary |
| $H_2$ flow rate | 30 cm/sec |
| Initial temp | 25° |
| Initional 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 J-2. POLYNUCLEAR AROMATIC HYDROCARBONS DETERMINED BY GC-MS

Phenanthrenes (178)

- Phenanthrene
- Anthracenes

Pyrenes (202)

- Pyrene
- Fluoranthene

Chrysenes (278)

- Chrysene
- Benz(a)anthracene
- Triphenylene

Benzopyrenes (252)

- Benzo(a)pyrene
- Benzo(e)pyrene
- Perylene
- Benzo(b)fluoranthene
- Benzo(j)fluoranthene
- Benzo(k)fluoranthene

Benzoperylenes (276)

- Benzo(g,h,i)perylene
- Indeno(1,2,3-c,d)pyrene

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

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.4.5 Data Reduction

A description of the PAH data reduction procedure is presented in Appendix B.

APPENDIX J.5

VENTURI SCRUBBER WATER MEASUREMENTS

INCLUDES

J.5.1 Sample Collection
J.5.2 Sample Recovery Procedures
J.5.3 Sample Analysis
- J.5.3.1 Temperature and pH
- J.5.3.2 Total Organic Carbon
- J.5.3.3 Trace Metal Analysis
- J.5.3.4 Polynuclear Aromatic Hydrocarbon (PAH) Analysis
- J.5.3.5 Total Solids

J.5.4 Data Reduction
J.5.5 Flow Rate Measurements

## J.5 Venturi Scrubber Water Measurements

### J.5.1 Sample Collection

Process water samples collected during the field testing program include:

- scrubber water to the venturi scrubber, and
- scrubber water from the venturi scrubber.

A sample of the process water pumped to the venturi scrubber was collected at the floating intake pump. The venturi scrubber return water sample was collected at the bottom of the venturi as the water was gravity fed to the settling pond. The samples were collected in amber glass bottles with teflon lid inserts.

Three sets of process water samples were collected during each sampling period, whenever possible. Process upsets frequented the collection of three samples during several sampling periods.

### J.5.2 Sample Recovery Procedures

During each sampling run at least two venturi scrubber influent and effluent water samples were collected. The grab samples collected during each sampling run were composited and filtered to determine total suspended solids. This combined filtrate was used for all subsequent analyses.

### J.5.3 Sample Analysis

#### J.5.3.1 Temperature and pH

A Type-K thermocouple and digital readout was used to measure the temperature of each scrubber sample. An Orion digital hand-held portable pH meter with temperature compensator was used to measure the pH of each scrubber water sample. Before each pH measurement the meter was standardized with a pH 7 and pH 10 buffer.

#### J.5.3.2 Total Organic Carbon

A detailed description of the TOC analysis procedure is presented in Section J.2.4.3.

J.5.3.3 Trace Metals Analysis

A detailed description of the trace metals analysis procedure is presented in Section J.2.4.4.

J.5.3.4 Polynuclear Aromatic Hydrocarbon (PAH) Analysis

A 400 ml aliquot of the filtered scrubber water was used for PAH analysis. The aliquot was spiked with 40 µl of a 1000 ppm benzo(a)pyrene-$d_{12}$ spiking solution. Using a separatory funnel, the aliquot was extracted three times with 50 ml portions of $MeCl_2$. The extract was then filtered to remove any remaining water. The filter flask was then rinsed with another 50 ml portion of $MeCL_2$. The sample was concentrated to one ml and analyzed by GC-MS as outlined in Section J.4.4.

J.5.3.5 Total Solids

The suspended and dissolved solids content of each scrubber water sample was determined on-site using the composite sample. 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 50°C, dessicated, and weighted to determine residue weight.

J.5.4 Data Reduction

A description of the data reduction procedures used to reduce the venturi scrubber process water data is presented in Appendix B.

J.5.5 Flow Rate Measurements

The total flow rate of water to the venturi and to the venturi throat was monitored using Signet Scientific Paddle-wheel flosensors. The flosenors

were installed in vertical sections of pipe on the discharge side of the pump. Installation of the sensors in this manner was necessary to ensure that the flow of water covered the entire cross-sectional area of the pipes for an accurate measure of flow rate which is based upon stream velocity. The flosensors were coupled with analog read-out devices which included flow accumulators. Flow rate data was recorded routinely during each particulate and condensible hydrocarbons loading, trace metals, and polynuclear aromatic run.

APPENDIX J.6

VIRGIN AGGREGATE AND RECYCLED ASPHALT PAVEMENT (RAP) MOISTURE DETERMINATIONS

INCLUDES

J.6.1 Sample Collection
J.6.2 Sample Preparation and Analysis
J.6.3 Data Reduction

## J.6 Virgin Aggregate and Recycled Asphalt Pavement (RAP) Moisture Determinations

### J.6.1 Sample Collection

Grab samples of the virgin aggregate and recycled asphalt pavement were collected for analysis during each sampling period. The virgin aggregate was collected as the aggregate dropped onto the feed conveyor belt. Samples of the recycle asphalt pavement were collected from the conveyor belt leading to the rotary drum mixer. Two gallon buckets were used to collect the solid samples. Samples were collected for analysis during each particulate, trace metal, and polynuclear aromatic hydrocarbon run.

### J.6.2 Sample Preparation and Analysis

Each virgin aggregate and recycled asphalt pavement sample was prepared for analysis by riffling. Riffling reduced the sample size from about 10 pounds to about 500 grams.

The 500 gram samples were then transferred to a preweighed aluminum pan. The sample and pan were then weighed to the nearest 0.1 grams. The sample was then dried at 105°C for 24 hours. The sample was reweighed and the differences determined.

### J.6.3 Data Reduction

The moisture content of the samples was calculated using the following equation:

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

where:

$M_s$ = 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 K

# PROJECT PARTICIPANTS

## APPENDIX K

## PROJECT PARTICIPANTS

INCLUDES

T. J. Campbell Co. Personnel
1. Ted Campbell - President
2. O'Flynn Sewell - Plant Manager
3. David Kuzmic - Plant Operator

Midwest Research Institute Personnel
1. William Terry - Project Monitor

Radian Personnel
1. Michael R. Fuchs - Project Director, Reporting
2. Eric P. Anderson - Gas Sampling Team Leader, Lab Analysis, Data Reduction, Reporting
3. Michael J. Krall - Gas Sampling Team Leader
4. Tim W. Trofe - Gas Sampler
5. Vince L. Lara - Gas Sampler
6. C. Barry Chapman - Cleanup/Lab, Lab Analysis
7. Carl S. Galloway - Solids and Liquids Sampler
8. Lee Garcia - Visual Determinations of Opacity
9. Larry A. Rohlack - Reporting
10. Ann E. Behl - Reporting

CMI Corporation Personnel
1. Louren Shave - Senior Engineer
2. Don Ratajczak - Senior Field Engineer

Environmental Protection Agency Personnel

Emission Measurement Branch
1. Peter Westlin - Technical Support
2. Clyde E. Riley - Task Manager

Industrial Studies Branch
1. Michael Clower - Assistant Project Lead Engineer
2. Jeffrey Telander - Project Lead Engineer

Standards Development Branch
1. Rick Colyer - SDB Project Engineer

APPENDIX L

PERTINENT CORRESPONDENCE

INCLUDES

L.1 Re: Site Visit Report for T. J. Campbell Co., 20 October 1983 - To: Mr. Clyde E. Riley, EPA

L.2 Re: Letter of Site Specific Plant Change Recommendations, 21 October 1983 - To: Mr. Ted Campbell, T. J. Campbell Construction Company

L.3 Re: Sampling Performed at the T. J. Campbell Asphalt Plant, 28 November 1983 - To: Mr. Clyde E. Riley, EPA

L.4 Re: Preparation of TOC Quality Control Samples for Proficiency Testing, 1 December 1983 - To: Mr. Clyde E. Riley, EPA

L.5 Re: Presentation of Analytical Matrices for T. J. Campbell Sample Analysis, 5 December 1983 - To: Mr. Clyde E. Riley, EPA

L.6 Re: Preliminary Data From the T. J. Campbell Asphalt Plant, 8 December 1983 - To: Mr. Clyde E. Riley, EPA

L.7 Re: Calibration Verification of Signet Flosensor, 29 December 1983 - To: Mr. Clyde E. Riley, EPA

APPENDIX L.1

20 October 1983 222-078-03-02

Mr. Clyde E. Riley
U.S. Environmental Protection Agency
ESED/EMB (MD-13)
Research Triangle Park, North Carolina 27711

Re: Site Visit Report for T. J. Campbell Co.
Contract No. 68-02-3850, Work Assignment 03
Method Development and Testing for Asphalt Concrete Plants

Dear Mr. Riley:

On October 12, Clyde Riley of the EPA and Michael Fuchs of Radian visited the T. J. Campbell Co. asphalt concrete plant in Oklahoma City, Oklahoma. The purpose of the visit was to assess the facility for adequacy and representativeness regarding sampling requirements for an impending field test at the plant. The purpose of the field test is to provide data to assist EPA in a review of the New Source Performance Standards (NSPS) for asphalt concrete plants. The emphasis of the project is to investigate plant emissions opacity during production with recycled asphalt pavement (RAP). The asphalt pavement industry requested a review of the NSPS because of purported higher hydrocarbon emissions during recycle operations which generate a "blue haze", resulting in higher plume opacity above the NSPS of 20%. Mr. Riley and Mr. Fuchs visited the Dover Equipment and Machine Company asphalt concrete plant on October 14. The site survey report for that facility will be submitted by 30 December 1983.

Midwest Research Institute (MRI) under contract to ESED as the NSS contractor has screened a considerable number of asphalt concrete plants. The T. J. Campbell plant was selected as a candidate site for field testing based upon plant operation (recycle), control equipment, and adequacy for sampling purposes. This report describes the facility with regard to the sampling requirements of this project.

The T. J. Campbell plant is a CMI Corp. drum-mix asphalt plant including a wet venturi for particulate control. The original plant was modified to allow utilization of RAP and has a rated production capacity of 350 tons per hour. The streams to be sampled are:

- Controlled air emissions,
- Uncontrolled air emissions,
- Water to venturi scrubber,
- Water from venturi scrubber,
- Pressure drop across venturi,
- Virgin aggregate,
- Recycled asphalt pavement, and
- Asphalt

A schematic of the T. J. Campbell plant and the parameters to be measured at each test location are identified in Figure 1. Figure 2 presents the sampling matrix which identifies the number of measurements for each parameter at each test location during each test series. At this time, three test series are proposed:

- conventional plant operation,
- ∿25-30% recycle operation with normal water flow rate to venturi, and
- ∿25-30% recycle operation with reduced water flow rate to venturi to produce the "blue haze."

Based upon the sampling matrix presented in Figure 2 and three test series, the estimated cost of testing activities at the T. J. Campbell plant is about $95,000 including about 2000 technical labor hours. Testing is presently planned for two weeks beginning November 7, 1983. Completion of the testing schedule will be very much dependent upon plant operations to provide 1) conventional and recycle production at a mix comparable to the testing schedule, and 2) 8 to 10 hours of production each day for the two-week period. Production is affected by sales (Mr. Campbell informed us that they have adequate sales to maintain production over the two-week period) and by the weather. Asphalt concrete cannot be laid during wet or cold (<45°F) weather.

Following are brief descriptions of the sampling locations and the adequacy and representativeness of each.

Controlled Air Emissions

The outlet stack is a rectangular duct 31 inches x 36 inches. At the base of the duct is the exhaust fan with a flow control damper just above the fan. Two sets of ports are in-place. About eight feet above the damper are three 3-inch ports, and about eight feet above those ports are six 3-inch ports. Loading and flow rate measurements will be taken at the six-port location; particle size distribution samples will be collected concurrently with particulate loading samples at the lower set of ports. According to EPA Method 1 protocol, twenty-four traverse points are necessary at the six-port location.

The six-port location is about 30 to 35 feet above ground level. Scaffolding will have to be erected to reach that level. Scaffolding will also be necessary to access the three-port location. It is anticipated the same scaffolding structure can be used for both locations.

One problem was identified with the controlled emissions sampling location. Water mist was present in the flue gases, and water was seen leaking from seams in the stack. Liquid water in the duct creates a difficult sampling

situation and may also serve as a method of control of hydrocarbon emissions. The facility had planned on installing a demister on the plant; indeed, the demister has been delivered to the plant. But CMI eliminated the water mist by adjusting the venturi throat; a manual, external adjustment. Mr. Louren Shave of CMI was contacted during the site visit and agreed to adjust the venturi throat to eliminate the water mist problem prior to the field tests beginning November 7.

Uncontrolled Air Emissions

Drum flue gases will also be sampled prior to the wet venturi scrubber. The duct work between the drum mixer and the venturi is complicated. The gases exit the drum into a duct which carries the gas upward about 10 to 12 feet. The gases then flow horizontally in a triangular duct. The triangular duct funnels the gas to a 90° downward bend into the venturi. The only practical location for sampling ports is in the triangular section of the duct.

Radian proposes to have four 3-inch ports mounted equidistantly across the width of the triangular duct, as shown in Figure 3; and one 6-inch port in the center of the side of the duct. The 3-inch ports will be used for flow rate, loading, and associated measurements. The 6-inch port will be used for particle size distribution sampling. The sampling location will not meet EPA Method 1 criteria but is the best possible application. It can be argued that additional ports will allow the collection of more representative samples; however, the number of traverse points which can be sampled will be controlled by the sample collection time which will be limited due to the high particulate loading.

It is difficult to assess the accuracy of test results which will be developed at the venturi inlet sampling location. However, a method which will be used to evaluate these results is a comparison of measured gas flow rates at the venturi inlet and in the stack. Flow rate, particulate loading, and particle size distribution data will be suspect. Gas phase data such as BaP and condensible hydrocarbons should be representative.

Gas streamlines in the venturi inlet duct are affected by the triangular duct, as shown in Figure 4. To obtain gas velocity measurements and to determine the proper alignment of the probe during particulate loading sampling, at each traverse point an S-type pitot will be inserted and rotated until a null reading is obtained. The position of the probe will be noted, and the proper alignment of the probe for measurements is then 90° from the null reading alignment.

The proposed location for installation of the sampling ports is about two feet upstream from water sprays in the triangular duct for cooling the flue gases prior to the venturi. These are co-current sprays according to information provided and should not interfere with sampling activities.

The ports which will be mounted across the top of the duct can be easily accessed. However, it will be necessary to install scaffolding to access the side entry 6-inch port.

Water to Venturi Scrubber

Samples of water being supplied to the venturi will be collected at the floating pump intake. The intake floats out in the pond and access to the intake is across a wooden plank. Samples will simply be scooped into a sample container. The temperature of the water will be monitored during sample collection.

The flow rate of water to the venturi will be monitored at two locations using paddle wheel-type sensors. Flosensors will be installed in the positive pressure main line to the venturi and in the line to the venturi throat. The sensors will be installed in vertical sections of pipe to ensure that the flow of water covers the entire cross-sectional area of the pipes which is necessary for an accurate measure of flow rate when based upon stream velocity. The flosensors will be coupled with analog read-out devices which include a flow accumulator.

Water from Venturi Scrubber

Venturi scrubber water drains into a collection box below the venturi. The water then drains back to the pond through 8-inch plastic pipe. Samples will be collected from the collection box below the scrubber. The temperature of the water will be monitored during sample collection.

It is not practical to collect samples of the water from the venturi which are representative of the suspended particulate loading. These data will be generated but should be critically reviewed.

Pressure Drop Across the Venturi

Holes have been "burned" into the scrubber duct work directly before and after the venturi. Mr. Campbell has agreed to weld 1/4-inch pipe couplings over the holes so that tight-sealing connections can be made. Hoses from each tap will be connected to a Magnehelic® differential pressure gauge. The venturi is reported to operate with a pressure drop of 12.5 to 18 inches of water gauge.

Virgin Aggregate and Recycled Asphalt Pavement

Samples of virgin aggregate and recycled asphalt pavement will be collected from conveyor belts which transport the materials from storage to the drum mixer.

Asphalt

After the site visit, asphalt was added to the sampling requirements of the test program although no analyses of the material have been specified. A sampling location for the asphalt being fed to the drum mixer has not been identified.

Electrical power for sampling equipment is available in the control room which is about 100 feet from the sampling locations. Radian will supply extension cords to provide electricity at the two gas sampling locations.

There is no space available on the plant site for sample train prep and sample recovery. Radian will deliver a mobile laboratory for these activities. The mobile lab can be parked near the maintenance building. At that location, the lab will not interfere with plant operations and 220V electrical power is available in the maintenance building.

There are modifications or additions to the plant which must be completed before the field effort can take place. Radian will provide the T. J. Campbell plant with the necessary information to perform the modifications or additions, which are:

- installation of ports at the venturi inlet for uncontrolled emissions sampling,
- installation of a flow meter on the inlet water line to the venturi,
- installation of pipe fittings over holes presently in-place at the venturi inlet and outlet for $\Delta P$ measurements,
- adjust the venturi to eliminate water mist in the emission gases, and
- direct the installation of scaffolding at the venturi inlet and stack sampling locations (Radian will order the scaffolding).

A Radian staff member will visit the plant several days prior to the projected start date of field testing to ensure the completion of the above tasks.

Sincerely,

Michael R. Fuchs
Project Director

MRF:kla

Attachments

cc: James Kamas

APPENDIX L.2

21 October 1983 222-078-03-02

Mr. Ted Campbell
T. J. Campbell Construction Company
6900 South Sunnylane Road
Oklahoma City, Oklahoma 73135

Dear Mr. Campbell:

First of all I would like to thank you for allowing the EPA to conduct a testing program at your asphalt concrete plant. Testing is planned for two weeks beginning Monday, November 7. During the site visit on October 12 by Clyde Riley of the EPA and Mike Fuchs of Radian, several changes or additions to your plant were requested to accommodate the testing program. Those requests include:

- installation of sampling ports in the triangular duct at the inlet to the venturi scrubber;
- installation of a flow meter in venturi water lines;
- installation of 1/4-pipe couplings over the holes for $\Delta P$ measurements at the venturi inlet and outlet;
- adjustment of the venturi to eliminate water mist in the stack; and
- direction of crews installing scaffolding at the stack and venturi inlet sampling locations.

Figure 1 is a sketch of the venturi inlet indicating the location, number, and types of ports which we would like to have installed. Hopefully, the figure is self-explanatory. We would like to have four 3-inch male pipe nipple ports installed across the top of the duct. The ports should be in line with and about 5 feet from the flange of the knock-out box. On the side of the duct, we would like to have installed one 6-inch male pipe nipple port in line with the 3-inch ports.

In this program, we would like to monitor the total flow of water to the venturi, and the water flow rate to the venturi throat. EPA, through Radian, will supply paddle wheel type flosensors to T. J. Campbell Co. for installation. The flosensors should be delivered to you by October 28. The best location for installation of the flosensor to monitor the total flow of water to the venturi was identified to be in a vertical run of 4-inch black pipe on the west side of the scrubber. The pipe comes out of the ground for a distance of about 5 feet before an elbow and flange connection. The flosensor should be installed about 2 feet upstream of the elbow. Task engineers would also like to monitor the flow rate of water to

the venturi throat. A flosensor will be provided to mount in a vertical run of 2-inch pipe to the venturi. I have not actually seen the flosensors or mounting attachments but pictures of these seem to indicate easy installation. A hole of about 1 to 2 inches is cut into the pipe and the mounting bracket bolts over the hole using a U-bolt. 110V power will be needed for the read-out devices, but Radian can install those when we arrive November 7.

During the testing effort, the $\Delta P$ across the venturi will be monitored. There presently are holes (~1 inch) "burned" through the ductwork at the inlet and outlet of the venturi. To provide a better connection and thus a better seal, Radian requests that 1/4-inch pipe couplings be welded over the holes. Radian will then provide connectors and tubing to monitor the venturi $\Delta P$ with a differential pressure gauge.

It was noticed during the site visit that there is water mist or droplets in the stack gases. The mist creates quite a few problems for the testing effort. It is imperative that the water mist be eliminated prior to testing. Apparently, the water mist was eliminated in the past by an adjustment to the venturi performed by CMI. It was agreed to have CMI adjust the venturi prior to the testing effort to eliminate the water mist from the stack gases.

For sampling personnel to reach the ports on the stack, scaffolding will have to be installed. Scaffolding will also be necessary to reach the sampling port on the side of the venturi. If you agree, Radian will make arrangements to have the scaffolding installed on Thursday, November 3. Of course, it will be necessary for your personnel to direct the installation. We will be using both sets of ports on the stack and hope to install only one set of scaffolding having two floors laid at the proper levels. The best height of the sampling platform is about 3 to 5 feet below the ports.

If you agree to the approach outlined, Radian will provide you with the water flow meters and mounting brackets by October 28 and will arrange to have the scaffolding installed on Thursday, November 3.

As a practical measure, we would like to view the final installation of the ports and flow meters, and inspect the stack gases to see that the water mist has been eliminated. I will contact you by phone in the near future to set up a short visit and to further discuss the schedule of the project.

I have enclosed a picture of the venturi inlet indicating the approximate locations of sampling ports and pictures of the venturi water pipes indicating the locations for the water flosensors. The pictures may be of more help than a written description.

Many thanks,

Michael Fuchs

MF:kla

Attachments

cc: Clyde Riley (EMB)

APPENDIX L.3

28 November 1983 222-078-03-10

Mr. Clyde E. Riley
U.S. Environmental Protection Agency
Emissions Measurement Branch
ESED/EMB (MD-13)
Research Triangle Park, North Carolina 27711

Re: Sampling Performed at the T. J. Campbell Asphalt Plant (83-ASP-4)

Dear Mr. Riley:

Sampling was conducted November 7 through 16 at the T. J. Campbell Construction Company asphalt plant in Oklahoma City, Oklahoma. The field effort was conducted by eight Radian staff members including:

Michael Fuchs - Project Director/crew chief,
Eric Anderson - gas sampling leader (uncontrolled),
Michael Krall - gas sampling leader (controlled),
Barry Chapman - sampling train clean-up,
Carl Galloway - liquids and solids sampler,
Lee Garcia - visible opacity measurements,
Tim Trofe - gas sampling, and
Vince Lara - gas sampling.

The purpose of this letter is to document the accomplishments of the field testing program relative to the testing schedule projected in the test plan.

The project test plan was submitted October 27 and identified the objectives of the project. Sampling was projected to occur during four test series identified in the test plan. The test series were:

- conventional operation,
- recycled asphalt pavement (RAP) utilization with typical process operations, and
- RAP utilization at two conditions of reduced water flow rate to the venturi.

During the conventional and RAP utilization test series, the following gas sampling was projected at the inlet and outlet of the venturi scrubber:

- particulate, condensible hydrocarbons, and TOC (2),
- particulate, condensible hydrocarbons, TOC, and trace metals (1),
- particle size distribution (3),

- BaP and selected organics (1),
- gas composition (during each sampling period), and
- visual opacity determinations (during each sampling period).

The last two test series were not conducted. The purpose of those test series was to investigate the contribution of condensible hydrocarbons to the "blue haze" plume by producing the "blue haze" plume and sampling the process. It should be noted that there was no "blue haze" plume during typical RAP utilization. The "blue haze" was to be created by reducing the water flow to the wet venturi scrubber. However, no increase in plume opacity was noted by a reduction in the flow of water to the venturi. For that reason, the final two test series were not conducted. Testing during those series was projected to be considerably less than during the conventional and RAP utilization test series and included only two runs for particulate and condensible hydrocarbons, two runs for particle size distribution, visual opacity determinations during each of the two process conditions, and scrubber waters, virgin aggregate, and RAP sample collection.

Concurrent with each of the gas sampling periods, three venturi scrubber water samples were to be collected for the following measurements:

- pH,
- temperature,
- total suspended solids (TSS),
- total dissolved solids (TDS),
- total organic carbon (TOC),
- trace metals, and
- BaP and selected organics.

Each of the water samples collected during each gas sampling period were analyzed for pH and temperature. The water samples from each gas sampling period were then composited for TSS, TDS, and TOC analysis. Trace metals and BaP/organics are to be analyzed in only one sample collected during conventional and RAP utilization operation.

Figures 1 and 2 present the sampling matrix presented in the test plan for testing during conventional and RAP utilization operation. Noted on those

figures are the number of samples collected or measurements performed during the testing periods. Other than particle size distribution (PSD) data, the gas sampling objectives of the program were achieved. Out of the total of twelve PSD samples projected, nine were collected. The incomplete data are during the RAP utilization operational period which, for the most part, occurred early in the program when a considerable number of mechanical problems with sampling equipment were experienced and process operation was sporadic. The test plan called for gas composition measurements for both uncontrolled and controlled flue gases. With the approval of the task manager, gas composition measurements of the controlled flue gas were not conducted after an initial simultaneous measurement at both locations gave essentially identical results indicating no ambient air in-leakage. By and large, the goals of the waters and solids sampling were achieved. The test plan called for triplicate solids samples; however, the number of solids samples required was reduced to one by the task manager.

The gas samples collected during the testing effort are listed in Figure 3. Sample collection times and plant operating mode are also presented. All of the gas samples are listed, and, as noted, some of the data generated have been rejected for various reasons including: non-isokinetic sampling rate; insufficient sampling period due to process changes, and; an increase in sampling pressure drop in some outlet PSD runs due to wetting of the impactor by excessive moisture in the flue gas. There are three other samples which have been accepted, with the concurrence of the task manager, even though not all traverse points were sampled, once again due to process problems or operational changes.

Figure 4 identifies the waters and solids collected, date and time of collection, and plant operational mode. The samples composited for further analyses are also indicated.

The time periods during which visual opacity was determined are listed in Figure 5. Visual opacity measurements were performed only during sampling periods when there was a clear, blue sky.

In the final analysis, I feel that the vast majority of the objectives of the program were met; however, not without difficulties created by the severe sampling situations. If there are any questions or comments, please call James Kamas or me.

Sincerely,

Michael Fuchs
Project Director
ESED Project No. 83-05

MF:kla

Attachments

**CORPORATION**

APPENDIX L.4

December 1, 1983

Mr. Clyde E. Riley
U. S. Environmental Protection Agency
Emissions Measurement Branch
ESED/EMB (MD-13)
Research Triangle Park, North Carolina 27711

Dear Mr. Riley:

Enclosed are items which you have requested:

- four copies of the T. J. Campbell test plan (83-ASP-4), and
- your copies of the J. H. Strain test matrix (83-ASP-7).

Three quality control samples for proficiency testing of Radian analytical laboratories for TOC analysis have been prepared, split into duplicate samples, and submitted to the lab on December 1. The samples were prepared using potassium hydrogen phthalate, and the concentrations of the samples are:

| | |
|---|---|
| Sample #1 | 80 ppmvC |
| #2 | 40 ppmvC |
| #3 | 80 ppmvC |
| #4 | 4 ppmvC |
| #5 | 5 ppmvC |
| #6 | 40 ppmvC |

The analytical results should be available within a week. No field collected samples will be submitted to the lab for TOC analysis until the lab has passed the proficiency testing (±10%).

If you have any questions or comments, do not hesitate to call.

Sincerely,

Michael Fuchs

Michael Fuchs
Project Director
ESED Project No. 83-05

MF/pt

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RADIAN CORPORATION

APPENDIX L.5

5 ~~November~~ DECEMBER 1983

222-078-03

Mr. Clyde E. Riley
U.S. Environmental Protection Agency
Emissions Measurement Branch
ESED/EMB (MD-13)
Research Triangle Park, NC 27711

Dear Mr. Riley:

Enclosed are the analytical matrices that have been developed as guides through the analytical process. Note that on each form that identifies the analytical sequences for collected samples are sample numbers. The sample numbers can be related to the sample descriptions presented in the sample log. By formatting the analytical schemes in this manner, which requires that the use of each sample be thought through, it becomes only necessary that laboratory personnel follow these directions. Sampling personnel prepared the sample log and numbered each sample.

You will note by comparison that some minor changes have been made to the analytical schemes presented in the test plan. The results will not change but the pathways may differ to reduce chances for error.

At this time, analytical activities include evaporating solvent rinses, compositing samples, and performing extractions. No analyses, per se, have begun.

If you have any questions or comments, do not hesitate to call.

Sincerely,

Michael Fuchs

Michael Fuchs
Project Director
ESED Project No. 83-05

MF:kla

Enclosures

APPENDIX L.6

8 December 1983 222-078-03-05

Mr. Clyde E. Riley
U.S. Environmental Protection Agency
Emissions Measurement Branch
ESED/EMB (MD-13)
Research Triangle Park, NC 27711

Re: Preliminary data from the T. J. Campbell Construction Co. asphalt plant sampling program
ESED Project No. 83-05
Project File No. 83-ASP-4

Dear Mr. Riley:

Enclosed are the preliminary data from the T. J. Campbell Construction Co. asphalt plant in Oklahoma City, Oklahoma. The preliminary data include:

- particulate (front-half) loadings,
- volumetric gas flow rates, and
- particle size distributions.

The data have been tabulated for presentation. The tables included are:

- Table 1 - Air Emissions Sampling Results;
- Table 2 - Front Half Loadings;
- Table 3 - Breakdown of Sampling Run Weight Gains; and
- Table 4 - Impactor Sampling Results--Uncontrolled Air Emissions.

There are also four figures presenting the particle size distribution (PSD) results for the four PSD runs for uncontrolled air emissions.

Also enclosed are copies of the computer data reduction sheets which present both results and inputs for the loading runs.

There are three runs--two uncontrolled and one controlled--which are outside of the isokinetic limit of 90 to 110%. All three runs are super isokinetic which was caused by inaccurate, low preliminary moisture data. In the case of the uncontrolled sample collected on 11/11 at 1645-1730, the moisture value from the prior run on the same day with the same plant conditions was used as the gas moisture content. However, the actual, measured moisture content was over seven percent higher. A wet bulb/dry bulb temperature was taken just prior to the uncontrolled run on 11/13 at 0956-1050. The wet bulb/dry bulb result for the moisture content was almost eight percent less than the actual, measured value. In both cases, if the preliminary moisture

data had been correct, the runs would have been within isokinetic guidelines. During the controlled emissions run on 11/11 at 1515-1704, the input moisture percent was based on the gas being saturated at the measured gas temperature. The measured moisture content was above saturation, indicating the presence of a water mist. The measured value is used by the computerized data reduction system to calculate percent isokinetic. In this case, the computer reduction is incorrect. Only water vapor is considered for the percent isokinetic determination and that value cannot be above the adiabatic saturation volume which was almost four percent less than the measured value. By using the correct moisture content, which is the saturation volume at the measured stack temperature, the run was 109 percent isokinetic.

There is one obvious shortcoming in the data set. No particle size distribution (PSD) results are presented for controlled air emissions. The sampling approach applied in this program for PSD measurements of controlled air emissions could not provide enough heat to vaporize all of the water in the sample gas and keep the water as a vapor through the impactor. When the substrates and particularly the back-up filter get wet, the pressure drop quickly increases to a point where the run must be terminated. PSD sampling runs lasted only about 30 minutes. Two hours of sampling time would have probably been necessary. Also, after the impactor substrates got wet, some substrate material (glass fiber) was lost during sample retrieval. As a result, approximately 90 percent of the substrates lost weight.

A quick overview of the particulate loading results points out a rather interesting problem. During RAP utilization operation, plant emissions averaged 0.0247 grains/DSCF which is within the NSPS of 0.04 grains/DSCF. However, during conventional operation (no RAP utilization), plant emissions averaged 0.0565 grains/DSCF which is above the NSPS. These results are just the opposite of what was expected.

The sampling data and results have been studied to find out if there are any obvious reasons for this.

One of the first observations is that the controlled emission gases were about 10 degrees hotter, on the average, during the conventional operation. The question is then asked, "Does this mean that a higher concentration of hydrocarbons were emitted either in the gases from the kiln or as devolatilized components from the scrubber water?" There appear to be no trends in the scrubber water temperatures which would explain the difference. Uncontrolled gas temperatures were actually less during conventional operation. The results in Table 2 which break down the loading results, indicate that while the probe rinse loadings increased during the conventional runs, so did the material collected on the filters. In both cases, the filter loadings were about 40 percent of the probe rinse loadings.

What does stand out is that the average uncontrolled particulate loading during RAP utilization is about 50 percent of the uncontrolled particulate loading during conventional operation. The removal efficiency across the venturi is 99.3 percent during RAP utilization and 99.2 percent during conventional operation. This would seem to indicate that the higher controlled emissions loading during conventional operation is due primarily to the higher uncontrolled emissions loading.

Gas volumetric flow rates were less during conventional operation. Uncontrolled emissions particle size distribution data indicate that the average size of particulate matter at the scrubber inlet was smaller during conventional operation than during RAP utilization operation. The reduced gas rate and smaller particle size during conventional operation may have contributed to greater particulate penetration through the venturi. These points need to be investigated further and will be as the data evaluation progresses. The increase in particulate penetration during conventional operation idea derived from flow rates and inlet PSD data identifies a need for the particle size distribution of the controlled air emissions. Radian proposes that scanning electron microscope photomicrographs be taken of particulate loading filters collected during both conventional and RAP utilization operation. If a review of the photomicrographs warrants, Radian would propose that particle counts be performed on the photomicrographs to develop particle size distribution results in that fashion.

I will be in touch to discuss further the idea of developing particle size distribution results using scanning electron microscopy. Please contact me if you have any questions or comments.

Sincerely,

Michael Fuchs

Michael Fuchs
Project Director
ESED Project No. 83-05

MF:kla

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**CORPORATION**

December 29, 1983

Mr. Clyde E. Riley
U. S. Environmental Protection Agency
Emissions Measurement Branch
ESED/EMB (MD-13)
Research Triangle Park, NC 27111

RE: Calibration verification of Signet Flosensor used during the T. J. Campbell Construction Company asphalt plant sampling program
ESED Project No. 83-05
Project File No. 83-ASP-4

Dear Mr. Riley:

Enclosed are the calibration results for the Signet Flosensor used to measure the water flow rate to the Venturi scrubber at the T. J. Campbell Construction Company asphalt concrete plant in Oklahoma City, Oklahoma.

The flosensor was factory calibrated for 4-inch schedule 40 pipe using an electronic signal. Radian's calibration was performed by passing a measured volume of water past the flosensor over a measured time period and correlating this measured rate to the flosensor indicated rate.

The calibration was accomplished using a submersible pump as a water source, a gate valve for flow control, the flosensor located 13 pipe diameters from the closest downstream disturbance and 6 pipe diameters from the upstream disturbance, and a calibrated vessel large enough to allow at least a 60 second fill time at the highest flow rate.

The actual calibration was done in 2-inch schedule 40 PVC pipe instead of 4-inch. The smaller pipe allowed the actual flow rate through the pipe to be reduced by a factor of four. The rate monitored at the Campbell plant was in the range of 200 to 250 gpm. It would have been very difficult to produce and measure a water flow rate of that magnitude. The method used to calibrate the sensor is accurate since the sensor actually monitors the velocity of the stream and converts that velocity to a volumetric flow rate based on the cross-sectional area of the pipe. By ratioing the actual inside diameter (ID) of the 2-inch pipe to the flosensor's calibrated value (4-inch pipe), the relationship between the flosensor reading and actual value was determined.

A total of nine tests were performed to verify the flosensor's calibration. The results of these tests are presented in Table 1.

The differences between the flosensor and the measured values ranged from -13.0 to +5.8 percent. At the lowest flow measured which is at the low end of the meter, the readout becomes difficult to read and can explain the higher (13.0%) difference between flosensor and actual measurement. Omitting this point, the 95% confidence interval for mean relative error is 0.6 ±2.6% over the equivalent flow rates measured. This interval represents an estimate of measurement bias or systematic error. Since it includes zero percent, a conclusion of bias is not justified and the measurements must be considered accurate within the limits of precision. In other words, experimental error is the primary source of observed differences between the flosensor measurements and the true (equivalent) flow rates. If this random error due to imprecision is taken into account, the data still indicate a 90% probability that at least 90% of the measurements would be expected to be within 0.6 ±8.8% of the true value.

If there are any further questions or comments concerning the calibration, do not hesitate to call Mike Fuchs or me.

Sincerely,

Eric P. Anderson
Task Leader

EPA/bb

Enclosure