AP42 Section:	12.2
Reference:	7
Title:	*Final Phase I Method Validation Report for Quantitative Coke Oven Door Leak Measurement Study*, ENSR Consulting and Engineering, for American Iron and Steel Institute, Washington, DC. December 1991.

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American Iron and Steel Institute

Washington, D.C

Final Phase I Method Validation Report for Quantitative Coke Oven Door Leak Measurement Study

ENSR Consulting and Engineering

December 1991

Document Number 0284-001-350(322)

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1.0 INTRODUCTION

ENSR Consulting and Engineering has been retained by the American Iron and Steel Institute (AISI) and the American Coke and Coal Chemicals Institute (ACCCI) to conduct a quantitative benzene-soluble organics (BSO) emissions study for coke oven door leaks. The study is being undertaken because the VEO procedure that the U.S. EPA is proposing to use to implement maximum achievable control technology (MACT) limits (Method 109) does not include a measure of the severity of individual leaking doors. The objective of this study is to develop quantitative coke oven door emission data, that in conjunction with a visual emission observation (VEO) procedure developed under separate contract, could serve as the basis for a mass emission standard consistent with the amended Clean Air Act of 1990. An additional objective is to provide emission information that can support, if necessary, any residual risk standards developed under the CAAA.

In a previous document, "Draft Sampling Plan for Quantitative Coke Oven Door Leak Measurements, May 1991, ENSR Document No. 0284-001-430," a series of sampling and analytical procedures were proposed for determining BSO mass emission rates from leaking coke oven doors. The combination of test methods, sampling durations, flow rates, and other parameters suggested in this document were evaluated during a method validation study towards selection and accuracy. In order to choose the conditions and methods which would provide the most meaningful and useful data during an actual test program, the method validation study was conducted to confirm that the proposed procedures could successfully collect and quantify BSO mass emission rates across a broad range of VEO classes for leaking coke oven doors. With this approach, the observations from the field testing team regarding the performance of the overall sample collection system, the final conditions and methods will be chosen for use in the test program.

This report summarizes the results of a method validation study conducted at the ARMCO Middletown, OH facility during the week of July 8, 1991. Mr. Roy Huntley of U.S. EPA-OAQPS-EMB and Mr. Scott Ajax of OMNI Environmental were present during the field sampling efforts. The collection and sampling procedures evaluated by ENSR during this study included the use of a flexible curtain shroud and U.S. EPA Method 5G. A number of issues were identified as potential areas of concern regarding the approach outlined in the ENSR May 1991 report, and are addressed in the present document. These issues include:

- Quantitative collection by the shroud;
- Minimizing losses to the surfaces of the shroud and ductwork;
- Duration of setup, sampling and takedown times;
- Variability of VEO rating over the duration of the sampling interval;
- Collection of sufficient sample mass at low VEO (0.5 to 1.0) ratings; and
- BSO breakthrough.

The present report summarizes the findings from the ENSR method validation study and additional quality assurance measures implemented for the coke oven door leak measurement study. The final recommended sampling and analytical methods for the test program are described and they will be incorporated into the final sampling plan.

2.0 MEASUREMENT PROGRAM DESCRIPTION

2.1 Overview

The measurement program was designed to capture BSO emissions from individual coke oven doors and to direct the gases and particles into a steady-state, induced-flow system from which representative samples could be collected and emission rates determined. Two independent techniques were used to collect representative samples from the capture system during the method validation study: U.S. EPA Method 5G and a modified PS-1. Of the two sampling procedures, Method 5G was the method of principal interest because it is a validated U.S. EPA procedure. The modified PS-1 method was evaluated during the method validation study as a potential alternative sampling method in the event that larger sample sizes than those provided by Method 5G were required to successfully complete this project. The capture system as well as the sampling techniques used are described in the subsections that follow.

2.2 Capture and Measurement System

2.2.1 Shroud and Capture System Design

The temporary coke oven door shroud and emissions capture system evaluated during this program is depicted in Figures 2-1 through 2-3. The shroud consisted of a flexible curtain made from a 10 mil, teflon coated, fiberglass fabric suspended from a light gauge sheet metal hood that was outfitted with a 6-inch diameter flexible duct adapter. This setup was hung from the top of the coke oven door. The curtain, which covered the oven door, was 20 feet long and 4 feet wide.

The general procedure for installing the capture system is described below. After identifying the oven door to be tested, the hood, with the rolled up curtain attached, was placed over the top of the oven door from on top of the battery between the standpipes. Once the hood was in place and adjusted, the curtain was carefully unrolled and clamped to the adjacent buckstays using 4-foot long sections of steel flat bars to create an enclosure with minimal leakage. Use of a portable scissor jack-type man-lift on the coke oven bench facilitated installation of the shroud. Once the oven door area was accessible and the man-lift was in place, the enclosure could be completely installed in approximately 10 minutes.

After the enclosure was installed, the 6-inch diameter flexible duct was connected from the top of the hood to the exhaust duct and blower. The exhaust duct consisted of approximately

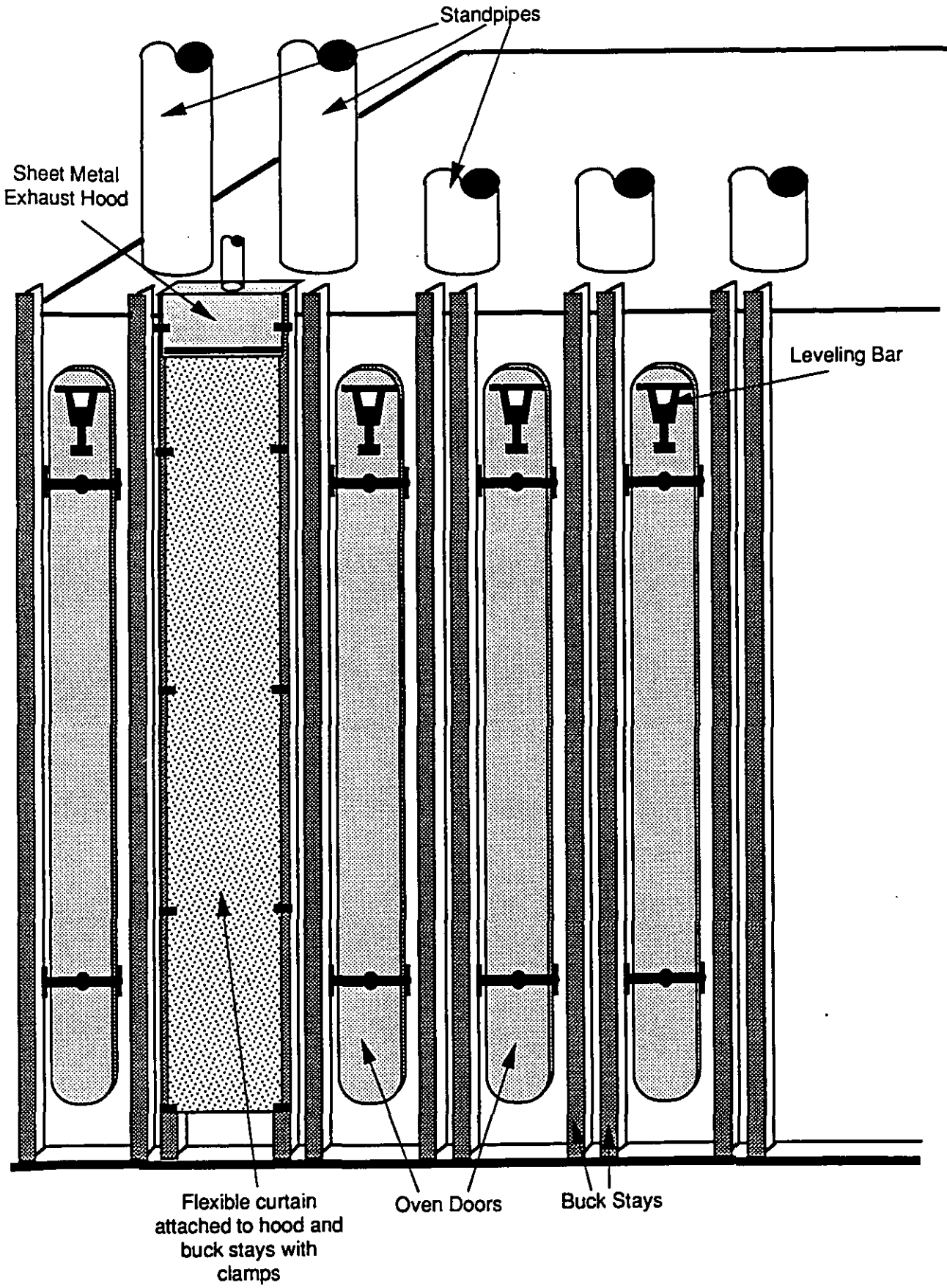


FIGURE 2-1

Coke Oven Door Capture SystemSchematic

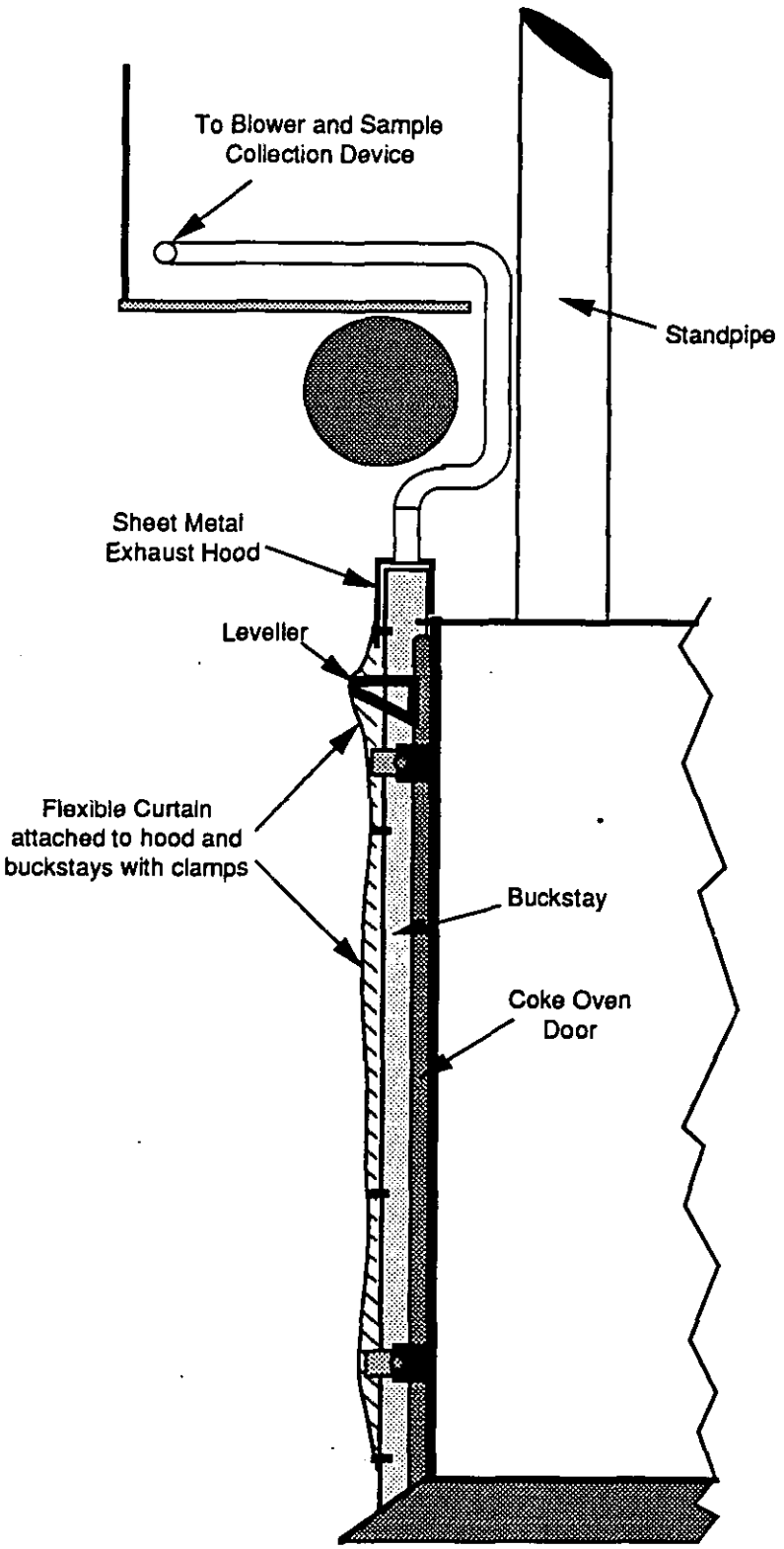


FIGURE 2-2

Capture System Design - Side View

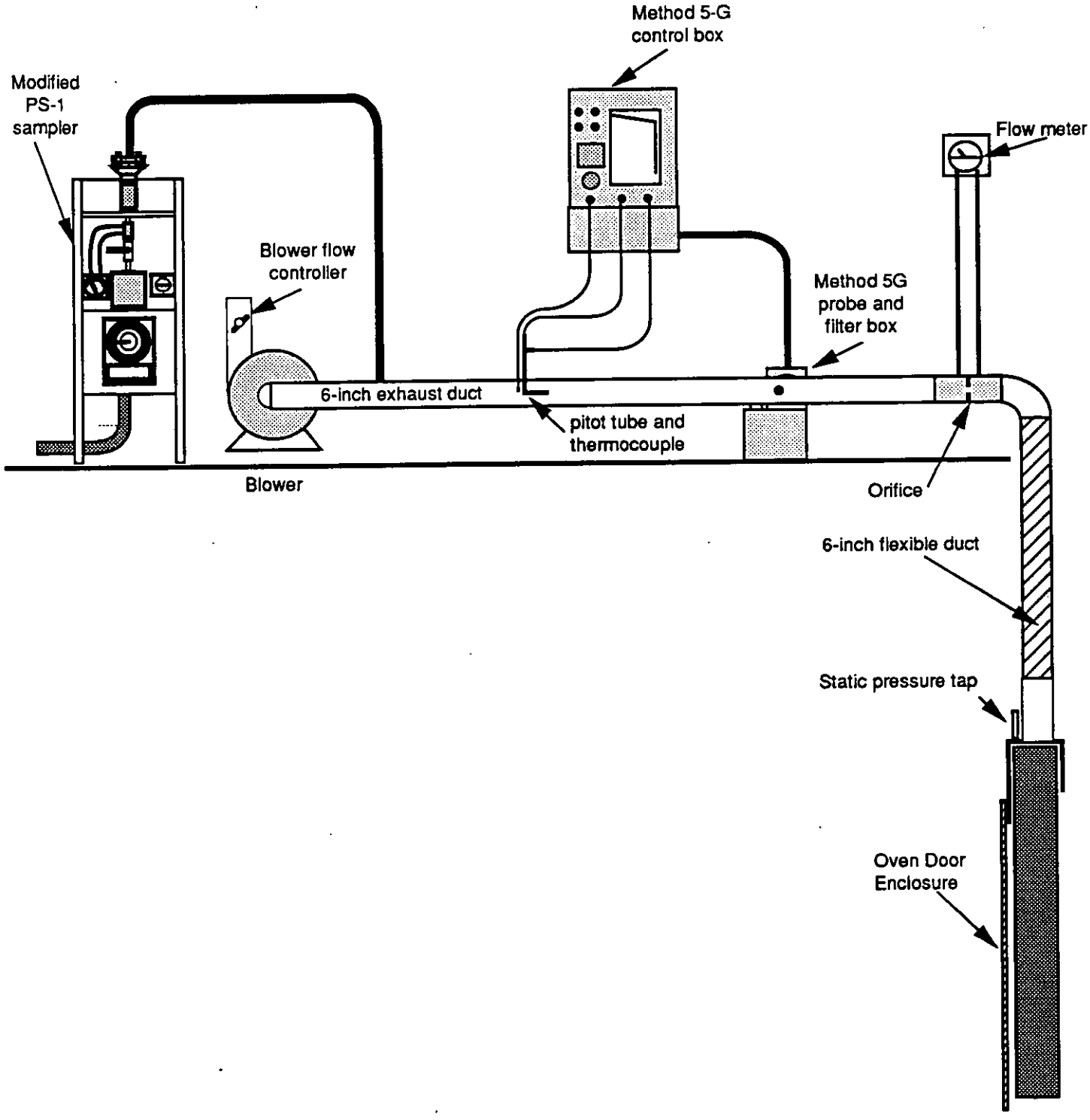


FIGURE 2-3

Sampling System Schematic

16 feet of 6-inch diameter steel ductwork with installed ports for sampling and flowrate measurements. The 6-inch diameter ductwork included a small removable section to evaluate sample losses to the collection system. The blower was equipped with a flow damper as a means of controlling the flowrate through the system. However, throughout the method validation study the blower was operated without restriction at approximately 250 dscfm. Approximate flowrates through the system were monitored using an orifice meter and differential pressure gauge in-line between the flexible duct and the exhaust duct of the system. The Method 5G sampling port was located in the 6-inch diameter duct 4 feet (8 duct diameters) downstream of the orifice meter. The pitot tube and thermocouple for the Method 5G system were located 4 feet downstream of the sampling port, and the PS-1 sampling port was located 4 feet downstream of the pitot tube and thermocouple. In order to verify the capture efficiency of the system, a static pressure gauge was used to assure negative pressure within the shroud.

2.2.2 VEO Determinations

Visible Emission Observation (VEO) determinations for each door tested were conducted prior to and immediately following each test run. A range of six leak rate classifications for visible emissions were used. These classifications (0, 0.5, 1, 2, 3, and 4) ranged from a numerical value of 0 (no visible leak) to 4 (extraordinarily heavy leak) with most of the leaks falling into the range of 1 to 3. Training of ENSR field personnel for leak classification determinations was conducted by two methods. First, ENSR personnel reviewed a video tape from OMNI Environmental, which under separate contract had developed the VEO classification system to be used in the present study. The tape gave examples of each coke oven door leak classification at a representative coke battery. Second, a representative from OMNI (Scott Ajax) visited the ARMCO site during the test period to help instruct ENSR field personnel in leak classification. At the conclusion for this training program, ENSR field personnel were able to accurately classify the leak rates of each door tested.

2.2.3 Flowrate Measurements

A standard pitot tube connected to an inclined water manometer was used to determine the velocity head of the gas stream as specified in U.S. EPA Methods 1A and 2 for small diameter ducts. The temperature of the gas stream was obtained by taking readings from a calibrated thermocouple concurrent with the velocity head measurements. Gas stream moisture was determined using the procedure specified in U.S. EPA Method 4.

2.2.4 Fixed Gas Measurements

Samples for determining the fixed gas composition (oxygen, carbon dioxide, carbon monoxide and nitrogen) of the gas stream were collected for the first two sample runs using the integrated bag technique detailed in U.S. EPA Method 3. Analyses of the collected samples were conducted using a Fyrite gas analyzer in accordance with U.S. EPA Method 3. Since these measurements indicated ambient levels of fixed gases (as expected), fixed gas measurements were discontinued for subsequent test runs and ambient concentrations were assumed.

2.2.5 Method 5G Collection System

The principal sample collection method used during this program was that described in U.S. EPA Method 5G. The sampling train consisted of an unheated stainless steel probe with a 0.378 inch diameter button hook nozzle connected to an assembly of two unheated filter holders each containing a single glass fiber filter. Downstream of the filter holder assembly, the filtered gas was directed through a glass impinger containing silica gel for moisture removal. The impinger was then connected by an umbilical cord to the pump, dry gas meter, and calibrated orifice (control box). The nozzle inlet was located at a single point at the center of the 6-inch diameter duct. The thermocouple and pitot tube were located 4 feet (8 duct diameters) downstream of the sample port as suggested in U.S. EPA Method 1A. The sample collection period in all cases was 15 minutes. The Method 5G sample collection train is depicted in Figure 2-4.

Prior to the start and at the conclusion of each test run, a leak check of the system was performed. Following each test run the nozzle, probe and filter assembly of the sample train (front half) were removed and taken to the recovery area in the control room of the coke battery. The samples were then recovered as detailed in Method 5G. Front half rinses were conducted using methylene chloride (dichloromethane) solvent and were sealed in labeled 250 ml amber glass sample bottles. Filters were recovered in aluminum foil lined plastic petri dishes, labeled and sealed with tape.

2.2.6 PS-1 Collection System

Because of the concern that insufficient sample mass would be collected by Method 5G, a modified PS-1 sampler was used in an evaluation of it as an alternative sample collection method. During the method validation study, the modified PS-1 sampler was used to collect samples simultaneously with the Method 5G sample collection train. The PS-1 sampler has the ability to collect approximately 8 times the sample volume as the Method 5G train and could therefore provide a much lower method detection limit for BSO.

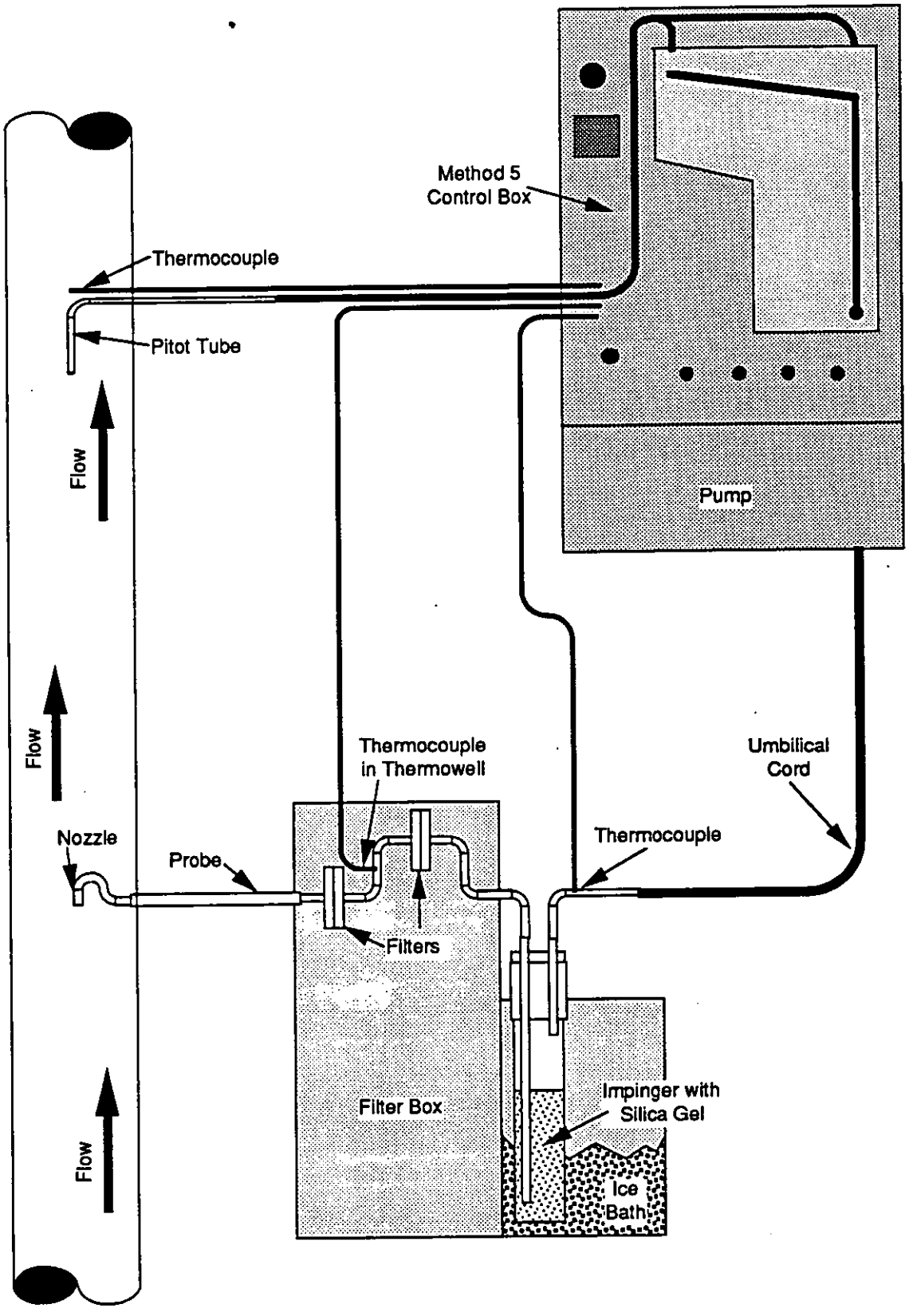


FIGURE 2-4

Method 5-G Sampling System Schematic

The PS-1 sampler is typically used to collect semi-volatile organic compounds in ambient air. For this program, however, the sampler was modified to collect samples from the coke oven door exhaust gas stream. A schematic of the modified PS-1 sampler used during the validation study is shown in Figure 2-5. The modified PS-1 employed both a glass fiber filter and polyurethane foam (PUF) sorbent trap to collect both particulate and vapor phase BSO. As stated in the ENSR May 1991 report "Draft Sampling Plan for Quantitative Coke Oven Door Leak Measurements," ENSR Document No. 0284-001-430(277), the PUF will collect any vapor phase BSO not sufficiently trapped on the pre-filter. Vapor phase BSO may occur as a result of the high filter face-velocity associated with the PS-1 samplers. The PS-1 sampler was equipped with an on/off timer, flow venturi, magnehelic flow gauge, voltage variator and elapsed timer.

Exhaust gas from the capture system was drawn through a 1/2-inch nozzle and 1-inch diameter teflon sample line to the particulate filter and back-up sorbent trap. The flowrate through the sample collection system was approximately 200 liters per minute. The sampler was calibrated prior to field use using an NIST traceable calibration orifice. Prior to sampling, the clean, pre-weighed filter and PUF sorbent trap were loaded into the sample head and the system was leak checked. The sampler flowrate was recorded before, during, and after the sample run. Following sample collection the elapsed time was noted, the system was leak checked once more, and the sample was recovered by removing the filter and PUF sorbent and returning them to their original containers.

2.2.7 Flame Ionization Detector (FID)

The sampling plan for the coke door leak measurement study includes use of a Foxboro OVA-128 organic vapor analyzer to provide additional assurance that the collection system had reached a state of equilibrium before sample collection began. During the initial test run the OVA-128 was used within the sampling duct to monitor total hydrocarbons. However, the OVA responded slowly and exhibited slow recovery when removed from the exhaust duct. This was probably due to semivolatile organic compounds present in the gas stream which were not ionized efficiently by the FID and which poisoned the detector. In consideration of the OVA, ENSR ceased using this analyzer to eliminate further potential for damage. In order to assure equilibrium in the system before sampling, the blower was allowed to run for approximately 5 minutes prior to sampling. A visual check of the smoke exiting the blower indicated that equilibrium was most likely reached within 10-30 seconds after starting the blower.

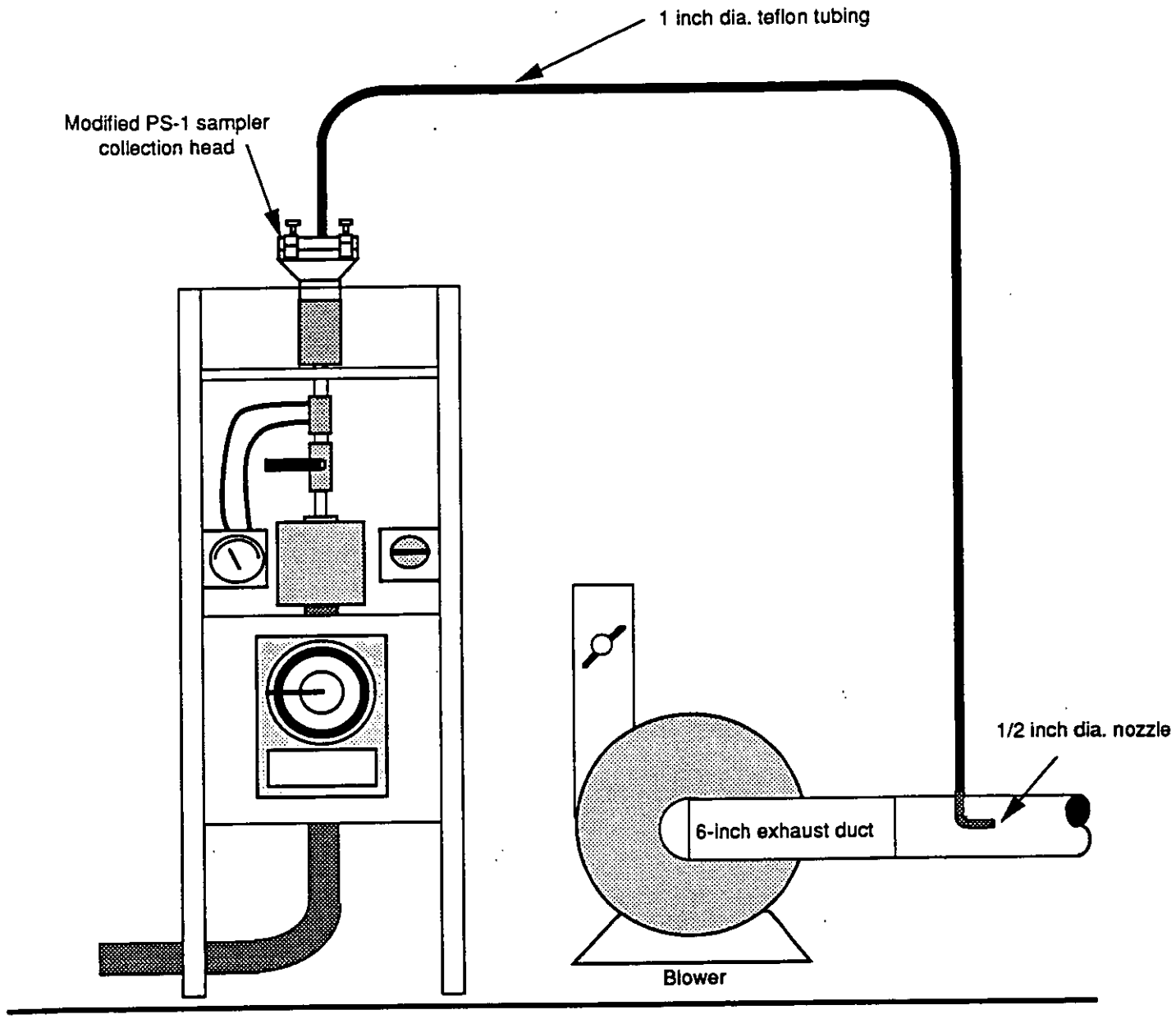


FIGURE 2-5

PS-1 Sampling System Schematic

2.2.8 Collection of Background Samples

Background samples for BSO determination were collected during each sampling run along the coke oven bench adjacent to the shroud inlet. Background samples were collected for nine (9) of twelve (12) runs. Samples were collected for periods of 4 hours to 7 hours according to NIOSH Method 5023 using personal monitoring pumps operating at about 3 lpm and PTFE filter membranes in a pre-loaded plastic filter holder. The extended background sample collection time was required to collect sufficient sample mass for laboratory analysis.

2.2.9 Routine Field Operations

The following operations were routinely completed for each sample collected during the method validation program:

1. Identify the door to be tested and classify the leak.
2. Install the shroud and connect the sample collection system.
3. Set up and leak check the sampling system and begin the test run.
4. Collect emissions samples for 15 minutes.
5. At the conclusion of the run, roll up the shroud and classify the leak.
6. Conduct a final leak check and recover the samples.

2.3 Sample Analysis Procedures

2.3.1 Analysis of Method 5G Samples

The front half washings of the probe and nozzle, as well as the two filters from each run, were analyzed separately for both particulate and BSO loading. The gravimetric analyses of the samples for particulates were conducted in accordance with the procedure detailed in U.S. EPA Method 5G. For each sample run, the dichloromethane washes were transferred to tared beakers and dried at ambient temperature and pressure in a laboratory ventilation hood. After removal of the dichloromethane, the residue was resuspended in benzene and then allowed to dry in a desiccator containing Drierite absorbent. The weight of the resultant residue was then determined by weighing the beaker on a Mettler balance and subtracting the original tare weight. A benzene blank was also prepared in the same manner and weighed to obtain the value of any weight gain which was attributable to the quantity of benzene used.

The glass fiber filters associated with each run were removed from their containers and also allowed to dry in a desiccator over Drierite. The filters were then weighed using a Mettler balance. The filter tare weight of each filter was subtracted from the final filter weight to obtain the mass of particulate collected.

Following the determination of particulate concentration, the front and backup filters along with the corresponding probe wash residue for each sample were analyzed separately, and subsequently were subjected to Soxhlet extraction for 16 hours in benzene. It should be noted that Method 5G does not specify a procedure for establishing probe rinse blank BSO concentrations. The insoluble phase from each sample set was then filtered from the benzene solution and the extract was decanted into a tared, 350 ml beaker. The beakers were then placed in a laboratory hood to dry overnight at ambient temperature and pressure. After removal of the benzene in the hood, the beakers were placed in a desiccator over Drierite and weighed using a Mettler balance. The net weight gain of each beaker represented the total BSO content of each sample.

2.3.2 Analysis of PS-1 Samples

The analysis of the PS-1 filters and PUF cartridges were conducted following the same procedures described above for the Method 5G samples. The sample filters were equilibrated for 24 hours in a desiccator over Drierite and weighed using a Mettler balance. Following the determination of total particulates for each sample, the filters and several of the PUF traps were extracted separately by Soxhlet using benzene. The benzene extracts were then placed into tared beakers and allowed to dry under a laboratory hood. After the removal of the benzene under the hood, the beakers were placed into a desiccator containing Drierite for 24 hours. The beakers were then weighed and the net weight gain of each beaker represented the total BSO content for each portion of the sample. A benzene blank was also collected and dried down in order to determine the contribution of the benzene to the total BSO in each sample.

2.3.3 Analysis of Background Samples

The analysis of the NIOSH Method 5023 filters was identical to that for the Method 5G filters. The sample filters were equilibrated for 24 hours in a desiccator over Drierite and weighed using a Mettler balance. Following the determination of total particulates for each sample, the filters were extracted separately by Soxhlet using benzene. The benzene extracts were then placed into tared beakers and allowed to dry under a laboratory hood. After the removal of the benzene under the hood, the beakers were placed into a desiccator containing Drierite for 24 hours. The beakers were then weighed and the net weight gain of each beaker represented the total BSO

content for each portion of the sample. A benzene blank was also collected and dried down in order to determine the contribution of the benzene to the total BSO in each sample.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL

3.1 Overview

All sampling activities and analytical measurements performed over the course of this program were supported by quality assurance/quality control measures. Specific procedures to ensure accurate, representative and complete data were implemented at every phase of the program. As discussed in detail below, the quality assurance methods included the following elements: the use of calibrated sampling equipment, sample custody documented at all times, with transfers done under Chain-of-Custody procedures. Analytical laboratory quality control measures included the use of certified laboratory standards as well as the analyses of method blanks, field bias blanks and reagent blanks. Laboratory analyses followed U.S. EPA methods where appropriate; NIOSH methods or other validated methods were used where U.S. EPA protocol was not applicable to the sample matrix or analytical requirement.

3.2 Sample Collection

3.2.1 Shroud Performance

To ensure that the shroud performed properly (i.e., functioned under negative pressure) during the study, a magnehelic gauge was attached to the metal hood at the top of the shroud. Throughout the sampling effort the magnehelic indicated a reading of approximately -0.5 inches of water (-12.7 mm water). The goal of maintaining the shroud at a slight negative pressure was to ensure that the shroud achieved quantitative collection of door leak emissions, and to minimize biasing of the coke oven door emissions towards higher emission rates by actually pulling and creating additional leaks. Thus, maintaining the shroud at a slightly negative pressure was a compromise in achieving quantitative capture of the door leak emissions and minimizing the undesirable enhancement effect on the door leak mass emission rates.

3.2.2 Source Sampling Equipment

Quality assurance begins with the calibration of the sampling equipment. The sampling equipment used for the Method 5G was calibrated by ENSR before shipping and recalibrated on return to ensure that the flow rates had not changed. The sampling equipment was calibrated according to U.S. EPA procedures specified in 40 CFR 60, Appendix A; and Methods 1-5G; ENSR Standard Operating Procedures; and manufacturing specifications. Calibration sheet results are provided in Appendix A.

3.2.2.1 Dry Gas Meter and Orifice Meter/U.S. EPA Method 5

The dry gas meter for the Method 5G sampling train was calibrated against a wet test meter which had been calibrated against a spirometer. The orifice meter in the particulate train meter control box was calibrated against a wet test meter and checked against the dry gas meter to which it was attached. These results are provided in Appendix A.

3.2.2.2 Sampling Nozzle

Each nozzle was measured with a micrometer on site prior to testing. The internal diameter of each sampling nozzle was measured to 0.001 inches along three points of the circumference with a dial vernier caliper. The three measurements were then averaged and recorded.

3.2.2.3 Thermocouple

The K-type thermocouples in the meter control box and impinged umbilical connector as well as the one attached to the probe were calibrated against ASTM mercury in glass thermometers at two temperature points. The first point was in an ice bath and the second in boiling water. These results are also provided in Appendix A.

3.2.2.4 Pitot Tubes

The "S" type stainless steel pitot tubes were designed to meet geometric configurations as defined in U.S. EPA Method 2.

3.2.2.5 PS-1 Samplers

Samplers were calibrated prior to each sampling session (ENSR SOP No. 2622-021) and checked following the completion of each session. Initial and final flowrate calibrations must have been within ±10% of each other for the sample to be considered valid.

The flowrate calibration standard was an orifice that connected to the inlet of each sample cartridge, in place of the filter and sorbent trap. The orifice was NIST-traceably calibrated against a Rootsmeter. All calibration measurements were standardized to 760 mm Hg and 25°C.

3.3 Analytical Instrumentation

3.3.1 Balance

The analytical balance was calibrated against Class M weights manufactured by the Mettler Corporation. The balance was also checked daily against a set of NIST traceable Class S weights.

3.4 Particulate and BSO Analysis

All filters used in the Method 5G train or PS-1 sample were properly conditioned before and after each sample run in a constant environment room to determine tares. All collected filters were conditioned in the dark prior to weighing. All the samples were collected on Method 5G samples trains or PS-1 samplers calibrated as previously described. Chain-of-custody procedures were utilized for each washing, and filter catch set for each test run. Field data sheets were maintained to document all test runs. One blank filter which had gone through all conditioning and weighing steps was analyzed for particulate and BSO net change. Blank samples of benzene which had gone through all extraction, conditioning and weighing steps were analyzed for residue blank BSO weights (Table 3-1). These blank values were used to correct both particulate and BSO residue sample values.

3.4.1 *Studies on Filter Mass Quantitation Limits and PUF BSO Blank Levels*

The primary objective of the method validation program was to optimize existing sampling and analysis methods for particulate and BSO determination such that they could reliably measure these contaminants in the range expected for the broad range of VEO leak classes found for coke oven doors. To this end two studies were undertaken. One of the studies was to determine the minimum weight that could be read reliably on a Mettler balance during the filter processing of Method 5G filters. The second study involved the backhalf analysis of the PUF sorbent from the alternate PS-1 sampling system. The purpose of this study was to determine whether the benzene-soluble impurities in the PUF would have an unacceptable impact on determining the backhalf BSO fraction collected during the sampling program.

3.4.1.1 Determination of the Method 5G Filter Quantitation Limits

For the filter quantitation limit study, ten filters were preconditioned in a desiccator for 24 hours and then weighed to a constant weight. The filters were then assembled in Method 5G filter holders and allowed to stay in the holders for 8 hours. The filters were subsequently recovered

TABLE 3-1

Benzene Blank Results

Benzene Blank #	Sample Volume (ml)	Sample Weight (g)	Blank Correction (mg/ml)
MB4074X	250	0.0004	0.0016
MB4078X	225	0.0002	0.0009
MB4081X	750	0.0013	0.0017
MB4084X	25	0.0000	0.0000
MB4047X	300	0.0013	0.0043

from the filter holders and reconditioned for 24 hours in a desiccator and again weighed to a constant weight. The change in filter weights was then determined.

From this study it was determined that the net change in filter weight from handling was less than 1 mg, with a mean of 0.48 mg (Table 3-2). Taking this weight change into consideration, the minimum weight change that could be accurately determined was to be 3 times this change, or approximately 1.5 mg.

3.4.1.2 PUF BSO Preconditioning Study

In this study, the ENSR AnalytiKEM laboratory in Houston, TX, was supplied with 6 PUFs obtained from a single manufacturer. Each of the PUF plugs was cut from 4'x4'x3" stock supplied to ENSR from a commercial vendor. The PUFs had not been subject to any pretreatment prior to shipment. The primary purpose of this study was to determine whether the PUF contained significant levels of BSO contaminants that would be released during the benzene extraction and, thus, provide biased BSO results for the PS-1 sampling approach.

Each of the 6 tested PUFs were Soxhlet extracted in benzene for 16 hours. The extracts were then taken down at room temperature and the residues weighted after being desiccated for 24 hours to a constant weight. Three of the PUFs were subsequently re-extracted by Soxhlet extraction for 16 hours in benzene to determine if the residue from the original extraction was due to impurities in the PUF or due to breakdown of the PUF during the benzene extraction process. This additional extraction study would also evaluate the importance of a pre-extraction step prior to using the PUFs for BSO sample collection.

The results from this study showed that approximately 30 mg of residue was present after the initial benzene extraction (Table 3-3). Thus, pre-extraction of the PUF is required for use in the present study. The re-extracted PUF had a residue weight of between 2-6 mg. These results suggest that if the PUF is pre-extracted prior to its initial use, it still may cause backhalf BSO residue problems for the low VEO leak classes, if the PS-1 samplers are selected for use in the present study.

3.5 Background Samples

Due to the nature of the sampling environment during this study, ambient background samples were taken to determine ambient concentrations of both particulate and BSO. The sampling approach adopted for the validation study required the use of a capture device in front of the coke oven doors that is similar to a dilution tunnel. The dilution air for the capture device was the ambient air in the vicinity of the coke oven doors. For small door leaks, where the mass

TABLE 3-2

Determination of Filter Weight Changes (in g)

Filter	Initial Weight	Final Weight	Weight Change
1	0.5982	0.5991	0.0009
2	0.6028	0.6037	0.0009
3	0.6017	0.6026	0.0009
4	0.6018	0.6023	0.0005
5	0.5990	0.5993	0.0003
6	0.6019	0.6018	-0.0001
7	0.6027	0.6030	0.0003
8	0.6026	0.6025	-0.0001
9	0.6110	0.6114	0.0004
10	0.6081	0.6089	0.0008

TABLE 3-3

Determination of BSO in PUFs (in mg)

PUF	First Extraction Weight Change	Second Extraction Weight Change
1	30.0	6.6
2	34.2	2.5
3	29.9	2.9
4	31.3	
5	29.2	

contribution from the doors would be low, the ambient concentration of particulates or BSO may have a significant impact on the mass emission rate estimates. On the other hand, when determining the mass emission rates from large coke oven door leaks, ambient concentrations of BSO may have insignificant impact on the mass emission rate estimates.

Ambient samples were collected on the bench adjacent to the shroud opening during some sample runs (9 of 12 runs) using NIOSH Method 5023 (Coal Tar Pitch Volatiles). These samples were analyzed in a similar manner as the Method 5G samples. However, due to the small sample volumes of the NIOSH Method 5023, background sample duration lasted between four (4) and six (6) hours, and thus did not exactly correspond to coke oven door leak sampling time interval. Although no significant contribution of BSO were found in the background samples (i.e., BSO values were less than 2 mg/m^3 in all background samples collected (Table 3-4), background sample collection should correspond as closely as possible to the door leak tests. Consequently, ENSR is recommending that the final test plan include use of a high volume sampling procedure (45 cfm) for the determination of background BSO levels in the vicinity of the target coke ovens. Such a sampling approach will provide more relevant background BSO data for the specific source sampling time interval.

3.6 General Laboratory Procedures

Standard quality control procedures were followed for all analyses. Laboratory reagent blanks, duplicate samples, and laboratory method blanks were analyzed concurrently with each set of submitted samples. The laboratory prepared and analyzed one blank and one sample for the set of samples received. The results of the quality control procedures were reviewed by the laboratory quality control. The results were in compliance with the established analytical control limits.

3.6.1 Method Blanks

Blanks processed through the sample preparation procedures to assess potential contamination introduced in the laboratory were utilized for both analyses.

3.6.2 Field Blanks

Field blank filters and cartridges were prepared and shipped as actual field samples. Each field blank was opened at the same time and in the same manner as one of the regular samples to be used for sampling. Once sampling had begun, the field blank was repackaged and stored on-site for the balance of the sampling session. When sampling was completed, the field blank was again opened during recovery of the samples. The field blank was then sealed back in its

TABLE 3–4
Background Sample BSO Concentrations

Date	Sample #	Total Weight Gain * (g/sample)	Flow Rate (cc/min)	Run Time (min)	Sample Volume (liter)	Background Concentration (mg/m3)
07–09–91	12	0.0008	3012	360	1084.3	0.74
07–09–91	1	0.0006	2965	240	711.6	0.84
07–09–91	17	0.0009	2994	180	538.9	1.67
07–10–91	18	0.0008	2982	480	1431.4	0.56
07–10–91	16	0.0008	3010	240	722.4	1.11
07–10–91	19	0.0013	3052	360	1098.7	1.18
07–11–91	14	0.0008	3953	405	1601.0	0.50
07–11–91	2	0.0007	2916	240	699.8	1.00
07–11–91	11	0.0007	3052	360	1098.7	0.64

* Solvent blank corrected

sample container at the same time as the sample cartridges, labeled, and returned to the sample cooler and then to the lab for analysis.

3.7 Documentation and Chain of Custody

To assure high quality data, requirements for the field effort included the use of standardized forms to insure completeness and consistency of documentation. Records of field measurements were maintained by the field supervisor. Appendix B contains calibration forms and field data sheets used during this project. Samples were transported to ENSR's Wilmington, MA laboratory by ENSR personnel or common carrier. Upon receipt at the laboratory, the samples were logged into the laboratory book and given an identification number and stored in a secure area until analyzed. Secured samples were sent to ENSR's Houston, TX, laboratory under the same strict chain-of-custody procedures for BSO analyses. Any time a sample was removed from the laboratory repository, the identification of personnel handling it was logged into the chain-of-custody book.

3.8 Field Data Reduction

The data collected in the field were recorded on the appropriate field data sheets, in the field logbook, and/or both were reviewed by at least two field sampling team members. Errors or discrepancies were noted in the field logbook. All data and calculations were checked by the project field coordinator or designee and were signed to indicate that the data has been reviewed and approved.

3.9 Laboratory Data Reduction

Analytical results were reduced to the concentration units specified in the respective Analytical Procedures using the equations given in the ENSR Procedure. All calculations were recorded in the laboratory notebook, and were checked and signed by the project laboratory coordinator or designee to indicate that the calculations and data had been approved and reviewed. All appropriate blank corrections were applied to data before it was released from the laboratory.

4.0 RESULTS

4.1 Shroud Performance

Based upon field use, the ENSR shroud and capture system design for this program appears to have proven successful in capturing gas emissions from the coke oven door and directing the gases to the sampling systems. The curtain itself was easily installed, proved to be durable, and could be tightly fastened to the buckstays in a short period of time. There was no visible evidence of condensation of organics on the curtain itself throughout the validation test period and the deposition of materials on the removable section of ductwork proved to be negligible. The only location which did not always appear to be leak tight was where the hood of the capture system attached to the top of the buckstays. Here, heavy build up of debris and tar created an uneven surface which was difficult to seal. Although cleaning of these areas before installing the hood was attempted, it proved to be extremely difficult. The sheet metal hood could not conform to the resulting irregularities and, as a result, spaces of up to 1 1/2 inches were visible during some sampling runs. It did not appear, however, that there were any losses of coke oven door emissions from these spaces. No visible smoke was noticed to be exiting those spaces during any of the tests, and the measured static pressure in the shroud was negative. On the contrary, fugitive emissions from the top of the battery may have been transferred into these spaces causing the collected samples to over present the emission rate estimates for the specific VEO leak class. Thus, for some sample data presented in this report, the mass emission rates may be overstated.

Two possible solutions to this problem are presented. First, the area at the top of the buckstays could be cleaned prior to the test program. ENSR will request that the target coke plants attempt to remove as much debris as possible from the selected coke batteries, particularly near the top of the buckstays, prior to our initiation of the source testing program at these facilities. Second, the hood could be outfitted with a flexible and thermally stable material along its edge to accommodate slightly irregular surfaces. ENSR is attempting to identify a material that can be attached to the sheet metal and which would eliminate this problem. ENSR is also recommending the use of smoke sticks, prior to the initiation of sampling collection from the shroud, as a qualitative indicator that leakage into shroud is not a factor in the mass loading for a specific sample run.

Installation and removal times for the shroud proved adequate (i.e., both installation and take down could each be achieved in about 10 minutes) but access to the tested oven doors was sometimes limited by the heavy machinery (pusher car, larry car, etc.) in use at the battery and

the coke pushing schedule. The use of a man-lift to access the oven doors proved to be extremely useful in the setup and take down of the shroud. The blower, ductwork and flexible hose all proved to be easily transportable and easy to set up in a short period of time.

As discussed earlier in this report, maintaining the shroud at a slightly negative pressure (-0.5 inches of water or -12.7 mm water) was necessary to insure that quantitative capture of door leak emissions took place during sample collection. However, maintaining the shroud under slight negative pressure has the potential disadvantage of enhancing the mass emission rates from the target coke oven doors. Internal oven pressures are a function of the time into the coking cycle. Early in the coking cycle, oven pressures vary from +250 mm water to about +50 mm water over the first hour of the cycle, and typically lie between +8 mm water and +12 mm water for much of the remaining coking cycle. The additional pressure differential present after the first hour of the coking cycle, due to the slightly negative pressures within the shroud, may have biased specific samples collected by ENSR as a result of the potential doubling of the pressure drop between the oven in interior and the shroud interior. Thus, although the maintenance of a slightly negative pressure within the shroud system is necessary to insure the complete capture of emissions during the sample collection program, this may lead to the overestimation of the BSO mass emission rates. ENSR plans on evaluating the performance of the shroud at about -0.25 inches of water in an attempt to further minimize the overestimation of the BSO mass emission rates.

4.2 OVA Performance

As discussed in Section 2.0, the OVA proved to be inappropriate for determining steady-state operation of the capture system. The instrument responded slowly and would not return to normal operation following sampling. This was probably due to the presence of semivolatile organics in the gas stream. Although the OVA may not be the appropriate instrument to determine steady state operations, visible observations of the blower exhaust indicate that equilibrium is reached almost immediately after the blower is turned on. To ensure equilibrium, the blower is allowed to run at least 5 minutes prior to sample collection.

4.3 Method 5G Performance

A significant fraction of the collected sample mass for all measurements was associated with the Method 5G probe rinse. In fact, for five (5) of twelve (12) sample runs all of the collected BSO mass was associated with the probe rinse after correction for solvent and filter blank BSO levels. ENSR had not anticipated that the probe rinse would account for a majority of the BSO mass collected for these samples. Although ENSR did determine solvent BSO blank levels, quality assurance studies on probe rinse blanks were inadequate. ENSR intends on conducting

additional quality assurance studies to address this issue. In addition, ENSR is proposing that a comparison study be conducted using Method 5G with a heated (248°F) and an unheated probe to reduce or eliminate the fraction of BSO mass collected on the probe, as compared with the filters.

Because of the probe rinse blank issue, it is difficult to provide final judgement on the use of Method 5G for the present application. Although Method 5G did allow for the collection of measurable BSO mass for probe rinses for all runs, after including blank corrected filter BSO mass, only nine of twelve sampling runs produce quantitative (lb/hr) results. In spite of this, ENSR believes that Method 5G will prove satisfactory for the present application after additional quality assurance studies are completed and a modification of the collection approach to increase the sample volume collected is executed.

Because of the amount of coking debris on the outside of the ovens, ENSR is recommending that Method 5G sampling train blanks be used to determine BSO emission rates for heated, but empty coke ovens. This effort will assist in properly allocating the mass emissions to door leaks, as opposed to coke debris around the batteries.

Total particulate results from the study are shown by sampling run number in Table 4-1, the BSO results are shown by sampling run number in Table 4-2. All BSO data shown in Table 4-2 have been corrected for solvent and/or field (filter) blanks, but not for BSO background levels in the vicinity of the battery. When the filter blank data exceeded the BSO mass values for a field sample, a negative value was the result. The filter blank value used for the method validation study was sufficiently high to result in a number of negative values, particularly for VEO classes 0 and 0.5. Additional filter blanking procedures and filter blank BSO quality assurance measurements will be required to resolve this issue.

As discussed above, total mass emission rates for each run were developed by including all negative filter BSO mass values with the probe rinse BSO mass results. This data reporting approach emphasizes the overall uncertainties associated with the initial round of sampling conducted under the present method validation study. Thus, when reviewing the method validation study results, the mass emission rates for the VEO classes of 0 and 0.5 should be viewed as having a large degree of uncertainty due to the fairly high filter blank BSO level. No BSO breakthrough to the back-half filter was found during the method validation study. Background BSO results were extremely low (less than 2 mg/m^3) and, thus, did not influence the mass measurements presented here. A comparison of the Method 5G particulate and BSO results in lbs/hr is shown in Figure 4-1. The percent of BSO in the collected particulate ranged from 24% to 85% for samples with measurable filter BSO levels. Although the number of data points in the present study are limited, there appears to be a direct relationship between a higher

TABLE 4-1

Method 5–G Particulate Emission Rates

Run #	Initial Front Filter Wt. (grams)	Final Front Filter Wt. (grams)	Initial Back Filter Wt. (grams)	Final Back Filter Wt. (grams)	Front Half Rinse Wt. (grams)	Weight Gain (g/sample)	Sample Volume (dscf)	Conc. (g/dscf)	Conc. (gr/dscf)	System Flowrate (dscfm)	Emission Rate (lbs/hr)	Leak Category
1	0.6124	0.6490	0.6160	0.6160	0.0032	0.0398	16.746	0.0024	0.0367	279	0.0877	3.0
2	0.6038	0.6562	0.6152	0.6127	0.0034	0.0533	16.486	0.0032	0.0499	277	0.1185	3.0
3	0.6165	0.6640	0.6156	0.6149	0.0103	0.0571	15.952	0.0036	0.0552	271	0.1283	2.0
4	0.6258	0.6391	0.6341	0.6344	0.0036	0.0172	15.550	0.0011	0.0171	265	0.0388	1.0
5	0.6310	0.6356	0.6210	0.6212	0.0086	0.0134	15.445	0.0009	0.0134	249	0.0286	0.5
6	0.6165	0.6214	0.6083	0.6094	0.0088	0.0148	15.317	0.0010	0.0149	258	0.0330	1.0
7	0.6076	0.8581	0.6105	0.6102	0.0111	0.2613	15.222	0.0172	0.2649	255	0.5790	4.0
8	0.6083	0.6877	0.6110	0.6119	0.0102	0.0905	15.064	0.0060	0.0927	254	0.2018	3.0
9	0.6250	0.6237	0.6258	0.6256	0.0060	0.0045	14.870	0.0003	0.0047	250	0.0100	1.0
10	0.6142	0.6161	0.6207	0.6207	0.0044	0.0063	14.575	0.0004	0.0067	245	0.0140	0.5
11	0.6163	0.6176	0.6116	0.6114	0.0033	0.0044	14.317	0.0003	0.0047	245	0.0100	0.0
12	0.6152	0.6178	0.6063	0.5984	0.0043	-0.0010	15.040	-0.0001	-0.0010	256	-0.0023	0.5

TABLE 4–2
Method 5–G BSO Emission Rates

Run #	Front Filter BSO (grams*)	Back Filter BSO (grams*)	Front Half Rinse BSO (grams*)	Total Weight Gain (g/sample*)	Sample Volume (dscf)	Conc. (g/dscf)	System Flowrate (dscfm)	Emission Rate (lbs/hr)	Leak Category
1	0.0237	-0.0044	0.0032	0.0225	16.746	0.0013	279	0.0496	3.0
2	0.0396	-0.0042	0.0034	0.0388	16.486	0.0024	277	0.0862	3.0
3	0.0431	-0.0047	0.0103	0.0487	15.952	0.0031	271	0.1094	2.0
4	0.0052	-0.0044	0.0036	0.0044	15.550	0.0003	265	0.0099	1.0
5	-0.0007	-0.0041	0.0086	0.0038	15.445	0.0002	249	0.0081	0.5
6	-0.0008	-0.0044	0.0088	0.0036	15.317	0.0002	258	0.0080	1.0
7	0.2118	-0.0039	0.0111	0.2190	15.222	0.0144	255	0.4853	4.0
8	0.0673	-0.0041	0.0102	0.0734	15.064	0.0049	254	0.1637	3.0
9	-0.0026	-0.0045	0.0060	-0.0011	14.870	-0.0001	250	-0.0024	1.0
10	-0.0025	-0.0043	0.0044	-0.0024	14.575	-0.0002	245	-0.0053	0.5
11	-0.0031	-0.0042	0.0033	-0.0040	14.317	-0.0003	245	-0.0091	0.0
12	0.0010	-0.0035	0.0043	0.0018	15.040	0.0001	256	0.0041	0.5

* (Solvent blank and field blank corrected.)

Run #	5-G particulate (lbs/hr)	5-G BSO (lbs/hr)	Leak Category
1	0.088	0.050	3
2	0.119	0.086	3
3	0.128	0.109	2
4	0.039	0.010	1
5	0.029	0.008	1/2
6	0.033	0.008	1
7	0.579	0.485	4
8	0.202	0.164	3
9	0.010	-0.002	1
10	0.014	-0.005	1/2
11	0.010	-0.009	0
12	-0.002	0.004	1/2

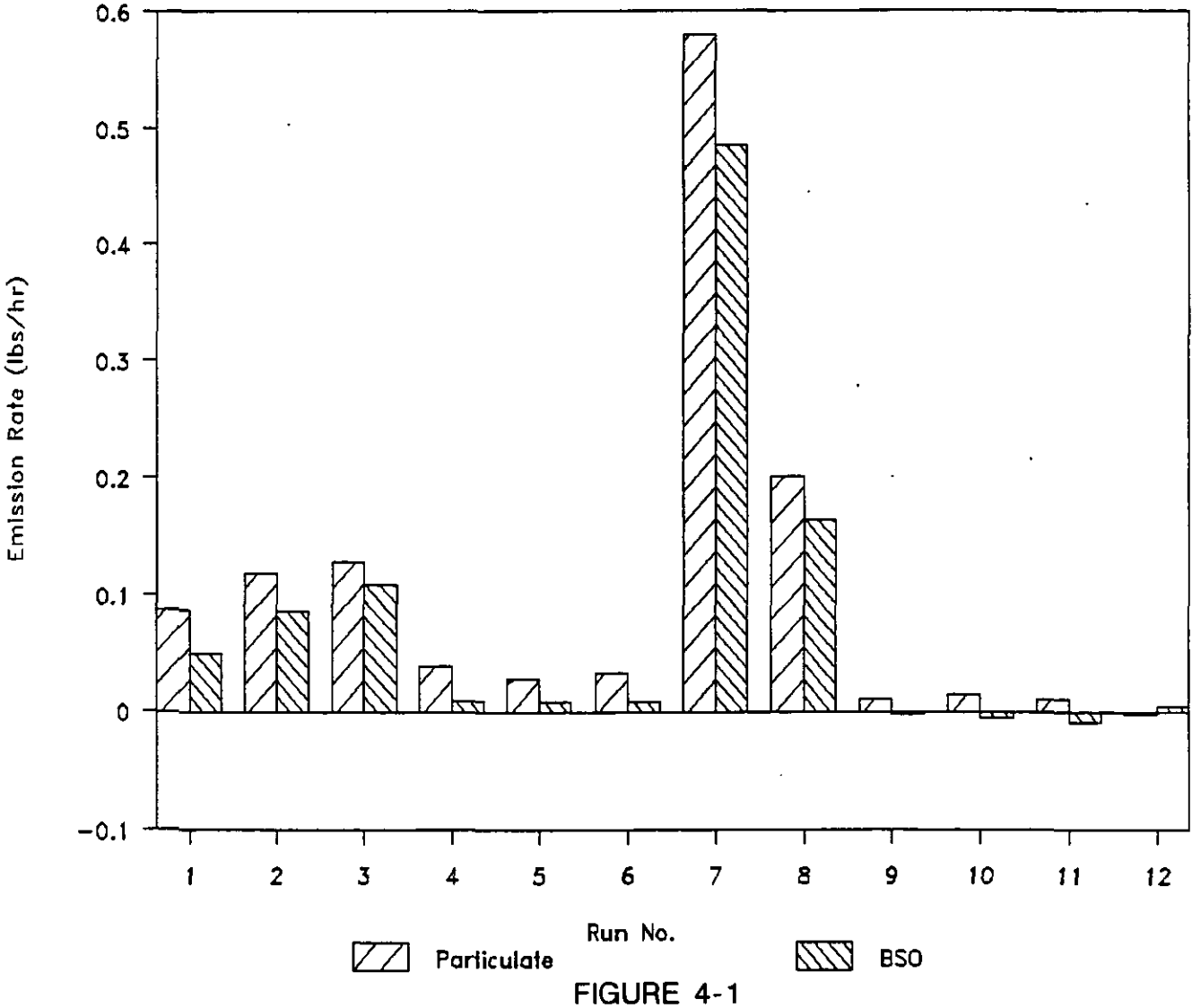


FIGURE 4-1
Comparison of the Method 5G Particulate and BSO Results

percent BSO and the relative VEO classification. Mean particulate and BSO emission rates (lbs/hr) are shown by VEO leak classification in Figure 4-2. Although the number of data points for each VEO classification is small, there is a consistent emission rate trend downward from leak class 4 to 0. Also, as both Figures 4-1 and 4-2 reveal, there appears to be some overlap associated with the BSO mass emission rates between a number of the VEO leak classes. These data indicate that the collection of larger sample volumes will be necessary to obtain sufficient sample quantities, particularly at the 0 and 0.5 VEO leak classes.

4.4 PS-1 Performance

Although the PS-1 samplers performed well during the field portion of the study, quality control experiments conducted prior to the method validation study indicated that the PUFs had relatively high BSO blank levels, even after two consecutive, 16 hour Soxhlet extractions. Thus, due to extensive clean-up requirements, the PUF adsorbent was not ideal for the present application. Total particulate results from the study are shown by sampling run number in Table 4-3, the BSO results are shown by sampling run number in Table 4-4. All BSO data shown in Table 4-4 have been corrected for solvent and field (filter and PUF) blanks, but not for BSO background levels in the vicinity of the battery. Only 4 PUFs (Runs 3, 7, 8, and 9) were analyzed for BSO, due to the better performance of the Method 5G sampling train. A comparison of the PS-1 and Method 5G BSO results in lbs/hr is shown in Figure 4-3. Although the PS-1 and Method 5G trends are consistent across VEO classes, the two sampling methods do not appear to provide equivalent results. These differences are partially due to lack of PUF extraction for 8 of the samples; however, other factors also could influence these differences. For example, Method 5G facilitates isokinetic sampling, while this cannot be accomplished with the PS-1. Also, no solvent rinsate was collected from the teflon sample line for the PS-1 samplers. Based on our experience with the Method 5G probe rinse, it is likely that sample losses to the teflon sample line occurred during the validation study. Thus, the PS-1 sampler could be modified to collect larger samples of BSO mass; however, additional effort would be required to identify a suitable alternative back-half material to substitute for PUF and additional quality assurance steps are required to establish teflon sampling line BSO rinsate blank levels.

leak category	Method 5-G ave. particulate emission rate lbs/hr	Method 5-G ave. BSO emission rate lbs/hr
0	0.010	-0.009
0.5	0.013	0.002
1	0.027	0.005
2	0.128	0.109
3	0.136	0.100
4	0.579	0.485

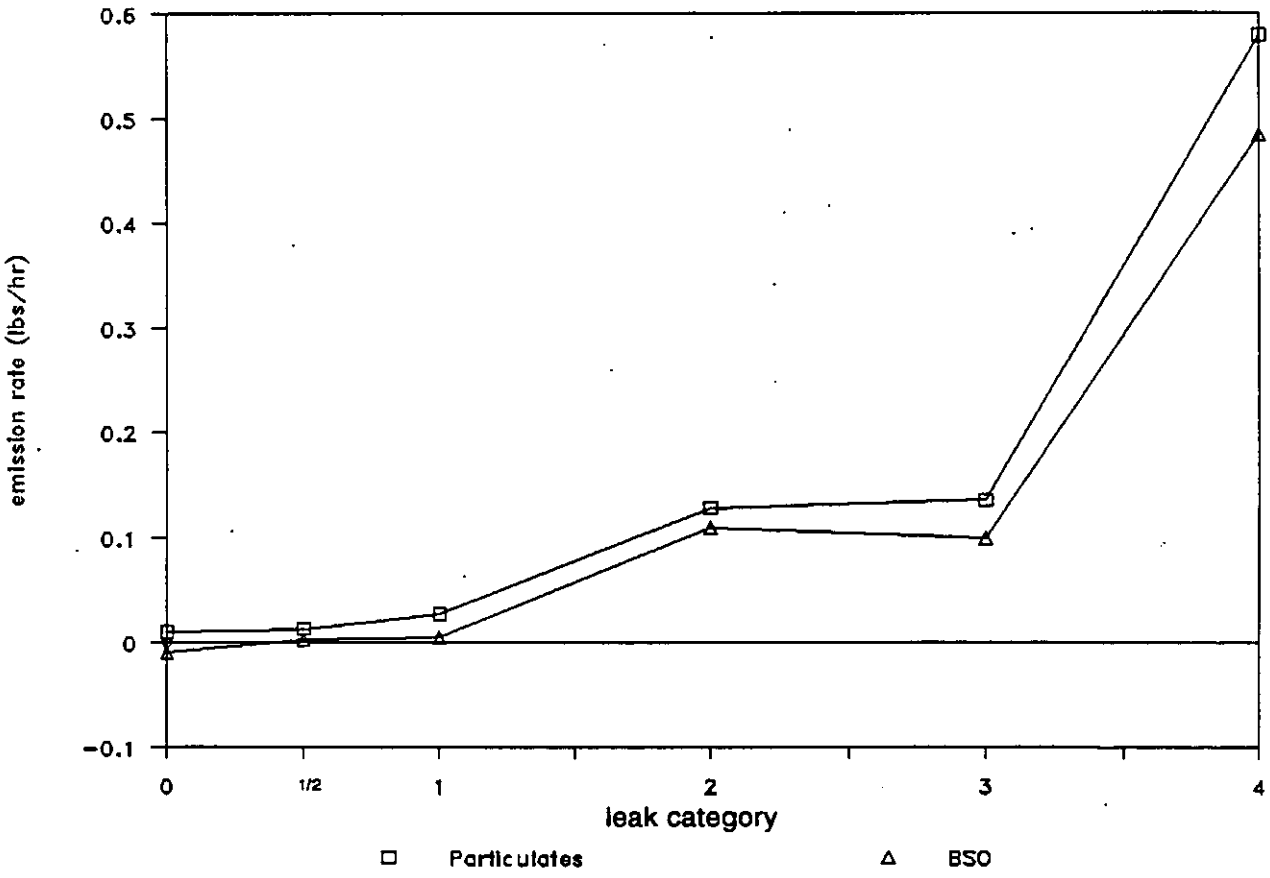


FIGURE 4-2

Mean Particulate and BSO Emission Rates

TABLE 4-3

PS-1 Particulate Emission Rates

Run #	Initial Filter Wt. (grams)	Final Filter Wt. (grams)	Weight Gain (g/sample)	Sample Volume (std m3)	Conc. (g/m3)	Conc. (gr/dscf)	System Flowrate (dscfm)	Emission Rate (lbs/hr)	Leak Category
1	0.4130	0.5372	0.1242	3.105	0.0400	0.0175	279	0.0418	3.0
2	0.4189	0.6128	0.1939	2.925	0.0663	0.0290	277	0.0688	3.0
3	0.4192	0.6279	0.2087	2.940	0.0710	0.0310	271	0.0721	2.0
4	0.4203	0.4958	0.0755	3.165	0.0239	0.0104	265	0.0237	1.0
5	0.4147	0.4387	0.0240	3.225	0.0074	0.0033	249	0.0069	0.5
6	0.4134	0.4344	0.0210	3.270	0.0064	0.0028	258	0.0062	1.0
7	0.4123	0.9381	0.5258	2.325	0.2262	0.0988	255	0.2160	4.0
8	0.4190	0.7898	0.3708	2.730	0.1358	0.0594	254	0.1292	3.0
9	0.4104	0.4207	0.0103	3.300	0.0031	0.0014	250	0.0029	1.0
10	0.4171	0.4255	0.0084	3.165	0.0027	0.0012	245	0.0024	0.5
11	0.4204	0.4293	0.0089	3.285	0.0027	0.0012	245	0.0025	0.0
12	0.4142	0.4399	0.0257	3.285	0.0078	0.0034	256	0.0075	0.5

TABLE 4–4
PS–1 BSO Emission Rates

Run #	Total BSO (g/sample*)	Sample Volume (std m3)	Conc. (g/m3)	Conc. (g/dscf)	System Flowrate (dscfm)	Emission Rate (lbs/hr)	Leak Category
1	0.0964	3.105	0.0310	0.0009	279	0.0324	3.0
2	0.3291	2.925	0.1125	0.0032	277	0.1167	3.0
3	0.1899	2.940	0.0646	0.0018	271	0.0656	2.0
4	0.0692	3.165	0.0219	0.0006	265	0.0217	1.0
5	0.0195	3.225	0.0060	0.0002	249	0.0056	0.5
6	0.0192	3.270	0.0059	0.0002	258	0.0057	1.0
7	0.4834	2.325	0.2079	0.0059	255	0.1986	4.0
8	0.3301	2.730	0.1209	0.0034	254	0.1150	3.0
9	0.0093	3.300	0.0028	0.0001	250	0.0026	1.0
10	0.0065	3.165	0.0021	0.0001	245	0.0019	0.5
11	0.0070	3.285	0.0021	0.0001	245	0.0020	0.0
12	0.0114	3.285	0.0035	0.0001	256	0.0033	0.5

* (Solvent blank and field blank corrected)

leak category	Modified PS-1 ave. BSO emission rate lbs/hr	Method 5-G ave. BSO emission rate lbs/hr
0	0.002	-0.009
0.5	0.004	0.002
1	0.010	0.005
2	0.066	0.109
3	0.088	0.100
4	0.199	0.485

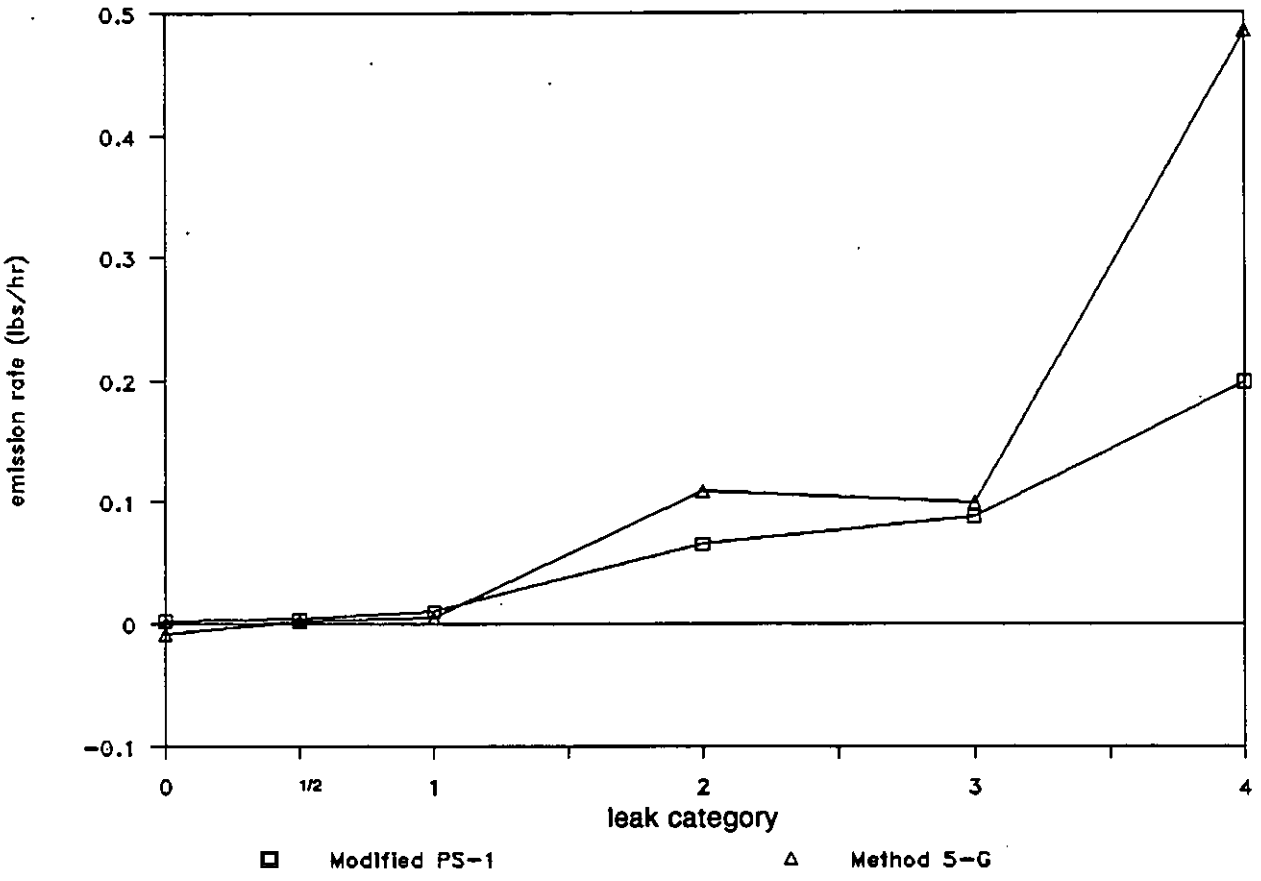


FIGURE 4-3

Comparison of the PS-1 and Method 5G BSO Results

5.0 CONCLUSIONS AND RECOMMENDATIONS

Overall, ENSR views the method validation study as a success. We were able to resolve most of the key technical issues which focus directly on the feasibility of collecting mass emission data from individual leaking coke oven doors. However, as is common when new and *untried* testing procedures are attempted for a specific application, additional and unforeseen quality assurance issues must be resolved prior to the complete validation of the measurement method. The following discussion summarizes ENSR's important findings from completing the method validation study and includes recommended quality assurance procedures that should be completed to properly validate the proposed enclosure and testing procedures.

The method validation study indicated that the ENSR-designed flexible curtain shroud could be installed rapidly (10 minutes) once a candidate coke oven door is identified. The procedure used by ENSR to attach the shroud to the buckstays, combined with a flow rate of 250 dscfm, eliminated any losses from the collection system (i.e., the collection efficiency of the shroud was quantitative). In ENSR's draft sampling plan, there was some discussion concerning the need to vary the flow rate through the collection system by using an adjustable blower. Results from the method validation study indicate that at the constant flow rate of 250 dscfm, quantitative results can be obtained throughout the range of VEO door leak classification.

A major concern regarding the ENSR sampling procedure was whether the VEO classification would change over the sample collection period of 15 minutes. For 10 of 12 runs there was no change in VEO classification before and after shroud setup, sampling and shroud takedown. The runs where the VEO classification changed were on doors that fluctuated between the VEO classification of 0.5 and 1.0. Thus, the use of the VEO class of 0.5 may add some uncertainty to the mass emission-VEO correlation at the lower portion of the door leak classification range. To resolve some of the uncertainty between the 0.5 and 1 VEO leak classes, ENSR is recommending that during our field sampling effort we attempt to collect approximately twice as many samples at these VEO leak classes than at the higher (i.e., 3 and 4) VEO leak classes.

The short sampling duration recommended by ENSR posed a potential quantitation limit problem with the use of Method 5G. ENSR had previously estimated that the total particulate Method 5G quantitation limit would be in the range of 2 mg to 5 mg. Sufficient total particulate mass was collected for virtually all runs, although at the lower VEO classes 0 and 0.5 the mass collected was near the quantitation limit. Measurable quantities of BSO were found at most VEO door leak classes. Correcting all samples collected for background BSO levels along the bench proved unnecessary due to the low values found in the present study. However, to reduce the

uncertainty of the mass emission rates at the 0 and 0.5 VEO leak classes, a larger sample volume will be required.

As noted previously, the results from the method validation study indicate that a significant fraction of the collected sample mass for all measurements is associated with the Method 5G probe rinse. After correcting for solvent and filter blank BSO levels, five (5) of twelve (12) sample runs indicated that all of the collected BSO mass was associated with the probe rinse. ENSR had not anticipated that the probe rinse would account for a majority of the BSO mass collected for these samples. Because the majority of the BSO collected in the present effort was in the probe rinse, the results presented in this report have a high degree of uncertainty until a thorough probe rinse blank quality assurance study is completed. Although ENSR did determine solvent blank BSO levels, thorough quality assurance studies on probe rinse blanks were not conducted. ENSR intends on conducting additional quality assurance studies to address this issue. ENSR also is proposing that we attempt to conduct a side-by-side study using Method 5G with a heated probe (248° F as required in EPA Method 5) and an unheated probe to reduce or eliminate the amount of BSO mass collected on the probe.

An unanticipated finding from the method validation study was that the Method 5G filter blank BSO levels were fairly high. To reduce the importance of BSO filter blanks, ENSR will implement three changes to the filter analysis quality assurance procedures. First, all filters will be blanked in the laboratory using a muffle furnace. This filter pretreatment procedure will reduce the organic blank on the filters used in the study. Second, a filter blank study will be run on six (6) filters that have been pretreated in the muffle furnace. Finally, ENSR will use the same glass fiber filter material (Whatman EPM 2000, or equivalent) used in the PS-1 samples for the Method 5G train, since our studies indicate that these filters are associated with a very low BSO blank level. These filter handling changes will increase the sensitivity and precision of the overall sampling and analytical procedures used in this study, resulting in lower BSO filter blanks.

Although the number of samples collected in the method validation study was small, as expected, there appears to be some overlap between the BSO mass emission rates and low VEO classes. The additional quality assurance procedures outlined below, along with an increase in the collected sample volume size will help resolve whether the cause of the mass emission-VEO class overlap is due to the overall imprecision of the capture, sampling and analytical procedures used in this study, or an inherent result of the variability associated with the mass emission-VEO classification relationship.

ENSR has reviewed the findings from the method validation study and concludes that our original approach as outlined in the draft sampling plan is fundamentally sound and is capable of collecting representative BSO samples from leaking coke oven doors. However, a thorough

analysis of the mass emission data collected can only be completed with sufficient oven data from the coke ovens being evaluated. These data include pressure, time into the coking cycle and any plant specific data that may influence the magnitude of coke oven door leaks.

ENSR is recommending that additional method validation studies be conducted prior to finalizing the overall sampling plan. These additional efforts would include:

- Develop a coke oven information data sheet that would be completed by operators at the target coke plants. The information will include, but not be limited to, data on oven size, age, pressure and time into the coking cycle;

- Request that the target coke plant remove debris on the coke battery (particularly at the top of the buckstays) that will be used to collect the door leak samples, prior to our testing efforts on these batteries;

- Attempt to reduce the negative pressure within the shroud from approximately -0.5 inches of water to -0.25 inches of water;

- Identify and attach a suitable, heat-resistant material to the sheet metal portion of the shroud to reduce the potential of leakage into the sample collection system. Smoke sticks would be used as a qualitative indicator of the success of this shroud modification;

- Conduct quality assurance studies on probe rinse BSO blank levels. This would be accomplished by conducting rinsing of the probes with dichloromethane in triplicate and analyzing the collected rinsate separately;

- Conduct a filter pretreatment procedure with a muffle furnace and run a filter blank study. Switch Method 5G glass fiber filter vendors to take advantage of a lower BSO blank level;

- Conduct a side-by-side comparison using Method 5G with a heated (248°F) and an unheated probe to determine the amount of BSO mass collected on the probe. The additional sampling effort will be conducted at the VEO classes 0.5, 1, and 2;

- Conduct a Method 5G field blank study by collecting three (3) sets of BSO samples through the shroud on a heated, but empty coke oven; and

- Use a high volume sampling procedure (45 cfm) for the determination of background BSO levels in the vicinity of the target coke ovens. Such a sampling approach would provide more relevant background BSO data for the specific source sampling time interval.

ENSR also proposes to implement a modification to the sampling procedures used during the first method validation study. Due to the sampling capacity of a standard Method 5G sampling train, it was not possible to collect larger sample volumes during the required 15 minute sample collection period. In order to address this issue, ENSR will attempt to increase the total collected sample volumes by approximate 50% by modifying the Method 5G sampling train. This would be accomplished by using two Method 5G sample pumps in parallel, replacing the zero to 10 inch water manometer in the control box with a zero to 20 inch manometer, and increasing the nozzle diameter to allow isokinetic sampling to take place at a higher sample flow rate. The resulting sample volume would allow the collection of greater BSO mass and should result in increased precision and accuracy of the measurements, particularly at the lower VEO leak classes.

Finally, although the total number of samples collected during the method validation study was small and a number of quality assurance issues still need to be resolved, the results from this effort support the idea that BSO mass emission rates from leaking coke oven doors are a function of the severity of the VEO classification for each individual door. For example, in the previous effort, ENSR found that there was approximately a 200-fold difference in the BSO mass emission rates for a 0.5 VEO class leak as compared to a 4 VEO class leak. By completing the additional studies outlined above and by implementing the entire field sampling effort for the present project, sufficient data may be generated to "validate" the BSO mass emission rate - VEO classification correlation for coke oven door leaks.

AISI Blower Orifice Calibration

Date: June 25, 1991

Duct Dia: 6 inches

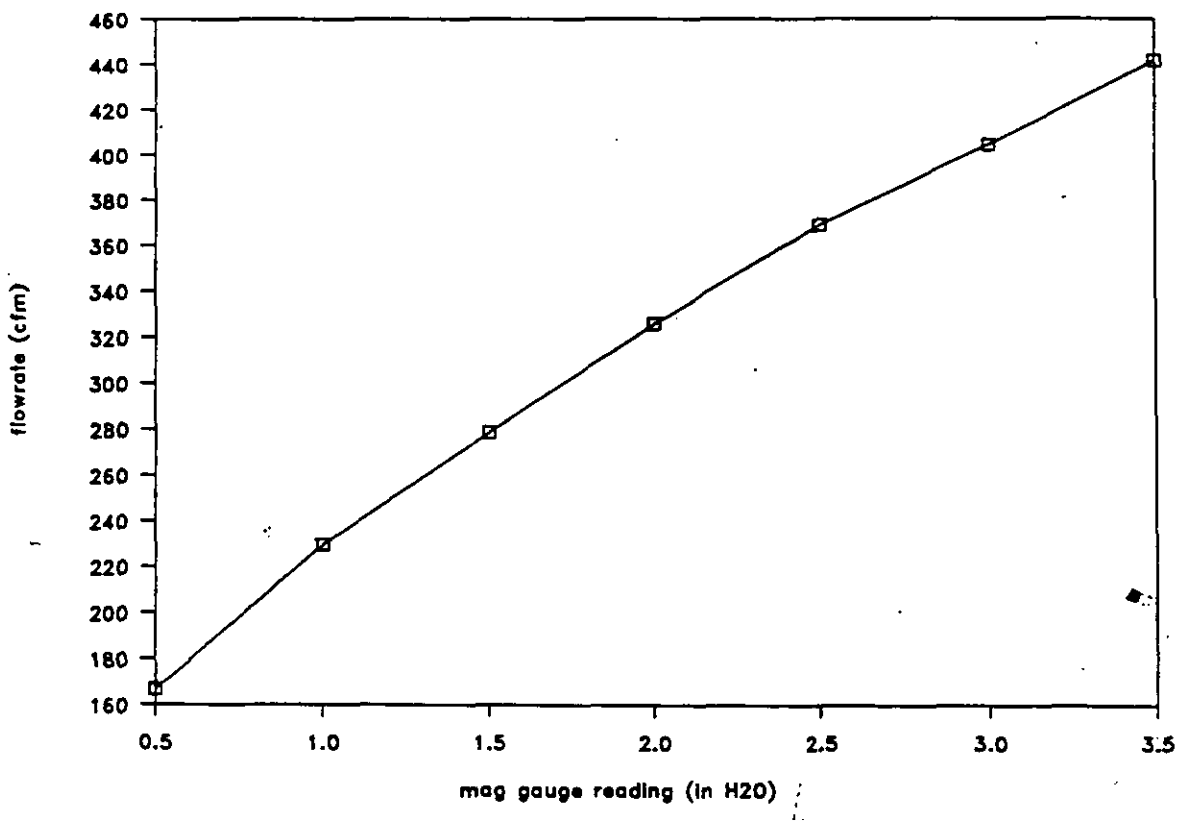
Bar Press: 762 mm Hg

Pitot Coef: 0.99

Temp: 22.5 deg C

Static Press: 1.5 in. H2O

mag gauge reading (in H2O)	diff. press. (in H2O)	velocity (fpm)	volumetric flowrate (cfm)	volumetric flowrate (m3/min)
0.5	0.045	850	166.90	4.73
1.0	0.085	1170	229.73	6.51
1.5	0.125	1420	278.82	7.90
2.0	0.170	1660	325.94	9.23
2.5	0.220	1880	369.14	10.45
3.0	0.265	2060	404.48	11.45
3.5	0.315	2250	441.79	12.51



DRY GAS METER POST-TEST

Operator: J. Gallagher

Project: AISE (Arnco)

Barometric pressure, Pb= 29.93 in. Hg

Date: 7-15-91

Max. Vac. 3 Ave. Delta H@ 4.0

Meter #: 80184

Orifice Press. Setting ΔH @ in. H20	Volume Wet Meter Vw ft3	Volume Dry Meter Vd ft3	Temperature				Time θ min.	Vac. " Hg	Y	Δ H @
			Wet Meter Tw F	Dry in Meter Tdi F	Dryout Meter Tdo F	Dryave Meter Td F				
4.0	10	10.055	71	77/84	73/75	77.25	9.49	3	.9976	1.9976
4.0	10	10.275	71	80/87	75/77	79.25	9.44	3	.9808	1.9675
4.0	10	10.444	71	84/90	78/79	82.75	9.51	3	.9703	1.9857
								Average	.983	1.984
								Pre-test	1.001	1.906
								% Deviation	1.8	7.8

Wet Test Meter Calibration Coefficient =

Y	Δ H @
Vw Pb(Td+460)	ΔH@ 0.0317(Tw+460)θ²
Vd(Pb+ Δ H/13.6)(Tw+460)	Pb(Td+460) Vw
10.012 29.93(72.25+460)	4.0317 (71+460) 9.49)²
10.055(29.93+4/13.6)(71+460)	29.93(72.25+460) 10.012
10.012 29.93(79.75+460)	4.0317 (71+460)(9.49)²
10.275(29.93+4/13.6)(71+460)	29.93(79.75+460) 10.012
10.012 29.93(82.75+460)	4.0317 (71+460)9.51)²
10.444(29.93+4/13.6)(71+460)	29.93(82.75+460) 10.012

Allowable Deviation = 5% of Pre-Test.

Y = Accuracy coefficient of dry test meter to wet test meter.

Δ H @ = Orifice pressure differential for 0.75 CFM at 70 degrees F and 29.92" Hg.

Maintenance Checklist

Vacuum system: Oil reservoir level ✓, Knockout jar ✓, Vacuum gage ✓, Leak check (no leak) 15" Hg ✓;

Quick connects: Clean ✓, Operational ✓, Clear ✓;

Manometer: No leaks ✓, Fluid level ✓, Clean ✓;

Fuses: 2.5 amp. Probe heater ✓, 7 amp. Pump ✓, 10 amp. Heater ✓;

Amphenol connector: Clean ✓, Tight ✓, Circuitry good ✓.

All items must be checked.

ENSR

DRY GAS METER CALIBRATION DATA
(English Units)

Date 2/8/90 Meter Box Number 80184

Barometric Pressure, P_b = 29.98 in. Hg Calibrated by Jim Morris

Orifice Manometer Setting (ΔH), in. H_2O	GAS VOLUME			TEMPERATURES			Time (θ), Min.	Y_i	ΔH@, in. H_2O
	Wet Test Meter (V_w), ft^3	Dry Gas Meter (V_d), ft^3	Wet Test Meter (t_w), F	Inlet (t_{d_i}) F	Outlet (t_{d_o}) F	Average (t_d) F			
0.5	5	5.091	63	76.7	71.3	74.0	13:03	1.001	1.867
1.0	5	5.108	63	81.0	74.0	77.5	9:48	1.005	1.933
2.0	10	10.256	63	85.7	80.0	82.9	13.70	1.007	1.999
							Avg.	1.004	1.933

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	$\Delta H@_i = \frac{0.0317\,\Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\,\theta}{V_w}\right]^2$
0.5	0.0368	1.001 = (5)(29.98)(534) / (5.091)(30.02)(523)	1.867 = (.0316) / (15919.38) [(523)(13.03) / 5]²
1.0	0.0737	1.005 = (5)(29.98)(538) / (5.108)(30.05)(523)	1.933 = (.0317) / (16129.24) [(523)(9.48) / 5]²
2.0	0.147	1.007 = (10)(29.98)(543) / (10.256)(30.13)(523)	1.999 = (.0634) / (16277.14) [(523)(13.70) / 10]²

* If there is only one thermometer on the dry gas meter, record the temperature under t_d

NOMENCLATURE:

V_w = Gas volume passing through the wet test meter, ft^3

V_d = Gas volume passing through the dry gas meter, ft^3

t_w = Temperature of the gas in the wet test meter, °F

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F

t_d = Average temperature of gas in dry gas meter, obtained by average t_{d_i} and t_{d_o} °F

ΔH = Pressure differential across orifice, in. H_2O

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run; tolerance Y_i = Y+0.02 Y.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all six runs; tolerance Y_i = Y+0.01 Y.

ΔH@i = Orifice pressure differential at each flow rate that gives 0.75 ft^3/min. of air at standard conditions for each calibration run, in. H_2O; Tolerance = ΔH@±0.15 (recommended).

ΔH@ = Average orifice pressure differential that gives 0.75 ft^3/min. of air at standard conditions for all six runs, in. H_2O; Tolerance = 1.84±0.25 (recommended).

θ = Time for each calibration run, min.

P_b = Barometric pressure, in. Hg

NOZZLE CALIBRATION

Date 6/12/91 Calibrated By: JIM MORRIS

Nozzle Identification Number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	$D_{AVERAGE}$
2A	.125	.125	.126	.001	.125
3A	.188	.187	.188	.001	.188
4A	.250	.250	.250	.000	.250
5A	.314	.314	.312	.002	.313
6A	.378	.378	.377	.001	.378
8A	.504	.504	.504	.000	.504

Where:

$D_{1,2,3}$ = Nozzle diameter measured on a different diameter, in. Tolerance = measure within 0.001 in.

ΔD = Maximum difference in any two measurements, in. Tolerance = 0.004 in.

$D_{AVERAGE}$ = Average of D1, D2, and D3

TEMPERATURE SENSOR CALIBRATION DATA FORM

EXTERNAL IMPINGER OUTLET

DATE 5.5.90 THERMOCOUPLE NUMBER TC.K.8.1

AMBIENT TEMPERATURE _____ °F BAROMETRIC PRESSURE 29.64 in. Hg

CALIBRATOR L.E. Yarnell REFERENCE: MERCURY-IN-GLASS A.S. ASTM 1 (-10 TO 220°F)

OTHER _____

Reference Point Number	Source (Specify)	Reference Thermometer Temperature, °F	Thermocouple Potentiometer Temperature °F	Temperature Difference ± 5.4 °F
1	ICE BATH	32	29	-3
2	AMBIENT	64	64	0
3	HOT WATER	149	150	+1
4	BOILING WATER	211	209	-2

TEMPERATURE SENSOR CALIBRATION DATA FORM

EXTERNAL IMPINGER OUTLET

DATE 5·5·90 THERMOCOUPLE NUMBER TC·K·6·1

AMBIENT TEMPERATURE 64 °F BAROMETRIC PRESSURE 29.64 in. Hg

CALIBRATOR [illegible] REFERENCE: MERCURY-IN-GLASS AES ASTM 1 (-10 TO 220°F)

OTHER

Reference Point Number	Source (Specify)	Reference Thermometer Temperature, °F	Thermocouple Potentiometer Temperature °F	Temperature Difference ± 5.4 °F
1	ICE BATH	32	30	-2
2	AMBIENT	64	64	0
3	HOT WATER	148	149	+1
4	BOILING WATER	211	213	+2

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

ATTACHED TO PROBE P-1-24"

Date 12·24·90 Thermocouple number TC-K-1-48"

Ambient temperature 67 °F Barometric pressure 29.40 in. Hg

Calibrator L. E. Myers / Reference: mercury-in-glass AES-ASTM 0-220°F

other

Reference point number	Source[a] (specify)	Reference thermometer temperature, °F	Thermocouple potentiometer temperature, °F	Temperature difference,[b] %
1	ICE BATH D.I.I.	32	34.6	-0.4
2	AMBIENT ROOM TEMP.	67	685	-0.1
3	BOILING WATER D.I.I	210	211	-0.1

[a] Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, } °F + 460) - (\text{test thermom temp, } °F + 460)}{\text{ref temp, } °F + 460}\right] 100 \leq 1.5\%$.

Quality Assurance Handbook M5-2.5

TEMPERATURE SENSOR CALIBRATION DATA FORM

INSTALLED OGM OUT 1187.3C

DATE 5.5.90 THERMOCOUPLE NUMBER TC-K-2-2

AMBIENT TEMPERATURE 64 °F BAROMETRIC PRESSURE 29.64 in. Hg

CALIBRATOR Lisa E. Myers REFERENCE: MERCURY-IN-GLASS AES ASTM 1 (-10 TO 220 °F)

OTHER

Reference Point Number	Source (Specify)	Reference Thermometer Temperature, °F	Thermocouple Potentiometer Temperature °F	Temperature Difference ± 5.4 °F*
1	ICE BATH	32	30	-2
2	AMBIENT	64	65	+1
3	BOILING WATER	211	212	+1

TEMPERATURE SENSOR CALIBRATION DATA FORM

INSTALLED OGM IN 1/87-307

DATE 5.5.90 THERMOCOUPLE NUMBER TC-K-2-1

AMBIENT TEMPERATURE 64 °F BAROMETRIC PRESSURE 29.64 in. Hg

CALIBRATOR L. E. Myers REFERENCE: MERCURY-IN-GLASS ARS ASTM 1 (-10 TO 220°F)

OTHER

Reference Point Number	Source (Specify)	Reference Thermometer Temperature, °F	Thermocouple Potentiometer Temperature °F	Temperature Difference ~~±~~ 5.4°F
1	ICE BATH	32	29	-3
2	AMBIENT	64	64	0
3	BOILING WATER	211	214	+3

ERT

SAMPLER CALIBRATION

Network AISI Site Modified PS-1 Sys No 1 2 3 4 5

Technician: RR Date 6-27-91 HI-VOL Serial No T002006

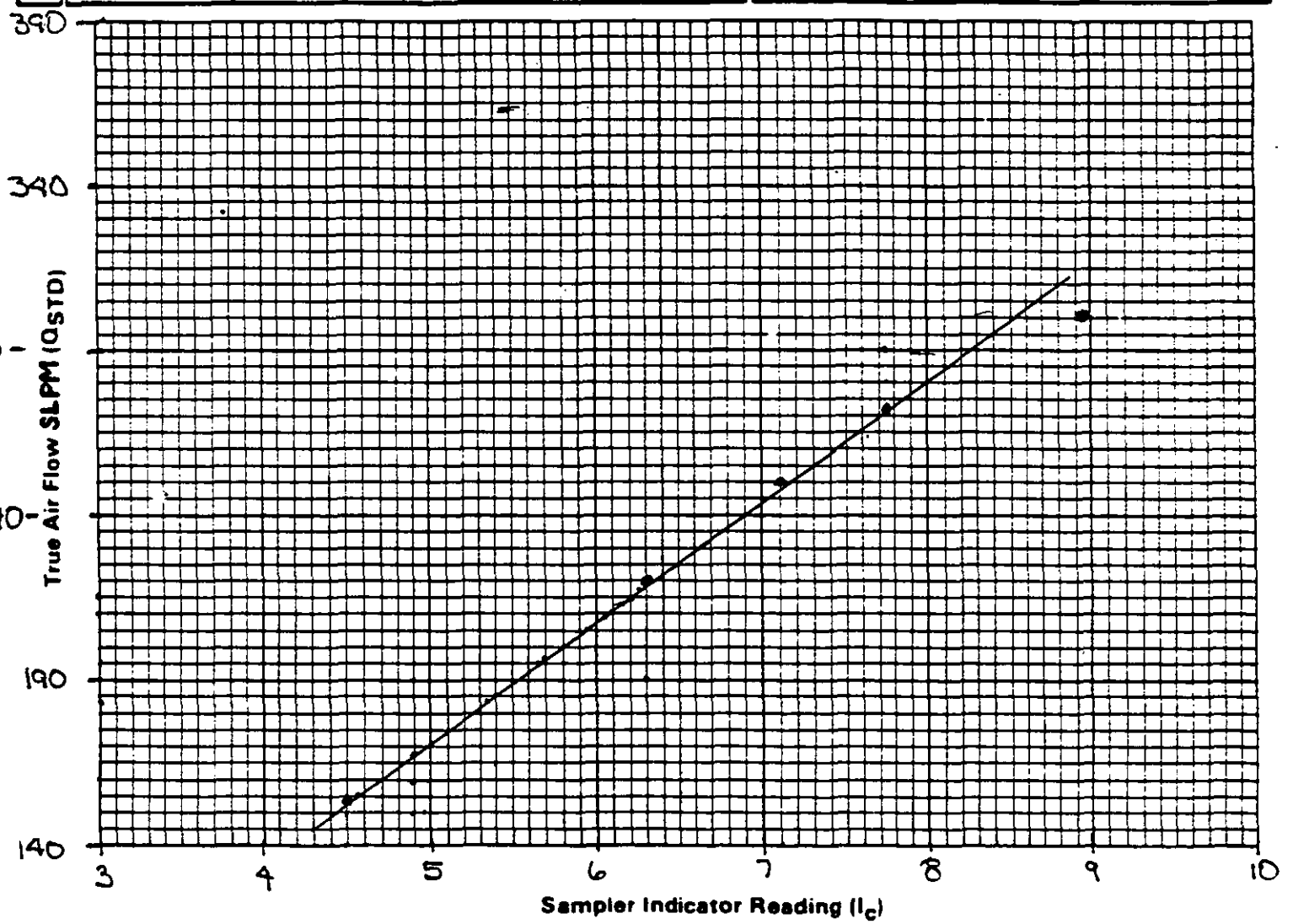
Orifice SN 47-C Cal. Date 12-14-90

Ambient Temp (K) 288.3 (=T_1) Barometric Pressure (mmHg) 760.3 (=P_1)

Seasonal Avg Temp. (K) 288 (=T_2) Site Mean Pressure (mmHg) 760 (=P_2)

Reason for Cal. ( ): ___ Motor/Brush Change ___ Quarterly Recal ___ New Hi-Vol ___ Other ✓ new project

Plate	ORIFICE: ΔH ("H_2O)	X 0.392 $\frac{P_1}{T_1}$ =	ΔH_c ("H_2O)	LOOK-UP Table: Q_{STD} (SLPM)	SAMPLER INDICATOR (Logarithmic): I	$\sqrt{T}$ X $\sqrt{\frac{P_1}{P_2} \times \frac{T_2}{T_1}}$ =		I_c
7	2.2	1.0338	2.27	154	20	4.47	0.9997	4.47
10	4.5	↓	4.65	220	40	6.32	↓	6.32
13	5.8		5.99	250	50	7.07		7.07
18	6.8		7.03	271	60	7.75		7.75
25	8.3	↓	8.58	300	80	8.94	↓	8.94
–								



QC Review ___ Flow Controller Set Point: ___

1.135-IP(10/84)

CALIBRATOR
ORIFICE
for
HIGH VOLUME AIR SAMPLER

CERTIFICATE
of
CALIBRATION

SERIAL NO. 472

BGI INCORPORATED
58 Guinan Street/Waltham, Massachusetts 02154/Telephone 617-891-9380

CALIBRATION WORK SHEET

Q_{STD}

For application ref. 1

(1) Run Point No.	(2) Elapsed Time - Δt Min.	(3) Initial Volume V_M M^3	(4) Meter Inlet Static Pressure-ΔP mm of Hg	(5) Standard Volume V_{STD} M^3	(6) Calibrator Orifice Static Press. ΔH in. of H_20	(7) Metric Flow Rate Q_{STD} M^3/min.	(8) English Flow Rate Q_{STD} ft^3/min.	(9) $\sqrt{\Delta H \left(\frac{Pa}{P_{STD}}\right)\left(\frac{298}{TA}\right)}$
1	7.091	1	3.2	1.045	2.0	0.147	5.2	
2	4.202	1	9.2	1.037	5.5	0.247	8.7	
3	3.369	1	14.2	1.030	8.5	0.306	10.8	
4	2.876	1	19.2	1.023	11.5	0.356	12.6	
5	2.548	1	24.1	1.017	14.5	0.399	14.1	
6	2.375	1	27.4	1.012	16.5	0.426	15.1	
7								

$V_{STD} = V_m \frac{(Pa-\Delta P)\, T_{STD}}{P_{STD}\, Ta}$

(7) and (8) are corrected to 760 mm of Hg 25° mm (298°K)

$Q_{STD} = \frac{V_{STD}}{\Delta t}$

$M^3 \times 35.31 = Ft^3$

Qa

For application see ref. 2

(1) Run Point No.	(2) Elapsed Time - Δt Min.	(3) Initial Volume Vm M^3	(4) Meter Inlet Static Pressure-ΔP mm of Hg	(5a) Actual Volume Va M^3	(6) Calibrator Orifice Static Press. ΔH in. of H_20	(7a) Metric Flow Rate Qa M^3/min.	(8a) $\sqrt{\Delta H \left(\frac{TA}{Pa}\right)}$
1	7.091	1	3.2	0.996	2.0	0.140	
2	4.202	1	9.2	0.988	5.5	0.235	
3	3.369	1	14.2	0.981	8.5	0.291	
4	2.876	1	19.2	0.975	11.5	0.339	
5	2.548	1	24.1	0.968	14.5	0.380	
6	2.375	1	27.4	0.964	16.5	0.406	
7							

$Va = Vm \frac{(PA-\Delta P)}{PA}$

$Qa = \frac{Va}{\Delta t}$

(9) Pa 781.3 mm of Hg

(10) Ta 19 °C + 273 = °K

(11) RH: 50 %

Roots Meter No.: 7509364

Calibrator Orifice:

Model No.: 40A

Serial No.: 47C

Calibration performed by: J. Lazaro

Calibration Code 12-14-90

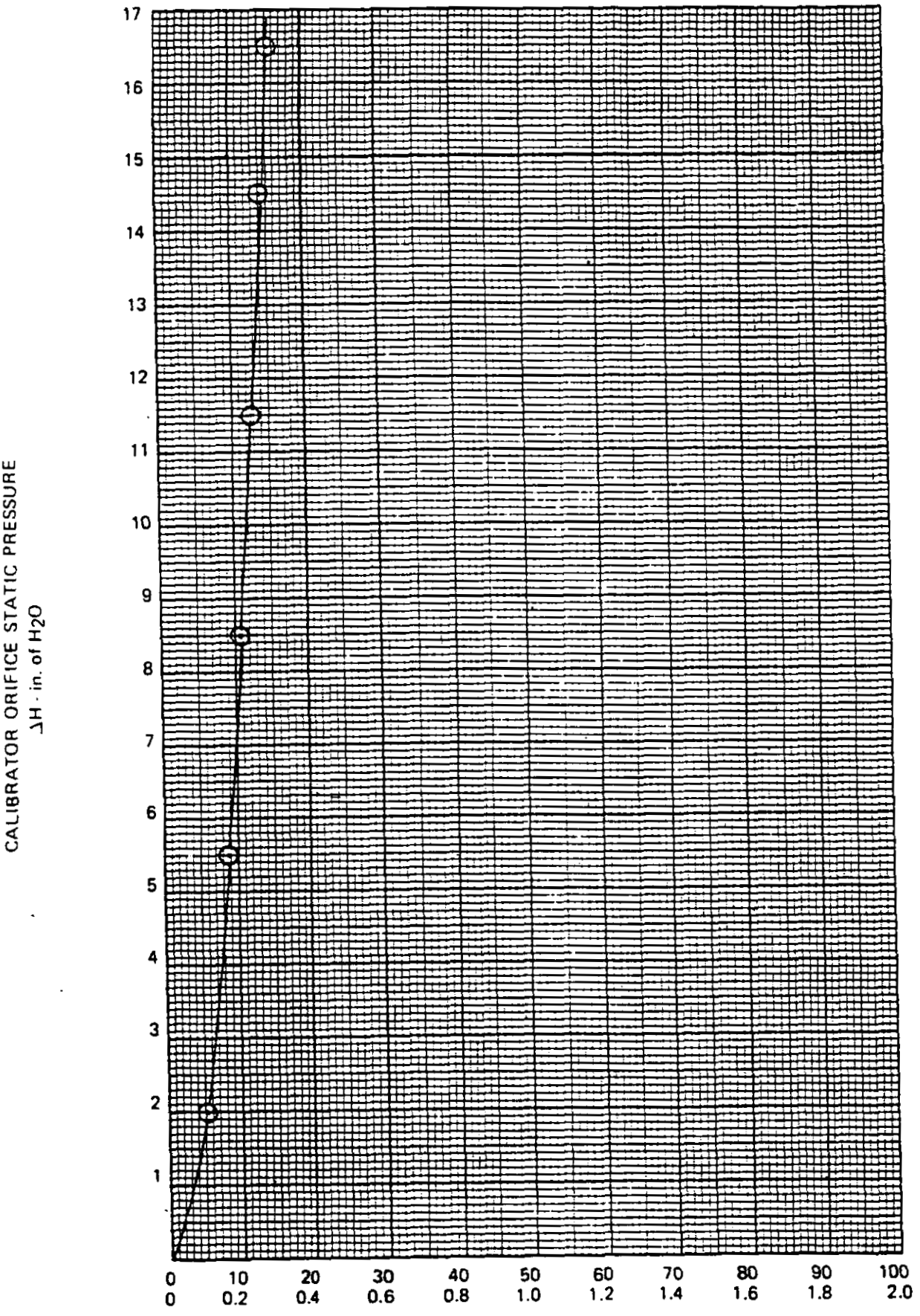
Date placed in service: (To be noted by user)

For additional information consult:

1. The Federal Register, Vol. 47, No. 234, pp. 54896-54921, December 6, 1982
2. Quality Assurance Handbook, Vol. II (EPA 600/4-77-027a), Section 2.11

Notes:

1. EPA recommends calibrators should be recalibrated after one year of field use.
2. Copies of this calibration are not kept on file.



THIS PLOT IS IN (check one)

cfm _____

M^3/min. _____

They are NOT EQUIVALENT

PUF SAMPLER ORIFICE CALIBRATION

Orifice SN: 47C Cal. Date : 12/14/90

t # (min)	V (M^3)	DelP # (mmHg)	Vstd (M^3)	Qstd (M^3/min)	DelH # ("H2O)	Sqrt DH (corr.)	Qstd (SLPM)
7.091	1.00	3.20	1.045	0.15	2.0	1.45	147.34
4.202	1.00	9.20	1.037	0.25	5.5	2.40	246.73
3.369	1.00	14.20	1.030	0.31	8.5	2.99	305.74
2.876	1.00	19.20	1.023	0.36	11.5	3.47	355.82
2.548	1.00	24.10	1.017	0.40	14.5	3.90	399.04

TEMP = 66.20 Deg. F = 19.00 Deg. C 292 K
#Bar P = 30.76 "Hg = 781.30 mmHg

DelHc = (0.009746 X Qstd +(0.0067)^2 r^2 = 0.999996

LOOKUP TABLE
DelHc = "H2O • P/T

Qstd	DelHc	Qstd	DelHc	Qstd	DelHc	Qstd	DelHc
100	0.96	162	2.51	224	4.80	286	7.81
102	1.00	164	2.58	226	4.88	288	7.92
104	1.04	166	2.64	228	4.97	290	8.03
106	1.08	168	2.70	230	5.05	292	8.14
108	1.12	170	2.77	232	5.14	294	8.25
110	1.16	172	2.83	234	5.23	296	8.36
112	1.21	174	2.90	236	5.32	298	8.47
114	1.25	176	2.97	238	5.41	300	8.59
116	1.29	178	3.03	240	5.50	302	8.70
118	1.34	180	3.10	242	5.59	304	8.82
120	1.38	182	3.17	244	5.69	306	8.93
122	1.43	184	3.24	246	5.78	308	9.05
124	1.48	186	3.31	248	5.87	310	9.17
126	1.52	188	3.38	250	5.97	312	9.29
128	1.57	190	3.45	252	6.06	314	9.41
130	1.62	192	3.53	254	6.16	316	9.53
132	1.67	194	3.60	256	6.26	318	9.65
134	1.72	196	3.67	258	6.36	320	9.77
136	1.77	198	3.75	260	6.45	322	9.89
138	1.83	200	3.83	262	6.55	324	10.01
140	1.88	202	3.90	264	6.65	326	10.14
142	1.93	204	3.98	266	6.76	328	10.26
144	1.99	206	4.06	268	6.86	330	10.39
146	2.04	208	4.14	270	6.96	332	10.51
148	2.10	210	4.22	272	7.06	334	10.64
150	2.16	212	4.30	274	7.17	336	10.77
152	2.21	214	4.38	276	7.27	338	10.90
154	2.27	216	4.46	278	7.38	340	11.02
156	2.33	218	4.54	280	7.48	342	11.15
158	2.39	220	4.63	282	7.59	344	11.29
160	2.45	222	4.71	284	7.70	346	11.42

METHOD 5
PARTICULATE
COKE BATTERY

ISOKINETICS

AISI – ARMCO STEEL

MIDDLETOWN, OHIO

RUN NUMBER	******	1	2	3	4	5	6
DATE OF RUN	******	7-9-91	7-9-91	7-9-91	7-10-91	7-10-91	7-10-91
CLOCK TIME: INITIAL	******	1302	1341	1544	1009	1100	1301
CLOCK TIME: FINAL	******	1317	1356	1559	1024	1115	1316
AVG. STACK TEMPERATURE	DEGREES F	127	134	131	128	125	135
AVG. SQUARE DELTA P	INCHES H20	0.387	0.387	0.378	0.370	0.346	0.361
NOZZLE DIAMETER	INCHES	0.378	0.378	0.378	0.378	0.378	0.378
BAROMETRIC PRESSURE	IN. HG.	29.39	29.39	29.39	29.33	29.33	29.33
SAMPLING TIME	MIN.	15.00	15.00	15.00	15.00	15.00	15.00
SAMPLE VOLUME	CUBIC FEET	17.709	17.710	16.905	16.247	16.168	16.199
AVG. METER TEMP.	DEGREES F	96	104	96	87	87	93
AVG. DELTA H	IN. H20	4.80	4.80	4.30	4.10	3.70	3.90
DGM CALIB. FACTOR [Y]	Y	1.001	1.001	1.001	1.001	1.001	1.001
WATER COLLECTED	MILLITERS	6.4	6.4	6.3	6.2	6.1	6.1
CO 2	PERCENT	0.0	0.0	0.0	0.0	0.0	0.0
O 2	PERCENT	21.0	21.0	21.0	21.0	21.0	21.0
CO	PERCENT	0.0	0.0	0.0	0.0	0.0	0.0
N 2	PERCENT	79.0	79.0	79.0	79.0	79.0	79.0
STACK AREA	SQUARE INCHES	28.30	28.30	28.30	28.30	28.30	28.30
STATIC PRESSURE	INCHES WG.	-4.00	-4.00	-4.00	-4.00	-3.90	-3.70
PITOT COEFFICIENT	CP	0.99	0.99	0.99	0.99	0.99	0.99
SAMPLE VOLUME DRY	DSCF	16.746	16.486	15.952	15.550	15.444	15.317
WATER AT STD.	SCF	0.302	0.302	0.297	0.292	0.288	0.288
MOISTURE	PERCENT	1.8	1.8	1.8	1.8	1.8	1.8
MOISTURE AT SATURATION	PERCENT	14.5	17.3	16.1	14.6	13.7	17.5
MOLE FRACTION DRY GAS	MD	0.982	0.982	0.982	0.982	0.982	0.982
MOLECULAR WT.DRY	LB/LB MOLE	28.84	28.84	28.84	28.84	28.84	28.84
EXCESS AIR	PERCENT	(14,583)	(14,583)	(14,583)	(14,583)	(14,583)	(14,583)
MOLECULAR WT. WET	LB/LB MOLE	28.65	28.65	28.64	28.64	28.64	28.64
STACK GAS PRESSURE	INCHES HG.	29.10	29.10	29.10	29.04	29.04	29.06
STACK VELOCITY	FPM	1,651	1,661	1,619	1,577	1,475	1,548
VOLUMETRIC FLOWRATE, DRY STD.	DSCFM	279	277	271	265	249	258
VOLUMETRIC FLOWRATE, ACTUAL	ACFM	325	326	318	310	290	304
ISOKINETIC RATIO	PERCENT	101	100	99	99	104	100
MASS AIR FLOW RATE	LBS/MINUTE	21	21	20	20	19	19

CALCULATIONS FOR GRAIN LOADING AND EMISSION RATES

FRONT FILTER TOTAL	mg	36.6	52.5	47.5	13.3	4.6	4.9
FRONT HALF PARTICULATE	gr/dscf	0.0337	0.0490	0.0459	0.0132	0.0046	0.0049
FRONT HALF RINSE TOTAL	mg	3.2	3.4	10.3	3.6	8.6	8.8
FRONT HALF RINSE PARTICULATE	gr/dscf	0.0029	0.0032	0.0099	0.0036	0.0086	0.0088
BACK FILTER TOTAL	mg	0.0	0.0	0.0	0.0	0.0	0.6
BACK HALF PARTICULATE	gr/dscf	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006
TOTAL PARTICULATE	lb/hr	0.087	0.124	0.130	0.038	0.028	0.032
	leak category	3.0	3.0	2.0	1.0	0.5	1.0

METHOD 5
PARTICULATE
COKE BATTERY

ISOKINETICS

AISI – ARMCO STEEL

MIDDLETOWN, OHIO

RUN NUMBER	******	7	8	9	10	11	12
DATE OF RUN	******	7-10-91	7-10-91	7-11-91	7-11-91	7-11-91	7-11-91
CLOCK TIME: INITIAL	******	1427	1527	850	1004	1044	1233
CLOCK TIME: FINAL	******	1442	1542	905	1019	1059	1300
AVG. STACK TEMPERATURE	DEGREES F	149	153	139	150	149	145
AVG. SQUARE DELTA P	INCHES H20	0.361	0.361	0.351	0.346	0.346	0.361
NOZZLE DIAMETER	INCHES	0.378	0.378	0.378	0.378	0.378	0.378
BAROMETRIC PRESSURE	IN. HG.	29.33	29.33	29.45	29.45	29.45	29.45
SAMPLING TIME	MIN.	15.00	15.00	15.00	15.00	15.00	15.00
SAMPLE VOLUME	CUBIC FEET	16.185	16.285	15.708	15.616	15.332	16.347
AVG. METER TEMP.	DEGREES F	96	108	95	103	102	111
AVG. DELTA H	IN. H20	3.90	3.90	3.70	3.90	3.60	3.90
DGM CALIB. FACTOR [Y]	Y	1.001	1.001	1.001	1.001	1.001	1.001
WATER COLLECTED	MILLITERS	6.0	6.0	5.9	5.8	5.7	6.0
CO 2	PERCENT	0.0	0.0	0.0	0.0	0.0	0.0
O 2	PERCENT	21.0	21.0	21.0	21.0	21.0	21.0
CO	PERCENT	0.0	0.0	0.0	0.0	0.0	0.0
N 2	PERCENT	79.0	79.0	79.0	79.0	79.0	79.0
STACK AREA	SQUARE INCHES	28.30	28.30	28.30	28.30	28.30	28.30
STATIC PRESSURE	INCHES WG.	-3.70	-3.70	-3.70	-3.70	-3.40	-3.70
PITOT COEFFICIENT	CP	0.99	0.99	0.99	0.99	0.99	0.99
SAMPLE VOLUME DRY	DSCF	15.221	15.063	14.870	14.575	14.317	15.041
WATER AT STD.	SCF	0.283	0.283	0.278	0.273	0.269	0.283
MOISTURE	PERCENT	1.8	1.8	1.8	1.8	1.8	1.8
MOISTURE AT SATURATION	PERCENT	25.3	28.3	19.8	25.8	25.5	22.9
MOLE FRACTION DRY GAS	MD	0.982	0.982	0.982	0.982	0.982	0.982
MOLECULAR WT.DRY	LB/LB MOLE	28.84	28.84	28.84	28.84	28.84	28.84
EXCESS AIR	PERCENT	(14,583)	(14,583)	(14,583)	(14,583)	(14,583)	(14,583)
MOLECULAR WT. WET	LB/LB MOLE	28.64	28.64	28.64	28.64	28.64	28.64
STACK GAS PRESSURE	INCHES HG.	29.06	29.06	29.18	29.18	29.20	29.18
STACK VELOCITY	FPM	1,566	1,572	1,510	1,503	1,502	1,558
VOLUMETRIC FLOWRATE, DRY STD.	DSCFM	255	254	250	245	245	256
VOLUMETRIC FLOWRATE, ACTUAL	ACFM	308	309	297	295	295	306
ISOKINETIC RATIO	PERCENT	101	100	100	100	98	99
MASS AIR FLOW RATE	LBS/MINUTE	19	19	19	18	18	19

CALCULATIONS FOR GRAIN LOADING AND EMISSION RATES

FRONT FILTER TOTAL	mg	250.5	79.4	0.0	1.9	1.3	2.6
FRONT HALF PARTICULATE	gr/dscf	0.2534	0.0812	0.0000	0.0020	0.0014	0.0027
FRONT HALF RINSE TOTAL	mg	11.1	10.2	6.0	4.4	3.3	4.3
FRONT HALF RINSE PARTICULATE	gr/dscf	0.0112	0.0104	0.0062	0.0046	0.0035	0.0044
BACK FILTER TOTAL	mg	0.0	0.4	0.0	0.0	0.0	0.0
BACK HALF PARTICULATE	gr/dscf	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000
TOTAL PARTICULATE	lb/hr	0.578	0.200	0.013	0.014	0.010	0.015
	leak category	4.0	3.0	1.0	0.5	0.0	0.5

Kf
1378 - 32.122

PARTICULATE TEST FIELD DATA SHEET

Plant: ARACO - MIDDLETOWN OH
Date: 7/9/91
Test Location: COKE BATTERY
Run Number: #1 - 24L
Stack Diameter Inches: 6"
Duct Dimensions In x In.: —
Start Time: 1302 - 1317
Operator: J.M. JG/G.S.

Barometric Pressure: 999 mb
Static Pressure: - 3.4
Probe Number: —
Pitot Coefficient: .99
Pitot Number: —
Meter Box Number: E0184
Orifice Coefficient: γ: 1.00 ΔH@ 1.906
Nozzle Size & Number: 6A .378

LEAK CHECKS
INITIAL: VAC 15 In. CFM .004 PITOT ✓✓
FINAL: VAC 5 In. CFM .000 PITOT ✓✓

FILTER DATA

NUMBER	TARE	FINAL WT.
1B-928	.6160	
1A-924	.6124	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
		1310	0	21.0	
SILICA GEL					
312.1	318.5				

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	STACK °F	PROBE °F	IMPINGER °F	ORGANIC MODULE °F	~~OVEN~~ Filter °F	GAS METER IN °F	GAS METER OUT °F	PUMP VACUUM in Hg	√ΔP	
0	A	1302	.15	4.8	498.703	128	—	68	—	~~114~~ 115	94	91	4.0	.3873	
5 ~~10~~		1307	.15	4.8	505.100	126	—	68	—	115	97	93	4.0	.3873	
10 ~~20~~		1312	.15	4.8	511.299	129	—	65	—	118	103	95	4.0	.3873	
15 ~~30~~		1317			516.412										
	AVG/TOTAL		.15	4.8	17.709	127.7					95.5			.3873	

2073 3/89

PARTICULATE TEST FIELD DATA SHEET

Plant: ARMCO - Middletown OH
Date: 7/9/91
Test Location: Coke Battery
Run Number: #2 - 242
Stack Diameter Inches: 6"
Duct Dimensions in x in.: —
Start Time: 1341 - 1356
Operator: C. Emily

Barometric Pressure: 999mb
Static Pressure: -4.0
Probe Number: —
Pitot Coefficient: .99
Pitot Number: —
Meter Box Number: 80184
Orifice Coefficient: 1.09 / 1.91
Nozzle Size & Number: .378

LEAK CHECKS
INITIAL: VAC 15 in. CFM 0.00 PITOT ✓
FINAL: VAC 4 in. CFM 0.00 PITOT ____

FILTER DATA

NUMBER	TARE	FINAL WT.
2A-948	.6038	
2B-916	.6152	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—	1310	0	21.0	
—	—				
SILICA GEL					
—	—				

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F Filter							PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
					STACK	PROBE	IMPINGER	ORGANIC MODULE	~~OVEN~~	GAS METER IN	GAS METER OUT			
0 A	1341	.15	4.8	516.695	137	—	68	—	101	100	97	-4.0	.3873	
5	1346	.15	4.8	524.000	133	—	68	—	108	105	98	-4.0	"	
10	1351	.15	4.8	528.700	132	—	67	—	108	108	98	-4.0	"	
15	1356			534.405	↓									
AVG/TOTAL		.15	4.8	17.710	134		67.7			104.3			.3873	

2073 3/89

130 - 30.217 - 4.5

PARTICULATE TEST ..ELD DATA SHEET

Plant ARMCO, Middletown, OH
Date 7-9-91
Test Location Coke BATTERY
Run Number #3 -
Stack Diameter Inches 6"
Duct Dimensions In x In. —
Start Time 1544
Operator G. Sill, 'Y4

Barometric Pressure 999mB
Static Pressure -3.8
Probe Number
Pitot Coefficient .99
Pitot Number 1
Meter Box Number 90184
Orifice Coefficient — 1.0/1.41
Nozzle Size & Number .378

LEAK CHECKS
INITIAL: VAC 15 In. 0.001 CFM ____ PITOT ✓
FINAL : VAC ____ In. CFM ____ PITOT ____

FILTER DATA

NUMBER	TARE	FINAL WT.
942	.6165	
915	.6156	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—	1310	0.0	21	—
—	—				
—	—				
SILICA GEL					
—	—				

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F: STACK	PROBE	IMPINGER	ORGANIC MODULE	~~OVEN~~ Filter	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0	A	1544	.15	4.5	534.575	128	—	68	—	104	94	94	4.0	.3873	
5		1549	.15	4.5	540.550	132	—	67	—	108	97	94	4.0	.3873	
10		1554	.13	3.9	546.720	134 146	—	67	—	111	102	95	4.0	.3606	
15		1559			551.480										
AVG/TOTAL				16.905	131.3					96				.3784	

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PARTICULATE TEST FIELD DATA SHEET

Plant: ARMCO, Middletown, OH
Date: 7-10-91
Test Location: coke oven #218
Run Number: #4/oven 218
Stack Diameter Inches: 6
Duct Dimensions in x in.: —
Start Time: 1009
Operator: C. Smith

Barometric Pressure: 997mb
Static Pressure: -4.0
Probe Number:
Pitot Coefficient: .95
Pitot Number:
Meter Box Number: 80184
Orifice Coefficient: 1.008 @ 1.91
Nozzle Size & Number: .378

LEAK CHECKS
INITIAL: VAC A in. CFM 0.00 PITOT ✓
FINAL: VAC 4 in. CFM 0.00 PITOT

FILTER DATA

NUMBER	TARE	FINAL WT.
955	.6259	
960	.6341	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—		0	21.0	
—	—				
SILICA GEL					
—	—				

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F: STACK	PROBE	IMPINGER	ORGANIC MODULE	~~OVEN~~ Filter	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0	A	1009	.15	4.5	552.168	129	—	68	—	85	84	83	1.0	.3873	
5		1014	.13	3.9	558.724	129	—	67	—	90	90	85	1.0	.3606	
10		1019	.13	3.9	563.320	125	—	63	—	91	94	85	1.0	.3606	
15		1024			568.415										
	AVG/TOTAL				16.2470	127.6					86.8			3695	

PARTICULATE TEST FIELD DATA SHEET

Plant: ARMCO Steel - Middletown Barometric Pressure: 997mb
Date: 7-10 91 Static Pressure: -3.9
Test Location: Coke Oven #218 Probe Number: —
Run Number: #5 Pitot Coefficient: .99
Stack Diameter Inches: 6" Pitot Number: —
Duct Dimensions in x in.: — Meter Box Number: 80184
Start Time: 1100 Orifice Coefficient: Y=1.0008 Q=1.91
Operator: G. Smith Nozzle Size & Number: .378

LEAK CHECKS
INITIAL: VAC 12 in. CFM 0.00 PITOT ✓
FINAL: VAC ____ in. CFM ____ PITOT ____

FILTER DATA

NUMBER	TARE	FINAL WT.
961	.6360	
954	.6210	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—			21.0	
—	—				
SILICA GEL					
—	—				

VEO = ½

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F: STACK	PROBE	IMPINGER	ORGANIC MODULE	~~OVEN~~ F.Box	GAS METER IN	GAS METER OUT	PUMP VACUUM In Hg	$\sqrt{\Delta P}$	
0 A	1100	.12	3.6	568.541	122	—	63	—	83	84	83	1.0	.3464	
5	1105	.12	3.7	575.002	124	—	64	—	87	88	84	1.0	.3464	
10	1110	.12	3.7	579.450	129	—	67	—	90	90	84	1.0	.3464	
15	1115			584.709										
AVG/TOTAL		.12	3.7	16.169	125					87.3			.3464	

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PARTICULATE TEST FIELD DATA SHEET

Plant ARMCO Steel Middletown, OH
Date 7-10-81
Test Location Coke Oven #241
Run Number #6
Stack Diameter Inches 6"
Duct Dimensions in x in.
Start Time 1301
Operator C. Smith & Friends

Barometric Pressure 997 mb
Static Pressure -3.7
Probe Number —
Pilot Coefficient .99
Pilot Number —
Meter Box Number 80184
Orifice Coefficient Y=1.000 @=1.91
Nozzle Size & Number .378

LEAK CHECKS
INITIAL: VAC 10 in. CFM 0.0 PITOT
FINAL: VAC 5 in. CFM 0.0 PITOT

FILTER DATA

NUMBER	TARE	FINAL WT.
#937	.6165	
#931	.6083	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—		0	21.0	
—	—				
SILICA GEL					
—	—				

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³ 584.999	TEMPERATURES °F STACK	PROBE	IMPINGER	ORGANIC MODULE	Filter Oven	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0	A	1301	.13	3.9	~~589.773~~	139	—	68	—	72	92	92	1.0	.3606	
5			.13	3.9	590.300	131	—	68	—	96	94	92	1.0	.3606	
10		1316	.13	3.9	595.200	134	—	67	—	98	97	92	1.0	.3606	
15					601.198										
AVG/TOTAL			.13	3.9	16.199	134.5					93.2			.3606	

PARTICULATE TEST FIELD DATA SHEET

Plant: Armco Steel Middletown, OH
Date: 7-10-91
Test Location: Coke oven # 246
Run Number: #7
Stack Diameter Inches: 64
Duct Dimensions in x in.: —
Start Time: 1427
Operator: G. Smith

Barometric Pressure: 997 mb
Static Pressure: -3.7
Probe Number: —
Pitot Coefficient: .99
Pitot Number: —
Meter Box Number: 80184
Orifice Coefficient: Y=1.0004 C=1.91
Nozzle Size & Number: .378

LEAK CHECKS
INITIAL: VAC 10 in. CFM 0.0 PITOT ✓
FINAL: VAC 2 in. CFM 0.0 PITOT ____

FILTER DATA

NUMBER	TARE	FINAL WT.
A930	.6076	
B918	.6106	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
+	−				
−	−			21.0	
SILICA GEL					
~	—				

VFO - 3+

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F: STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0	A	1427	0.13	3.9	601.373	142	—	69	~	102	94	91	1.0	.3606	
5			0.13	3.9	607.883	152	—	69	—	112	99	92	1.0	.3606	
10			0.13	3.9	612.300	152	—	69	—	118	106	98	1.0	.3606	
15					617.558										
	AVG/TOTAL		.13	3.9	16.185	148.7					96.2			.3606	

PARTICULATE TEST ..ELD DATA SHEET

Plant ARMCO Steel/ Middletown, OH
Date 7-10-91
Test Location Gate Oven #246
Run Number # 8
Stack Diameter Inches 64
Duct Dimensions in x in. —
Start Time 1527
Operator D. Smith

Barometric Pressure 997 mb
Static Pressure -3.7
Probe Number —
Pitot Coefficient .99
Pitot Number
Meter Box Number 80189
Orifice Coefficient Y=1.008@=1.91
Nozzle Size & Number .378

LEAK CHECKS
INITIAL: VAC 13 in. CFM 0.0 PITOT
FINAL : VAC 7 in. CFM 0.0 PITOT

FILTER DATA

NUMBER	TARE	FINAL WT.
A919	.6083	
B926	.6440	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—			21.0	
SILICA GEL					
—	—				

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F STACK	PROBE	IMPINGER	ORGANIC MODULE	~~OVEN~~ KILN	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0	A	1527	.13	3.9	617.665	152	—	73	—	105	105	104	1.0	.3606	
5		1532	.13	3.9	623.050	155	—	68	—	113	107	102	1.0	.3606	
10		1537	.13	3.9	630.500	153	—	78	—	114	111	104	1.0	.3606	
15		1542			637.950										
AVG/TOTAL			.13	3.9	16.285	153.3					105.5			.3606	

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PARTICULATE TEST ..eLD DATA SHEET

Plant ARMCO Steel, Middletown
Date 7-10-91
Test Location Oven # 2 SS
Run Number #9
Stack Diameter Inches 6'
Duct Dimensions in x in. —
Start Time 0850
Operator C. Smith

Barometric Pressure 999 mb
Static Pressure -3.7
Probe Number —
Pilot Coefficient .99
Pilot Number —
Meter Box Number 80184
Orifice Coefficient Y=1.008 @ 1.91
Nozzle Size & Number .378

LEAK CHECKS
INITIAL: VAC ~~0.00~~ 15 in. CFM 0.02 PITOT —
FINAL : VAC 5 in. CFM 0.0 PITOT —

FILTER DATA

NUMBER	TARE	FINAL WT.
A958	.6250	
13962	.6258	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
SILICA GEL					

VFD - 60

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F							PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
						STACK	PROBE	IMPINGER	ORGANIC MODULE	~~OVEN~~ Filter	GAS METER IN	GAS METER OUT			
0	A	0850	.13	3.9	633.998	140	—	—	—	109	93	90	1.0	.3606	
5		0855	.12	3.6	639.924	138	—	—	—	110	97	93	1.0	.3464	
10		0900	.12	3.6	644.800	140	—	—	—	113	100	94	1.0	.3464	
15		0905			649.706										
	AVG/TOTAL			3.7	15.708	139.3					94.5			.3511	

PARTICULATE TEST ..eLD DATA SHEET

Plant ARMCO Steel - Middletown
Date 7-10-91
Test Location Coke Oven #255
Run Number #10
Stack Diameter Inches 6"
Duct Dimensions in x in. —
Start Time 1004
Operator G. Smith

Barometric Pressure 999mb
Static Pressure -3.7
Probe Number —
Pitot Coefficient .99
Pitot Number —
Meter Box Number 80184
Orifice Coefficient Y=1.008@1.91
Nozzle Size & Number .378

LEAK CHECKS
INITIAL: VAC 10 In. CFM 0.0 PITOT ____
FINAL: VAC 5 In. CFM 0.0 PITOT ____

FILTER DATA

NUMBER	TARE	FINAL WT.
A920	.6142	
B922	.6207	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—		0.0	21.0	
—	—				
SILICA GEL					
—	—				

VEO = 0-4

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN °F/Hg	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0	A	1004	.12	3.9	649.829	~~145~~	—	—	—	103	101	100	1.0	.3464	
5		1009	.12	3.9	655.100	152	—	—	—	112	104	100	1.0	.3464	
10		1014	.12	3.9	660.700	152	—	—	—	116	104	102	1.0	.3464	
15		1019			665.445										
						1									
	AVG/TOTAL													.3464	

PARTICULATE TEST FIELD DATA SHEET

Plant: ARMCO Steel, Middletown, OH
Date: 7-11-91
Test Location: Coke Oven # 255
Run Number: #11
Stack Diameter Inches: 6"
Duct Dimensions in x in.: —
Start Time: 1044
Operator: G. Smith

Barometric Pressure: 999 mb
Static Pressure: -3.4
Probe Number: 1
Pitot Coefficient: .99
Pitot Number: —
Meter Box Number: 80184
Orifice Coefficient: Y=1.008, @=1.91
Nozzle Size & Number: .378

LEAK CHECKS
INITIAL: VAC 10 In. CFM ____ PITOT ____
FINAL: VAC ____ In. CFM ____ PITOT ____

FILTER DATA

NUMBER	TARE	FINAL WT.
A936	.6163	
B917	.6116	

IMPINGER VOLUME		TIME	CO_2	O_2	CO
—	—		0	21.0	
—	—				
SILICA GEL					
—					

	SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F: STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN F. Filter	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0	A	1044	.12	3.6	665.628	145	—	—	—	101	100	100	1.0	.3464	
5		1049	.12	3.6	671.000	152	—	—	—	116	104	101	1.0	.3464	
10		1054	.12	3.6	676.150	151	—	—	—	110	106	101	1.0	.3464	
15		1059			680.960										
	AVG/TOTAL			3.6	15.332	149.3					102			.3464	

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PARTICULATE TEST ..ELD DATA SHEET

Plant ARMCO Steel - Middletown, OH
Date 7-11-91
Test Location #218 Coke Oven
Run Number #12
Stack Diameter Inches 6"
Duct Dimensions in x in. —
Start Time 1233
Operator C. Smith

Barometric Pressure 29.9 in Hg
Static Pressure —
Probe Number —
Pitot Coefficient .99
Pitot Number —
Meter Box Number 20184
Orifice Coefficient —
Nozzle Size & Number .378

LEAK CHECKS
INITIAL: VAC 10 in. CFM 0.00 PITOT —
FINAL: VAC 5 in. CFM 0.000 PITOT —

FILTER DATA

NUMBER	TARE	FINAL WT.
14938	.6152	
13944	.6063	

IMPINGER VOLUME	TIME	CO_2	O_2	CO
— —		0	21.0	
— —				
SILICA GEL				
— —				

14.8 12.5 - 2.8

SAMPLE POINT	CLOCK TIME	VELOCITY HEAD ΔP in. wg	ORIFICE METER ΔH in wg	GAS METER VOLUME FT³	TEMPERATURES °F STACK	PROBE	IMPINGER	ORGANIC MODULE	OVEN Filter	GAS METER IN	GAS METER OUT	PUMP VACUUM in Hg	$\sqrt{\Delta P}$	
0 A	1233	.13	3.9	681.303	145	—	—	—	118	110	110	1.0	.3606	
5	1238	.13	3.9	680.700	145	—	—	—	122	111	110	1.0	.3606	
10 *	1242	.13	3.9	693.323	145	—	—	—	122	114	110	1.0	.3606	
15	1300	~~1247~~		697.~~6~~50										
		* Power problems @ 1244 - restart @ 1247												
AVG/TOTAL			3.9	16.347	145					110.8			.3606	

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
UNEXPOSED FILTERS

Batch/
Lot #: _____ Filter #: _____ TO 415

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial							
Weight 1	Thursday	6-27-91	17:30	47	74	AR	
Weight 2							
Weight 3							
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial	✓			✓				weight 1
Final		✓			✓			
Initial								weight 2
Final								
Initial								weight 3
Final								
Initial								weight 4
Final								

Unfilters

Filter #	Weight 1 Client	Weight ~~1~~	Weight 2	Delta Wght	Weight 3	Delta Wght	Weight 4	Delta Wght	Avg. Tare Weight
979	0.4182	0.C	0.4186	+.0004					.4184
980	0.4127		0.4132	+.0005					.4130
981	0.4127		0.4132	+.0005					.4130
982	0.4133		0.4136	+.0003					.4135
983	0.4137		0.4140	+.0003					.4139
984	0.4181		0.4182	+.001					.4182
985	0.4176		0.4181	+.005					.4179
986	0.4200		0.4205	+.005					.4203
987	0.4145		0.4148	+.003					.4147
988	0.4188		0.4192	+.004					.4190
989	0.4203		0.4205	+.002					.4204
990	0.4179		0.4182	+.003					.4181
991	0.4137		0.4142	+.005					.4140
992	0.4168		0.4173	+.005					.4171
993	0.4191		0.4193	+.002					.4192

* Delta Wght Tolerance = $< \pm 0.5$ mg (6/90)

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
UNEXPOSED FILTERS

Batch/
Lot #: _____ Filter #: _____ TO _____

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial							
Weight 1	Thursday	6-27-91	15:00	47	74	HR	
Weight 2	"						
Weight 3							
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial	✓			✓				weight 1
Final		✓			✓			"
Initial								weight 2
Final								"
Initial								weight 3
Final								"
Initial								weight 4
Final								"

Dry filters

Filter #	Client	Weight 1	Weight 2	Delta Wght*	Weight 3	Delta Wght*	Weight 4	Delta Wght*	Avg. Tare Weight
964	0.4240	→	0.4243	+.0003					.4242
965	0.4242	→	0.4247	+.0005					.4245
966	0.4185	→	0.4185	0					.4185
967	0.4188	→	0.4190	+.0002					.4189
968	0.4160	→	0.4165	+.0005					.4163
969	0.4133	→	0.4135	+.0002					.4134
970	0.4145	→	0.4145	0					.4192
971	0.4191	→	0.4193	+.0002					.4192
972	0.4122	→	0.4123	+.0001					.4123
973	0.4106	→	0.4102	-.0004					.4104
974	0.4109	→	0.4108	0					.4108
975	0.4188	→	0.4189	+.0001					.4189
976	0.4192	→	0.4193	+.0001					.4193
977	0.4129	→	0.4130	+.0001					.4130
978	0.4142	→	0.4142	0					.4142

* Delta Wght Tolerance = $< \pm 0.5$ mg

(6/90)

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
UNEXPOSED FILTERS

Batch/
Lot #: _____ Filter #: _____ TO _____

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial							
Weight 1							
Weight 2							
Weight 3							
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial								weight 1
Final								"
Initial								weight 2
Final								"
Initial								weight 3
Final								"
Initial								weight 4
Final								"

Filter #	Client Wt	Weight 1	Weight 2	Delta Wght*	Weight 3	Delta Wght*	Weight 4	Delta Wght*	Avg. Tare Weight
959	0.6323		.6320	.0003					.6322
960	0.6342		.6340	.0002					.6341
961	0.6310		.6310	0					.6310
962	0.6258		.6257	.0001					.6258
963	0.6183		.6181	.0002					.6182

* Delta Wght Tolerance = $< \pm 0.5$ mg (6/90)

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
UNEXPOSED FILTERS

Batch/
Lot #: _____ Filter #: _____ TO _____

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial							
Weight 1	MONDAY	7/1/91	9:25	47	69	MQ	
Weight 2	FRIDAY	6/28/91	9:00	47	74	MQ	
Weight 1	TUESDAY	7/2/91	9:00	47	73	MQ	
Weight 2	FRIDAY	6/28/91	11:00	41	75	MQ	

RS 949-947
ERS 948-943
UERS 944-947
ERS 948-943

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #
Initial							
Final							
Initial							
Final							
Initial							
Final							
Initial							
Final							

weight 1
weight 2
weight 3
weight 4

Filter #	Weight 1 Client	Weight 1	Weight 2	Delta Wght	Weight 3	Delta Wght	Weight 4	Delta Wght	Avg. Tare Weight
944	.6060		.6065	.0005					.6063
945	.6058		.6060	.0002					.6059
946	.5986		.5990	.0004					.5988
947	.5995		.6000	.0005					.5998
948	0.6039		.60396	+.0003					.60398
949	0.6060		.60556	+.0004					.6058
950	0.6102		.6098	-.0004					.6100
951	0.6165		.6161	+.0004					.6163
952	0.6134		.61378	-.0001					.6139
953	0.6184		.6181	-.0003					.6183
954	0.6211		.6209	-.0002					.6210
955	0.6259		.6257	-.0002					.6258
956	0.6250		.6250	0					.6250
957	0.6248		.6248	0					.6248
958	0.6294		.6292	-.0002					.6293

* Delta Wght Tolerance = < ± 0.5 mg

(6/90)

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
UNEXPOSED FILTERS

Batch/
Lot #: _____ Filter #: _____ TO _____

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial							
Weight 1	Monday	7/1/91	9:25	47	69	MG	
Weight 2	Tuesday	7/2/91	9:00	47	73	MG	
Weight 3							
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial								weight 1
Final								
Initial								weight 2
Final								
Initial								weight 3
Final								
Initial								weight 4
Final								

Filter #	Client	Weight 1	Weight 2	Delta Wght *	Weight 3	Delta Wght *	Weight 4	Delta Wght *	Avg. Tare Weight
929		.6101	.6097	-.0004					.6099
930		.6078	.6076	-.0002					.6076
931		.6085	.6081	-.0004					.6083
932		.6090	.6087	-.0003					.6089
933		.6131	.6133	+.0002					.6132
934		.6160	.6163	+.0003					.6162
935		.6119	.6119	0					.6119
936		.6162	.6163	+.0001					.6163
937		.6163	.6166	+.0003					.6165
938		.6150	.6154	+.0004					.6152
939		.6100	.6102	+.0002					.6101
940		.6167	.6172	+.0005					.6170
941		.6162	.6165	+.0003					.6164
942		.6162	.6167	+.0005					.6165
943		.6100	.6110	+.0010					.6105

* Delta Wght Tolerance = $< \pm 0.5$ mg

(6/90)

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
UNEXPOSED FILTERS

Batch/
Lot #: _____ Filter #: _____ TO _____

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial							
Weight 1	MONDAY	9/11/91	9:25	47	69	MQ	
Weight 2	TUESDAY	9/12/91	9:00	47	73	MQ	
Weight 3							
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial								weight 1
Final								"
Initial								weight 2
Final								"
Initial								weight 3
Final								"
Initial								weight 4
Final								"

Filter #	Client	Weight 1	Weight 2	Delta Wght *	Weight 3	Delta Wght *	Weight 4	Delta Wght *	Avg. Tare Weight
914		.6129	.6127	-.0002					.6128
915		.6158	.6154	-.0004					.6156
916		.6153	.6151	-.0002					.6152
917		.6118	.6114	-.0004					.6116
918		.6107	.6102	-.0005					.6105
919		.6084	.6081	-.0003					.6083
920		.6143	.6140	-.0003					.6142
921		.6118	.6114	-.0004					.6116
922		.6208	.6205	-.0003					.6207
923		.6129	.6126	-.0003					.6128
924		.6124	.6123	-.0001					.6124
925		.6112	.6108	-.0004					.6110
926		.6199	.6197	-.0002					.6198
927		.6143	.6142	-.0001					.6143
928		.6161	.6156	-.0005					.6160

* Delta Wght Tolerance = $< \pm 0.5$ mg

(6/90)

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

Blue Plug ≡ Outlet
Red Plug ≡ Inlet

Figure 2

BLIND AUDIT SHEET
****
ASHLAND OIL
****

FILTER #	WGT. 1 ~~TEMP~~	BY	Audit WGT. ~~HUM.~~	BY	DELTA WGT.	TEMP.	HUM. %	DATE
1	44.34	MQ				73	47	9/2/91
2	44.47							
3	42.70							
4	43.80							
5	45.39							
6	44.80							
7	45.98							
8	~~44.98~~		44.98	MQ				
9	45.80							
10	42.39							
11	45.72							
12	44.78							
13	44.18							
14	44.11		44.08					
15	45.11							
16	45.15							
17	41.81		41.81					
18	45.36							
19	44.64							
20	44.18							

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
EXPOSED FILTERS

Client Name: ARMCO STEEL Project #: 0284-001-330

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial	7-23-91	Tuesday	14:00	48	75	HR	
Weight 1	7-24-91	Wednesday	14:30	47	74	HR	
Weight 2	7-26-91	Friday	13:30	47	73	HR	
Weight 3	7-29-91	Monday	10:00	50	72	HR	
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial	✓			✓				weight 1 •
Final		✓			✓			
Initial		✓			✓			weight 2 •
Final		✓			✓			
Initial		✓			✓			weight 3 •
Final		✓			✓			
Initial								weight 4 •
Final								

Filter #	Field ID	Weight 1	Weight 2	Delta Wght	Weight 3	Delta Wght	Weight 4	Delta Wght	Avg. Weight	Avg. TARE Weight
977	Run #1 PS	0.5374	0.5369	0.0005						.4130
975	Run 2 PS	0.6141	0.6130	0.0011	0.6125	0.0005				.4189
970	3	0.6291	0.6281	0.0010	0.6276	0.0005				.4192
986	4	~~0.4957~~	0.4958	0.0000						.4205
967	5	0.4388	0.4385	0.0003						.4147
969	6	0.4345	0.4343	0.0002						.434
972	7	0.9395	0.9374	0.0021	0.9378	0.0006				.4123
988	8	0.7901	0.7895	0.0006						.4190
973	9 *	0.4205	0.4208	0.0003						.4104
992	10	0.4255	0.4255	0.0000						.4171
989	11	0.4295	0.4291	0.0004						.4204
978	12	0.4301	0.4296	0.0005						.4142
	Blank	0.4188	0.4187	0.0003						

* Delta Wght Tolerance = ≤ ± 0.5 mg

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

(6/90)

* Run 4 0.4959

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
EXPOSED FILTERS

Client Name: ARMCO STEEL Project #: 0284-001-330

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial	Tuesday	7.23.91	14:00	48	75	HL	
Weight 1	Friday	7-26-91	13:30	47	73	HL	
Weight 2	Tuesday	7-14-91	14:30	42	74	HL	
Weight 3	Monday	7-29-91	10:00	50	72	HL	
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial		✓			✓			weight 1 •
Final		✓			✓			
Initial		✓			✓			weight 2 •
Final		✓			✓			
Initial		✓			✓			weight 3 •
Final		✓			✓			
Initial								weight 4 •
Final								

Filter #	Field ID	Weight 1	Weight 2	Delta Wght	Weight 3	Delta Wght	Weight 4	Delta Wght	Avg. Weight	Avg. TARE Weight
924	1A PF	0.6492	0.6488	0.0004						.6124
928	1B PF	0.6157	0.6163	0.0006						.6160
948	2A PF	0.6563	0.6560	0.0003						.6038
916	2B PF	0.6124	0.6129	0.0005						.6152
942	3A PF	0.6642	0.6637	0.0005						.6165
915	3B PF	0.6152	0.6146	0.0006						.6156
955	4A PF	*0.6399	0.6389	0.0010						.6258
960	4B PF	0.6345	0.6343	0.0002						.6341
961	5A PF	0.6358	0.6354	0.0004						.6310
954	5B PF	0.6209	0.6214	0.0005						.6210
937	6A PF	0.6215	0.6212	0.0003						.6165
931	6B PF	0.6095	0.6092	0.0003						.6083
930	7A PF	0.8596	0.8584	0.0012	0.8578	0.0006				.6076
918	7B PF	0.6103	0.6100	0.0003						.6105
919	8A PF	0.6880	0.6874	0.0006						.6083

• Delta Wght Tolerance = < ± 0.5 mg (6/90)

•• Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

*0.6399 / 9551 HL

ENSR

FILTER WEIGHT DATA SHEET
METHOD 5 FILTERS
EXPOSED FILTERS

Client Name: ARMCO STEEL Project #: 0284-001-330

PRECONDITIONING

	Day	Date	Time	R.H. (%)	R.T. (°F)	By	Remarks
Initial	Tuesday	7-23-91	14:00	48	75	HA	
Weight 1	Wednesday	7-24-91	14:30	47	74	HA	
Weight 2	Thursday	7-26-91	13:30	47	73	HA	
Weight 3	Friday	7-29-91	10:00	50	72	HA	
Weight 4							

GRAVIMETRIC ANALYSIS

Balance Zero	Drift +	Drift 0	Drift -	Rezero Yes	Rezero No	Prior to Filter Number	Balance #	
Initial								weight 1
Final								"
Initial								weight 2
Final								"
Initial								weight 3
Final								"
Initial								weight 4
Final								"

Filter #	Field ID	Weight 1	Weight 2	Delta Wght	Weight 3	Delta Wght	Weight 4	Delta Wght	Avg. Weight	Avg. TAF Weight
925	8 B PF	0.6119	0.6118	0.0001						.6110
956	9A PF	0.6270	0.6275	0.0005						.625
962	9B PF	0.6258	0.6254	0.0004						.6258
920	10A PF	0.6161	0.6160	0.0001						.6142
922	10B PF	0.6210	0.6204	0.0006						.6207
936	11A PF	0.6177	0.6175	0.0002						.6163
917	11B PF	0.6115	0.6112	0.0003						.6116
938	12A PF	0.6174	0.6180	0.0006	0.6176	0.0004				.6152
964	12B PF	0.5983	0.5984	0.0001						.6062
923	Blank PF	0.6135	0.6130	0.0005						.6122

* Delta Wght Tolerance = < ± 0.5 mg (6/90)

** Initial Conditioning = > 24 hrs; Further Conditioning = > 6 hrs

AnalytiKEM *An American NuKEM Company*

FAX LEAD SHEET

AnalytiKEM Inc.
2925 Richmond Avenue
Houston, TX 77098
713/520-1495
713/520-9900
Fax: 713/523-7107

URGENT _____ DATE _____

CONFIDENTIAL _____ JOB NO. _____

CALL FOR PICK UP _____ TIME IN _____

TO (COMPANY NAME): ENSR C+E

CITY AND STATE: Somerset NJ

FAX NUMBER: _____

ATTENTION: Ron Harkov

FROM (DEPARTMENT):

ADMINISTRATIVE	X
FIELD EQUIPMENT	
QUALITY ASSURANCE	
SAMPLE AND DATA MANAGEMENT	

SUBJECT: Updated RSD data

COMMENTS: _____

SENT BY: B. Basile

RETURN ORIGINAL AND
COPY OF LEAD SHEET TO: _____ TRASH: _____

TO BE COMPLETED BY OPERATOR

TIME SENT: 1635 DATE SENT: 8/13/91

OPERATOR: BBB

NO. OF PAGES SENT (including this page): 2

Receiving from Panafax UF-250 (713) 523-7107
AnalytiKEM - Houston (713) 520-1495

VERSION #2

Mark Greenberg Acton MA
8/13/91 1615 fax

BENZENE SOLUBLE ORGANICS ANALYSIS

SAMPLE ID	FIELD ID	SAMPLE WT (G)
MB4074X	BENZENE BLANK	0.0004
A7054-2	928-1B-PF	0.0009 FILTERED
A7054-4	915-2B-PF	0.0011
A7054-6	915-3B-PF	0.0006 FILTERED
A7054-8	960-4B-PF	0.0009 FILTERED
A7054-10	954-5B-PF	0.0012
A7054-12	931-6B-PF	-1.3223 FILTERED
A7054-14	918-7B-PF	0.0014
A7054-16	925-8B-PF	0.0012
A7054-18	952-9B-PF	0.0008 FILTERED
A7054-20	922-10B-PF	0.0010
A7054-22	917-11B-PF	0.0011
A7054-24	944-12B-PF	0.0018
A7057-1	RUN#1-PS1	0.0974
A7057-2	RUN#2-PS1	-1.3419 *
A7057-3	RUN#3-PS1	0.1909
A7057-4	RUN#4-PS1	0.0702
A7057-5	RUN#5-PS1	0.0205
A7057-6	RUN#6-PS1	0.0202
A7057-7	RUN#7-PS1	0.4644
A7057-8	RUN#8-PS1	0.3311
A7057-9	RUN#9-PS1	0.0103
A7057-10	RUN#10-PS1	0.0075
A7057-11	RUN#11-PS1	0.0060
A7057-12	RUN#12-PS1	0.0124
A7057-13	FIELD BLANK	0.0010
MB4078X	BENZENE BLANK	0.0002
A7083-1	#1	0.0008
A7083-2	#1	0.0009
A7083-3	#11	0.0009
A7083-4	#12	0.0010
A7083-5	#14	0.0010
A7083-6	#16	0.0010
A7083-7	#17	0.0011
A7083-8	#18	0.0010
A7083-9	#19	0.0015
MB4081X	BENZENE BLANK	0.0013
A7063-1	977-3 PUF	0.1529
A7063-2	972-7 PUF	0.0561
A7063-3	986-8 PUF	0.0710
A7063-4	973-9 PUF	0.0659
A7063-5	00-BLANK-PUF	0.1151

SAMPLE ID	FIELD ID	SAMPLE WT (G)
MB4084X	BENZENE BLANK	ZERO
A7045-1	1-FHR	0.0036
A7045-2	2-FHR	0.0039
A7045-3	3-FHR	0.0107
A7045-4	4-FHR	0.0040
A7045-5	5-FHR	0.0090
A7045-6	6-FHR	0.0092
A7045-7	7-FHR	-1.3346
A7045-8	8-FHR	0.0106
A7045-9	9-FHR	0.0064
A7045-10	10-FHR	0.0048
A7045-11	11-FHR	0.0037
A7045-12	12-FHR	0.0047
A7045-13	RINSE BLANK	0.0004
MB4047X	BENZENE BLANK	0.0013
A7054-1	924-1A-PF	0.0290
A7054-3	948-2A-PF	0.0449
A7054-5	942-3A-PF	0.0484
A7054-7	955-4A-PF	0.0105
A7054-9	961-5A-PF	0.0046
A7054-11	937-6A-PF	0.0045
A7054-13	930-7A-PF	0.2171
A7054-15	919-8A-PF	0.0726
A7054-17	956-9A-PF	0.0027
A7054-19	920-10A-PF	0.0028
A7054-21	935-11A-PF	0.0022
A7054-23	938-12A-PF	0.0063
A7054-25	923-BL-PF	0.0053
PUF1	REEXTRACT	0.0056
PUF2	REEXTRACT	0.0025
PUF3	REEXTRACT	0.0029
PUFBLANK		0.0014
MB4047X	300 ML	
MB4074X	250 ML	
MB4078X	225 ML	
MB4081X	780 ML	
MB4084X	25 ML	

* READINGS: 1.6963, 1.6805, 1.6799, 1.6788, 1.6776

What do you want done. The sample is oily

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-9-91	Site: ARMCO
Run No: 1	Battery ID: 24
Sampler ID: T002008	Door ID: 24
Filter ID: #970	Initial Leak Classification: 3
PUF ID: #970	Final Leak Classification: 3
Start Time: 13:02	End Time: 13:17
Last Cal Date: 6-2	System Flow Rate: ~1300 fpm (1.8)
Orifice ID:	Nozzle Size: ½"

Sample Exposure Data

Final Elapsed Timer Indication: 43502.1

Initial Elapsed Timer Indication: 43487.1

Total Sample Run Time (min): 15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	1302	~~92~~ 115	29.39	40	6.32	220
End	1317	~~92~~ 115	29.39	32	5.66	195
Ave	15 min	~~92~~ 115	29.39	36	6.00	207

AVE = 207

Total Sample Volume (std m3): 3.105

Comments

leak check ok -torn filter at recovery

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-9-91	Site: ARMCO
Run No: 3	Battery ID: 246
Sampler ID: T002008	Door ID: 246
Filter ID: 977	Initial Leak Classification: 2
PUF ID: 977	Final Leak Classification: 2-3
Start Time: 1544	End Time: 1559
Last Cal Date:	System Flow Rate: ~ 1200 fpm (1A)
Orifice ID: 47C	Nozzle Size: 1/2"

Sample Exposure Data

Final Elapsed Timer Indication:	43532.7
Initial Elapsed Timer Indication:	43517.7
Total Sample Run Time (min):	15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	1544	104	29.39	40	6.32	220
End	1559	112	↓	25	5.00	170
Ave	15	108	↓	32.5	5.70	196

Total Sample Volume (std m3): ~~2.925~~ 2.940

Comments

leak check okay

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-10	Site: ARMCO
Run No: 4	Battery ID: 2B
Sampler ID: TOOLBOX B	Door ID: 218
Filter ID: 986	Initial Leak Classification: 1
PUF ID: 986	Final Leak Classification: 1
Start Time: ~~1004~~ 1009	End Time: 1024
Last Cal Date:	System Flow Rate: ~1400 fpm (1.6)
Orifice ID: 97C	Nozzle Size: 2"

Sample Exposure Data

Final Elapsed Timer Indication: 43548.3

Initial Elapsed Timer Indication: 43533.2

Total Sample Run Time (min): 15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	1009	88	29.33	40	6.32	220
End	1024	92	↓	35	5.92	205
Ave	15	90	↓	37.5	6.12	211

Total Sample Volume (std m3): 3.165

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-10 Site: ARMCO

Run No: 5 Battery ID: 28

Sampler ID: T002008 Door ID: 28

Filter ID: 987 Initial Leak Classification: 1/2

PUF ID: 987 Final Leak Classification: 1

Start Time: 1100 End Time: 1115

Last Cal Date: System Flow Rate: ~1400 fpm

Orifice ID: 47-C Nozzle Size: 1/2"

Sample Exposure Data

Final Elapsed Timer Indication: 43563.8

Initial Elapsed Timer Indication: 43548.8

Total Sample Run Time (min): 15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	1100	85	29.33	40	6.32	220
End	1115	92	↓	37	6.08	208
Ave	15	87.5	↓	38.5	6.20	215

Total Sample Volume (std m3): 3.225

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date:	7-10-91	Site:	AMICO
Run No:	6	Battery ID:	241
Sampler ID:	T002008	Door ID:	241
Filter ID:	969	Initial Leak Classification:	1
PUF ID:	969	Final Leak Classification:	1 - ½
Start Time:	~~255~~ 1301	End Time:	13:16
Last Cal Date:	~~[illegible]~~	System Flow Rate:	~1600 ~~fpm~~
Orifice ID:	47C	Nozzle Size:	½"

Sample Exposure Data

Final Elapsed Timer Indication:	43579.6
Initial Elapsed Timer Indication:	43564.1
Total Sample Run Time (min):	15.4

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	~~1301~~ 1301	92	29.33	40	6.32	220
End	13:16	98	↓	38	6.16	213
Ave	15	95	↓	39	6.24	218

Total Sample Volume (std m3): 3.270

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date:	7-10-91	Site:	ARMCO
Run No:	17	Battery ID:	246
Sampler ID:	T002008	Door ID:	246
Filter ID:	972	Initial Leak Classification:	3-4
PUF ID:	972	Final Leak Classification:	3-4
Start Time:	1427	End Time:	
Last Cal Date:	1442	System Flow Rate:	1600 fpm
Orifice ID:	47-C	Nozzle Size:	½"

Sample Exposure Data

Final Elapsed Timer Indication:	43594.7
Initial Elapsed Timer Indication:	43579.7
Total Sample Run Time (min):	15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	1422	112	29.33	40	6.32	220
End	1442	118	↑	2	1.41	—
Ave	15	115	↓	21	4.58	155

Total Sample Volume (std m3): 2.325

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-10-91	Site: ARMCO
Run No: 8	Battery ID: 246
Sampler ID: T002008	Door ID: 246
Filter ID: 988	Initial Leak Classification: #3
PUF ID: 988	Final Leak Classification: 3
Start Time: 1322	End Time: 1337
Last Cal Date:	System Flow Rate: ~1600 fpm
Orifice ID: 47-C	Nozzle Size: ½"

Sample Exposure Data

Final Elapsed Timer Indication: 43609.8

Initial Elapsed Timer Indication: 43594.8

Total Sample Run Time (min): 15

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	1322	105	29.33	40	6.32	220
End	1337	114	↓	17	4.12	—
Ave	15	110	↓	28.5	5.34	182

Total Sample Volume (std m3): 2.730

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-11-91	Site: ARMCO
Run No: 9	Battery ID: 255
Sampler ID: T002006	Door ID: 255
Filter ID: 973	Initial Leak Classification: 1
PUF ID: 973	Final Leak Classification: 1/2
Start Time: 0850	End Time: 0905
Last Cal Date:	System Flow Rate: ~1400 lpm
Orifice ID: 47-C	Nozzle Size: ½"

Sample Exposure Data

Final Elapsed Timer Indication: 4362 4.9

Initial Elapsed Timer Indication: 4360 9.9

Total Sample Run Time (min): 15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	0850	109	29.45	40	6.32	220
End	0905	113		40	6.32	220
Ave	15	111	↓	40	6.32	220

Total Sample Volume (std m3): 3.300

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-11-91 | Site: ARMCO

Run No: 10 | Battery ID: 255

Sampler ID: T062008 | Door ID: 255

Filter ID: 992 | Initial Leak Classification: ½ - 0

PUF ID: 992 | Final Leak Classification: 0

Start Time: 1003 | End Time: 1018

Last Cal Date: | System Flow Rate: ~1400 fpm

Orifice ID: 47-C | Nozzle Size: ½"

Sample Exposure Data

Final Elapsed Timer Indication: 43640.2

Initial Elapsed Timer Indication: 43625.2

Total Sample Run Time (min): 15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (l)	$\sqrt{l}$	Flow Rate (SLPM)
Start	1003	103	29.45	40	6.32	220
End	1018	116	↓	35	5.92	205
Ave	15	109.5	↓	37.5	6.12	211

Total Sample Volume (std m3): 3.165

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-11-91	Site: ARMCO
Run No: 11	Battery ID: 255
Sampler ID: T002608	Door ID: 255
Filter ID: 989	Initial Leak Classification: 0
PUF ID: 989	Final Leak Classification: 0
Start Time: 10:45	End Time: 11:00
Last Cal Date:	System Flow Rate: ~1400 fpm
Orifice ID: 47-C	Nozzle Size: ½"

Sample Exposure Data

Final Elapsed Timer Indication: 43655.4

Initial Elapsed Timer Indication: 43640.4

Total Sample Run Time (min): 15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	$\sqrt{I}$	Flow Rate (SLPM)
Start	10:45	116	29.45	40	6.32	220
End	11:00	118	↓	39	6.24	218
Ave	15	117	↓	39.5	6.28	219

Total Sample Volume (std m3): 3.285

Comments

PS-1 Sample Collection Data Sheet
AISI Coke Oven Door Fugitive Emissions Monitoring Program

Date: 7-11-91 Site: AMICO

Run No: 12 Battery ID: 218

Sampler ID: T002008 Door ID: 218

Filter ID: 978 Initial Leak Classification: 1

PUF ID: 978 Final Leak Classification: ~~1~~ 0

Start Time: 12:33 End Time: 12

Last Cal Date: ~~12:48~~ 1301* System Flow Rate: ~1400 lpm

Orifice ID: 47-C Nozzle Size: ½"

Sample Exposure Data

Final Elapsed Timer Indication: 43670.9

Initial Elapsed Timer Indication: 43655.9

Total Sample Run Time (min): 15.0

Sample Flow Data

	Time	Gas Temp (F)	Bar Pres (in Hg)	Mag Gauge Reading (I)	√I	Flow Rate (SLPM)
Start	1233	118	29.45	40	6.32	220
End	*1301 ~~1248~~	122	"	39	6.24	218
Ave	15	120	"	39.5	6.28	219

Total Sample Volume (std m3): 3.285

Comments

power failure - for 10 minutes resumed sample at 1258 for final 3 minutes

SAMPLE DAT. HEET

DATE: 7/10/91 - 7/11/91 RUN #: DAY 2+3

CLIENT: ARMCO STEEL - MIDDLETOWN OH LOCATION: COKE BATTERY

PROJECT#: 0284-001-440 AMBIENT TEMP (°F): 74 TIME: 0910

OPERATOR: TIM MORRIS BAROMETRIC PRESS. (Hg) 997

SAMPLE ID#	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME (min)	AVG. STD. FLOW RATE (cc/min)	TOTAL VOL. (.ℓ)	ANALYTICAL RESULT ( )
#18	PTFE FILTER	Door # 210	1911	0900	1700	480	2982	1431.36	
#16	↓	Door # 223	5790	0916	1316	240	3010	722.4	
#19	↓	Door # 242	10030	0907	1507	360	3052	1098.7	
#14	PTFE FILTER	Door # 208	5790	0805	1450	405	3953	1600.96	
#2	↓	Door # 249	1911	0812	1212	240	2916	699.84	
#11	↓	Door # 226	10030	0808	1408	360	3052	1098.72	

Tare wt

4536

4515

SAMPLE DA.A SHEET

DATE: 7/9/91 RUN #: DAY 1

CLIENT: AISI - ARMCO / MIDDLETOWN LOCATION: COKE BATTERY

PROJECT#: 0284-001-440 AMBIENT TEMP (°F): 80° TIME: 1100

OPERATOR: JIM MORRIS BAROMETRIC PRESS. (Hg) 1000 mb

SAMPLE ID#	COLLECTION MEDIA	SAMPLE LOCATION	PUMP NUMBER	START TIME	END TIME	ELAPSED TIME (MIN)	AVG. STD. FLOW RATE (cc/min)	TOTAL VOL. (ℓ)	ANALYTICAL RESULT ( )	Tare wt
#12	PTFE FILTER	Door #207	10030	1045	1645	360	3012	1084.32	COKE DUST ON FILTER	44.78
#1	↓	Door # 233	1911	1050	1450	240	2965	711.60		44.34
#17	↓	Door # 245	5790	1100	1400	180	2994	538.92	COKE DUST ON FILTER DUE TO [redacted] PUSHING ACTIVITIES	41.81

M6C08S

DUPONT ALPHA-1 CALIBRATION DATA SHEET

PROJECT # : 0284 - 001 - 440

LOCATION : ARMCO STEEL - MIDDLETOWN 01410

DATE : 7/10/91 - 7/11/91

SAMPLE MEDIA TYPE : PTFE FILTER - -

MINI BUCK S/N : M - 7308

	PRE-TEST	POST-TEST
TIME :	0835	1700

			PRE-TEST (CC/MIN)				POST-TEST (CC/MIN)				
	PUMP S/N	TARGET FLOW RATE (cc/min)	RUN 1	RUN 2	RUN 3	STANDARD FLOW RATE	RUN 1	RUN 2	RUN 3	STANDARD FLOW RATE	AVERAGE STANDARD FLOW RATE
7/10	1911	3000	2970	3000	2985	2985	2912	2985	2937	2978	2952
	5790	3000	3029	3002	3017	3016	3008	2985	3017	3003	3010
	10030	3000	3012	3054	3021	3029	3052	3098	3074	3074	3052
							-				
7/11	1911	3000	2923	2870	2775	2923	2896	2921	2909	2909	2916
	5790	4000	3976	4034	4020	4010	3934	3901	3854	3896	3953
	10030	3000	2993	3048	3012	3018	3086	3082	3040	3086	3052

COMMENTS : _____

M60057

Do PRE-TEST and POST-TEST standard flow rates for each pump agree within + or - 10%? ____ Y ____ N

Are all calibrations and date clearly documented? ____ Y ____ N

Date: _____ Time: _____ Technician _____

DUPONT ALPHA-1 CALIBRATION DATA SHEET

PROJECT #: 0284-001-440

LOCATION: ARMCO - MIDDLETOWN

DATE: 7/9/91

SAMPLE MEDIA TYPE: PTFE FILTER

~~BUBBLE TUBE~~ S/N: 7308
Mini Buck

	PRE-TEST	POST-TEST
TIME:	0900	1710
BAROMETRIC PRESS. (mm Hg):	1050 mb	919
VAPOR PRESS. (mmHg):		
TEMP. (DEG C):	20	

PUMP S/N	VOLUME (ml)	PRE-TEST RUN TIME RUN 1	RUN 2	RUN 3	AVE(SEC)	AVE(MIN)	PRE-TEST STANDARD FLOW RATE	POST-TEST RUN TIME RUN 1	RUN 2	RUN 3	AVE(SEC)	AVE(MIN)	POST-TEST STANDARD FLOW RATE	AVERAGE STANDARD FLOW RATE
10030	3038	3037	3017	2998			3017	2997	3044	3037			3025	3012
5790	3080	2978	2963	2954			2965	3037	2993	3039			3023	2994
1911	3080	2945	2986	2993			2975	2909	2985	2969			2954	2965
10033	3000	2974	3000	2969			2981							

DO PRE-TEST AND POST-TEST STANDARD FLOW RATES FOR EACH PUMP AGREE WITHIN + OR - 10% ? ___Y ___N

ARE ALL CALIBRATIONS AND DATA CLEARLY DOCUMENTED? ___Y ___N

DATE: _____ TIME: _____ TECHNICIAN: _____

$$\text{STANDARD FLOWRATE} = \frac{\text{VOL (ml)}}{\text{TIME (min)}} \times \frac{(P - P_v)}{760} \times \frac{298.16}{(273 + T)}$$

ER	BLIND WGT.	BY	ORIG WGT.	BY	DELTA WGT.	TEMP.	HUM. %	DATE
1	MQ	44.33	44.30	HR	+0.03	73	47	8-1-91
2		44.45	44.42		+0.03			
11		45.98	45.98		ϕ			
12		~~44.86~~	44.86		+0.01			
14		44.43	44.42		+0.01			
16		45.25	45.24		+0.01			
17		41.94	41.94		ϕ			
18		45.42	45.42		ϕ			
19		44.77	44.77		ϕ			
		44.87						

M901378

CHAIN OF CUSTODY RECORD

ENSR

Client/Project Name: AISI

Project Location: ARMCO STEEL - MIDDLETOWN OH

Project Number: 0284-001-350

Field Logbook No.:

Chain of Custody Tape No.:

Sampler: (Print Name) /Affiliation: Jim Morris

Signature:

Send Results/Report to: Rick Cumba - ALTON

Analysis Requested: Gravimetric

Field Sample No./ Identification	Date	Time	Grab	Comp	Sample Container (Size/Matl)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	Gravimetric						Lab I.D.	Remarks
#1	7/11/11				Filter Pak	Filter			✓							
#2									✓							
#11									✓							
#12									✓							
#14									✓							
#16									✓							
#17									✓							
#18									✓							
#19	↓								✓							

Relinquished by: (Print Name)	Date:	Received by: (Print Name)	Date:
Jim Morris	7/[illegible]/11	[illegible]	7/[illegible]/11
Signature:	Time: 1605	Signature:	Time: 16[illegible]
Relinquished by: (Print Name)	Date:	Received by: (Print Name)	Date:
Signature:	Time:	Signature:	Time:
Relinquished by: (Print Name)	Date:	Received by: (Print Name)	Date:
Signature:	Time:	Signature:	Time:

Analytical Laboratory (Destination):

Seq. No. 100733

CHAIN OF CUSTODY RECORD

Client/Project Name	Project Location
AISI - ARMCO STEEL	MIDDLETOWN OHIO
Project No. 0284-001-350	**Field Logbook No.**
Sampler: (Signature) Jim Mercer	**Chain of Custody Tape No.** 35367

Sample No./ Identification	Date	Time	Lab Sample Number	Type of Sample	ANALYSES: B50 / particulate						REMARKS
1-FHR	7-9-91	1700		MeCl2 Rinse	✓						
2-FHR	↓	↓		↓	✓						
3-FHR	↓	↓		↓	✓						
4-FHR	7-10-91	1820		↓	✓						
5-FHR	↓	↓		↓	✓						
6-FHR	↓	↓		↓	✓						
7-FHR	↓	↓		↓	✓						
8-FHR	↓	↓		↓	✓						

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Jim Mercer	7/29	1630			
Relinquished by: (Signature)	**Date**	**Time**	**Received by: (Signature)**	**Date**	**Time**
Relinquished by: (Signature)	**Date**	**Time**	**Received for Laboratory: (Signature)**	**Date**	**Time**
Sample Disposal Method:	**Disposed of by: (Signature)**			**Date**	**Time**

SAMPLE COLLECTOR

SEND RESULTS OR Questions TO RICK Rumba - Acton office of ENSR

ANALYTICAL LABORATORY

AnalytiKEM
33 Industrial Way
Wilmington, MA 01887
(508) 657-4290

AnalytiKEM

1974-3-84

CHAIN OF CUSTODY RECORD

Client/Project Name	Project Location
AISI - ARMCO STEEL	MIDDLETOWN OHIO
Project No.	**Field Logbook No.**
0284-001-350	
Sampler: (Signature)	**Chain of Custody Tape No.**
Jim Morris	35367

Sample No./ Identification	Date	Time	Lab Sample Number	Type of Sample	1350 / Particulate						REMARKS
9-FHR	7/10/91	1820		MeCl2 Rinse	✓						
10-FHR	7/11/91	1530			✓						
11-FHR	↓	↓			✓						
12-FHR				↓	✓						
Blank-FHR				Acetone Blank	✓						

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Jim Morris	7/29	1630			
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received for Laboratory: (Signature)	Date	Time
Sample Disposal Method:			Disposed of by: (Signature)	Date	Time

SAMPLE COLLECTOR

SEND RESULTS OR QUESTIONS TO RICK RUMBA - ACTON OFFICE

ANALYTICAL LABORATORY

AnalytiKEM
33 Industrial Way
Wilmington, MA 01887
(508) 657-4290

AnalytiKEM

1974-3-84

FORM M-5290-S

DAILY PUSHER REPORT

COKE PLANT DEPT.

DATE 7-9-91

7-3 A

Tues

NO.	OVEN NO.	POUNDS CHARGED	TIME PUSHED	TIME CHARGED
1				
2				2
3				
4				1
5				
6				
7				2
8				
9				
10				1
11				
12				2
13				
14				
15				1
16				
17				
18				2
19				
20				1
21				
22				
23				
24				2
25				
26				
27				1
28				
29				
30				2
31				
32				
33				1
34				
35				
36				2
37				
38				

NO.	OVEN NO.	POUNDS CHARGED	TIME PUSHED	TIME CHARGED
46	216	7 00	7 13	24 40
47	218	13	26	23 50
48	120	26	39	24 15
49	122	39	52	24 15
50	124	52	8 05	23 45
51	220	8 05	18	24 20
52	222	18	31	24 25
53	224	31	44	23 45
54	126	44	57	24 35
55	128	57	9 10	23 25
56	226	9 10	23	24 15
57	228	23	36	24 15
58	230	36	49	22 50
59	132	49	10 02	24 20
60	134	10 02	15	24 15
61	136	15	28	23 20
62	232	28	41	23 25
63	234	41	54	23 40
64	236	54	11 07	23 25
65	140	11 07	20	23 40
66	142	20	33	23 15
67		LUNCH		
68	238	47	59	24 10
69	240	59	12 12	24 20
70	242	12 12	25	23 40
71	144	25	38	24 10
72	146	38	51	24 20
73	148	51	13 04	24 00
74	244	13 04	17	24 30
75	246	17	30	24 35
76	248	30	43	23 50
77	150	43	56	24 10
78	152	56	14 09	24 15
79	156	14 09	22	24 20
80	250	22	35	24 30
81	252	35	48	24 40
82	254	48	58	24 50
83				

NO.	OVEN NO.	POUNDS CHARGED	TIME PUSHED	TIME CHARGED
91				
92		58,000		
93				
94				
95				
96				
97				
98				
99				
100				
101				
102		58,000		
103		58,000		
104				
105				
106				
107				
108				
109				
110		58,000		
111				
112				
113				
114				
115				
116				
117				
118				
119				
120				
121				
122				
123				
124		58,000		
125				
126				
127				
128				
129				

FORM M-9290-5

DAILY PUSHER REPORT

COKE PLANT DEPT.

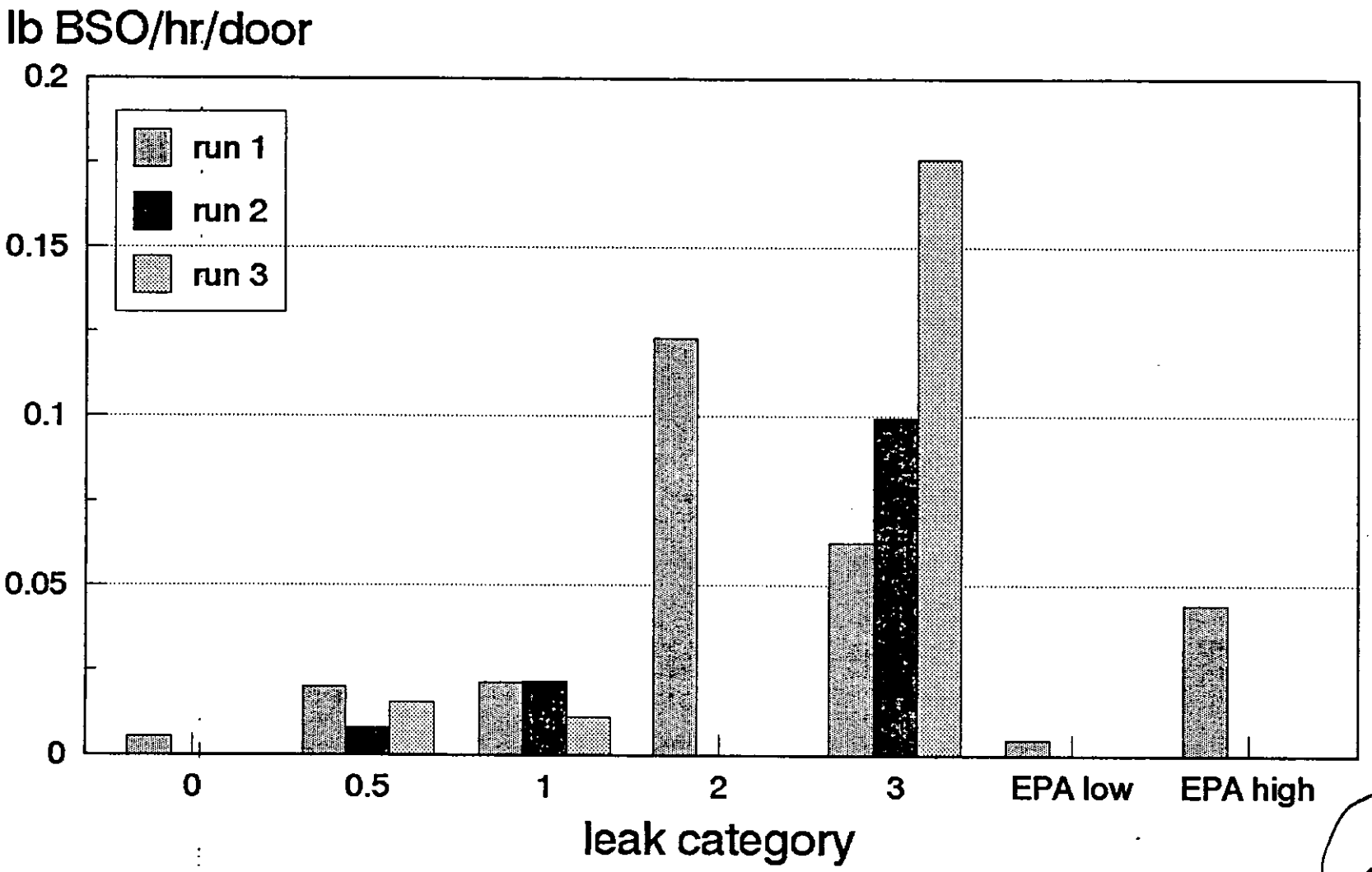
DATE 7-10-91

7-3

Wed

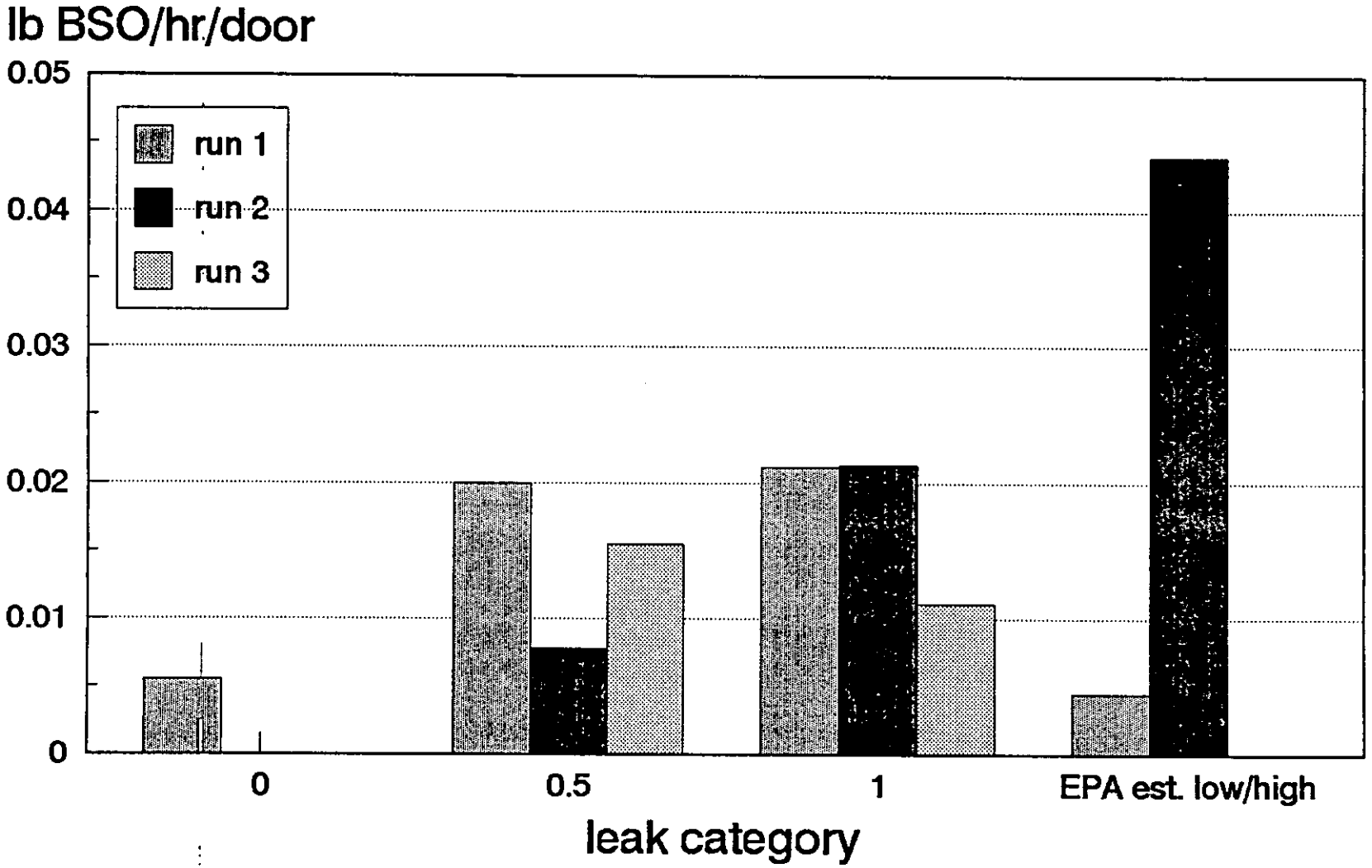
NO.	OVEN NO.	POUNDS CHARGED	TIME PUSHED	TIME CHARGED	NO.	OVEN NO.	POUNDS CHARGED	TIME PUSHED	TIME CHARGED	NO.	OVEN NO.	POUNDS CHARGED	TIME PUSHED	TIME CHARGED
1				1	46	118	7 00	7 13	2440	91				
2					47	214	13	26	2445	92				
3				2	48	216	26	39	2415	93				
4					49	218	39	52	2420	94		58000#		
5					50	120	52	8 05	2420	95				
6				1	51	122	8 05	18	2425	96				
7					52	124	18	31	2435	97				
8					53	220	31	44	2435	98				
9				2	54	222	44	57	2440	199				
10					55	224	57	9 10	2340	100				
11				1	56	126	9 10	23	2405	101		CHARGE 130		
12					57	128	23	36	2345	102		10 SERIES.		
13					58	226	36	49	2415	103				
14				2	59	228	49	10 02	2420	104		58000#		
15					60	230	10 02	15	2355	105		58000#		
16					61	132	15	28	2430	106				
17				1	62	134	28	41	2440	107				
18					63	136	41	54	2325	108				
19					64	232	54	11 07	2445	109				
20				2	65	234	11 07	20	2450	110				
21					66	236	20	33	2450	111				
22					67	[redacted]	- Lunch		[redacted]	112				
23				1	68	140	46	59	2435	113		58000#		
24					69	142	59	12 12	2350	114				
25					70	238	12 12	25	2415	115		58000#		
26				2	71	240	25	38	2420	116				
27					72	242	38	51	2335	117				
28					73	144	51	13 04	2430	118				
29				1	74	146	13 04	17	2435	119				
30					75	148	17	30	2325	120				
31					76	244	30	43	2415	121				
32				2	77	246	43	56	2420	122				
33					78	248	56	14 09	2335	123				
34					79	150	14 09	22	2410	124				
35				1	80	152	22	35	2410	125				
36					81	156	35	49	2325	126		58000#		
37				2	82	250	48	59	2420	127				
38					83					128				
39					84		36 POUNDS	3 MIN.		129				

BSO Emissions from coke oven doors



AISI report-Middletown, Ohio, 12/91
plot without leak category 4

BSO Emissions from coke oven doors



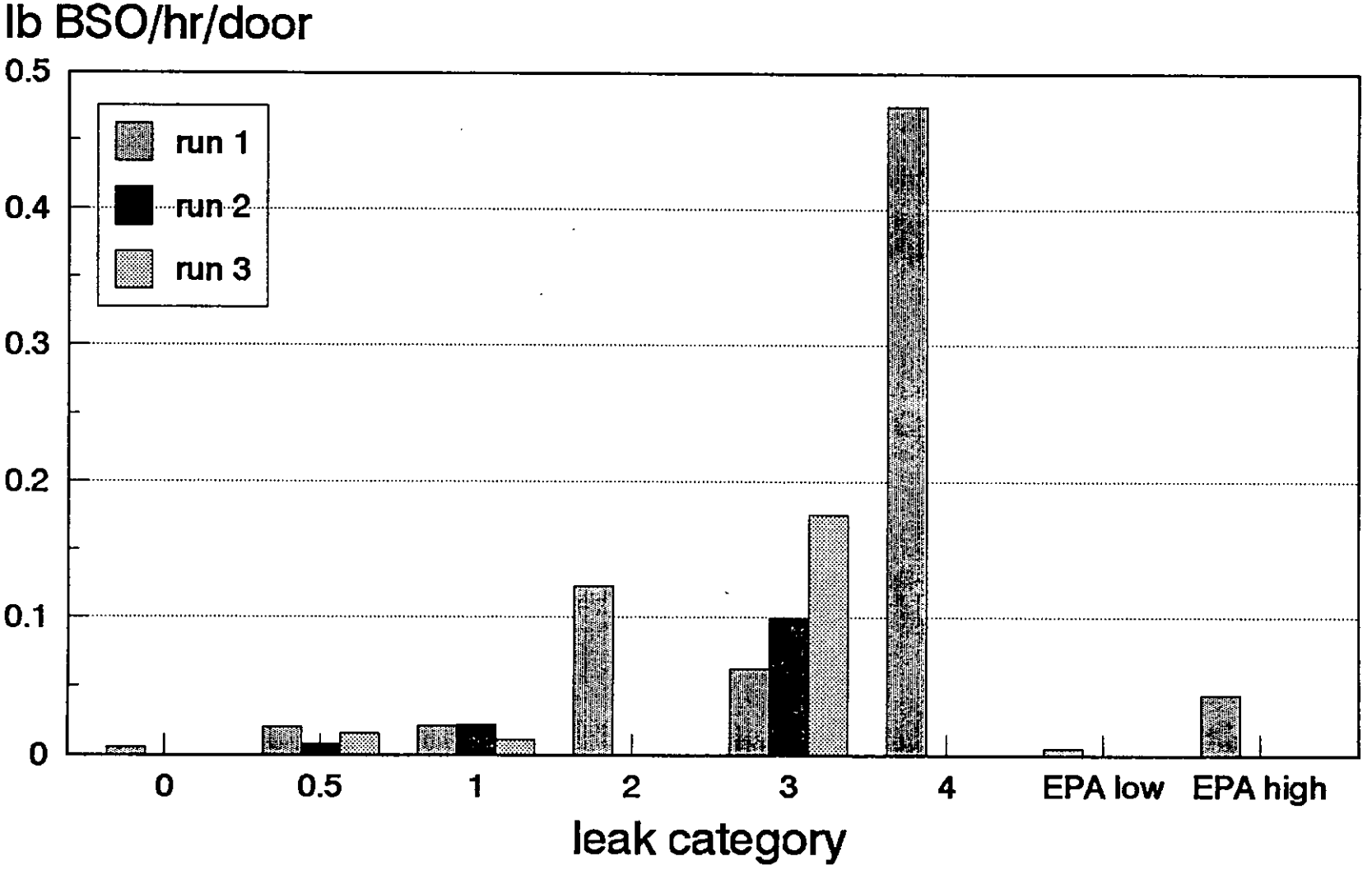
AISI report-Middletown, Ohio, 12/91
plot without leak category # 2, 3, + 4

Ron - You don't have to return this copy of the report. It's yours. Table 4-2 is of interest. Notice the negative numbers (-4 mg) for the back filter. This is because the filter blank was high (5.3 mg). My graphs are based on the recalculated emission rates using a more realistic blank of 1.4 mg.

Roy

BSO Emissions from coke oven doors

AISI report-Middletown, Ohio, 12/91



American Coke and Coal Chemicals Institute

1255 Twenty-Third Street, N.W., Washington, D.C. 20037 (202) 452-1140 Telecopier: (202) 833-3636

January 9, 1992

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
MD-13
Research Triangle Park, North Carolina 27111

Attn.: Doug Bell, Branch Chief
Standards Development Branch

Re.: AISI/ACCCI Report - "Final Phase I Method Validation Report for Quantitative Coke Oven Door Leak Measurement Study"

Dear Mr. Bell:

Attached for EPA's review and consideration in its development of coke oven standards under the Clean Air Act Amendments of 1990 is the December 1991 AISI/ACCCI Report "Final Phase I Method Validation Report for Quantitative Coke Oven Door Leak Measurement Study". The Report, which was prepared for AISI/ACCCI by ENSR Consulting and Engineering, summarizes the results of a method validation study conducted by ENSR at the ARMCO Middletown, Ohio, coke plant in July 1991. A report on a subsequent Phase II method validation study conducted by ENSR at the Citizens Gas & Coke Utility coke plant in Indianapolis, Indiana, in December 1991, is now being prepared and will be submitted to you upon its completion.

Call Bruce Steiner (202-452-7271) or myself if you have any questions.

Sincerely,

David C. Ailor, P.E.
Director of Regulatory Affairs
Attachment

cc: Roy Huntley, EPA/EMB

cc (w/o Attachment):
Bruce Steiner, American Iron and Steel Institute
R024a