United States Environmental Protection Agency

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

EPA-454/R-00-028
May 2000

AIR

EPA

Final Report

Hot Mix Asphalt Plants, Truck Loading, Manual Methods Testing

Asphalt Plant D
Barre, MA

Volume 1 of 1

Office of Air Quality Planning and Standards
Clean Air
OAQPS

FINAL REPORT

HOT MIX ASPHALT PLANTS
TRUCK LOADING
MANUAL METHODS TESTING
ASPHALT PLANT D, BARRE, MASSACHUSETTS

EPA Contract No. 68-D-98-004
Work Assignment No. 3-02

Prepared for:

Mr. Michael L. Toney (MD-19)
Work Assignment Manager
SMTG, EMC, OAQPS
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

May 2000

Submitted by

PACIFIC ENVIRONMENTAL SERVICES, INC.
5001 S. Miami Blvd., Suite 300
Post Office Box 12077
Research Triangle Park, NC 27709-2077
(919) 941-0333
FAX (919) 941-0234

DISCLAIMER

The information in this document has been funded wholly or in part by the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency (EPA) under contract to Pacific Environmental Services, Inc. (PES). PES performed the work presented in this document under three EPA contracts and seven Work Assignments; EPA Contract No. 68-D-98-004, Work Assignment Nos. 1-08, 2-07, 3-02, and 3-05; EPA Contract No. 68-D-70002, Work Assignment Nos. 0-05 and 1-07; and EPA Contract No. 68-D-70069, Work Assignment No. 2-16. This document has been prepared by PES, reviewed following PES' internal quality assurance procedures, and approved by PES for distribution. This document has been subjected to the Agency's review, and has been approved by EPA for publication as an EPA document. Mention of trade names does not constitute endorsement by the EPA or PES.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONCLUDED)

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF TERMS

ASTM – American Society for Testing and Materials
CAAP – Coalition Against the Asphalt Plant
CEMS – Continuous Emissions Monitoring System
CTS – Calibration Transfer Standard
DQO – Data Quality Objective
EFIG – Emission Factor and Inventory Group
EMC – Emissions Measurement Center
EMAD – Emission Monitoring and Analysis Division
ESD – Emission Standards Division
ESP – Electrostatic Precipitator
FID – Flame Ionization Detector
FTIR – Fourier Transform Infrared Spectroscopy
HAP – Hazardous Air Pollutant
MCEM – Methylene Chloride Extractable Matter
MRI – Midwest Research Institute
NDO – Natural Draft Opening
OAQPS – Office of Air Quality Planning and Standards

GLOSSARY OF TERMS (CONTINUED)

PES	– Pacific Environmental Services
PM	– Particulate Matter
PTE	– Permanent Total Enclosure
RAP	– Recycled Asphalt
RTFOT	– Rolling Thin Film Oven Test
SED	– Silo Exhaust Duct
SMTG	– Source Measurement Technology Group
SVOHAP	– Semi-Volatile Organic Hazardous Air Pollutant
TED	– Tunnel Emissions Duct
TFOT	– Thin Film Oven Test
THC	– Total Hydrocarbons
TTE	– Temporary Total Enclosure
VOHAP	– Volatile Organic Hazardous Air Pollutant
VOST	– Volatile Organic Sampling Train

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards (OAQPS) is investigating the asphalt manufacturing industry to identify and quantify particulate matter (PM) and methylene chloride extractable matter (MCEM) emissions from load-out operations. In support of this investigation, the EPA's Emissions, Monitoring and Analysis Division (EMAD) issued Pacific Environmental Services, Inc. (PES) six separate work assignments to conduct emissions testing at an asphalt plant during load-out operations. This report was prepared under the sixth and final work assignment, WA 3-05 on EPA Contract 68-D-98-004.

The primary objective of the emissions testing was to characterize the uncontrolled emissions of PM and MCEM from a batch production, hot mix asphalt plant during load-out operation. Asphalt Plant D, a batch production facility in Barre, Massachusetts with the capacity to produce 1,600 tons per day of hot mix asphalt, was selected as the host facility. To capture load-out emissions, a temporary total enclosure (TTE) and exhaust system was built around the load-out bay at Plant D. During load-out, emissions were drawn off the TTE through an exhaust duct with a 15,000 cubic feet per minute (cfm) exhaust fan. Testing for load-out emissions was performed in the exhaust duct using EPA Test Methods 1, 2, 4, and 315. Three tests were performed over three consecutive days beginning on October 5, 1998. Each test started early in the morning, ran most of the day, and included most of the plant's production for the day. For each test, two simultaneous EPA Method 315 runs were performed. An Emissions Test Log is presented in Table 1.1.

In addition to the emissions testing described above, PES monitored and recorded process operations, collected process samples, and measured the temperature of the asphalt concrete in the bed of selected transport trucks as the trucks left the load-out area. Also, measurements were taken to estimate the deposition of MCEM on the ceiling of the TTE and in the TTE exhaust duct.

Midwest Research Institute (MRI), another EPA contractor, was also on-site for the testing and measured total hydrocarbon emissions from the TTE simultaneously with the PM & MCEM testing. The MRI data are presented in a separate report.

PES used three subcontractors for this effort: Advanced Asphalt Technologies, LP (AAT), Eastern Research Group (ERG), and Atlantic Technical Services, Inc. (ATS). AAT provided analysis of the asphalt samples. ERG provided analysis of the EPA Method 315 samples. ATS provided support during the field testing and the preparation of the Draft Final Report.

TABLE 1.1

EMISSIONS TEST LOG - TTE EXHAUST DUCT ASPHALT PLANT D, BARRE, MASSACHUSETTS

Run No.	Date	Pollutant	Start Time	Finish Time
Location No. 2				
M315-1	10/05/98	PM & MCEM	0721	1403
M315-2	10/06/98	PM & MCEM	0714	1326
M315-3	10/07/98	PM & MCEM	0636	1313
Location No. 1				
M315-6	10/05/98	PM & MCEM	0721	1400
M315-7	10/06/98	PM & MCEM	0714	1326
M315-8	10/07/98	PM & MCEM	0636	1313

The PES field test crew consisted of Frank Phoenix (Project Manager and Field Team Leader), Dennis D. Holzschuh, Derek Hawkes, and Josh Berkowitz. The PES on-site QA coordinator was Dennis P. Holzschuh. The ATS field crew consisted of Emil Stewart and Allan Lowe. On-site direction and overall coordination for the project was provided by Michael L. Toney, the EMAD Work Assignment Manager for WA 2-07, and Ron Myers with EPA's Emission Factor and Inventory Group. The test project organization and major lines of communication are presented in Figure 1.1.

In Section 2.0 of this report, a summary of results from emissions testing is presented. More detailed results appear in Appendix A. In Section 3.0, a brief description of the process, a summary of the process data collected, and results of analysis of the process samples is presented. More detailed process information is presented in Appendix B. In Section 4.0, descriptions of the sampling locations are presented. In Section 5.0, descriptions of the sampling and analytical procedures used during the test program are discussed. Copies of the test methods appear in Appendix G. Detailed analytical results appear in Appendix C. In Section 6.0, the quality assurance/quality control (QA/QC) procedures used during the test program are presented. Additional QA/QC data are presented in Appendix F.

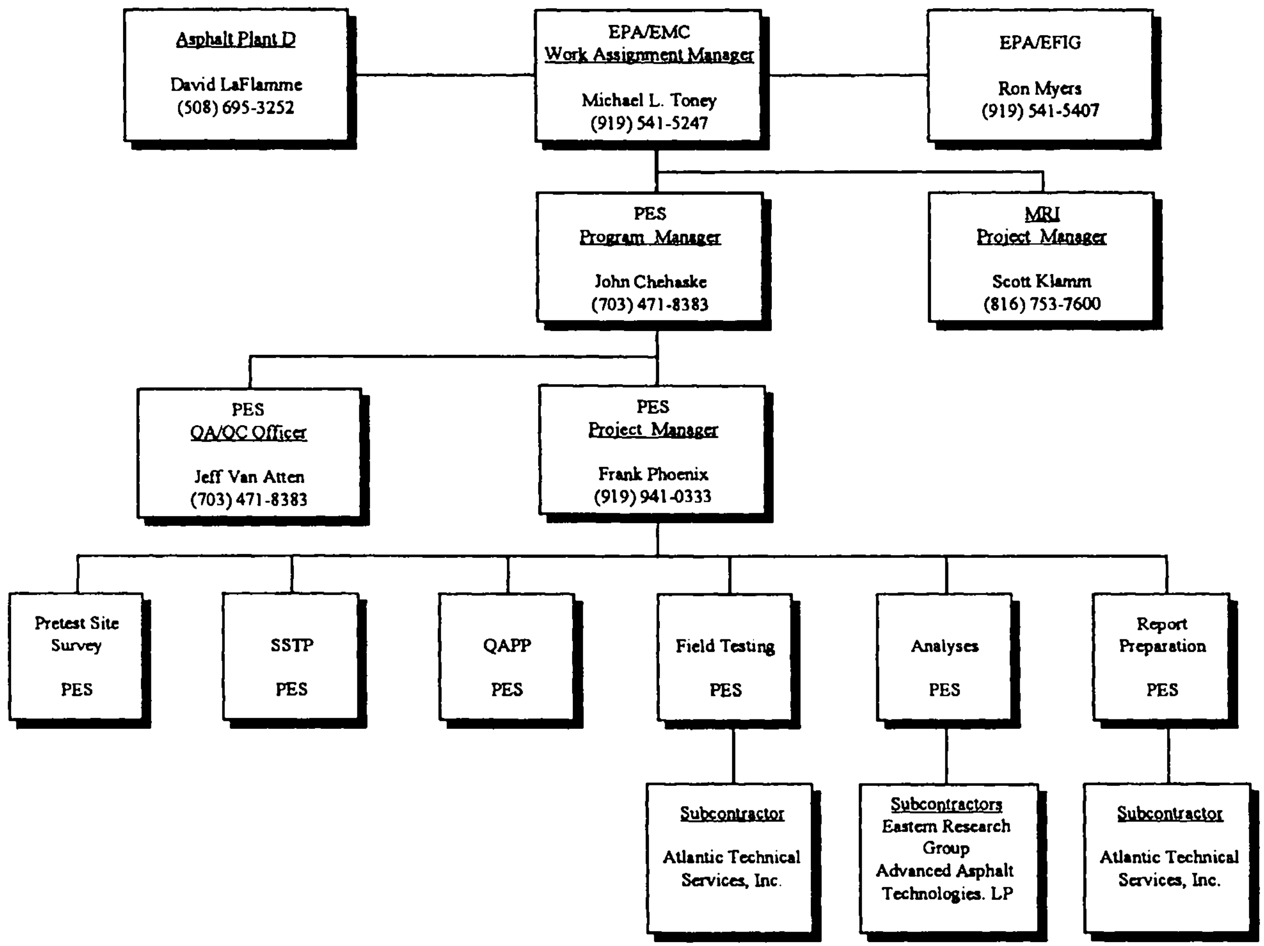


Figure 1.1 Project Organization - US EPA Hot Mix Asphalt Load-out Operation, Asphalt Plant D, Barre, Massachusetts

2.0 SUMMARY OF TEST RESULTS

In this section, the results of the Method 315 tests performed at Asphalt Plant D are presented. The Method 315 tests were performed in the TTE exhaust duct during load-out operations. A description of the procedures used to coordinate sampling and load-out operations is presented in Section 3.0 of this report.

2.1 PM AND MCEM MEASUREMENTS

In Table 2.1, a comparison of results from the simultaneous Method 315 runs are presented. Note that there are variations in the results, even between simultaneous measurements. The variations, while significant on a relative basis, do not compromise the quality or usefulness of the data. The variations stand out because the measured concentrations are very low and are close to the lower detection limit of Method 315. For example, the relative percent difference (RPD) is 82.8% between the simultaneous MCEM measurements from repetition 2. The MCEM catch weights for repetition 2 are 0.0043 grams for Location 1 and 0.0018 grams for Location 2. While the relative percentage difference between these two catch weights appears to be significant, both catch weights are very small, and close to the detection limit of Method 315. Even in light of this difference and the high RPD, both sets of data demonstrate that very little MCEM was present in the TTE exhaust.

In Tables 2.2 and 2.3, PM and MCEM emission sampling and exhaust gas parameters are presented. In Tables 2.4 and 2.5, PM and MCEM emission gas concentrations and emission rates are presented. Note that emission rates are presented in pounds per test period (lb/test period) and pounds per ton of hot mix asphalt loaded (lb/ton). Pounds per test period emission rates were calculated by multiplying the concentration in grains per dry standard cubic feet (gr/dscf) first by the exhaust gas flow rate in dry standard cubic feet per minute (dscfm) and second by the test time in minutes. Pounds per ton emission rates were calculated by dividing the pounds per test period by the tons of asphalt loaded during the test period.

It should be noted that the results for Plant D presented here may be biased high. From inside the TTE during and after load-out, material of sufficient size to quickly settle to the ground under normal operations was observed on the screens covering the hood inlets and on the surface of the hood near the hood inlets (normal operations refers to load-out without a TTE). It is likely that some of this "large" material was drawn into the TTE ventilation system and captured by the Method 315 trains.

TABLE 2.1

COMPARISON OF SIMULTANEOUS TESTS DURING HOT MIX ASPHALT LOAD-OUT AT ASPHALT PLANT D

	Location 1	Location 2	Average
Exhaust Gas Flow Rate, dscfm[a]			
Repetition 1	15,488	15,378	15,433
Repetition 2	14,646	14,123	14,385
Repetition 3	13,431	13,964	13,698
Particulate Matter			
Emission Rate, lb/test period [b]			
Repetition 1	1.58E+00	8.73E-01	1.23E+00
Repetition 2	1.90E+00	1.36E+00	1.63E+00
Repetition 3	5.42E-01	7.03E-01	6.23E-01
MCEM			
Emission Rate, lb/test period [b]			
Repetition 1	2.35E-01	2.05E-01	2.20E-01
Repetition 2 [c]	1.94E-01	8.06E-02	1.37E-01
Repetition 3	1.33E-01	8.46E-02	1.09E-01

[a] Dry standard cubic feet per minute at 68°F (20° C) and 1 atm.

[b] Pounds per test period.

[c] Relative percent difference; calculated as the absolute value of the difference between Location 1 and Location 2 divided by the average of both locations times 100; equal to 82.8% for repetition 2.

TABLE 2.2

PARTICULATE AND METHYLENE CHLORIDE EXTRACTABLE MATTER EMISSIONS SAMPLING AND EXHAUST GAS PARAMETERS TTE EXHAUST, LOCATION 2 HOT MIX ASPHALT PLANT D, BARRE, MASSACHUSETTS

Run No.	M315-1	M315-2	M315-3	Average
Date	10/5/98	10/6/98	10/7/98	
Total Sampling Time, minutes	240.0	247.5	250.7	
Average Sampling Rate, dscfm [a]	0.695	0.695	0.692	0.694
Sample Volume:				
dscf [b]	166.863	172.033	173.427	170.774
dscm [c]	4.725	4.871	4.911	4.836
Average Exhaust Gas Temperature, °F	59	57	54	57
O_2 Concentration, % by Volume	20.9	20.9	20.9	20.9
CO_2 Concentration, % by Volume	0.0	0.0	0.0	0.0
Moisture, % by Volume	0.7	0.5	0.6	0.6
Exhaust Gas Volumetric Flow Rate:				
acfm [d]	15,300	13,900	13,700	14,300
dscfm [a]	15,400	14,100	14,000	14,500
dscmm [e]	435	400	395	410
Isokinetic Sampling Ratio, %	90.0	97.9	98.6	95.5
Process Parameters				
RTFOT[f] Results, Mass Change at 325°F, %	-0.204	-0.246	-0.261	-0.237
Asphalt Temperature at Load-out, °F	306.7	325.1	326.7	319.5
Asphalt Loaded per Test Period, Tons	893.5	916.2	856.7	888.8

[a] Dry standard cubic feet per minute at 68°F (20° C) and 1 atm.

[b] Dry standard cubic feet at 68°F (20° C) and 1 atm.

[c] Dry standard cubic meters at 68°F (20° C) and 1 atm.

[d] Actual cubic feet per minute at exhaust gas conditions.

[e] Dry standard cubic meters per minute at 68°F (20° C) and 1 atm.

[f] Rolling Thin Film Oven Test (ASTM D 2872).

TABLE 2.3

PARTICULATE AND METHYLENE CHLORIDE EXTRACTABLE MATTER EMISSIONS SAMPLING AND EXHAUST GAS PARAMETERS TTE EXHAUST, LOCATION 1 HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

Run No.	M315-6	M315-7	M315-8	Average
Date	10/5/98	10/6/98	10/7/98	
Total Sampling Time, minutes	240.0	246.9	250.1	
Average Sampling Rate, dscfm [a]	0.754	0.714	0.666	0.711
Sample Volume:				
dscf [b]	181.042	176.253	166.637	174.644
dscm [c]	5.127	4.991	4.719	4.945
Average Exhaust Gas Temperature, °F	60	58	55	58
O_2 Concentration, % by Volume	20.9	20.9	20.9	20.9
CO_2 Concentration, % by Volume	0.0	0.0	0.0	0.0
Moisture, % by Volume	0.6	0.3	0.7	0.5
Exhaust Gas Volumetric Flow Rate:				
acfm [d]	15,400	14,400	13,200	14,300
dscfm [a]	15,500	14,600	13,400	14,500
dscmm [e]	439	415	380	411
Isokinetic Sampling Ratio, %	95.9	100.2	99.8	98.6
Process Parameters				
RTFOT[f] Results, Mass Change at 325°F, %	-0.204	-0.246	-0.261	-0.237
Asphalt Temperature at Load-out, °F	306.7	325.1	326.7	319.5
Asphalt Loaded per Test Period, Tons	893.5	916.2	856.7	888.8

[a] Dry standard cubic feet per minute at 68°F (20° C) and 1 atm.

[b] Dry standard cubic feet at 68°F (20° C) and 1 atm.

[c] Dry standard cubic meters at 68°F (20° C) and 1 atm.

[d] Actual cubic feet per minute at exhaust gas conditions.

[e] Dry standard cubic meters per minute at 68°F (20° C) and 1 atm.

[f] Rolling Thin Film Oven Test (ASTM D 2872).

TABLE 2.4

PARTICULATE AND METHYLENE CHLORIDE EXTRACTABLE MATTER EXHAUST GAS CONCENTRATIONS AND EMISSION RATES TTE EXHAUST, LOCATION 2 HOT MIX ASPHALT PLANT D, BARRE, MASSACHUSETTS

Run No.	M315-1	M315-2	M315-3	Average
Date	10/5/98	10/6/98	10/7/98	
Clock Time, 24-hr clock	0721-1403	0714-1326	0636-1313	
Tons of asphalt loaded per test period	893.5	916.2	856.7	888.8
Particulate Matter				
Concentration, gr/dscf [a]	1.66E-03	2.72E-03	1.41E-03	1.93E-03
Concentration, g/dscm [b]	3.79E-03	6.22E-03	3.22E-03	4.41E-03
Emission Rate, lb/test period [c]	8.73E-01	1.36E+00	7.03E-01	9.78E-01
Emission Rate, lb/ton [d]	9.77E-04	1.48E-03	8.21E-04	1.09E-03
Methylene Chloride Extractable Matter				
Concentration, gr/dscf [a]	3.88E-04	1.61E-04	1.69E-04	2.40E-04
Concentration, g/dscm [b]	8.89E-04	3.70E-04	3.87E-04	5.48E-04
Emission Rate, lb/test period [c]	2.05E-01	8.06E-02	8.46E-02	1.23E-01
Emission Rate, lb/ton [d]	2.29E-04	8.80E-05	9.87E-05	1.39E-04

[a] Grains per dry standard cubic feet at 68°F (20° C) and 1 atm.

[b] Grams per dry standard cubic meters at 68°F (20° C) and 1 atm.

[c] Pounds per test period.

[d] Pounds per ton of asphalt loaded.

TABLE 2.5

PARTICULATE AND METHYLENE CHLORIDE EXTRACTABLE MATTER EXHAUST GAS CONCENTRATIONS AND EMISSION RATES TTE EXHAUST, LOCATION 1 HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

Run No.	M315-6	M315-7	M315-8	Average
Date	10/5/98	10/6/98	10/7/98	
Clock Time, 24-hr clock	0721-1403	0714-1326	0636-1313	
Tons of asphalt loaded per test peri	893.5	916.2	856.7	888.8
Particulate Matter				
Concentration, gr/dscf [a]	2.97E-03	3.67E-03	1.13E-03	2.59E-03
Concentration, g/dscm [b]	6.79E-03	8.40E-03	2.59E-03	5.92E-03
Emission Rate, lb/test period [c]	1.58E+00	1.90E+00	5.42E-01	1.34E+00
Emission Rate, lb/ton [d]	1.76E-03	2.07E-03	6.33E-04	1.49E-03
Methylene Chloride Extractable Matter				
Concentration, gr/dscf [a]	4.43E-04	3.76E-04	2.78E-04	3.66E-04
Concentration, g/dscm [b]	1.01E-03	8.62E-04	6.36E-04	8.37E-04
Emission Rate, lb/test period [c]	2.35E-01	1.94E-01	1.33E-01	1.88E-01
Emission Rate, lb/ton [d]	2.63E-04	2.12E-04	1.56E-04	2.10E-04

[a] Grains per dry standard cubic feet at 68°F (20° C) and 1 atm.

[b] Grams per dry standard cubic meters at 68°F (20° C) and 1 atm.

[c] Pounds per test period.

[d] Pounds per ton of asphalt loaded.

2.2 MCEM DEPOSITION MEASUREMENTS

Measurements were made to estimate the MCEM deposition on the ceiling of the TTE and in the TTE exhaust plenum and exhaust duct. The results of these measurements show that MCEM deposition was low relative to the MCEM emissions measured in the air drawn off the TTE.

Clean metal plates and clean C-channels were placed on the ceiling of the TTE on both sides of the load-out area before the first test began. After the third test, the plates and C-channels were removed and cleaned. The recovered samples were analyzed following the procedures of Method 315. The results of the Method 315 analyses were used in conjunction with the amount of hot asphalt concrete loaded while the plates and C-channels were in place to estimate pounds of MCEM deposition on the TTE ceiling per ton of asphalt loaded. Details of these estimates appear in Section 5 and in Appendix D. Total ceiling deposition was estimated to be 3.13E-06 pounds of MCEM per ton of asphalt loaded.

An estimate of the MCEM deposition inside the TTE exhaust plenum and exhaust duct was also developed following procedures similar to those discussed above. MCEM deposition inside the TTE exhaust plenum and exhaust duct was estimated to be 4.53E-07 pounds per ton. Refer to Appendix D for more details.

3.0 PROCESS DESCRIPTION

Asphalt Plant D is a batch production plant located in Barre, Massachusetts. A simplified process flow schematic is shown in Figure 3.1. The plant has a normal production capacity of 150 tons per hour (tph) of hot mix asphalt. The plant typically starts up at 6:30 a.m. and produces asphalt concrete until around 2:00 p.m. A realistic rate for a full production day is about 200 to 210 tph. The facility air permit allows up to 255 tph of production and is based on a production rate of 1 batch per minute for 60 minutes. The air permit also cites an annual production of 600,000 tons per year. Seasonal restrictions and city-restricted operating hours (5 days per week, 10 hours per day maximum) prohibit maximum production from being achieved. Typical annual production for the facility is about 100,000 tons.

Under normal operations a truck pulls into the load-out bay and is loaded with 20 to 32 tons of asphalt concrete in 5 to 10 minutes. The exact mix of each batch (aggregate size, etc.) is determined by the customer's request. Details of each mix are programmed into the control room computer, along with the total tonnage for the customer. The computer controls the batch of production by dividing the total load into an equal number of batches. A 21-ton load, for example, would likely be divided into seven batches weighing 3 tons each or six batches weighing 3.5 tons each. Scales above the mixer pre-weigh the mix components, which usually consist of 1) hot aggregate from the dryer, 2) the hot asphalt binder from the heated storage tanks, and 3) reclaimed asphalt from the cold storage bins. When the first batch is ready, the mix components are dropped into the mixer. Mixing usually takes about one minute. When mixing is complete, the hot asphalt concrete is dropped (i.e., loaded) into the transport truck waiting in the load-out bay under the mixer. While the first batch is in the mixer, the scales are loaded with a second batch. Just after the first batch is loaded, the second pre-weighed batch is dropped into the mixer. The process continues until the entire load is mixed and loaded into the transport truck. From beginning to end, the entire process takes about 5 to 10 minutes depending on the size of the load.

The asphalt temperature as it drops from the mixing chamber to the truck is normally about 300°F. In an effort to create a "worst case" emissions scenario for these tests, asphalt temperatures were raised from 300°F to 325°F.

3.1 FACILITY MODIFICATIONS FOR THE TESTING

Specifically for this project, a Temporary Total Enclosure (TTE) was built around the load-out area. The TTE was built to meet the requirements of Method 204. Fumes from

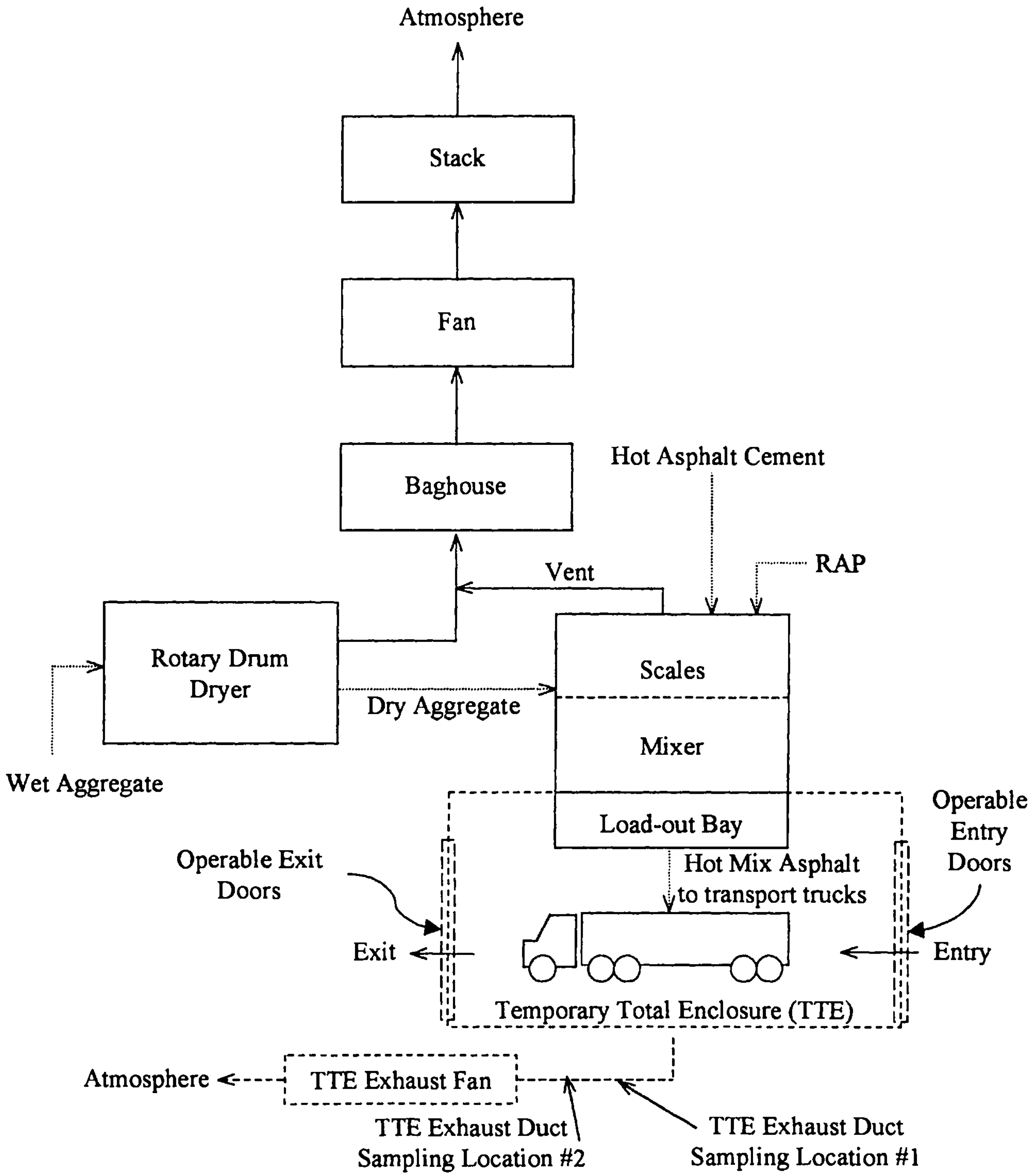


Figure 3.1 Process Flow Schematic, Asphalt Plant D, Barre, Massachusetts

asphalt load-out were captured using a hood or "tuning fork" over the truck bed. Gases were withdrawn from the TTE along a short length of duct where samples were collected. A stack vented the exhaust gases clear of the area. The floor of the TTE was the unpaved roadway under the load-out area. To minimize roadway dust in and around the TTE, the roadway was periodically sprayed with water. In Figure 3.2 a schematic of the TTE is presented. In Figure 3.3 a schematic of the ventilation system is presented.

3.2 COORDINATION BETWEEN TESTING AND PROCESS OPERATIONS

A TTE, 104 feet long by 16 feet wide by 14 feet high, was built around the load-out bay. Directly above the load-out area, a "tuning fork" shaped exhaust hood was built into the ceiling of the TTE. Attached to the outlet end of the exhaust hood was a 23.5 inch square exhaust duct leading to a 15,000 cfm fan. Manual swing doors were positioned at the entrance and exit of the TTE. The sequence of events leading up to and through load-out and testing were as follows:

1. At the beginning of the day, the TTE exhaust fan was turned on.
2. With the arrival of the first truck, the TTE entrance doors were opened.
3. The truck pulled into the TTE and was positioned under the mixer in the load-out bay.
4. A vent hose was placed over the truck exhaust to exclude diesel emissions from the TTE exhaust system.
5. The entrance and exit doors of the TTE were closed and secured.
6. The scales dropped the first load of mix components into the mixer.
7. The Method 315 runs were started.
8. A second batch of mix components were loaded on the scales.
9. After approximately one minute of mixing, the first batch of asphalt concrete was loaded into the transport truck.
10. The second batch of mix components were dropped into the mixer, mixed, and loaded into the transport truck.
11. The third batch was mixed and loaded into the transport truck.
12. The fourth batch was mixed and loaded into the transport truck.
13. The fifth batch was mixed and loaded into the transport truck.
14. The sixth batch was mixed and loaded into the transport truck.
15. The seventh and final batch of asphalt concrete was mixed and loaded into the transport truck. Note that most loads were seven batch loads totaling between 20 to 25 tons of asphalt concrete. Some loads, however, were smaller and were made up of fewer than seven batches.
16. After the last load, the Method 315 testing continued for 15 to 20 seconds and then stopped when visual observations indicated that load-out emissions had stopped.

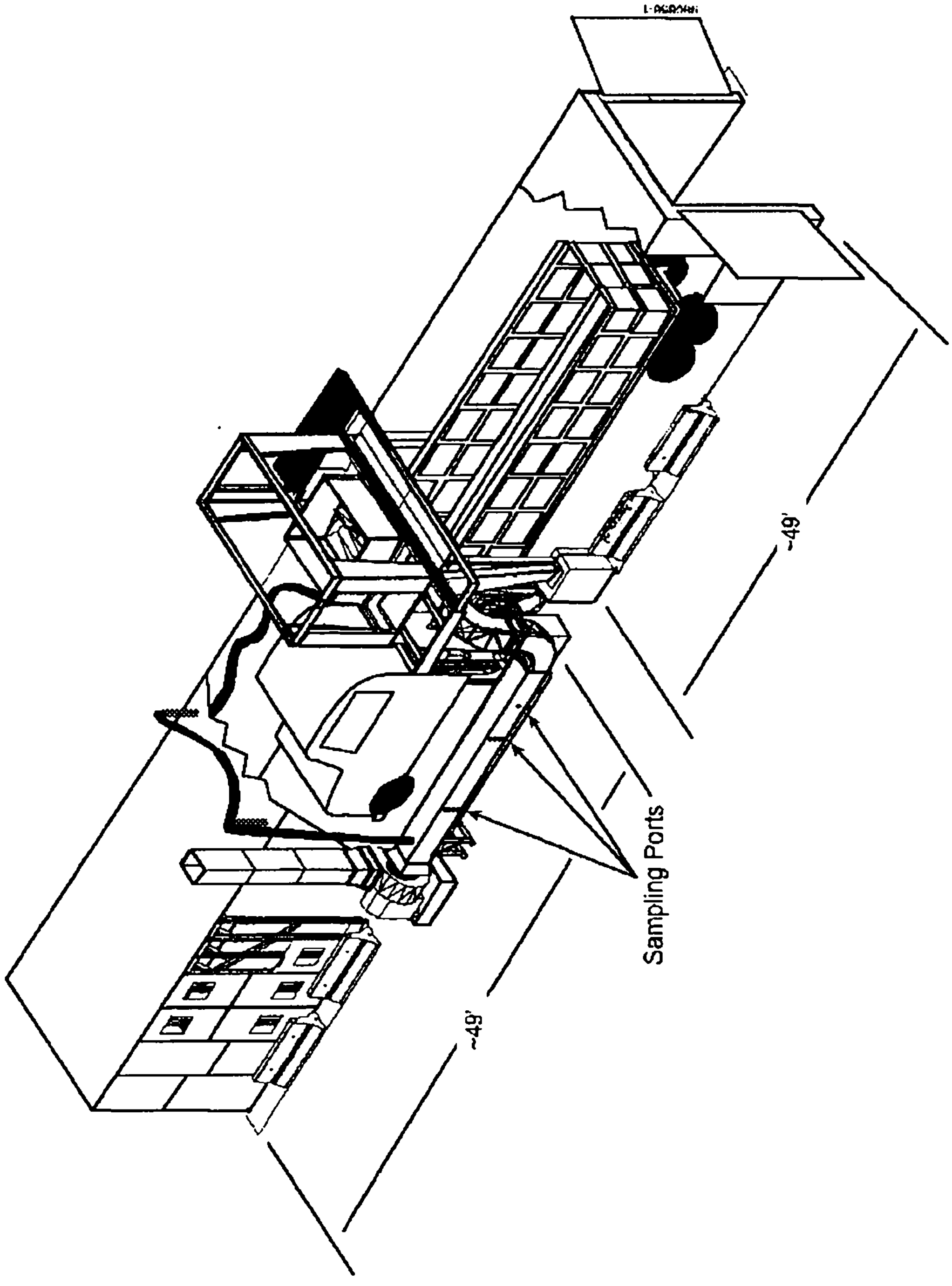


Figure 3.2 Temporary Total Enclosure

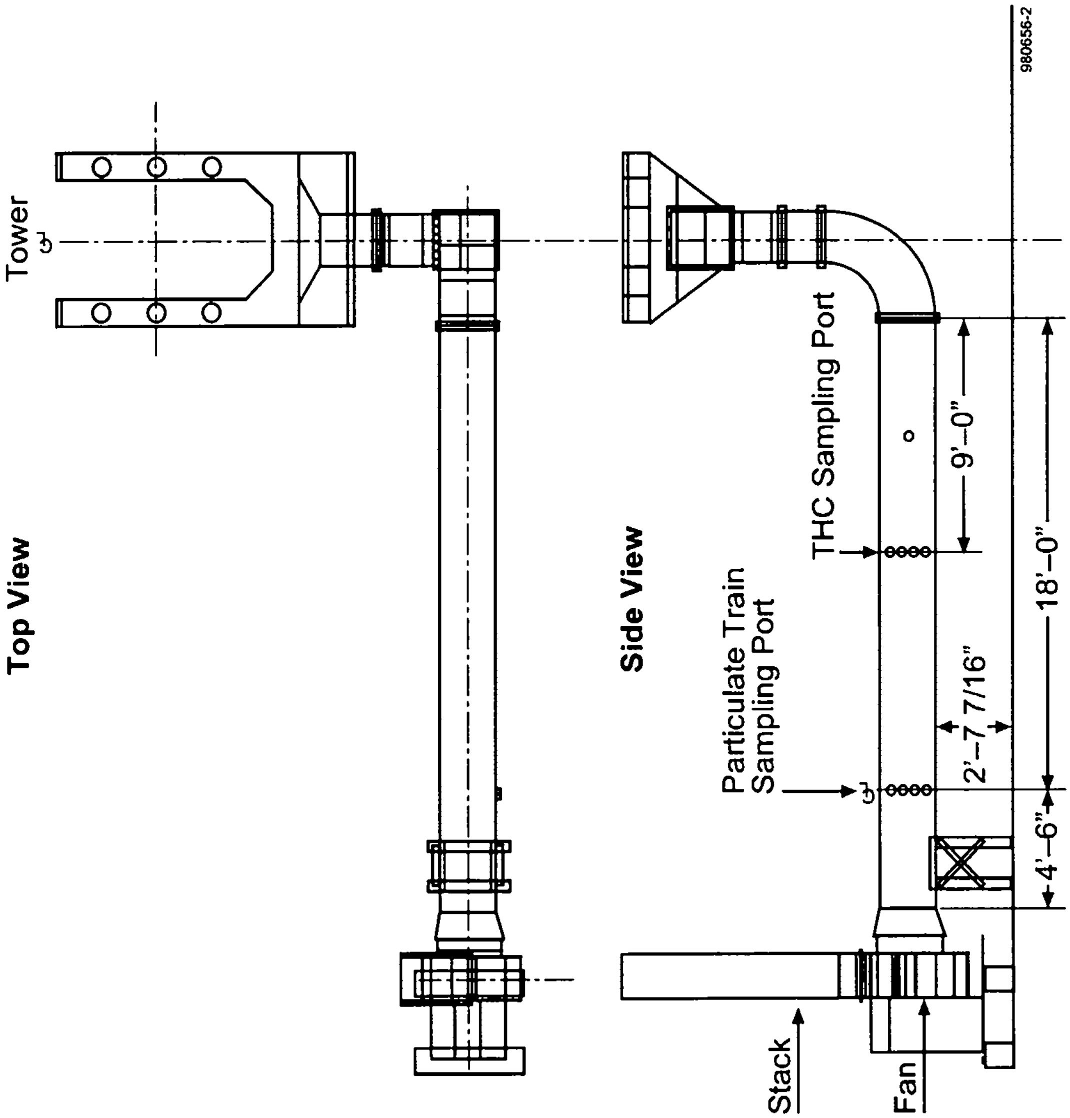


Figure 3.3 TTE Hood and Duct System

17. Once the Method 315 runs were stopped, the exit doors were opened and the truck was pulled out of the TTE.
18. With the arrival of the second (or next) transport truck, the TTE entrance doors were opened and the sequence was repeated, starting with Step 3.

Opacity observations were made from the control room during the testing. For each batch load-out, a distinct, white, moisture-type plume was observed exiting the exhaust stack. Fifteen to twenty seconds after the load-out was complete, the white plume would dissipate and then appear again at the start of the next load-out. It should be noted that the observations did not meet EPA Method 9 criteria with respect to location, periodicity, nor interference due to moisture. However, the observation was useful in validating load-out operations. This pattern was observed over and over again and the Method 315 testing was run continuously, starting just before the first white plume was observed until after the white plume from the last batch dissipated.

3.3 PROCESS MONITORING DURING TESTING

During the testing, PES personnel monitored and recorded process operations and measured the temperature of the asphalt concrete just after load-out. This information is presented in Appendix B and includes for each load: the time of the load, the job number, the truck number, the mix type, the ticket number, the mix temperature, the stack temperature, the asphalt temperature, and the tons of asphalt concrete loaded. The mix types produced during the testing are summarized in Table 3.1. The process temperatures recorded during the testing are summarized in Table 3.2. In Table 3.2, the mix temperature is the temperature of dried aggregate leaving the dryer and the asphalt temperature is the temperature of asphalt concrete in the bed of the truck just after load-out. Also included in Appendix B are copies of the plant logs for each batch loaded. These logs show the weights for each mix component for each production batch.

3.4 PROCESS SAMPLES

Two samples of the asphalt cement were collected each day during the test program for a total of six samples. The first sample each day was collected near the beginning of the test run and the second collected near the end of the test run. All six asphalt cement samples were analyzed twice for volatile content: 1) following the procedures of ASTM D 1754 - Effects of Heat and Air on Asphalt Materials (Thin Film Oven Test) and 2) following the procedures of ASTM D 2872 - Effects of Heat and Air on a Moving Film of Asphalt (Rolling Thin Film Oven Test). The results of these tests are shown in Table 3.2.

Both ASTM D 1754 and ASTM D 2872 specify an oven temperature of 325°F. Three of the asphalt cement samples (one from each day) were analyzed 1) using ASTM D 1754

TABLE 3.1

PRODUCTION DATA, ASPHALT PLANT D

Test Date	Mix Description [1]	Mix Type	Total Weight, pounds	Total Weight, tons
10/05/98 (Test 1)	½ inch binder	2	39,958	19.98
	Binder Mix	8	8,151	4.08
	State dense top	16	48,150	24.08
	State binder with 10% RAP	30	1,684,356	842.18
	Sidewalk	67	50,134	25.07
Total Test 1			1,830,749	915.37
10/06/98 (Test 2)	Binder mix	8	80,663	40.33
	State dense top	16	144,154	72.08
	Modified top with 10% RAP	24	1,520,852	760.43
	3/8 inch top	33	66,745	33.37
	Sidewalk	67	20,014	10.01
Total Test 2			1,832,428	916.21
10/07/98 (Test 3)	½ inch binder	2	32,121	16.06
	State dense top	16	144,531	72.27
	State binder	18	30,211	15.11
	State top with 10% RAP	25	1,368,125	684.06
	State binder with 10% RAP	30	48,358	24.18
	3/8 inch top	33	72,144	36.07
	People's top	60	17,966	8.98
Total Test 3			1,713,456	856.73

[1] Mix formulas are presented at the end of Appendix B.

TABLE 3.2

PROCESS DATA, ASPHALT PLANT D

	Asphalt Loaded During Test	Mass Change of Asphalt at 325°F, %		Asphalt Temp. At Load-out	Dry Aggregate Mix Temp.[3]
	Tons	TFOT[1]	RTFOT[2]	°F	°F
10/05/98	915.4	-0.106	-0.204	306.7	377.1
10/06/98	916.2	-0.129	-0.246	325.1	394.5
10/07/98	856.7	-0.143	-0.261	326.7	379.8
Average	896.1	-0.126	-0.237	319.5	383.8

[1] ASTM D1754-94 - Effects of Heat and Air on Asphalt Materials (Thin Film Oven Test - TFOT)
[2] ASTM D2872-88 - Effects of Heat and Air on a Moving Film of Asphalt (Rolling Thin Film Oven Test - RTFOT)
[3] Temperature of the dry aggregate measured in the mix chute between the dryer and hot elevator

with an oven temperature of 300°F, 2) using ASTM D 1754 with an oven temperature of 350°F, 3) using ASTM D 2872 with an oven temperature of 300°F, and 4) using ASTM D 2872 with an oven temperature of 350°F. The results of these analyses appear in Appendix B.

Two samples of the reclaimed asphalt pavement (RAP) were collected each day during the test program for a total of six RAP samples. Three of the samples, one from each day, were archived and three were analyzed as follows. The asphalt cement in the RAP was separated from the aggregate following the procedures of ASTM D 2172-88, Quantitative Extraction of Bitumen from Bituminous Paving Mixtures. The asphalt cement was then recovered from the extract following the procedures of ASTM D 1856-95a, Recovery of Asphalt from Solution by Abson Method. The results of these analyses appear in Appendix B.

3.5 CAPTURE OF LARGE DIAMETER MATERIAL

Material captured by the ventilation system included not only the fumes generated from the hot asphalt, but some quantity of small (visible to the naked eye) dust. The evidence of capture of this dust could be seen on the screens that covered the hood openings that faced the drop chute. Of the eight screens that covered the hood openings, the two center screens on each side had a significant build up of asphalt product. This buildup was greatest at the bottom of the screens. The buildup was caused by the pug mill paddles, which tossed some of the asphalt to the sides. Although two steel plates were installed in an attempt to eliminate the impaction of the asphalt on the hood, they did not extend far enough to completely eliminate this impaction. Observations of the load-outs confirmed the potential for impaction. The two end screens on each side of the hood did not have as much buildup as the center screens. Additional evidence of the capture of this dust was seen on the particulate collected by the filters of the Method 315 trains. In addition to the fine particulate typical of asphalt fume emissions, there was particulate of a size that was readily visible as individual grains of material. It is estimated that the size of the individual grains was approximately 0.1 millimeters in diameter.

4.0 SAMPLING LOCATIONS

Emissions testing was conducted in the TTE exhaust duct to determine uncontrolled emissions of PM and MCEM from the load-out operation at Asphalt Plant D in Barre, Massachusetts. The TTE exhaust duct is discussed below.

4.1 TTE EXHAUST DUCT

The TTE exhaust duct was a horizontal 23.5-inch square duct that led from the TTE exhaust hood to the TTE exhaust fan. Two sets of sampling ports were installed in the side of the duct as shown in Figure 4.1. For isokinetic testing at Location 1, a 24-point traverse matrix consisting of six traverse points on each of four parallel traverse lines were used. For isokinetic testing at Location 2, a 12-point traverse matrix consisting of three points on each of four parallel lines were used. The results of the EPA Method 1 calculations and locations of the traverse points are presented in Figures 4.2 and 4.3 for Locations 1 and 2, respectively.

Prior to testing, the TTE exhaust was checked for the presence of non-parallel flow by recording yaw angle misalignment at each isokinetic sampling point as specified in Section 2.4 of Method 1. The average yaw angle at each location was found to be 6°, which is less than the EPA requirement of 20°.

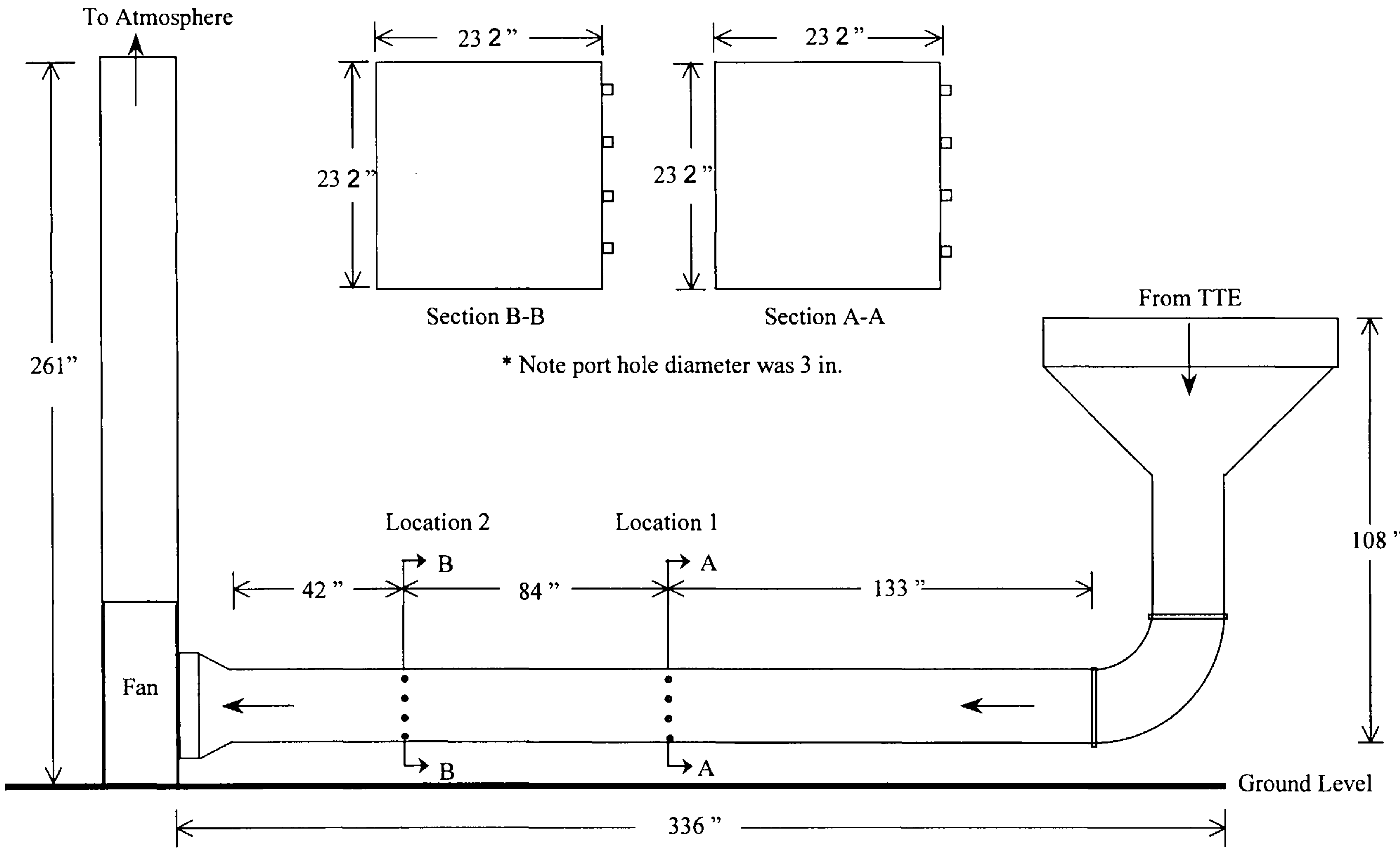
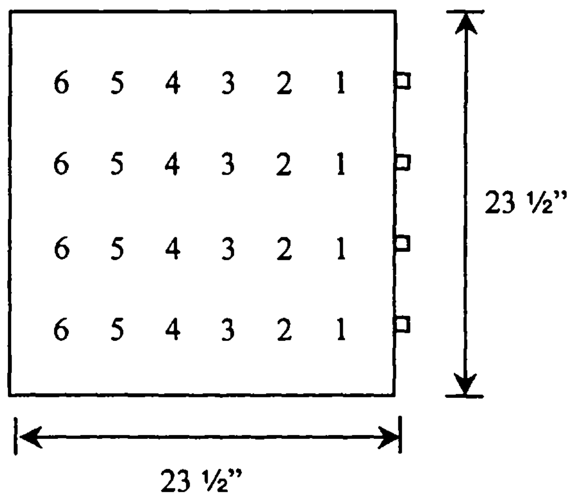


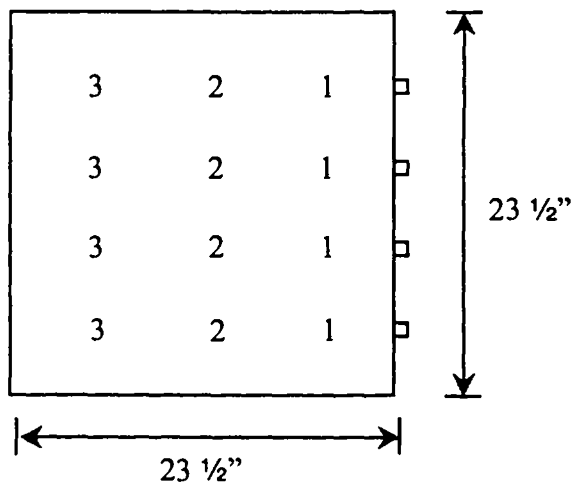
Figure 4.1 TTE Exhaust Sampling Port Locations, Hot Mix Asphalt Plant D



* Note port hole diameter was 3 in.

Traverse Point Number	Distance from Duct Wall, inches
1	1 15/16
2	5 7/16
3	9 13/16
4	13 ¾
5	17 ⅝
6	21 9/16

Figure 4.2 TTE Exhaust Traverse Point Locations, Location 1, Hot Mix Asphalt Plant D



* Note port hole diameter was 3 in.

Traverse Point Number	Distance from Duct Wall, inches
1	3 13/16
2	11 3/4
3	19 9/16

Figure 4.3 TTE Exhaust Traverse Point Locations, Location 2, Hot Mix Asphalt Plant D

5.0 SAMPLING AND ANALYTICAL PROCEDURES

Source sampling was performed in the TTE exhaust to determine the concentrations and mass emission rates of particulate matter (PM) and methylene chloride extractable matter (MCEM). Three tests were performed over three consecutive days beginning on October 5, 1998. Each test started early in the morning, ran most of the day, and included most of the plant's production for the day. For each test, two simultaneous Method 315 runs were performed. Each run consisted of four hours of sampling over a period of six and one-half hours. Sampling starts and stops coincided with load-out operations as discussed in Section 3.0. The sampling and analytical methods that were used are summarized in Table 5.1. Brief descriptions of the sampling and analysis procedures used are presented below. Copies of all the methods which were used are presented in Appendix G.

5.1 LOCATION OF MEASUREMENT SITES AND SAMPLE/VELOCITY TRAVERSE POINTS

EPA Method 1, "Sample and Velocity Traverses for Stationary Sources," was used to position velocity and sample traverse point locations. The process ductwork and the locations of measurement sites and traverse points are discussed in Section 4.0 of this document.

5.2 DETERMINATION OF EXHAUST GAS VOLUMETRIC FLOW RATE

EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)," was used to determine exhaust gas velocity. A Type S Pitot tube, constructed according to Method 2 criteria and having an assigned coefficient of 0.84, was connected to an inclined-vertical manometer. The pitot tube was inserted into the duct and the velocity pressure (Δp) was recorded at each traverse point. The effluent gas temperature was also recorded at each traverse point using a Type-K thermocouple. The average exhaust gas velocity was calculated from the average square roots of the velocity pressure, average exhaust gas temperature, exhaust gas molecular weight, and absolute stack pressure. The volumetric flow rate was calculated as the product of velocity and the cross-sectional area of the duct at the sampling location.

TABLE 5.1

SUMMARY OF SAMPLING AND ANALYTICAL METHODS
ASPHALT PLANT D, BARRE, MASSACHUSETTS

Sampling Location	Parameter	Test Methods	No. of Tests	Minimum Run Times, Minutes
TTE Exhaust (Location 1)	Flow Rate	EPA 1&2	3	240
	Moisture	EPA 4	3	240
	PM/MCEM	EPA Method 315	3	240
TTE Exhaust (Location 2)	Flow Rate	EPA 1&2	3	240
	Moisture	EPA 4	3	240
	PM/MCEM	EPA Method 315	3	240

5.3 DETERMINATION OF EXHAUST GAS DRY MOLECULAR WEIGHT

The exhaust gas drawn from the TTE and into the exhaust duct during load out was essentially ambient air. Correspondingly, the exhaust gas was assigned the dry molecular weight of ambient air (28.84 g/g-mol).

5.4 DETERMINATION OF EXHAUST GAS MOISTURE CONTENT

EPA Method 4, "Determination of Moisture Content in Stack Gases," was used to determine the flue gas moisture content. EPA Method 4 was performed in conjunction with each EPA Method 315 test run. Integrated, multi-point, isokinetic sampling was performed. Condensed moisture was determined by recording pre-test and post-test weights of the impingers, reagents, and silica gel.

5.5 DETERMINATION OF PARTICULATE MATTER AND METHYLENE CHLORIDE EXTRACTABLE MATTER

EPA Method 315, "Determination of Particulate Matter (PM) and Methylene Chloride Extractable Matter (MCEM) Emissions from Stationary Sources," was used to collect PM and MCEM samples in the TTE exhaust duct. Multi-point integrated samples were extracted isokinetically from a total of 24 traverse points at Location 1 (on runs M315-6, M315-7, and M315-8) and a total of 12 traverse points at Location 2 (on runs M315-1, M315-2, and M315-3). Each point was sampled for 10 minutes at Location 1 for a minimum net run time of 240 minutes, and 20 minutes at Location 2 for a minimum net run time of 240 minutes. Readings were taken and recorded every 5 minutes. If load-out continued past the scheduled completion of sampling at the last point in a port, testing continued until load-out was completed. This additional testing increased the net run times by as much as 11 minutes for some runs.

The Method 315 samples were extracted through a glass nozzle, a heated glass-lined probe, a heated glass fiber filter, and a series of chilled impingers. The first and second impinger each contained 100 milliliters (mL) of deionized (DI) water. The third impinger remained empty. The fourth and final impinger contained 200 grams of silica gel. A schematic of the EPA Method 315 sampling train is shown in Figure 5.1.

The samples were analyzed according to EPA Method 315. Each component of the front half of the sample train was dried and weighed to give particulate matter results. All components were then extracted with methylene chloride to give MCEM results.

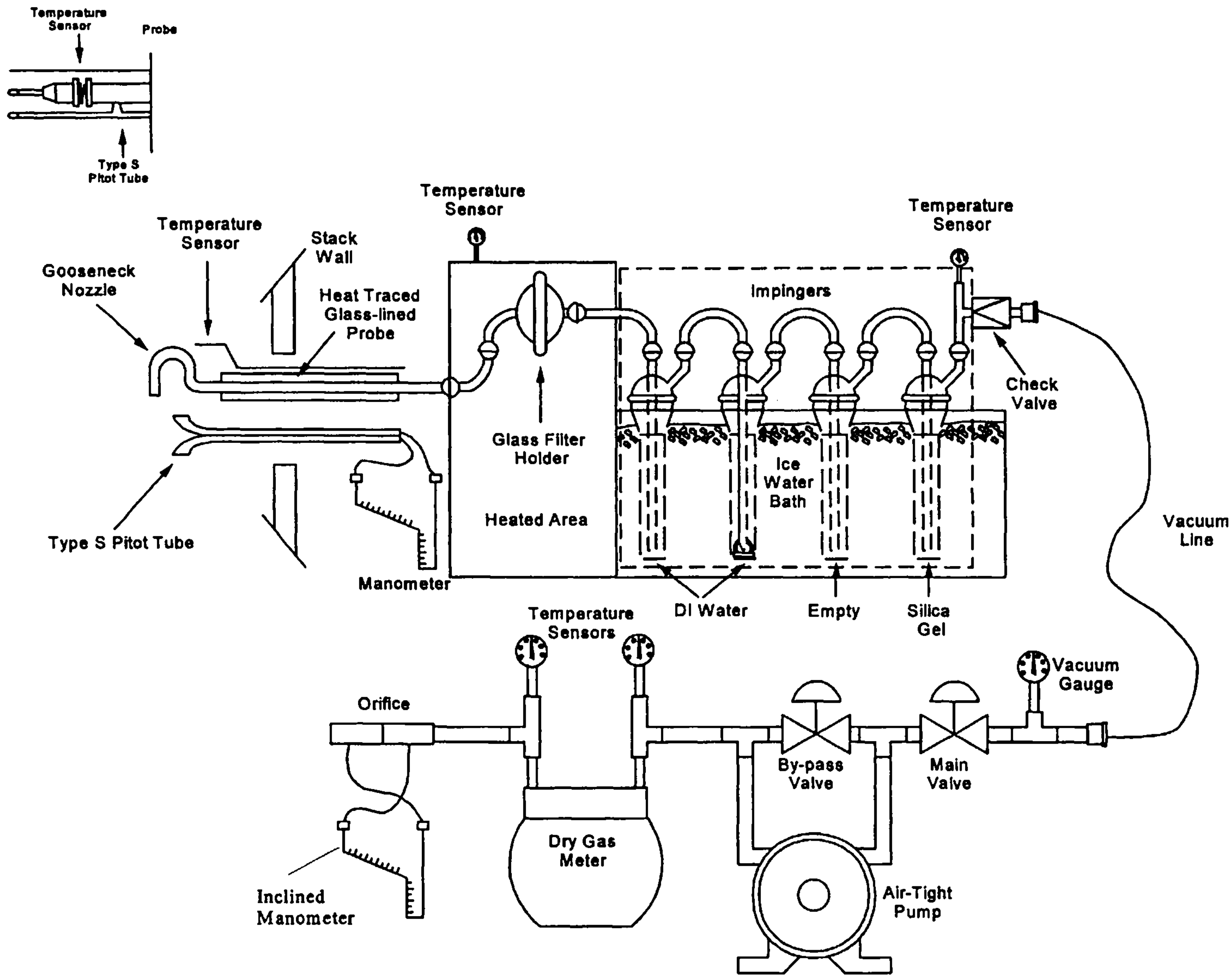


Figure 5.1 EPA Method 315 Sampling Train Schematic

5.6 MCEM DEPOSITION ON THE CEILING OF THE TTE

MCEM deposition on the ceiling of the TTE was estimated as follows. The ceiling of the TTE was divided into five equal areas. Before the start of the test program, five clean plates and five C-channel sections were attached to the ceiling of the TTE, one each near the center of each equal area. The plates were positioned to represent the TTE ceiling. The C-channels were positioned to represent the structural beams supporting the ceiling. At the end of the test program, the plates and C-channels were removed and cleaned with acetone. Each of the ten samples was then analyzed following the procedures of Method 315 producing five MCEM plate results and five MCEM C-channel results. Total ceiling deposition was calculated by multiplying each MCEM plate result by a ratio of areas equal to the ceiling area divided by the test plate area. Total C-channel deposition was calculated by multiplying each MCEM C-channel result by a ratio of areas equal to total C-channel area divided by the test C-channel area. Note that both plate and C-channel field blank samples were collected and analyzed and show over 90% sample recovery for these measurements. Refer to Appendix D for more details.

5.7 MCEM DEPOSITION INSIDE THE TTE EXHAUST DUCT

A procedure similar to the ceiling procedure described above was used to estimate the MCEM deposition inside the TTE exhaust duct. Instead of installing plates and C-channels, however, sections of the duct were cleaned before the test program and again after the testing was finished. Refer to Appendix D for more details.

6.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES AND RESULTS

For any environmental measurement, a degree of uncertainty exists in the data generated due to the inherent limitations of the measurement system employed. The goals of a QA/QC program are to ensure, to the highest degree possible, the accuracy of the data collected. This section summarizes the QA/QC procedures that were employed by PES in the performance of this test program. The procedures contained in the reference test methods and in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, EPA/600/R-94/038c, served as the basis for performance for all testing and related work activities in this project.

6.1 CALIBRATION AND PREPARATION OF APPARATUS

Brief descriptions of the calibration procedures used by PES are presented below. The results of equipment and sensor calibrations may be found in Appendix F. Detailed procedures as presented in the EPA test methods are presented in Appendix G.

6.1.1 Barometers

PES used barometric pressure values reported by a nearby National Weather Service station.

6.1.2 Temperature Sensors

Bimetallic dial thermometers and Type K thermocouples were verified using the procedure described in Calibration Procedure 2 of EPA/600/R-94/038c. Each temperature sensor was checked over the expected range of use against an ASTM 3C or 3F thermometer. Table 6.1 summarizes the type of calibrations performed, the acceptable levels of variance, and the results. Digital thermocouple displays were calibrated using a thermocouple simulator having a range of 0-2400°F.

Dial Thermometers were used to determine asphalt product temperature. The thermometers were checked against a mercury-in-glass thermometer standard. The results of the calibration checks are presented in Table 6.1.

TABLE 6.1

SUMMARY OF TEMPERATURE SENSOR CALIBRATION DATA

Temp. Sensor I.D.	Usage	Temperature, °F		Temperature Difference[a]	Tolerance
		Reference	Sensor		
RT-6	Stack Gas	32	32	0.00%	<±1.5%
		72	69	-0.56%	<±1.5%
		210	210	0.00%	<±1.5%
ES-1	Stack Gas	32	32	0.00%	<±1.5%
		72	72	0.00%	<±1.5%
		210	210	0.00%	<±1.5%
MB-11	Meter Box Inlet	32	32	0.00%	<±1.0%
		74	74	0.00%	<±1.0%
		210	208	-0.30%	<±1.0%
	Meter Box Outlet	32	32	0.00%	<±1.0%
		74	74	0.00%	<±1.0%
		208	208	0.00%	<±1.0%
MB-10	Meter Box Inlet	33	34	0.20%	<±1.0%
		76	76	0.00%	<±1.0%
		206	205	-0.15%	<±1.0%
	Meter Box Outlet	32	34	0.41%	<±1.0%
		76	76	0.00%	<±1.0%
		206	205	-0.15%	<±1.0%

[a] Calculated using the absolute temperature, °R.

TABLE 6.1 (CONTINUED)

SUMMARY OF TEMPERATURE SENSOR CALIBRATION DATA

Temp. Sensor I.D.	Usage	Temperature, °F		Temperature Difference[a]	Tolerance
		Reference	Sensor		
RMB-15	Meter Box Inlet	33	35	0.41%	<±1.0%
		74	74	0.00%	<±1.0%
		208	210	0.30%	<±1.0%
	Meter Box Outlet	33	33	0.00%	<±1.0%
		74	75	0.19%	<±1.0%
		208	208	0.00%	<±1.0%
T-1	Asphalt	32	32	0.00%	<±1.5%
		69	69	0.00%	<±1.5%
		212	212	0.00%	<±1.5%
T-2	Asphalt	32	32	0.00%	<±1.5%
		69	69	0.00%	<±1.5%
		212	212	0.00%	<±1.5%
T-3	Asphalt	32	32	0.00%	<±1.5%
		69	69	0.00%	<±1.5%
		212	212	0.00%	<±1.5%

[a] Calculated using the absolute temperature, °R.

6.1.3 Pitot Tubes

PES used Type S pitot tubes constructed according to EPA Method 2 specifications. Each pitot tube was inspected for conformance to the geometric specifications by the application of Calibration Procedure 2 of EPA/600/R-94/038c. Pitot tubes that meet these requirements are assigned a pitot coefficient, C_p, of 0.84. The dimensional criteria and results for each pitot tube used are presented in Table 6.2.

6.1.4 Differential Pressure Gauges

PES used Dwyer inclined/vertical manometers to measure differential pressures. The differential pressure measurements included velocity pressure, static pressure, and meter orifice pressure. Manometers were selected with sufficient sensitivity to accurately measure pressures over the entire range of expected values. Manometers are primary standards and require no calibration.

6.1.5 EPA Method 315 Dry Gas Meters and Orifices

The EPA Method 315 dry gas meters and orifices were calibrated in accordance with Sections 5.3.1 and 5.3.2 of EPA Method 5. This procedure involves direct comparison of the metered volume passed through the dry gas meter to a reference dry test meter. The reference dry test meter is calibrated annually using a wet test meter. Before its initial use in the field and annually thereafter, the metering system is calibrated over the entire range of operation as specified in EPA Method 5. Acceptable tolerances for the individual dry gas meter correction factor (γ) and orifice calibration factor ($\Delta H_{@}$) during initial or annual calibrations are ±0.02 and ±0.20 from the average, respectively. After field use, a calibration check of the metering system was performed at a single intermediate setting based on the previous field test. The post-test calibration check of the dry gas meter correction factor must agree within five percent of the correction factor generated during the initial or annual calibration. The results for the gas meters and orifices used in this test program are summarized in Table 6.3.

TABLE 6.2

SUMMARY OF PITOT TUBE DIMENSIONAL DATA

Measurement	Criteria	Results Pitot Tube Identification RP-19	 ES-1
α_1	<10°	0	0
α_2	<10°	1	1
β1	<5°	0	0
β2	<5°	1	0
γ	-	0	1
θ	-	0	1
A	-	0.938	1.031
Ż	≤ 0.125 in.	0	0.0175
W	≤ 0.03125 in.	0	0.0175
D_t	0.1875in. ≤ D_t≤ 0.375 in.	0.375	0.375
$(A/2)/D_t$	01.05 D_t ≤ A/2 ≤ 1.50 D_t	1.25	1.37
	Acceptable	Yes	Yes
	Assigned Coefficient	0.84	0.84

TABLE 6.3

SUMMARY OF DRY GAS METER AND ORIFICE CALIBRATION DATA

Meter No.	Dry Gas Meter Correction Factor, γ				Orifice Coefficient, $\Delta H_{@}$		
	Pre-test	Post-test	% Diff.	EPA Criteria	Average	Range	EPA Criteria
11	0.987	0.991	0.41%	± 5%	1.93	1.87-1.97	1.73-2.13
15	1.000	1.000	0.0%	± 5%	1.90	1.86-1.92	1.70-2.10

6.2 REAGENTS AND GLASSWARE PREPARATION

Sample reagents consisted of pesticide (or better) grade acetone and methylene chloride for glassware preparation and sample recoveries. Water used in sample recoveries and the impinger trains was HPLC-grade reagent water.

6.3 ON-SITE SAMPLING

The on-site QA/QC activities are described below.

6.3.1 Measurement Sites

Prior to sampling, the duct was checked dimensionally to determine measurement site locations, location of velocity and sample test ports, inside duct dimensions, and sample traverse point locations. Inside duct dimensions were checked through each traverse line to ensure uniformity of the stack/duct inside diameter. The inside duct dimensions, wall thickness, and sample port depths were measured to the nearest 1/16 inch.

6.3.2 Velocity Measurements

All velocity measurement apparatus were assembled, leveled, zeroed, and leak-checked prior to use and at the end of each determination. The static pressure was determined at a single point near the center of the duct cross-section.

6.3.3 Moisture

The Method 315 trains were used to determine stack gas moisture. During sampling, the exit gas of the last impinger was maintained below 68 °F to ensure adequate condensation of the exhaust gas water vapor. The total moisture was determined on-site gravimetrically using an electronic platform balance with 0.1 gram sensitivity.

6.3.4 EPA Method 315

The field sampling QA/QC for EPA Method 315 began in the sample recovery area. The sample trains were set up and leak-checked to verify sample train integrity before transport to the sampling sites. At the sampling sites, the sample trains were leak checked a second time. Leaks found in excess of 0.02 cubic feet per minute (cfm) were corrected prior to beginning the test runs. Leak checks were also conducted before and after any sample train component changes and upon completion of the test runs. Table 6.4 summarizes the EPA Method 315 field sampling QA/QC measurements and EPA's acceptability criteria.

In addition to the samples, reagent blanks and field blank samples were collected. Reagent blanks were collected for acetone, methylene chloride, and filter media. An EPA Method 315 sampling train was assembled and transported to each sampling location, and leak-checked. The sample trains were then recovered using the same procedures employed during the recovery of the sample trains used during actual sample runs. The collected fractions were transferred to labeled, pre-cleaned sample bottles, transported to the subcontract laboratory, and analyzed in the same manner as the collected samples. Results are shown in Table 6.5.

6.4 LABORATORY ANALYTICAL QA/QC PROCEDURES

6.4.1 Analysis of Blank Samples

The Method 315 blank samples were analyzed following the procedures of EPA Method 315. Field blanks and laboratory blanks were used to evaluate the effectiveness of the sample train clean-up procedures and to check for contamination of the reagent materials. The results of these blank analyses are presented in Table 6.5.

6.5 QA COORDINATOR FIELD AUDIT

To meet the goals of the Quality Control Program as described in the QAPP, PES supplied an on-site QA Coordinator to observe the emission testing and to audit the personnel, equipment, procedures, and record keeping. The QA Coordinator assured that all sampling train glassware and sample recovery apparatus were preconditioned following the procedures of Method 315. Prior to testing, the QA Coordinator oversaw pre-test calibration and the checking of the equipment. These procedures included checks on the dry gas meters, pitot tubes, thermocouples, and sampling nozzles.

During the testing, audits and observations were conducted at regular intervals giving ample opportunity for on-site corrections. The QA Coordinator oversaw the checks and audits of sampling, data acquisition, sample recovery, and chain of custody. The QA Coordinator also recorded his observations on standardized forms, copies of which appear in Appendix F.

TABLE 6.4

SUMMARY OF EPA METHOD 315 FIELD SAMPLING QA/QC DATA

Run No.	**M315-1**	**M315-2**	**M315-3**	**M315-6**	**M315-7**	**M315-8**
Site	TTE Exhaust	TTE Exhaust	TTE Exhaust	TTE Exhaust, Duplicate	TTE Exhaust, Duplicate	TTE Exhaust, Duplicate
Date	10/05/98	10/06/98	10/07/98	10/05/98	10/06/98	10/07/98
Pre-Test Leak Rate, acfm[a]	0.009	0.011	0.005	0.002	0.002	0.001
Post-Test Leak Rate, acfm	0.005	0.001	0.005	0.004	0.003	0.001
EPA Criteria, acfm	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Percent Isokinetic	90.0	97.9	98.6	95.9	100.2	99.8
EPA Criteria	90-110%	90-110%	90-110%	90-110%	90-110%	90-110%

[a] Actual cubic feet per minute.

TABLE 6.5

SUMMARY OF EPA METHOD 315 BLANK SAMPLE CATCHES

Blank[a]	Mass of Residue (mg)	Volume of Blank (mL)	Concentration of Blank (mg/mg)[b]
Acetone Wash Blank	0.2	250.7	1.0E-06
Methylene Chloride Blank	0.1	209.1	3.6E-07
Filter Blank	0.0	N/A	0.0
Field Blank 1, Filter - PM	0.0	N/A	N/A
Field Blank 1, Filter -MCEM	0.0	N/A	N/A
Field Blank 1, FH Acetone Rinse - PM	0.4	N/A	N/A
Field Blank 1, FH MeCl Rinse - MCEM	0.1	N/A	N/A
Field Blank 1, BH Solvent Rinse - MCEM	0.0	N/A	N/A
Field Blank 1, Impinger/H_2O Rinse - MCEM	0.4	N/A	N/A
Field Blank 2, Filter - PM	0.0	N/A	N/A
Field Blank 2, Filter -MCEM	0.0	N/A	N/A
Field Blank 2, FH Acetone Rinse - PM	0.8	N/A	N/A
Field Blank 2, FH MeCl Rinse - MCEM	0.1	N/A	N/A
Field Blank 2, BH Solvent Rinse - MCEM	0.2	N/A	N/A
Field Blank 2, Impinger/H_2O Rinse - MCEM	0.1	N/A	N/A

[a] FH = Front Half; BH = Back Half

[b] Calculated using the EPA Method 315 given densities for acetone and methylene chloride of 785.1 mg/mL and 1,316.8 mg/mL, respectively.

APPENDIX A

PM AND MCEM TEST RESULTS

Summary of Stack Gas Parameters and Test Results
EPA Method 315 - Particulate and Methylene Chloride Extractable Matter
TTE Exhaust, Location 2
Hot Mix Asphalt Plant D, Barre, Massachusetts

	RUN NUMBER RUN DATE RUN TIME	M315-1 10/5/98 0721-1403	M315-2 10/6/98 0714-1326	M315-3 10/7/98 0636-1313	Average
	MEASURED DATA				
γ	Meter Box Correction Factor	1.001	1.001	1.001	1.001
ΔH	Avg Meter Orifice Pressure, in. H_2O	2.01	1.53	1.50	1.68
P_{bar}	Barometric Pressure, inches Hg	30.30	30.45	30.43	30.39
V_m	Sample Volume, ft^3	159.115	160.833	162.172	160.707
T_m	Average Meter Temperature, °F	52.7	44.5	44.3	47.2
P_{static}	Stack Static Pressure, inches H_2O	-7.0	-7.0	-7.2	-7.1
T_s	Average Stack Temperature, °F	59.0	56.9	53.8	56.6
V_{lc}	Condensate Collected, ml	24.3	17.1	23.2	21.5
CO_2	Carbon Dioxide content, % by volume	0.0	0.0	0.0	0.0
O_2	Oxygen content, % by volume	20.9	20.9	20.9	20.9
N_2	Nitrogen content, % by volume	79.1	79.1	79.1	79.1
C_p	Pitot Tube Coefficient	0.84	0.84	0.84	0.84
$\Delta p^{1/2}$	Average Square Root Δp, (in. $H_2O)^{1/2}$	1.1892	1.0852	1.0719	1.1154
Θ	Sample Run Duration, minutes	240.0	247.5	250.7	246.1
D_n	Nozzle Diameter, inches	0.188	0.188	0.188	0.188
	Tons of asphalt loaded per test period	893.5	916.2	856.7	888.8
	CALCULATED DATA				
A_n	Nozzle Area, ft^2	0.000193	0.000193	0.000193	0.000193
$V_{m(std)}$	Standard Meter Volume, dscf	166.863	172.033	173.427	170.774
$V_{m(std)}$	Standard Meter Volume, dscm	4.725	4.871	4.911	4.836
P_s	Stack Pressure, inches Hg	29.79	29.94	29.90	29.87
B_{ws}	Moisture, % by volume	0.7	0.5	0.6	0.6
$B_{ws(sat)}$	Moisture (at saturation), % by volume	1.7	1.6	1.4	1.5
V_{wstd}	Standard Water Vapor Volume, ft^3	1.142	0.805	1.092	1.013
$1-B_{ws}$	Dry Mole Fraction	0.993	0.995	0.994	0.994
M_d	Molecular Weight (d.b.), lb/lb•mole	28.84	28.84	28.84	28.84
M_s	Molecular Weight (w.b.), lb/lb•mole	28.76	28.79	28.77	28.77
V_s	Stack Gas Velocity, ft/s	66.5	60.4	59.5	62.1
A	Stack Area, ft^2	3.835	3.835	3.835	3.835
Q_a	Stack Gas Volumetric flow, acfm	15,295	13,889	13,689	14,291
Q_s	Stack Gas Volumetric flow, dscfm	15,378	14,123	13,964	14,488
$Q_{s(cmm)}$	Stack Gas Volumetric flow, dscmm	435.4	399.9	395.42	410.3
I	Isokinetic Sampling Ratio, %	90.0	97.9	98.6	95.5

Summary of Stack Gas Parameters and Test Results
EPA Method 315 - Particulate and Methylene Chloride Extractable Matter
TTE Exhaust, Location 2
Hot Mix Asphalt Plant D, Barre, Massachusetts

	RUN NUMBER	**M315-1**	**M315-2**	**M315-3**	
	RUN DATE	**10/05/98**	**10/06/98**	**10/07/98**	**Average**
	RUN TIME	**0721-1403**	**0714-1326**	**0636-1313**	
	EMISSIONS DATA				
	Particulate Matter				
PM	Target Catch, g	0.0179	0.0303	0.0158	
C_{PM}	Concentration, gr/dscf	1.66E-03	2.72E-03	1.41E-03	1.93E-03
C_{PM}	Concentration, g/dscm	3.79E-03	6.22E-03	3.22E-03	4.41E-03
	Emission Rate, lb/test period	8.73E-01	1.36E+00	7.03E-01	9.78E-01
	Emission Rate, lb/ton	9.77E-04	1.48E-03	8.21E-04	1.09E-03
	Methylene Chloride Extractable Matter				
M_{CEM}	Target Catch, g	0.0042	0.0018	0.0019	
C_{MCEM}	Concentration, gr/dscf	3.88E-04	1.61E-04	1.69E-04	2.40E-04
C_{MCEM}	Concentration, g/dscm	8.89E-04	3.70E-04	3.87E-04	5.48E-04
	Emission Rate, lb/test period	2.05E-01	8.06E-02	8.46E-02	1.23E-01
	Emission Rate, lb/ton	2.29E-04	8.80E-05	9.87E-05	1.39E-04

EPA Method 315 Catch Weight Calculations
Run Number: M315-1

Particulate Matter (PM) Determinations

Acetone Wash Blank PM Calculations

Symbol	Description	Value	QC limit	
M_a	Mass of residue of acetone, mg	0.2		
ρ_A	Density of acetone, mg/mL	785.1		
V_a	Volume of acetone blank, mL	250.7		
C_a	Acetone blank concentration, mg/mg	1.0E-06		
V_{aw}	Volume of acetone used in wash, mL	91.8		
W_a	Acetone wash blank, mg	0.073	0.072	*Note

Container Number	Final weight grams	Tare of dish or beaker, g	Tare of filter, g	Weight Gain grams
1	169.7918	169.4491	0.3409	0.0018
2	111.26945	111.2533		0.0162
Total				0.0180

Total particulate catch weight, in milligrams = 18.0
Total particulate minus the acetone blank (W_a), mg = 17.9

MeCl Extractable Matter (MCEM) Determinations

Container Number	Final weight in grams	Tare of dish, g	Weight Gain grams	Acetone Wash Volume, mL	MeCl Wash Volume, mL
1	1.6693	1.6680	0.0013		
2+2M	1.6386	1.6371	0.0015	91.8	80.0
3W	1.6567	1.6558	0.0009		
3S	1.6595	1.6588	0.0007	90.15	90.15
Total			0.0044	181.95	170.15
		totals from line above are:	m_{total} in mg	sum of V_{aw}, mL	sum of V_{tw}, mL
			4.4	181.95	170.15

Symbol	Description	Sample Data	QC limit	
W_a	Acetone wash blank, mg	0.145	0.143	*Note
M_t	Mass of residue of MeCl blank, mg	0.1		
ρ_T	Density of MeCl, mg/mL	1316.8		
V_t	Volume of MeCl blank, mL	209.1		
C_t	MeCl blank concentration, mg/mg	3.63E-07		
W_t	MeCl wash blank, mg	0.08	0.358	
F_b	Filter Blank, mg	0.0		
M_{MCEM}	Total MeCl Extractable Matter weight, mg	4.2		

*The QC limit value was substracted instead of the calculated acetone wash blank value.

EPA Method 315 Catch Weight Calculations
Run Number: M315-2

Particulate Matter (PM) Determinations			
Acetone Wash Blank PM Calculations			QC limit
M_a	Mass of residue of acetone, mg	0.2	
ρ_A	Density of acetone, mg/mL	785.1	
V_a	Volume of acetone blank, mL	250.7	
C_a	Acetone blank concentration, mg/mg	1.0E-06	
V_{aw}	Volume of acetone used in wash, mL	175.3	
W_a	Acetone wash blank, mg	0.140	0.138 *Note

Container Number	Final weight grams	Tare of dish or beaker, g	Tare of filter, g	Weight Gain grams
1	167.6932	167.3514	0.3363	0.0055
2	103.74945	103.7245		0.0249
Total				0.0304
		Total particulate catch weight, in milligrams =		30.4
		Total particulate minus the acetone blank (W_a), mg =		30.3

MeCl Extractable Matter (MCEM) Determinations					
Container Number	**Final weight in grams**	**Tare of dish, g**	**Weight Gain grams**	**Acetone Wash Volume, mL**	**MeCl Wash Volume, mL**
1	1.6663	1.6659	0.0004		
2+2M	1.6392	1.6387	0.0005	175.3	98.5
3W	1.6606	1.6600	0.0006		
3S	1.6660	1.6655	0.0005	85.4	85.4
Total			0.0020	260.7	183.9
		totals from line above are:	m_{total} in mg	sum of V_{aw}, mL	sum of V_{tw}, mL
			2	260.7	183.9

		Sample Data	QC limit	
W_a	Acetone wash blank, mg	0.21	0.205	*Note
M_t	Mass of residue of MeCl blank, mg	0.1		
ρ_T	Density of MeCl, mg/mL	1316.8		
V_t	Volume of MeCl blank, mL	209.1		
C_t	MeCl blank concentration, mg/mg	3.63E-07		
W_t	MeCl wash blank, mg	0.09	0.387	
F_b	Filter Blank, mg	0.0		
M_{MCEM}	Total MeCl Extractable Matter weight, mg	1.7		

*The QC limit value was substracted instead of the calculated acetone wash blank value.

EPA Method 315 Catch Weight Calculations
Run Number: M315-3

Particulate Matter (PM) Determinations			
Acetone Wash Blank PM Calculations			QC limit
M_a	Mass of residue of acetone, mg	0.2	
ρ_A	Density of acetone, mg/mL	785.1	
V_a	Volume of acetone blank, mL	250.7	
C_a	Acetone blank concentration, mg/mg	1.0E-06	
V_{aw}	Volume of acetone used in wash, mL	164.8	
W_a	Acetone wash blank, mg	0.131	0.129 *Note

Container Number	Final weight grams	Tare of dish or beaker, g	Tare of filter, g	Weight Gain grams
1	168.1872	167.8462	0.3391	0.0019
2	102.7281	102.7141		0.0140
Total				0.0159
			Total particulate catch weight, in milligrams =	15.9
			Total particulate minus the acetone blank (W_a), mg =	15.8

MeCl Extractable Matter (MCEM) Determinations					
Container Number	Final weight in grams	Tare of dish, g	Weight Gain grams	Acetone Wash Volume, mL	MeCl Wash Volume, mL
1	1.6664	1.6658	0.0006		
2+2M	1.6581	1.6578	0.0003	164.8	88.5
3W	1.6649	1.6645	0.0004		
3S	1.6545	1.6537	0.0008	63.2	63.2
Total			0.0021	228	151.7
		totals from line above are:	m_{total} in mg	sum of V_{aw}, mL	sum of V_{tw}, mL
			2.1	228	151.7

		Sample Data	QC limit	
W_a	Acetone wash blank, mg	0.18	0.179	*Note
M_t	Mass of residue of MeCl blank, mg	0.1		
ρ_T	Density of MeCl, mg/mL	1316.8		
V_t	Volume of MeCl blank, mL	209.1		
C_t	MeCl blank concentration, mg/mg	3.63E-07		
W_t	MeCl wash blank, mg	0.07	0.320	
F_b	Filter Blank, mg	0.0		
M_{MCEM}	Total MeCl Extractable Matter weight, mg	1.8		

*The QC limit value was substracted instead of the calculated acetone wash blank value.

Summary of Stack Gas Parameters and Test Results
EPA Method 315 - Particulate and Methylene Chloride Extractable Matter
TTE Exhaust, Location 1
Hot Mix Asphalt Plant D - Barre, Massachusetts
Page 1 of 2

	RUN NUMBER RUN DATE RUN TIME	M315-6 10/5/98 0721-1403	M315-7 10/6/98 0714-1326	M315-8 10/7/98 0636-1313	Average
	MEASURED DATA				
γ	Meter Box Correction Factor	0.9802	0.9802	0.9802	0.980
ΔH	Avg Meter Orifice Pressure, in. H_2O	2.07	1.92	1.68	1.89
P_{bar}	Barometric Pressure, inches Hg	30.30	30.45	30.43	30.39
V_m	Sample Volume, ft^3	176.641	168.879	159.567	168.362
T_m	Average Meter Temperature, °F	53.7	46.8	45.9	48.8
P_{static}	Stack Static Pressure, inches H_2O	-7.0	-7.0	-7.2	-7.1
T_s	Average Stack Temperature, °F	60.1	57.6	55.2	57.7
V_{lc}	Condensate Collected, ml	23.8	12.2	24.3	20.1
CO_2	Carbon Dioxide content, % by volum	0.0	0.0	0.0	0.0
O_2	Oxygen content, % by volume	20.9	20.9	20.9	20.9
N_2	Nitrogen content, % by volume	79.1	79.1	79.1	79.1
C_p	Pitot Tube Coefficient	0.84	0.84	0.84	0.84
$\Delta p^{1/2}$	Average Square Root Δp, (in. $H_2O)^{1/2}$	1.1983	1.1250	1.0328	1.1187
Θ	Sample Run Duration, minutes	240.0	246.9	250.1	245.7
D_n	Nozzle Diameter, inches	0.189	0.185	0.187	0.187
	Tons of asphalt loaded per test perio	893.5	916.2	856.7	888.8
	CALCULATED DATA				
A_n	Nozzle Area, ft^2	0.000195	0.000187	0.000191	0.000191
$V_{m(std)}$	Standard Meter Volume, dscf	181.042	176.253	166.637	174.644
$V_{m(std)}$	Standard Meter Volume, dscm	5.127	4.991	4.719	4.945
P_s	Stack Pressure, inches Hg	29.79	29.94	29.90	29.87
B_{ws}	Moisture, % by volume	0.6	0.3	0.7	0.5
$B_{ws(sat)}$	Moisture (at saturation), % by volum	1.8	1.6	1.5	1.6
V_{wstd}	Standard Water Vapor Volume, ft^3	1.120	0.574	1.144	0.946
$1-B_{ws}$	Dry Mole Fraction	0.994	0.997	0.993	0.995
M_d	Molecular Weight (d.b.), lb/lb•mole	28.84	28.84	28.84	28.84
M_s	Molecular Weight (w.b.), lb/lb•mole	28.77	28.80	28.76	28.78
V_s	Stack Gas Velocity, ft/s	67.0	62.6	57.4	62.3
A	Stack Area, ft^2	3.835	3.835	3.835	3.835
Q_a	Stack Gas Volumetric flow, acfm	15,427	14,404	13,210	14,347
Q_s	Stack Gas Volumetric flow, dscfm	15,488	14,646	13,431	14,522
$Q_{s(cmm)}$	Stack Gas Volumetric flow, dscmm	438.6	414.7	380.33	411.2
I	Isokinetic Sampling Ratio, %	95.9	100.2	99.8	98.6

Summary of Stack Gas Parameters and Test Results
EPA Method 315 - Particulate and Methylene Chloride Extractable Matter
TTE Exhaust, Location 1
Hot Mix Asphalt Plant D - Barre, Massachusetts
Page 2 of 2

	RUN NUMBER	**M315-6**	**M315-7**	**M315-8**	
	RUN DATE	**10/05/98**	**10/06/98**	**10/07/98**	**Average**
	RUN TIME	**0721-1403**	**0714-1326**	**0636-1313**	
	EMISSIONS DATA				
	Particulate Matter				
PM	Target Catch, g	0.0348	0.0419	0.0122	
C_{PM}	Concentration, gr/dscf	2.97E-03	3.67E-03	1.13E-03	2.59E-03
C_{PM}	Concentration, g/dscm	6.79E-03	8.40E-03	2.59E-03	5.92E-03
	Emission Rate, lb/test period	1.58E+00	1.90E+00	5.42E-01	1.34E+00
	Emission Rate, lb/ton	1.76E-03	2.07E-03	6.33E-04	1.49E-03
	Methylene Chloride Extractable Matter				
M_{CEM}	Target Catch, g	0.0052	0.0043	0.0030	
C_{MCEM}	Concentration, gr/dscf	4.43E-04	3.76E-04	2.78E-04	3.66E-04
C_{MCEM}	Concentration, g/dscm	1.01E-03	8.62E-04	6.36E-04	8.37E-04
	Emission Rate, lb/test period	2.35E-01	1.94E-01	1.33E-01	1.88E-01
	Emission Rate, lb/ton	2.63E-04	2.12E-04	1.56E-04	2.10E-04

EPA Method 315 Catch Weight Calculations
Run Number: M315-6

Particulate Matter (PM) Determinations					
Acetone Wash Blank PM Calculations					QC limit
M_a	Mass of residue of acetone, mg			0.2	
ρ_A	Density of acetone, mg/mL			785.1	
V_a	Volume of acetone blank, mL			250.7	
C_a	Acetone blank concentration, mg/mg			1.0E-06	
V_{aw}	Volume of acetone used in wash, mL			90.1	
W_a	Acetone wash blank, mg			0.072	0.071 *Note

Container Number	Final weight grams	Tare of dish or beaker, g	Tare of filter, g	Weight Gain grams
1A	168.1073	167.7654	0.3403	0.0016
1B	168.2777	167.9357	0.3362	0.0058
2	113.6695	113.642		0.0275
Total				0.0349
Total particulate catch weight, in milligrams =				34.9
Total particulate minus the acetone blank (W_a), mg =				34.8

MeCl Extractable Matter (MCEM) Determinations					
Container Number	Final weight in grams	Tare of dish, g	Weight Gain grams	Acetone Wash Volume, mL	MeCl Wash Volume, mL
1A	1.6677	1.6673	0.0004		
1B	1.6718	1.6712	0.0006		
2+2M	1.6445	1.6430	0.0015	90.1	90.7
3W	1.6758	1.6742	0.0016		
3S	1.6666	1.6653	0.0013	96.4	96.4
Total			0.0054	186.5	187.1
		totals from line above are:	m_{total} in mg	sum of V_{aw}, mL	sum of V_{tw}, mL
			5.4	186.5	187.1

		Sample Data	QC limit
W_a	Acetone wash blank, mg	0.15	0.146 *Note
M_t	Mass of residue of MeCl blank, mg	0.1	
ρ_T	Density of MeCl, mg/mL	1316.8	
V_t	Volume of MeCl blank, mL	209.1	
C_t	MeCl blank concentration, mg/mg	3.63E-07	
W_t	MeCl wash blank, mg	0.09	0.394
F_b	Filter Blank, mg	0.0	
M_{MCEM}	Total MeCl Extractable Matter weight, mg	5.2	

*The QC limit value was substracted instead of the calculated acetone wash blank value.

EPA Method 315 Catch Weight Calculations
Run Number: M315-7

Particulate Matter (PM) Determinations			
Acetone Wash Blank PM Calculations			QC limit
M_a	Mass of residue of acetone, mg	0.2	
ρ_A	Density of acetone, mg/mL	785.1	
V_a	Volume of acetone blank, mL	250.7	
C_a	Acetone blank concentration, mg/mg	1.0E-06	
V_{aw}	Volume of acetone used in wash, mL	92.7	
W_a	Acetone wash blank, mg	0.074	0.073 *Note

Container Number	Final weight grams	Tare of dish or beaker, g	Tare of filter, g	Weight Gain grams
1	168.1264	167.7704	0.3378	0.0182
2	107.1823	107.1585		0.0238
Total				0.0420
	Total particulate catch weight, in milligrams =			42.0
	Total particulate minus the acetone blank (W_a), mg =			41.9

MeCl Extractable Matter (MCEM) Determinations					
Container Number	Final weight in grams	Tare of dish, g	Weight Gain grams	Acetone Wash Volume, mL	MeCl Wash Volume, mL
1	1.6638	1.6622	0.0016		
2+2M	1.6492	1.649	0.0002	92.7	89.2
3W	1.6617	1.6595	0.0022		
3S	1.6673	1.6668	0.0005	91.35	91.35
Total			0.0045	184.05	180.55
		totals from line above are:	m_{total} in mg	sum of V_{aw}, mL	sum of V_{tw}, mL
			4.5	184.05	180.55

		Sample Data	QC limit	
W_a	Acetone wash blank, mg	0.15	0.144	*Note
M_t	Mass of residue of MeCl blank, mg	0.1		
ρ_T	Density of MeCl, mg/mL	1316.8		
V_t	Volume of MeCl blank, mL	209.1		
C_t	MeCl blank concentration, mg/mg	3.63E-07		
W_t	MeCl wash blank, mg	0.09	0.380	
F_b	Filter Blank, mg	0.0		
M_{MCEM}	Total MeCl Extractable Matter weight, mg	4.3		

*The QC limit value was substracted instead of the calculated acetone wash blank value.

EPA Method 315 Catch Weight Calculations

Run Number: M315-8

Particulate Matter (PM) Determinations			
Acetone Wash Blank PM Calculations			QC limit
M_a	Mass of residue of acetone, mg	0.2	
ρ_A	Density of acetone, mg/mL	785.1	
V_a	Volume of acetone blank, mL	250.7	
C_a	Acetone blank concentration, mg/mg	1.0E-06	
V_{aw}	Volume of acetone used in wash, mL	129.8	
W_a	Acetone wash blank, mg	0.104	0.102 *Note

Container Number	Final weight grams	Tare of dish or beaker, g	Tare of filter, g	Weight Gain grams
1	168.04845	167.7067	0.3390	0.0027
2	102.9602	102.9506		0.0096
Total				0.0123
Total particulate catch weight, in milligrams =				12.3
Total particulate minus the acetone blank (W_a), mg =				12.2

MeCl Extractable Matter (MCEM) Determinations					
Container Number	Final weight in grams	Tare of dish, g	Weight Gain grams	Acetone Wash Volume, mL	MeCl Wash Volume, mL
1	1.6697	1.6681	0.0016		
2+2M	1.6483	1.648	0.0003	129.8	105.4
3W	1.6672	1.6665	0.0007		
3S	1.6768	1.6762	0.0006	92.7	92.7
Total			0.0032	222.5	198.1
totals from line above are:			m_{total} in mg	sum of V_{aw}, mL	sum of V_{tw}, mL
			3.2	222.5	198.1

		Sample Data	QC limit	
W_a	Acetone wash blank, mg	0.18	0.175	*Note
M_t	Mass of residue of MeCl blank, mg	0.1		
ρ_T	Density of MeCl, mg/mL	1316.8		
V_t	Volume of MeCl blank, mL	209.1		
C_t	MeCl blank concentration, mg/mg	3.63E-07		
W_t	MeCl wash blank, mg	0.09	0.417	
F_b	Filter Blank, mg	0.0		
M_{MCEM}	Total MeCl Extractable Matter weight, mg	2.9		

*The QC limit value was substracted instead of the calculated acetone wash blank value.

Example Calculations
Hot Mix Asphalt Plant D- Barre, Massachusetts
US EPA Method 315 - PM
(Using Data from Run M315-1)

Note: Discrepancies may exist between the computer generated reported results, which use more significant figures, and the values manually calculated from the displayed values.

1. Volume of dry gas sampled corrected to standard conditions of 68 °F, 29.92 in. Hg, ft^3.

$$V_{m(std)} = 17.64 V_m \gamma \left(\frac{P_{bar} + \frac{\Delta H}{13.6}}{460 + t_m} \right)$$

$$V_{m(std)} = (17.64)(159.115)(1.001) \left(\frac{30.3 + \frac{2.01}{13.6}}{460 + 52.7} \right)$$

$$V_{m(std)} = 166.863 \text{ dscf}$$

2. Volume of dry gas sampled corrected to standard conditions of 68°F, 29.92 in. Hg, m^3.

$$V_{m(std)m^3} = V_{m(std)}(0.028317)$$

$$V_{m(std)m^3} = (166.863)(0.028317)$$

$$V_{m(std)m^3} = 4.725 \text{ dscm}$$

3. Volume of water vapor at standard conditions, ft^3.

$$V_{w(std)} = 0.04707 V_{lc}$$

$$V_{w(std)} = (0.04707)(24.3)$$

$$V_{w(std)} = 1.142 \text{ scf}$$

4. Moisture content in stack gas, as measured.

$$B_{ws} = \frac{V_{w(std)}}{\left(V_{m(std)} + V_{w(std)}\right)} (100)$$

$$B_{ws} = \frac{1.142}{166.863 + 1.142} (100)$$

$$B_{ws} = 0.7$$

Moisture content in stack gas, at saturation. Used as B_{ws} if lower than measured moisture.

$$B_{ws(sat)} = 10^{(6.691 - (3144/(ts + 390.86)))} / Ps * 100$$

$$B_{ws(sat)} = 10^{(6.691 - (3144/(59 + 390.86)))} / 29.79 * 100$$

$$B_{ws(sat)} = 1.7$$

5. Dry molecular weight of stack gas, lb/lb-mol.

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

$$M_d = 0.44(0.0) + 0.32(20.9) + 0.28(79.1 + 0)$$

$$M_d = 28.84 \text{ lb/lb·mol}$$

6. Molecular weight of stack gas, lb/lb-mol.

$$M_s = M_d(1 - B_{ws}/100) + 18(B_{ws}/100)$$

$$M_s = 28.84(1 - 0.7/100) + 18(0.7/100)$$

$$M_s = 28.76 \text{ lb/lb·mol}$$

7. Absolute stack gas pressure, in. Hg.

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$

$$P_s = 30.3 + \frac{-7.0}{13.6}$$

$$P_s = 29.79 \text{ inches Hg}$$

8. Stack velocity at stack conditions, fps.

$$v_s = 85.49\ C_p \left(\sqrt{\Delta p}\right)_{avg} \sqrt{\frac{t_s + 460}{M_s\ P_s}}$$

$$v_s = (85.49)(0.84)(1.1892) \sqrt{\frac{(59.0 + 460)}{(28.76)(29.79)}}$$

$$v_s = 66.5 \text{ fps}$$

9. Isokinetic Variation.

$$\%I = \frac{\left(V_{m(std)}\right)\left(t_s + 460\right)(17.32)}{\left(v_s\right)\left(D_n^2\right)(\theta)\left(P_s\right)\left(1 - B_{ws}/100\right)}$$

$$\%I = \frac{(166.863)\ (59.0 + 460)\ (17.32)}{(66.5)\ (0.188)^2\ (240)\ (29.79)\ (1 - 0.7/100)}$$

$$\%I = 90.0$$

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

$$Q_a = (60)\ (A)\ (v_s)$$

$$Q_a = (60)\ (3.835)\ (66.5)$$

$$Q_a = 15{,}295 \text{ acfm}$$

11. Dry stack gas volumetric flow rate at standard conditions, dscfm.

$$Q_{s(std)} = 17.64\ Q_a\ \frac{P_s}{(t_s + 460)} \left(1 - B_{ws}/100\right)$$

$$Q_{s(std)} = (17.64)\ (15{,}295) \left(\frac{29.79}{59.0 + 460}\right) \left(1 - 0.7/100\right)$$

$$Q_{s(std)} = 15{,}378 \text{ dscfm}$$

12. Dry stack gas volumetric flow rate at standard conditions, dscmm.

$$Q_{s(cmm)} = Q_{s(std)}\ 0.028317$$

$$Q_{s(cmm)} = (15{,}379)\ (0.028317)$$

$$Q_{s(cmm)} = 435 \text{ dscmm}$$

13. PM concentration, gr/dscf.

$$gr/dscf = (15.43)\ \frac{g}{V_{m(std)m^3}}$$

$$gr/dscf = (15.43)\ \frac{0.0179}{166.863}$$

$$gr/dscf = 0.00166\ \ gr/dscf$$

14. PM concentration, g/dscm.

$$g/dscm = \frac{g}{V_{m(std)m^3}}$$

$$g/dscm = \frac{0.0179}{4.725}$$

$$g/dscm = 0.00379\ \ g/dscm$$

15. PM emission rate, lb/test period.

$$lb/test\ period = \frac{(\theta)\ (g)\ (Q_{s(std)})}{(453.592)\ (V_{m(std)})}$$

$$lb/test\ period = \frac{(240)\ (0.0179)\ (15{,}378)}{(453.592)\ (166.863)}$$

$$lb/test\ period = 0.873\ \ lb/test\ period$$

16. PM Emission Rate, lb/ton.

$$\text{lb/ton} = \frac{\text{lb per test period}}{\text{tons of asphalt loaded per test period}}$$

$$\text{lb/ton} = \frac{0.873}{893.5}$$

$$\text{lb/ton} = 0.000977 \text{ lb/ton}$$

Nomenclature

γ	Meter Box Correction Factor
ΔH	Avg Meter Orifice Pressure, in. H_2O
P_{bar}	Barometric Pressure, inches Hg
V_m	Sample Volume, ft^3
t_m	Average Meter Temperature, °F
P_{static}	Stack Static Pressure, inches H_2O
t_s	Average Stack Temperature, °F
V_{lc}	Condensate Collected, ml
CO_2	Carbon Dioxide content, % by volume
O_2	Oxygen content, % by volume
N_2	Nitrogen content, % by volume
C_p	Pitot Tube Coefficient
$\Delta p_{1/2}$	Average Square Root Δp, (in. $H_2O)^{1/2}$
Θ	Sample Run Duration, minutes
D_n	Nozzle Diameter, inches
A_n	Nozzle Area, ft^2
$V_{m(std)}$	Standard Meter Volume, dscf
$V_{m(std)m3}$	Standard Meter Volume, dscm
P_s	Stack Pressure, inches Hg
B_{ws}	Moisture, % by volume
$V_{w(std)}$	Standard Water Vapor Volume, ft^3
$1-B_{ws}$	Dry Mole Fraction
M_d	Molecular Weight, dry, lb/lb•mole
M_s	Molecular Weight, wet, lb/lb•mole
v_s	Stack Gas Velocity, ft/s
A	Stack Area, ft^2
Q_a	Stack Gas Volumetric flow, acfm
$Q_{s(std)}$	Stack Gas Volumetric flow, dscfm
$Q_{s(cmm)}$	Stack Gas Volumetric flow, dscmm
I	Isokinetic Sampling Ratio, %
gr/dscf	Concentration, g/dscf
g/dscm	Concentration, g/dscm
lb/test period	Emission Rate, pounds per test period

APPENDIX B

PROCESS DATA

PES PROCESS LOG - ASPHALT PLANT D IN BARRE, MA
Run No. 1 - October 5, 1998
Data recorded by Frank Phoenix

START (7)	STOP	JOB #	TRUCK	MIX TYPE	TICKET NO.	MIX TEMP, F	STACK TEMP, F	ASPHALT TEMP, F	ASPHALT LOADED AND TESTED, LBS	ASPHALT LOADED BUT NOT TESTED, LBS	COMMENTS
6:24	6:25	9999	2	15	9381					15,898	7
6:29	6:35	3089	LC 757	30	9382					49,054	
6:36	6:41	9999	2	16	9383					48,291	
6:48	6:54	3089	WAD	30	9384					47,676	
6:55	7:00	3089	5G	30	9385					48,178	
7:03	7:08	3058	5G 22	18	9386					48,166	
7:09	7:18	3089	LC 542	30	9387					66,658	
7:21	7:27	3089	LC 751	30	9388	361	247		48,093		
7:29	7:39	3089	LC 543	30	9389	417	226		64,180		
7:41	7:47	3089	LC 752	30	9390	393	235		48,303		
7:57	8:04	3089	LC 757	30	9391	353	186		48,081		
8:08	8:15	3089	COS	30	9392	201	115		48,776		
8:17	8:23	3089	WAD	30	9393	340	297		48,495		
8:25	8:33	3089	5 G	30	9394	401	249		48,139		
8:37	8:45	3089	LC 542	30	9395	375	229				Same Truck
8:47	8:50	3089	LC 542	30	9395	407	230		66,647		Same Truck (1)
8:56	9:03	3089	LC 543	30	9396					64,143	
9:06	9:12	3089	LC 752	30	9397	400	212		48,644		2
9:14	9:20	3089	LC 752	30	9398	364	229		48,398		
9:22	9:27	2959	YOU	16	9399	385	220	321	48,150		
9:28	9:34	3089	LC 757	30	9400	364	248	320	48,213		
9:35	9:41	3089	WAD	30	9401	355	283	290	48,358		
9:42	9:43	9999	3	8	9402	377	247		8,151		3
9:45	9:51	3089	5 G	30	9403	370	249		48,463		4
9:52	10:00	3089	LC 542	30	9404	391	248		66,265		
10:01	10:09	3089	LC 543	30	9405	373	245		64,332		
10:10	10:17	3089	LC 751	30	9406	378	245	280	48,334		
10:16	10:22	3089	LC 751	30	9407			290		48,705	
10:25	10:31	3089	BLK	30	9408	367	231		47,975		
10:33	10:38	3089	LC 757	30	9409	383	241	294	48,496		
10:38	10:39	9999	3	33	9410					12,185	
10:41	10:43	8888	4	33	9411			290		17,904	
10:46	10:51	3089	WAD	30	9412	387	230		48,282		
10:54	11:02	3089	5 G	30	9413	270	137	299			Same Truck (5)
11:05	11:06	3089	WAD	30	9413	326	210		48,741		Same Truck
11:08	11:17	3089	LC 542	30	9414	379	254	303	66,365		
11:18	11:28	3089	LC 543	30	9415	385	253		64,312		
11:29	11:35	3089	LC 751	30	9416	392	251	310	48,613		
11:36	11:41	3089	LC 752	30	9417	387	246	310	48,125		
11:42	11:48	3089	LC 757	30	9418	407	244		48,319		6
11:48	11:54	2959	BLK	16	9419			313		48,233	
11:56	11:59	8888	4	67	9420	396	270		20,149		
12:00	12:06	3089	WAD	30	9421	385	285		46,626		
12:07	12:13	3089	5 G	30	9422	396	386		48,521		
12:14	12:22	3089	LC 542	30	9423	424	263		65,814		
12:23	12:30	3089	LC 543	30	9424	398	258		64,724		
12:32	12:37	3089	LC 751	30	9425	393	259		48,423		
12:40	12:44	9999	2	67	9426	418	269		29,985		
12:46	12:51	3089	LC 757	30	9427	449	195		48,445		
12:52	12:59	3089	WAD	30	9428	383	259		48,854		
13:52	14:03	9999	3	2	9429				39,958		
Total						377.1		Total (lbs.)	1,830,749	515,091	
								Total (tons)	915.4	257.5	

Comments

1 Confusion in Control Room, Problem Releasing Material to Mixer, Dump took Longer Than Expected.
2 Truck not Dampered
3 No Truck Exhaust Stack
4 Missed First Dump
5 Kettle Problem
6 Port Change
7 Note: Two Minute Difference Log Printout Reads Two Minutes Slow.

PES PROCESS LOG - ASPHALT PLANT D IN BARRE, MA
Run No. 1 - October 5, 1998
Data recorded by Frank Phoenix

Asphalt By Mix Type

START (7)	STOP	JOB #	TRUCK	MIX TYPE	TICKET NO.	MIX TEMP, F	STACK TEMP, F	ASPHALT TEMP, F	ASPHALT LOADED AND TESTED, LBS	Asphalt by Mix	COMMENTS
13:52	14:03	9999	3	2	#VALUE!				39,958	39,958	
9:42	9:43	9999	3	8	#VALUE!	377	247		8,151	8,151	3
9:22	9:27	2959	YOU	16	#VALUE!	385	220	321	48,150	48,150	
7:21	7:27	3089	LC 751	30	9388	361	247		48,093		
7:29	7:39	3089	LC 543	30	9389	417	226		64,180		
7:41	7:47	3089	LC 752	30	9390	393	235		48,303		
7:57	8:04	3089	LC 757	30	9391	353	186		48,081		
8:08	8:15	3089	COS	30	9392	201	115		48,776		
8:17	8:23	3089	WAD	30	9393	340	297		48,495		
8:25	8:33	3089	5 G	30	9394	401	249		48,139		
8:37	8:45	3089	LC 542	30	9395	375	229				Same Truck
8:47	8:50	3089	LC 542	30	9395	407	230		66,647		Same Truck (1)
9:06	9:12	3089	LC 752	30	9397	400	212		48,644		2
9:14	9:20	3089	LC 752	30	9398	364	229		48,398		
9:28	9:34	3089	LC 757	30	9399	364	248	320	48,213		
9:35	9:41	3089	WAD	30	9400	355	283	290	46,358		
9:45	9:51	3089	5 G	30	9401	370	249		48,463		4
9:52	10:00	3089	LC 542	30	9402	391	248		66,265		
10:01	10:09	3089	LC 543	30	9403	373	245		64,332		
10:10	10:17	3089	LC 751	30	9404	378	245	280	48,334		
10:33	10:38	3089	LC 757	30	9409	383	241	294	48,496		
10:25	10:31	3089	BLK	30	9408	367	231		47,975		
10:46	10:51	3089	WAD	30	9412	387	230		48,282		
10:54	11:02	3089	5 G	30	9413	270	137	299			Same Truck (5)
11:05	11:06	3089	WAD	30	9413	326	210		48,741		Same Truck
11:08	11:17	3089	LC 542	30	9414	379	254	303	66,365		
11:18	11:28	3089	LC 543	30	9415	385	253		64,312		
11:29	11:35	3089	LC 751	30	9416	392	251	310	48,613		
11:36	11:41	3089	LC 752	30	9417	387	246	310	48,125		
11:42	11:48	3089	LC 757	30	9418	407	244		48,319		6
12:00	12:06	3089	WAD	30	9421	385	285		48,626		
12:07	12:13	3089	5 G	30	9422	396	386		48,521		
12:14	12:22	3089	LC 542	30	9423	424	263		65,814		
12:23	12:30	3089	LC 543	30	9424	398	258		64,724		
12:32	12:37	3089	LC 751	30	9425	393	259		48,423		
12:46	12:51	3089	LC 757	30	9426	449	195		48,445		
12:52	12:59	3089	WAD	30	9427	383	259		48,854		
										1,684,356	
11:56	11:59	8888	4	67	9420	396	270		20,149		
12:40	12:44	9999	2	67	9421	418	269		29,985		
										50,134	
Total						376 0		Total (lbs.)	1,830,749	1,830,749	3,661,498
								Total (tons)	915.4	915.4	

Comments

1 Confusion in Control Room, Problem Releasing Material to Mixer, Dump took Longer Than Expected.
2 Truck not Dampered
3 No Truck Exhaust Stack
4 Missed First Dump
5 Kettle Problem
6 Port Change
7 Note: Two Minute Difference Log Printout Reads Two Minutes Slow.

23

Datasheet

Asphalt Plant D
Barre, MA

Date: 10-5-98

Run #1
Josh Berkowitz
Frank Phoenix

Asphalt temp per thermometer ↓

Truck count	Test Time: Start *	Stop	Job #	Truck #	Mix Temp °F	Stack Temp °F	Mix +	
1	7:21	7:27	3089	LC 751	361	247	30	
2	7:29	7:38	3089	LC 543	417	226	30	
3	7:41	7:47	3089	LC 752	393	235	30	
4	7:57	8:04	3089	LC 757	353	186	30	
5	8:09	8:15	3089	LOS	201	115	30	
6	8:17	8:23	3089	WAD	340	297	30	
7	8:25	8:33	3089	SG	401	249	30	
Same truck 8	8:37	8:45	3089	LC 542	375	229	30	
	8:47	8:50	3089	LC 542	407	230	30	
9	9:06	9:12	3089	LC 752	400	212	→	Truck not damper…
10	9:14	9:20	3089	LC 752	364	229	30	
9:22 (11)	~~9:20~~	9:27	2959	YOU	385	220	16 (321)	
12	9:28	9:34	3089	LC 757	364	248	30	← 320
13	9:35	9:41	3089	WAD	355	283	30 (290)	
14	9:42	9:43	9999	3	377	247	8	→ No exh stack
15	9:45	9:51	3089	SG	370	249	30	missed 1st dump
16	9:52	10:00	3089	LC542	391	248	30	
17	10:01	10:09	3089	LC543	373	245	30	
18	10:10	10:17	3089	LC 751	378	245	30 (280)	
19	10:25	10:31	3089	BLK	367	231	30 (290)	
10:33 20	10:38	10:38	3089	LC 757	383	241	30	Kettle problem
21	10:46	10:51	3089	WAD	387	230	30 (294)	
22	10:54	11:02	3089	SG	270	137	30 →	Plant problem
	11:05	11:06	3089	WAD	326	210	30	
23	11:08	11:17	3089	LC 542	379	254	30 (290)	
24	11:18	11:28	3089	LC 543	385	253	30	
25	11:29	11:35	3089	LC 751	392	251	30 (299)	
26	11:36	11:41	3089	LC 752	387	246	30	
27	11:42	11:48	3089	LC 757	407	244	30 (303)	
Pit change 28	11:56	11:59	8888	4 WAD	396	270	64	
29	12:00	12:06	3089	WAD ~~[illegible]~~	385	285	30 (310)	
30	12:07	12:13	3089	SG	396	286	30 (310)	
31	12:14	12:22	3089	LC 542	424	263	30	
32	12:23	12:30	3089	LC 543	398	258	30 (313)	
33	12:32	12:37	3089	LC 751	393	259	30	
34	12:40	12:44	9999	2	418	269	67	
35	12:46	12:51	3089	LC 757	449	195	30	
36	12:52	12:59	3089	WAD	393	259	30	
37	13:52	14:03	9999	3	—	—	3	
One last job					Production plant off line			

Confusion in … problem releasing material …

Barre Plant Data Sheets

24 * 2 minute difference log printout reads two minutes slow

1st Truck Tested,
7:21 our time

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 751
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9388

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
7:19:05	10	2770	780	740	840	2480	7610	16	355	355	7965
7:19:59	20	2820	820	710	830	2540	7720	13	351	351	16036
7:21:41	20	2880	790	760	790	2480	7700	15	355	355	24091
7:22:47	20	2710	830	750	830	2480	7600	14	351	351	32042
7:23:53	10	2770	800	800	820	2540	7730	13	352	352	40124
7:25:00	-10	2720	790	720	850	2540	7620	14	349	349	48093

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
5	129.84	07:25:52 10/05/98	F	2

Truck #2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# LC 543
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9389

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
7:30:17	-10	2810	790	740	780	2510	7630	6	357	357	7987
7:31:00	20	2820	810	770	820	2500	7720	14	350	350	16057
7:32:06	30	2790	820	730	800	2510	7650	15	352	352	24059
7:33:12	20	2810	800	790	810	2540	7750	15	350	350	32159
7:34:18	30	2770	810	700	790	2490	7560	15	350	350	40069
7:35:24	30	2730	780	750	800	2510	7570	15	356	356	47995
7:36:30	30	2800	780	730	820	2570	7700	18	353	353	56048
7:37:37	30	2840	790	760	830	2560	7780	16	352	352	64180

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
6	161.93	07:38:30 10/05/98	F	2

Truck #3

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 752
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9390

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
7:39:03	20	2720	780	780	820	2580	7680	16	355	355	8035
7:39:51	40	2870	830	750	850	2590	7890	15	350	350	16275
7:41:22	40	2820	810	680	830	2510	7650	16	351	351	24276
7:42:28	50	2860	810	760	820	2460	7710	15	349	349	32335
7:43:34	0	2760	760	780	810	2580	7690	15	351	351	40376
7:44:40	30	2770	790	740	810	2460	7570	15	357	357	48303

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
7	186.08	07:45:33 10/05/98	F	2

Truck # 4

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3009
PLAINVILLE, MASS.	OAKHAM	Truck# LC 757
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9391

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
7:56:49	0	2780	820	750	790	2550	7690	7	355	355	8045
7:57:30	30	2820	790	730	820	2490	7650	16	351	351	16046
7:58:37	10	2750	780	770	790	2510	7600	17	350	350	23996
7:59:43	30	2830	800	740	830	2510	7710	15	355	355	32061
8:00:51	20	2810	810	770	820	2540	7750	16	349	349	40160
8:01:57	30	2770	830	700	780	2490	7570	16	351	351	48081

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
8	210.12	08:02:50 10/05/98	F	2

Truck 5

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# COS
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9392

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
8:08:12	0	2830	800	720	790	2530	7670	9	360	360	8030
8:09:13	20	2770	790	730	790	2520	7600	16	350	350	15980
8:10:19	30	2780	810	770	830	2580	7770	18	350	350	24100
8:11:26	40	2880	780	740	790	2530	7720	18	356	356	32176
8:12:32	40	3060	780	770	850	2520	7980	17	350	350	40506
8:13:38	30	2860	810	760	860	2630	7920	17	350	350	48776

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
9	234.51	08:14:31 10/05/98	F	2

29

Truck 8

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# WAD
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9393

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
8:15:49	0	2910	820	700	780	2440	7650	9	356	356	8006
8:16:42	10	2750	810	770	840	2490	7660	16	346	346	16012
8:17:50	70	2930	790	780	810	2580	7890	17	353	353	24255
8:18:55	30	2850	790	770	820	2560	7790	15	352	352	32397
8:20:01	30	2820	800	750	830	2510	7710	15	349	349	40456
8:21:07	30	2790	780	760	810	2550	7690	17	349	349	48495

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
10	258.76	08:22:00 10/05/98	F	2

Truck 7

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3009
PLAINVILLE, MASS.	OAKHAM	Truck# 5 G
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9394

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
8:24:39	0	2790	820	740	800	2470	7620	9	362	362	7982
8:26:29	30	2860	800	730	840	2460	7690	16	348	348	16020
8:27:36	20	2700	840	770	800	2530	7640	15	353	353	24013
8:28:42	30	2770	780	700	780	2510	7540	16	351	351	31904
8:29:48	30	2750	810	750	820	2520	7650	16	355	355	39909
8:30:54	40	2960	800	780	850	2490	7880	16	350	350	48139

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
11	282.83	08:31:47 10/05/98	F	2

TRUCK #8

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 542
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9395

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2867	825	771	825	2599			363		8250
8:35:47	-10	2940	830	770	840	2590	7970	7	367	367	8337
8:36:32	40	2950	830	770	840	2580	7970	14	363	363	16670
8:37:38	30	2860	820	760	830	2650	7920	15	362	362	24952
8:38:45	20	2860	850	810	820	2650	7990	14	357	357	33299
8:39:51	30	2870	840	770	880	2630	7990	15	365	365	41654
8:40:57	50	2890	810	810	840	2600	7950	15	360	360	49964
8:42:03	40	2920	750	740	780	2560	7750	1	370	370	58084
8:47:32	40	3020	870	810	850	2650	8200	14	363	363	66647

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
12	316.15	08:48:25 10/05/98	F	2

DELAY IN TUNNEL DUE TO PROBLEM WITH SCALES + MIXER

Truck #9

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 752
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9397

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
9:04:52	0	2860	810	820	850	2570	7910	12	353	353	8263
9:05:35	0	2800	810	760	830	2500	7700	15	352	352	16315
9:07:12	30	2880	790	740	790	2540	7740	17	350	350	24405
9:08:18	40	2860	820	800	830	2560	7870	15	352	352	32627
9:09:24	0	2840	760	760	730	2460	7550	16	353	353	40530
9:10:29	20	2860	800	760	810	2530	7760	15	354	354	48644

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
14	372.54	09:11:23 10/05/98	F	2

Truck #10

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 752
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9398

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
9:12:48	-10	2940	800	750	810	2520	7820	10	356	356	8176
9:13:35	20	2880	830	750	830	2540	7830	16	347	347	16353
9:14:41	20	2700	790	750	830	2490	7560	15	349	349	24262
9:15:47	30	2700	830	750	830	2480	7590	15	354	354	32206
9:16:53	20	2860	780	700	840	2540	7720	15	351	351	40277
9:17:59	40	2860	800	790	830	2490	7770	16	351	351	48398

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
15	396.74	09:18:52 10/05/98	F	2

34

TRuck #11

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM OF MASS.
RTE 9
LEICESTER

Cust# 1
Job# 2959
Truck# YOU
Mix# 16
Name STATE DENSE TOP
Operator
Ticket# 9399

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
9:19:45	-10	2520	4950	7470	13	579	579	8049
9:20:16	40	2560	4950	7510	13	581	581	16140
9:21:45	30	2570	4950	7520	13	575	575	24235
9:22:51	20	2560	4890	7450	11	580	580	32265
9:23:57	10	2460	4870	7330	12	577	577	40172
9:25:03	30	2510	4890	7400	11	578	578	48150

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.08	09:25:57 10/05/98	F	2

TRUCK #12

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 757
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9400

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	740	800	2520			352		8000
9:26:46	-10	2830	780	760	780	2600	7750	15	349	349	8099
9:27:32	10	2840	790	760	820	2590	7800	15	345	345	16244
9:29:00	20	2860	780	740	800	2480	7660	15	352	352	24256
9:30:06	10	2870	790	720	750	2450	7580	16	356	356	32192
9:31:11	30	2880	780	730	750	2490	7630	15	350	350	40172
9:32:18	0	2820	780	760	810	2520	7690	15	351	351	48213

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
16	420.85	09:33:11 10/05/98	F	2

13

Truck #13

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# WAD
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9401

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
9:33:36	0	2790	840	730	830	2520	7710	16	351	351	8061
9:34:30	-10	2720	800	760	850	2470	7600	15	349	349	16010
9:35:42	20	2890	840	790	790	2580	7890	15	356	356	24256
9:36:49	10	2820	840	780	820	2490	7750	15	347	347	32353
9:37:55	30	2820	760	690	800	2500	7570	15	357	357	40280
9:39:01	20	2830	810	730	850	2510	7730	15	348	348	48358

Agg Tare   Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
17	445.03	09:39:54 10/05/98	F	2

37

TRUCK #14

NO EXHAUST STACK ON TRUCK

DIESEL FUMES EXHAUST INTO TUNNEL

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 8
Name BINDER MIX
Operator
Ticket# 9402

Time	Agg T	AGG 4	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2812	1140	1140	2508			400		8000
9:40:30	10	2850	1170	1200	2530	7750	13	401	401	8151

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	4.08	09:41:00 10/05/98	F	2

15

Truck # 15

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3009
PLAINVILLE, MASS.	OAKHAM	Truck# 5 G
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9403

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	740	800	2520			352		8000
9:42:48	0	2790	820	770	810	2540	7730	8	353	353	8083
9:43:34	20	2810	780	710	780	2490	7570	14	351	351	16004
9:45:48	30	2840	800	720	880	2510	7750	15	350	350	24104
9:46:55	20	2880	780	780	850	2570	7860	15	355	355	32319
9:48:01	10	2730	820	760	800	2510	7620	15	351	351	40290
9:49:07	20	2930	790	770	800	2530	7820	17	353	353	48463

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
18	469.26	09:50:00 10/05/98	F	2

39

16

Truck #16

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 542
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9404

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2867	825	771	825	2599			363		8250
9:50:26	20	2910	790	810	840	2620	7970	15	363	363	8333
9:51:20	50	2930	790	700	800	2570	7790	14	359	359	16482
9:52:43	30	2960	810	760	850	2610	7990	15	365	365	24837
9:53:49	40	2870	810	790	830	2620	7920	16	366	366	33123
9:54:56	40	2930	890	810	830	2550	8010	15	363	363	41496
9:56:02	40	2830	870	750	820	2610	7880	16	361	361	49737
9:57:08	30	2990	870	790	810	2620	8080	16	361	361	58178
9:58:14	20	2880	760	730	800	2550	7720	15	367	367	66265

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
19	502.39	09:59:07 10/05/98	F	2

40

17

Truck #17

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 543
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9405

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
9:59:57	0	2830	810	740	820	2530	7730	12	351	351	8081
10:00:44	30	2840	860	770	810	2560	7840	15	350	350	16271
10:02:04	20	2810	820	740	820	2530	7720	16	351	351	24342
10:03:10	30	2780	800	800	810	2500	7690	15	354	354	32386
10:04:17	20	2750	830	740	810	2530	7660	16	351	351	40397
10:05:22	40	2700	810	690	780	2450	7430	16	350	350	48177
10:06:29	0	2700	780	750	840	2520	7590	15	353	353	56120
10:07:35	30	2940	780	710	840	2590	7860	16	352	352	64332

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
20	534.56	10:08:28 10/05/98	F	2

41

18

Truck #18

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 751
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9406

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
10:08:54	10	2830	820	800	830	2530	7810	16	359	359	8169
10:09:47	40	2790	790	760	820	2470	7630	16	348	348	16147
10:11:25	10	2900	790	710	730	2510	7640	17	356	356	24143
10:12:49	10	2820	770	730	810	2520	7650	16	351	351	32144
10:13:55	30	2820	820	790	810	2510	7750	16	351	351	40245
10:15:01	40	2780	830	750	820	2560	7740	16	349	349	48334

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
21	558.73	10:15:54 10/05/98	F	2

42

TRUCK #19

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# BLK
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9408

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	740	800	2520			352		8000
10:23:44	0	2830	780	760	820	2580	7770	13	350	350	8120
10:24:28	10	2830	820	730	830	2580	7790	17	347	347	16257
10:25:55	0	2800	780	720	740	2480	7520	16	352	352	24129
10:27:01	30	2790	790	730	790	2470	7570	16	354	354	32053
10:28:07	20	2780	800	770	810	2460	7620	16	352	352	40025
10:29:13	40	2770	800	750	790	2490	7600	16	350	350	47975

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
23	607.07	10:30:07 10/05/98	F	2

43

TRUCK # 20

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# LC 757
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9409

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
10:30:25	10	2780	780	740	830	2600	7730	17	355	355	8085
10:31:26	20	2800	790	770	820	2580	7760	17	350	350	16195
10:32:51	30	2790	820	720	760	2480	7570	17	351	351	24116
10:33:57	10	2900	780	750	790	2500	7720	17	357	357	32193
10:35:04	0	2810	810	760	810	2590	7780	17	351	351	40324
10:36:09	30	2850	820	770	810	2570	7820	17	352	352	48496

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
24	631.32	10:37:03 10/05/98	F	2

20

44

21

Truck #21

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# WAD
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9412

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	740	800	2520			352		8000
10:44:02	10	2790	820	750	810	2460	7630	14	350	350	7980
10:45:06	0	2820	800	770	800	2510	7700	14	351	351	16031
10:46:12	30	2820	770	720	790	2450	7550	15	352	352	23933
10:47:19	40	2760	780	730	850	2530	7650	15	349	349	31932
10:48:25	10	2790	760	740	1020	2530	7840	15	355	355	40127
10:49:31	10	2780	750	790	910	2570	7800	16	355	355	48282

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
25	655.46	10:50:24 10/05/98	F	2

45

22

TRUCK # 22

KETTLE PROBLEM – TRUCK IN TUNNEL LONGER THAN NORMAL

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# 5 G
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9413

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
10:54:55	0	2770	790	740	810	2490	7600	9	356	356	7956
10:55:42	40	2780	810	730	730	2650	7700	17	348	348	16004
10:56:49	10	2790	840	760	780	2520	7690	17	348	348	24042
10:57:55	40	2830	830	770	990	2540	7960	6	356	356	32358
11:00:59	50	2740	830	740	830	2780	7920	16	352	352	40630
11:04:44	70	2950	790	740	750	2530	7760	18	351	351	48741

Agg Tare   Asp Tare

Cost/Ton   Percent Tax   Load Cost   Amount Tax   Dest Charge   Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
26	679.83	11:05:36 10/05/98	F	2

Truck #23

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 542
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9414

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2867	825	771	825	2599			363		8250
11:07:35	40	2940	850	700	790	2650	7930	10	364	364	8294
11:08:24	60	2920	830	790	880	2540	7960	16	361	361	16615
11:09:31	50	2850	830	760	840	2570	7850	16	368	368	24833
11:10:36	60	2910	810	790	850	2670	8030	15	357	357	33220
11:11:43	60	2900	760	800	860	2550	7870	15	363	363	41453
11:12:49	60	2880	820	780	830	2630	7940	15	363	363	49756
11:14:14	30	2840	890	700	760	2540	7730	16	364	364	57850
11:15:18	70	3070	860	810	840	2570	8150	16	365	365	66365

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
27	713.01	11:16:11 10/05/98	F	2

24

Truck # 24

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# LC 543
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9415

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
11:18:23	50	2880	790	700	830	2530	7730	9	352	352	8082
11:19:11	50	2790	850	790	850	2550	7830	15	348	348	16260
11:20:17	30	2840	800	760	830	2550	7780	15	351	351	24391
11:21:23	50	2770	810	770	830	2480	7660	14	350	350	32401
11:22:29	40	2800	770	750	800	2490	7610	14	352	352	40363
11:23:35	50	2820	800	800	860	2570	7850	15	351	351	48564
11:24:42	30	2730	770	700	770	2450	7420	15	358	358	56342
11:25:47	60	2750	810	720	830	2510	7620	15	350	350	64312

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
28	745.17	11:26:41 10/05/98	F	2

48

25

Truck # 25

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 751
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9416

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
11:27:03	30	2940	800	740	850	2550	7880	15	354	354	8234
11:28:00	40	2870	800	790	810	2510	7780	15	352	352	16366
11:29:35	40	2870	820	750	820	2550	7810	15	353	353	24529
11:30:40	50	2820	790	750	820	2530	7710	14	349	349	32588
11:31:46	50	2760	800	710	850	2460	7580	15	351	351	40519
11:32:52	40	2780	790	790	850	2530	7740	14	354	354	48613

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
29	769.48	11:33:46 10/05/98	F	2

Truck # 26

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# LC 752
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9417

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
11:34:15	20	2750	790	740	800	2520	7600	16	355	355	7955
11:35:04	60	2820	820	740	820	2550	7750	14	353	353	16058
11:36:23	40	2770	760	740	830	2540	7640	15	349	349	24047
11:37:29	50	2780	730	790	770	2460	7530	15	356	356	31933
11:38:35	40	2830	780	720	800	2550	7680	14	353	353	39966
11:39:41	20	2920	810	720	850	2510	7810	15	349	349	48125

Agg Tare   Asp Tare

Cost/Ton   Percent Tax   Load Cost   Amount Tax   Dest Charge   Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
30	793.54	11:40:35 10/05/98	F	2

27

Truck # 27

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 757
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9418

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
11:41:06	30	2840	820	770	840	2500	7770	14	352	352	8122
11:41:54	40	2850	810	740	830	2510	7740	14	350	350	16212
11:43:11	50	2880	760	730	800	2540	7710	15	352	352	24274
11:44:18	20	2750	820	800	830	2530	7730	15	354	354	32358
11:45:24	50	2810	810	700	720	2510	7550	15	351	351	40259
11:46:29	40	2930	760	720	780	2520	7710	15	350	350	48319

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
31	817.70	11:47:23 10/05/98	F	2

51

28

TRuck # 2-8

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 67
Name SIDE WALK
Operator
Ticket# 9420

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2000	4250			417		6667
11:55:19	30	2010	4320	6330	13	411	411	6741
11:55:56	70	2010	4230	6240	11	420	420	13401
11:57:06	70	2020	4310	6330	10	418	418	20149

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	10.07	11:58:01 10/05/98	F	2

52

29

Truck # 29

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# WAD
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9421

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
11:58:23	40	2860	810	750	740	2460	7620	13	355	355	7975
11:59:21	70	2920	850	730	790	2470	7760	12	350	350	16085
12:00:28	40	2830	850	830	790	2550	7850	11	347	347	24282
12:01:34	40	2840	810	750	820	2540	7760	12	351	351	32393
12:02:39	70	2780	790	720	840	2500	7630	11	349	349	40372
12:03:45	50	2960	810	760	830	2540	7900	11	354	354	48626

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
32	842.01	12:04:39 10/05/98	F	2

Truck #30

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# 5 G
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9422

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
12:05:06	30	2810	770	790	810	2550	7730	13	354	354	8084
12:05:58	30	2860	780	690	800	2470	7600	10	352	352	16036
12:07:35	20	2840	810	740	860	2590	7840	10	349	349	24225
12:08:41	40	2800	810	760	840	2500	7710	10	352	352	32287
12:09:47	40	2810	800	760	810	2510	7690	11	351	351	40328
12:10:53	40	2890	800	760	800	2590	7840	12	353	353	48521

Agg Tare   Asp Tare

Cost/Ton   Percent Tax   Load Cost   Amount Tax   Dest Charge   Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
33	866.27	12:11:46 10/05/98	F	2

3\

Truck # 31

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 542
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9423

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2867	825	771	825	2599			363		8250
12:12:11	30	2810	840	810	850	2580	7890	12	363	363	8253
12:13:05	20	2820	790	720	760	2530	7620	11	365	365	16238
12:14:26	50	2890	840	780	890	2530	7930	11	361	361	24529
12:15:33	40	2850	820	770	860	2580	7880	11	362	362	32771
12:16:39	60	2820	800	820	870	2640	7950	11	362	362	41083
12:17:45	20	2900	840	720	860	2690	8010	12	366	366	49459
12:18:52	30	2920	790	800	840	2560	7910	13	362	362	57731
12:19:58	20	2870	790	730	750	2580	7720	12	363	363	65814

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
34	899.18	12:20:51 10/05/98	F	2

55

32

TRuck # 32

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 543
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9424

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	740	800	2520			352		8000
12:21:25	20	2780	780	720	890	2630	7800	13	352	352	8152
12:22:22	40	2910	810	750	850	2520	7840	14	353	353	16345
12:23:41	30	2820	830	780	850	2450	7730	13	355	355	24430
12:24:47	10	2880	810	750	810	2540	7790	14	352	352	32572
12:25:53	50	2930	790	760	830	2520	7830	14	352	352	40754
12:26:59	-10	2800	830	690	800	2500	7620	15	354	354	48728
12:28:05	20	2800	810	760	790	2450	7610	15	348	348	56686
12:29:11	50	2750	790	760	850	2540	7690	15	348	348	64724

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
35	931.54	12:30:05 10/05/98	F	2

56

33

Truck # 3[illegible]

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# LC 751
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9425

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
12:30:30	20	2900	800	780	800	2550	7830	14	355	355	8185
12:31:24	50	2840	830	750	840	2510	7770	15	354	354	16309
12:32:47	20	2830	800	770	840	2520	7760	14	351	351	24420
12:33:53	50	2740	780	670	830	2470	7490	15	348	348	32258
12:34:59	30	2700	790	710	810	2520	7530	15	351	351	40139
12:36:05	40	2930	800	780	840	2580	7930	16	354	354	48423

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
36	955.75	12:36:59 10/05/98	F	2

57

35

Truck # 34

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 2
Mix# 67
Name SIDE WALK
Operator
Ticket# 9426

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2250	4781			469		7500
12:39:48	10	2270	4830	7100	10	471	471	7571
12:40:19	50	2270	4770	7040	13	473	473	15084
12:41:28	40	2190	4750	6940	12	472	472	22496
12:42:34	40	2250	4770	7020	12	469	469	29985

Agg Tare   Asp Tare

Cost/Ton   Percent Tax   Load Cost   Amount Tax   Dest Charge   Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	14.99	12:43:29 10/05/98	F	2

58

Truck # 35

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 757
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9427

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
12:43:59	40	2880	800	810	830	2540	7860	16	350	350	8210
12:44:48	50	2850	820	730	800	2530	7730	13	349	349	16289
12:46:04	50	2800	760	770	830	2520	7680	14	351	351	24320
12:47:11	30	2830	790	720	810	2460	7610	14	351	351	32281
12:48:16	20	2790	800	720	830	2530	7670	14	349	349	40300
12:49:22	50	2890	790	740	850	2520	7790	14	355	355	48445

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
37	979.97	12:50:16 10/05/98	F	2

59

36

Truck # 36

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# WAD
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9428

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
12:50:45	30	2840	920	780	830	2540	7910	16	353	353	8263
12:52:23	20	2790	940	760	870	2440	7800	14	351	351	16414
12:53:29	40	2820	830	730	770	2510	7660	13	353	353	24427
12:54:35	40	3070	780	770	800	2560	7980	14	353	353	32760
12:55:41	40	2710	830	750	810	2520	7620	14	347	347	40727
12:56:47	40	2760	870	770	790	2580	7770	15	357	357	48854

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
38	1004.40	12:57:40 10/05/98	F	2

60

.37

Truck # 37

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 2
Name 1/2 BINDER
Operator
Ticket# 9429

Time	Agg T	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2540	2700	2400			360		8000
1:52:03	0	2550	2700	2390	7640	11	361	361	8001
1:52:38	60	2540	2690	2400	7630	16	358	358	15989
1:53:44	20	2530	2730	2420	7680	16	363	363	24032
1:54:50	50	2510	2640	2350	7500	15	362	362	31894
1:55:56	50	2550	2730	2420	7700	14	364	364	39958

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	19.98	13:56:50 10/05/98	F	2

61

Asphalt Plant D
Barre MA
RUN #1

Date: 10-5-98
Josh Berkowitz, Derek Hawkes
Frank Phoenix

START	STOP	JOB #	TRUCK	MIX TYPE	TICKET NUM.	MIX TEMP	STACK TEMP	ASPHALT TEMP	BATCH TOTAL
						DEG F (10)	DEG F (11)	DEG F	(lbs)
6:24	6:25	9999	2	15	9381				15898
6:29	6:35	3089	LC 757	30	9382				49054
6:36	6:41	9999	2	16	9383				48291
6:48	6:54	3089	WAO	30	9384				47676
6:55	7:00	3089	56	30	9385				48178
7:03	7:08	3058	56-22	18	9386				48166
7:09	7:18	3089	LC542	30	9387				66658
8:56	9:03	3089	LC 543	30	9396				64143
10:16	10:22	3089	LC 751	30	9407				48705
10:38	10:39	9999	3	33	9410				12185
10:41	10:43	8888	4	33	9411				17904
11:48	11:54	2959	BLK	16	9419				48283

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 2
Mix# 15
Name STATE TOP (TYPE I)
Operator
Ticket# 9381

Time	Agg T	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1488	2680	3344			488		8000
6:24:24	0	1460	2640	3390	7490	8	491	491	7981
6:24:58	40	1470	2650	3310	7430	13	487	487	15898

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	7.95	06:26:01 10/05/98	F	2

63

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# LC 757
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9382

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
6:29:22	-10	2840	990	790	840	2510	7970	9	358	358	8328
6:30:28	20	2800	1200	750	820	2590	8160	15	352	352	16840
6:31:34	30	2790	930	700	820	2470	7710	14	348	348	24898
6:32:41	40	2770	750	750	820	2490	7580	14	355	355	32833
6:33:47	10	2810	740	760	850	2520	7680	12	351	351	40864
6:34:53	40	2860	780	750	850	2600	7840	12	350	350	49054

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.53	06:35:46 10/05/98	F	2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 2
Mix# 16
Name STATE DENSE TOP
Operator
Ticket# 9383

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
6:36:28	0	2530	4940	7470	9	565	565	8035
6:37:05	30	2550	4900	7450	6	586	586	16071
6:38:12	30	2470	4950	7420	5	582	582	24073
6:39:18	20	2510	4950	7460	5	574	574	32107
6:40:24	20	2540	4910	7450	5	577	577	40134
6:41:31	10	2540	5040	7580	4	577	577	48291

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.15	06:42:24 10/05/98	F	2

65

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# WAD
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9384

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
6:48:31	0	2780	780	770	820	2470	7620	2	352	352	7972
6:49:16	20	2740	840	770	790	2480	7620	12	348	348	15940
6:50:23	20	2760	800	770	790	2480	7600	12	348	348	23888
6:51:29	30	2790	760	710	780	2480	7520	12	351	351	31759
6:52:35	10	2790	800	740	730	2540	7600	13	357	357	39716
6:53:41	10	2740	810	760	810	2490	7610	12	350	350	47676

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	48.37	06:54:34 10/05/98	F	2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# 5 G
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9385

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
6:54:55	10	2800	800	770	810	2550	7730	13	351	351	8081
6:55:53	30	2810	800	760	860	2490	7720	12	350	350	16151
6:57:02	20	2840	780	780	860	2540	7800	13	350	350	24301
6:58:09	20	2740	810	730	810	2560	7650	13	352	352	32303
6:59:15	20	2720	780	710	820	2440	7470	13	354	354	40127
7:00:21	0	2770	840	730	830	2530	7700	13	351	351	48178

Agg Tare   Asp Tare

Cost/Ton   Percent Tax   Load Cost   Amount Tax   Dest Charge   Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	72.46	07:01:14 10/05/98	F	2

67

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
TOWN OF ORANGE
HOLDSHIRE RD

Cust# 9999
Job# 3058
Truck# SG 22
Mix# 18
Name STATE BINDER
Operator
Ticket# 9386

Time	Agg T	AGG 4	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2800	900	900	3000			400		8000
7:02:53	-10	2850	930	890	3030	7700	6	407	407	8107
7:03:33	30	2860	880	920	3010	7670	12	405	405	16182
7:04:39	40	2780	920	930	3010	7640	12	401	401	24223
7:05:45	40	2780	900	830	2940	7450	11	398	398	32071
7:06:51	20	2770	880	860	3010	7520	12	399	399	39990
7:07:58	40	2920	900	910	3050	7780	11	396	396	48166

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.08	07:08:52 10/05/98	F	2

68

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 542
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9387

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2867	825	771	825	2599			363		8250
7:09:23	10	2950	830	810	890	2590	8070	12	362	362	8432
7:10:10	30	2940	820	780	840	2600	7980	11	359	359	16771
7:12:14	30	2960	850	790	840	2580	8020	12	365	365	25156
7:13:20	0	2850	800	700	820	2550	7720	12	364	364	33240
7:14:26	10	2890	810	790	830	2600	7920	14	363	363	41523
7:15:32	30	2930	840	790	880	2640	8080	12	359	359	49962
7:16:38	20	2900	850	780	870	2620	8020	13	365	365	58347
7:17:44	20	2920	820	750	830	2630	7950	13	361	361	66658

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
4	105.79	07:18:37 10/05/98	F	2

69

X

No M315 Testing For This Truck

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	BAY STATE HOMES	Cust# 1
3 BELCHER ST.	CRAWFORD RD.	Job# 3089
PLAINVILLE, MASS.	OAKHAM	Truck# LC 543
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9396

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	740	800	2520			352		8000
8:55:44	0	2800	800	680	780	2500	7560	8	354	354	7914
8:56:28	10	2830	810	730	830	2530	7730	15	350	350	15994
8:57:35	20	2810	810	750	830	2530	7730	15	352	352	24076
8:58:41	10	2810	790	780	840	2520	7740	15	352	352	32168
8:59:47	10	2770	790	750	790	2520	7620	16	350	350	40138
9:00:54	40	2770	830	720	840	2480	7640	16	352	352	48130
9:02:00	10	2700	750	710	780	2560	7500	15	352	352	55982
9:03:06	30	2920	810	730	830	2520	7810	16	351	351	64143

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
13	348.22	09:04:00 10/05/98	F	2

70

X

PORT CHANGE - DID NOT TEST THIS TRUCK

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
BAY STATE HOMES
CRAWFORD RD.
OAKHAM

Cust# 1
Job# 3089
Truck# LC 751
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9407

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
10:16:19	10	2960	790	760	840	2500	7850	17	356	356	8206
10:17:14	20	2800	820	760	820	2550	7750	16	350	350	16306
10:18:50	20	2850	820	710	720	2550	7650	17	351	351	24307
10:19:56	30	2800	800	760	830	2500	7690	17	349	349	32346
10:21:03	40	2880	780	770	780	2520	7730	18	355	355	40431
10:22:09	10	3010	810	740	820	2540	7920	18	354	354	48705

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
22	583.08	10:23:02 10/05/98	F	2

X

SMALL LOAD - DID NOT TEST TRUCK

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
CASH SALE	DRIVEWAY MIX	Cust# 9999
CUST. ON FILE		Job# 9999
		Truck# 3
		Mix# 33
		Name 3/8 TOP
		Operator
		Ticket# 9410

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2778	2835			387		6000
10:37:35	10	2820	2850	5670	15	389	389	6059
10:38:20	40	2810	2930	5740	14	386	386	12185

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	6.09	10:39:36 10/05/98	F	2

72

X

SMALL LOAD - DID NOT TEST THIS TRUCK

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9411

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2778	2835			387		6000
10:41:05	-10	2750	2780	5530	9	389	389	5919
10:41:32	30	2740	2820	5560	14	387	387	11866
10:42:52	50	2800	2850	5650	12	388	388	17904

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	8.95	10:43:47 10/05/98	F	2

73

~~78~~

PORT CHANGE - DID NOT TEST THIS TRUCK

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM OF MASS.
RTE 9
LEICESTER

Cust# 1
Job# 2959
Truck# BLK
Mix# 16
Name STATE DENSE TOP
Operator
Ticket# 9419

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
11:48:32	10	2560	4890	7450	9	575	575	8025
11:49:06	50	2570	4960	7530	12	580	580	16135
11:50:23	50	2540	4880	7420	11	578	578	24133
11:51:30	60	2530	5170	7700	11	575	575	32408
11:52:36	30	2470	4830	7300	10	575	575	40283
11:53:41	70	2510	4860	7370	11	580	580	48233

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	48.20	11:54:35 10/05/98	F	2

74

PES PROCESS LOG - ASPHALT PLANT D IN BARRE, MA
Run No. 2 - October 6, 1998
Data recorded by Frank Phoenix

START	STOP	JOB #	TRUCK	MIX TYPE	TICKET NO.	MIX TEMP, F (10)	STACK TEMP, F (11)	ASPHALT TEMP, F	ASPHALT LOADED AND TESTED, LBS	ASPHALT LOADED BUT NOT TESTED, LBS	COMMENTS
6:29 (16)	6:29	2948	LC 757	24	9430					7895	16
7:04	7:11	7777	1	24	9432					66058	
7:14	7:20	2948	WAD	24	9433	387	351	315	48,114		
7:21	7:27	2959	BLK	16	9434	400	360	350	48,233		1
7:28	7:34	2948	SG 22	24	9435	404	321	320	48,088		
7:35	7:40	9999	3	8	9436	419	306		40,437		
7:40	7:52	2948	LC 544	24	9437	413	286		66,095		2
7:53	8:02	2948	LC 542	24	9438	396	302		66,196		
8:02	8:09	2948	LC 750	24	9439	399	302		48,131		
8:10	8:15	9999	3	8	9440	402	316		40,226		
8:16	8:26	2948	LC 543	24	9441	404	342		63,645		
8:26	8:33	2948	LC 36	24	9442					64,257	
8:37	8:43	2948	LC 752	24	9443	386	359	315/320	48,094		3, 4
8:44	8:47	8888	4	67	9444	411	337		20,014		
8:50	8:57	2948	RS	24	9445					65,832	
9:00	9:06	2948	LC 751	24	9446	386	348	325	48,077		5
9:07	9:13	2948	LC 757	24	9447	391	370	320	47,960		
9:16	9:24	2948	1	24	9448					66,158	
9:28	9:34	2959	PER	16	9449	404	326		47,996		6, 7
9:35	9:40	9999	3	33	9450	449	255		34,130		8
9:40	9:46	2948	WAD	24	9451	410	214	330	48,081		
9:48	9:54		SG 22	24	9452	411	265		47,919		
9:55	10:03	2948	LC 541	24	9453	404	311		65,766		
10:03	10:04	9999	3	8	9454					10,145	
10:08	10:16	2948	LC 542	24	9455	416	302	332	65,858		9
10:17	10:22	2948	LC 750	24	9456					48,203	
10:24	10:26	8888	4	33	9457					18,034	
10:28	10:37	2948	LC 543	24	9458	385	277	330	66,064		
10:38	10:46	2948	LC 36	24	9459	394	284		64,046		
10:47	10:53	2948	LC 752	24	9460	390	307		47,914		12
11:04	11:11	2948	RS	24	9461	412	297		66,173		
11:12	11:18	2948	LC 751	24	9462	393	297	320/325	48,020		13
11:19	11:25	2948	LC 757	24	9463	401	288		47,961		
11:27	11:35	2948	WE 7	24	9464	391	284		66,033		14
11:35	11:39	8888	4	33	9465	392	279		30,446		
11:40	11:46	2959	BRN	16	9466	383	283	350	47,925		
11:46	11:51	2948	SG 22	24	9467					48,217	
11:54	12:00	2948	WAD	24	9468	389	278	320/325	48,186		15
12:02	12:09	2948	LC 541	24	9469	393	273		65,967		17
12:15	12:17	9999	3	33	9470	403	309		2,169		
12:38	12:45	2948	LC 750	24	9471	208	127		48,720		
12:46	12:57	2948	LC 542	24	9472	376	260		63,726		
12:58	13:07	2948	LC 543	24	9473	400	307		64,141		
13:08	13:18	2948	LC 36	24	9474	410	320	320	63,838		
13:19	13:26	2948	LC 752	24	9475	391	303	320	48,039		
13:33	13:39	2948	LC 757	24	9476					48,480	
13:58		9999	3	8	9477					14,109	
14:11		9999	3	33	9478					8,026	
14:51		9999	3	33	9479					22,264	
15:19		9999	3	15	9481					49,034	
Total								**Total (lbs.)**	1,832,428	536,712	
								Total (tons)	916.2	268.4	

Comments
1. No RAP In Mix (Also Truck w/o Exhaust Stack)
2. Waiting On AFF - Slow Down In Tunnel
3. Port Change
4. Emissions Off Body Of Truck
5. Missed Truck - Tunnel Not Secure
6. Dumped Dry Gravel Into Truck - Stopped Sampling, Shut Down Fan
7. Missed Part Of First Dump
8. Truck w/o Exhaust Stack
9. Missed First Part Of First Drop
10. Temp In Shoot That Feeds Hot Elevator
11. Stack Temp At Baghouse Inlet
12. Extended Test - Truck Left In Tunnel Beyond 15 Second Hold Time (10:53-11:02)
13. Missed First Part Of First Drop
14. Truck w/o Exhaust Cover
15. Port Change
16. Plant Start Up
17. Extended Test Start (12:09-12:14)

PES PROCESS LOG - ASPHALT PLANT D IN BARRE, MA
Run No. 2 - October 6, 1998
Data recorded by Frank Phoenix

Asphalt By Mix Type

START	STOP	JOB #	TRUCK	MIX TYPE	TICKET NO.	MIX TEMP, F (10)	STACK TEMP, F (11)	ASPHALT TEMP, F	ASPHALT LOADED AND TESTED, LBS	Asphalt By Mix	COMMENTS
7:35	7:40	9999	3	8	1	419	306		40,437		
8:10	8:15	9999	3	8	2	402	316		40,226		
										80,663	
7:21	7:27	2959	BLK	16	9434	400	360	350	48,233		1
9:28	9:34	2959	PER	16	9449	404	326		47,996		6, 7
11:40	11:46	2959	BRN	16	9466	383	283	350	47,925		
										144,154	
7:14	7:20	2948	WAD	24	9433	387	351	315	48,114		
7:28	7:34	2948	SG 22	24	9435	404	321	320	48,088		
7:40	7:52	2948	LC 544	24	9436	413	286		66,095		2
7:53	8:02	2948	LC 542	24	9437	396	302		66,196		
8:02	8:09	2948	LC 750	24	9438	399	302		48,131		
8:16	8:26	2948	LC 543	24	9439	404	342		63,645		
8:37	8:43	2948	LC 752	24	9443	386	359	315/320	48,094		3, 4
9:00	9:06	2948	LC 751	24	9446	386	348	325	48,077		5
9:07	9:13	2948	LC 757	24	9447	391	370	320	47,960		
9:40	9:46	2948	WAD	24	9451	410	214	330	48,081		
9:48	9:54		SG 22	24	9452	411	265		47,919		
9:55	10:03	2948	LC 541	24	9453	404	311		65,766		
10:08	10:16	2948	LC 542	24	9455	416	302	332	65,858		9
10:28	10:37	2948	LC 543	24	9458	385	277	330	66,064		
10:38	10:46	2948	LC 36	24	9459	394	284		64,046		
10:47	10:53	2948	LC 752	24	9460	390	307		47,914		12
11:04	11:11	2948	RS	24	9461	412	297		66,173		
11:12	11:18	2948	LC 751	24	9462	393	297	320/325	48,020		13
11:19	11:25	2948	LC 757	24	9463	401	288		47,961		
11:27	11:35	2948	WE 7	24	9464	391	284		66,033		14
11:54	12:00	2948	WAD	24	9468	389	278	320/325	48,186		15
12:02	12:09	2948	LC 541	24	9469	393	273		65,967		17
12:38	12:45	2948	LC 750	24	9471	208	127		48,720		
12:46	12:57	2948	LC 542	24	9472	376	260		63,726		
12:58	13:07	2948	LC 543	24	9473	400	307		64,141		
13:08	13:18	2948	LC 36	24	9474	410	320	320	63,838		
13:19	13:26	2948	LC 752	24	9475	391	303	320	48,039		
										1,520,852	
9:35	9:40	9999	3	33	9450	449	255		34,130		8
11:35	11:39	8888	4	33	9465	392	279		30,446		
12:15	12:17	9999	3	33	9470	403	309		2,169		
										66,745	
8:44	8:47	8888	4	67	9444	411	337		20,014	20,014	
Total						394.5		**Total (lbs.)**	1,832,428	1,832,428	
								Total (tons)	916.2	916.2	

Comments
1. No RAP In Mix (Also Truck w/o Exhaust Stack)
2. Waiting On AFF - Slow Down In Tunnel
3. Port Change
4. Emissions Off Body Of Truck
5. Missed Truck - Tunnel Not Secure
6. Dumped Dry Gravel Into Truck - Stopped Sampling, Shut Down Fan
7. Missed Part Of First Dump
8. Truck w/o Exhaust Stack
9. Missed First Part Of First Drop
10. Temp In Shoot That Feeds Hot Elevator
11. Stack Temp At Baghouse Inlet
12. Extended Test - Truck Left In Tunnel Beyond 15 Second Hold Time (10:53-11:02)
13. Missed First Part Of First Drop
14. Truck w/o Exhaust Cover
15. Port Change
16. Plant Start Up
17. Extended Test Start (12:09-12:14)

(14) TRUCK w/o EXHAUST COVER
(15) PORT CHANGE (16) PLT START UP 6:15, SHUT DOWN AT 6:20 STARTED BACKUP A 7:00
(3) TRUCKS ARE 6 DUMPS = 48,000 lbs | TRAILERS ARE 8 DUMPS = 66000 lbs (17) EXTENDED TEST START 12:09 - 12:14

Datasheet

ASPHALT PLANT D
BARRE, MA
RUN # 2

DATE: 10/6/98
~~Date:~~
FRANK PHOENIX

TRUCK COUNT #	START (16)	STOP	TRUCK #	MIX #	MIX TEMP °F (10)	STACK TEMP °F (11)	TOTAL ~~TONS~~ BATCH (lbs)	ASPHALT TEMP °F
1	7:14	7:20	WAD	24	387	351	48114	
2	7:21	7:27	BLK	9434/16	400	360	48233	315
3	7:28	7:34	SG 22	24-9435	404	321	48088	350 (1)
4	7:35	7:40	3	8-9436	419	306	40437	320
(2) → 5	7:40	7:52	LC 544	24-9437	413	286	66095	
6	7:53	8:02	LC 542	24-9438	396	302	66196	
7	8:02	8:09	LC 750	24-9439	399	302	48131	
PORT CHANGE 8	8:10	8:15	3	8-9440	402	316	40226	
9	8:16	8:26	LC 543	24-9441	404	342	63445	(3)
(5) 10	8:37	8:43	LC 752	24-9443	386	359	48094	(4)
11	8:44	8:47	4	67-9444	411	337	20014	315/320
12	9:00	9:06	LC 751	24-9446	386	348	48077	
(6) → 13	9:07	9:13	LC 757	24-9447	391	370	47960	325
14	9:28	9:34	PER	16-9449	404	326	47996	320
(7) → (8) 15	9:35	9:40	3	33-9450	449	255	34130	
16	9:40	9:46	WAD	24-9451	410	214	48081	330
17	9:48	9:54	SG 22	24-9452	411	265	47919	(9)
18	9:55	10:03	LC 541	24-9453	404	311	65766	
19	10:08	10:16	LC 542	24-9455	416	302	65858	332 ~~330~~
20	10:28	10:37	LC 543	24-9458	385	277	66,064	330/330
21	10:38	10:46	LC 36	24-9459	394	284	64,046	
(12) → 22	10:47	10:53	LC 752	24-9460	390	307	47,914	
23	11:04	11:11	RS	24-9461	412	297	66,173	
(13) 24	11:12	11:18	LC 751	24-9462	393	297	48020	320/320
25	11:19	11:25	LC 757	24-9463	401	288	47961	
(14) 26	11:27	11:35	WE 7	24-9464	391	284	66033	
27	11:35	11:39	4	33-9465	392	279	30446	
28	11:40	11:46	BRN	16-9466	383	283	47925	350 (1)
(15) 29	11:54	12:00	WAD	24-9468	389	278	48186	320/325
(17) 30	12:02	12:09	LC 541	24-9469	393	273	65967	
31	12:15	12:17	3	33-9470	403	309	2169	
32	12:38	12:45	LC 750	24-9471	208	127	48720	
33	12:46	12:57	LC 542	24-9472	376	260	63726	
34	12:58	13:07	LC 543	24-9473	400	307	64141	
35	13:08	13:18	LC 36	24-9474	410	320	63838	305/320
36	13:19	13:26	LC 752	24-9475	391	303	48039	320
	END OF TEST							

(12) EXTENDED TEST - TRUCK LEFT IN TUNNEL BEYOND
IS SECOND HOLD TIME 10:53 - 11:02
(13) MISSED FIRST PART OF FIRST DROP

(1) NO RAP IN MIX (ALSO TRUCK w/o EXHAUST STACK) (2) WAITING ON AGG - SLOW DOWN IN TUNNEL (4) EMISSIONS OFF BODY OF TRUCK (5) MISSED TRUCK - TUNNEL NOT SECURE (6) DUMPED DRY GRAVEL INTO TRUCK - STOPPED SAMPLING, SHUT DOWN FAN (7) MISSED PART OF FIRST DUMP (8) TRUCK w/o EXHAUST (9) MISSED FIRST PART OF FIRST DROP (10) TEMP IN SHOOT THAT FEEDS HOT ELEVATOR (11) STACK TEMP AT BAGHOUSE INLET

Barre Plant Data Sheets

①

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# WAD
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9433

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
7:13:07	-20	2480	730	1360	2920	7490	9	387	387	7877
7:13:57	0	2450	920	1410	2920	7700	13	386	386	15963
7:15:03	20	2470	860	1430	2920	7680	14	382	382	24025
7:16:09	20	2510	850	1450	2900	7710	12	381	381	32116
7:17:15	10	2480	760	1430	2940	7610	13	382	382	40108
7:18:22	-10	2490	770	1410	2950	7620	11	386	386	48114

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	48.00	07:19:14 10/06/98	F	2

2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM OF MASS.	Cust# 1
3 BELCHER ST.	RTE 9	Job# 2959
PLAINVILLE, MASS.	LEICESTER	Truck# BLK
02762		Mix# 16
		Name STATE DENSE TOP
		Operator
		Ticket# 9434

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
7:19:51	0	2570	4900	7470	9	579	579	8049
7:20:33	20	2480	4910	7390	7	577	577	16016
7:21:44	0	2540	4890	7430	5	576	576	24022
7:22:51	-10	2550	4920	7470	7	577	577	32069
7:23:57	20	2520	4870	7390	8	578	578	40037
7:25:03	10	2550	5070	7620	6	576	576	48233

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.12	07:25:56 10/06/98	F	2

79

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# 5G 22
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9435

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
7:26:52	-10	2460	780	1440	2880	7560	8	385	385	7945
7:27:39	10	2450	790	1390	2910	7540	11	381	381	15866
7:28:45	0	2460	820	1430	2880	7590	10	382	382	23838
7:29:51	-10	2490	840	1420	2910	7660	9	382	382	31880
7:30:57	10	2480	830	1420	2930	7660	10	386	386	39926
7:32:04	20	2500	800	1430	3050	7780	10	382	382	48088

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	72.04	07:32:56 10/06/98	F	2

80

4

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 8
Name BINDER MIX
Operator
Ticket# 9436

Time	Agg T	AGG 4	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2812	1140	1140	2508			400		8000
7:33:31	0	3120	1100	1110	2500	7830	7	401	401	8231
7:34:20	20	2890	1140	1120	2500	7650	9	398	398	16279
7:35:33	10	2850	1150	1140	2510	7650	8	401	401	24330
7:36:39	20	2840	1180	1130	2510	7660	8	401	401	32391
7:37:45	10	2880	1120	1150	2500	7650	7	396	396	40437

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	20.22	07:38:38 10/06/98	F	2

81

460 5

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 544
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9437

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
7:39:51	-20	2560	850	1510	3010	7930	0	404	404	8334
7:40:37	20	2530	820	1430	3030	7810	7	391	391	16535
7:41:45	20	2540	840	1450	3040	7870	7	394	394	24799
7:42:52	10	2570	830	1480	3040	7920	8	401	401	33120
7:46:42	20	2530	810	1410	2950	7700	9	392	392	41212
7:47:49	0	2540	820	1470	3030	7860	8	395	395	49467
7:48:55	0	2560	770	1490	3000	7820	9	397	397	57684
7:50:00	20	2560	960	1480	3010	8010	9	401	401	66095

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
4	105.09	07:50:53 10/06/98	F	2

82

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 542
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9438

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
7:51:33	-20	2620	890	1500	3010	8020	6	395	395	8415
7:52:19	0	2550	800	1460	3020	7830	9	397	397	16642
7:54:11	0	2510	810	1410	2990	7720	9	394	394	24756
7:55:17	10	2550	830	1440	3010	7830	9	394	394	32980
7:56:24	20	2530	780	1450	3020	7780	8	395	395	41155
7:57:29	20	2560	920	1480	3020	7980	8	402	402	49537
7:58:35	20	2570	860	1490	3020	7940	9	392	392	57869
7:59:42	0	2570	830	1510	3020	7930	10	397	397	66196

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
5	138.19	08:00:35 10/06/98	F	2

83

7

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 750
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9439

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
8:01:25	-20	2420	860	1350	2870	7500	6	384	384	7884
8:02:10	10	2470	810	1400	2920	7600	9	383	383	15867
8:03:32	20	2490	770	1460	2900	7620	9	384	384	23871
8:04:38	30	2510	870	1400	2940	7720	9	384	384	31975
8:05:45	20	2500	840	1450	2940	7730	9	382	382	40087
8:06:50	30	2500	810	1450	2900	7660	9	384	384	48131

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
6	162.26	08:07:43 10/06/98	F	2

84

[redacted]

8

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 8
Name BINDER MIX
Operator
Ticket# 9440

Time	Agg T	AGG 4	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2812	1140	1140	2500			400		8000
8:08:15	0	2750	1150	1070	2490	7460	9	404	404	7864
8:09:03	10	2810	1160	1130	2500	7600	7	403	403	15867
8:11:19	20	2840	1180	1170	2500	7690	7	398	398	23955
8:12:25	0	2830	1180	1170	2580	7760	6	400	400	32115
8:13:31	10	2880	1130	1170	2530	7710	6	401	401	40226

Agg Tare   Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	40.33	08:14:24 10/06/98	F	2

85

9

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 543
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9441

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
8:14:58	0	2420	770	1340	2860	7390	4	384	384	7774
8:15:43	20	2460	780	1420	2890	7550	6	382	382	15706
8:18:32	-10	2500	810	1450	2950	7710	7	383	383	23799
8:19:38	0	2520	740	1440	2950	7650	7	383	383	31832
8:20:44	0	2500	720	1430	2940	7590	7	383	383	39805
8:21:50	-10	2490	750	1360	2840	7440	7	383	383	47628
8:22:56	10	2430	780	1410	2910	7530	7	385	385	55543
8:24:02	0	2490	820	1450	2960	7720	6	382	382	63645

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
7	194.08	08:24:55 10/06/98	F	2

86

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 752
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9443

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
8:35:57	-20	2430	830	1380	2930	7570	0	387	387	7957
8:36:40	20	2490	800	1410	2950	7650	7	383	383	15990
8:37:47	10	2500	800	1420	2900	7620	7	382	382	23992
8:38:53	20	2470	830	1440	2900	7640	7	381	381	32013
8:39:59	20	2480	800	1430	2950	7660	7	384	384	40057
8:41:05	20	2480	800	1430	2940	7650	7	387	387	48094

Agg Tare　　Asp Tare

Cost/Ton　Percent Tax　Load Cost　Amount Tax　Dest Charge　Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
9	250.26	08:41:57 10/06/98	F	2

87

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT. ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 67
Name SIDE WALK
Operator
Ticket# 9444

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2000	4250			417		6667
8:42:36	-10	1950	4240	6190	4	415	415	6605
8:43:16	0	2010	4260	6270	3	421	421	13296
8:45:19	0	2030	4270	6300	4	418	418	20014

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	10.01	08:46:13 10/06/98	F	2

88

12

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 751
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9446

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
8:59:09	0	2510	800	1410	2970	7690	2	388	388	8078
8:59:52	50	2480	830	1400	2920	7630	6	384	384	16092
9:01:14	40	2500	800	1420	2900	7620	6	384	384	24096
9:02:21	40	2500	800	1420	2950	7670	6	381	381	32147
9:03:27	40	2490	780	1390	2880	7540	6	387	387	40074
9:04:33	30	2460	790	1450	2920	7620	6	383	383	48077

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
11	307.22	09:05:26 10/06/98	F	2

89

17

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 757
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9447

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
9:06:04	20	2500	820	1420	2910	7650	4	384	384	8034
9:06:48	40	2490	810	1460	2920	7680	6	384	384	16098
9:08:03	40	2490	830	1420	2930	7670	7	387	387	24155
9:09:10	10	2480	780	1460	2930	7650	7	383	383	32188
9:10:16	40	2450	770	1350	2860	7430	6	383	383	40001
9:11:22	40	2500	790	1390	2900	7580	7	379	379	47960

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
12	331.20	09:12:14 10/06/98	F	2

990

14

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM OF MASS.	Cust# 1
3 BELCHER ST.	RTE 9	Job# 2959
PLAINVILLE, MASS.	LEICESTER	Truck# PER
02762		Mix# 16
		Name STATE DENSE TOP
		Operator
		Ticket# 9449

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
9:25:56	0	2560	4890	7450	4	577	577	8027
9:26:30	40	2510	4880	7390	7	577	577	15994
9:28:33	10	2530	4920	7450	8	580	580	24024
9:29:39	40	2540	4930	7470	6	576	576	32070
9:30:45	50	2540	4900	7440	7	576	576	40086
9:31:51	40	2470	4860	7330	7	580	580	47996

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	48.12	09:32:45 10/06/98	F	2

91

15

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9450

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3936	4016			548		8500
9:34:54	0	3950	4070	8020	3	545	545	8565
9:35:28	40	3980	4050	8030	6	550	550	17145
9:36:35	40	3930	4030	7960	6	545	545	25650
9:37:41	50	3960	3970	7930	6	550	550	34130

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	17.07	09:38:34 10/06/98	F	2

92

16

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# WAD
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9451

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
9:39:10	30	2460	850	1380	2840	7530	8	386	386	7916
9:39:54	50	2490	750	1410	2930	7580	7	380	380	15876
9:41:38	60	2440	850	1410	2930	7630	8	380	380	23886
9:42:44	40	2460	830	1430	2930	7650	8	386	386	31922
9:43:50	30	2500	840	1440	2940	7720	9	382	382	40024
9:44:56	50	2500	810	1450	2910	7670	8	387	387	48081

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
14	388.32	09:45:49 10/06/98	F	2

93

18

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 541
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9453

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
9:53:27	10	2520	800	1400	3010	7730	7	402	402	8132
9:54:10	60	2540	810	1480	2990	7820	9	394	394	16346
9:55:59	40	2570	830	1490	3010	7900	10	393	393	24639
9:57:05	50	2560	860	1490	3020	7930	10	393	393	32962
9:58:11	50	2510	840	1500	3030	7880	10	399	399	41241
9:59:17	50	2570	810	1390	2970	7740	10	393	393	49374
10:00:24	30	2520	790	1440	2990	7740	10	394	394	57508
10:01:30	60	2540	820	1460	3040	7860	10	398	398	65766

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
16	445.16	10:02:23 10/06/98	F	2

94

19

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 542
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9455

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
10:07:05	10	2520	850	1410	3010	7790	2	396	396	8186
10:07:50	50	2540	810	1460	3010	7820	9	395	395	16401
10:08:56	40	2560	850	1490	3020	7920	9	394	394	24715
10:10:03	30	2540	840	1480	2990	7850	9	398	398	32963
10:11:09	20	2610	830	1460	3040	7940	10	396	396	41299
10:12:15	50	2570	830	1440	3020	7860	9	400	400	49559
10:13:21	60	2550	810	1430	3000	7790	9	394	394	57743
10:14:27	40	2510	790	1410	3010	7720	9	395	395	65858

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
17	478.09	10:15:19 10/06/98	F	2

95

20

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 542
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9458

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
10:27:16	10	2580	790	1390	2960	7720	5	396	396	8116
10:28:00	50	2600	840	1450	3030	7920	8	394	394	16430
10:29:23	40	2580	790	1500	3020	7890	9	393	393	24713
10:30:29	60	2560	850	1460	3070	7940	10	400	400	33053
10:31:35	60	2560	840	1470	3000	7870	9	394	394	41317
10:32:41	60	2580	850	1480	3080	7990	9	394	394	49701
10:33:48	50	2480	840	1510	2970	7800	9	398	398	57899
10:34:54	50	2570	790	1400	3010	7770	9	395	395	66064

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
19	535.22	10:35:46 10/06/98	F	2

96

2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 36
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9459

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
10:36:17	50	2460	800	1420	2880	7560	10	384	384	7944
10:37:06	70	2500	810	1420	2940	7670	10	389	389	16003
10:38:36	50	2490	790	1410	2870	7560	10	379	379	23942
10:39:42	30	2510	780	1440	2960	7690	11	384	384	32016
10:40:48	60	2480	790	1460	2910	7640	10	386	386	40042
10:41:54	50	2450	840	1360	2920	7570	10	387	387	47999
10:43:00	60	2480	780	1410	2930	7600	9	385	385	55984
10:44:07	60	2440	780	1460	3000	7680	9	382	382	64046

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
20	567.24	10:44:59 10/06/98	F	2

M B[illegible]
M HD

97

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 752
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9460

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
10:45:47	20	2500	790	1420	2950	7660	7	387	387	8047
10:46:31	50	2520	830	1450	2850	7650	10	378	378	16075
10:47:37	40	2420	790	1360	2950	7520	10	382	382	23977
10:48:43	60	2510	800	1400	3000	7710	10	389	389	32076
10:49:49	40	2450	790	1420	2850	7510	10	384	384	39970
10:50:55	60	2490	790	1420	2860	7560	9	384	384	47914

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
21	591.20	10:51:47 10/06/98	F	2

98

23

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# R S
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9461

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
11:01:06	20	2640	780	1510	3050	7980	3	396	396	8376
11:02:39	60	2550	800	1420	2990	7760	12	394	394	16530
11:03:57	60	2550	830	1470	3040	7890	12	394	394	24814
11:05:04	60	2560	890	1490	2990	7930	12	399	399	33143
11:06:10	30	2580	850	1500	3010	7940	11	394	394	41477
11:07:16	60	2590	830	1460	3010	7890	11	397	397	49764
11:08:23	60	2560	810	1510	2970	7850	10	394	394	58008
11:09:28	60	2500	810	1510	2950	7770	10	395	395	66173

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
22	624.29	11:10:20 10/06/98	F	2

99

2-1

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 751
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9462

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
11:10:43	40	2460	790	1430	2900	7580	10	389	389	7969
11:11:40	60	2490	820	1420	2930	7660	9	382	382	16011
11:12:52	40	2490	810	1460	2910	7670	10	385	385	24066
11:13:58	40	2460	810	1430	2930	7630	10	382	382	32078
11:15:04	50	2510	810	1400	2960	7680	10	389	389	40147
11:16:10	50	2430	800	1380	2880	7490	9	383	383	48020

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
23	648.30	11:17:02 10/06/98	F	2

100

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 757
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9463

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
11:17:56	30	2460	780	1450	2950	7640	7	386	386	8026
11:18:39	60	2470	790	1400	2900	7560	10	382	382	15968
11:19:46	40	2490	820	1420	2920	7650	10	385	385	24003
11:20:52	70	2460	860	1450	2910	7680	9	384	384	32067
11:21:58	50	2570	770	1360	2900	7600	9	384	384	40051
11:23:26	70	2420	750	1410	2950	7530	9	380	380	47961

Agg Tare   Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
24	672.28	11:24:18 10/06/98	F	2

101

76

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# WE 7
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9464

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
11:25:00	30	2530	840	1520	3060	7950	7	396	396	8346
11:25:46	50	2560	810	1480	3000	7850	9	393	393	16589
11:27:16	60	2540	820	1480	2980	7820	9	399	399	24808
11:28:22	60	2580	830	1460	3020	7890	9	396	396	33094
11:29:29	60	2530	790	1430	3060	7810	9	397	397	41301
11:30:35	40	2550	800	1440	3070	7860	9	395	395	49556
11:31:42	60	2590	850	1480	2950	7870	9	400	400	57826
11:32:48	70	2510	810	1440	3050	7810	10	397	397	66033

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
25	705.30	11:33:40 10/06/98	F	2

102

27

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
CHARGE SALE	MUNICIPAL PAVING	Cust# 8888
ACCT.ON FILE		Job# 8888
		Truck# 4
		Mix# 33
		Name 3/8 TOP
		Operator
		Ticket# 9465

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3473	3544			484		7501
11:34:20	50	3520	3600	7120	7	484	484	7604
11:34:59	60	3510	3760	7270	7	482	482	15356
11:36:05	70	3540	3510	7050	8	486	486	22892
11:37:12	80	3510	3560	7070	6	484	484	30446

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	24.24	11:38:04 10/06/98	F	2

103

4

23

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM OF MASS.
RTE 9
LEICESTER

Cust# 1
Job# 2959
Truck# BRN
Mix# 16
Name STATE DENSE TOP
Operator
Ticket# 9466

MB ... MD

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
11:39:11	40	2510	4880	7390	4	576	576	7966
11:39:47	90	2550	4830	7380	7	574	574	15920
11:40:52	80	2550	5070	7620	8	574	574	24114
11:41:59	80	2540	4880	7420	9	580	580	32114
11:43:05	110	2470	4830	7300	8	577	577	39991
11:44:11	100	2510	4850	7360	9	574	574	47925

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	72.08	11:45:04 10/06/98	F	2

104

79

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2940
Truck# WAD
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9468

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
11:52:31	50	2480	800	1410	2890	7580	10	386	386	7966
11:53:19	40	2420	780	1440	2990	7630	10	384	384	15980
11:55:22	50	2520	830	1430	2880	7660	10	379	379	24019
11:56:28	70	2520	770	1340	2840	7470	10	387	387	31876
11:57:34	70	2550	800	1420	2980	7750	10	388	388	40014
11:58:41	70	2570	800	1450	2970	7790	11	382	382	48186

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
27	753.50	11:59:33 10/06/98	F	2

105

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 541
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9469

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
12:00:01	40	2560	820	1480	3060	7920	13	399	399	8319
12:00:55	40	2480	850	1450	3120	7900	11	395	395	16614
12:02:09	40	2640	820	1460	2930	7850	11	400	400	24864
12:03:16	70	2490	810	1500	2990	7790	11	393	393	33047
12:04:21	90	2520	800	1410	2990	7720	11	394	394	41161
12:05:28	90	2600	840	1450	2980	7870	10	397	397	49428
12:06:33	80	2560	860	1520	3030	7970	9	395	395	57793
12:07:40	60	2510	840	1420	3010	7780	10	394	394	65967

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
28	786.48	12:08:46 10/06/98	F	2

31

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	Cust# 9999
CASH SALE	DRIVEWAY MIX	Job# 9999
CUST. ON FILE		Truck# 3
		Mix# 33
		Name 3/8 TOP
		Operator
		Ticket# 9470

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		926	945			129		2000
12:15:24	40	940	1100	2040	3	129	129	2169

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	18.15	12:15:38 10/06/98	F	2

107

32

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 750
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9471

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
12:37:48	30	2610	800	1450	3030	7890	6	390	390	8280
12:38:40	70	2560	790	1440	2960	7750	14	378	378	16408
12:39:46	90	2480	800	1390	2910	7580	13	383	383	24371
12:40:52	80	2480	790	1410	2910	7590	13	384	384	32345
12:41:58	70	2480	790	1400	2950	7620	13	384	384	40349
12:43:05	70	2680	790	1460	3060	7990	14	381	381	48720

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
29	810.84	12:43:57 10/06/98	F	2

108

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC ~~543~~ 542
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9472

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
12:46:43	30	2480	800	1390	2930	7600	8	384	384	7984
12:47:34	60	2460	790	1430	2910	7590	13	383	383	15957
12:48:42	70	2490	780	1410	2860	7540	12	381	381	23878
12:49:46	70	2420	800	1440	2890	7550	12	384	384	31812
12:50:52	50	2540	870	1420	2890	7720	11	382	382	39914
12:51:58	70	2470	760	1370	2870	7470	11	385	385	47769
12:53:10	40	2410	790	1410	2900	7510	11	383	383	55662
12:54:16	50	2550	780	1420	2930	7680	10	384	384	63726

Agg Tare   Asp Tare

Cost/Ton   Percent Tax   Load Cost   Amount Tax   Dest Charge   Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
30	842.70	12:55:09 10/06/98	F	2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	CONN. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 543
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9473

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
12:57:36	30	2460	790	1440	2920	7610	5	384	384	7994
12:58:18	50	2520	790	1440	2950	7700	11	383	383	16077
12:59:25	70	2530	800	1360	2890	7580	10	383	383	24040
1:00:32	60	2530	770	1460	2910	7670	10	384	384	32094
1:01:38	50	2420	840	1420	2930	7610	9	382	382	40086
1:02:44	70	2490	870	1430	2970	7760	9	384	384	48230
1:03:50	50	2470	720	1460	2920	7570	10	386	386	56186
1:04:56	70	2440	780	1420	2930	7570	9	385	385	64141

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
31	874.77	13:05:48 10/06/98	F	2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 36
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9474

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
1:08:27	40	2460	790	1390	2890	7530	4	385	385	7915
1:09:10	60	2490	810	1420	2930	7650	10	381	381	15946
1:10:17	60	2470	780	1420	2920	7590	10	380	380	23916
1:11:23	70	2510	790	1450	2910	7660	9	394	394	31970
1:12:30	60	2500	820	1410	2920	7650	10	387	387	40007
1:13:35	70	2480	780	1360	2880	7500	10	387	387	47894
1:14:42	70	2420	790	1400	2930	7540	10	388	388	55822
1:15:48	70	2450	820	1450	2910	7630	10	386	386	63838

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
32	906.69	13:16:40 10/06/98	F	2

IIF

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 752
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9475

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
1:18:45	30	2510	800	1440	2950	7700	5	386	386	8086
1:19:30	60	2510	810	1420	2990	7730	11	380	380	16196
1:20:37	50	2470	780	1380	2850	7480	10	381	381	24057
1:21:42	50	2470	770	1430	2890	7560	11	383	383	32000
1:22:48	80	2490	830	1430	2940	7690	11	383	383	40073
1:23:55	70	2460	800	1420	2900	7580	10	386	386	48039

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
33	930.71	13:24:47 10/06/98	F	2

117

ASPHALT PLANT D
BARRE, MA
RUN # 2

FRANK PHOENIX
Date: 10-6-98
TRUCKS NOT SAMPLED

Truck ID — COMPUTER TIME — TICKET PRINTED POUNDS ~~TONS~~

	START	STOP	TRUCK #	MIX #	TICKET #	CLOCK TIME	BATCH TOTAL
A	7:04	7:11:34	# 1	24	9432	7:12	66,058
B	8:25:35	8:23:52	LC 36	24	9442	8:34	64257
C	8:50:03	8:57:24	RS	24	9445	8:58	65,832
D	9:16:34	9:23:55	1	24	9448	9:24	66,158
E	10:02:47	10:03:39	3	8	9454	10:05	10,145
F	10:17:12	10:22:19	LC 750	24	9456	10:23	48,203
G	10:23:50	10:25:41	4	33	9457	10:26	18,034
H	11:45:35	11:51:06	SG 22	24	9467	11:52	48217
I	13:33:17	13:38:26	LC 757	24	9476	13:39	48480
10 SECOND THE TEST	Before or after testing						
	6.29		LC 757	24	9430		7815
	13:58		3	8	9477		14109
	14:11		3	33	9478		8026
	14.51		3	33	9479		22264
	15:~~84~~19	3:24	3	15	9451		49034

A

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
LORUSSO CORP.
VARIOUS CONTRACTS

Cust# 1
Job# 7777
Truck# 1
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9432

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
7:04:13	-20	2570	840	1510	3070	7990	6	401	401	8391
7:04:57	-10	2560	850	1470	3060	7940	13	391	391	16722
7:06:03	20	2570	830	1450	3020	7870	14	398	398	24990
7:07:09	10	2520	800	1400	2980	7700	14	396	396	33086
7:08:15	10	2540	780	1510	3090	7920	14	398	398	41404
7:09:22	-10	2530	760	1470	2950	7710	13	395	395	49509
7:10:28	20	2560	870	1520	3000	7950	13	395	395	57854
7:11:34	-20	2590	800	1430	2990	7810	13	394	394	66058

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	33.03	07:12:25 10/06/98	F	2

William Lawless MHD
7:12 am

114

B ~~10~~

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 36
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9442

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
8:25:35	-30	2460	730	1410	2910	7510	3	385	385	7895
8:26:21	-10	2500	940	1460	2950	7850	6	385	385	16130
8:28:22	-20	2490	780	1430	2920	7620	7	385	385	24135
8:29:27	0	2420	760	1370	2920	7470	7	386	386	31991
8:30:33	0	2480	850	1410	2900	7640	7	385	385	40016
8:31:39	10	2480	810	1420	2890	7600	7	383	383	47999
8:32:46	20	2480	920	1460	2940	7800	6	383	383	56182
8:33:52	-10	2510	840	1430	2910	7690	7	385	385	64257

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
8	226.21	08:34:44 10/06/98	F	2

Ex1 + Ex3 → YES TO TTE

P15, P16, P9 → PTE

Ex2, L9, L12

115

C

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# R S
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9445

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
8:50:03	0	2530	810	1450	2970	7760	-1	400	400	8160
8:50:47	40	2580	820	1450	2990	7840	6	391	391	16391
8:51:54	0	2540	840	1490	3010	7880	5	395	395	24666
8:53:00	40	2560	830	1470	3030	7890	6	393	393	32949
8:54:07	10	2550	750	1480	3030	7810	6	397	397	41156
8:55:12	40	2560	820	1510	3030	7920	6	395	395	49471
8:56:19	10	2510	830	1390	2950	7680	6	393	393	57544
8:57:24	50	2560	840	1480	3010	7890	7	398	398	65832

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
10	283.18	08:58:17 10/06/98	F	2

2 x 1 + 6 x 3 → 4TS to TTC

P15, P16, P9 → PTC

C x 2, C9, C12

.416

D

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# 1
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9448

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2553	825	1464	3011			396		8249
9:16:34	0	2550	830	1520	3090	7990	3	402	402	8392
9:17:19	40	2520	750	1500	2990	7760	10	395	395	16547
9:18:25	20	2550	800	1490	3000	7840	10	394	394	24781
9:19:31	40	2560	800	1460	3030	7850	11	395	395	33026
9:20:37	30	2570	840	1500	3050	7960	10	394	394	41380
9:21:43	10	2580	780	1500	3070	7930	10	394	394	49704
9:22:49	30	2560	840	1490	2980	7870	11	400	400	57974
9:23:55	40	2570	840	1400	2980	7790	11	394	394	66158

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
13	364.28	09:24:47 10/06/98	F	2

117

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 8
Name BINDER MIX
Operator
Ticket# 9454

Time	Agg T	AGG 4	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1758	713	713	1568			250		5002
10:02:47	30	1750	760	740	1580	4830	12	252	252	5082
10:03:39	50	1750	730	740	1590	4810	8	253	253	10145

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	45.40	10:05:03 10/06/98	F	2

E

118

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 750
Mix# 24
Name MODIFIED TOP 10% RAP
Operator
Ticket# 9456

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
10:17:12	10	2460	800	1490	2920	7670	3	387	387	8057
10:17:54	40	2550	800	1490	2930	7770	9	384	384	16211
10:19:00	50	2480	840	1460	2950	7730	9	383	383	24324
10:20:06	50	2440	790	1360	2850	7440	10	382	382	32146
10:21:12	20	2470	800	1410	2920	7600	9	384	384	40130
10:22:19	20	2510	800	1400	2980	7690	9	383	383	48203

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
18	502.19	10:23:11 10/06/98	F	2

119

G

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9457

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2778	2835			387		6000
10:23:50	30	2780	2820	5600	7	389	389	5989
10:24:28	60	2820	2850	5670	7	387	387	12046
10:25:41	60	2790	2810	5600	7	388	388	18034

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	9.02	10:26:35 10/06/98	F	2

120

H 7

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	Cust# 1
LORUSSO CORP.	COMM. OF MASS.	Job# 2948
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Truck# 5G 22
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Mix# 24
02762		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9467

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
11:45:35	80	2520	760	1410	2960	7650	13	385	385	8035
11:46:35	90	2510	810	1450	2910	7680	10	379	379	16094
11:47:48	80	2540	830	1470	2950	7790	10	381	381	24265
11:48:55	70	2480	840	1400	2900	7620	10	386	386	32271
11:50:01	50	2440	780	1410	2900	7530	10	384	384	40185
11:51:06	60	2480	840	1400	2930	7650	9	382	382	48217

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
26	729.41	11:51:59 10/06/98	F	2

121

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 757
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9476

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
1:33:17	30	2460	790	1460	2970	7680	5	388	388	8068
1:34:01	60	2500	780	1390	2900	7570	11	382	382	16020
1:35:07	80	2440	720	1410	2940	7510	10	382	382	23912
1:36:13	90	2460	900	1410	2920	7690	10	384	384	31986
1:37:19	90	2480	820	1430	3170	7900	10	384	384	40270
1:38:26	50	2420	880	1440	3090	7830	10	380	380	48480

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
34	~~954.95~~ 987.98	13:39:18 10/06/98	F	2

122

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM. OF MASS.	Cust# 1
3 BELCHER ST.	DIST. 3 / CONTRACT # 9	Job# 2948
PLAINVILLE, MASS.	RTE. 12 ASHBURNHAM	Truck# LC 757
02762		Mix# 24
		Name MODIFIED TOP 10% RAP
		Operator
		Ticket# 9430

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2476	800	1420	2920			384		8000
6:29:06	0	2480	720	1410	2900	7510	7	385	385	7895

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
0	0.00	06:33:26 10/06/98	F	2

123

R. STANLEY

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 8
Name BINDER MIX
Operator
Ticket# 9477

Time	Agg T	AGG 4	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2461	998	998	2195			350		7002
1:58:05	50	2570	1030	1020	2130	6750	9	356	356	7106
1:58:55	100	2470	1020	990	2170	6650	15	353	353	14109

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
4	52.45	13:59:50 10/06/98	F	2

People's

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9478

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3704	3780			516		8000
2:11:04	60	3710	3800	7510	12	516	516	8026

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	22.16	14:11:25 10/06/98	F	2

125

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9479

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3395	3465			473		7333
2:39:34	110	3380	3460	6840	14	471	471	7311
2:40:13	120	3400	3560	6960	20	471	471	14742
2:51:29	140	3440	3610	7050	16	472	472	22264

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
4	33.29	14:52:22 10/06/98	F	2

126

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CASH SALE
CUST. ON FILE

Job
DRIVEWAY MIX

Cust# 9999
Job# 9999
Truck# 3
Mix# 15
Name STATE TOP (TYPE I)
Operator
Ticket# 9481

Time	Agg T	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1519	2736	3414			498		8167
3:18:55	70	1520	2780	3420	7720	7	500	500	8220
3:19:31	80	1530	2770	3450	7750	12	503	503	16473
3:20:38	100	1470	2690	3370	7530	10	499	499	24502
3:21:44	110	1500	2740	3440	7680	10	499	499	32681
3:22:50	90	1530	2720	3400	7650	11	496	496	40827
3:23:56	110	1510	2750	3450	7710	10	497	497	49034

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.52	15:24:49 10/06/98	F	2

127

PES PROCESS LOG - ASPHALT PLANT D IN BARRE, MA
Run No. 3 - October 7, 1998
Data recorded by Frank Phoenix

START	STOP	JOB #	TRUCK	MIX TYPE	TICKET NO	MIX TEMP, F	STACK TEMP, F	ASPHALT TEMP, F	ASPHALT LOADED AND TESTED, LBS	ASPHALT LOADED BUT NOT TESTED, LBS	COMMENTS
6:26	6:32	3057	LC 757	30	9482					48,137	
6:36	6:43	2959	BLK	16	9483	398	228	350	48,569		
6:44	6:51	3057	WAD	30	9484	391	233	315	48,358		
6:52	7:00	3057	WE 7	25	9485	411	255	315	66,121		1
7:01	7:09	3057	LC 544	25	9486	408	241		66,131		
7:11	7:20	3057	COMO	25	9487	405	258		66,248		2
7:21	7:27	3057	SG 22	25	9488	407	331		48,289		3
7:38	7:46	3057	LC 36	25	9489	425	292		64,090		
7:48	7:56	2948	LC 543	25	9490	387	290	325	63,819		
7:58	8:05	3057	LC 754	25	9491					48,486	
8:07	8:10	8888	4	60	9492	441	266		17,966		4
8:11	8:19	3057	RS	25	9493	414	299	340	65,939		
8:21	8:29	3057	MAC	25	9494	421	280	340	65,934		
8:30	8:36	3057	LC 753	25	9495	403	312		48,078		
8:38	8:44	3057	LC 757	25	9496	406	304	330	48,082		
8:45	8:52	2959	VOU	16	9497	401	321		47,966		6
8:52	8:55	8888	4	33	9498	398	318		20,123		
8:56	8:59	8888	4	33	9499	396	319		20,005		5
9:10	9:16	3057	WAD	25	9500	253	129		48,237		
9:53	10:07	3057	WE 7	25	9501	147	88	320	65,744		7, 8, 12
10:13	10:24	3057	LC 544	25	9502	267	136		66,394		
10:28	10:38	3057	COMO	25	9503	419	290	310	66,071		9
10:39	10:45	3057	SG 22	25	9504	408	280		48,222		10, 11
10:59	11:09	3057	LC 36	25	9505	187	127	316	64,072		
11:10	11:20	3057	LC 543	25	9506	424	263		64,275		
11:21	11:27	3057	LC 754	25	9507	401	299		47,935		
11:27	11:28	8888	4	60	9508					12,021	13
11:31	11:40	3057	RS	25	9509	409	299	320	66,241		14
11:40	11:42	8888	4	33	9510					20,160	
11:45	11:50	9999	3	18	9511	357	368		30,211		15, 16
11:55	12:01	3057	LC 753	25	9512	383	321		48,168		17
12:06	12:15	3057	MAC	25	9513			305	66,025		
12:23	12:31	8888	4	33	9514	359	311		11,947		
12:32	12:40	3057	LC 757	25	9515	401	349		48,124		
12:43	12:52	2959	BLK	16	9516	394	350		47,996		
12:53	12:56	8888	4	33	9517	381	340		20,069		
13:00	13:08	3057	WE 7	25	9518	420	296		65,886		18
13:09	13:13	9999	3	2	9519	410	303	345	32,121		19
Total								**Total (lbs.)**	1,713,456	128,804	
								Total (tons)	856.7	64.4	

Comments (Exhaust refers to truck engine exhaust)

1. Can't Cover Truck Exhaust
2. Exhaust Stacks Too High - Exhaust Into TTE
3. Extended Test 7:27-7:36, Exhaust Not Completely Sealed
4. Port Change
5. Extended Test 8:59-9:09 (2.5 ppm)
6. Ticket Taken By Driver
7. Waiting On Trucks
8. Truck w/o Exhaust
9. Truck w/o Exhaust
10. Missed First Part of First Dump
11. Extend Test 10:45-10:56 (1.9 ppm)
12. Mix Temp Low When The Elevator is Empty
13. Dryer Shut Down
14. Did Not Sample Truck (C)
15. Port Change
16. No Cover On Exhaust
17. Tunnel Slow To Secure
18. Can't Cover Exhaust
19. Extended Test 13:13-13:23 (2.4 ppm) (Truck w/o RAP)

PES PROCESS LOG - ASPHALT PLANT D IN BARRE, MA

Run No. 3 - October 7, 1998

Data recorded by Frank Phoenix

Asphalt By Mix Type

START	STOP	JOB #	TRUCK	MIX TYPE	TICKET NO.	MIX TEMP, F	STACK TEMP, F	ASPHALT TEMP, F	ASPHALT LOADED AND TESTED, LBS	Asphalt by Mix	COMMENTS
13:09	13:13	9999	3	2	#VALUE!	410	303	345	32,121	32,121	19
6:36	6:43	2959	BLK	16	9483	398	228	350	48,569		
8:45	8:52	2959	VOU	16	9484	401	321		47,966		6
12:43	12:52	2959	BLK	16	9485	394	350		47,996		
										144,531	
11 45	11:50	9999	3	18	9511	357	368		30,211	30,211	15, 16
6:52	7:00	3057	WE 7	25	9512	411	255	315	66,121		1
7:01	7:09	3057	LC 544	25	9513	408	241		66,131		
7:11	7:20	3057	COMO	25	9514	405	258		66,248		2
7:21	7:27	3057	SG 22	25	9515	407	331		48,289		3
7:38	7:46	3057	LC 36	25	9516	425	292		64,090		
7:48	7:56	2948	LC 543	25	9517	387	290	325	63,819		
8:11	8:19	3057	RS	25	9518	414	299	340	65,939		
8:21	8:29	3057	MAC	25	9519	421	280	340	65,934		
8:30	8:36	3057	LC 753	25	9520	403	312		48,078		
8:38	8:44	3057	LC 757	25	9521	406	304	330	48,082		
9:10	9:16	3057	WAD	25	9522	253	129		48,237		
9:53	10:07	3057	WE 7	25	9523	147	88	320	65,744		7, 8, 12
10:13	10:24	3057	LC 544	25	9524	267	136		66,394		
10:28	10:38	3057	COMO	25	9525	419	290	310	66,071		9
10:39	10:45	3057	SG 22	25	9526	408	280		48,222		10, 11
10:59	11:09	3057	LC 36	25	9527	187	127	316	64,072		
11:10	11:20	3057	LC 543	25	9528	424	263		64,275		
11:21	11:27	3057	LC 754	25	9529	401	299		47,935		
11:31	11:40	3057	RS	25	9509	409	299	320	66,241		14
11:55	12:01	3057	LC 753	25	9512	383	321		48,168		17
12:06	12:15	3057	MAC	25	9513			305	66,025		
12:32	12:40	3057	LC 757	25	9514	401	349		48,124		
13:00	13:08	3057	WE 7	25	9515	420	296		65,886		18
										1,368,125	
6 44	6 51	3057	WAD	30	9484	391	233	315	48,358	48,358	
8 52	8 55	8888	4	33	9485	398	318		20,123		
8:56	8:59	8888	4	33	9486	396	319		20,005		5
12 23	12:31	8888	4	33	9487	359	311		11,947		
12:53	12:56	8888	4	33	9488	381	340		20,069		
										72,144	
8:07	8:10	8888	4	60	9492	441	266		17,966	17,966	4
Total						379 8		Total (lbs.)	1,713,456	1,713,456	
								Total (tons)	856.7	856.7	

Comments (Exhaust refers to truck engine exhaust)

1 Can't Cover Truck Exhaust
2 Exhaust Stacks Too High - Exhaust Into TTE
3 Extended Test 7:27-7:36; Exhaust Not Completely Sealed.
4 Port Change
5 Extended Test 8:59-9:09 (2.5 ppm).
6 Ticket Taken By Driver
7 Waiting On Trucks
8 Truck w/o Exhaust
9 Truck w/o Exhaust
10 Missed First Part of First Dump
11 Extend Test 10:45-10:56 (1.9 ppm)
12 Mix Temp Low When The Elevator is Empty
13 Dryer Shut Down
14 Did Not Sample Truck (C)
15 Port Change
16 No Cover On Exhaust
17 Tunnel Slow To Secure
18 Can't Cover Exhaust
19 Extended Test 13:13-13:23 (2.4 ppm) (Truck w/o RAP)

(12) MIX TEMP LOW WHEN THE ELEVATOR IS EMPTY (13) DRYER SHUT DOWN (14) DID NOT SAMPLE TRUCK [C] (15) PORT CHANGE (16) NO COVER ON EXHAUST (17) TUNNEL SLOW TO SECURE (18) CAN'T COVER EXHAUST (19) EXTENDED TEST 13:13 – 13:23 (2.4 ppm) (TRUCK w/o RAP)

Datasheet

ASPHALT PLANT D
BARRE, MA
RUN # 3

FRANK PHOENIX

Date: 10-7-98

Notes	Truck count	Test time: Start	Test time: Stop	Truck # No.	Type No.: Mix - Ticket #	°F Mix Temp	°F Stack Temp	Pounds: Batch Total	°F Asphalt Temp.
	1	6:36	6:43	BLK	16 - 9483	398	228	48,569	350 w/o
	2	6:44	6:51	WAD	30 - 9484	391	233	48,358	315
(1)	3	6:52	7:00	WE 7	25 - 9485	411	255	66,121	315
	4	7:01	7:09	LC 544	25 - 9486	408	241	66131	
(2)	5	7:11	7:20	COMO	25 - 9487	405	258	66 248	
(3)	6	7:21	7:27	SG - 22	25 - 9488	407	331	48 289	
	7	7:38	7:46	LC 36	25 - 9489	425	292	64,090	
(4) →	8	7:48	7:56	LC 543	25 - 9490	387	290	63,819	325/32
	9	8:07	8:10	4	60 - 9492	441	266	17,966	
	10	8:11	8:19	RS	25 - 9493	414	299	65,939	340/34
	11	8:21	8:29	MAC	25 - 9494	421	280	65,934	340/34
	12	8:30	8:36	LC 753	25 - 9495	403	312	48,078	
	13	8:38	8:44	LC 757	25 - 9496	406	304	48,082	330/33
(6)	14	8:45	8:52	You	16 - 9497	401	321	47,966	
	15	8:52	8:55	4	33 - 9498	398	318	20,123	
(5)	16	8:56	8:59	4	33 9499	396	319	20,005	
(7) →	17	9:10	9:16	WAD	25 - 9500	253	129 (13)	48,237	
(8) →	18	9:53	10:07	WE 7	25 - 9501	147 (12)	88 (13)	65,744	320
	19	10:13	10:24	LC 544	25 - 9502	267	136	66,394	
(9)	20	10:28	10:38	COMO	25 – 9503	419	290	66,071	310
(11) (10)	21	10:39	10:45	SG 22	25 - 9504	408	280	48,222	
	22	10:59	11:09	LC 36	25 - 9505	187 (12)	127	64,072	316
	23	11:10	11:20	LC 543	25 - 9506	424	263	64,275	
(14) →	24	11:21	11:27	LC 754	25 - 9507	401	299	47,935	
	25	11:31	11:40	RS	25 - 9509	409	299	66,241	320
(15) →	26	11:45	11:50	3	18 - 9511	357	368 ~~357~~	30,211	
(16) →	27	11:55	12:01	LC 753	25 - 9512	383	321	48,168	
(17) →	28	12:06	12:15	MAC	25 - 9513	PLANT DOWN	PLANT DOWN	66,025	305
	29	12:23	12:31	4	33 - 9514	359	311	11,947	
	30	12:32	12:40	LC 757	25 - 9515	401	349	48,124	
	31	12:43	12:52	BLK	16 - 9516	394	350	47,996	
	32	12:53	12:56	4	33 - 9517	381	340	20,069	
(18)	33	13:00	13:08	WE 7	25 - 9518	420	296	~~66~~ 65,886	
(19)	34	13:09	13:13	3	2 - 9519	410	303	32,121	345
		END OF TEST							

130

(1) CAN'T COVER EXHAUST (2) EXHAUST STACKS TOO HIGH - EXHAUST INTO TTE (3) EXTENDED TEST 7:27 – 7:36; EXHAUST NOT COMPLETELY SEALED FOR → (4) PORT CHANGE (5) EXTENDED TEST 8:59 – 9:09 (2.5 ppm) (6) TICKET TAKEN BY DRIVER (7) WAITING ON TRUCKS (8) TRUCK w/o EXHAUST 10:45 – 10:56 (1.9 ppm) (9) TRUCK w/o EXHAUST (10) MISSED FIRST PART OF FIRST DUMP (11) EXTEND TEST

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	COMM OF MASS.	Cust# 1
3 BELCHER ST.	RTE 9	Job# 2959
PLAINVILLE, MASS.	LEICESTER	Truck# BLK
02762		Mix# 16
		Name STATE DENSE TOP
		Operator
		Ticket# 9483

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
6:35:39	40	2570	4910	7480	10	576	576	8056
6:36:13	70	2560	4920	7480	16	577	577	16113
6:37:19	70	2500	4860	7360	16	579	579	24052
6:38:25	80	2490	4870	7360	15	573	573	31985
6:39:31	50	2560	5190	7750	14	575	575	40310
6:41:03	70	2540	5140	7680	14	579	579	48569

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.28	06:41:56 10/07/98	F	2

131

2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2452

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE,MASS.
02762

Job
TOWN OF IRVING
VARIOUS STREETS

Cust# 1
Job# 305[illegible]
Truck# WAD
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 3464

Time	Agg 7	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2760	800	740	800	2520			352		8000
6:43:36	30	2840	670	739	750	2480	7570	11	353	351	8023
6:44:38	[illegible]	2270	430	760	820	2440	7740	17	350	350	16113
6:45:44	[illegible]	3020	810	710	830	2480	7880	15	349	349	24342
6:46:51	40	2730	720	790	610	2520	7550	[illegible]	353	353	32285
6:47:56	70	2700	760	730	790	2500	7500	15	349	349	40134
6:49:03	50	2940	610	780	840	2500	7870	15	354	354	48358

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Pro/Del Location
2	48.25	06:49:55 10/07/98	[illegible] 2

132

3

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2152

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3007
PLAINVILLE, MASS.		Truck# WC 7
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9485

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	26P A	Asp Total	Batch Total
Target		1155	925	2500	3300			462		6250
6:50:39	30	1120	880	2490	3240	7730	5	466	466	8196
6:51:45	50	1120	860	2450	3330	7760	15	461	461	16417
6:52:51	60	1170	840	2540	3320	7870	15	463	463	24750
6:53:58	60	1180	770	2540	3590	8080	15	460	460	33290
6:55:04	70	1160	780	2520	3320	7790	15	463	463	41543
6:56:11	60	1170	800	2510	3310	7790	16	464	464	49797
6:57:17	70	1100	830	2440	3240	7610	16	464	464	57871
6:58:22	70	1180	800	2480	3330	7790	16	460	460	66121

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Pcb/Del	Location
1	33.06	06:59:15 10/07/96	F	3

133

4

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2352

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE,MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 544
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9486

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
7:00:01	40	1170	850	2530	3330	7880	13	460	460	8340
7:00:46	80	1140	770	2570	3310	7790	15	466	466	16596
7:01:56	50	1150	810	2500	3340	7800	16	460	460	24856
7:03:02	90	1210	890	2550	3300	7950	16	460	460	33266
7:04:08	80	1090	770	2470	3220	7550	16	461	461	41277
7:05:14	90	1180	850	2480	3320	7830	15	462	462	49569
7:06:20	60	1150	820	2530	3270	7770	16	461	461	57800
7:07:26	50	1200	840	2530	3300	7870	16	461	461	66131

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	66.13	07:08:21 10/07/98	F	2

134

5

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2953

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE,MASS.		Truck# LORO
02762		Mix# 21
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9487

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
7:11:10	40	1100	850	2470	3450	7870	9	464	464	8334
7:11:56	70	1170	840	2480	3440	7930	14	460	460	16724
7:13:03	50	1150	850	2520	3330	7850	14	464	464	25038
7:14:05	70	1160	790	2540	3400	7910	14	463	463	33411
7:15:15	70	1170	840	2520	3360	7890	13	461	461	41762
7:16:21	70	1170	750	2520	3290	7730	14	461	461	49953
7:17:27	60	1090	840	2430	3310	7670	14	461	461	58064
7:18:33	80	1140	830	2490	3240	7700	13	464	464	66248

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	95.25	07:13:26 10/07/98	F	2

135

6

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE,MASS.		Truck# 5G 22
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9488

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
7:20:48	30	1130	810	2450	3210	7600	7	449	449	8049
7:21:38	40	1130	820	2470	3250	7670	13	446	446	16165
7:22:36	40	1140	810	2450	3210	7610	12	451	451	24226
7:23:43	60	1150	340	2430	3260	7680	12	446	446	32352
7:24:45	60	1050	870	2410	3160	7490	12	451	451	40293
7:25:55	60	1130	750	2420	3250	7550	12	446	446	48289

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
4	123.39	07:26:48 10/07/98	F	2

136

7

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE,MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 36
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9489

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			443		8000
7:37:08	20	1140	860	2460	3160	7620	7	450	450	8070
7:37:49	50	1140	790	2440	3210	7580	13	450	450	16100
7:39:01	60	1100	820	2380	3160	7460	13	447	447	24007
7:40:07	50	1110	830	2430	3160	7530	12	448	448	31985
7:41:13	60	1130	730	2440	3200	7500	13	446	446	39931
7:42:19	60	1120	810	2460	3240	7630	12	450	450	48011
7:43:25	70	1140	790	2430	3200	7560	11	449	449	56020
7:44:31	70	1110	840	2460	3210	7620	11	450	450	64090

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
5	155.44	07:45:25 10/07/98	F	2

137

8

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-3952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE,MASS.
02762

Job
COMM. OF MASS.
DIST. 3 / CONTRACT # 9
RTE. 12 ASHBURNHAM

Cust# 1
Job# 2948
Truck# LC 543
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9490

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
7:45:52	30	1070	800	2390	3210	7470	10	442	442	7912
7:46:43	60	1120	820	2400	3180	7520	10	451	451	15883
7:48:43	40	1130	810	2460	3230	7630	10	447	447	23960
7:49:49	30	1140	760	2470	3230	7600	10	447	447	32007
7:50:55	60	1150	810	2430	3220	7610	10	448	448	40065
7:52:01	50	1140	730	2360	3200	7430	11	447	447	47942
7:53:07	60	1070	800	2420	3180	7470	10	451	451	55863
7:54:13	60	1110	740	2460	3200	7510	10	446	446	63819

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	31.91	07:55:06 10/07/98	F	2

138

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 60
Name PEOPLE'S TOP
Operator
Ticket# 9492

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3120	2508			372		6000
8:06:10	30	3100	2570	5670	11	370	370	6040
8:06:58	50	3070	2450	5520	7	373	373	11933
8:08:21	50	3140	2520	5660	6	373	373	17966

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	8.98	08:39:17 10/07/98	F	2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE,MASS.		Truck# R 5
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9493

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
8:10:03	20	1130	830	2520	3320	7800	6	460	460	8260
8:10:47	50	1090	840	2540	3300	7770	8	462	462	16492
8:12:18	50	1140	850	2540	3290	7820	5	468	468	24780
8:13:24	50	1170	760	2450	3250	7630	6	463	463	32873
8:14:30	60	1100	780	2480	3260	7620	9	460	460	40953
8:15:36	60	1150	870	2510	3360	7890	5	464	464	49307
8:16:42	60	1170	780	2540	3290	7780	6	461	461	57548
8:17:49	30	1170	900	2520	3340	7930	7	461	461	65939

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
7	212.65	08:18:42 10/07/98	F	2

11

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE,MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# MAC
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9494

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
8:19:26	10	1150	840	2530	3310	7830	6	455	455	8285
8:20:09	50	1100	830	2440	3260	7630	6	465	465	16380
8:22:08	50	1160	830	2510	3310	7810	9	465	465	24655
8:23:15	30	1180	810	2530	3330	7850	9	465	465	32970
8:24:20	50	1150	840	2530	3290	7810	9	459	459	41239
8:25:27	40	1180	840	2540	3320	7880	9	462	462	49561
8:26:33	50	1170	860	2530	3280	7840	9	462	462	57883
8:27:39	30	1100	800	2450	3240	7590	8	461	461	65934

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Foc/Del	Location
8	245.62	08:26:31 10/07/98	F	2

141

12

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2352

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE,MASS.		Truck# LC 753
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9495

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
8:29:27	20	1130	770	2420	3220	7540	6	446	446	7986
8:30:09	60	1140	810	2440	3230	7620	6	453	453	16059
8:31:30	20	1120	770	2460	3210	7560	10	449	449	24068
8:32:36	40	1130	860	2430	3200	7620	8	444	444	32132
8:33:42	50	1080	790	2490	3150	7510	6	446	446	40088
8:34:46	40	1110	780	2470	3180	7540	9	456	450	48075

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
9	269.66	08:35:41 10/07/98	F	2

142

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE,MASS.		Truck# LC 757
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9496

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
8:36:22	20	1140	840	2440	3250	7670	7	446	446	8116
8:37:03	50	1120	780	2430	3220	7550	8	450	450	16116
8:38:55	20	1120	810	2470	3230	7630	9	448	448	24194
8:40:02	40	1160	820	2420	3210	7610	9	450	450	32254
8:41:08	50	1090	750	2380	3150	7370	9	448	448	40072
8:42:14	50	1110	810	2430	3210	7560	9	450	450	48082

Agg Tare   Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
10	293.70	08:43:07 10/07/98	F	2

14

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2952

Customer	Job	Cust# 1
LORUSSO CORP.	COMM OF MASS.	Job# 2959
3 BELCHER ST.	RTE 9	Truck# YOU
PLAINVILLE,MASS.	LEICESTER	Mix# 16
02762		Name STATE DENSE TOP
		Operator
		Ticket# 9497

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
8:43:45	30	2550	4920	7470	8	567	567	8037
8:44:26	50	2540	4920	7460	6	579	579	16076
8:46:08	40	2550	4860	7410	6	579	579	24065
8:47:13	60	2520	4900	7420	5	575	575	32060
8:48:19	50	2480	4830	7310	5	578	578	39948
8:49:26	50	2530	4910	7440	5	578	578	47966

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	48.26	08:50:19 10/07/98	F	2

144

15

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9498

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3087	3150			430		6667
8:52:03	20	3090	3170	6260	4	427	427	6687
8:52:32	50	3100	3180	6280	6	430	430	13397
8:53:47	40	3100	3200	6300	6	426	426	20123

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	10.06	08:54:42 10/07/98	F	2

145

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT. ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9499

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3087	3150			430		6667
8:55:24	20	3030	3170	6200	6	429	429	6629
8:55:59	50	3090	3180	6270	6	433	433	13332
8:57:39	50	3100	3140	6240	7	433	433	20005

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	20.06	08:58:34 10/07/98	F	2

17

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# WAD
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9500

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
9:09:59	20	1100	790	2420	3180	7490	4	446	446	7936
9:10:38	50	1140	810	2440	3190	7580	9	450	450	15966
9:11:45	30	1130	800	2440	3230	7600	9	446	446	24012
9:12:51	30	1130	810	2450	3200	7590	8	449	449	32051
9:13:57	40	1130	810	2440	3240	7620	8	450	450	40121
9:15:03	50	1150	830	2470	3220	7670	8	446	446	48237

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
11	317.82	09:15:57 10/07/98	F	2

147

18

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# WE 7
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9501

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
9:57:55	10	1160	830	2510	3250	7750	6	458	458	8208
9:58:36	20	1110	790	2440	3240	7580	14	462	462	16250
9:59:42	50	1130	810	2530	3360	7830	13	464	464	24544
10:00:51	40	1160	820	2510	3290	7780	15	460	460	32784
10:01:56	60	1170	820	2490	3300	7780	13	462	462	41026
10:03:01	30	1150	840	2530	3270	7790	12	460	460	49276
10:04:07	30	1180	820	2500	3300	7800	12	461	461	57537
10:05:14	50	1170	810	2460	3300	7740	12	467	467	65744

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
12	350.69	10:06:06 10/07/98	F	2

19

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 544
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9502

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
10:14:12	10	1120	840	2520	3300	7780	7	458	458	8238
10:14:54	20	1150	810	2550	3310	7820	13	464	464	16522
10:16:00	30	1140	840	2490	3320	7790	12	464	464	24776
10:17:06	50	1170	830	2540	3280	7820	12	464	464	33060
10:18:13	30	1110	830	2540	3300	7780	13	458	458	41298
10:19:18	30	1340	830	2470	3320	7960	14	462	462	49720
10:21:09	40	1270	820	2490	3310	7890	13	462	462	58072
10:22:15	50	1190	840	2510	3320	7860	14	462	462	66394

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
13	383.89	10:23:24 10/07/98	F	2

149

20

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE, MASS.		Truck# COMO
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9503

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
10:29:15	10	1250	810	2500	3310	7870	6	462	462	8332
10:30:03	30	1220	820	2510	3300	7850	14	468	468	16650
10:31:08	50	1170	820	2530	3260	7780	14	462	462	24892
10:32:15	60	1170	840	2530	3320	7860	14	464	464	33216
10:33:21	40	1110	800	2460	3260	7630	14	463	463	41309
10:34:27	50	1150	830	2490	3320	7790	14	462	462	49561
10:35:33	60	1180	810	2530	3340	7860	14	462	462	57883
10:36:39	60	1160	830	2470	3270	7730	15	458	458	66071

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
14	416.93	10:37:31 10/07/98	F	2

150

2

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# 5G 22
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9504

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
10:38:00	30	1130	820	2460	3320	7730	17	445	445	8175
10:38:51	50	1130	790	2450	3140	7510	15	447	447	16132
10:40:20	70	1080	790	2400	3320	7590	15	449	449	24171
10:41:25	80	1120	800	2410	3170	7500	14	448	448	32119
10:42:32	70	1140	790	2460	3320	7710	15	448	448	40277
10:43:38	80	1120	790	2470	3120	7500	16	445	445	48222

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
15	441.04	10:44:30 10/07/98	F	2

151

22

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	Cust# 1
LORUSSO CORP.	TOWN OF ERVING	Job# 3057
3 BELCHER ST.	VARIOUS STREETS	Truck# LC 36
PLAINVILLE, MASS.		Mix# 25
02762		Name STATE TOP 10% RAP
		Operator
		Ticket# 9505

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
10:59:37	40	1140	800	2430	3160	7530	10	453	453	7983
11:00:22	90	1140	820	2430	3300	7690	17	449	449	16122
11:01:28	60	1080	790	2370	3170	7410	17	448	448	23980
11:02:34	90	1100	810	2420	3170	7500	17	450	450	31930
11:03:40	70	1120	810	2440	3330	7700	17	449	449	40079
11:04:46	70	1140	800	2430	3130	7500	17	444	444	48023
11:05:53	90	1140	800	2470	3160	7570	17	452	452	56045
11:06:58	140	1120	790	2460	3210	7580	17	447	447	64072

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
16	473.08	11:07:51 10/07/98	F	2

152

23

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 543
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9506

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
11:10:23	60	1110	800	2400	3320	7630	12	445	445	8075
11:11:11	80	1090	800	2410	3170	7470	18	451	451	15996
11:12:18	90	1160	790	2470	3350	7770	18	451	451	24217
11:13:23	90	1110	830	2450	3150	7540	18	446	446	32203
11:14:30	80	1140	800	2380	3170	7490	18	446	446	40139
11:15:36	70	1070	780	2400	3200	7450	17	449	449	48038
11:16:42	80	1140	780	2460	3250	7630	17	449	449	56117
11:17:48	90	1130	810	2480	3290	7710	17	448	448	64275

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
17	505.22	11:18:41 10/07/98	F	2

153

2X

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 754
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9507

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
11:20:06	40	1150	810	2470	3230	7660	13	446	446	8106
11:20:48	80	1120	790	2430	3120	7460	17	450	450	16016
11:21:53	60	1090	790	2370	3330	7580	17	448	448	24044
11:23:00	80	1110	820	2440	3140	7510	17	445	445	31999
11:24:06	60	1120	770	2440	3220	7550	17	447	447	39996
11:25:12	70	1140	800	2430	3120	7490	18	449	449	47935

Agg Tare   Asp Tare

Cost/Ton   Percent Tax   Load Cost   Amount Tax   Dest Charge   Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
18	529.19	11:26:04 10/07/98	F	2

154

25

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# R S
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9509

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
11:31:07	40	1150	820	2530	3260	7760	11	463	463	8223
11:31:49	50	1170	810	2560	3270	7810	17	462	462	16495
11:32:55	80	1160	890	2510	3310	7870	17	463	463	24828
11:34:01	80	1170	810	2470	3440	7890	17	462	462	33180
11:35:07	60	1150	800	2500	3270	7720	17	463	463	41363
11:36:13	60	1120	820	2500	3300	7740	17	462	462	49565
11:37:19	80	1300	840	2510	3330	7980	18	459	459	58004
11:38:26	40	1090	830	2510	3340	7770	17	467	467	66241

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
19	562.31	11:39:18 10/07/98	F	2

155

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
CASH SALE	DRIVEW	Cust# 9999
CUST. ON FILE		Job# 9999
		Truck# 3
		Mix# 18
		Name STATE BINDER
		Operator
		Ticket# 9511

Time	Agg T	AGG 4	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2625	844	844	2813			375		7501
11:45:26	40	2770	830	850	2950	7400	12	372	372	7772
11:46:13	70	2650	830	850	2920	7250	16	373	373	15395
11:47:19	50	2570	800	840	2770	6980	17	377	377	22752
11:48:25	40	2620	830	800	2830	7080	16	379	379	30211

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	15.11	11:49:18 10/07/98	F	2

156

2X

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 753
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9512

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
11:53:56	30	1100	790	2440	3180	7510	10	443	443	7953
11:54:36	40	1110	780	2500	3160	7550	15	449	449	15952
11:55:42	70	1140	820	2470	3210	7640	15	449	449	24041
11:56:48	40	1120	800	2440	3220	7580	15	452	452	32073
11:57:54	70	1130	800	2440	3200	7570	15	448	448	40091
11:59:00	40	1140	810	2450	3230	7630	16	447	447	48168

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
20	586.39	11:59:53 10/07/98	F	2

157

28

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE, MASS.		Truck# MAC
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9513

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
12:05:22	30	1150	820	2530	3290	7790	10	457	457	8247
12:06:03	50	1190	840	2500	3290	7820	16	466	466	16533
12:07:09	70	1120	820	2440	3250	7630	16	463	463	24626
12:08:14	60	1140	810	2480	3390	7820	16	462	462	32908
12:09:21	60	1170	820	2530	3260	7780	16	459	459	41147
12:10:27	80	1160	820	2530	3310	7820	16	464	464	49431
12:11:33	80	1170	820	2550	3330	7870	16	465	465	57766
12:12:40	70	1150	810	2520	3320	7800	16	459	459	66025

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
21	619.40	12:14:10 10/07/98	F	2

158

29

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
CHARGE SALE	MUNICIPAL PAVING	Cust# 8888
ACCT.ON FILE		Job# 8888
		Truck# 4
		Mix# 33
		Name 3/8 TOP
		Operator
		Ticket# 9514

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2778	2835			387		6000
12:28:36	40	2730	2880	5610	12	382	382	5992
12:29:02	100	2740	2830	5570	19	385	385	11947

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
4	36.11	12:29:57 10/07/98	F	2

159

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE, MASS.		Truck# LC 757
02762		Mix# 25
		Name STATE TOP 10% RAP
		Operator
		Ticket# 9515

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
12:33:12	50	1120	790	2500	3310	7720	13	450	450	8170
12:33:59	90	1120	820	2430	3130	7500	18	450	450	16120
12:35:04	80	1150	820	2370	3180	7520	17	450	450	24090
12:36:10	50	1070	820	2410	3180	7480	17	446	446	32016
12:37:16	50	1100	810	2450	3240	7600	16	448	448	40064
12:38:22	80	1130	820	2460	3200	7610	16	450	450	48124

Agg Tare   Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
22	643.46	12:39:15 10/07/98	F	2

160

31

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
COMM OF MASS.
RTE 9
LEICESTER

Cust# 1
Job# 2959
Truck# BLK
Mix# 16
Name STATE DENSE TOP
Operator
Ticket# 9516

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2524	4900			576		8000
12:44:12	30	2510	4900	7410	12	570	570	7980
12:44:45	60	2560	4910	7470	15	579	579	16029
12:46:26	50	2550	4890	7440	15	578	578	24047
12:47:31	70	2530	4900	7430	15	577	577	32054
12:48:37	60	2540	4900	7440	15	572	572	40066
12:49:43	50	2460	4890	7350	14	580	580	47996

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	72.26	12:50:37 10/07/98	F	2

1161

32

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9517

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3087	3150			430		6667
12:52:39	20	3100	3150	6250	13	427	427	6677
12:53:08	40	3100	3150	6250	14	431	431	13358
12:54:41	60	3110	3170	6280	15	431	431	20069

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
5	46.14	12:55:36 10/07/98	F	2

162

33 34

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# WE 7
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9518

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1155	825	2508	3300			462		8250
12:58:07	20	1140	810	2500	3300	7750	11	464	464	8214
12:59:32	50	1150	790	2510	3310	7760	16	464	464	16438
1:00:47	50	1170	810	2490	3280	7750	15	461	461	24649
1:01:52	50	1170	810	2540	3320	7840	16	464	464	32953
1:02:59	50	1170	820	2490	3290	7770	16	458	458	41181
1:04:05	40	1120	820	2460	3270	7670	15	462	462	49313
1:05:11	30	1160	810	2520	3320	7810	16	462	462	57585
1:06:17	70	1160	840	2550	3290	7840	16	461	461	65886

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
23	676.40	13:07:10 10/07/98	F	2

163

34

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
CASH SALE	DRIVEWAY MIX	Cust# 9999
CUST. ON FILE		Job# 9999
		Truck# 3
		Mix# 2
		Name 1/2 BINDER
		Operator
		Ticket# 9519

Time	Agg T	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2540	2700	2400			360		8000
1:08:08	20	2510	2700	2410	7620	13	356	356	7976
1:08:41	60	2810	2710	2410	7930	15	363	363	16269
1:09:53	60	2560	2730	2410	7700	15	361	361	24330
1:10:59	50	2460	2630	2340	7430	14	361	361	32121

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	16.06	13:11:52 10/07/98	F	2

164

Asphalt Plant D
Barre, MA
Run # 3

Frank Phoenix
Date: 10-7-98
Truck

Truck 10

— Computer Time —

	Start	Stop	Truck #	Mix #	Ticket #	Ticket Printed Clock Time	Pounds Batch Total
A	6:28:38	6:32:08	LC 757	30	9482	6:28	48,137
B	7:58:16	8:04:48	LC 754	25	9491	8:05	48,486
C	11:26:45	11:27:22	4	60	9508	11:29	12,021
D	11:39:58	11:42:22	4	33	9510	11:43	20,160

A

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer	Job	
LORUSSO CORP.	TOWN OF ERVING	Cust# 1
3 BELCHER ST.	VARIOUS STREETS	Job# 3057
PLAINVILLE, MASS.		Truck# LC 757
02762		Mix# 30
		Name STATE BINDER 10% RAP
		Operator
		Ticket# 9482

Time	Agg T	AGG 4	AGG 5	AGG 3	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		2780	800	748	800	2520			352		8000
6:26:38	50	2860	730	750	810	2500	7650	11	349	349	7999
6:27:30	70	2820	800	760	790	2520	7690	20	349	349	16038
6:28:37	80	2700	750	780	840	2530	7600	21	351	351	23989
6:29:55	50	2870	770	760	860	2550	7810	20	355	355	32154
6:31:02	70	2740	760	710	770	2490	7470	19	351	351	39975
6:32:08	50	2770	940	750	850	2500	7810	18	352	352	48137

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
1	24.07	06:33:02 10/07/98	F	2

166

B ~~A~~

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 754
Mix# 25
Name STATE TOP 10% RAP
Operator
Ticket# 9491

Time	Agg T	AGG 3	AGG 5	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		1120	800	2432	3200			448		8000
7:58:15	20	1160	820	2470	3230	7680	3	450	450	8130
7:58:57	60	1140	790	2440	3150	7520	9	446	446	16096
8:00:19	40	1090	800	2390	3210	7490	10	447	447	24033
8:01:25	40	1120	900	2440	3170	7630	10	445	445	32108
8:02:32	20	1130	830	2470	3240	7670	11	451	451	40229
8:04:48	30	1360	820	2440	3190	7810	11	447	447	48486

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
6	179.60	08:05:40 10/07/98	F	2

167

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 60
Name PEOPLE'S TOP
Operator
Ticket# 9508

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3120	2508			372		6000
11:26:45	40	3130	2530	5660	15	370	370	6030
11:27:22	80	3070	2550	5620	16	371	371	12021

Agg Tare Asp Tare

Cost/Ton Percent Tax Load Cost Amount Tax Dest Charge Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
2	14.99	11:28:43 10/07/98	F	2

168

D

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2952

Customer
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
Job# 8888
Truck# 4
Mix# 33
Name 3/8 TOP
Operator
Ticket# 9510

Time	Agg T	AGG 2	AGG 1	Agg Total	Asp T	ASP A	Asp Total	Batch Total
Target		3087	3150			430		6667
11:39:58	60	3110	3100	6210	16	430	430	6640
11:40:36	80	3050	3220	6270	15	429	429	13339
11:42:22	80	3110	3280	6390	15	431	431	20160

Agg Tare Asp Tare

Cost/Ton	Percent Tax	Load Cost	Amount Tax	Dest Charge	Total Cost

Load#	Job Total	Time & Date	Fob/Del	Location
3	30.14	11:43:16 10/07/98	F	2

ASPHATL PLANT D - RESULTS FROM ADVANCED ASPHALT TECHNOLOGIES

Asphalt Binder Samples - ASTM Analysis Results for Asphalt Plant D in Barre, MA
Two analyses were performed at three temperatures (300, 325,and 350 Degrees F)
1. ASTM D1754-94 - Effects of Heat and Air on Asphalt Materials; Thin Flim Oven Test (TFOT)
2. ASTM D2872-88 - Effects of Heat and Air on a Moving Film of Asphalt; Rolling Thin Film Ovent Test (RTFOT)

				Oven Temp. 325 F		Oven Temp. 300 F		Oven Temp. 350 F	
Sample Date	Sample Time	Day Number	Sample ID	TFOT	RTFOT	TFOT	RTFOT	TFOT	RTFOT
8/18/98	nav	Pretest	A1	-0.197	-0.365	na	na	na	na
9/25/98	nav	Pretest	A2	-0.215	-0.414	na	na	na	na
9/30/98	nav	Pretest	A3	-0.168	-0.310	na	na	na	na
Average				-0.193	-0.363				

				Oven Temp. 325 F		Oven Temp. 300 F		Oven Temp. 350 F	
Sample Date	Sample Time	Day Number	Sample ID	TFOT	RTFOT	TFOT	RTFOT	TFOT	RTFOT
10/5/98	9:03 AM	Day 1	LA1B	-0.117	-0.216	-0.048	-0.089	-0.228	-0.400
10/5/98	1:08 PM	Day 1	LA1E	-0.095	-0.192	na	na	na	na
Average				-0.106	-0.204	-0.048	-0.089	-0.228	-0.400

				Oven Temp. 325 F		Oven Temp. 300 F		Oven Temp. 350 F	
Sample Date	Sample Time	Day Number	Sample ID	TFOT	RTFOT	TFOT	RTFOT	TFOT	RTFOT
10/6/98	8:07 AM	Day 2	LA2B	-0.107	-0.206	-0.047	-0.105	-0.253	-0.395
10/6/98	1:03 PM	Day 2	LA2E	-0.151	-0.285	na	na	na	na
Average				-0.129	-0.246	-0.047	-0.105	-0.253	-0.395

				Oven Temp. 325 F		Oven Temp. 300 F		Oven Temp. 350 F	
Sample Date	Sample Time	Day Number	Sample ID	TFOT	RTFOT	TFOT	RTFOT	TFOT	RTFOT
10/7/98	8:46 AM	Day 3	LA3B	-0.111	-0.218	-0.045	-0.109	-0.229	-0.380
10/7/98	1:15 PM	Day 3	LA3E	-0.175	-0.304	na	na	na	na
Average				-0.143	-0.261	-0.045	-0.109	-0.229	-0.380

	Oven Temp. 325 F		Oven Temp. 300 F		Oven Temp. 350 F	
	TFOT	RTFOT	TFOT	RTFOT	TFOT	RTFOT
THREE DAY AVERAGE	-0.126	-0.237	-0.047	-0.101	-0.237	-0.392

	Thin Film Oven Test			Rolling Tin Film Oven Test		
	300 F	325 F	350 F	300 F	325 F	350 F
THREE DAY AVERAGE	-0.047	-0.126	-0.237	-0.101	-0.237	-0.392

Notes:

nav = not available
na = not applicable, i.e., analysis was not performed

ADVANCED ASPHALT TECHNOLOGIES

LABORATORY AND TECHNICAL SERVICES

TEST REPORT

Test Report No.: 03840003.DOC

Report Date: 09/21/98 [X] **Original** [ ] **Amended**

Client:		**Project No.:**	WO#384
Pacific Environmental Services, Inc. **560 Herndon Parkway, Suite 200** **Herndon Virginia 20170-5240**		**Description:**	Mass Loss Study for Pacific Environmental
Report Distribution:	Mr. Frank Phoenix		
Sample No.:	AC601 AC602 FS403 FS494	**Date Received:**	9/2/98
Sample Description:	"Plainville Plant, AC, 8/18/98" - AAT# AC601 "Barre Plant, AC, 8/18/98" -AAT# AC602 "Plainville Plant, RAP, 8/18/98" -AAT# FS493 "Barre Plant, RAP, 8/18/98" -AAT# FS494		
Technical Responsibility		**Technical Contact**	
Name	William Pennington	**Name:**	Kevin J. Knechtel
Title:	Binder Team Leader	**Title:**	Laboratory Manager
Signature:	[signature]	**Signature:**	[signature]
Date:	9/21/98	**Date:**	9/21/98
Comments:	- This a true record of test results obtained by Advanced Asphalt Technologies, L.P. in accordance with the test methods and procedures stipulated by AASHTO/ASTM.		

Test Results

Test	Method	Test Result			
		AC601 "Plainville Plant, AC, 8/18/98"	**AC602** "Barre Plant, AC, 8/18/98"	**FS493** "Plainville Plant, RAP, 8/18/98"	**FS494** "Barre Plant, RAP, 8/18/98"
Mass Change, using the Thin Film Oven Test (TFOT) at 325^{o}F	ASTM D 1754	**-0.372**	**-0.197**		
Mass Change, using the Rolling Thin Film Oven Test (RTFOT) at 325^{o}F	ASTM D 2872	**-0.570**	**-0.365**		
Moisture Content, %				**2.60**	**5.32**

A1

Advanced Asphalt Technologies, LP
108 POWERS COURT, SUITE 100
STERLING, VA 20166-9321
PH (800) 395 6686
PH (703) 444 4200
FX (703) 444 4368

ADVANCED ASPHALT TECHNOLOGIES
LABORATORY AND TECHNICAL SERVICES

TEST REPORT

Test Report No.: 03840006.DOC
Report Date: 10/05/98

[X] **Original** [ ] **Amended**

Client:	**Project No.:** WO#384
Pacific Environmental Services, Inc. **560 Herndon Parkway, Suite 200** **Herndon Virginia 20170-5240**	**Description:** Mass Loss Study for Pacific Environmental
Report Distribution: Mr. Frank Phoenix	
Sample No.: AC627 & AC628	**Date Received:** 9/28/98 - 10/2/98
Sample Description: "Lorusso/Barre 9/25/98 PG64-22" - AAT# AC627 "Lorusso/Barre 9/30/98 PG64-22" - AAT# AC628	
Technical Responsibility	**Technical Contact**
Name for William Pennington	**Name:** Kevin J. Knechtel
Title: Binder Team Leader	**Title:** Laboratory Manager
Signature: [signature]	**Signature:** [signature]
Date: 10/5/98	**Date:** 10/5/98
Comments: - This a true record of test results obtained by Advanced Asphalt Technologies, L.P. in accordance with the test methods and procedures stipulated by AASHTO/ASTM.	

Test Results

Test	Method	Test Result	
		AC627	AC628
Mass Change, using the Thin Film Oven Test (TFOT) at 325°F	ASTM D 1754	-0.215	-0.168
Mass Change, using the Rolling Thin Film Oven Test (RTFOT) at 325°F	ASTM D 2872	-0.414	-0.310
		A2	A3

171

ADVANCED ASPHALT TECHNOLOGIES
LABORATORY AND TECHNICAL SERVICES

TEST REPORT

Test Report No.: 03840009.DOC
Report Date: 11/05/98

[X] **Original** [ ] **Amended**

Client: Pacific Environmental Services, Inc. 560 Herndon Parkway, Suite 200 Herndon Virginia 20170-5240	**Project No.:** WO#384 **Description:** Mass Loss Study for Pacific Environmental
Report Distribution: Mr. Frank Phoenix	
Sample No.: See Below	**Date Received:** 10/19/98
Sample Description: "See Below	
Technical Responsibility	**Technical Contact**
Name William Pennington	**Name:** Kevin J. Knechtel
Title: Binder Team Leader	**Title:** Laboratory Manager
Signature: [signature]	**Signature:** [signature]
Date: 11/5/98	**Date:** 11/5/98

Comments: This a true record of test results obtained by Advanced Asphalt Technologies, L.P. in accordance with the test methods and procedures stipulated by AASHTO/ASTM.

TEST RESULTS

PES Sample ID#	*AAT Sample ID#*	Mass Change of Asphalt Samples, %: *Rolling Thin FilmOven Test* ASTM D 1754, Temperature (F) 300	325	350	*Thin Film Oven Test* ASTM D 2872, Temperature (F) 300	325	350
LA1B	*AC630*	-0.089	-0.216	-0.400	-0.048	-0.117	-0.228
LA1E	*AC631*		-0.192			-0.095	
LA2B	*AC632*	-0.105	-0.206	-0.395	-0.047	-0.107	-0.253
LA2E	*AC633*		-0.285			-0.151	
LA3B	*AC634*	-0.109	-0.218	-0.380	-0.045	-0.111	-0.229
LA3E	*AC635*		-0.304			-0.175	

ADVANCED ASPHALT TECHNOLOGIES
LABORATORY AND TECHNICAL SERVICES

TEST REPORT

Test Report No.: 03840009.DOC

Report Date: 11/05/98

[X] **Original**   [ ] **Amended**

PES Sample ID#	*AAT Sample ID#*	*Asphalt Content, %* ASTM D 2172	*Moisture Content, %*
RC1B	*FS536*	5.83	2.04
RC1E	*FS537*		
RC2B	*FS538*	5.32	1.95
RC2E	*FS539*		
RC3B	*FS540*	5.40	1.52
RC3E	*FS541*		

Advanced Asphalt Technologies, LP
108 POWERS COURT, SUITE 100
STERLING, VA 20166-9321
PH (800) 395 6686
PH (703) 444 4200
FX (703) 444 4368

ASPHALT PLANT D IN BARRE, MA - ASPHALT TEMPERATURES AT LOAD-OUT

Measurements taken by Josh Berkowitz with PES

TEST 1			Temperature, F			TEST 1
Date	Time	Truck #	PES 1	PES 2	Plant	Comments
10/5/98	9:30	YOU		326		
10/5/98	9:37	LC 575		325		Thermometer not wiped off
10/5/98	9:43	WAD		295		Thermometer not wiped off
10/5/98	10:20	LC 751		285		Temp of material in plant was 290.
10/5/98	10:32	BLK		295		Temp of material in plant was 290.
10/5/98	10:52	WAD		299		Temp of material in plant was 290.
10/5/98	11:18	LC 542		295		Temp of material in plant was 290.
10/5/98	11:37	LC 751		304		
10/5/98	11:50	LC 757		308		
10/5/98	12:08	WAD		315		
10/5/98	12:16	5 G		315		
10/5/98	12:34	LC 543		318		
Average				306.7		

TEST 2			Temperature, F			TEST 2
Date	Time	Truck #	PES 1	PES 2	Plant	Comments
10/6/98	7:22	WAD	315		315	
10/6/98	7:30	BLK	350		350	No RAP in mix
10/6/98	7:36	5 G22	320		320	
10/6/98	8:46	LC 752	315		320	
10/6/98	9:08	LC 751	325		325	
10/6/98	9:15	LC 757	320		320	
10/6/98	9:48	WAD	330		325	
10/6/98	10:19	LC 542	332		335	
10/6/98	10:40	LC 543	330		330	
10/6/98	11:20	LC 751	320		325	
10/6/98	11:47	BRN	350		350	No RAP in mix
10/6/98	12:02	WAD	320		325	
10/6/98	13:20	LC 36	305		320	May not have kept thermometer in long enough
10/6/98	13:27	LC 752	320		325	
Average			325.1		327.5	PES 1 data used in report

TEST 3			Temperature, F			TEST 3
Date	Time	Truck #	PES 1	PES 2	Plant	Comments
10/7/98	6:45	BLK	350			No RAP in mix
10/7/98	6:52	WAD	315			
10/7/98	7:03	WE 7	315			
10/7/98	7:58	LC 543	325	330		
10/7/98	8:21	RS	340	345		
10/7/98	8:31	MAC	340	345		
10/7/98	8:47	LC 757	325	330		
10/7/98	9:18	WAD	325	325		
10/7/98	10:09	WE 7	320	320		
10/7/98	10:42	COMO	310	311		
10/7/98	11:11	LC 36	315	315		
10/7/98	11:43	RS	320	320		
10/7/98	12:18	MAC	305	305		
10/7/98	12:55	BLK	350	355		
10/7/98	13:25	3	345	345		
Average			326.7	328.8		PES 1 data used in the report

Notes:

1. Asphalt cement temperatures were taken with 12" dial thermometers.
2. The dial thermometers were inserted into the hot asphalt in the bed of the truck just after load-out.
3. The dial thermometers were left in the asphalt until the temperature readings stabalized.
4. Thermometer PES 2 was used the first and third day.
5. Thermometer PES 1 was used the second and third day.
6. A plant thermometer was also used on the second day.

MIX FORMULA SUMMARY, ASPHALT PLANT D, MASSACHUSETTS

		MIX NUMBER											
MATERAL	**FEED BIN**	**2**	**8**	**10**	**15**	**16**	**18**	**24**	**25**	**30**	**33**	**60**	**67**
3/4" or 1 1/2" Stone, pounds	4		703	700			700			695			
RAP, pounds	5							200	200	200			
1/2" Stone, pounds	3	635	285	225	372		225	617	280	187			
3/8" Stone, pounds	2	675	285	225	670	631	225	354	608	200	926	1040	600
Sand, pounds	1	600	627	750	836	1225	750	728	800	630	945	836	1273
Liquid Asphalt, pounds	A	90	100	100	122	144	100	101	112	88	129	124	127
Total, pounds		2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000

From:	RON MYERS
To:	RTPMAINHUB:RTPMAINHUB.INTERNET:"sklamm@mriresearch...
Date:	2/10/00 8:40am
Subject:	Hot Mix Asphalt - Plant D Mix formulae

Frank/Scott
Attached is a FAX (in Acrobat PDF format) I received from Dave Laflamme concerning the bin usages and Mix formulae used by Plant D. I think this would almost satisfy the desire of some to determine what was made during our test. Although the Mix Designs Dave has specifically listed comprise more than 80% of the production, to fully satisfy their desires we should add the lesser used mixes. The following are other Mixes that are listed in Table 3.1 of the PES test report. I have calculated the formulations per ton of total mix as Dave has on his FAX. All of this should be part of one of the Appendices of the Plant D report.

Bin	Mix 24	Mix 2	Mix 8
4	-	-	703
5	200	-	-
3	619	635	285
2	355	675	285
1	730	600	627
A	96	90	100
Total	2,000	2,000	2,000

Bin	Mix 16	Mix 15	Mix 33
4	-	-	-
5	-	-	-
3	-	372	-
2	631	670	926
1	1225	836	945
A	144	122	129
Total	2,000	2,000	2,000

Bin	Mix 18	Mix 60	Mix 67
4	700	-	-
5	-	-	-
3	225	-	-
2	225	1040	600
1	750	836	1275
A	100	124	129
Total	2,000	2,000	2,000

CC: TONEY-MIKE, LAMASON-BILL, RTP3.RTMU546.JOHNSON-MAR...

176

3 Belcher St.
Plainville, MA 02762
Phone: (508) 695 3252 x 259
Fax: (508) 643 9411

Lorusso Corp.

Fax

To:	Ron Myers	**From:**	David J. LaFlamme
Fax:	(919) 541 1039	**Date:**	January 27, 2000
Phone:	(919) 541 5407	**Pages:**	2
Re:	Asphalt plant tickets	**CC:**	File

Urgent **X For Review** **Please Comment** **Please Reply** **Please Recycle**

•Comments:

Ron,

In our plants the following is standard: bin #1= sand, bin #2= 3/8" stone, bin #3= 1/2" stone, bin #4= 3/4" or 1-1/2" stone, bin #5= recycle asphalt and bin "A"= liquid asphalt.

On the ticket there can be 12 columns depending on the mix design, and they are as follows: column #1= batch time, c#2= aggregate scale tare weight, c#3=agg bin 4 net wgt. c#4= agg bin 5 net wgt., c#5= agg bin #3 net wgt., c#6= agg bin #2 net wgt., c#7= agg bin 1 net wgt., c#8= agg total, c#9= asphalt scale tare wgt., c#10= asphalt net wgt., c#11= asphalt total wgt., c#12= batch total cumulative weight.

Next on the ticket there can be several rows depending on load size, the first of which is: r#1= selected bins for use, r#2= Target scale weights, r#3= Actual weights achieved by bin and so on.

MIX DESIGNS	#10	24	25	30	MATERIAL
BIN 4	700			695	3/4" or 1-1/2" stone ✓
BIN 5		200	200	200	RAP
BIN 3	225	617	280	187	1/2" stone
BIN 2	225	354	608	200	3/8" stone ✓
BIN 1	750	728	800	630	sand ✓
BIN A	100	101	112	88	Liquid Asphalt ✓
	2,000	2,000	2,000	2,000	TOTAL POUNDS

01/27/00

177

I hope this information is helpful in answering any questions you may be confronted with regarding plant operations and ingredients within a given mix design. There are always variables in this process such as material weights per bin can change because of sieve analysis results of manufactured aggregates. Typically, these changes are minor in nature but they do occur periodically.

If I can be of any further assistance please do not hesitate to contact my office at (508) 695 3252 x259.

David J. LaFlamme

VP Engineering

APPENDIX C

EPA METHOD 315 ANALYTICAL DATA

ERG
EASTERN RESEARCH GROUP, INC.

P.O. Box 2010
Morrisville, NC 27560
Ph. (919) 468-7800

Narrative

Site: ***Asphalt Plant D***
Prepared for: ***Frank Phoenix*** **(PES)**
Prepared by: ***Linh Nguyen***

Description of Procedures for EPA Method 315 and Observations:

Filters -

Procedure:

The filters (including any loose particles) were transferred to a tared amber jar. The amber jars were placed into a desiccator overnight in a temperature controlled environment. The following day, the samples were weighed and initial weights were taken. To ensure that all conditions remained the same, the samples were placed back into the desiccator and allowed to sit overnight and the second weighings were taken at the same time the next day. Once constant weight had been attained, 100 mL of methylene chloride was added to each jar. The jars were placed in a sonicator and allowed to sonicate for 3 minutes. After sonication was complete, the samples were taken out of the sonicator. Each sample was filtered through a buchner funnel reinforced with an additional Whatman 934-AH filter to prevent cross contamination on the buchner funnels. Once the solutions were vacuum filtered, the extract was placed into a triple rinsed beaker (methylene chloride solvent). The beaker containing the extract was placed onto a hotplate at low heat and the solvent was allowed to evaporate. Once the samples almost reached dryness, the samples were taken off the hotplate and poured into a tared aluminum pan. The beakers were triple rinsed with methylene chloride and then the solvent was poured into the aluminum pan. The rinse was performed to ensure that no material remained in the beaker. The aluminum weighing pan was heated to complete dryness, placed into a desiccator and allowed to sit in the desiccator overnight. The following day, the samples were weighed and the weights recorded.

Observations:

The filters had dark gray/black discoloration, especially in places where the air flowed through the filters. All contents of the filters and any loose particles were transferred to a tared 250 mL amber jar.

Acetone Front Half Rinse-

Procedure:

The rinses were poured into 400 mL tared beakers that were triple rinsed with methylene chloride. The weights of the beakers including the rinses were taken to give an initial and a final weight from which the volumes of the rinses were calculated. A separate sheet (attached) explains how the volumes were calculated. The beakers containing the rinses were allowed to sit overnight in a hood to allow the acetone solvent to evaporate. The next day the beakers, which now contained no solvent, were placed into the desiccator and allowed to sit in the desiccator overnight. The next day, initial weighings for the samples were taken. The samples were then allowed to sit in the desiccator again for 24 hours. The next day at approximately the same time, the samples were weighed again for the second weighings. Once constant weight was attained, the weights were recorded for the

Particulate Mass (PM) portion of the analysis. Next, 25 mL of methylene chloride was added to each beaker. Aluminum foil was placed over the tops of the beakers. The beakers were then placed into a sonicator and allowed to sonicate for 3 minutes. This fraction was combined with the methylene chloride Front Half Rinse.

Observations:

No conditions out of the ordinary were noted.

Methylene Chloride Front Half Rinse-

Procedure:

The rinses were poured into 400 mL tared beakers triple rinsed with methylene chloride. The weights of the beakers including the rinses were taken to give an initial and a final weight from which the volumes of the rinses were calculated. At this point, the extracts from the Acetone Front Half Rinse were combined with this fraction. The combined fractions were placed onto a hotplate and allowed to heat gently at a low temperature setting. Once the solution had almost reached dryness, the solution was poured into a tared aluminum pan. The pan was then placed back onto the hotplate and taken to complete dryness. The pans were then transferred to the desiccator and allowed to sit overnight. The following day, the samples were weighed and the weights recorded for the MCEM analysis.

Observations:

No conditions out of the ordinary were noted.

Impinger, Back Half Water-

Procedure:

The samples were poured into a clean, pre-weighed, 500 mL amber jar. After the impinger contents had been emptied into the jar, a second weight was obtained. The difference was then used to calculate the volume of the sample. Once the volume had been determined, each sample was poured into a clean, 1000 mL separatory funnel. Once in the separatory funnel, the amber jars containing the original samples were triple rinsed with methylene chloride and the rinses poured into the separatory funnel. The approximate volume of this rinse was 50 mL. The samples were then shaken for 1 minute. After 1 minute, the bottom methylene chloride layer was drained into a clean, 250 mL beaker. After the methylene chloride was drained, an additional 25 mL of $MeCl_2$ was added. The solution was then shaken for another minute and the bottom methylene chloride layer drained into the same 250 mL beaker. This process was repeated once more. Once the third shake was completed and the methylene chloride drained into the 250 mL beaker, the beaker was placed onto a hotplate and gently heated to evaporate the solvent. Once the solution was evaporated almost to dryness, the solution was transferred to a tared aluminum pan. The pan was then placed back onto the hotplate and heated to complete dryness. After heating, the pans were placed into the desiccator to sit overnight. The following day, the pans were weighed and the weights recorded for the MCEM analysis of the Impinger, Back Half Water Rinse.

Observations:

The samples looked cloudy upon initial inspection. They did not seem to consist solely of water. During the extraction of these samples, the solution formed what seemed like an emulsion between the water and methylene chloride layer. When the methylene chloride was drained, this emulsion layer was left behind, so that only the methylene chloride layer was taken.

Acetone, Back Half Rinse-

Procedure:

The exact same procedure was used for the Back Half Rinse as was used for the Front Half Rinse. The only difference was that since PM analysis was not required, when the solvent dried down in the beaker, constant weight was not taken for these samples. After the solvent had evaporated, 25 mL of methylene chloride was added to each beaker and sonicated for 3 minutes each. The rest of the procedure was the same as the Acetone Front Half Rinse.

Observations:

No observations out of the ordinary were noted.

Methylene Chloride, Back Half Rinse-

Procedure:

The solution was poured into a tared beaker. After the solution had been poured into the beaker, another weight was taken to calculate the volume. Once the volume had been determined, the sample was filtered through the buchner funnel. The extract was placed into a clean, 250 mL beaker. The beaker containing the rinse was placed onto a hotplate and gently heated almost to dryness. Once the rinse was almost dry, the solution was transferred to a tared aluminum pan. The pans were placed back onto the hotplate and the solution heated to complete dryness. Once the pans were dry, the aluminum pans were transferred to a desiccator and allowed to sit overnight. The following day, the pans were weighed and the weights recorded as the MCEM values for the methylene chloride Back Half Rinse.

Observations:

No observations out of the ordinary were noted.

Field Reagent Blanks-

Procedure:

The samples were poured into tared beakers. Weights were taken after the reagent blank rinses were poured in. These final weights were used to calculated the volumes of the reagent blanks. The reagent blanks were allowed to sit on a hotplate at low heat. After the solvents had evaporated, the final weights of the beakers with any contents remaining were taken. Particulate Mass was calculated. For the filter blank, 100 mL of methylene chloride was added to the beaker and sonicated for 3 minutes. Afterwards, the methylene chloride was filtered and poured into a clean beaker. The beaker containing the solvent was heated down to near dryness. The solvent was then transferred to a tared aluminum pan. The pan was placed onto the hotplate and reduced to dryness. The pan was desiccated and weighed the next day for Particulate Mass.

Observations:

No observations out of the ordinary were noticed.

Laboratory Reagent Blanks-

Procedure:

The same procedures were used for Laboratory Reagent blanks as for the Field Reagent Blanks. Solvents that were used during the extraction process were tested in the reagent blank. A filter from the same lot that was sent to the field was used to go through the extraction process.

Observations:

No observations out of the ordinary were noticed

Deposition Samples-

Procedure:

Each one of the deposition samples was poured into a pre-weighed beaker. If the entire sample did not fit into one beaker, then it was separated into 2 or more beakers. The samples were allowed to sit in the hood overnight to allow the solvent to evaporate. The next day, initial weights were taken on the beakers containing the samples. The samples were allowed to sit overnight before a second weighing was taken. Once the samples had attained constant weights, the weights were recorded for the Particulate Mass (PM) analysis. Once the PM analyses were finished, 25 mL of methylene chloride was added to each beaker. The samples were covered with aluminum foil and placed into a sonicator to sonicate for 3 minutes. After sonication was complete, the samples were filtered through a buchner funnel and MCEM analysis was done using the same method as described in methylene chloride FHR (for MCEM analysis).

Observations:

Some of the samples had very high volumes and so they had to be separated into 2 or more beakers. Slow heating of the samples had to be performed to prevent any of the samples from popping or cracking. The samples showed some signs of coagulation as the liquid decreased to a minimum amount. Since the samples had to be completely dry, the samples were initially allowed to sit on the hotplate at low heat for approximately six hours. After this period of time, the sample still had some "tar-like" properties, which indicated that the sample was still not completely dry. This coagulation into a tar-like property raised the question of how long to heat the samples since low heat would not cause the "tar" to evaporate. Eventually, the heat was increased in order to drive the samples to complete dryness. Once the judgment was made that the samples were dry, the samples were desiccated overnight to get constant weights. For the MCEM analysis portion of the extraction process, the same complications arose. Once the samples had evaporated to almost dryness, there remained a small portion of a "tar-like" residue. The samples would not produce a valid weight when weighed "as is" because in doing so, some samples produced an MCEM value which was greater than the PM value, which is not possible. Upon observation of this anomaly, the samples were allowed to sit at high heat until all the "tar-like" appearance had evaporated leaving only a black organic residue. During the evaporation process of this stage, the sample produced smoke, indicating that there might be some organics being driven off as aerosolized particles. One can not conclude, however, how much, if any, organic analytes are being driven off. In conclusion, the values produced for the MCEM analysis for the deposition samples represent minimum values for this analysis.

Matrix = ***FILTERS***

Method = **PM**

Sample ID:	Weight of Amber jar (g)	Filter Pre-weight (g)	Avg. wt. Of filter+jar (g)	Final weight of filter PM (g)
M315-1-F (100198-05)	169.4491	0.3409	169.7918	0.0018
M315-2-F (100198-09)	167.3514	0.3363	167.6932	0.0055
M315-3-F (100198-07)	167.8462	0.3391	168.1872	0.0019
M315-6-F [1] (100198-01)	167.7654	0.3403	168.1073	0.0016
M315-6-F [2] (100198-04)	167.9357	0.3362	168.2777	0.0058
M315-7-F (100198-08)	167.7704	0.3378	168.1264	0.0182
M315-8-F (100198-06)	167.7067	0.3390	168.0485	0.0027
M315-FB1-F (100198-03)	167.1318	0.3386	167.4705	0.0001
M315-FB2-F (100198-02)	167.9323	0.3361	168.2684	0.0000

Method = **MCEM**

Sample ID:		Weight of Alum. pan (g)	Weight after evaporation (g)	Final weight of MCEM (g)
M315-1-F (100198-05)	1	1.6680	1.6693	0.0013
M315-2-F (100198-09)	2	1.6659	1.6663	0.0004
M315-3-F (100198-07)	3	1.6658	1.6664	0.0006
M315-6-F [1] (100198-01)	4	1.6673	1.6677	0.0004
M315-6-F [2] (100198-04)	5	1.6712	1.6718	0.0006
M315-7-F (100198-08)	6	1.6622	1.6638	0.0016
M315-8-F (100198-06)	7	1.6681	1.6697	0.0016
M315-FB1-F (100198-03)	8	1.6582	1.6583	0.0001
M315-FB2-F (100198-02)	9	1.7429	1.7429	0.0000

184

Matrix = ***Acetone FHR***

Method = **PM**

Sample ID:	Volume of liquid (mL)	Weight of beaker (g)	Final weight of rinse (g)	Final weight of filter PM (g)
M315-1-FH-A	91.8	111.2533	111.2695	0.0162
M315-2-FH-A	175.3	103.7245	103.7495	0.0249
M315-3-FH-A	164.8	102.7141	102.7281	0.0140
M315-6-FH-A	90.1	113.6420	113.6695	0.0275
M315-7-FH-A	92.7	107.1585	107.1823	0.0238
M315-8-FH-A	129.8	102.9506	102.9602	0.0096
M315-FB1-FH-A	97.1	113.5846	113.5850	0.0004
M315-FB2-FH-A	101.1	113.7496	113.7505	0.0008

Matrix = ***Methylene Chloride FHR***

Method = **MCEM**

Sample ID:		Volume of liquid (mL)	Weight of Alum. pan (g)	Weight after evaporation (g)	Final weight of MCEM (g)
M315-1-FH-M	1	80.0	1.6371	1.6386	0.0015
M315-2-FH-M	2	98.5	1.6387	1.6392	0.0005
M315-3-FH-M	3	88.5	1.6578	1.6581	0.0003
M315-6-FH-M	4	90.7	1.6430	1.6445	0.0015
M315-7-FH-M	5	89.2	1.6490	1.6492	0.0002
M315-8-FH-M	6	105.4	1.6480	1.6483	0.0003
M315-FB1-FH-M	7	84.7	1.6646	1.6647	0.0001
M315-FB2-FH-M	8	92.3	1.6272	1.6273	0.0001

185

Matrix = ***Solvent BHR***

Method = **MCEM**

Sample ID:		Volume of liquid (mL)	Weight of Alum. pan (g)	Weight after evaporation (g)	Final weight of MCEM (g)
M315-1-BH-S	9	180.3	1.6588	1.6595	0.0007
M315-2-BH-S	10	170.8	1.6655	1.6660	0.0005
M315-3-BH-S	11	126.4	1.6537	1.6545	0.0008
M315-6-BH-S	12	192.8	1.6653	1.6666	0.0013
M315-7-BH-S	13	182.7	1.6668	1.6673	0.0005
M315-8-BH-S	14	185.4	1.6762	1.6768	0.0006
M315-FB1-BH-S	15	241.4	1.6637	1.6637	0.0000
M315-FB2-BH-S	16	198.2	1.6599	1.6601	0.0002

Matrix = ***H20 Impinger rinses***

Method = **MCEM**

Sample ID:		Volume of liquid (mL)	Weight of Alum. pan (g)	Weight after evaporation (g)	Final weight of MCEM (g)
M315-1-IMP H20	17	279.7	1.6558	1.6567	0.0009
M315-2-IMP H20	18	405.0	1.6600	1.6606	0.0006
M315-3-IMP H20	19	338.2	1.6645	1.6649	0.0004
M315-6-IMP H20	20	281.2	1.6742	1.6758	0.0016
M315-7-IMP H20	21	270.2	1.6595	1.6617	0.0022
M315-8-IMP H20	22	203.3	1.6665	1.6672	0.0007
M315-FB1-IMP H20	23	330.9	1.6630	1.6634	0.0004
M315-FB2-IMP H20	24	307.5	1.6716	1.6717	0.0001

186

Matrix = ***Deposition Samples***

Method = **PM**

Sample ID:	Volume of liquid (mL)	Weight of beaker (g)	Final weight of rinse (g)	Final weight of filter PM (g)
CP1 - Ceiling Plate	138.4	188.7011	188.7336	0.0325
CP2 - Ceiling Plate	138.3	190.4239	190.4574	0.0335
CP3 - Ceiling Plate	112.3	190.2507	190.2649	0.0142
CP4 - Ceiling Plate	144.4	191.1617	191.1852	0.0235
CP5 - Ceiling Plate	106.5	194.4285	194.4499	0.0214
CPBlank - Ceiling Plate Blk	83.2	187.8606	187.8638	0.0032
BE1 - Ceiling Beam	199.1	189.7796	189.8136	0.0340
BE2 - Ceiling Beam	164.5	190.8499	190.9636	0.1137
BE3 - Ceiling Beam	184.3	192.5560	192.7926	0.2366
BE4 - Ceiling Beam	134.1	191.1950	191.2284	0.0334
BE5 - Ceiling Beam	185.1	188.5549	188.5842	0.0293
BEBlank - Ceiling Beam Blk	120.1	192.4630	192.4772	0.0142
E1A - Elbow Bend (1 side) - [1]	209.9	188.6042	188.7546	0.1504
E1A - Elbow Bend (1 side) - [2]	170.7	191.1933	191.3234	0.1301
E1B - Elbow Bend (3 sides) - [1]	268.4	188.7055	188.7900	0.0845
E1B - Elbow Bend (3 sides) - [2]	230.6	190.8564	191.1140	0.2576
E1Blank - Elbow Bend Blk	267.8	178.6420	178.6963	0.0543
E2A - Elbow Bend (1 side)	253.1	177.2705	177.5972	0.3267
E2B - Elbow Bend (3 sides)	249.7	178.4876	178.8030	0.3154
E2Blank - Elbow Bend Blk	196.6	175.1560	175.2159	0.0599

187

Matrix = ***Deposition Samples***

Method = **MCEM**

Sample ID:		Volume of liquid (mL)	Weight of Alum. pan (g)	Weight after evaporation (g)	Final weight of MCEM (g)
CP1 - Ceiling Plate	1	138.4	1.6641	1.6687	0.0046
CP2 - Ceiling Plate	2	138.3	1.6601	1.6631	0.0030
CP3 - Ceiling Plate	3	112.3	1.6669	1.671	0.0041
CP4 - Ceiling Plate	4	144.4	1.5828	1.5876	0.0048
CP5 - Ceiling Plate	5	106.5	1.6412	1.6447	0.0035
CPBlank - Ceiling Plate Blk	6	83.2	1.6636	1.6662	0.0026
BE1 - Ceiling Beam	7	199.1	1.6630	1.6678	0.0048
BE2 - Ceiling Beam	8	164.5	1.6484	1.6541	0.0057
BE3 - Ceiling Beam	9	184.3	1.6658	1.6786	0.0128
BE4 - Ceiling Beam	10	134.1	1.6700	1.6751	0.0051
BE5 - Ceiling Beam	11	185.1	1.6587	1.6636	0.0049
BEBlank - Ceiling Beam Blk	12	120.1	1.6428	1.6463	0.0035
E1A - Elbow Bend (1 side) - [1]	13	209.9	1.6373	1.6533	0.0160
E1A - Elbow Bend (1 side) - [2]	14	170.7	1.6578	1.6684	0.0106
E1B - Elbow Bend (3 sides) - [1	15	268.4	1.6652	1.6856	0.0204
E1B - Elbow Bend (3 sides) - [2	16	230.6	1.6671	1.6801	0.0130
E1Blank - Elbow Bend Blk	17	267.8	1.6735	1.6823	0.0088
E2A - Elbow Bend (1 side)	18	253.1	1.6650	1.6912	0.0262
E2B - Elbow Bend (3 sides)	19	249.7	1.6660	1.6848	0.0188
E2Blank - Elbow Bend Blk	20	196.6	1.6688	1.6764	0.0076

188

Matrix = ***Blanks***

Method = **PM**

Sample ID:	Weight of Amber jar (g)	Avg. wt. Of filter+jar (g)	Filter Pre-weight (g)	Final weight of filter PM (g)
M315-Filter Blk (100198-10)	168.4604	168.7989	0.3384	0.0001

Sample ID:	Volume of liquid (mL)	Weight of beaker (g)	Avg. wt. Of beaker+cont.	Final weight of filter PM (g)
M315-ACE Blk	250.7	187.2768	187.2771	0.0003
M315-MeCl Blk	209.1	190.3888	190.3889	0.0001
M315-DI Water Blk	254.7	177.5518	177.5520	0.0002

Sample ID:	Volume of liquid (mL)	Weight of beaker (g)	Avg. wt. Of beaker+cont.	Final weight of PM (g)
Lab Blank - Filter		188.6254	188.6255	0.0001
Lab Blank - Acetone	200.4	189.9936	189.9937	0.0001
Lab Blank - MeCl2	176.2	190.6747	190.6751	0.0004

Method = **MCEM**

Sample ID:		Weight of Alum. pan (g)	Weight after evaporation (g)	Final weight of MCEM (g)
M315-Filter Blk	10	1.7353	1.7353	0.0000

Matrix = ***Previous Blanks***

Method = **PM**

Sample ID:	Volume of liquid (mL)	Weight of beaker (g)	Avg. wt. Of beaker+cont.	Final weight of filter PM (g)
AC-1 - Acetone Blk	200.3	188.0787	188.0789	0.0001
MC-1 - MeCl2 Blk	189.1	188.1987	188.1987	0.0000
WA-1 - DI Water Blk	199.3	188.8102	188.8104	0.0002

Method = **MCEM**

Sample ID:		Weight of Alum. pan (g)	Weight after evaporation (g)	Final weight of MCEM (g)
F-1 - Filter Blk	11	1.7264	1.7264	0.0000

189

APPENDIX D

MCEM DEPOSITION DATA

MCEM Deposition in TTE Exhaust Duct

The TTE exhaust duct work, from the TTE exhaust plenum to the sampling locations, included 2 elbows and a long section of straight run. MCEM deposited in the 2 elbows during the test program was recovered and used to estimate MCEM deposition in the entire ductwork upstream of the sampling locations. The impaction surfaces of the two elbows were the only impaction surfaces in the ductwork. Samples recovered from these sections were used to represent MCEM impaction deposition. Samples collected from the non-impaction areas of the elbows were collected and used to represent the non-impaction MCEM deposition. These MCEM deposition values, along with the ratio of areas calculations shown below were used to estimate MCEM deposition in the TTE exhaust duct.

MCEM Catch from M 315 Analysis, grams	
Elbow 1A Deposition (impact zone), grams	0.0266
Elbow 2A Deposition (impact zone), grams	0.0262
Total Deposition Impact Zone, grams	0.0528
Elbow 1B Deposition (non-impact zone), grams	0.0334
Elbow 2B Deposition (non-impact zone), grams	0.0188
Total Deposition in Non-impact Zone Sample area, grams	0.0522
Surface Area Values, square feet	
Total Area of Non-impact Zone, square feet	205.18
Non-impact Sample Area, square feet	53.27
Ratio of Areas non-impaction	3.852
Exhaust Plenum, square feet (assumed to be the same as Plant C exhaust plenum)	158.95
Impaction Sample Area, square feet (assumed to be 1/3 of non-impaction area)	17.76
Ratio of Areas impaction (assumes entire exhaust plenum is impaction)	8.95
Deposition Estimates, pounds	
Estimate of Deposition in Non-impaction zone, grams	0.2011
Estimate of Deposition in Impaction zone, grams	0.4727
Estimate of Total MCEM Deposition, grams	0.6738
Estimate of Total MCEM Deposition, pounds	1.48E-03
Asphalt Production, tons	
Day 1 - October 5, 1998, Tons	1,172.9
Day 2 - October 6, 1998, Tons	1,184.6
Day 3 - October 7, 1998, tons	921.1
Three Day Total	3,278.6
Deposition Estimates, pounds per ton	
Estimate of MCEM Deposition, pounds per ton of asphalt loaded	4.53E-07

NOTE: SEE THE PICTURE ON THE NEXT PAGE

TTE EXHAUST DUCTWORK - INCLUDES 2 ELBOWS AND A SECTION OF STRAIGHT RUN

NOTE E1 = TOP ELBOW
E2 = BOTTOM ELBOW

MCEM Deposition on C-Channels

The ratio of the total C-channel areas to the test C-channel areas, along with the test C-channel analytical results, were used to calculate MCEM deposition as shown below.

C-Channel Section No.	MCEM Catch, g.	Length of each C-Channel, ft.	Cross-sectional surface area of C-Channel, ft^2/ft	No. of C-Channels in each section	Surface areas, ft^2			Total MCEM Deposition based on ratio of areas, g
					Total Section	Test Channel	Ratio of areas	
BE1	0.0048	15.42	1.49	15	344.56	2.98	115.625	0.5550
BE2	0.0057	15.42	1.49	13	298.62	2.98	100.208	0.5712
BE3	0.0128	15.42	1.49	11	252.68	2.98	84.792	1.0853
BE4	0.0051	15.42	1.49	14	321.59	2.98	107.917	0.5504
BE5	0.0049	15.42	1.49	13	298.62	2.98	100.208	0.4910
TOTAL								3.253

BE Blank	0.0035 grams

Asphalt Production in Tons	
Day 1	1172.9
Day 2	1184.6
Day 3	921.1
TOTAL	3278.6

Total MCEM deposition on the C-Channel in lb/ton =	2.19E-06

NOTE: SEE THE PICTURE THAT FOLLOWS THE NEXT PAGE

MCEM Deposition on Ceiling

The ratio of the total Ceiling areas to the test plates areas, along with the test plate analytical results, were used to calculate MCEM deposition as shown below.

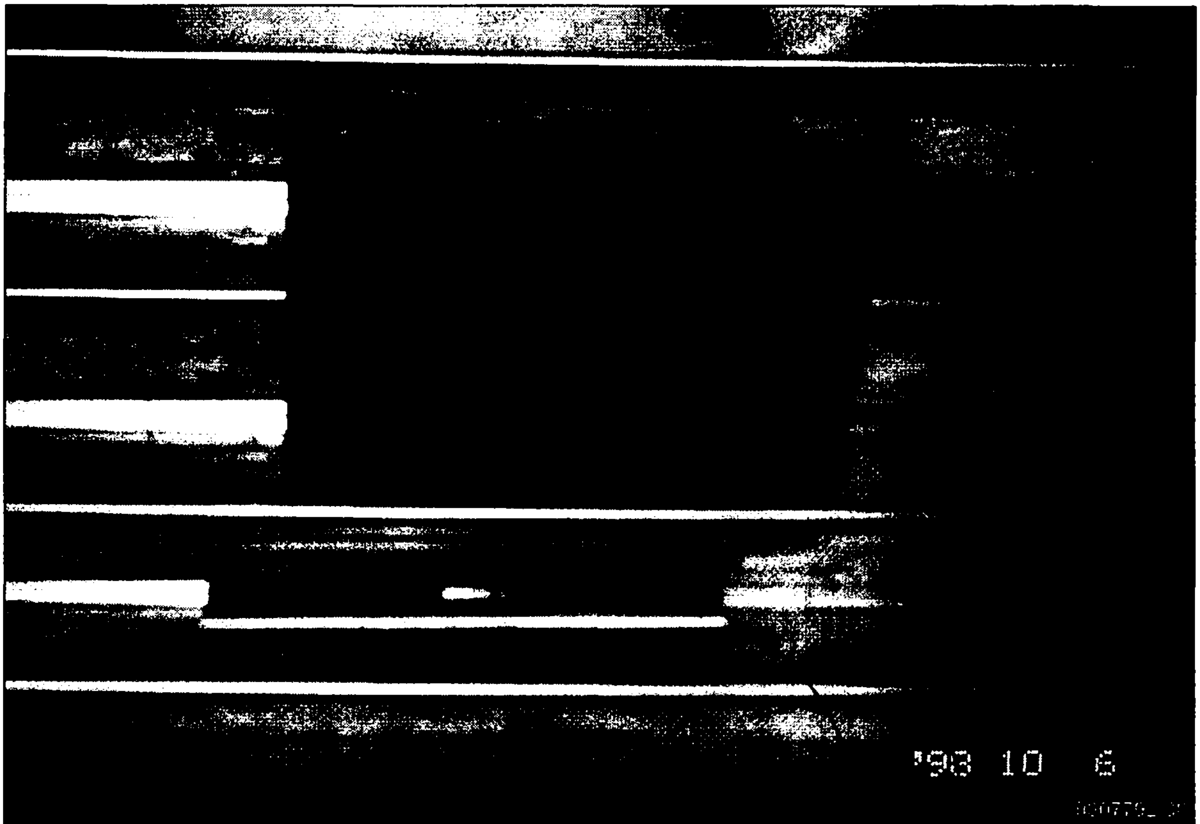
Ceiling Plate No.	MCEM Catch, g	Length of Ceiling Section, ft	Width of Ceiling Section, ft	Total Ceiling Section surface Area, ft^2	Length of each C-Channel, ft	Cross-sectional surface area of C-Channel, ft^2/ft	Surface area of each C-Channel in contact with ceiling, ft	No. of C-Channels in each section	Total Surface Area covered y Channels, ft	Net Ceiling surface area, ft^2	Surface area of test plate, ft^2	Ratio of areas	Total MCEM Deposition based on ratio of areas, g
CP1	0.0046	15.42	21.25	327.60	15.42	1.49	1.93	15	28.9	298.7	4	74.7	0.3435
CP2	0.0030	15.42	21.50	331.46	15.42	1.49	1.93	13	25.1	306.4	4	76.6	0.2298
CP3	0.0041	15.42	19.00	292.92	15.42	1.49	1.93	11	21.2	271.7	4	67.9	0.2785
CP4	0.0048	15.42	18.50	285.21	15.42	1.49	1.93	14	27.0	258.2	4	64.6	0.3099
CP5	0.0035	15.42	19.00	292.92	15.42	1.49	1.93	13	25.1	267.9	4	67.0	0.2344
TOTAL													1.396

CE blank	0.0026 grams

Asphalt Production in Tons	
Day 1	1172.9
Day 2	1184.6
Day 3	921.1
TOTAL	3278.6

Total MCEM deposition on the ceiling in lb/ton =	9.39E-07
Total MCEM deposition on the C-Channels in lb/ton =	2.19E-06
Total Ceiling and C-Channel	3.13E-06

NOTE: SEE THE PICTURE ON THE NEXT PAGE



CEILING PLATE

PICTURE OF CEILING INSIDE TTE

I BEAM SECTION

196

APPENDIX E

FIELD DATA

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

Plant: Asphalt Plant D

Date: 10/05/98

Sampling Location: Tunnel Exhaust Duct

Inside of Far Wall to Outside of Nipple: 25 1/8

Inside of Near Wall to Outside of Nipple (Nipple Length): 1 5/8"

Stack I.D.: 23½"

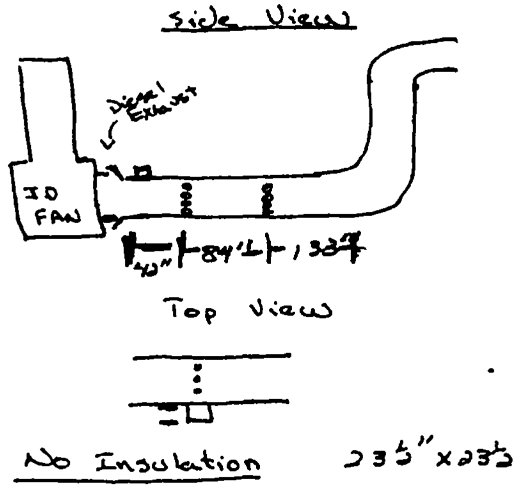
Distance Downstream from Flow Disturbance (Distance B):

______ inches / Stack I.D. = ______ dd

Distance Upstream from Flow Disturbance (Distance A):

______ inches / Stack I.D. = ______ dd

Calculated By: Dennis D. Holzschuh



Schematic of Sampling Location

Traverse Point Number	Fraction of Length	Length (inches)	Product of Columns 2 & 3 (To nearest 1/8")	Nipple Length (inches)	Traverse Point Location (Sum of Col. 4 & 5)
1		23½"	3.91	1 5/8"	5½"
2		23½"	11.75	1 5/8"	13 3/8"
3		23½	19.58	1 5/8"	21¼"

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant: Asphalt Plant D Date: 10/4/98

Sampling Location: TTE Exhaust Duplicate Clock Time: 1705

Run #: m2-1 Operators: AFL, EWS

Barometric Pressure, in. Hg: approx 30.2 Static Pressure, in. H_2O: -7.5

Moisture, %: approx 1% Molecular wt., Dry: 28.84 Pitot Tube, Cp: 0.84

Stack Dimension, in. Diameter or Side 1: 23.5" Side 2: 23.5"

Wet Bulb, °F: — Dry Bulb, °F: —

Traverse Point Number	~~Velocity Head in. H_2O~~ Yaw Angle	Stack Temp. °F
A 1	+12°	
2	-6°	
3	-9°	
B 1	+7°	
2	0°	
3	15°	
C 1	7°	
2	0°	
3	-10°	
D 1	8°	
2	0°	
3	0°	
	$\sqrt{\Delta P}$ =	Ts =

$Md = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$

$Md = (0.44 \times \quad) + (0.32 \times \quad) + (0.28 \times \quad)$

Md =

$Ms = Md \times (1 - \frac{\% H_2O}{100}) + 18 (\frac{\% H_2O}{100})$

$Ms = (\quad) \times (1 - \frac{\quad}{100}) + 18 (\frac{\quad}{100})$

Ms =

Ts = °F = °R (°F + 460)

$Ps = Pb + \frac{S.P.}{13.6} = (\quad) + \frac{\quad}{13.6}$

Ps = in. Hg

$\sqrt{\Delta P}$ =

$Vs = 85.49 \times Cp \times \sqrt{\Delta P} \times \sqrt{\frac{Ts\ (°R)}{Ps \times Ms}}$

$Vs = 85.49 \times (\quad) \times (\quad) \times \sqrt{\quad}$

Vs = ft/s

As = ft^2

Qs = Vs x As x 60 s/m

Qs = x x 60

Qs = acfm

$Qs_{std} = Qs \times 17.647 \times \frac{Ps}{Ts} \times (1 - \frac{\% H_2O}{100})$

$Qs_{std} = \quad \times 17.647 \times \frac{\quad}{\quad} \times (1 - \frac{\quad}{100})$

Qs_{std} = dscfm

201

FIELD DATA SHEET

GLI

Plant: Asphalt Plant D   Sample Type: 3VS   Operator: DDH   Nozzle ID (GLI) .188   Thermocouple #: KT 6

Sampling Location: Tunnel Exhaust Duct   Pbar: 30.30   Ps: -7.0   Assumed Bws: 2   Filter #: 100198-05.3409

Run Number: M315-1   Date: 10-05-98   CO2: 0   O2: 20.9   Meter Box #: RMB-15   Y: 1.001   ΔH@: 1.830

Pretest Leak Rate: 0.009 cfm @ 15 in. Hg.   Probe Length/Type: 4'/Glass   Pitot #: RP-19   Post-Test Leak Rate: 12" cfm @ .005 in. Hg.

Pretest Leak Check: Pitot: ✓   Orsat: N/A   Stack Diameter: 23.5 x 23.5 ~~As:~~ Cp = .84 RPH   Post-Test Leak Check: Pitot: ✓   Orsat: N/A

K = 1.349   1.325

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft³	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Orifice Pressure Differential (ΔH) in H2O Actual	Stack Temp. (Ts)	Temperature °F Probe	Temperature °F Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Dry Gas Meter Temp. Outlet (Tm out °F)	Pump Vacuum (in. Hg)
A 1	0	0721	781.150										
	5	0726	784.000	1.40	1.92	1.92	43	252	252	48	50	51	5
	10	0734	788.323	1.40	1.96	1.96	42	251	251	45	51 [illegible]	50	5
	15	0739	792.000	1.40	1.86	1.86	42	255	252	48	~~38~~ 36	35	5
2	20	0745	795.410	1.40	1.87	1.87	40	253	252	48	36	35	5
	25	0800	799.032	1.80	2.40	2.40	42	252	251	48	38	35	5
	30		802.00	1.70	2.23	2.23	42	252	251	47	37	34	5
	35		805.210	1.70	2.23	2.23	41	253	251	46	37	35	5
3	40	0819	808.450	1.70	2.23	2.23	41	252	251	46	37	35	5
	45	0826	812.000	1.80	2.35	2.35	48	252	251	45	38	34	5
	50	0832	815.400	1.80	2.37	2.37	49	251	252	44	39	35	5
	55	0840	818.60	1.80	2.31	2.31	54	251	251	49	40	35	5
B 4	60	0849	821.330	1.80	2.33	2.33	54	252	252	44	40	36	5
	65	0854	825.400	1.50	1.95	1.95	54	253	251	45	40	36	5
	70	0918	828.035	1.50	1.95	1.95	54	253	252	45	40	37	5
	75	0924	831.000	1.40	1.84	1.84	51	253	252	51	50	46	5
2	80	0930	833.906	1.40	1.84	1.84	51	253	252	51	50	48	5
	85	0935	836.87	1.40	1.80	1.80	59	250	252	52	45	45	5
	90	0940	839.86	1.40	1.80	1.80	59	250	252	50	45	45	5
	95	0952	842.564	1.40	1.83	1.83	55	252	251	48	48	46	5
3	100	0957	845.710	1.40	1.79	1.79	66	252	253	49	48	47	5
-	105	1003	848.500	1.50	1.94	1.94	61	251	252	49	48	48	5
	110	1008	851.210	1.50	1.94	1.94	62	252	254	50	50	48	5
	115	1015	854.350	1.60	2.06	2.06	65	252	253	52	52	49	5
C 1	120	1028	857.300	1.60	2.06	2.06	65	252	253	52	52	49	5
	125	1033	860.270	1.20	1.55	1.55	64	250	251	52	52	49	5
	130	1039	863.145	1.20	1.56	1.56	64	253	251	50	53	49	5

ΔVm= ________ $\overline{\sqrt{\Delta p}}$= ________ $\overline{\Delta H}$= ________ $\overline{Ts}$= ________ $\overline{Tm}$= ________

.83
821.330
822.300
10" 0.000

856.120
856.200
10" 0.00

202

Plant Name: Asphalt Plant D **Test Date:** 10-5-98

Run Number: M315-1 **Operator:** D. Holzschuh

Traverse Point Number	Sampling Time, (min.)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. °F (T_s)	Probe Temp. / Filter Temp. °F	Impinger Temp. °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum In. Hg
	135	1052	865.000	1.20	1.56	1.56	67	252 / 251	46	54	52	5
2	140	1059	867.560	1.26	1.54	1.54	72	251 / 252	47	55	51	5
	145	1110	870.200	1.30	1.69	1.69	63	252 / 253	47	53	52	5
	150	1115	873.100	1.30	1.68	1.68	67	253 / 251	47	52	51	5
	155	1120	875.500	1.26	1.55	1.55	67	252 / 252	47	51	51	5
3	160	1126	878.370	1.20	1.55	1.55	66	251 / 253	48	55	53	5
	165	1131	881.200	1.20	1.55	1.55	66	251 / 252	48	59	53	5
	170	1137	884.000	1.70	2.23	2.23	65	252 / 253	49	61	58	5
	175	1143	887.090	1.70	2.21	2.21	70	253 / 252	48	62	58	5
D 1	180	1149	890.255	1.70	2.21	2.21	70	253 / 250	49	62	58	5
	185		893.190	1.20	1.58	1.58	65	253 / 251	49	62	59	5
	190	1208	896.045	1.20	1.58	1.58	65	252 / 251	49	62	58	5
	195	1215	898.780	1.20	1.58	1.58	65	250 / 250	49	62	58	5
2	200	1221	902.310	1.20	1.60	1.60	68	251 / 253	49	62	58	5
	205	1228	906.00	1.10	1.48	1.48	67	250 / 252	49	78	72	5
	210	1233	909.830	1.10	1.48	2.00	67	252 / 253	48	78	73	5
	215	1238	914.000	1.10	1.48	2.00	67	253 / 251	49	78	76	5
3	220	1246	918.207	1.10	1.48	2.00	67	252 / 250	49	78	77	5
	225	1251	923.404	1.50	2.03	2.50	66	253 / 251	49	78	77	5
	230	1256	929.000	1.50	2.03	3.50	66	253 / 251	49	78	77	5
	235		935.000	1.50	2.03	3.50	66	253 / 252	48	78	77	5
	240	1403	942.000	1.10	1.48	3.50	66	253 / 253	48	78	78	5

890.255
891.260
5" 0.005

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Sample Recovery Data

Plant: Asphalt Plant D
Date: 10-5-98
Sample Location: Tunnel Exhaust
Sample Type: M315
Sample Recovery Person: Dennis D. Holzschuh
Comments: 90% spent silica gel

Run No.: TED-M315-1
Job No.: 5517-002
Filter No.: 100198-05

FRONT HALF

Acetone Container No.: ~~M315~~ M315-1-FH-A
Liquid Level Marked: ✓
Sealed: ✓

Filter Container No.: 100198-05
Sealed: ✓

Description of Filter: Brown Particulate

Samples Stored and Locked: Locked and stored in truck

BACK HALF/MOISTURE

Container No.: M315-1-BH-W

Liquid Level Marked: ✓
Sealed: ✓

Impinger Number	Contents	Initial Volume (ml)	Weight (g) or dwt Initial	Final	Net gm
1	DI	100 ml.	392.2	~~[illegible]~~ 373.4	-29.2
2	DI	100 ml.	394.7	~~[illegible]~~ 405.8	17.3
3	MT	MT	326.8	330.7	6.1
4	SG	~200 g	476.6	496.0	30.2
5					
6					
TOTAL					24.3

203

Description of Impinger Catch: Impinger CATCH is Cloudy

42g=27 dwt ⇒ 1.5556 gm/dwt

Isokinetic Sampling Data Reduction Spreadsheet
TTE Exhaust

HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

1

Metered Sample Volume

	M315-1		
Run Start	781.150		
Run End	942.000		
Leak Check 1 Start	821.830		
Leak Check 1 End	822.500		
Leak Check 2 Start	856.170		
Leak Check 2 End	856.200		
Volume Metered	159.115	0.000	0.000
Leak Check 3 Start	890.255		
Leak Check 3 End	891.29		

Impinger/XAD H2O	Init Tare	Final	Net H2O Gain	
	392.2	373.4	-18.8	(29.2)
	394.7	405.8	11.1	17.3
	326.8	330.7	3.9	6.1
	476.6	496	19.4	30.2
	0	0	0	0.0
	0	0	0	0.0
	Condensate Collected:		15.6	24.3

913- 928 Fim IFP

204

Effluent Gas Velocity Head, (ΔP

Pt	Δp	M315-1 $\Delta p^{1/2}$	ΔH	T_S	meter temp tm Inlet	Outlet	Inlet
A-1	1.4	1.183	1.92	43	50	51	
	1.4	1.183	1.96	42	51	50	
	1.4	1.183	1.86	42	~~38~~ 36	35	
	1.4	1.183	1.87	40	36	35	
2	1.8	1.342	~~2.36~~ 2.4	42	38	35	
	1.7	1.304	2.23	~~41~~ 42	37	34	
	1.7	1.304	2.23	41	37	35	
	1.7	1.304	2.23	41	37	35	
3	1.8	1.342	2.35	45	38	34	
	1.8	1.342	2.37	49	39	35	
	1.8	1.342	2.31	54	40	35	
	1.8	1.342	~~2.31~~ 2.33	54	40	36	
B-1	1.5	1.225	1.95	54	40	36	
	1.5	1.225	1.95	54	40	37	
	1.4	1.183	1.84	~~54~~ 51	50	46	
	1.4	1.183	1.84	~~54~~ 51	50	48	
2	1.4	1.183	1.8	59	45	45	
	1.4	1.183	1.8	59	45	45	
	1.4	1.183	1.83	55	48	46	
	1.4	1.183	1.79	66	48	47	
3	1.5	1.225	1.94	61	48	48	
	1.5	1.225	1.94	62	50	48	
	1.7	1.304	2.19	65	52	49	
	1.6	1.265	2.06	65	52	49	
C-1	1.2	1.095	1.55	64	52	49	
	1.2	1.095	1.56	64	53	49	
	1.2	1.095	1.~~55~~56	67	54	52	
	1.2	1.095	1.54	72	55	51	
2	1.3	1.140	1.69	63	53	52	
	1.3	1.140	1.68	67	52	51	
	1.2	1.095	1.55	67	51	51	
	1.2	1.095	1.55	66	55	53	
3	1.2	1.095	1.55	66	59	53	
	1.7	1.304	2.23	65	61	58	
	1.7	1.304	2.21	70	62	58	
	1.7	1.304	2.21	70	62	58	
D-1	1.2	1.095	1.58	65	62	59	
	1.2	1.095	1.58	65	62	58	
	1.2	1.095	1.58	65	62	58	
	1.2	1.095	1.6	68	62	58	
2	1.1	1.049	1.48	67	78	72	
	1.1	1.049	2	67	78	73	
	1.1	1.049	2	67	78	76	
	1.1	1.049	2	67	78	77	
3	1.5	1.225	2.5	66	78	77	
	1.5	1.225	3.5	66	78	77	
	1.5	1.225	3.5	66	78	77	
	1.1	1.049	3.5	66	78	78	
		0.000					
		0.000					
Average $\Delta P^{1/2}$		1.1892	2.01	59		52.7	
		1.4141		590			

205

FIELD DATA SHEET

206

Plant: Asphalt Plant D | Sample Type: 315 | Operator: DDH | Nozzle ID: GL1-.188 DH (.196 struck) | Thermocouple #: RT 6

Sampling Location: Tunnel Exhaust Duct | Pbar: 30.45 | Ps: -7.0 | Assumed Bws: 1 | Filter #: 100198-09 .3363

Run Number: M315-2 | Date: 10-6-98 | CO2: 0 | O2: 20.9 | Meter Box #: RMB-15 | Y: 1.001 | ΔH@: 1.830

Pretest Leak Rate: .011 cfm @ 15 in. Hg. | Probe Length/Type: 4'/Glass | Pitot #: RP-A | Post-Test Leak Rate: .001 cfm @ 5 in. Hg.

Pretest Leak Check: Pitot: ✓ Orsat: N/A | Stack Diameter: 23½ x 23½ | K = 1.300 | As: approx 4 sq ft | Post-Test Leak Check: Pitot: ✓ Orsat: N/A

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft³	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Orifice Pressure Differential (ΔH) in H2O Actual	Stack Temp. (Ts)	Temperature °F Probe	Temperature °F Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Dry Gas Meter Temp. Outlet (Tm out °F)	Pump Vacuum (in. Hg)
A 1	0	0714	943.482 DH										
	5	0719	946.401	1.00 DH	1.36	1.36	42	252	259	48	50	50	4
	10	0725	949.375	.98	1.27	1.27	41	253	254	49	33	32	4
	15	0731	952.330	.98	1.27	1.27	41	253	252	49	34	31	4
2	20	0737	955.310	.98	1.27	1.27	42	251	254	49	35	34	4
	25	0743	958.230	1.30	1.66	1.66	51	253	252	49	35	34	4
	30	0748	961.510	1.30	1.69	1.69	43	254	253	48	35	34	4
	35	0754	964.780	1.30	1.68	1.68	45	252	252	48	35	34	4
3	40	0759	968.050	1.30	1.69	1.69	42	253	253	49	35	32	4
	45	0804	971.450	1.30	1.67	1.67	51	251	254	49	37	36	4
	50	0810	974.833	1.30	1.67	1.67	51	252	253	48	37	36	4
Extra time → 4:58	55	0815	978.830	1.80	2.31	2.31	51	254	253	48	37	36	4
B 1	60	0838	986.285	1.70	2.21	2.21	45	253	252	48	37	37	4
	65	0843	989.310	.98	1.27	1.27	48	254	253	48	37	37	4
	70	0901	992.280	.99	1.28	1.28	48	253	252	48	38	37	4
	75	0906	995.320	.99	1.28	1.28	49	252	251	49	39	38	4
2	80	0912	998.400	.99	1.28	1.28	49	253	251	49	39	38	4
	85	0931	1001.900	1.20	1.55	1.55	54	252	252	48	DH 38	38	4
	90	0937	1004.987	1.40	1.76	1.76	63	253	252	47	41	40	4
	95	0945	1008.880 DH	1.40	1.79	1.79	58	252	251	48	42	41	4
3	100	0950	1012.340	1.40	1.80	1.80	57	253	253	47	43	42	4
	105	0955	1015.980	1.40	1.77	1.77	66	251	252	47	43	42	4
	110	1000	1019.520	1.40	1.79	1.79	58	252	253	47	43	43	4
Extra time → 1:33	115	1010	1022.550	1.40	1.79	1.79	59	253	252	46	44	43	4
C 1	120	1017	1027.345	1.40	1.79	1.79	59	253	252	46	44	42	4
	125	1032	1030.330	.95	1.21	1.21	62	252	253	46	44	43	4
	130	1037	1032.540	.98	1.26	1.26	58	252	253	46	44	43	4

ΔVm= ______ $\overline{\sqrt{\Delta p}}$= ______ $\overline{\Delta H}$= ______ $\overline{Ts}$= ______ $\overline{Tm}$= ______

986.265
986.285
(5")
.005

1027.32
1027.34
5"00

207

Plant Name: Asphalt Plant D **Test Date:** 10-6-98

Run Number: M315-2 **Operator:** Dennis D. Holzschuh

Traverse Point Number	Sampling Time, (min.) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. °F (T_s)	Probe Temp. / Filter Temp. °F	Impinger Temp. °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum In. Hg
	135 / 1044	1035.570	.98	1.26	1.26	58	252 / 251	49	44	43	4
2	140 / 1049	1038.650	.98	1.26	1.26	58	252 / 251	49	44	43	4
	145 / 1105	1041.300	1.00	1.28	1.28	63	252 / 252	49	48	46	4
	150 / 1110	1044.860	1.00	1.28	1.28	63	253 / 251	49	48	47	4
	155 / 1116	1048.140	1.20	1.54	1.54	62	252 / 253	49	48	47	4
3	160 / 1121	1051.420	1.10	1.42	1.42	60	253 / 250	49	49	47	4
	165 / 1128	1054.800	1.40	1.78	1.78	68	252 / 251	48	49	48	4
	170 / 1133	1058.760	1.40	1.81	1.81	61	253 / 253	48	50	48	4
	175 / 1139	1062.430	1.40	1.81	1.81	63	252 / 253	51	51	48	4
D 1	180 / 1145	1066.000	1.40	1.82	1.82	61	252 / 252	52	50	48	4
	185 / 1159	~~[illegible]~~ 1069.000 DD	.90	1.16	1.16	63	254 / 251	50	50	48	4
	190 / 1204	1072.000	.93	1.21	1.21	62	253 / 251	50	53	52	4
	195 / 1210	1075.020	.93	1.21	1.21	62	252 / 251	50	53	53	4
2	200 / 1241	1077.800	.93	1.21	1.21	62	251 / 251	50	53	53	4
	205 / 1247	1080.800	.94	1.22	1.22	64	251 / 250	50	54	53	4
	210 / 1252	1083.765	.90	1.18	1.18	61	252 / 250	50	55	53	4
	215 / 1257	1086.66	1.00	1.30	1.30	65	253 / 251	51	56	55	4
3	220 / 1303	1090.000	1.30	1.70	1.70	65	252 / 252	51	58	55	4
	225 / 1308	1093.650	1.30	1.69	1.69	65	252 / 250	50	58	54	4
	230 / 1313	1097.345	1.30	1.69	1.69	65	253 / 252	52	58	55	4
	235 / 1318	~~[illegible]~~ 1100.92 DH	1.30	1.68	1.68	72	252 / 250	51	60	58	4
	240 / 1326	1104.385	1.30	1.68	1.68	72	252 / 250	51	60	58	4
	/						/				
+ Extra Time	7.5 /						/				

= 247.5 min

1066.000
1066.020
4" - .005

PES

SAMPLE RECOVERY DATA

Plant: Asphalt Plant D Run No.: M315-2

Date: 10-06-98 Sample Box No.: 1 Job No.: 5517-002

Sample Location: Tunnel Exhaust Duct

Sample Type: M315 Filter No.: 100198-09-.3363

Sample Recovery Person: Dennis D. Holzschuh

Comments: 80% spent on the Silica Gel Impinger

FRONT HALF

Acetone Container No.: M315-2-FH-A Liquid Level Marked: ✓ Sealed: ✓

Filter Container No.: 100198-09 Sealed: ✓

Description of Filter: Light loading of Brown Particulate

Samples Stored and Locked: ✓

BACK HALF/MOISTURE

Container No.: M315-1-BH-W

Liquid Level Marked: ✓ Sealed: ✓

IMP. NO.	CONTENTS	INITIAL VOL (ml)	WEIGHT (grams)		
			INITIAL	FINAL	NET
1	DI	100 ml.	575.2	548.0	-27.2
2	DI	100 ml	657.1	671.3	14.2
3	MT	MT	509.0	512.0	3.0
4	Silica Gel	200	825.1	852.2	27.1
5					
6					
TOTAL					17.1 g

Description of Impinger Catch: Cloudy

208

2

Isokinetic Sampling Data Reduction Spreadsheet
TTE Exhaust
HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

Metered Sample Volume

	M315-2		
Run Start	943.492		
Run End	1104.385		
Leak Check 1 Start	986.265		
Leak Check 1 End	986.285		
Leak Check 2 Start	1027.325		
Leak Check 2 End	1027.345		
Volume Metered	160.833	0.000	0.000
Leak Check 3 Start	1066		
Leak Check 3 End	1066.02		

Impinger/XAD H2O

Init Tare	Final	Net H2O Ga
575.2	548	-27.2
657.1	671.3	14.2
509	512	3
825.1	852.2	27.1
0	0	0
0	0	0
Condensate Collected:		17.1

0.4656953

1.55556

Effluent Gas Velocity Head, (ΔP)

Pt	Δp	ΔH	T_S	meter temp tr Inlet	Outlet
A-1	1	1.36	42	50	50
	0.98	1.27	41	33	32
	0.98	1.27	41	34	31
	0.98	1.27	42	35	34
2	1.3	1.66	51	35	34
	1.3	1.69	43	35	34
	1.3	1.68	45	35	34
	1.3	1.69	42	35	32
3	1.3	1.67	51	37	36
	1.3	1.67	51	37	36
	1.8	2.31	51	37	36
	1.7	2.21	45	37	37
B-1	0.98	1.27	48	37	37
	0.99	1.28	48	38	37
	0.99	1.28	49	39	38
	0.99	1.28	49	39	38
2	1.2	1.55	54	38	38
	1.4	1.76	65	41	40
	1.4	1.79	58	42	41
	1.4	1.8	57	43	42
3	1.4	1.77	66	43	42
	1.4	1.79	58	43	43
	1.4	1.79	59	44	43
	1.4	1.79	59	44	42
C-1	0.95	1.21	62	44	43
	0.98	1.26	58	44	43
	0.98	1.26	58	44	43
	0.98	1.26	58	44	43
2	1	1.28	63	48	46
	1	1.28	63	48	47
	1.2	1.54	62	48	47
	1.1	1.42	60	49	47
3	1.4	1.78	68	49	48
	1.4	1.81	61	50	48
	1.4	1.81	63	51	48
	1.4	1.82	61	52	48
D-1	0.9	1.16	63	50	48
	0.93	1.21	62	53	52
	0.93	1.21	62	53	53
	0.93	1.21	62	53	53
2	0.94	1.22	64	54	53
	0.9	1.18	61	55	53
	1	1.3	65	56	55
	1.3	1.7	65	58	55
3	1.3	1.69	65	58	54
	1.3	1.69	65	58	55
	1.3	1.68	72	60	58
	1.3	1.68	72	60	58
Average $\Delta P^{1/2}$		1.53	57		44.5

209

FIELD DATA SHEET

N/O

.84 = Cp

Plant: Asphalt Plant D
Sampling Location: Tunnel Exhaust Duct
Run Number: M315-3 Date: 10-7-98
Pretest Leak Rate: .005 cfm @ 15" in. Hg.
Pretest Leak Check: Pitot: ✓ Orsat: N/A

Sample Type: 315 Operator: DDH
Pbar: 30.45 Ps: -7.2
CO2: 0 O2: 20.9
Probe Length/Type: 4'/Glass Pitot #: RP-19
Stack Diameter: 23.5"x23.5" As: approx. 4 ft²
K= 1.300

Nozzle ID: GL-1 .188 Thermocouple #: RT-6
Assumed Bws: 1 Filter #: 1000198-07
Meter Box #: RMB-15 Y: 1.001 ΔH@: 1.830
Post-Test Leak Rate: .005 cfm @ 6 in. Hg.
Post-Test Leak Check: Pitot: ✓ Orsat: N/A

Tare .3391

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft³	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Actual	Stack Temp. (Ts)	Temperature °F Probe	Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Outlet (Tm out °F)	Pump Vacuum (in. Hg)
A 1	0	0636	104.562										
	5	0642	107.710	1.0	1.30	1.30	37	252	252	39	36	37	2
	10	0647	111.123	1.0	1.30	1.30	37	252	252	41	36	37	4
	15	0652	114.040	1.0	1.30	1.30	37	253	253	41	32	37	4
2	20	0658	117.150	1.0	1.30	1.30	37	252	253	41	32	37	4
	25	0703	120.130	1.0	1.30	1.30	37	252	253	41	32	37	4
	30	0708	123.810	1.40	1.82	1.82	42	253	252	40	34	34	4
	35	0715	127.320	1.40	1.82	1.82	42	252	253	40	36	36	4
3	40	0720	130.770	1.40	1.82	1.82	42	252	253	42	36	35	4
	45		134.42	1.40	1.82	1.82	45	253	252	41	35	36	4
	50		137.912	1.50	1.94	1.94	45	253	253	42	34	34	4
	55	0748	141.430	1.50	1.93	1.93	46	253	252	42	33	33	4
B 1	60	0757	147.765	1.40	1.80	1.80	46	252	253	41	33	32	4
	65	0813	150.674	.98	1.25	1.25	50	253	250	42	33	33	4
	70	0819	153.320	.90	1.16	1.16	47	252	251	42	35	34	4
	75	0825	156.055	.93	1.20	1.20	50	250	251	42	37	35	4
2	80	0831	159.000	.93	1.20	1.20	50	252	250	43	37	35	4
	85		162.270	1.10	1.43	1.43	45	253	252	42	36	36	4
	90		165.100 DH	1.10	1.43	1.43	45	253	252	42	36	35	4
	95	0845	168.040	1.10	1.43	1.43	45	252	253	42	36	35	4
3	100	0851	171.210	1.10	1.43	1.43	45	252	253	42	39	35	4
	105	0856	174.910	1.40	1.82	1.82	47	253	252	42	40	36	4
	110	0907	178.550	1.40	1.82	1.82	47	253	252	42	40	36	4
	115	0954	181.990	1.40	1.81	1.81	50	253	252	42	40	37	4
C 1	120	1003	187.762	1.30	1.69	1.69	49	252	252	42	40	37	4
	125	1014	190.935	.99	1.29	1.29	51	252	253	45	45	44	4
	130	1019	194.015	.99	1.29	1.29	51	252	253	45	45	44	4

ΔVm=_____ $\overline{\sqrt{\Delta p}}$=_____ $\overline{\Delta H}$=_____ Ts=_____ $\overline{Tm}$=_____

Margin notes (left): 4:19 over clock timer off by 7 min starting 0748; 5:25 over

Margin notes (right): 147.7?? / 147.765 / 5" – 0.00?; 187.762 / 187.787 / 5" – 0.00?

Plant Name: Asphalt Plant D **Test Date:** 10-7-98

Run Number: M315-3 **Operator:** D. Holzschuh

Traverse Point Number	Sampling Time, (min.)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. °F (T_s)	Probe Temp. / Filter Temp. °F	Impinger Temp. °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum In. Hg
	135	1029	197.231	.99	1.29	1.29	53	253 / 252	49	47	47	5
2	140	1035	200.340	.98	1.28	1.28	57	252 / 253	49	49	48	5
	145	1040	203.920	1.2	1.55	1.55	61	253 / 252	49	49	48	5
	150	1100	206.987	1.10	1.42	1.42	63	252 / 253	50	48	48	5
	155	1105	210.000	.92	1.19	1.19	62	252 / 253	50	50	50	5
3	160	1110	212.970	1.0	1.29	1.29	62	253 / 251	50	50	49	5
	165	1115	216.020	1.3	~~1.30~~ 1.68 DH	~~1.30~~ 1.68 DH	63	254 / 251	50	52	50	5
	170	1121	219.710	1.3	~~1.30~~ 1.68 DH	~~1.30~~ 1.68 DH	63	254 / 251	50	52	51	5
	175	1135	222.74	1.3	1.67	1.67	67	252 / 250	50	54	53	5
1 min Over D 1	180	1141	DH 216.903	1.3	1.65	1.65	73	245 / 234	50	53	50	5 226.905
	185	1143	230.132	1.0	1.29	1.29	74	245 / 244	50	60	58	5 226.933
	190	1148	233.400	.95	1.22	1.22	79	245 / 244	50	60	58	5 5"–0.005
	195	1203	236.266	1.0	1.30	1.30	65	245 / 244	50	56	58	5
2	200	1210	239.570	1.10	1.44	1.44	62	246 / 245	50	57	56	5
	205	1215	243.015	1.10	1.44	1.44	62	246 / 247	50	57	56	5
	210	1222	246.300	1.20	1.57	1.57	62	248 / 248	51	57	56	5
	215	1230	250.008	1.20	1.56	1.56	64	244 / 248	51	57	56	5
3	220	1235	253.018	1.20	1.57	1.57	64	249 / 250	51	59	56	5
	225	1240	256.365	1.20	1.57	1.57	64	249 / 250	51	59	56	5
	230	1250	260.000	1.20	1.56	1.56	68	254 / 253	52	59	56	5
	235	1255	262.830	1.2	1.56	1.56	68	254 / 252	52	59	56	5
	240	1300	266.819	1.10	1.43	1.43	68	254 / 251	51	59	58	5
xtra time	10.7	(1313 @ plant time)						/				
	250.7' Total test time							/				

PES

SAMPLE RECOVERY DATA

Plant: Asphalt Plant D Run No.: M315-3 5517-002

Date: 10-07-98 Sample Box No.: 1 Job No.: ~~100198-07-.3391~~

Sample Location: Tunnel Exhaust Duct

Sample Type: M315 Filter No.: 100198-07 = .3391

Sample Recovery Person: Dennis D. Holzschuh

Comments: Silica Gel is 100% Spent

FRONT HALF

Acetone Container No.: M315-3-FH-A Liquid Level Marked: ✓ Sealed: ✓

Filter Container No.: 100198-07 Sealed: ✓

Description of Filter: Dark Brown Particulate

Samples Stored and Locked: ✓ Dennis Holzschuh

BACK HALF/MOISTURE

Container No.: M315-3-BH-W

Liquid Level Marked: ✓ Sealed: ✓

IMP. NO.	CONTENTS	INITIAL VOL (ml)	WEIGHT (grams) INITIAL	FINAL	NET
1	DI Water	100 ml	594.2	575.2	-19.0
2	DI water	100 ml	674.5	688.8	14.3
3	MT	MT	509.4	511.6	2.2
4	Silica Gel	200	799.7	825.4	25.7
5					
6					
TOTAL					23.2

Description of Impinger Catch: Cloudy → 1st & 2nd
3rd → MT 4th SG

212

3

Isokinetic Sampling Data Reduction Spreadsheet
TTE Exhaust
HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

Metered Sample Volume

	M315-3		
Run Start	104.562		
Run End	266.819		
Leak Check 1 Start	147.735		
Leak Check 1 End	147.765		
Leak Check 2 Start	187.762		
Leak Check 2 End	187.787		
Volume Metered	162.172	0.000	0.000
Leak Check 3 Start	226.903		
Leak Check 3 End	226.933		

Impinger/XAD H2O

Init Tare	Final	Net H2O Ga
594.2	575.2	-19
674.5	688.8	14.3
509.4	511.6	2.2
799.7	825.4	25.7
0	0	0
0	0	0
Condensate Collected:		23.2

0.62569608

1.55556

Effluent Gas Velocity Head, (ΔP)

Pt	Δp	ΔH	T_S	meter temp tm Inlet	Outlet
A-1	1	1.3	37	30	37
	1	1.3	37	30	37
	1	1.3	37	32	37
	1	1.3	37	32	37
2	1	1.3	37	32	37
	1.4	1.82	42	34	34
	1.4	1.82	42	36	36
	1.4	1.82	42	36	35
3	1.4	1.82	45	35	36
	1.5	1.94	45	34	34
	1.5	1.93	46	33	33
	1.4	1.8	46	33 35	32
B-1	0.98	1.25	50	33	33
	0.9	1.16	47	35	34
	0.93	1.2	50	37	35
	0.93	1.2	50	37	35
2	1.1	1.43	45	36	36
	1.1	1.43	45	36	35
	1.1	1.43	45	36	35
	1.1	1.43	45	39	35
3	1.4	1.82	47	40	36
	1.4	1.82	47	40	36
	1.4	1.81	50	40	37
	1.3	1.69	49	40	37
C-1	0.99	1.29	51	45	44
	0.99	1.29	51	45	44
	0.99	1.29	53	47	47
	0.98	1.28	57	49	48
2	1.2	1.55	61	49	48
	1.1	1.42	63	48	48
	0.92	1.19	62	50	50
	1	1.29	62	50	49
3	1.3	1.68	63	52	50
	1.3	1.68	63	52	51
	1.3	1.67	67	54	48 53
	1.3	1.65	73	53	50
D-1	1	1.29	74	60	58
	0.95	1.22	74	60	58
	1	1.3	65	56	58
	1.1	1.44	62	57	56
2	1.1	1.44	62	57	56
	1.2	1.57	62	57	56
	1.2	1.56	64	57	56
	1.2	1.57	64	59	56
3	1.2	1.57	64	59	56
	1.2	1.56	68	59	56
	1.2	1.56	68	59	56
	1.1	1.43	68	59	58
Average $\Delta P^{1/2}$	1.50		54		44.2

M315-FB-1

FIELD DATA SHEET

4-2

Plant: Asphalt Plant D
Sampling Location: Tunnel Exhaust Duct
Run Number: M315-FB-1 Date: 10-07-98
Pretest Leak Rate: 0.009 cfm @ 15" in. Hg.
Pretest Leak Check: Pitot: N/A Orsat: N/A

Sample Type: 315 Operator: DDH
Pbar: 30.35 Ps: 0
CO2: 0 O2: 20.9
Probe Length/Type: 4'/Glass Pitot #: RP-19
Stack Diameter: 23.5x23.5 As: ~4 sq ft

Nozzle ID: .188 Thermocouple #: RT-6
Assumed Bws: 1 Filter #: 100198-03/03386
Meter Box #: RMB-5 Y: 1.001 ΔH@: 1.830
Post-Test Leak Rate: 0.005 cfm @ 15 in. Hg.
Post-Test Leak Check: Pitot: ✓ Orsat: N/A

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft³	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Orifice Pressure Differential (ΔH) in H2O Actual	Stack Temp. (Ts)	Temperature °F Probe	Temperature °F Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Dry Gas Meter Temp. Outlet (Tm out °F)	Pump Vacuum (in. Hg)
A 1	0	14:59	266.925										
	5	15:04	267.070	N/A	N/A	N/A	60	250	250	49	80	80	N/A
	10	15:09	267.160	↓	↓	↓	↓	↓	↓	↓	↓	↓	
	15	15:14	267.248										
	20	15:19	267.320										

15" - 0.005
15" - 0.005

ΔVm= ______ $\overline{\sqrt{\Delta p}}$= ______ $\overline{\Delta H}$= ______ $\overline{Ts}$= ______ $\overline{Tm}$= ______

PES

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

Plant: Asphalt Plant D

Date: 10/14/98

Sampling Location: TTE Exhaust

Inside of Far Wall to Outside of Nipple: 25 1/8

Inside of Near Wall to Outside of Nipple (Nipple Length): 1 5/8

Stack I.D.: 23 1/2 × 23 1/2

Distance Downstream from Flow Disturbance (Distance B):

_______ inches / Stack I.D. = _______ dd

Distance Upstream from Flow Disturbance (Distance A):

_______ inches / Stack I.D. = _______ dd

Calculated By: [signature]

Schematic of Sampling Location

Traverse Point Number	Fraction of Length	Length (inches)	Product of Columns 2 & 3 (To nearest 1/8")	Nipple Length (inches)	Traverse Point Location (Sum of Col. 4 & 5)
1	0.083	23.5	1.95	1.625	3.575
2	0.25	23.5	5.875	1.625	7.5
3	0.417	23.5	9.8	1.625	11.425
4	0.584	23.5	13.72	1.625	15.345
5	0.75	23.5	17.625	1.625	19.25
6	0.917	23.5	21.55	1.625	23.175

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant: Asphalt Plant D Date: 10/4/98
Sampling Location: TTE Exhaust Clock Time: 1655
Run #: M2-1 Operators: AFL, BNS
Barometric Pressure, in. Hg: approx. 30.2 Static Pressure, in. H_2O: -7.5
Moisture, %: approx. 1% Molecular wt., Dry: 28.84 Pitot Tube, Cp: 0.84
Stack Dimension, in. Diameter or Side 1: 23.5" Side 2: 23.5"
Wet Bulb, °F: ——— Dry Bulb, °F: ———

Yaw Angle	Traverse Point Number	Velocity Head in. H_2O	Stack Temp. °F
~~16~~ 6°	A 1	1.55	62
2°	2	1.60	62
-7°	3	1.65	63
8°	B 1	1.50	63
0°	2	1.55	62
-9°	3	1.60	62
+8°	C 1	1.35	63
-3°	C 2	1.45	62
-14°	3	1.55	62
11°	D 1	1.25	62
0°	2	1.40	62
0°	3	1.40	62
		$\sqrt{\Delta P}$ = 1.219	Ts = 62

— = counter clockwise

$Md = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$

$Md = (0.44 \times \quad) + (0.32 \times \quad) + (0.28 \times \quad)$

Md = 28.84

$Ms = Md \times (1 - \frac{\%H_2O}{100}) + 18(\frac{\%H_2O}{100})$

$Ms = (28.84) \times (1 - \frac{}{100}) + 18(\frac{}{100})$

Ms =

Ts = °F = °R (°F + 460)

$Ps = Pb + \frac{S.P.}{13.6} = (\quad) + \frac{}{13.6}$

Ps = in. Hg

$\sqrt{\Delta P}$ =

$Vs = 85.49 \times Cp \times \sqrt{\Delta P} \times \sqrt{\frac{Ts(°R)}{Ps \times Ms}}$

$Vs = 85.49 \times (1.219) \times (0.84) \times \sqrt{\frac{522}{812}}$

Vs = 70.18 ft/s

As = 3.835 ft^2

Qs = Vs x As x 60 s/m

Qs = 70.18 x 3.835 x 60

Qs = 16,148 acfm

$Qs_{std} = Qs \times 17.647 \times \frac{Ps}{Ts} \times (1 - \frac{\%H_2O}{100})$

$Qs_{std} = \quad \times 17.647 \times \frac{}{} \times (1 - \frac{}{100})$

Qs_{std} = dscfm

216 ~~12.6~~ 14.626 87.52

FIELD DATA SHEET

1.5

0.189

Tare Wts:
0.3403
0.3365

Plant: Asphalt Plant D
Sampling Location: TTE Exhaust
Run Number: M315-6 Date: 10/5/98
Pretest Leak Rate: 0.002 cfm @ 10 in. Hg.
Pretest Leak Check: Pitot: ✓ Orsat: N/A

Sample Type: M315 Operator: AFL
Pbar: 30.30 Ps: -7.0
CO2: 0 O2: Ambient
Probe Length/Type: 5 Pitot #: E51
Stack Diameter: 23.5×23.5 As: ~4 sq ft
CP = .84

Nozzle ID: 6-2 Thermocouple #: E51
Assumed Bws: [illegible] Filter #: 100198-01, 04
Meter Box #: 11 Y: 0.9802 ΔH@: 1.99
Post-Test Leak Rate: 0.004 cfm @ 15 in. Hg.
Post-Test Leak Check: Pitot: ✓ Orsat: N/A

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft³	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Actual	Stack Temp. (Ts)	Temperature °F Probe	Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Outlet (Tm out °F)	Pump Vacuum (in. Hg)
A 1	0	0721	685.191										
1	5	0726	688.63	1.3	1.90	1.90	39	235	270	38	29	29	9
1	10	0734	691.50	1.35	1.95	1.95	41	250	247	31	34	31	9
2	15	0739	694.82	1.35	1.97	1.97	43	250	247	34	35	31	10
2	20		698.0	1.3	1.90	1.90	44	248	247	37	35	32	10
3	25		701.6	1.6	2.34	2.34	43	248	247	40	36	32	10
3	30		705.5	1.6	2.32	2.34	43	246	247	40	36	33	10
4	35		709.3	1.6	2.23	2.35	38	247	248	43	36	33	15
4	40		713.08	1.6	2.24	2.4	43	246	246	46	37	34	15
5	45		716.95	1.6	2.24	2.4	46	245	249	48	38	35	15
5	50		720.68	1.6	2.26	2.4	42	248	248	48	36	39	15
6	55		724.55	1.75	2.49	2.4	46	244	247	48	39	36	15
6	60(+1)		729.003	1.70	2.36	2.3	49	244	249	47	38	36	15
C 1	65		732.52	1.25	1.83	1.83	46	250	239	44	41	39	2
1	70		735.77	1.2	1.69	1.7	48	247	242	42	44	39	2
2	75		739.05	1.2	1.69	1.7	50	243	243	43	46	40	2
2	80		742.35	1.35	1.9	1.9	50	248	243	44	46	41	2
3	85		745.90	1.4	1.95	1.95	58	249	246	43	48	43	2
3	90		749.35	1.35	1.9	1.9	57	248	246	44	50	44	2
4	95		753.05	1.45	2.02	2.0	61	245	246	47	53	46	2
4	100	0957	756.71	1.45	2.02	2.0	65	243	247	48	54	48	2
5	105	1002	760.23	1.45	2.02	2.0	64	241	244	48	55	49	2
5	110		763.90	1.5	2.106	2.1	62	246	247	50	56	51	2
6	115		768.02	1.7	2.37	2.5	66	240	247	50	58	52	2
6	120	AFL	772.0	1.7	2.37	2.5	63	238	242	48	58	53	2

ΔVm= ______ $\overline{\sqrt{\Delta p}}$= ______ $\overline{\Delta H}$= ______ $\overline{Ts}$= ______ $\overline{Tm}$= ______

812

Plant Name: Asphalt Plant D **Test Date:** 10/5/98

Run Number: M315-6 **Operator:** AFL

Traverse Point Number	Sampling Time, (min.)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. °F (T_s)	Probe Temp. / Filter Temp. °F	Impinger Temp. °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum In. Hg
		1722						/				
B 1	125	/	775.3	1.2	1.69	1.7	61	241/244	47	57	54	2
1	130	/	778.68	1.2	1.69	1.7	60	242/243	48	59	53	2
2	135	/	782.53	1.3	1.84	2.0	63	244/245	48	60	56	2
2	140	/	786.30	1.3	1.84	2.0	68	241/244	47	60	56	2
3	145	/	789.80	1.3	1.84	2.0	65	243/249	49	62	58	2
3	150	/	793.38	1.3	1.84	2.0	69	243/244	50	63	60	2
4	155	/	797.08	1.2	1.69	1.7	70	240/245	50	66	61	2
4	160	/	800.46	1.4	1.99	2.0	66	244/245	51	65	62	2
5	165	/	804.23	1.45	2.04	2.0	74	243/243	50	67	63	2
5	170	/	808.17	1.5	2.13	2.1	70	242/245	52	68	65	2
6	175	/	812.22	1.75	2.504	2.5	67	244/245	52	70	65	2
6	180	/	816.510	1.7	2.416	2.4	70	239/245	51	70	66	2
A 1	185	/	819.82	1.2	1.69	1.7	68	245/249	59	68	66	2
1	190	/	823.30	1.2	1.70	1.7	69	244/246	54	68	67	2
2	195	/	826.90	1.35	1.937	1.94	67	245/247	58	70	68	2
2	200	/	830.70	1.4	1.98	2.0	76	245/248	58	72	69	2
3	205	/	834.48	1.4	1.98	2.0	73	241/250	57	72	70	2
3	210	/	838.30	1.4	1.98	2.0	74	241/248	56	71	69	2
4	215	/	842.28	1.5	2.13	2.1	76	242/242	59	72	70	2
4	220	/	846.08	1.5	2.13	2.1	77	241/246	57	72	69	2
5	225	/	850.00	1.55	2.21	2.2	71	240/246	59	70	69	2
5	230	/ ~~OFF~~	854.03	1.55	2.21	2.2	74	243/247	57	72	70	2
6	~~~~ 235	8:5810	~~854.9~~	1.55	2.21	2.2	77	242/245	57	73	70	2
OFF 6	~~240~~ 240	~~231.08~~ 1400	862.208	1.60	2.34	2.34	74	241/247	54	77	73	2

← Plant [illegible]

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Sample Recovery Data

Plant: Asphalt Plant D
Run No.: M315-6
Date: 10/5/98
Job No.: 5517.002
Sample Location: TTE Exhaust
Sample Type: M315
Filter No.: 100198-01, 04
Sample Recovery Person: AFL
Comments: 95% spent silica gel

FRONT HALF

Acetone Container No.: ~~N/A~~ M315-6-FH-A
Liquid Level Marked: ✓
Sealed: ✓

Filter Container No.: 100198-01, 100198-04
Sealed: ✓

Description of Filter: Small amount of loose particulate

Samples Stored and Locked: ✓

BACK HALF/MOISTURE

Container No.: ~~N/A~~ M315-6-BH-W

Liquid Level Marked: ✓
Sealed: ✓

Impinger Number	Contents	Initial Volume (ml)	Weight (~~g~~) dwt		
			Initial	Final	Net gm
1	DI Water	100ml	399.7	379.2	-31.9
2	DI Water	100ml	441.9	452.2	16.0
3	EMPTY	—	363.9	367.3	5.3
4	Sil Gel	~200 gm	529.2	~~857.4~~	34.4
5				551.3	23.8
6					
TOTAL					

(1.556 x Final − Initial)

219

Description of Impinger Catch: Cloudy

27 dwt = 42 gm

6

Isokinetic Sampling Data Reduction Spreadsheet
TTE Exhaust
HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

Metered Sample Volume

	M315-6		
Run Start	685.191		
Run End	~~854.030~~ 862.208		
Leak Check 1 Start	729.003		
Leak Check 1 End	729.268		
Leak Check 2 Start	770.503		
Leak Check 2 End	770.550		
Volume Metered	168.463	0.000	0.000
Leak Check 3 Start	816.51		
Leak Check 3 End	816.574		

Impinger/XAD H2O	Init Tare	Final	Net H2O	Gain
	399.7	379.2	-20.5	(31.9)
	441.9	452.2	10.3	16.0
	363.9	367.3	3.4	5.3
	529.2	551.3	22.1	34.4
	0	0	0	0.0
	0	0	0	0.0
	Condensate Collected:		15.3	23.8

0.644644 23.8

42 g
27 dwt
1.55556

220

Effluent Gas Velocity Head, (ΔP

Pt	Δp	M315-6 $\Delta p^{1/2}$	ΔH	T_S	Meter tm Inlet	Meter tm Outlet
D-1	1.3	1.140	1.9	39	29	29
	1.35	1.162	1.95	41	34	31
2	1.35	1.162	1.97	43	35	31
	1.3	1.140	1.9	44	35	32
3	1.6	1.265	2.34	43	36	32
	1.6	1.265	2.34	43	36	33
4	1.6	1.265	2.35	38	36	33
	1.6	1.265	2.4	43	37	34
5	1.6	1.265	2.4	46	38	35
	1.6	1.265	2.4	42	36	39
6	1.75	1.323	2.4	46	39	36
	1.7	1.304	2.3	49	38	36
C-1	1.25	1.118	1.83	46	41	39
	1.2	1.095	1.7	48	44	39
2	1.2	1.095	1.7	50	46	40
	1.35	1.162	1.9	50	46	41
3	1.4	1.183	1.95	58	48	43
	1.35	1.162	1.9	57	50	44
4	1.45	1.204	2	61	53	46
	1.45	1.204	2	65	54	48
5	1.45	1.204	2	64	55	49
	1.5	1.225	2.1	62	56	51
6	1.7	1.304	2.5	66	58	52
	1.7	1.304	2.5	63	58	53
B-1	1.2	1.095	1.7	61	57	54
	1.2	1.095	1.7	60	59	55
2	1.3	1.140	2	63	60	56
	1.3	1.140	2	68	60	56
3	1.3	1.140	2	65	62	58
	1.3	1.140	2	69	63	60
4	1.2	1.095	1.7	70	66	61
	1.4	1.183	2	66	65	62
5	1.45	1.204	2	74	67	63
	1.5	1.225	2.1	70	68	65
6	1.75	1.323	2.5	67	70	65
	1.7	1.304	2.4	70	70	66
A-1	1.2	1.095	1.7	68	68	66
	1.2	1.095	1.7	69	68	67
2	1.35	1.162	1.94	67	70	68
	1.4	1.183	2	76	72	69
3	1.4	1.183	2	73	72	70
	1.4	1.183	2	74	71	69
4	1.5	1.225	2.1	76	72	70
	1.5	1.225	2.1	77	72	69
5	1.55	1.245	2.2	71	70	69
	1.55	1.245	2.2	74	72	70
6	1.55	1.245	2.2	77	73	70
	1.60	1.265	2.34	74	77	73
		0.000				
		0.000				
Average $\Delta P^{1/2}$		1.1983	2.07	60		53.7
		1.4359		60.1		

221

...\Data\M315.xls, bd B

FIELD DATA SHEET

Plant: Asphalt Plant B
Sampling Location: TTE Exhaust
Run Number: M315-7 Date: 10/6/98
Pretest Leak Rate: 0.002 cfm @ 10 in. Hg.
Pretest Leak Check: Pitot: ✓ Orsat: N/A

Sample Type: M315 Operator: AFL
Pbar: 30.45 Ps:
CO2: — O2: Ambient
Probe Length/Type: 5' glass Pitot #: ES-1
Stack Diameter: 23.5" x 23.5" As: ~4 sq. ft

Nozzle ID: GL3 (0.185) Thermocouple #: ES-1
Assumed Bws: 0.01 Filter #: 100198-08 / 08378
Meter Box #: 11 Y: 0.9802 ΔH@: 1.94
Post-Test Leak Rate: 0.003 cfm @ 8 in. Hg.
Post-Test Leak Check: Pitot: ✓ Orsat: N/A

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft³	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Actual	Stack Temp. (Ts)	Temperature °F Probe	Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Outlet (Tm out °F)	Pump Vacuum (in. Hg)
	0	0714	862.757										
D1	5	0719	865.97	1.5 1.3	1.95 1.67	1.7	55 42	250	248	30	30	30	2
1	10	0725	869.29	1.4	1.79	1.8	43	247	249	30	29	28	2
2	15	0731	872.65	1.3	1.67	1.8 2.0	42	249	248	34	32	29	2
2	20	0737	876.08	1.25	1.61	2.0	42	250	248	36	34	31	2
3	25	0743	879.53	1.3	1.79 1.67	2.0	42	248	249	35	34	30	2
3	30	0748	882.95	1.3	1.79 1.67	2.0	43	256	248	35	36	32	2
4	35	0754	886.42	1.3	1.79 1.67	2.0	44	248	247	35	36	32	2
4	40	0759	889.82	1.35	1.73	2.0	48	246	248	36	38	33	2
5	45	0805	893.40	1.4	1.79	2.2	46	248	247	35	36	32	2
5	50	0810	896.93	1.4	1.79	2.2	48	252	247	36	38	33	2
6	55	0815	900.58	1.55	1.99	2.3	48	247	248	36	38	34	2
6	60 ★	0826	907.758	1.5	1.92	2.3	49	246	248	38	40	35	2
C1	65	0842	910.80	1.1	1.41	1.6	47	252	249	38	36	35	1
1	70	0901	913.77	1.1	1.41	1.6	51	252	251	38	40	37	1
2	75	0906	917.03	1.1	1.41	1.8	46	246	251	37	40	36	1
2	80	0912	920.30	1.1	1.41	1.8	54	249	248	38	43	39	1
3	85	0931	923.70	1.2	1.53	1.9	57	248	249	39	44	40	1
3	90	0937	927.00	1.2	1.53	1.8	64	247	249	41	45	44	1
4	95	0943	930.46	1.25	1.60	2.0	58	246	248	41	47	45	2
4	100	0949	933.76	1.2	1.53	1.8	61	246	247	41	48	44	2
5	105	0955	937.21	1.3	1.67	2.0	57	248	246	42	47	45	2
5	110	1000	940.68	1.3	1.67	2.0	61	245	245	43	48	44	2
6	115	1010	944.45	1.5	1.92	2.3	60	245	246	43	48	45	2
6	120 ★	1028	949.132	1.4	1.79	2.2	60	247	246	45	47	45	2
B1	125	1033	952.50	1.2	1.53	1.8	58	252	249	46	48	47	2
1	130	1039	955.80	1.15	1.48	1.8	60	245	248	43	51	47	2

★ See Test Log

ΔVm= ______ $\overline{\sqrt{\Delta p}}$= ______ $\overline{\Delta H}$= ______ $\overline{Ts}$= ______ $\overline{Tm}$= ______

989.97

223

Plant Name: Asphalt Plant D **Test Date:** 10/6/98

Run Number: M315-7 **Operator:** AFL

Traverse Point Number	Sampling Time, (min.)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. °F (T_s)	Probe Temp. / Filter Temp. °F	Impinger Temp. °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum In. Hg
B 2	135*	1044	959.08	1.2	1.54	1.8	59	247 / 247	44	51	48	2
2	140	1050	962.46	1.2	1.54	1.8	64	245 / 248	45	53	49	2
3	145	1106	965.80	1.2	1.54	1.8	60	245 / 246	46	54	50	2
3	150	1111	969.20	1.2	1.64	1.8	62	247 / 246	46	52	50	2
4	155	1117	972.53	1.25	1.60	1.9	65	244 / 247	45	54	51	2
4	160	1123	975.90	1.2	1.54	1.8	64	244 / 246	46	53	50	2
5	165	1130	979.41	1.3	1.67	2.0	62	243 / 248	47	54	51	2
5	170	1136	982.90	1.3	1.67	2.0	63	242 / 247	47	54	51	2
6	175	1142	986.43	1.3	1.67	2.0	63	242 / 247	47	54	51	2
6	180*	1155	989.492	1.45	1.87	2.2	63	246 / 245	48	56	54	2
A 1	185	1200	993.14	1.0	1.28	1.4	69	246 / 247	50	56	55	[illegible]
1	190	1205	996.10	1.0	1.28	1.4	67	248 / 250	50	57	56	1
2	195	1216	999.13	1.05	1.35	1.45	68	245 / 249	51	57	56	1
2	200	1242	1002.27	1.05	1.35	1.45	69	247 / 249	54	59	56	1
3	205	1248	1005.83	1.3	1.67	2.0	62	243 / 250	54	58	57	2
3	210	1253	1009.51	1.3	1.67	2.0	62	250 / 249	54	59	57	2
4	215	1259	1013.09	1.3	1.67	2.0	68	248 / 250	56	62	59	2
4	220	1304	1016.66	1.35	1.75	2.0	64	247 / 250	60	64	60	2
5	225	1310	1020.20	1.35	1.75	2.0	69	245 / 251	59	64	59	2
5	230	1314	1023.8	1.35	1.75	2.0	70	251 / 251	62	64	61	2
6	235	1320	1027.4	1.4	1.81	2.2	71	244 / 251	57	66	61	2
6	240	1326	1031.98	1.4	1.81	2.2	71	245 / 250	59	65	61	2
*xtra time 6.9'								/				
246.9' total								/				

SAMPLE RECOVERY DATA

PLANT Asphalt Plant D Run No. M315-7

DATE 10-6-98 Sample Box No. 2 Job No. 5517.002

SAMPLE LOCATION TTE Exhaust Filter No. 100198-06

TRAIN PREPARER [illegible]

SAMPLE RECOVERY PERSON [illegible]

COMMENTS 90% Sil Gel

FRONT HALF M315-7-FH-A

Acetone Container No. ~~[illegible]~~ N/A Liquid Level Marked ✓ Sealed ✓

Filter Container No. N/A Sealed ✓

Description of Filter small amount of loose particulate

Samples Stored and Locked ✓

BACK HALF/MOISTURE

Container No. ~~N/A~~ M315-7-BH-W

Liquid Level Marked ✓ Sealed ✓

IMP. NO.	CONTENTS	INITIAL VOL (ml)	WEIGHT (grams)		
			INITIAL	FINAL	NET
1	DI Water	100ml	624.1	597.8	-26.3
2	DI Water	100ml	687.8	698.5	10.7
3	EMPTY	EMPTY	568.7	568.7	0
4	Sil Gel	~200grams	766.6	794.4	27.8
5					
6					
TOTAL					12.2

224

Description of Impinger Catch: Cloudy

7

Isokinetic Sampling Data Reduction Spreadsheet
TTE Exhaust
HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

Metered Sample Volume

	M315-7		
Run Start	862.757		
Run End	1031.798		
Leak Check 1 Start	907.758		
Leak Check 1 End	907.826		
Leak Check 2 Start	949.132		
Leak Check 2 End	949.179		
Volume Metered	168.879	0.000	0.000
Leak Check 3 Start	989.492		
Leak Check 3 End	989.539		

Impinger/XAD H2O	Init Tare	Final	Net H2O G
	624.1	597.8	-26.3
	687.8	698.5	10.7
	568.7	568.7	0
	766.6	794.4	27.8
	0	0	0
	0	0	0
	Condensate Collected:		12.2

0.324754 18.98

42 g
27 dwt
1.55556

Effluent Gas Velocity Head, (ΔP)

Pt	M315-7 Δp	ΔH	T_S	Meter tm Inlet	Outlet
D-1	1.3	1.7	42	30	30
	1.4	1.8	43	29	28
2	1.3	2	42	32	29
	1.25	2	42	34	31
3	1.3	2	42	34	30
	1.3	2	43	36	32
4	1.3	2	44	36	32
	1.35	2	48	38	33
5	1.4	2.2	46	36	32
	1.4	2.2	48	38	33
6	1.55	2.3	48	38	34
	1.5	2.3	49	40	35
C-1	1.1	1.6	47	36	35
	1.1	1.6	51	40	37
2	1.1	1.8	46	40	36
	1.1	1.8	54	43	39
3	1.2	1.9	57	44	40
	1.2	1.8	64	45	44
4	1.25	2	58	47	45
	1.2	1.8	61	48	44
5	1.3	2	57	47	45
	1.3	2	61	48	44
6	1.5	2.3	60	48	45
	1.4	2.2	60	47	45
B-1	1.2	1.8	58	48	47
	1.15	1.8	60	51	47
2	1.2	1.8	59	51	48
	1.2	1.8	64	53	49
3	1.2	1.8	60	54	50
	1.2	1.8	62	52	50
4	1.25	1.9	65	54	51
	1.2	1.8	64	53	50
5	1.3	2	62	54	51
	1.3	2	63	54	51
6	1.3	2	63	54	51
	1.45	2.2	63	56	54
A-1	1	1.4	69	56	55
	1	1.4	67	57	56
2	1.05	1.45	68	57	56
	1.05	1.45	69	59	56
3	1.3	2	62	58	57
	1.3	2	62	59	57
4	1.3	2	68	62	59
	1.35	2	64	64	60
5	1.35	2	69	64	59
	1.35	2	70	64	61
6	1.4	2.2	71	66	61
	1.4	2.2	71	65	61
Average $\Delta P^{1/2}$	1.92		58		46.8

...\Data\M315-2&7.xls, bd B

225

FIELD DATA SHEET Cp ~0.84

0.187

Plant: Asphalt Plant D | Sample Type: M315 | Operator: AL | Nozzle ID: GL4 | Thermocouple #: ES-1

Sampling Location: TTE Exhaust | Pbar: 30.43 | Ps: ~~30.43~~ 0.72 | Assumed Bws: 0.01 | Filter #: 100198-06 63390

Run Number: M315-3 | Date: 10/7/98 | CO2: 0 | O2: Ambient | Meter Box #: 11 | Y: 0.9902 | ΔH@: 1.94

Pretest Leak Rate: 0.001 cfm @ 10 in. Hg. | Probe Length/Type: 5' Glass | Pitot #: ES-1 | Post-Test Leak Rate: 0.001 cfm @ 10 in. Hg.

Pretest Leak Check: Pitot: ✓ | Orsat: N/A | Stack Diameter: 23.5×23.5 | As: ~4 sq ft | Post-Test Leak Check: Pitot: ✓ | Orsat: N/A

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft³	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Actual	Stack Temp. (Ts)	Temperature °F Probe	Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Outlet (Tm out °F)	Pump Vacuum (in. Hg)
—	0	0636	31.881										
D1	5	0641	34.83	0.9	1.13	1.3	36	260	257	30	33	53	1
1	10	0646	37.51	0.9	1.13	1.3	42	260	230	30	34	33	6
2	15	0652	40.58	1.1	1.43	1.7	37	260	230	31	35	33	6
2	20	0657	43.73	1.1	1.43	1.8	43	262	241	33	37	33	7
3	25	0703	47.0	1.15	1.49	1.8	41	243	239	34	37	34	7
3	30	0708	50.13	1.15	1.49	1.89	42	270	260	34	38	34	7
4	35	0713	53.53	1.15	1.49	1.8	42	246	242	36	37	34	7
4	40	0720	56.77	1.10	1.43	1.8	43	246	242	34	37	37	9
5	45	0725	60.28	1.20	1.61	2.1	46	247	244	35	35	35	9
5	50	0741	63.65	1.15	1.49	1.9	44	244	242	35	37	34	9
6	55	0756	66.97	1.15	1.49	1.9	45	248	243	35	36	35	10
6	64:06	0808	73.262	1.2	1.61	2.1	50	248	243	35	37	34	10
C1	5	0813	76.2	0.90	1.18	1.3	44	252	245	34	36	36	7
1	10	0819	79.0	0.88	1.18	1.3	44	246	245	36	38	36	7
2	15	0825	81.97	0.83	1.11	1.3	47	245	245	35	37	34	7
2	20	0830	84.80	0.80	1.07	1.3	48	249	245	35	38	35	6
3	25	0836	87.46	0.91	1.18	1.3	54	248	244	37	40	37	7
3	30	0842	90.33	0.88	1.18	1.3	50	249	244	36	41	37	6
4	35	0849	93.20	0.90	1.18	1.3	48	244	245	36	38	37	7
4	40	0855	96.08	0.87	1.17	1.3	48	247	248	34	39	37	7
5	45	0911	98.55	0.93	1.24	1.35	52	246	246	35	39	37	7
5	50	0916	101.96	0.87	1.17	1.3	49	244	246	35	39	36	7
6	55	0957	105.26	1.1	1.43	1.7	53	244	244	35	40	38	7
6	64:43	1014	111.594	1.1	1.43	1.7	50	241	244	40	44	42	8

ΔVm= ______ $\overline{\sqrt{\Delta p}}$= ______ $\overline{\Delta H}$= ______ $\overline{Ts}$= ______ $\overline{Tm}$= ______

422

Plant Name: Asphalt Plant D **Test Date:** 10/07/98

Run Number: M315-8 **Operator:** [illegible]

Traverse Point Number	Sampling Time, (min.)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. °F (T_s)	Probe Temp. / Filter Temp. °F	Impinger Temp. °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum In. Hg
B1	5	1019	114.58	0.95	1.3	1.4	51	246/244	43	48	46	6
1	10	1024	117.68	0.95	1.3	1.5	55	244/243	42	49	46	6
2	15	1033	120.78	0.90	1.22	1.3	56	245/242	42	51	47	7
2	20	1038	123.70	0.90	1.22	1.3	56	245/242	42	51	47	7
3	25	1044	126.72	0.95	1.3	1.5	61	241/243	43	51	48	7
3	30	1103	129.83	0.95	1.3	1.5	64	241/243	44	52	49	7
4	35	1108	133.10	1.1	1.43	1.8	66	242/242	47	54	52	7
4	40	1115	136.45	1.05	1.40	1.7	68	240/240	46	55	53	7
5	45	1120	139.75	1.1	1.43	1.8	70	241/241	46	56	53	8
5	50	1126	143.09	1.1	1.43	1.8	67	237/241	46	57	54	8
6	55	1135	146.65	1.3	1.76	2.0	67	238/242	46	57	55	8
6	60.32	1140	150.509	1.3	1.76	2.0	66	242/242	49	57	56	8
A1	5	1155	153.86	1.1	1.43	1.8	63	241/245	53	57	56	8
1	10	1200	157.22	1.1	1.43	1.8	66	239/243	50	57	57	8
2	15	1210	160.53	1.1	1.43	1.8	66	240/243	50	59	57	8
2	20	1215	163.83	1.1	1.43	1.8	67	240/243	54	59	57	8
3	25	1228	167.38	1.2	1.61	2.1	72	244/246	53	60	59	8
3	30	1234	170.90	1.3	1.76	2.0	63	243/244	53	59	58	9
4	35	1240	174.45	1.3	1.76	2.0	62	239/244	51	60	58	9
4	40	1247	178.00	1.3	1.76	2.0	67	240/244	51	61	58	9
5	45	1252	181.53	1.3	1.76	2.0	63	241/246	53	59	59	9
5	50	1301	185.06	1.3	1.76	2.0	74	243/246	52	60	59	9
6	55	1306	188.58	1.3	1.76	2.0	67	241/244	54	59	58	9
6	60.45	1313	192.679	1.3	1.76	2.0	72	240/245	52	60	58	9

Total = 250.1

PES

SAMPLE RECOVERY DATA

Plant: Asphalt Plant D   Run No.: M315-8

Date: 10/17/96   Sample Box No.: 2   Job No.: 5517002

Sample Location: TTE Exhaust

Sample Type: M315   Filter No.: 100198-06

Sample Recovery Person: AFL

Comments: 80% spent silica gel

FRONT HALF M315-8-FH-A

Acetone Container No.: ~~N/A~~ AFL   Liquid Level Marked: ✓   Sealed: ✓

Filter Container No.: N/A   Sealed: ✓

Description of Filter: Some loose particulate

Samples Stored and Locked: ✓

BACK HALF/MOISTURE

Container No.: ~~N/A~~ AFL M315-8-BH-W

Liquid Level Marked: ✓   Sealed: ✓

IMP. NO.	CONTENTS	INITIAL VOL (ml)	WEIGHT (grams) INITIAL	FINAL	NET
1	DI Water	100	586.1	590.1	4.0
2	DI Water	100	642.4	634.3	-8.1
3	Empty	0 ~~[illegible]~~ AFL	567.6	569.0	1.4
4	Sil Gel	~~[illegible]~~ grams AFL	~~737.4~~ AFL 887.4	914.4	27.0
5					
6					
TOTAL					24.3

Description of Impinger Catch: cloudy

228

8

Isokinetic Sampling Data Reduction Spreadsheet

TTE Exhaust

HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

Metered Sample Volume

	M315-8		
Run Start	31.881		
Run End	192.679		
Leak Check 1 Start	72.262		
Leak Check 1 End	73.333		
Leak Check 2 Start	111.594		
Leak Check 2 End	111.678		
Volume Metered	159.567	0.000	0.000
Leak Check 3 Start	150.509		
Leak Check 3 End	150.585		

Impinger/XAD H2O	Init Tare	Final	Net H2O G
	586.1	590.1	4
	642.4	634.3	-8.1
	567.6	569	1.4
	887.4	914.4	27
	0	0	0
	0	0	0
		Condensate Collected:	24.3

0.681722 37.8

42 g
27 dwt
1.55556

Effluent Gas Velocity Head, (ΔP)

Pt	Δp	ΔH	T_S	Meter tm Inlet	Meter tm Outlet
D-1	0.9	1.3	36	33	33
	0.9	1.3	42	34	33
2	1.1	1.7	37	35	33
	1.1	1.8	43	37	33
3	1.15	1.8	41	37	34
	1.15	1.9	42	38	34
4	1.15	1.8	42	37	34
	1.1	1.8	43	37	37
5	1.2	2.1	46	38	35
	1.15	1.7	48	37	34
6	1.15	1.9	45	36	35
	1.2	2.1	50	37	34
C-1	0.9	1.3	44	36	36
	0.88	1.3	44	38	36
2	0.83	1.3	47	37	34
	0.8	1.3	48	38	35
3	0.91	1.3	54	40	37
	0.88	1.3	50	41	37
4	0.9	1.3	48	38	37
	0.87	1.3	48	39	37
5	0.93	1.35	52	39	37
	0.87	1.3	49	39	36
6	1.1	1.7	53	40	38
	1.1	1.7	50	44	42
B-1	0.95	1.4	51	48	46
	0.95	1.5	55	49	46
2	0.9	1.3	56	51	47
	0.9	1.3	56	51	47
3	0.95	1.5	61	51	48
	0.95	1.5	64	52	49
4	1.1	1.8	66	54	52
	1.05	1.7	68	55	53
5	1.1	1.8	70	56	53
	1.1	1.8	67	57	54
6	1.3	2	67	57	55
	1.3	2	66	57	56
A-1	1.1	1.8	63	57	56
	1.1	1.8	66	57	57
2	1.1	1.8	66	59	57
	1.1	1.8	67	59	57
3	1.2	2.1	72	60	59
	1.3	2	63	59	58
4	1.3	2	62	60	58
	1.3	2	67	61	58
5	1.3	2	63	59	59
	1.3	2	74	60	59
6	1.3	2	67	59	58
	1.3	2	72	60	58
Average $\Delta P^{1/2}$		1.68	55.2		45.9

\Data\M315-3&8.xls, bd B

229

FB-2

FIELD DATA SHEET

0,187

230

Plant: Asphalt Plant D
Sampling Location: TTE Exhaust
Run Number: M315FB2 Date: 10/7/98
Pretest Leak Rate: 0,015 cfm @ 15 in. Hg.
Pretest Leak Check: Pitot: N/A Orsat: N/A

Sample Type: 315 Operator: AFL
Pbar: 30,35 Ps: NA
CO2: 0 O2: Ambient
Probe Length/Type: 5' glass Pitot #: ES-1
Stack Diameter: — As: —

Nozzle ID: GL4 Thermocouple #: ES-1
Assumed Bws: 0,00 Filter #: 100198-2/0,3361
Meter Box #: 15 Y: 1,001 ΔH@: 1,83
Post-Test Leak Rate: 0,05 cfm @ 15 in. Hg.
Post-Test Leak Check: Pitot: NA Orsat: NA

Traverse Point Number	Sampling Time (min)	Clock Time (24-hour clock)	Gas Meter Reading (Vm) ft^3	Velocity Head (Δp) in H2O	Orifice Pressure Differential (ΔH) in H2O Desired	Orifice Pressure Differential (ΔH) in H2O Actual	Stack Temp. (Ts)	Temperature °F Probe	Temperature °F Filter	Impinger Temp. °F	Dry Gas Meter Temp. Inlet (Tm in °F)	Dry Gas Meter Temp. Outlet (Tm out °F)	Pump Vacuum (in. Hg)
		1516	267,322										
		1518	267,438	NA	NA	NA	56	250	250	53	57	56	
		1520	267,525	↓	↓	↓	70	247	249	51	57	56	
		1522	267,637				70	247	249	51	57	56	
		1524	267,700				70	248	249	52	58	57	

ΔVm= ______ $\overline{\sqrt{\Delta p}}$= ______ $\overline{\Delta H}$= ______ $\overline{Ts}$= ______ $\overline{Tm}$= ______

231

EASTERN RESEARCH GROUP, INC.

Eastern Research Group
Sample Chain of Custody

PES Filters

Filter Pre-Weights:

Filter Sample ID:	Weigh 1 (10/01/98) (Approx. 9:00 AM)	Weigh 2 (10/01/98) (Approx. 3:00 PM)	Avg. weight of filter (g)	Abs. Diff. of Weigh1-Weigh2	Constant Weight	Avg. weight of filters
100198-01	0.3403	0.3402	0.3403	0.0001	YES	0.3403
100198-02	0.3361	0.3361	0.3361	0.0000	YES	0.3361
100198-03	0.3387	0.3385	0.3386	0.0002	YES	0.3386
100198-04	0.3362	0.3362	0.3362	0.0000	YES	0.3362
100198-05	0.3408	0.3409	0.3409	0.0001	YES	0.3409
100198-06	0.3389	0.3390	0.3390	0.0001	YES	0.3390
100198-07	0.3390	0.3391	0.3391	0.0001	YES	0.3391
100198-08	0.3377	0.3378	0.3378	0.0001	YES	0.3378
100198-09	0.3362	0.3363	0.3363	0.0001	YES	0.3363
100198-10	0.3384	0.3384	0.3384	0.0000	YES	0.3384
DI Water Blank	176.4277	176.4278	176.4278	0.0001	YES	

Relinquished by: [signature]
Date: 10/2/98

Received by: ____________________
Date: ____________________

232

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Sample Chain of Custody Record

PLANT: Asphalt Plant D	PROJECT NO.: S617.002
RECOVERY PERSON: [signature]	SAMPLERS: [signature]

Sample Identification	Sample Description	Number of Containers	Analytical Request: PM Analysis	Analytical Request: MCEM Analysis	Transfer Documentation	Comments
M315-1-F ✓	Method 315 Filter – Petri Dish	one	yes	yes	✓	Tested 10/5/98 / very small amt loose partic
M315-1-FH-A ✓	Method 315 Front Half Acetone rinse (500 ml.)	one	yes	yes	✓	
M315-1-FH-M ✓	Method 315 Front Half MeCl rinse (250 ml.)	one		yes	✓	
M315-1-BH-W ✓	Method 315 Back Half & BH Water rinse (500 ml.)	one		yes	✓	cloudy
M315-1-BH-S ✓	Method 315 Back Half Solvent rinse (500 ml.)	one		yes	✓	
M315-2-F ✓	Method 315 Filter → Petri Dish	one	yes	yes	✓	Tested 10/6/98 & very small amt loose particulate
M315-2-FH-A	Method 315 Front Half Acetone rinse (500 ml.)	one	yes	yes	✓	
M315-2-FH-M	Method 315 Front Half MeCl rinse (500 ml.)	one		yes	✓	
M315-2-BH-W	Method 315 Back Half & BH Water rinse (500 ml.)	one		yes	✓	Cloudy
M315-2-BH-S	Method 315 Back Half Solvent rinse (250 ml.)	one		yes	✓	
M315-3-F	Method 315 Filter → Petri Dish	one	yes	yes	✓	Tested 10/7/98
M315-3-FH-A	Method 315 Front Half Acetone rinse (500 ml.)	one	yes	yes	✓	
M315-3-FH-M	Method 315 Front Half MeCl rinse (500 ml.)	one		yes	✓	
M315-3-BH-W	Method 315 Back Half & BH Water rinse (500 ml.)	one		yes	✓	Cloudy
M315-3-BH-S	Method 315 Back Half Solvent rinse (500 ml.)	one		yes	✓	
~~M315-4-F~~	~~Method 315 Filter~~	0	~~yes~~	~~yes~~		
~~M315-4-FH-A~~	~~Method 315 Front Half Acetone rinse~~		~~yes~~	~~yes~~		
~~M315-4-FH-M~~	~~Method 315 Front Half MeCl rinse~~			~~yes~~		
~~M315-4-BH-W~~	~~Method 315 Back Half & BH Water rinse~~			~~yes~~		
~~M315-4-BH-S~~	~~Method 315 Back Half Solvent rinse~~			~~yes~~		
~~M315-5-F~~	~~Method 315 Filter~~	0	~~yes~~	~~yes~~		
~~M315-5-FH-A~~	~~Method 315 Front Half Acetone rinse~~		~~yes~~	~~yes~~		
~~M315-5-FH-M~~	~~Method 315 Front Half MeCl rinse~~			~~yes~~		
~~M315-5-BH-W~~	~~Method 315 Back Half & BH Water rinse~~			~~yes~~		
~~M315-5-BH-S~~	~~Method 315 Back Half Solvent rinse~~			~~yes~~		

		Date	Time
Relinquished by: Frank J. Phoenix	[signature]	10/13/98	4:40
~~Relinquished by:~~ Received by: Linh Nguyen	[signature]	10/13/98	4:42

custody.xls

233

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Sample Chain of Custody Record

PLANT: Asphalt Plant D RECOVERY PERSON: AFL	PROJECT NO.: S517.002 SAMPLERS: AFL

Sample Identification	Sample Description	Number of Containers	Analytical Request: PM Analysis	Analytical Request: MCEM Analysis	Transfer Documentation	Comments
						100198-01, -04
M315-6-F	Method 315 Filter 2 petri dishes	2	yes	yes	✓	2 filters: some loose particulate
M315-6-FH-A	Method 315 Front Half Acetone rinse 250ml jar	1	yes	yes	✓	
M315-6-FH-M	Method 315 Front Half MeCl rinse 250ml jar	1		yes	✓	
M315-6-BH-W	Method 315 Back Half & BH Water rinse 500ml jar	1		yes	✓	cloudy
M315-6-BH-S	Method 315 Back Half Solvent rinse 500ml jar	1		yes	✓	
						100198-08
M315-7-F	Method 315 Filter petri dish	1	yes	yes	✓	
M315-7-FH-A	Method 315 Front Half Acetone rinse 250ml jar	1	yes	yes	✓	
M315-7-FH-M	Method 315 Front Half MeCl rinse 250ml jar	1		yes	✓	
M315-7-BH-W	Method 315 Back Half & BH Water rinse 500ml jar	1		yes	✓	cloudy
M315-7-BH-S	Method 315 Back Half Solvent rinse 500ml jar	1		yes	✓	
M315-8-F	Method 315 Filter petri dish	1	yes	yes	✓	100198-06
M315-8-FH-A	Method 315 Front Half Acetone rinse ~~500ml jar~~	1	yes	yes	✓	250 ml jar
M315-8-FH-M	Method 315 Front Half MeCl rinse 500ml jar	1		yes	✓	
M315-8-BH-W	Method 315 Back Half & BH Water rinse 500ml jar	1		yes	✓	cloudy
M315-8-BH-S	Method 315 Back Half Solvent rinse 500ml jar	1		yes	✓	
~~M315-9-F~~	~~Method 315 Filter~~		~~yes~~	~~yes~~		
~~M315-9-FH-A~~	~~Method 315 Front Half Acetone rinse~~		~~yes~~	~~yes~~		
~~M315-9-FH-M~~	~~Method 315 Front Half MeCl rinse~~			~~yes~~		
~~M315-9-BH-W~~	~~Method 315 Back Half & BH Water rinse~~			~~yes~~		
~~M315-9-BH-S~~	~~Method 315 Back Half Solvent rinse~~			~~yes~~		
~~M315-10-F~~	~~Method 315 Filter~~		~~yes~~	~~yes~~		
~~M315-10-FH-A~~	~~Method 315 Front Half Acetone rinse~~		~~yes~~	~~yes~~		
~~M315-10-FH-M~~	~~Method 315 Front Half MeCl rinse~~			~~yes~~		
~~M315-10-BH-W~~	~~Method 315 Back Half & BH Water rinse~~			~~yes~~		
~~M315-10-BH-S~~	~~Method 315 Back Half Solvent rinse~~			~~yes~~		

		Date	Time		
Relinquished by: Frank Phoenix	Frank Phoenix (signature)	10/13/98	4:40		
~~Relinquished by:~~ Received by: Linh Nguyen	(signature)	10/13/98	4:42		

234

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Sample Chain of Custody Record

PLANT: Asphalt Plant D	PROJECT NO.: S517.002
RECOVERY PERSON: Dennis D Holzschuh	SAMPLERS: Dennis D Holzschuh

Sample Identification	Sample Description	Number of Containers	Analytical Request: PM Analysis	Analytical Request: MCEM Analysis	Transfer Documentation	Comments
M315-FB1-F	Method 315 Filter (Petri Dish)	one	yes	yes	✓	Tested 10/7/98
M315-FB1-FH-A	Method 315 Front Half Acetone rinse	One	yes	yes	✓	
M315-FB1-FH-M	Method 315 Front Half MeCl rinse	One		yes	✓	
M315-FB1-BH-W	Method 315 Back Half & BH Water rinse	One		yes	✓	
M315-FB1-BH-S	Method 315 Back Half Solvent rinse	One		yes	✓	
M315-FB2-F	Method 315 Filter (PETRI DISH)	ONE	yes	yes	✓	
M315-FB2-FH-A	Method 315 Front Half Acetone rinse	ONE	yes	yes	✓	
M315-FB2-FH-M	Method 315 Front Half MeCl rinse	ONE		yes	✓	
M315-FB2-BH-W	Method 315 Back Half & BH Water rinse	ONE		yes	✓	
M315-FB2-BH-S	Method 315 Back Half Solvent rinse	ONE		yes	✓	
M315-Filter Blk	Method 315 Filter Blank (PETRI DISH)	ONE	yes	yes	✓	
M315-ACE Blk	Method 315 Acetone Blank	ONE	yes	yes	✓	
M315-MeCl Blk	Method 315 Methylene Chloride Blank	ONE	yes	yes	✓	
M315-DI Water Blk	Method 315 DI Water Reagent Blank	ONE		yes	✓	

Relinquished by: Frank J. Phoenix	[signature]	Date 10/13/98	Time 4:40
~~Relinquished by:~~ received by: Linh Nguyen	[signature]	Date 10/13/98	Time 4:42

Custody

235

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Sample Chain of Custody Record

PLANT: Asphalt Plant D RECOVERY PERSON: DEREK HAWKES	PROJECT NO.: S517.002 SAMPLERS: DEREK HAWKES

Sample Identification	Sample Description	Number of Containers	Analytical Request: PM Analysis	Analytical Request: MCEM Analysis	Transfer Documentation	Comments
CP1	Ceiling Plate		yes	yes	✓	
CP2	Ceiling Plate		yes	yes	✓	
CP3	Ceiling Plate		yes	yes	✓	
CP4	Ceiling Plate		yes	yes	✓	
CP5	Ceiling Plate		yes	yes	✓	
~~CP6~~	~~Ceiling Plate~~		~~yes~~	~~yes~~		DID NOT COLLECT CP6
~~CP7~~	~~Ceiling Plate~~		~~yes~~	~~yes~~		" " " CP7
CPBlank	Ceiling Plate Blank		yes	yes	✓	
BE1	Ceiling Beam		yes	yes	✓	
BE2	Ceiling Beam		yes	yes	✓	
BE3	Ceiling Beam		yes	yes	✓	
BE4	Ceiling Beam		yes	yes	✓	
BE5	Ceiling Beam		yes	yes	✓	
~~BE6~~	~~Ceiling Beam~~		~~yes~~	~~yes~~		DID NOT COLLECT BE6
~~BE7~~	~~Ceiling Beam~~		~~yes~~	~~yes~~		" " " BE7
BEBlank	Ceiling Beam Blank		yes	yes	✓	
E1A	Elbow Bend (one side)		yes	yes	✓	
E1B	Elbow Bend (three sides)		yes	yes	✓	
E1Blank	Elbow Bend Blank		yes	yes	✓	
E2A	Elbow Bend (one side)		yes	yes	✓	
E2B	Elbow Bend (three sides)		yes	yes	✓	
E2Blank	Elbow Bend Blank		yes	yes	✓	

≈ 25.

		Date	Time
Relinquished by: Frank J Phoenix	Frank J Phoenix	10/14/98	1:23
~~Relinquished by:~~ Received by: Mark Owens	Mark Owens	10/14/98	1:23

APPENDIX F

QA/QC DATA

NOZZLE CALIBRATION SHEET

DATE: 8-5-98 CALIBRATION BY: Dennis Holzschuh

Nozzle Identification Number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	D_{avg}
GL-1	0.188	0.188	0.188	-0-	0.188

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_{avg} = average of D_1, D_2, D_3.

NOZZLE CALIBRATION SHEET

DATE: 8-5-98 CALIBRATION BY: DDH

Nozzle Identification Number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	D_{avg}
GL-2	.188	.190	.190	.002	.189

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_{avg} = average of D_1, D_2, D_3.

NOZZLE CALIBRATION SHEET

DATE: 8-5-98 CALIBRATION BY: DDH

Nozzle Identification Number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	D_{avg}
GL-3	.185	.185	.185	0	.185

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_{avg}= average of D_1, D_2, D_3.

NOZZLE CALIBRATION SHEET

DATE: 8-5-98 CALIBRATION BY: DDH

Nozzle Identification Number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	D_{avg}
6L-4	.187	.187	.187	0	.187

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_{avg}= average of D_1, D_2, D_3.

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. ES - 1 **Sensor Type** K -TC **Length** ______
Ambient Temp. °F 72 **Barometric Pressure, "Hg** 30.15
Reference Temp. Sensor: 72

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
	1	ICE H2O	32	32	0	Y	DDH
	2	Amb. Air	72	72	0	Y	DDH
	3	Boil H2O	210	210	0	Y	DDH
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

242

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

LEAK CHECK
0.0 @ 29" Hg

Initial Dry Gas Meter Calibration Form (English Units)

Date: 10-1-98 P_{bar} in Hg 29.85 Calibrator: JWB Meter Box No. MB-11

ΔH = 0.5 15" Hg VAC

Trial	Trial Duration (min)	Dry Gas Meter: Gas Volume Initial (ft³)	Final (ft³)	Net (ft³)	Meter Temperatures: Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5.0	626.565	625.560	1.995	77	77	77	77	77	77
2	5.0	628.560	630.560	2.000	77	79	78	77	78	78
3	5.0	630.560	632.571	2.011	79	80	80	78	79	79

Trial	Reference Meter: Gas Volume Initial (ft³)	Final (ft³)	Net (ft³)	Meter Temperature: Initial (°F)	Final (°F)	Avg. (°F)	Meter Box Correction Factor γ	Reference Orifice Press $\Delta H_@$ (in. H_2O)	γ	$\Delta H_@$
									$\overline{.9910}$	$\overline{1.901}$
1	787.701	789.648	1.947	79	79	79	#DIV/0!	#DIV/0!	.9711	1.922
2	789.648	791.661	2.013	78	79	79	#DIV/0!	#DIV/0!	1.003	1.893
3	791.667	793.616	1.949	79	80	80	#DIV/0!	#DIV/0!	.9988	1.897

ΔH = 0.75 7"

Trial	Trial Duration (min)	Dry Gas Meter: Gas Volume Initial (ft³)	Final (ft³)	Net (ft³)	Meter Temperatures: Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5.0	640.201	642.667	2.466	82	82	82	80	80	80
2	5.0	642.667	645.133	2.466	82	83	83	80	81	81
3	5.0	645.133	647.623	2.490	83	84	84	81	82	82

Trial	Reference Meter: Gas Volume Initial (ft³)	Final (ft³)	Net (ft³)	Meter Temperature: Initial (°F)	Final (°F)	Avg. (°F)	Meter Box Correction Factor γ	Reference Orifice Press $\Delta H_@$ (in. H_2O)	γ	$\Delta H_@$
									$\overline{.9645}$	$\overline{1.888}$
1	801.020	803.396	2.376	79	79	79	#DIV/0!	#DIV/0!	.9653	1.894
2	803.396	805.773	2.377	79	79	79	#DIV/0!	#DIV/0!	.9675	1.889
3	805.773	808.152	2.379	79	79	79	#DIV/0!	#DIV/0!	.9607	1.882

ΔH = 1.0 1''

Trial	Trial Duration (min)	Dry Gas Meter: Gas Volume Initial (ft³)	Final (ft³)	Net (ft³)	Meter Temperatures: Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5.0	647.623	650.453	2.830	[illegible]	85	85	82	82	82
2	5.0	650.453	653.260	2.807	85	86	86	82	82	82
3	5.0	653.260	656.090	2.830	86	87	87	82	83	83

	Reference Meter						Meter Box	Reference	.9679	1.932
	Gas Volume			Meter Temperature			Correction	Orifice Press		
Trial	Initial (ft³)	Final (ft³)	Net (ft³)	Initial (°F)	Final (°F)	Avg. (°F)	Factor γ	ΔH@ (in. H_2O)	γ	ΔH@
1	808.152	810.863	2.711	79	79	79	#DIV/0!	#DIV/0!	.9662	1.92
2	810.863	813.555	2.692	79	79	79	#DIV/0!	#DIV/0!	.9691	1.949
3	813.555	816.272	2.717	79	79	79	#DIV/0!	#DIV/0!	.9684	1.921

ΔH = 2.0

		Dry Gas Meter								
	Trial	Gas Volume			Meter Temperatures					
Trial	Duration (min)	Initial (ft³)	Final (ft³)	Net (ft³)	Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5.0	656.090	659.958	3.868	86	88	87	83	84	84
2	5.0	659.958	663.833	3.875	88	89	89	84	84	84
3	5.0	663.833	667.711	3.878	89	90	90	84	85	85

	Reference Meter						Meter Box	Reference	.9777	2.005
	Gas Volume			Meter Temperature			Correction	Orifice Press		
Trial	Initial (ft³)	Final (ft³)	Net (ft³)	Initial (°F)	Final (°F)	Avg. (°F)	Factor γ	ΔH@ (in. H_2O)	γ	ΔH@
1	816.272	820.022	3.750	79	79	79	#DIV/0!	#DIV/0!	.9773	2.009
2	820.022	823.773	3.751	79	79	79	#DIV/0!	#DIV/0!	.9776	2.004
3	823.773	827.529	3.756	79	80	80	#DIV/0!	#DIV/0!	.9781	2.003

ΔH = 4.0

		Dry Gas Meter								
	Trial	Gas Volume			Meter Temperatures					
Trial	Duration (min)	Initial (ft³)	Final (ft³)	Net (ft³)	Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5.0	667.711	673.084	5.373	88	90	89	85	85	85
2	5.0	673.084	678.469	5.385	90	90	90	85	85	85
3	5.0	678.469	683.845	5.376	89	90	90	85	85	85

	Reference Meter						Meter Box	Reference	1.000	1.978
	Gas Volume			Meter Temperature			Correction	Orifice Press		
Trial	Initial (ft³)	Final (ft³)	Net (ft³)	Initial (°F)	Final (°F)	Avg. (°F)	Factor γ	ΔH@ (in. H_2O)	γ	ΔH@
1	827.529	832.878	5.349	80	80	80	#DIV/0!	#DIV/0!	.9986	1.979
2	832.878	838.240	5.362	80	80	80	#DIV/0!	#DIV/0!	1.006	1.965
3	838.240	843.570	5.330	80	80	80	#DIV/0!	#DIV/0!	.9963	1.989

Calibration Results

ΔH	γ	ΔH@
0.50	#DIV/0!	#DIV/0!
0.75	#DIV/0!	#DIV/0!
1.0	#DIV/0!	#DIV/0!
2.0	#DIV/0!	#DIV/0!
4.0	#DIV/0!	#DIV/0!

Meter Box Calibration Factor #DIV/0! .9802

Meter Box Reference Orifice Pressure #DIV/0! 1.94

master.xls 8/22/97

244

245

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Posttest Dry Gas Meter Calibration Form (English Units)

Pretest Calibration Factor 0.9802
System Vacuum Setting, (in Hg) 3.5
Reference Meter Correction Factor 1.0077
Date: 10/12/98 P_{bar}, in Hg 30.20 Calibrator: D. D. Holzschuh Meter Box No. MB-11

ΔH =	2	Dry Gas Meter MB-11								
Trial	Duration (min)	Initial (ft³)	Final (ft³)	Net (ft³)	Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	Final, Outlet (°F)	Avg. Outlet (°F)
1	10	202.206	209.703	7.497	71	74	72.5	71	73	72
2	10	209.703	217.134	7.431	74	76	75	72	73	72.5
3	10	217.134	224.633	7.499	76	78	77	73	74	73.5

	Reference Meter						Meter Box Correction Factor	Reference Orifice Press
	Gas Volume			Meter Temperature				
Trial	Initial (ft³)	Final (ft³)	Net (ft³)	Initial (°F)	Final (°F)	Avg. (°F)	γ	$\Delta H_@$ (in. H2O)
1	14.958	22.368	7.410	74	74	74	0.988	2.040
2	22.368	29.73	7.362	74	74	74	0.993	2.061
3	29.73	37.127	7.397	74	73	73.5	0.992	2.032
						AVERAGE:	0.9911	2.044
						% Change:	1.11%	

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Initial Dry Gas Meter Calibration Form (English Units)

Date: 10/1/98   Calibrator: DDH   Meter Box No.: RMB-15

P_{bar}, in Hg 29.85   Reference Meter Correction Factor: 1.0077 (10/5/97)

ΔH = 0.5

	Dry Gas Meter RMB-15									
	Trial Duration	Gas Volume			Meter Temperatures					
Trial	(min)	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5	730.932	732.982	2.050	72	72	72	72	72	72
2	5	732.982	735.020	2.038	72	73	72.5	72	72	72
3	5	735.020	737.058	2.038	73	73	73	72	73	72.5

	Reference Meter						Meter Box	Reference
	Gas Volume			Meter Temperature			Correction	Orifice Press
Trial	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial (°F)	Final (°F)	Avg. (°F)	Factor γ	$\Delta H_@$ (in. H_2O)
1	844.147	846.153	2.006	74	74	74	0.981	1.75
2	846.153	848.168	2.015	74	74	74	0.992	1.74
3	848.168	850.187	2.019	74	74	74	0.995	1.73

ΔH = 0.75

	Dry Gas Meter RMB-15									
	Trial Duration	Gas Volume			Meter Temperatures					
Trial	(min)	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5	737.058	739.547	2.489	73	75	74	73	73	73
2	5	739.547	742.023	2.476	74	77	75.5	73	74	73.5
3	5	742.023	744.495	2.472	76	78	77	74	74	74

	Reference Meter						Meter Box	Reference
	Gas Volume			Meter Temperature			Correction	Orifice Press
Trial	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial (°F)	Final (°F)	Avg. (°F)	Factor γ	$\Delta H_@$ (in. H_2O)
1	850.187	852.653	2.466	74	74	74	0.996	1.74
2	852.653	855.109	2.456	74	74	74	0.999	1.75
3	855.109	857.530	2.421	74	74	74	0.988	1.80

ΔH = 1.0

	Dry Gas Meter RMB-15									
	Trial Duration	Gas Volume			Meter Temperatures					
Trial	(min)	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5	744.495	747.314	2.819	77	80	78.5	74	75	74.5
2	5	747.314	750.143	2.829	79	81	80	75	76	75.5
3	5	750.153	752.971	2.818	80	82	81	76	77	76.5

	Reference Meter						Meter Box	Reference
	Gas Volume			Meter Temperature			Correction	Orifice Press
Trial	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial (°F)	Final (°F)	Avg. (°F)	Factor γ	$\Delta H_@$ (in. H_2O)
1	857.53	860.327	2.797	74	74	74	1.002	1.79
2	860.327	863.120	2.793	74	74	74	0.999	1.79
3	863.120	865.899	2.779	74	74	74	1.000	1.81

246

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

ΔH = 2.0 — Dry Gas Meter RMB-15

Trial	Trial Duration (min)	Gas Volume Initial (ft^3)	Gas Volume Final (ft^3)	Gas Volume Net (ft^3)	Meter Temperatures Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5	752.971	756.800	3.829	81	84	82.5	77	78	77.5
2	5	756.800	760.694	3.894	83	85	84	78	78	78
3	5	760.694	764.523	3.829	84	86	85	78	79	78.5

Trial	Reference Meter Gas Volume Initial (ft^3)	Final (ft^3)	Net (ft^3)	Meter Temperature Initial (°F)	Final (°F)	Avg. (°F)	Meter Box Correction Factor γ	Reference Orifice Press $\Delta H_@$ (in. H_2O)
1	865.899	869.679	3.780	74	74	74	1.001	1.95
2	869.679	873.482	3.803	74	74	74	0.992	1.93
3	873.482	877.283	3.801	74	74	74	1.010	1.93

ΔH = 4.0 — Dry Gas Meter RMB-15

Trial	Trial Duration (min)	Gas Volume Initial (ft^3)	Gas Volume Final (ft^3)	Gas Volume Net (ft^3)	Meter Temperatures Initial, Inlet (°F)	Final, Inlet (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	inal, Outle (°F)	Avg. Outlet (°F)
1	5	764.523	769.997	5.474	92	94	93	85	85	85
2	5	769.997	775.385	5.388	93	97	95	87	87	87
3	5	775.385	780.990	5.605	92	94	93	85	85	85

Trial	Reference Meter Gas Volume Initial (ft^3)	Final (ft^3)	Net (ft^3)	Meter Temperature Initial (°F)	Final (°F)	Avg. (°F)	Meter Box Correction Factor γ	Reference Orifice Press $\Delta H_@$ (in. H_2O)
1	877.283	882.686	5.403	73	74	73.5	1.014	1.89
2	882.686	888.028	5.342	73	73	73	1.023	1.92
3	889.028	894.463	5.435	73	74	73.5	0.996	1.87

Calibration Results

ΔH	γ	$\Delta H_@$
0.50	0.989	1.74
0.75	0.994	1.76
1.0	1.001	1.80
2.0	1.001	1.94
4.0	1.018	1.90

Dry Gas Meter RMB-15 on 10/01/98

Meter Box Calibration Factor	**1.001**
Meter Box Reference Orifice Pressure	**1.83**

247

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Posttest Dry Gas Meter Calibration Form (English Units)

Pretest Calibration Factor	1.001
System Vacuum Setting, (in Hg)	7
Reference Meter Correction Factor	1.008

Date: 10/13/98 P_{bar}, in Hg 30.10 Calibrator: DDH Meter Box No. RMB-15

ΔH = 2

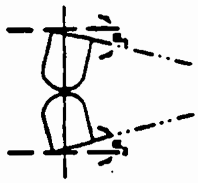
		Dry Gas Meter								
Trial	Duration (min)	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial, Inlet (°F)	Final, Inle (°F)	Avg. Inlet (°F)	Initial, Outlet (°F)	Final, Outlet (°F)	Avg. Outlet (°F)
1	7	283.996	289.263	5.267	68	68	68	67	67	67
2	7	289.263	294.547	5.284	68	70	69	67	67	67
3	7	294.547	299.823	5.276	71	72	71.5	68	68	68

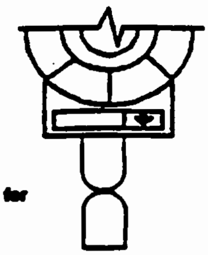
	Reference Meter						Meter Box Correction Factor	Reference Orifice Press
	Gas Volume			Meter Temperature				
Trial	Initial (ft^3)	Final (ft^3)	Net (ft^3)	Initial (°F)	Final (°F)	Avg. (°F)	γ	$\Delta H_{@}$ (in. H2O)
1	170.349	175.542	5.193	64	64	64	0.996	1.98
2	175.542	180.785	5.243	65	65	65	1.001	1.95
3	180.785	186.024	5.239	66	66	66	1.003	1.95

AVERAGE:	1.000	1.963
% Change:	-0.1%	

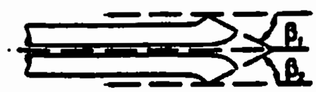
248

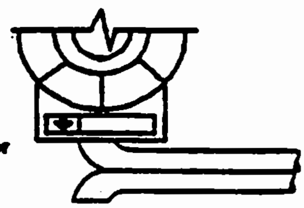
CALIBRATION DATA SHEET 2
Type S Pitot Tube Inspection



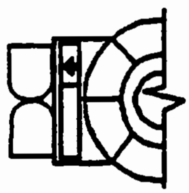


Degree indicating level position for determining α1 and α2.

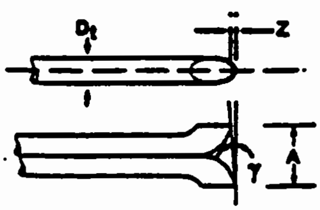


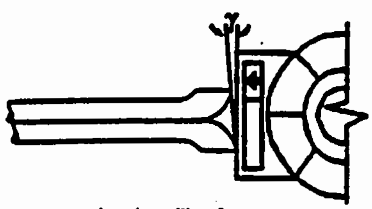


Degree indicating level position for determining β1 and β2.



Degree indicating level position for determining θ





Degree indicating level position for determining γ then calculate Z.

Level and Perpendicular?	YES
Obstruction?	NO
Damaged?	NO
α_1 $(-10° \leq \alpha_1 \leq +10°)$	0
α_2 $(-10° \leq \alpha_2 \leq +10°)$	1
β_1 $(-5° \leq \beta_1 \leq +5°)$	0
β_2 $(-5° \leq \beta_2 \leq +5°)$	1
γ	0
θ	0
$z = A \tan \gamma$ $(\leq 0.125")$	0
$w = A \tan \theta$ $(\leq 0.03125")$	0
D_t $(3/16" \leq D_t \leq 3/8")$	3/8
A	.938
$A/2D_t$ $(1.05 \leq P_A/D_t \leq 1.5)$	1.25

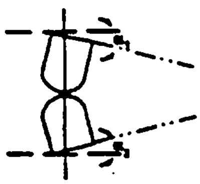
QA/QC Check
Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

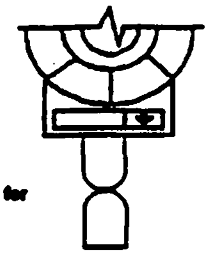
Certification
I certify that the Type S pitot tube/probe ID# RP-14 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube calibration factor C_p of 0.84.

Certified by: L. Brown 7-14-98 ______________________________
Personnel (Signature/Date) Team Leader (Signature/Date)

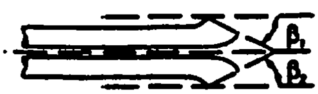
249

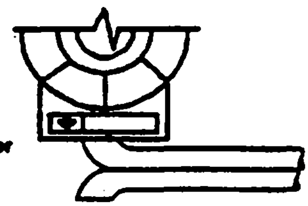
CALIBRATION DATA SHEET 2
Type S Pitot Tube Inspection



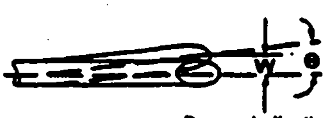


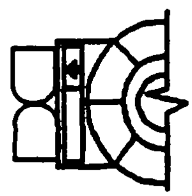
Degree indicating level position for determining α_1 and α_2.



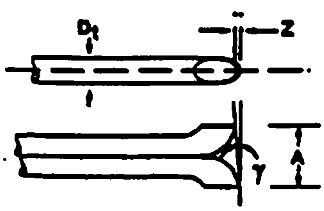


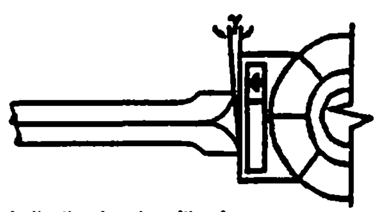
Degree indicating level position for determining β_1 and β_2.





Degree indicating level position for determining θ





Degree indicating level position for determining γ then calculate Z.

Level and Perpendicular?	Yes
Obstruction?	No
Damaged?	No
α_1 $(-10° \leq \alpha_1 \leq +10°)$	0
α_2 $(-10° \leq \alpha_2 \leq +10°)$	1
β_1 $(-5° \leq \beta_1 \leq +5°)$	0
β_2 $(-5° \leq \beta_2 \leq +5°)$	0
γ	1
θ	1
$z = A \tan \gamma$ $(\leq 0.125")$	.0175
$w = A \tan \theta$ $(\leq 0.03125")$	.0175
D_t $(3/16" \leq D_t \leq 3/8")$	3/8"
A	1 1/32"
$A/2D_t$ $(1.05 \leq P_A/D_t \leq 1.5)$	1.37

QA/QC Check

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

Certification

I certify that the Type S pitot tube/probe ID# ES-1 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube calibration factor C_p of 0.84.

Certified by: Dennis [signature] ______________________________

Personnel (Signature/Date) Team Leader (Signature/Date)

250

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. RT-6 Sensor Type K-TC Length ______
Ambient Temp. °F 72 Barometric Pressure, "Hg 30.21
Reference Temp. Sensor: ______________________

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
1-22-98	1	ICE H2O	32	32	0	Y	JWB
"	2	AMB. AIR	72	69	-.65	Y	JWB
"	3	BOIL. H2O	210	210	0	Y	JWB
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\,\%$$

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. ES - 1 **Sensor Type** K -TC **Length** ______
Ambient Temp. °F 72 **Barometric Pressure, "Hg** 30.15
Reference Temp. Sensor: 72

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
	1	ICE H2O	32	32	0	Y	DDH
	2	Amb. Air	72	72	0	Y	DDH
	3	Boil H2O	210	210	0	Y	DDH
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\%\ Temp.\ Diff = \frac{(Ref.\ Temp + 460) - (Test\ Temp. + 460)}{(Ref.\ Temp. + 460)} \times 100 \leq 1.5\ \%$$

252

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. ~~DGM-IN~~ MB-11 **Sensor Type** K-TC **Length** 10"
Ambient Temp. °F 74 **Barometric Pressure, "Hg** 30.24
Reference Temp. Sensor: ____________________

Date	Ref. Point No.	Temp. Source	Temp. °F Ref. Sensor	Temp. °F Test Sensor	Temp. Diff. %	Within Limits Y/N	Calibrated By
3-18-98	1	Ice H2O	32	32	0	Y	JWB
"	2	Amb. Air	74	74	0	Y	JWB
"	3	Boil H2O	210	208			
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

253

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. MB-11 DGM-OUT Sensor Type K-TC Length 1'
Ambient Temp. °F 74 Barometric Pressure, "Hg 30.24
Reference Temp. Sensor: ____________

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
3-18-98	1	ICE H_2O	32	32	0	Y	JWB
"	2	AMB. AIR	74	74	0	Y	JWB
"	3	BOIL H_2O	208	208	0	Y	JWB
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\,\%$$

TEMPERATURE SENSOR CALIBRATION FORM

DGM-IN

Temperature Sensor No. MB-10 Sensor Type K-TC Length 8"
Ambient Temp. °F 76 Barometric Pressure, "Hg 29.61"
Reference Temp. Sensor: ______

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
3-20-98	1	ICE H_2O	33	34			
"	2	AMB. AIR	76	76	0		
"	3	BOIL. H_2O	206	205			
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \ Temp.\ Diff = \frac{(Ref.\ Temp + 460) - (Test\ Temp. + 460)}{(Ref.\ Temp. + 460)} \times 100 \le 1.5\ \%$$

255

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. DGM-OUT MB-10 Sensor Type K-TC Length 12"
Ambient Temp. °F 76 Barometric Pressure, "Hg 29.61"
Reference Temp. Sensor: ____________

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
3-20-98	1	ICE H2O	32	34	.406	Y	JWB
"	2	AMB. AIR	76	77	.186	Y	JWB
"	3	BOIL H2O	206	205	.150	Y	JWB
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \ Temp. \ Diff = \frac{(Ref. \ Temp + 460) - (Test \ Temp. + 460)}{(Ref. \ Temp. + 460)} \times 100 \leq 1.5 \%$$

256

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. RMB-15 DGM-1D   Sensor Type K-TC   Length 1'
Ambient Temp. °F 74   Barometric Pressure, "Hg 30.24"
Reference Temp. Sensor:

Date	Ref. Point No.	Temp. Source	Temp. °F Ref. Sensor	Temp. °F Test Sensor	Temp. Diff. %	Within Limits Y/N	Calibrated By
3-18-98	1	ICE H2O	33	35	.406	Y	JWB
"	2	AMB. AIR	74	74	0	Y	JWB
"	3	BOIL. H2O	208	210	.299	Y	JWB
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \le 1.5\ \%$$

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. RMB-15 DCM-OUT **Sensor Type** K-TC **Length** 2'
Ambient Temp. °F 74 **Barometric Pressure, "Hg** 30.24"
Reference Temp. Sensor: ______

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
3-18-98	1	ICE H_2O	33	33	0	Y	JWB
"	2	AMB AIR	74	75	.187	Y	JWB
"	3	BOIL. H_2O	208	208	0	Y	JWB
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

258

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. T-1 **Sensor Type** Process Thermometer **Length** 12"
Ambient Temp. °F 69 **Barometric Pressure, "Hg** 30.1
Reference Temp. Sensor: 69

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
	1	Amb.	69	69	0	✓	AFL
	2	ICE	32	32	0	✓	AFL
	3	Boiling Water	212	212	0	✓	AFL
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\,\%$$

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. T-2 Sensor Type Thermometer Length 12"
Ambient Temp. °F 69 Barometric Pressure, "Hg 30.10
Reference Temp. Sensor: 69

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
10-14	1	Amb. ~~69~~	69	69	0	✓	AFL
10-14	2	ICE ~~69~~	32	32	0	✓	AFL
10-14	3	Boiling H2O ~~69~~	212	212	0	✓	AFL
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. 7-3 **Sensor Type** Thermometer **Length** 12"
Ambient Temp. °F 69 **Barometric Pressure, "Hg** 30.10
Reference Temp. Sensor: 69

Date	Ref. Point No.	Temp. Source	Temp. °F		Temp. Diff. %	Within Limits Y/N	Calibrated By
			Ref. Sensor	Test Sensor			
10-14	1	Amb.	69	69	0	✓	AFL
10-14	2	Ice	32	32	0	✓	AFL
10-14	3	Boiling Water	212	212	0	✓	AFL
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						
	1						
	2						
	3						

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Tunnel Exhaust

Method 315

MB operator Dennis Holzschuh

Run 1

Quality Control Check	Observation
Prior to Start of Tests	
Keep all cleaned glassware sealed until train assembly	Done
Assemble trains in dust free environment	done
Visually inspect each train for proper assembly	Done
Level and zero manometer	Done
Calculate proper sampling nozzle size	Done (.188)
Visually inspect sampling nozzle for chips	Done
Visually inspect Type S Pitot tube	Done
Leak check each leg of Type S Pitot tube	Done
Leak check entire sampling train	Done .009 @ 15"Hg
During Testing	
Read temperatures and differential pressures at each traverse point	yes
Sample data and calculations recorded on preformatted data sheets	yes
Unusual occurrences noted in test log	yes
Properly maintain the roll and pitch of axis of Type S Pitots and sampling nozzle	N/A
Leak check train before and after any component changes during test	yes
Maintain the probe and filter temperature	yes
Maintain ice in ice water bath and maintain impinger exit temperature	yes
Calibration forms reviewed for completeness and accuracy	yes
Data sheets reviewed by PM daily during testing	yes

Method 315 MB# 15

y = 1.001

ΔH = 1.830

K Factor 1.349

Quality Control Check	Observation
After Testing	
Visually inspect sampling nozzle	yes
Visually inspect Type S Pitot tube	yes
Leak check each leg of the Type S Pitot tube	yes
Leak check the entire sampling train	yes
Record observations if any	yes
Field Log	
Project name/ID and location	Hot Mix Plant D Barre, Mass.
Sampling personnel (names/position)	Dennis Holzschuh
Geological observations including map	Sitting in amongst Rolling Hills
Sample run times and dates	240 MIN. 10-5-98
Sample descriptions	Particulate & Extractable Organic Matter
Description of QC samples	N/A
Deviations from QAPP	no
Difficulties in sampling or unusual conditions	Batch
Sample Labels	yes
Sample ID	yes
Date and time of collection	10-5-98 7:21 to
Lab technician initials	DDH
Analytical parameter	Particulate, Extractable Organic Matter
Preservative required	all samples sealed, marked & Handled with Care

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Tunnel Exhaust
Method 315

Date 10-5-98

MB operator Allan Lowe

Run 6

Quality Control Check	Observation
Prior to Start of Tests	
Keep all cleaned glassware sealed until train assembly	done
Assemble trains in dust free environment	Done
Visually inspect each train for proper assembly	Done
Level and zero manometer	Done
Calculate proper sampling nozzle size	Done (.189)
Visually inspect sampling nozzle for chips	Done
Visually inspect Type S Pitot tube	Done
Leak check each leg of Type S Pitot tube	Done
Leak check entire sampling train	Done
During Testing	
Read temperatures and differential pressures at each traverse point	yes
Sample data and calculations recorded on preformatted data sheets	yes
Unusual occurrences noted in test log	yes
Properly maintain the roll and pitch of axis of Type S Pitots and sampling nozzle	N/A
Leak check train before and after any component changes during test	yes
Maintain the probe and filter temperature	yes
Maintain ice in ice water bath and maintain impinger exit temperature	yes
Calibration forms reviewed for completeness and accuracy	yes
Data sheets reviewed by PM daily during testing	yes.

Method 315 MB # 11
y = .9802
ΔH = 1.99
K Factor 1.5

.264

Quality Control Check	Observation
After Testing	
Visually inspect sampling nozzle	yes
Visually inspect Type S Pitot tube	yes
Leak check each leg of the Type S Pitot tube	yes
Leak check the entire sampling train	yes
Record observations if any	yes
Field Log	
Project name/ID and location	Hot Mix Plant D Barre, Mass.
Sampling personnel (names/position)	Allan Lowe & Derek Hawkes
Geological observations including map	Plant sit in amongst rolling Hills
Sample run times and dates	240 min. 10-5-98
Sample descriptions	Particulate & Extracable Organic Matter
Description of QC samples	N/A
Deviations from QAPP	no
Difficulties in sampling or unusual conditions	Batch Sampling
Sample Labels	yes
Sample ID	yes
Date and time of collection	10-5-98 7:21AM to
Lab technician initials	Particulate, Extractable Organic Matter
Analytical parameter	AL
Preservative required	All samples sealed & Marked & Handled with Care

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

oct 5, 1998

Tunnel Exhaust

I. Test Run Observations

R = Recommended
M = Mandatory

			Test Run 1	Test Run ~~2~~ 6	Test Run 3	Test Run 4
		Date	10-5-98	10-5-98		
			M-315	M-315		
1. Train set up	filter ID		1001980S	1001980S .01	1*	
	filter weight		N/A	N/A		
	filter checked for holes		yes	yes		
	filter centered		yes	yes		
	nozzle clean		yes	yes		
	nozzle undamaged		yes	yes		
	nozzle diameter (in.)		.188	.189		
	probe liner clean		yes	yes		
	probe markings correct		yes	yes		
	probe heated along entire length		yes	yes		
	impingers charged		yes	yes		
	impingers iced		yes	yes		
	meter box leveled		yes	yes		
	pitot manometer zeroed		yes	yes		
	orifice manometer zeroed		yes	yes		
	filter box or holder at temp.		yes	yes		
	all ball joints lightly greased		N/A	N/A		
	all openings capped		yes	yes		
2. Train leak check at nozzle: (<0.02 cfm @ 15 in. Hg initial. Intermediate and final at highest Vacuum during test run.)	initial (R)	LC	.009	.005		
		VAC	15"Hg	10"Hg		
	intermediate (R)	LC		.004		
		VAC		15"Hg	1*	
	intermediate (R)	LC				
		VAC				
	intermediate (R)	LC				
		VAC				
	final (M)	LC	.005	.004		
		VAC	12"Hg	15"Hg		
3. Pitot lines leak check: (hold 3 in. H_2O) on manometer for (15 sec.)	initial	positive line (R)	>3" ok	>3" ok		
		negative line (R)	>3" ok	>3" ok		
	final	positive line (M)	>3" ok	>3" ok		
		negative line (R)	>3" ok	>3" ok		
		pitot tube undamaged	yes	yes		
M-3 bag initial leak check (M) 2* Tedlar bag:	Should hold 2 to 4 in. H_2O pressure for 10 minutes or		N/A	N/A		
	zero flow meter reading on continuous evacuation or		N/A	N/A		
	Completely fill bag and let stand overnight—no deflation.		N/A	N/A		

266

1* Changed out Filter & holder

2* Exhaust gas is ambient Air, so it has been assigned dry molecular wt of ambient Air 28.84 g/g-mol

	Date	10-5-98	10-5-98		
R = Recommended M = Mandatory		Test Run 1 M-315	Test Run ~~2~~ 6 M-315	Test Run 3	Test Run 4
4. M-3 sampling train check:	initial (M)	N/A	N/A		
(should hold 10 in. vacuum	final (M)	N/A	N/A		
for 1/2 min.)		N/A	N/A		
Purge sample train with stack gas		N/A	N/A		
Constant rate sampling 1 pm		N/A	N/A		
5. Time test started		7:21AM	7:21AM		
Time test ended		2:00PM	2:03PM		
6. Dry gas meter volume:	( ) port initial	781.150	685.191		
	final				
	( ) port initial				
	final				
	( ) port initial				
	final				
	( ) port initial				
	final	942.00	862.208		
7. Train operation during run	Nozzle changed during run — NOT ALLOWED	NO	NO		
pitch and yaw of probe o.k.		✓	✓		
nozzle not scraped on nipple		✓	✓		
effective seal around probe		yes	yes		
probe moved at proper time		yes	yes		
probe heated		yes	yes		
calculator constants or nomograph changed when TS and/or TM changes significantly		N/A	N/A		
average time to set isokenetics after probe moved to next point		< 10 sec	< 10 sec		
Average values: impinger temperature should be ≤ 70°F		< 70°F	< 70°F		
Post filter gas streamer or Filter box temperature (250°F ± 25) ≤320°F, °F circle one		yes	yes		
stack temperature		59.1°A	53.7°A		
barometric P taken and value		30.30	30.30		
was probe ever disconnected from filter holder while in stack?		no	no		
was filter changed during run?		no	yes		

Date	10-5-98	10-5-98		
R = Recommended M = Mandatory	Test Run 1 M-315	Test Run ~~2~~ 6 M-315	Test Run 3	Test Run 4
Check on filter holder loosening of clamping device holder	✓	✓		
was silica gel changed during run?	no	no		
was any particulate lost?	no	no NA		
Accurate reading of: ΔP Average Square Rt. ΔP	1.1892	~~[illegible]~~	1.2064	
ΔH Average Meter Orifice Pressure	2.01	2.04		
meter temperature	52.7°F	53.7		
stack temperature	59.1°F	60°F		
meter vacuum	5" Hg	15" Hg, 8" Hg *		
time per point	20 Min	10 min		
impinger temperature	<70°F	<70°F		
filter box temperature	250±25	250°±25		
Minimum sample time of 240 min met Minimum sample volume of 160 dscf collected	✓	✓		
8. Post test: – All openings sealed	yes	yes		
– recovery area clean sheltered	yes	yes		
– filter handled with gloves, forceps	yes	yes		
– petri dish sealed, labeled	yes	yes		
– any sample lost	no	no		
water measured grad cyl. mL / weighed gms	24.3	23.8 .6%		
– silica gel weighed, net gms	30.2	34.4		
– condition – color Blue to Pink	✓	✓		
% spent	90%	95%		
– probe cooled sufficiently	yes	yes		
– nozzle removed and brushed	yes	yes		
– probe brushed 6 times	yes	yes		
– nozzle brushes clean	yes	yes		
– wash bottles clean	yes	yes		
– acetone clean	yes	yes		
– M-8 15 minute purge	N/A	N/A		
– water/solution clean	yes	yes		
Methylene Chloride – blank taken: acetone, water, other	yes	yes		
Probe brush and extension clean.	yes	yes		
Sample container: Clean	yes	yes		
Capped	yes	yes		
Labeled	yes	yes		
Sealed	yes	yes		
Liquid level marked	yes	yes		

* Was at 15" Hg and we change out Filter & Filter housing at first port change vacuum remained @ 8" Hg the remainder of test.

		Date	10-5-98	10-5-98		
R = Recommended M = Mandatory			Test Run 1 M-315	Test Run ~~2~~ 6 M-315	Test Run 3	Test Run 4
9.	Post test Orsat Analysis of integrated bag sample Orsat analyzer - Analyzer leak check (levels should not fall below cap. tubing and not more than 0.2 mL in burrette for 2 min.)	Initial (M)	N/A	N/A		
		Final (M)	N/A	N/A		
			N/A	N/A		
	Orsat samples: Each bag analyzed 3 times		N/A	N/A		
		% CO_2 agrees within 0.2%	N/A	N/A		
		% O_2 agrees within 0.2%	N/A	N/A		
		% CO agrees within 0.2%	N/A	N/A		
	Analysis at end of test. Orsat analyzer checked against air (20.9 ± 0.3)		N/A	N/A		
	Orsat Analysis: *	CO_2%	N/A	N/A		
		O_2%				
		CO%				
		$F_o = \frac{20.9 - \% O_2}{\% CO_2}$	N/A	N/A		
		Fuel	N/A	N/A		
		F_o range for fuel				
		Orsat analysis valid				
		Orsat solutions changed when calculated F_o exceeds fuel type range	N/A	N/A		
10.	All samples locked up		yes	yes		
	All sampling components clean and sealed		yes	yes		
	All data sheets submitted to observer		yes	yes		
	- Orsat		N/A	N/A		
	- Run isokenetic	Team/Observer	yes	yes		
	- Particulate recovery		yes	yes		
	- Process data		yes	yes		
	- Charts		N/A	N/A		
	- Calibration sheets		yes	yes		

* Ambient Air $CO_2 = 0$ O_2 20.9

J. NOTES: Care should be taken, when sampling for organic compounds, to follow stringent quality control guidelines to avoid contamination of the sample and sampling train. Take note of any occurences which could bias the sample in any manner.

Include: (1) General comments; (2) Changes to pretest agreement with justification; (3) Identify (manufacturer) and describe condition of sampling equipment; (4) any abnormal occurrences during test program. (Additional page(s) attached: Yes ✓, No ___.)

Run 6 of Method 315 train, we were getting high Vaccum 15"+ at the port change (1 hour) we investigated the Filter housing & frit we were using was a T configuration. It appeared to have heavy loading due to the fact we could not get more distribution of the sample. The problem was addressed by changing out the Filter + Frit & Filter housing. With the new frit we increase emission distribution & we did not ~~there~~ have this problem again.

Note: a corrective Action Report was filled out and will be included in final report.

Dennis P Holzschuh
Signature of Observer

P.E.S.
Affiliation of Observer

10-5-98
Date

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Tunnel Exhaust
Method 315
M.B. Operator Dennis Holzschuh

Date 10-6-98

Run 2

Quality Control Check	Observation
Prior to Start of Tests	
Keep all cleaned glassware sealed until train assembly	Done
Assemble trains in dust free environment	Done
Visually inspect each train for proper assembly	Done
Level and zero manometer	Done
Calculate proper sampling nozzle size	Done (.188)
Visually inspect sampling nozzle for chips	Done
Visually inspect Type S Pitot tube	Done
Leak check each leg of Type S Pitot tube	Done
Leak check entire sampling train	Done
During Testing	
Read temperatures and differential pressures at each traverse point	yes
Sample data and calculations recorded on preformatted data sheets	yes
Unusual occurrences noted in test log	yes
Properly maintain the roll and pitch of axis of Type S Pitots and sampling nozzle	N/A
Leak check train before and after any component changes during test	yes
Maintain the probe and filter temperature	yes
Maintain ice in ice water bath and maintain impinger exit temperature	yes
Calibration forms reviewed for completeness and accuracy	yes
Data sheets reviewed by PM daily during testing	yes

Method 315 MB #15
Y = 1.001
ΔH = 1.830
K Factor = 1.300

Quality Control Check	Observation
After Testing	
Visually inspect sampling nozzle	yes
Visually inspect Type S Pitot tube	yes
Leak check each leg of the Type S Pitot tube	yes
Leak check the entire sampling train	yes
Record observations if any	yes
Field Log	
Project name/ID and location	Hot Mix Asphalt - Plant D Barre, Mass
Sampling personnel (names/position)	Dennis Holzschuh
Geological observations including map	Set in Amongst Rolling hills.
Sample run times and dates	240 min (7:14AM - 1:26PM) 10-6-98
Sample descriptions	Method 315
Description of QC samples	N/A
Deviations from QAPP	no
Difficulties in sampling or unusual conditions	Batch Sampling
Sample Labels	yes
Sample ID	M315-2
Date and time of collection	10-6-98 7:14AM - 1:26PM
Lab technician initials	DDH
Analytical parameter	Particulate & Extractable Organic Matter
Preservative required	All Samples Sealed & Handled with Care.

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Tunnel Exhaust
Method 315
MB operator Allan Lowe

Date 10-6-98
Page 1 of 2
RUN ~~2~~ 7 OPH

Quality Control Check	**Observation**
Prior to Start of Tests	
Keep all cleaned glassware sealed until train assembly	Done
Assemble trains in dust free environment	Done
Visually inspect each train for proper assembly	Done
Level and zero manometer	Done
Calculate proper sampling nozzle size	Done (.185)
Visually inspect sampling nozzle for chips	Done
Visually inspect Type S Pitot tube	Done
Leak check each leg of Type S Pitot tube	Done
Leak check entire sampling train	Done
During Testing	
Read temperatures and differential pressures at each traverse point	yes
Sample data and calculations recorded on preformatted data sheets	yes
Unusual occurrences noted in test log	yes
Properly maintain the roll and pitch of axis of Type S Pitots and sampling nozzle	N/A
Leak check train before and after any component changes during test	yes
Maintain the probe and filter temperature	yes
Maintain ice in ice water bath and maintain impinger exit temperature	yes
Calibration forms reviewed for completeness and accuracy	yes
Data sheets reviewed by PM daily during testing	yes

Method 315 MB #11
Y = .9802
ΔH = 1.99
K Factor = 1.318

-273

Quality Control Check	Observation
After Testing	
Visually inspect sampling nozzle	yes
Visually inspect Type S Pitot tube	yes
Leak check each leg of the Type S Pitot tube	yes
Leak check the entire sampling train	yes
Record observations if any	yes
Field Log	
Project name/ID and location	Hot Asphalt Mix - Plant D, Barre, Mass
Sampling personnel (names/position)	Allan Lowe
Geological observations including map	Stamongst rolling hills
Sample run times and dates	7:14 AM — 1:26 PM 10-6-98
Sample descriptions	M-315
Description of QC samples	N/A
Deviations from QAPP	no
Difficulties in sampling or unusual conditions	Batch operation
Sample Labels	yes
Sample ID	M 315-7
Date and time of collection	10-6-98 7:14 AM-1:26 240 min
Lab technician initials	AL
Analytical parameter	Particulate & Extractable Organic Matter
Preservative required	All Samples Sealed & handled with Care

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Oct 6, , 1998

Tunnel Exhaust

I. Test Run Observations R = Recommended M = Mandatory			Date	Oct 6-98	10-6-98	10-6-98	
				Test Run 2 M315	Test Run ~~2~~ 7 M-315	Test Run 3	Test Run 4
1. Train set up	filter ID			100198-07	100198-08		
	filter weight			.3363	.3378		
	filter checked for holes			yes	yes		
	filter centered			yes	yes		
	nozzle clean			yes	yes		
	nozzle undamaged			yes	yes		
	nozzle diameter (in.)			.188	.188		
	probe liner clean			yes	yes		
	probe markings correct			yes	yes		
	probe heated along entire length			yes	yes		
	impingers charged			yes	yes		
	impingers iced			yes	yes		
	meter box leveled			yes	yes		
	pitot manometer zeroed			yes	yes		
	orifice manometer zeroed			yes	yes		
	filter box or holder at temp.			yes	yes		
	all ball joints lightly greased			N/A	N/A		
	all openings capped			yes	yes		
2. Train leak check at nozzle: ($\leq$0.02 cfm @ 15 in. Hg initial. Intermediate and final at highest Vacuum during test run.)	initial (R)		LC	.011	.002		
			VAC	@ 12" Hg	10" Hg		
	intermediate (R)		LC				
			VAC				
	intermediate (R)		LC				
			VAC				
	intermediate (R)		LC				
			VAC				
	final (M)		LC	.001	.003		
			VAC	5" Hg	3" Hg		
3. Pitot lines leak check: (hold 3 in. H_2O) on manometer for (15 sec.)	initial	positive line (R)		23" ok	23" ok		
		negative line (R)		23" ok	23" ok		
	final	positive line (M)		23" ok	23" ok		
		negative line (R)		23" ok	23" ok		
		pitot tube undamaged		yes	yes		
M-3 bag initial leak check (M) Tedlar bag:	Should hold 2 to 4 in. H_2O pressure for 10 minutes or			N/A	N/A		
	zero flow meter reading on continuous evacuation or			N/A	N/A		
	Completely fill bag and let stand overnight—no deflation.			N/A	N/A		

275

	Date	10-6-98	10-6-98		
R = Recommended M = Mandatory		Test Run #2	Test Run #7	Test Run 3	Test Run 4
4. M-3 sampling train check:	initial (M)	N/A	N/A		
(should hold 10 in. vacuum	final (M)	N/A	N/A		
for 1/2 min.)		N/A	N/A		
Purge sample train with stack gas		N/A	N/A		
Constant rate sampling	1 pm	N/A	N/A		
5. Time test started		7:14 Am	7:14 Am		
Time test ended		1:26 PM	1:26 PM		
6. Dry gas meter volume:	( ) port initial	943.492	862.751		
	final				
	( ) port initial				
	final				
	( ) port initial				
	final				
	( ) port initial				
	final	943.492	1031.998		
7. Train operation during run	Nozzle changed during run — NOT ALLOWED	NO	NO		
pitch and yaw of probe o.k.		yes	yes		
nozzle not scraped on nipple		yes	yes		
effective seal around probe		yes	yes		
probe moved at proper time		yes	yes		
probe heated		yes	yes		
calculator constants or nomograph changed when TS and/or TM changes significantly		N/A	N/A		
average time to set isokenetics after probe moved to next point		< 10 Sec	< 10 Sec		
Average values: impinger temperature should be ≤ 70°F		< 70°F	< 70°F		
Post filter gas streamer or Filter box temperature (250°F ± 25) ≤320°F, °F circle one		yes	yes		
stack temperature		56.9°F	58°F		
barometric P taken and value		30.45	30.45		
was probe ever disconnected from filter holder while in stack?		NO	NO		
was filter changed during run?		NO	NO		

276

R = Recommended
M = Mandatory

	Test Run X2 M-315	Test Run X7 M-315	Test Run 3	Test Run 4
Date	10-6-98	10-6-98		
Check on filter holder loosening of clamping device holder	Done	Done		
was silica gel changed during run?	NO	NO		
was any particulate lost?	no	no		
Accurate reading of: ΔP Average Sq Rt ΔP	1.0802	1.1250		
ΔH Average Meter orifice Pressure	1.53	1.92		
meter temperature	44.5	46.8		
stack temperature	56.9	58 F		
meter vacuum	4	2		
time per point	20 Min	10 Min		
impinger temperature	< 60°F	< 60°F		
filter box temperature	250±25	250±25		
Minimum sample time of ______ min met				
Minimum sample volume of ______ dscf collected	172.035	176.253		
8. Post test: - All openings sealed	yes	yes		
- recovery area clean sheltered	yes	yes		
- filter handled with gloves, forceps	yes	yes		
- petri dish sealed, labeled	yes	yes		
- any sample lost	no	no		
water measured mL / grad cyl. weighed gms	22.1	12.2		
- silica gel weighed, net gms	17.1	27.8		
- condition - color Blue to Pink	✓	✓		
% spent	80%	90%		
- probe cooled sufficiently	yes	yes		
- nozzle removed and brushed	yes	yes		
- probe brushed 6 times	yes	yes		
- nozzle brushes clean	yes	yes		
- wash bottles clean	yes	yes		
- acetone clean	yes	yes		
- M-8 15 minute purge	N/A	N/A		
- water/solution clean	yes	yes		
- blank taken: acetone, water, other (Methylene Chloride)	yes	yes		
Probe brush and extension clean.	yes	yes		
Sample container: Clean	yes	yes		
Capped	yes	yes		
Labeled	yes	yes		
Sealed	yes	yes		
Liquid level marked	yes	yes		

R = Recommended M = Mandatory	Date	10-6-98	10-6-98		
		Test Run ~~1~~ 2 M-315	Test Run ~~2~~ 7 M-315	Test Run 3	Test Run 4
9. Post test Orsat Analysis of integrated bag sample Orsat analyzer - Analyzer leak check (levels should not fall below cap. tubing and not more than 0.2 mL in burrette for 2 min.)	Initial (M)	N/A	N/A		
	Final (M)	N/A	N/A		
		N/A	N/A		
Orsat samples: Each bag analyzed 3 times		N/A	N/A		
% CO_2 agrees within 0.2%		N/A	N/A		
% O_2 agrees within 0.2%		N/A	N/A		
% CO agrees within 0.2%		N/A	N/A		
Analysis at end of test. Orsat analyzer checked against air (20.9 ± 0.3)		N/A	N/A		
Orsat Analysis: * CO_2%		N/A	N/A		
* O_2%		N/A	N/A		
CO%		N/A	N/A		
$F_o = \frac{20.9 - \%\ O_2}{\%\ CO_2}$		N/A	N/A		
Fuel		N/A	N/A		
F_o range for fuel		N/A	N/A		
Orsat analysis valid		N/A	N/A		
Orsat solutions changed when calculated F_o exceeds fuel type range		N/A	N/A		
10. All samples locked up		yes	yes		
All sampling components clean and sealed		yes	yes		
All data sheets submitted to observer		yes	yes		
- Orsat		N/A	N/A		
- Run isokenetic Team/Observer		97.9	100.2		
- Particulate recovery		yes	yes		
- Process data		yes	yes		
- Charts		N/A	N/A		
- Calibration sheets		yes	yes		

* Ambient Air CO_2 0% O_2 20.9%

J. NOTES: Care should be taken, when sampling for organic compounds, to follow stringent quality control guidelines to avoid contamination of the sample and sampling train. Take note of any occurences which could bias the sample in any manner.

Include: (1) General comments; (2) Changes to pretest agreement with justification; (3) Identify (manufacturer) and describe condition of sampling equipment; (4) any abnormal occurrences during test program. (Additional page(s) attached: Yes ____, No ✓.)

Dennis P Holzschuh	PES	10-6-98
Signature of Observer	Affiliation of Observer	Date

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Tunnel Exhaust
Method 315
MB Operator Dennis Holzschuh

Date 10-7-98

Run 3

Quality Control Check	Observation
Prior to Start of Tests	
Keep all cleaned glassware sealed until train assembly	Done
Assemble trains in dust free environment	Done
Visually inspect each train for proper assembly	Done
Level and zero manometer	Done
Calculate proper sampling nozzle size	Done (.188)
Visually inspect sampling nozzle for chips	Done
Visually inspect Type S Pitot tube	Done
Leak check each leg of Type S Pitot tube	Done
Leak check entire sampling train	Done
During Testing	
Read temperatures and differential pressures at each traverse point	yes
Sample data and calculations recorded on preformatted data sheets	yes
Unusual occurrences noted in test log	yes
Properly maintain the roll and pitch of axis of Type S Pitots and sampling nozzle	yes
Leak check train before and after any component changes during test	yes
Maintain the probe and filter temperature	yes
Maintain ice in ice water bath and maintain impinger exit temperature	yes
Calibration forms reviewed for completeness and accuracy	yes
Data sheets reviewed by PM daily during testing	yes

Method 315 MB #5
$Y = 1.001$
$\Delta H = 1.830$
K. Factor 1.30

300

Date 10-7-98
Page 2 of 2

Run 3

Quality Control Check	Observation
After Testing	
Visually inspect sampling nozzle	yes
Visually inspect Type S Pitot tube	yes
Leak check each leg of the Type S Pitot tube	yes
Leak check the entire sampling train	yes
Record observations if any	yes
Field Log	
Project name/ID and location	Hot Mix Asphalt Plant D Barre, Mas
Sampling personnel (names/position)	Dennis Holzschuh
Geological observations including map	Set amongst Rolling Hills
Sample run times and dates	6:36 AM to 1:13 PM 10-7-98
Sample descriptions	Method 315
Description of QC samples	N/A
Deviations from QAPP	no
Difficulties in sampling or unusual conditions	Batch Sampling
Sample Labels	yes
Sample ID	yes
Date and time of collection	10-7-98 6:36 AM to 1:13 PM
Lab technician initials	DWH
Analytical parameter	Particulate & Extractable Organic Matter
Preservative required	all Samples Sealed & Handled with Care

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Tonnel Exhaust
Method 315
MB operator Allan lowe

Date 10-7-98

Run 8

Quality Control Check	Observation
Prior to Start of Tests	
Keep all cleaned glassware sealed until train assembly	Done
Assemble trains in dust free environment	Done
Visually inspect each train for proper assembly	Done
Level and zero manometer	Done
Calculate proper sampling nozzle size	Done (.187)
Visually inspect sampling nozzle for chips	Done
Visually inspect Type S Pitot tube	Done
Leak check each leg of Type S Pitot tube	Done
Leak check entire sampling train	Done
During Testing	
Read temperatures and differential pressures at each traverse point	yes
Sample data and calculations recorded on preformatted data sheets	yes
Unusual occurrences noted in test log	yes
Properly maintain the roll and pitch of axis of Type S Pitots and sampling nozzle	yes
Leak check train before and after any component changes during test	yes
Maintain the probe and filter temperature	yes
Maintain ice in ice water bath and maintain impinger exit temperature	yes
Calibration forms reviewed for completeness and accuracy	yes
Data sheets reviewed by PM daily during testing	yes

Method 315 MB #11
Y = .9802
ΔH = 1.99
K. Factor 1.318

302

Quality Control Check	Observation
After Testing	y
Visually inspect sampling nozzle	yes
Visually inspect Type S Pitot tube	yes
Leak check each leg of the Type S Pitot tube	yes
Leak check the entire sampling train	yes
Record observations if any	yes
Field Log	
Project name/ID and location	Hot Asphalt Mix - Plant D Barre, Mass
Sampling personnel (names/position)	Allan Lowe
Geological observations including map	Set amongst rolling hills
Sample run times and dates	6:36 AM to 1:13 PM 10-7-98
Sample descriptions	Method 315
Description of QC samples	N/A
Deviations from QAPP	no
Difficulties in sampling or unusual conditions	Batch Sampling
Sample Labels	yes
Sample ID	yes
Date and time of collection	10-7-98 - 6:36 AM to 1:13 PM
Lab technician initials	A L
Analytical parameter	Particulate & Extractable Organic Matter
Preservative required	All samples sealed & handled with Care

Emission Test
Hot Asphalt Plant D
Barre, Massachusetts

Oct 7, 1998

Tunnel Exhaust

I. Test Run Observations R = Recommended M = Mandatory		Date	10-6-98	10-6-98		
			Test Run ~~1~~ 3 M-315	Test Run ~~2~~ 8 M-315	Test Run 3	Test Run 4
1. Train set up	filter ID		100198-07	100198-06		
	filter weight		.3391	.3390		
	filter checked for holes		yes	yes		
	filter centered		yes	yes		
	nozzle clean		yes	yes		
	nozzle undamaged		yes	yes		
	nozzle diameter (in.)		.188	.187		
	probe liner clean		yes	yes		
	probe markings correct		yes	yes		
	probe heated along entire length		yes	yes		
	impingers charged		yes	yes		
	impingers iced		yes	yes		
	meter box leveled		yes	yes		
	pitot manometer zeroed		yes	yes		
	orifice manometer zeroed		yes	yes		
	filter box or holder at temp.		yes	yes		
	all ball joints lightly greased		N/A	N/A		
	all openings capped		yes	yes		
2. Train leak check at nozzle: (<.002 cfm @ 15 in. Hg initial. Intermediate and final at highest Vacuum during test run.)	initial (R)	LC	.005	.001		
		VAC	15	10"Hg		
	intermediate (R)	LC				
		VAC				
	intermediate (R)	LC				
		VAC				
	intermediate (R)	LC				
		VAC				
	final (M)	LC	.003	.001		
		VAC	6"Hg	10"Hg		
3. Pitot lines leak check: (hold 3 in. H_2O) on manometer for (15 sec.)	initial positive line (R)		>3 ok	>3 ok		
	negative line (R)		>3" ok	>3" ok		
	final positive line (M)		>3" ok	>3" ok		
	negative line (R)		>3" ok	>3" ok		
	pitot tube undamaged		yes	yes		
M-3 bag initial leak check (M) Tedlar bag:	Should hold 2 to 4 in. H_2O pressure for 10 minutes or		N/A	N/A		
	zero flow meter reading on continuous evacuation or		N/A	N/A		
	Completely fill bag and let stand overnight—no deflation.		N/A	N/A		

304

R = Recommended M = Mandatory	Date	10-7-98 Test Run #3 M-315	10-7-98 Test Run #8 M-315	Test Run 3	Test Run 4
4. M-3 sampling train check:	initial (M)	N/A	N/A		
(should hold 10 in. vacuum for 1/2 min.)	final (M)	N/A	N/A		
		N/A	N/A		
Purge sample train with stack gas		N/A	N/A		
Constant rate sampling	1 pm	N/A	N/A		
5. Time test started		6:36 AM	6:36 AM		
Time test ended		1:13 PM	1:13 PM		
6. Dry gas meter volume:	( ) port initial	104.562	31.881		
	final				
	( ) port initial				
	final				
	( ) port initial				
	final				
	( ) port initial				
	final	266.819	192.674		
7. Train operation during run	Nozzle changed during run — NOT ALLOWED	NO	NO		
pitch and yaw of probe o.k.		yes	yes		
nozzle not scraped on nipple		no	no		
effective seal around probe		yes	yes		
probe moved at proper time		yes	yes		
probe heated		yes	yes		
calculator constants or nomograph changed when TS and/or TM changes significantly		N/A	N/A		
average time to set isokenetics after probe moved to next point		<10 sec	<10 sec		
Average values: impinger temperature should be ≤ 70°F		<70°F	<70°F		
Post filter gas streamer or Filter box temperature 250°F ± 25, ≤320°F, °F circle one		250±25	250±25		
stack temperature		53.8	55.9		
barometric P taken and value		30.43	30.43		
was probe ever disconnected from filter holder while in stack?		no	no		
was filter changed during run?		no	no		

305

R = Recommended
M = Mandatory

	Test Run ~~1~~ 3 M-315	Test Run ~~2~~ 8 M-315	Test Run 3	Test Run 4
Date	10-7-98	10-7-98		
Check on filter holder loosening of clamping device holder	yes	yes		
was silica gel changed during run?	no	no		
was any particulate lost?	no	no		
Accurate reading of: ΔP Average Sq Rt ΔP	1.0719	1.0328		
ΔH Average Meter orifice Pressure IN H_2O	1.50	1.68		
meter temperature	44.3	45.9		
stack temperature	53.8	55.2		
meter vacuum	<3"	<10"		
time per point	30 min	10 min		
impinger temperature	<52°F	<54°F		
filter box temperature	250±25	250±25		
Minimum sample time of 240 min met Minimum sample volume of ____ dscf collected	yes	yes		
8. Post test: - All openings sealed	yes	yes		
- recovery area clean sheltered	yes	yes		
- filter handled with gloves, forceps	yes	yes		
- petri dish sealed, labeled	yes	yes		
- any sample lost	no	no		
water measured ✓ mL (grad cyl.) gms (weighed)	23.2	24.3		
- silica gel weighed, net gms	23.7	27.0		
- condition - color Blue to Pink	✓	✓		
% spent	100%	80%		
- probe cooled sufficiently	yes	yes		
- nozzle removed and brushed	yes	yes		
- probe brushed 6 times	yes	yes		
- nozzle brushes clean	yes	yes		
- wash bottles clean	yes	yes		
- acetone clean	yes	yes		
- M-8 15 minute purge	N/A	N/A		
- water/solution clean	yes	yes		
Methylene Chloride - blank taken: acetone, water, other	yes	yes		
Probe brush and extension clean.	yes	yes		
Sample container: Clean	yes	yes		
Capped	yes	yes		
Labeled	yes	yes		
Sealed	yes	yes		
Liquid level marked	yes	yes		

R = Recommended M = Mandatory	Date	10-7-98	10-7-98		
		Test Run #3 M-315	Test Run #8 M-315	Test Run 3	Test Run 4
9. Post test Orsat Analysis of integrated bag sample Orsat analyzer - Analyzer leak check (levels should not fall below cap. tubing and not more than 0.2 mL in burrette for 2 min.)	Initial (M)	N/A	N/A		
	Final (M)	N/A	N/A		
		N/A	N/A		
Orsat samples: Each bag analyzed 3 times		N/A	N/A		
% CO_2 agrees within 0.2%		N/A	N/A		
% O_2 agrees within 0.2%		N/A	N/A		
% CO agrees within 0.2%		N/A	N/A		
Analysis at end of test. Orsat analyzer checked against air (20.9 ± 0.3)		N/A	N/A		
Orsat Analysis: * CO_2%		N/A	N/A		
O_2%		N/A	N/A		
CO%		N/A	N/A		
$Fo = \frac{20.9 - \% O_2}{\% CO_2}$		N/A	N/A		
Fuel		N/A	N/A		
F_o range for fuel		N/A	N/A		
Orsat analysis valid		N/A	N/A		
Orsat solutions changed when calculated F_o exceeds fuel type range		N/A	N/A		
10. All samples locked up		yes	yes		
All sampling components clean and sealed		yes	yes		
All data sheets submitted to observer		yes	yes		
- Orsat		N/A	N/A		
- Run isokenetic Team/Observer		98.6	99.8		
- Particulate recovery		yes	yes		
- Process data		yes	yes		
- Charts		N/A	N/A		
- Calibration sheets		yes	yes		

* Ambient Air CO_2 - 0% O_2 - 20.9%

J. NOTES: Care should be taken, when sampling for organic compounds, to follow stringent quality control guidelines to avoid contamination of the sample and sampling train. Take note of any occurences which could bias the sample in any manner.

Include: (1) General comments; (2) Changes to pretest agreement with justification; (3) Identify (manufacturer) and describe condition of sampling equipment; (4) any abnormal occurrences during test program. (Additional page(s) attached: Yes ____, No ✓.)

Dennis P Hobzchuk
Signature of Observer

PES
Affiliation of Observer

10-7-98
Date

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Filter Tare Weight Worksheet

Plant: Hot Mix Asphalt Plant D **City, State:** Barre, Mass

Date: 10-5-98 **Initials:** DPH

RUN ID	FILTER ID	REFERENCE TARE WEIGHT	DATA SHEET TARE WT.	ANALYTICAL TARE WEIGHT *
M315-1	100198-05	.3409	.3409	.3409
M315-6	100198-01 100198-04	.3403 .3362	.3403 .3362	.3403 .3362
M315-2	100198-09	.3363	.3363	.3363
M315-7	100198-08	.3378	.3378	.3378
M315-3	100198-07	.3391	.3391	.3391
M315-8	100198-06	.3390	.3390	.3390
	100198-02			.3361
	100198-03			.3386
	100198-10			.3384

* While observing analytical procedures at ERG Labs of Hot Mix Plant D MCEM analysis on 11-2-98, Jim allow me to copy the Analytical Tare Wts from his original Filter Pre-weights data sheet.

PES PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Nozzle Calibration Worksheet

Plant: Hot Asphalt Mix Plant D **City, State:** Barre, Mass

Date: 10-5-98 **Initials:** DPH

RUN ID	NOZZLE ID	CALIBRATION DIAMETER	DATA SHEET DIAMETER	CALIBRATION DATE	TEST DATE
~~M315-1~~					
M315-6	GL-2	.189	.189	8-5-98	10-5-98
M315-1	GL-1	.188	.188	8-5-98	10-5-98
M315-2	GL-1	.188	.188	8-5-98	10-6-98
M315-7	GL-3	.185	.185	8-5-98	10-6-98
M315-3	GL-1	.188	.188	8-5-98	10-7-98
M315-8	GL-4	.187	.187	8-5-98	10-7-98

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Corrective Action Report

Plant: Hot Asphalt Mix - Plant D **City, State:** Barre, Mass

Originator: Dennis P Holzschuh	Date: 10-5-98
Project Number: 5517-002	Corrective Action Number: 1
Description of Problem (Give Date and Time Identified) 10-5-98 In the first hour of 4 hour run we noticed Vacuum running 15"+ at Port change (1 hour) we change out Filter and Filter housing	State Cause of Problem Filter housing configuration was a T or cross pattern  we went to a star pattern which increased the the area of collection 10 times
State Corrective Action Planned (Include Persons Involved in Action) changing out Filter & Filter housing	QA Officer Comments: Decision made was the right one. It did not hinder or interfere with the outcome of the test run
Signatures QA Officer: Dennis P Holzschuh Project Manager: Frank J Phoenix Originator: Dennis P. Holzschuh	Project Manager Comments:

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Data Sheet Completeness Worksheet

Plant: Hot Asphalt Mix - Plant D. **City, State:** Barre, Mass

Date: 10-5-98 **Initials:** DPH

Run ID	Nozzle Number	Filter Number	Post-Test Leak Check	Post-Test Pitot Leak Check	Start and Stop Time	Pitot Number
M315-1	GL-1	100198-05	.005@12"Hg	73" Pos ok Neg ok	7:21 AM 2:03 PM	RP-19
M315-6	GL-2	100198-04 -01	.004@10"Hg	73" Pos ok Neg ok	7:21 AM 2:00 PM	ES1
M315-2	GL-1	100198-09	.001@5"Hg	73" Pos ok Neg ok	7:14 AM 1:26 PM	RP-19
M315-7	GL-3	100198-08	.003@3"Hg	73" Pos ok Neg ok	7:14 AM 1:24 PM	ES1
M315-3	GL-1	100198-07	.005@6"Hg	73" Pos ok Neg ok	6:36 AM 1:13 PM	RP-19
M315-8	GL-4	100198-06	.001@10"Hg	73" Pos ok Neg ok	6:36 AM 1:13 PM	ES1

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX: (919) 941-0234

Pitot Calibration Worksheet

Plant: Hot Asphalt Mix - Plant D **City, State:** Barre, Mass.

Date: 10-5-98 **Initials:** DPH

RUN ID	PITOT ID	CALIBRATION COEFFICIENT	DATA SHEET COEFF.	CALIBRATION DATE	TEST DATE
M315-1	RP-19	.84	.84	7-14-98	10-5-98
M315-6	ES1	.84	.84	10-12-98	10-5-98
M315-2	RP-19	.84	.84	7-14-98	10-6-98
M315-7 DPH	ES1	.84	.84	10-12-98	10-6-98
M315-3	RP-19	.84	.84	7-14-98	10-7-98
M315-8	ES1	.84	.84	10-12-98	10-7-98

APPENDIX G

TEST METHODS

METHOD 1

Method 1 - Sample and Velocity Traverses for Stationary Sources

1. PRINCIPLE AND APPLICABILITY

1.1 **Principle.** To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 **Applicability.** This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4), (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m^2 (113 $in.^2$) in cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. PROCEDURE

2.1 **Selection of Measurement Site.** Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2LW}{(L + W)}$$

Eq. 1-1

Where
L = Length and W = width.

An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This procedure,
determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12 and 24 in.); and (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12 and 24 in.).

When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that used for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.

2.3 Cross-Sectional Layout and Location of Traverse Points.

2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to the approval of the Administrator.

In addition, for stacks having diameters greater than 0.61 m (24 in.), no traverse points shall be within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.

2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When

any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the
stack walls, relocate them away from the stack walls to: (1) a distance of
2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points. Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

2.3.1.2 Stacks With Diameters Equal To or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.
If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4 x 3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9 x 4 or 12 x 3, and would not necessarily have to be 6 x 6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area. The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination. Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to ±90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable, and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses. The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above.

2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent or duct diameters downstream or less than one-half duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation.

NOTE: Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.

2.5.1 Apparatus.

2.5.1.1 Directional Probe. Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (**NOTE:** Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional probe, and permanently mark or engrave the number on the body of the probe. The pressure holes of directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "back-purging" with pressurized air is required.

2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, or other differential pressure gauges (e.g., magnehelic gauges) that meet the specifications described in Method 2, Section 2.2.

NOTE: If the differential pressure gauge produces both negative and positive readings, then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, Section 2.2.

2.5.2 Traverse Points. Use a minimum of 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow Section 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location is determined to be acceptable according to the criteria in this alternative procedure, use the same traverse point number and locations for sampling and velocity measurements.

2.5.3 Measurement Procedure.

2.5.3.1 Prepare the directional probe and differential pressure gauges as recommended by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, pressurize or use suction on the impact opening until a reading of at least 7.6 cm (3 in.) H_20 registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.

2.5.3.2 Level and zero the manometers. Since the manometer level and zero may drift because of vibrations and temperature changes, periodically check the level and zero during the traverse.

2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for the yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibration curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point.

A post-test check as described in Section 2.5.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, and repeat the flow angle measurements.

2.5.4 Calculate the resultant angle at each traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculations retaining at least one extra significant figure beyond that of the acquired data.

Round the values after the final calculations.

2.5.4.1 Calculate the resultant angle at each traverse point:

$$R_i = \text{arc cosine}[(\text{cosine}Y_i)(\text{cosine}P_i)]$$

Eq. 1-2

Where:

R_i = resultant angle at traverse point i, degree.
Y_i = yaw angle at traverse point i, degree.
P_i = pitch angle at traverse point i, degree.

2.5.4.2 Calculate the average resultant for the measurements:

$$\bar{R} = \frac{\Sigma R_i}{n}$$

Eq. 1-3

Where:

R_{avg} = average resultant angle, degree.
n = total number of traverse points.

2.5.4.3 Calculate the standard deviations:

$$S_d = \sqrt{\frac{\sum_{i=1}^{n} (R_i - \bar{R})^2}{(n-1)}}$$

Eq. 1-4

Where:

S_d = standard deviation, degree.

2.5.5 The measurement location is acceptable if $R_{avg} \leq 20°$ and $S_d \leq 10°$.

325

2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3600 ft/min).

2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurements should be made at the same point in the test section, preferably at the centroid of the test section.

2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be ±2° of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.

2.5.6.3 Pitch Angle Calibration. Perform a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from -60° to +60° at one velocity in each of the two ranges specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured datavalues and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and

60°.

2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows: Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-dimensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.

BIBLIOGRAPHY

1. Determining Dust Concentration in a Gas Stream, ASME Performance Test Code No. 27. New York. 1957.

2. DeVorkin, Howard, et al. Air Pollution Source Testing Manual. Air Pollution Control District. Los Angeles, CA. November 1963.

3. Methods for Determining of Velocity, Volume, Dust and Mist Content of Gases. Western Precipitation Division of Joy Manufacturing Co. Los Angeles, CA. Bulletin WP-50. 1968.

4. Standard Method for Sampling Stacks for Particulate Matter. In: 1971 Book of ASTM Standards, Part 23. ASTM Designation D 2928-71. Philadelphia, PA. 1971.

5. Hanson, H.A., et al. Particulate Sampling Strategies for Large Power Plants Including Nonuniform Flow. USEPA, ORD, ESRL, Research Triangle Park, NC. EPA-600/2-76-170. June 1976.

6. Entropy Environmentalists, Inc. Determination of the Optimum

Number of Sampling Points: An Analysis of Method 1 Criteria. Environmental Protection Agency. Research Triangle Park, NC. EPA Contract No. 68-01-3172, Task 7.

7. Hanson, H.A., R.J. Davini, J.K. Morgan, and A.A. Iversen. Particulate Sampling Strategies for Large Power Plants Including Nonuniform Flow. USEPA, Research Triangle Park, NC. Publication No. EPA-600/2-76-170. June 1976. 350 p.

8. Brooks, E.F., and R.L. Williams. Flow and Gas Sampling Manual. U.S. Environmental Protection Agency. Research Triangle Park, NC. Publication No. EPA-600/2-76-203. July 1976. 93 p.

9. Entropy Environmentalists, Inc. Traverse Point Study. EPA Contract No. 68-02-3172. June 1977. 19 p.

10. Brown, J. and K. Yu. Test Report: Particulate Sampling Strategy in Circular Ducts. Emission Measurement Branch. Emission Standards and Engineering Division. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. July 31, 1980. 12 p.

11. Hawksley, P.G.W., S. Badzioch, and J.H. Blackett. Measurement of Solids in Flue Gases. Leatherhead, England, The British Coal Utilisation Research Association. 1961. p. 129-133.

12. Knapp, K.T. The Number of Sampling Points Needed for Representative Source Sampling. In: Proceedings of the Fourth National Conference on Energy and Environment. Theodore, L. et al. (ed). Dayton, Dayton Section of the American Institute of Chemical Engineers. October 3-7, 1976. p. 563-568.

13. Smith, W.S. and D.J. Grove. A Proposed Extension of EPA Method 1 Criteria. Pollution Engineering. XV (8):36-37. August 1983.

14. Gerhart, P.M. and M.J. Dorsey. Investigation of Field Test Procedures for Large Fans. University of Akron. Akron, OH.

(EPRI Contract CS-1651). Final Report (RP-1649-5). December 1980.

15. Smith, W.S. and D.J. Grove. A New Look at Isokinetic Sampling - Theory and Applications. Source Evaluation Society Newsletter. VIII(3):19-24. August 1983.

Table 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

TABLE 1-2
LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS
(Percent of stack diameter from inside wall to traverse point)

Traverse Point Number on a Diameter	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	112.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3

331

12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

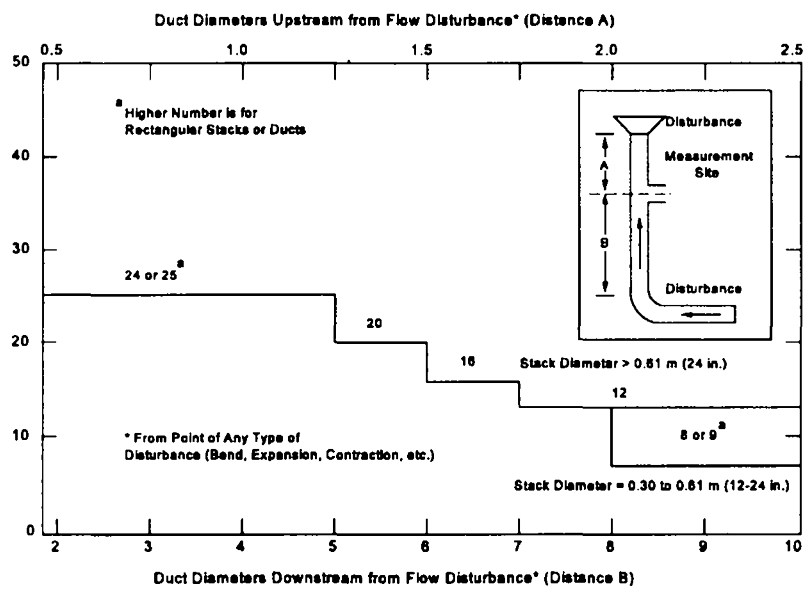


Figure 1-1. Minimum number of traverse points for particulate traverses.

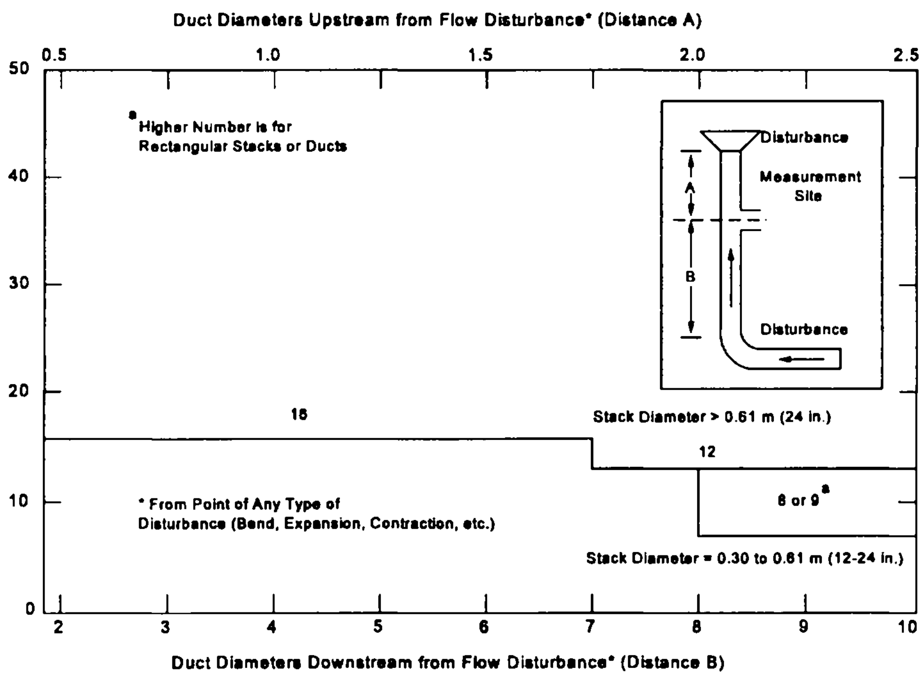


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

Traverse Point	Distance % of diameter
1	4.4
2	14.7
3	29.5
4	70.5
5	85.3
6	95.6

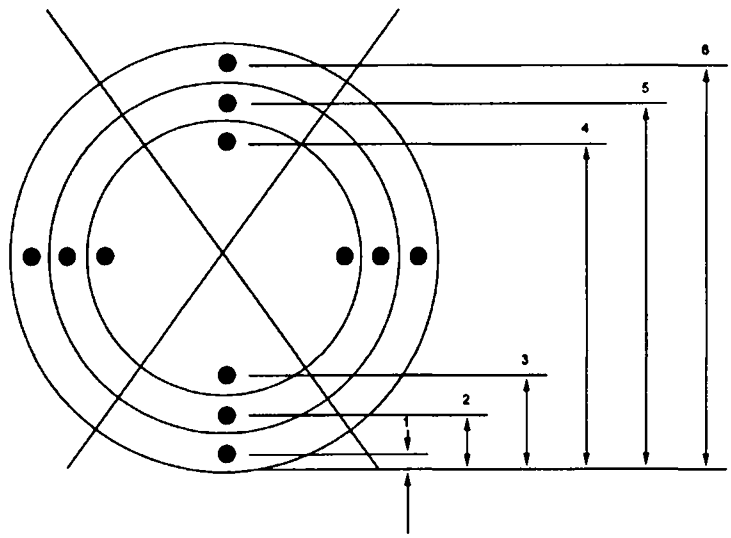


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

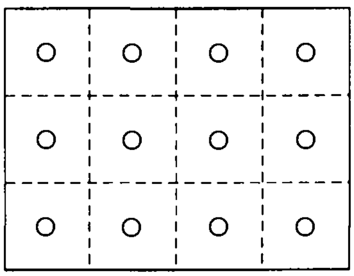


Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

METHOD 2

Method 2 - Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

1. PRINCIPLE AND APPLICABILITY

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites that fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. APPARATUS

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

2.1 Type S Pitot Tube. Pitot tube made of metal tubing (e.g., stainless steel) as shown in Figure 2-1. It is recommended that the external tubing diameter (dimension D_t, Figure 2-2b) be between 0.48 and 0.95 cm (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B, Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube. A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same ($\pm$5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0- to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in the Bibliography describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T = \frac{\sum_{i=1}^{n} \sqrt{\Delta p_i + K}}{\sum_{i=1}^{n} \sqrt{\Delta p_i}}$$

Where:

Δp_i = Individual velocity head reading at a traverse point, mm (in.) H_2O.

n = Total number of traverse points.

K = 0.13 mm H_2O when metric units are used and 0.005 in. H_2O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

NOTE: If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used, subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternative positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm (0.1 in.) Hg. See **NOTE** in Method 5, Section 2.1.9.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube for a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 70 S, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in Sections 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in the Bibliography) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99 ± 0.01.

2.7.1 Hemispherical (shown in Figure 2-4) ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90-degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.

2.7.5 Ninety-degree bend, with curved or mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm (0.005 in.) H_2O. For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm (0.005 in.) H_2O for Δp values between 1.3 and 25 mm (0.05 and 1.0 in.) H_2O, and to the nearest 1.3 mm (0.05 in.) H_2O for Δp values above 25 mm (1.0 in.) H_2O. A special, more sensitive gauge will be required to read Δp values below 1.3 mm (0.05 in.) H_2O (see Citation 18 in the Bibliography).

3. PROCEDURE

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted as follows: (1) blow through the pitot impact opening until at least

7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak-check procedures, subject to the approval of the Administrator, may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. CALIBRATION

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.), and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the

344

pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1).

If D_t, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in Sections 4.1.2 through 4.1.5 below.

4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in the Bibliography); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6B).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D_e = \frac{2LW}{(L + W)}$$

Eq. 2-1

Where:

D_e = Equivalent diameter.
L = Length.
W = Width.

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to ±3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to ±5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in the Bibliography for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

4.1.3.2 Level and zero the manometer. Turn on the fan, and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read Δp_{std}, and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct, and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read Δp_s, and enter its value in the data table. Remove the Type S pitot tube from the duct, and disconnect it from the manometer.

4.1.3.7 Repeat Steps 4.1.3.3 through 4.1.3.6 above until three pairs of Δp readings have been obtained.

4.1.3.8 Repeat Steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of Δp readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$

Eq. 2-2

Where:

$C_{p(s)}$ = Type S pitot tube coefficient.

$C_{p(std)}$ = Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

Δp_{std} = Velocity head measured by the standard pitot tube, cm (in.) H_2O.

Δp_s = Velocity head measured by the Type S pitot tube, cm (in.) H_2O.

4.1.4.2 Calculate $\bar{C}_p$ (side A), the mean A-side coefficient, and $\bar{C}_p$ (side B), the mean B-side coefficient; calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of $C_{p(s)}$ from $\bar{C}_p$ (side A), and the deviation of each B-side values of $C_{p(s)}$ from $\bar{C}_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p_{(s)}} - \bar{C}_p(\text{A or B})$$

Eq. 2-3

4.1.4.4 Calculate σ, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma(\text{side A or B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A or B}) \right|}{3}$$

Eq. 2-4

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between $\bar{C}_p$ (A) and $\bar{C}_p$ (B) is 0.01 or less.

4.1.5 Special Considerations.

4.1.5.1 Selection of Calibration Point.

4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., $\bar{C}_p$ (side A) and $\bar{C}_p$ (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6 and 2-8).

348

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in the Bibliography). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6A), the value of $C_{p(s)}$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or 1/4 in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in the Bibliography).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4.)

4.1.6 Field Use and Recalibration.

4.1.6.1 Field Use.

4.1.6.1.1 When a Type S pitot tube (isolated or in an assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.

4.1.6.1.2 When a probe assembly is used to sample a small duct, 30.5 to 91.4 cm (12 to 36 in.) in diameter, the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $C_{p(s)}$. Consult Citation 9 in the Bibliography for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 30.5 cm (12 in.) (see Citation 16 in the Bibliography).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of the Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings, or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figure 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings, or recalibrate the assembly.

4.2 Standard Pitot Tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of an assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).

4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405°C (761°F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405°C (761°F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternative reference, subject to the approval of the Administrator.

If, during calibration, the absolute temperature measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. CALCULATIONS

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

350

A = Cross-sectional area of stack, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant,

$$34.97 \frac{m}{sec} \left[\frac{(g/g-mole)(mmHg)}{(^{\circ}K)\ (mmH_2O)} \right]^{1/2}$$

for the metric system.

$$85.49 \frac{ft}{sec} \left[\frac{lb/lb-mole)\ (in.Hg)}{(^{\circ}R)\ (in.H_2O)} \right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6), g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$$= M_d(1 - B_{ws}) + 18.0B_{ws}$$

Eq. 2-5

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack static pressure, mm Hg (in. Hg).

P_s = Absolute stack pressure, mm Hg (in. Hg),

$$= P_{bar} + P_g$$

Eq. 2-6

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dsm^3/hr (dscf/hr).

351

t_s = Stack temperature, °C (°F).

T_s = Absolute stack temperature, °K (°R).

$$= 273 + t_s$$

Eq. 2-7

for metric.

$$= 460 + t_s$$

Eq. 2-8

for English.

T_{std} = Standard absolute temperature, 293°K (528°R).

v_s = Average stack gas velocity, m/sec (ft/sec).

Δp = Velocity head of stack gas, mm H_2O (in. H_2O).

3,600= Conversion factor, sec/hr.

18.0 = Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average Stack Gas Velocity.

$$v_s = K_p C_p \left(\sqrt{\Delta p}\right)_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

Eq. 2-9

5.3 Average Stack Gas Dry Volumetric Flow Rate.

$$Q_{sd} = 3{,}600(1 - B_{ws}) v_s A \frac{T_{std}}{T_{s(avg)}} \frac{P_s}{P_{std}}$$

Eq. 2-10

BIBLIOGRAPHY

1. Mark, L.S. Mechanical Engineers' Handbook. New York. McGraw-Hill Book Co., Inc. 1951.

2. Perry. J.H. Chemical Engineers' Handbook. New York. McGraw-Hill Book Co., Inc. 1960.

3. Shigehara, R.T., W.F. Todd, and W.S. Smith. Significance of Errors in Stack Sampling Measurements. U.S. Environmental Protection Agency, Research Triangle Park, N.C. (Presented at the Annual Meeting of the Air Pollution Control Association, St. Louis, MO., June 14-19, 1970).

4. Standard Method for Sampling Stacks for Particulate Matter. In: 1971 Book of ASTM Standards, Part 23. Philadelphia, PA. 1971. ASTM Designation D 2928-71.

5. Vennard, J.K. Elementary Fluid Mechanics. New York. John Wiley and Sons, Inc. 1947.

6. Fluid Meters - Their Theory and Application. American Society of Mechanical Engineers, New York, N.Y. 1959.

7. ASHRAE Handbook of Fundamentals. 1972. p. 208.

8. Annual Book of ASTM Standards, Part 26. 1974. p. 648.

9. Vollaro, R.F. Guidelines for Type S Pitot Tube Calibration. U.S. Environmental Protection Agency, Research Triangle Park, N.C. (Presented at 1st Annual Meeting, Source Evaluation Society, Dayton, OH, September 18, 1975.)

10. Vollaro, R.F. A Type S Pitot Tube Calibration Study. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, N.C. July 1974.

11. Vollaro, R.F. The Effects of Impact Opening Misalignment on the Value of the Type S Pitot Tube Coefficient. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, NC. October 1976.

12. Vollaro, R.F. Establishment of a Baseline Coefficient Value for Properly Constructed Type S Pitot Tubes. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, NC. November 1976.

13. Vollaro, R.F. An Evaluation of Single-Velocity Calibration Technique as a Means of Determining Type S Pitot Tube Coefficients. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, NC. August 1975.

14. Vollaro, R.F. The Use of Type S Pitot Tubes for the Measurement of Low Velocities. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, NC. November 1976.

15. Smith, Marvin L. Velocity Calibration of EPA Type Source Sampling Probe. United Technologies Corporation, Pratt and Whitney Aircraft Division, East

Hartford, CT. 1975.

16. Vollaro, R.F. Recommended Procedure for Sample Traverses in Ducts Smaller than 12 Inches in Diameter. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, NC. November 1976.

17. Ower, E. and R.C. Pankhurst. The Measurement of Air Flow, 4th Ed. London, Pergamon Press. 1966.

18. Vollaro, R.F. A Survey of Commercially Available Instrumentation for the Measurement of Low-Range Gas Velocities. U.S. Environmental Protection Agency, Emission Measurement Branch, Research Triangle Park, NC. November 1976. (Unpublished Paper).

19. Gnyp, A.W., C.C. St. Pierre, D.S. Smith, D. Mozzon, and J. Steiner. An Experimental Investigation of the Effect of Pitot Tube-Sampling Probe Configurations on the Magnitude of the S Type Pitot Tube Coefficient for Commercially Available Source Sampling Probes. Prepared by the University of Windsor for the Ministry of the Environment, Toronto, Canada. February 1975.

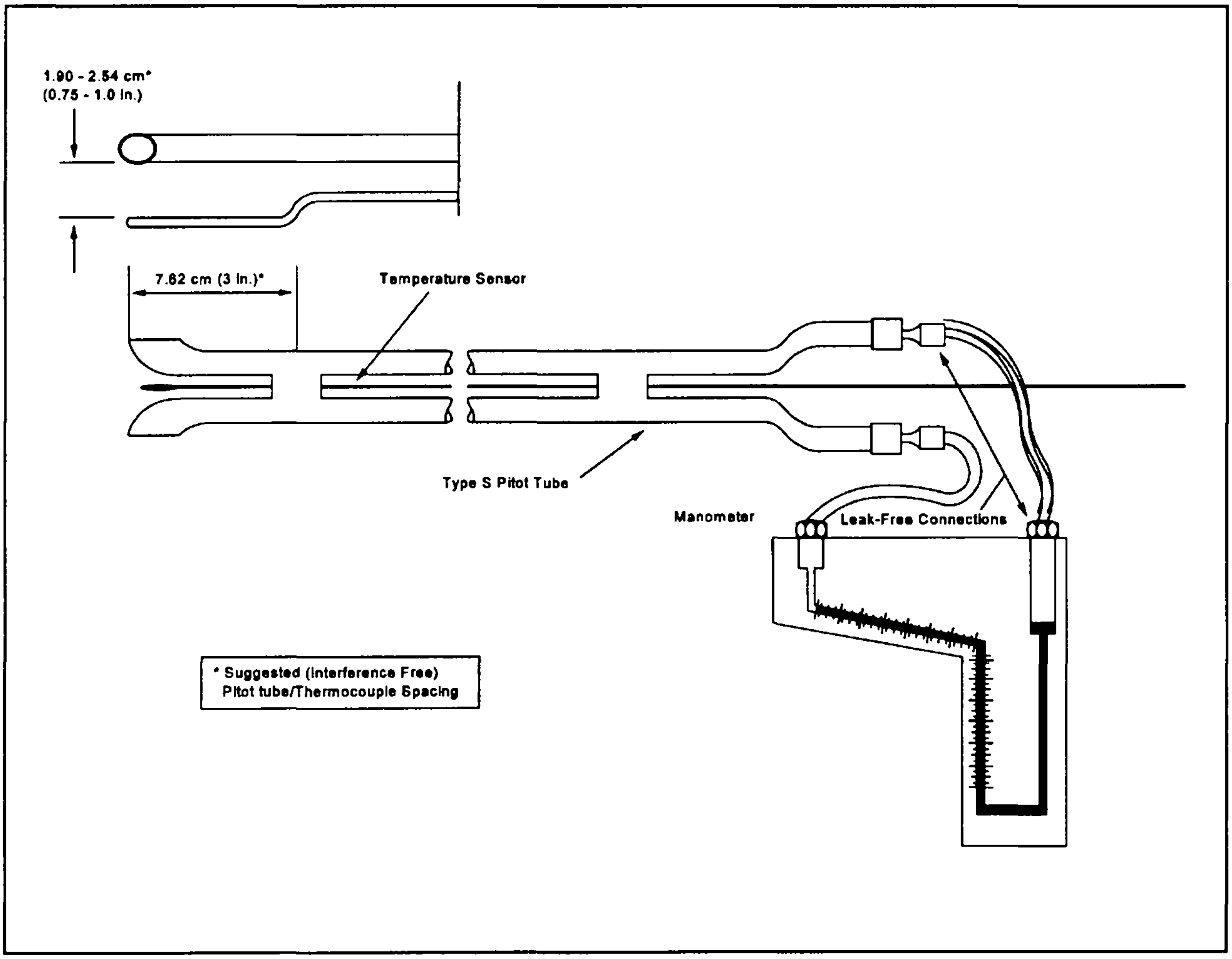


Figure 2-1. Type S pitot tube manometer assembly.

355

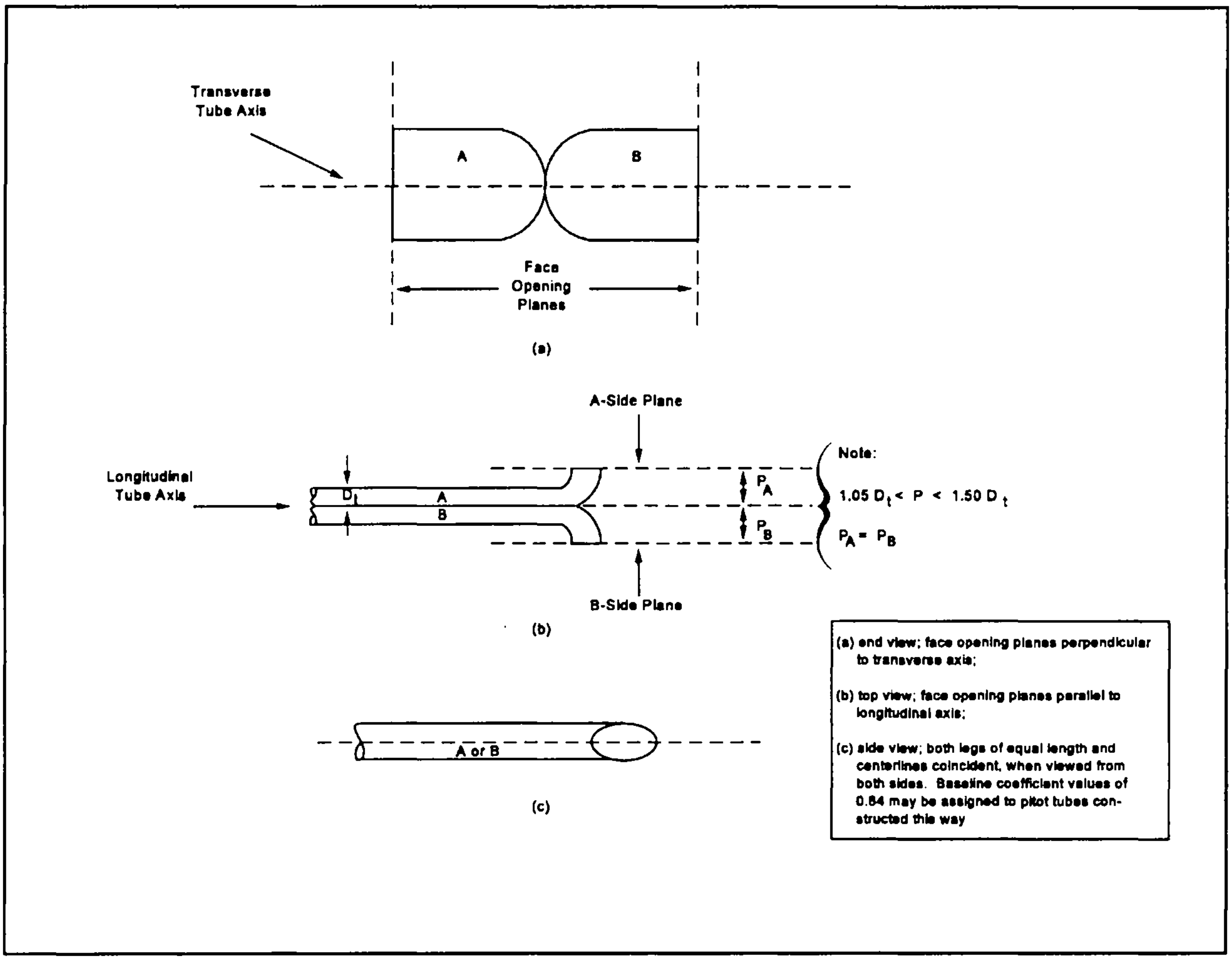


Figure 2-2. Properly constructed Type S pitot tube.

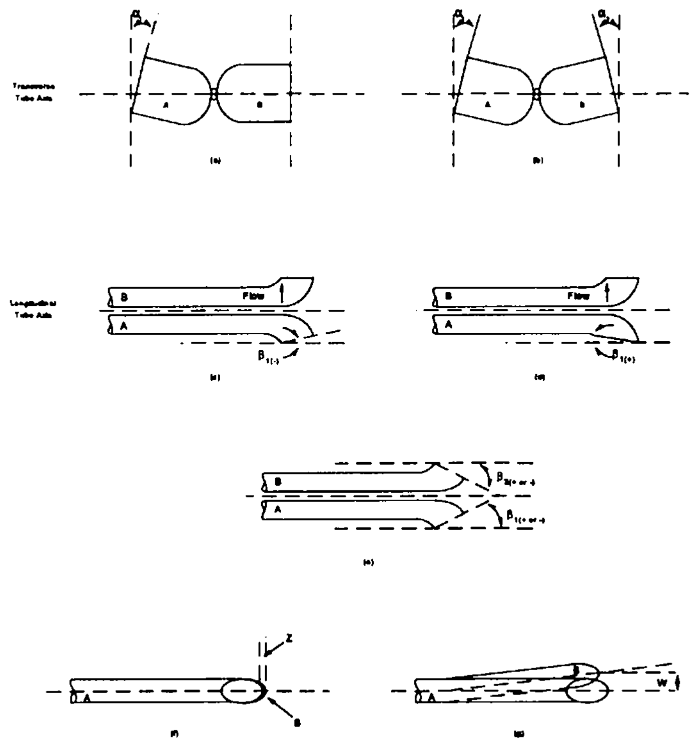


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of Cp(s) so long as α^1 and $\alpha^2 \leq 10°$, β^1 and $\beta^2 \leq 5°$, z $\leq$0.32 cm (1/8 in.) and w $\leq$0.08 cm (1/32 in.) (citation 11 in Bibliography).

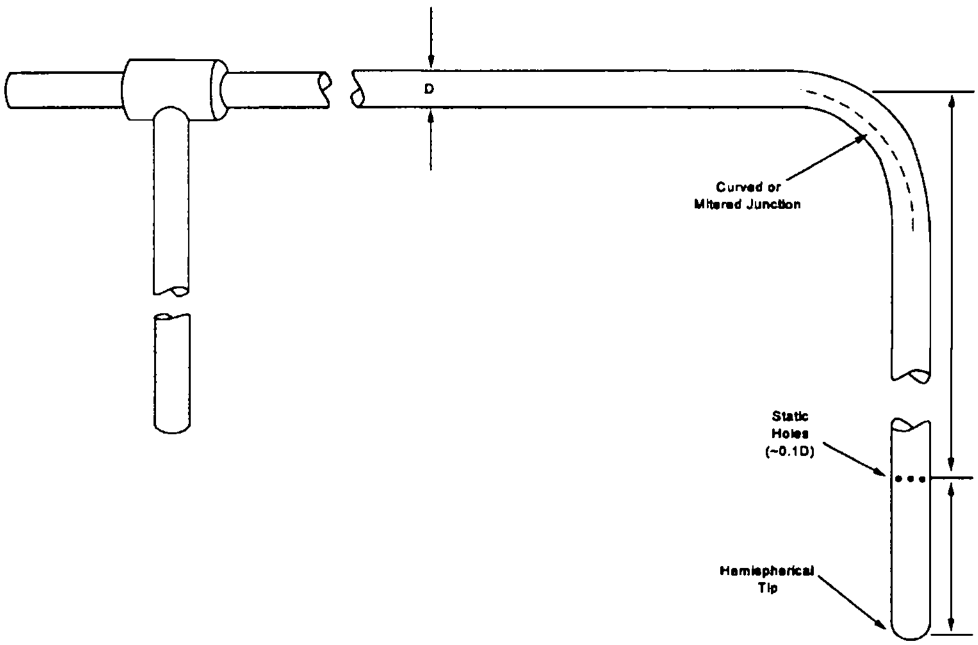


Figure 2-4. Standard pitot tube design specifications.

PLANT ______________________________
DATE __________ RUN NO. ________________STACK DIA. OR
DIMENSIONS, m (in.) _____ BAROMETRIC PRESS., mm Hg
(in. Hg) _____CROSS SECTIONAL AREA, m^2 (ft^2)________
OPERATORS ______________________________
PITOT TUBE I.D. NO. __________________
AVG. COEFFICIENT, Cp = _____________
LAST DATE CALIBRATED ________________

SCHEMATIC OF STACK
CROSS SECTION

Traverse Pt. No.	Vel. Hd., Δp mm (in.) H_2O	Stack Temperature		P_g mm Hg (in.Hg)	$(\Delta p)^{1/2}$
		T_s, °C (°F)	T_s, °K (°R)		
		Average			

Figure 2-5. Velocity traverse data.

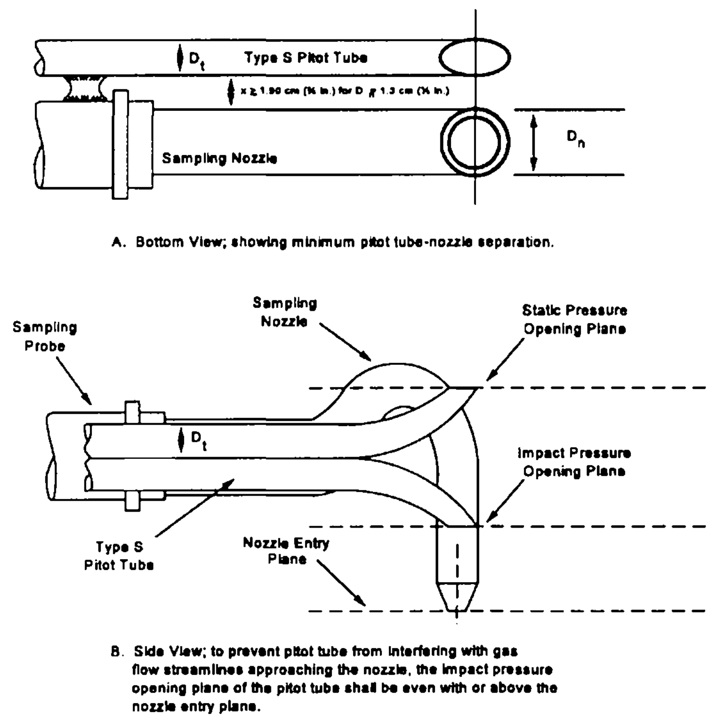


Figure 2-6. Proper pitot tube-sampling nozzle configuration to prevent aerodynamic interference; button-hook type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

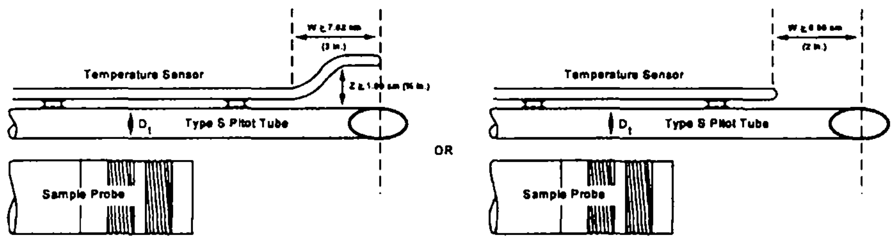


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

362

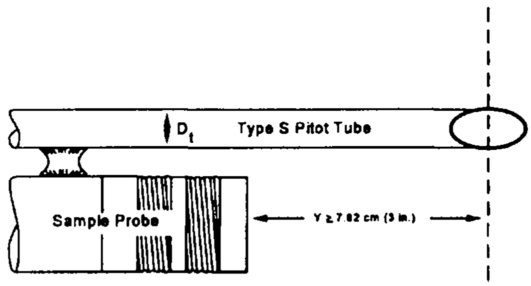


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

PITOT TUBE IDENTIFICATION NUMBER: _________ DATE: _____________CALIBRATED BY: ____

	"A" SIDE CALIBRATION			
RUN NO.	ΔP_{std} cm H_2O (in H_2O)	$\Delta P_{(s)}$ cm H_2O (in H_2O)	$C_{p(s)}$	Deviation $C_{p(s)} - C_p(A)$
1				
2				
3				
		$C_{p,avg}$ (SIDE A)		

	"B" SIDE CALIBRATION			
RUN NO.	ΔP_{std} cm H_2O (in H_2O)	$\Delta P_{(s)}$ cm H_2O (in H_2O)	$C_{p(s)}$	Deviation $C_{p(s)} - C_p(B)$
1				
2				
3				
		$C_{p,avg}$ (SIDE B)		

$$\text{Average Deviation} = \sigma_{(A\,or\,B)} = \frac{\sum_{i=1}^{3} \left| C_{p(s)} - \bar{C}_{p(A\,or\,B)} \right|}{3} \leftarrow \text{Must Be} \leq 0.01$$

$$\left| \bar{C}_p(\text{Side A}) - \bar{C}_p(\text{Side B}) \right| \leftarrow \text{Must Be} \leq 0.01$$

Figure 2-9. Pitot tube calibration data.

365

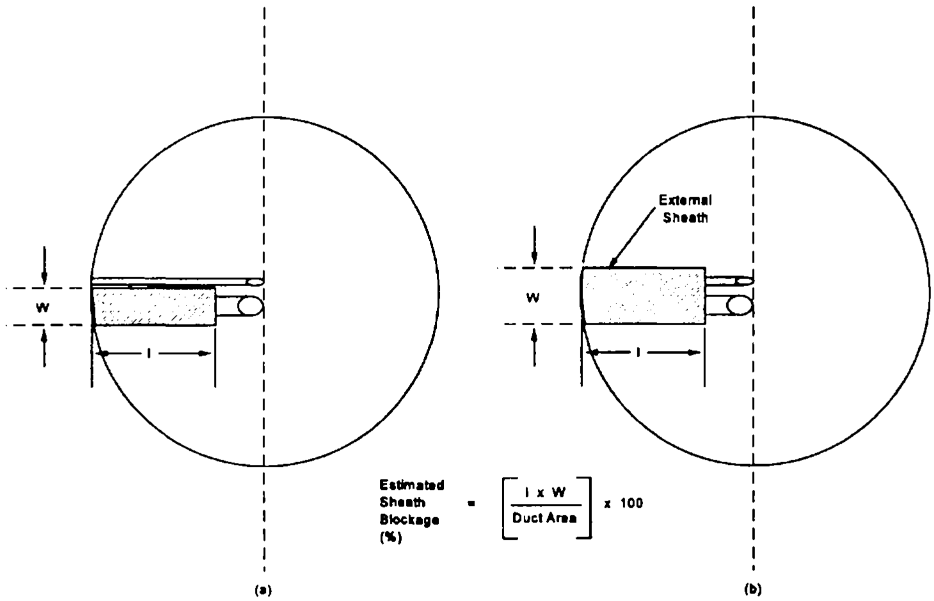


Figure 2-10. Projected-area models for typical pitot tube assemblies.

366

METHOD 315

367

APPENDIX A TO PART 63--TEST METHODS

* * * * *

METHOD 315 - DETERMINATION OF PARTICULATE AND METHYLENE CHLORIDE EXTRACTABLE MATTER (MCEM) FROM SELECTED SOURCES AT PRIMARY ALUMINUM PRODUCTION FACILITIES

NOTE: This method does not include all of the specifications (e.g., equipment and supplies) and procedures (e.g., sampling and analytical) essential to its performance. Some material is incorporated by reference from other methods in this part. Therefore, to obtain reliable results, persons using this method should have a thorough knowledge of at least the following additional test methods: Method 1, Method 2, Method 3, and Method 5 of 40 CFR part 60, appendix A.

1.0 Scope and Application.

1.1 Analytes. Particulate matter (PM). No CAS number assigned. Methylene chloride extractable matter (MCEM). No CAS number assigned.

1.2 Applicability. This method is applicable for the simultaneous determination of PM and MCEM when specified in an applicable regulation. This method was developed by consensus with the Aluminum Association and the U.S. Environmental Protection Agency (EPA) and has limited precision estimates for MCEM; it should have similar precision to Method 5 for PM in 40 CFR part 60, appendix A since the procedures are similar for PM.

1.3 Data quality objectives. Adherence to the requirements of this method will enhance the quality of the data obtained from air pollutant sampling methods.

2.0 Summary of Method.

Particulate matter and MCEM are withdrawn isokinetically from the source. PM is collected on a glass fiber filter maintained at a temperature in the range of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The PM mass, which includes any material that condenses on the probe and is subsequently removed in an acetone rinse or on the filter at or above the filtration temperature, is determined gravimetrically after removal of uncombined water. MCEM is then determined by adding a methylene chloride rinse of the probe and filter holder, extracting the condensable hydrocarbons collected in the impinger water, adding an acetone rinse followed by a methylene chloride rinse of the sampling train components after the filter and before the silica gel impinger, and determining residue gravimetrically after evaporating the solvents.

3.0 Definitions. [Reserved]

4.0 Interferences. [Reserved]

5.0 Safety.

This method may involve hazardous materials, operations, and equipment. This method does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to performing this test method.

6.0 Equipment and Supplies.

NOTE: Mention of trade names or specific products does not constitute endorsement by the EPA.

6.1 Sample collection. The following items are required for sample collection:

6.1.1 Sampling train. A schematic of the sampling train used in this method is shown in Figure 5-1, Method 5, 40 CFR part 60, appendix A. Complete construction details are given in APTD-0581 (Reference 2 in section 17.0 of this method); commercial models of this train are also available. For changes from APTD-0581 and for allowable modifications of the train shown in Figure 5-1, Method 5, 40 CFR part 60, appendix, A see the following subsections.

NOTE: The operating and maintenance procedures for the sampling train are described in APTD-0576 (Reference 3 in section 17.0 of this method). Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The use of grease for sealing sampling train components is not recommended because many greases are soluble in methylene chloride. The sampling train consists of the following components:

6.1.1.1 Probe nozzle. Glass or glass lined with sharp, tapered leading edge. The angle of taper shall be ≤30°, and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. Other materials of construction may be used, subject to the approval of the Administrator. A range of nozzle sizes suitable for isokinetic sampling should be available. Typical nozzle sizes range from 0.32 to 1.27 cm (1/8 to 1/2 in.) inside diameter (ID) in increments of 0.16 cm (1/16 in.). Larger nozzle sizes are also available if higher volume sampling trains are used. Each nozzle shall be calibrated according to the procedures outlined in section 10.0 of this method.

6.1.1.2 Probe liner. Borosilicate or quartz glass tubing with a heating system capable of maintaining a probe gas temperature at the exit end during sampling of 120 ± 14°C (248 ± 25°F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Because the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and using the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable. Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480°C (900°F); quartz liners shall be used for temperatures between 480 and 900°C (900 and 1,650°F). Both types of liners may be used at higher temperatures than specified for short periods of time, subject to the approval of the Administrator. The softening temperature for borosilicate glass is 820°C (1,500°F) and for quartz glass it is 1,500°C (2,700°F).

6.1.1.3 Pitot tube. Type S, as described in section 6.1 of Method 2, 40 CFR part 60, appendix A, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1 of Method 5, 40 CFR part 60, appendix A) to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b, 40 CFR part 60, appendix A) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in section 10.0 of Method 2, 40 CFR part 60, appendix A.

6.1.1.4 Differential pressure gauge. Inclined manometer or equivalent device (two), as described in section 6.2 of Method 2, 40 CFR part 60, appendix A. One manometer shall be used for velocity head (Dp) readings, and the other, for orifice differential pressure readings.

6.1.1.5 Filter holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

6.1.1.6 Filter heating system. Any heating system capable of maintaining a temperature around the filter holder of 120 ± 14°C (248 ± 25°F) during sampling, or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

6.1.1.7 Temperature sensor. A temperature sensor capable of measuring temperature to within ±3°C (5.4°F) shall be installed so that the sensing tip of the temperature sensor is in direct contact with the sample gas, and the temperature around the filter holder can be regulated and monitored during sampling.

6.1.1.8 Condenser. The following system shall be used to determine the stack gas moisture content: four glass impingers connected in series with leak-free ground glass fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3 cm (1/2 in.) ID glass tube extending to about 1.3 cm (1/2 in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. The first and second impingers shall contain known quantities of water (section 8.3.1 of this method), the third shall be empty, and the fourth shall contain a known weight of silica gel or equivalent desiccant. A temperature sensor capable of measuring temperature to within 1°C (2°F) shall be placed at the outlet of the fourth impinger for monitoring.

6.1.1.9 Metering system. Vacuum gauge, leak-free pump, temperature sensors capable of measuring temperature to within 3°C (5.4°F), dry gas meter (DGM) capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1 of Method 5, 40 CFR part 60, appendix A. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall allow periodic checks of isokinetic rates.

6.1.1.10 Sampling trains using metering systems designed for higher flow rates than that described in APTD-0581 or APTD-0576 may be used provided that the specifications of this method are met.

6.1.2 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm (0.1 in.) Hg.

NOTE: The barometric reading may be obtained from a nearby National Weather Service station. In this case, the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be made at a rate of minus 2.5 mm (0.1 in) Hg per 30 m (100 ft) elevation increase or plus 2.5 mm (0.1 in) Hg per 30 m (100 ft) elevation decrease.

6.1.3 Gas density determination equipment. Temperature sensor and pressure gauge, as described in sections 6.3 and 6.4 of Method 2, 40 CFR part 60, appendix A, and gas analyzer, if necessary, as described in Method 3, 40 CFR part 60, appendix A. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-4, 40 CFR part 60, appendix A). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature sensor need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

6.2 Sample recovery. The following items are required for sample recovery:

6.2.1 Probe-liner and probe-nozzle brushes. Nylon or Teflon® bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) constructed of stainless steel, nylon, Teflon®, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

6.2.2 Wash bottles. Glass wash bottles are recommended. Polyethylene or tetrafluoroethylene (TFE) wash bottles may be used, but they may introduce a positive bias due to contamination from the bottle. It is recommended that acetone not be stored in polyethylene or TFE bottles for longer than a month.

6.2.3 Glass sample storage containers. Chemically resistant, borosilicate glass bottles, for acetone and methylene chloride washes and impinger water, 500 ml or 1,000 ml. Screw-cap liners shall either be rubber-backed Teflon® or shall be constructed so as to be leak-free and resistant to chemical attack by acetone or methylene chloride. (Narrow-mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

6.2.4 Petri dishes. For filter samples, glass, unless otherwise specified by the Administrator.

6.2.5 Graduated cylinder and/or balance. To measure condensed water, acetone wash and methylene chloride wash used during field recovery of the samples, to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any such balance is suitable for use here and in section 6.3.4 of this method.

6.2.6 Plastic storage containers. Air-tight containers to store silica gel.

6.2.7 Funnel and rubber policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

6.2.8 Funnel. Glass or polyethylene, to aid in sample recovery.

6.3 Sample analysis. The following equipment is required for sample analysis:

6.3.1 Glass or Teflon® weighing dishes.

6.3.2 Desiccator. It is recommended that fresh desiccant be used to minimize the chance for positive bias due to absorption of organic material during drying.

6.3.3 Analytical balance. To measure to within 0.1 mg.

6.3.4 Balance. To measure to within 0.5 g.

6.3.5 Beakers. 250 ml.

6.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

6.3.7 Temperature sensor. To measure the temperature of the laboratory environment.

6.3.8 Buchner fritted funnel. 30 ml size, fine (<50 micron)-porosity fritted glass.

6.3.9 Pressure filtration apparatus.

6.3.10 Aluminum dish. Flat bottom, smooth sides, and flanged top, 18 mm deep and with an inside diameter of approximately 60 mm.

7.0 Reagents and Standards.

7.1 Sample collection. The following reagents are required for sample collection:

7.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (<0.05 percent penetration) on 0.3 micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM Method D 2986-95A (incorporated by reference in § 63.841 of this part). Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO_2 or SO_3, the filter material must be of a type that is unreactive to SO_2 or SO_3. Reference 10 in section 17.0 of this method may be used to select the appropriate filter.

7.1.2 Silica gel. Indicating type, 6 to 16 mesh. If previously used, dry at 175°C (350°F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

7.1.3 Water. When analysis of the material caught in the impingers is required, deionized distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

7.1.4 Crushed ice.

7.1.5 Stopcock grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon® sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator. [Caution: Many stopcock greases are methylene chloride-soluble. Use sparingly and carefully remove prior to recovery to prevent contamination of the MCEM analysis.]

7.2 Sample recovery. The following reagents are required for sample recovery:

7.2.1 Acetone. Acetone with blank values < 1 ppm, by weight residue, is required. Acetone blanks may be run prior to field use, and only acetone with low blank values may be used. In no case shall a blank value of greater than 1E-06 of the weight of acetone used be subtracted from the sample weight.

NOTE: This is more restrictive than Method 5, 40 CFR part 60, appendix A. At least one vendor (Supelco Incorporated located in Bellefonte, Pennsylvania) lists <1 mg/l as residue for its Environmental Analysis Solvents.

7.2.2 Methylene chloride. Methylene chloride with a blank value <1.5 ppm, by weight, residue. Methylene chloride blanks may be run prior to field use, and only methylene chloride with low blank values may be used. In no case shall a blank value of greater than 1.6E-06 of the weight of methylene chloride used be subtracted from the sample weight.

NOTE: A least one vendor quotes <1 mg/l for Environmental Analysis Solvents-grade methylene chloride.

7.3 Sample analysis. The following reagents are required for sample analysis:

7.3.1 Acetone. Same as in section 7.2.1 of this method.

7.3.2 Desiccant. Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

7.3.3 Methylene chloride. Same as in section 7.2.2 of this method.

8.0 Sample Collection, Preservation, Storage, and Transport.

NOTE: The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

8.1 Pretest preparation. It is suggested that sampling equipment be maintained according to the procedures described in APTD-0576.

8.1.1 Weigh several 200 g to 300 g portions of silica gel in airtight containers to the nearest 0.5 g. Record on each container the total weight of the silica gel plus container. As an alternative, the silica gel need not be preweighed but may be weighed directly in its impinger or sampling holder just prior to train assembly.

8.1.2 A batch of glass fiber filters, no more than 50 at a time, should placed in a soxhlet extraction apparatus and extracted using methylene chloride for at least 16 hours. After extraction, check filters visually against light for irregularities, flaws, or pinhole leaks. Label the shipping containers (glass or plastic petri dishes), and keep the filters in these containers at all times except during sampling and weighing.

8.1.3 Desiccate the filters at 20 ± 5.6°C (68 ± 10°F) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., <0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for longer than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven-dried at 104°C (220°F) for 2 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

8.2 Preliminary determinations.

8.2.1 Select the sampling site and the minimum number of sampling points according to Method 1, 40 CFR part 60, appendix A or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2, 40 CFR part 60, appendix A; it is recommended that a leak check of the pitot lines (see section 8.1 of Method 2, 40 CFR part 60, appendix A) be performed. Determine the moisture content using Approximation Method 4 (section 1.2 of Method 4, 40 CFR part 60, appendix A) or its alternatives to make isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in section 8.6 of Method 2, 40 CFR part 60, appendix A; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

8.2.2 Select a nozzle size based on the range of velocity heads such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see section 8.2 of Method 2, 40 CFR part 60, appendix A).

8.2.3 Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the required probe length.

8.2.4 Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that: (1) The sampling time per point is not less than 2 minutes (or some greater time interval as specified by the Administrator); and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

8.2.5 The sampling time at each point shall be the same. It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to eliminate timekeeping errors.

8.2.6 In some circumstances (e.g., batch cycles), it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

8.3 Preparation of sampling train.

8.3.1 During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin. Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

8.3.2 Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

8.3.3 When glass liners are used, install the selected nozzle using a Viton A 0-ring when stack temperatures are less than 260°C (500°F) and an asbestos string gasket when temperatures are higher. See APTD-0576 for details. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

8.3.4 Set up the train as in Figure 5-1 of Method 5, 40 CFR part 60, appendix A, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack gas.

8.3.5 Place crushed ice around the impingers.

8.4 Leak-check procedures.

8.4.1 Leak check of metering system shown in Figure 5-1 of Method 5, 40 CFR part 60, appendix A. That portion of the sampling train from the pump to the orifice meter should be leak-checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 5-2 of Method 5, 40 CFR part 60, appendix A): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing, and observe the manometer for 1 minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

8.4.2 Pretest leak check. A pretest leak-check is recommended but not required. If the pretest leak-check is conducted, the following procedure should be used.

8.4.2.1 After the sampling train has been assembled, turn on and set the filter and probe heating systems to the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A 0-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm (15 in.) Hg vacuum.

NOTE: A lower vacuum may be used, provided that it is not exceeded during the test.

8.4.2.2 If an asbestos string is used, do not connect the probe to the train during the leak check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm (15 in.) Hg vacuum. (See NOTE in section 8.4.2.1 of this method). Then connect the probe to the train and perform the leak check at approximately 25 mm (1 in.) Hg vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm (15 in.) Hg vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, are unacceptable.

8.4.2.3 The following leak check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with the bypass valve fully open and the coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Do not reverse the direction of the bypass valve, as this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak check as shown below and start over.

8.4.2.4 When the leak check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and the silica gel from being entrained backward into the third impinger.

8.4.3 Leak checks during sample run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes necessary, a leak check shall be conducted immediately before the change is made. The leak check shall be done according to the procedure outlined in section 8.4.2 of this method, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered; if, however, a higher leakage rate is obtained, either record the leakage rate and plan to correct the sample volume as shown in section 12.3 of this method or void the sample run.

NOTE: Immediately after component changes, leak checks are optional; if such leak checks are done, the procedure outlined in section 8.4.2 of this method should be used.

8.4.4 Post-test leak check. A leak check is mandatory at the conclusion of each sampling run. The leak check shall be performed in accordance with the procedures outlined in section 8.4.2 of this method, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, either record the leakage rate and correct the sample volume, as shown in section 12.4 of this method, or void the sampling run.

8.5 Sampling train operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120 ± 14°C (248 ± 25°F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator.

8.5.1 For each run, record the data required on a data sheet such as the one shown in Figure 5-2 of Method 5, 40 CFR part 60, appendix A. Be sure to record the initial reading. Record the DGM readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted. Take other readings indicated by Figure 5-2 of Method 5, 40 CFR part 60, appendix A at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

8.5.2 Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap and verify that the filter and probe heating systems are up to temperature and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient (C_p) is 0.85 ± 0.02 and the stack gas equivalent density (dry molecular weight) is 29 ± 4. APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above-stated ranges, do not use the nomographs unless appropriate steps (see Reference 7 in section 17.0 of this method) are taken to compensate for the deviations.

8.5.3 When the stack is under significant negative pressure (height of impinger stem), close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

8.5.4 When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

8.5.5 Traverse the stack cross-section, as required by Method 1, 40 CFR part 60, appendix A or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes; this minimizes the chance of extracting deposited material.

8.5.6 During the test run, make periodic adjustments to keep the temperature around the filter holder at the proper level; add more ice and, if necessary, salt to maintain a temperature of less than 20°C (68°F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

8.5.7 If the pressure drop across the filter becomes too high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of the sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. Before a new filter assembly is installed, conduct a leak check (see section 8.4.3 of this method). The total PM weight shall include the summation of the filter assembly catches.

8.5.8 A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

NOTE: When two or more trains are used, separate analyses of the front-half and (if applicable) impinger catches from each train shall be performed, unless identical nozzle sizes were used in all trains, in which case the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of the front-half catch and one analysis of the impinger catch may be performed.

8.5.9 At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final DGM reading, and then conduct a post-test leak check, as outlined in section 8.4.4 of this method. Also leak-check the pitot lines as described in section 8.1 of Method 2, 40 CFR part 60, appendix A. The lines must pass this leak check in order to validate the velocity head data.

8.6 Calculation of percent isokinetic. Calculate percent isokinetic (see Calculations, section 12.12 of this method) to determine whether a run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates because of source conditions, consult the Administrator for possible variance on the isokinetic rates.

8.7 Sample recovery.

8.7.1 Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

8.7.2 When the probe can be safely handled, wipe off all external PM near the tip of the probe nozzle and place a cap over it to prevent losing or gaining PM. Do not cap off the probe tip tightly while the sampling train is cooling down. This would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

8.7.3 Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

8.7.4 Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

8.7.5 Save a portion of the acetone and methylene chloride used for cleanup as blanks. Take 200 ml of each solvent directly from the wash bottle being used and place it in glass sample containers labeled "acetone blank" and "methylene chloride blank," respectively.

8.7.6 Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

8.7.6.1 Container No. 1. Carefully remove the filter from the filter holder, and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the PM cake is inside the fold. Using a dry nylon bristle brush and/or a sharp-edged blade, carefully transfer to the petri dish any PM and/or filter fibers that adhere to the filter holder gasket. Seal the container.

8.7.6.2 Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover PM or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Perform the acetone rinse as follows:

8.7.6.2.1 Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

8.7.6.2.2 Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

8.7.6.2.3 Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces are wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid in transferring liquid washes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe, hold a sample container under the lower end of the probe, and catch any acetone and PM that is brushed from the probe. Run the brush through the probe three times or more until no visible PM is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above-described manner at least six times, since metal probes have small crevices in which PM can be entrapped. Rinse the brush with acetone and quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

8.7.6.2.4 It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

8.7.6.2.5 After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone also (if applicable).

8.7.6.2.6 After rinsing the nozzle, probe, and front half of the filter holder with acetone, repeat the entire procedure with methylene chloride and save in a separate No. 2M container.

8.7.6.2.7 After acetone and methylene chloride washings and PM have been collected in the proper sample containers, tighten the lid on the sample containers so that acetone and methylene chloride will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label each container to identify clearly its contents.

8.7.6.3 Container No. 3. Note the color of the indicating silica gel to determine whether it has been completely spent, and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal the container. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for Container No. 3 in section 11.2.3 of this method.

8.7.6.4 Impinger water. Treat the impingers as follows:

8.7.6.4.1 Make a notation of any color or film in the liquid catch. Measure the liquid that is in the first three impingers to within 1 ml by using a graduated cylinder or by weighing it to within 0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

8.7.6.4.2 Following the determination of the volume of liquid present, rinse the back half of the train with water, add it to the impinger catch, and store it in a container labeled 3W (water).

8.7.6.4.3 Following the water rinse, rinse the back half of the train with acetone to remove the excess water to enhance subsequent organic recovery with methylene chloride and quantitatively recover to a container labeled 3S (solvent) followed by at least three sequential rinsings with aliquots of methylene chloride. Quantitatively recover to the same container labeled 3S. Record separately the amount of both acetone and methylene chloride used to the nearest 1 ml or 0.5g.

NOTE: Because the subsequent analytical finish is gravimetric, it is okay to recover both solvents to the same container. This would not be recommended if other analytical finishes were required.

8.8 Sample transport. Whenever possible, containers should be shipped in such a way that they remain upright at all times.

9.0 Quality Control.

9.1 Miscellaneous quality control measures.

Section	Quality Control Measure	Effect
8.4, 10.1-10.6	Sampling and equipment leak check and calibration	Ensure accurate measurement of stack gas flow rate, sample volume

9.2 Volume metering system checks. The following quality control procedures are suggested to check the volume metering system calibration values at the field test site prior to sample collection. These procedures are optional.

9.2.1 Meter orifice check. Using the calibration data obtained during the calibration procedure described in section 10.3 of this method, determine the $\Delta H_@$ for the metering system orifice. The $\Delta H_@$ is the orifice pressure differential in units of in. H_20 that correlates to 0.75 cfm of air at 528°R and 29.92 in. Hg. The $\Delta H_@$ is calculated as follows:

$$\Delta H_@ = 0.0319\ \Delta H \frac{T_m\ \Theta^2}{P_{bar}\ Y^2\ V_m^2}$$

where

0.0319 = (0.0567 in. Hg/°R)(0.75 cfm)^2;

ΔH = Average pressure differential across the orifice meter, in. H_20;

T_m = Absolute average DGM temperature, °R;

Θ = Total sampling time, min;

P_{bar} = Barometric pressure, in. Hg;

Y = DGM calibration factor, dimensionless;

V_m = Volume of gas sample as measured by DGM, dcf.

9.2.1.1 Before beginning the field test (a set of three runs usually constitutes a field test), operate the metering system (i.e., pump, volume meter, and orifice) at the $\Delta H_@$ pressure differential for 10 minutes. Record the volume collected, the DGM temperature, and the barometric pressure. Calculate a DGM calibration check value, Y_c, as follows:

$$Y_c = \frac{10}{V_m}\left[\frac{0.0319\ T_m}{P_{bar}}\right]^{\frac{1}{2}}$$

where

Y_c = DGM calibration check value, dimensionless;

10 = Run time, min.

9.2.1.2 Compare the Y_c value with the dry gas meter calibration factor Y to determine that: $0.97\ Y < Y_c < 1.03Y$. If the Y_c value is not within this range, the volume metering system should be investigated before beginning the test.

9.2.2 Calibrated critical orifice. A calibrated critical orifice, calibrated against a wet test meter or spirometer and designed to be inserted at the inlet of the sampling meter box, may be used as a quality control check by following the procedure of section 16.2 of this method.

10.0 Calibration and Standardization.

NOTE: Maintain a laboratory log of all calibrations.

10.1 Probe nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the ID of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

10.2 Pitot tube assembly. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in section 10.1 of Method 2, 40 CFR part 60, appendix A.

10.3 Metering system.

10.3.1 Calibration prior to use. Before its initial use in the field, the metering system shall be calibrated as follows: Connect the metering system inlet to the outlet of a wet test meter that is accurate to within 1 percent. Refer to Figure 5-5 of Method 5, 40 CFR part 60, appendix A. The wet test meter should have a capacity of 30 liters/revolution (1 ft^3/rev). A spirometer of 400 liters (14 ft^3) or more capacity, or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should be periodically calibrated with a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained. Run the metering system pump for about 15 minutes with the orifice manometer indicating a median reading, as expected in field use, to allow the pump to warm up and to permit the interior surface of the wet test meter to be thoroughly wetted. Then, at each of a minimum of three orifice manometer settings, pass an exact quantity of gas through the wet test meter and note the gas volume indicated by the DGM. Also note the barometric pressure and the temperatures of the wet test meter, the inlet of the DGM, and the outlet of the DGM. Select the highest and lowest orifice settings to bracket the expected field operating range of the orifice. Use a minimum volume of 0.15 m^3 (5 cf) at all orifice settings. Record all the data on a form similar to Figure 5-6 of Method 5, 40 CFR part 60, appendix A, and calculate Y (the DGM calibration factor) and $\Delta H_@$ (the orifice calibration factor) at each orifice setting, as shown on Figure 5-6 of Method 5, 40 CFR part 60, appendix A. Allowable tolerances for individual Y and $\Delta H_@$ values are given in Figure 5-6 of Method 5, 40 CFR part 60, appendix A. Use the average of the Y values in the calculations in section 12 of this method.

10.3.1.1. Before calibrating the metering system, it is suggested that a leak check be conducted.

For metering systems having diaphragm pumps, the normal leak check procedure will not detect leakages within the pump. For these cases the following leak check procedure is suggested: make a 10-minute calibration run at 0.00057 m^3/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and DGM volumes; divide the difference by 10 to get the leak rate. The leak rate should not exceed 0.00057 m^3/min (0.02 cfm).

10.3.2 Calibration after use. After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test) with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the DGM calibration factor. If the value has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as previously detailed.

NOTE: Alternative procedures, e.g., rechecking the orifice meter coefficient, may be used, subject to the approval of the Administrator.

10.3.3 Acceptable variation in calibration. If the DGM coefficient values obtained before and after a test series differ by more than 5 percent, either the test series shall be voided or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

10.4 Probe heater calibration. Use a heat source to generate air heated to selected temperatures that approximate those expected to occur in the sources to be sampled. Pass this air through the probe at a typical sample flow rate while measuring the probe inlet and outlet temperatures at various probe heater settings. For each air temperature generated, construct a graph of probe heating system setting versus probe outlet temperature. The procedure outlined in APTD-0576 can also be used. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used. Also, probes with outlet temperature monitoring capabilities do not require calibration.

NOTE: The probe heating system shall be calibrated before its initial use in the field.

10.5 Temperature sensors. Use the procedure in section 10.3 of Method 2, 40 CFR part 60, appendix A to calibrate in-stack temperature sensors. Dial thermometers, such as are used for the DGM and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

10.6 Barometer. Calibrate against a mercury barometer.

11.0 Analytical Procedure.

11.1 Record the data required on a sheet such as the one shown in Figure 315-1 of this method.

11.2 Handle each sample container as follows:

11.2.1 Container No. 1.

11.2.1.1 PM analysis. Leave the contents in the shipping container or transfer the filter and any loose PM from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this section, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings (overnight desiccation is a common practice). If a third weighing is required and it agrees within ±0.5 mg, then the results of the second weighing should be used. For quality assurance purposes, record and report each individual weighing; if more than three weighings are required, note this in the results for the subsequent MCEM results.

11.2.1.2 MCEM analysis. Transfer the filter and contents quantitatively into a beaker. Add 100 ml of methylene chloride and cover with aluminum foil. Sonicate for 3 minutes then allow to stand for 20 minutes. Set up the filtration apparatus. Decant the solution into a clean Buchner fritted funnel. Immediately pressure filter the solution through the tube into another clean, dry beaker. Continue decanting and pressure filtration until all the solvent is transferred. Rinse the beaker and filter with 10 to 20 ml methylene chloride, decant into the Buchner fritted funnel and pressure filter. Place the beaker on a low-temperature hot plate (maximum 40°C) and slowly evaporate almost to dryness. Transfer the remaining last few milliliters of solution quantitatively from the beaker (using at least three aliquots of methylene chloride rinse) to a tared clean dry aluminum dish and evaporate to complete dryness. Remove from heat once solvent is evaporated. Reweigh the dish after a 30-minute equilibrium in the balance room and determine the weight to the nearest 0.1 mg. Conduct a methylene chloride blank run in an identical fashion.

11.2.2 Container No. 2.

11.2.2.1 PM analysis. Note the level of liquid in the container, and confirm on the analysis sheet whether leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250 ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours, and weigh to a constant weight. Report the results to the nearest 0.1 mg.

11.2.2.2 MCEM analysis. Add 25 ml methylene chloride to the beaker and cover with aluminum foil. Sonicate for 3 minutes then allow to stand for 20 minutes; combine with contents of Container No. 2M and pressure filter and evaporate as described for Container 1 in section 11.2.1.2 of this method.

NOTES FOR MCEM ANALYSIS:

1. Light finger pressure only is necessary on 24/40 adaptor. A Chemplast adapter #15055-240 has been found satisfactory.

2. Avoid aluminum dishes made with fluted sides, as these may promote solvent "creep," resulting in possible sample loss.

3. If multiple samples are being run, rinse the Buchner fritted funnel twice between samples with 5 ml solvent using pressure filtration. After the second rinse, continue the flow of air until the glass frit is completely dry. Clean the Buchner fritted funnels thoroughly after filtering five or six samples.

11.2.3 Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

11.2.4 Container 3W (impinger water).

11.2.4.1 MCEM analysis. Transfer the solution into a 1,000 ml separatory funnel quantitatively with methylene chloride washes. Add enough solvent to total approximately 50 ml, if necessary. Shake the funnel for 1 minute, allow the phases to separate, and drain the solvent layer into a 250 ml beaker. Repeat the extraction twice. Evaporate with low heat (less than 40°C) until near dryness. Transfer the remaining few milliliters of solvent quantitatively with small solvent washes into a clean, dry, tared aluminum dish and evaporate to dryness. Remove from heat once solvent is evaporated. Reweigh the dish after a 30-minute equilibration in the balance room and determine the weight to the nearest 0.1 mg.

11.2.5 Container 3S (solvent).

11.2.5.1 MCEM analysis. Transfer the mixed solvent to 250 ml beaker(s). Evaporate and weigh following the procedures detailed for container 3W in section 11.2.4 of this method.

11.2.6 Blank containers. Measure the distilled water, acetone, or methylene chloride in each container either volumetrically or gravimetrically. Transfer the "solvent" to a tared 250 ml beaker, and evaporate to dryness at ambient temperature and pressure. (Conduct a solvent blank on the distilled deionized water blank in an identical fashion to that described in section 11.2.4.1 of this method.) Desiccate for 24 hours, and weigh to a constant weight. Report the results to the nearest 0.1 mg.

NOTE: The contents of Containers No. 2, 3W, and 3M as well as the blank containers may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone and methylene chloride are highly flammable and have a low flash point.

12.0 Data Analysis and Calculations.

12.1 Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

12.2 Nomenclature.

A_n = Cross-sectional area of nozzle, m^3 (ft^3).

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_a = Acetone blank residue concentration, mg/g.

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

I = Percent of isokinetic sampling.

L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i = Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (I = l, 2, 3...n), m^3/min (cfm).

L_p = Leakage rate observed during the post-test leak check, m^3/min (cfm).

m_a = Mass of residue of acetone after evaporation, mg.

m_n = Total amount of particulate matter collected, mg.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_{bar} = Barometric pressure at the sampling site, mm Hg (in Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 [(mm Hg)(m^3)]/[(°K)(g-mole)] {21.85 [(in. Hg)(ft^3)]/[(°R)(lb-mole)]}.

T_m = Absolute average dry gas meter (DGM) temperature (see Figure 5-2 of Method 5, 40 CFR part 60, appendix A), °K (°R).

T_s = Absolute average stack gas temperature (see Figure 5-2 of Method 5, 40 CFR part 60, appendix A), °K(°R).

T_{std} = Standard absolute temperature, 293°K (528°R).

V_a = Volume of acetone blank, ml.

V_{aw} = Volume of acetone used in wash, ml.

V_t = Volume of methylene chloride blank, ml.

V_{tw} = Volume of methylene chloride used in wash, ml.

V_{lc} = Total volume liquid collected in impingers and silica gel (see Figure 5-3 of Method 5, 40 CFR part 60, appendix A), ml.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

V_s = Stack gas velocity, calculated by Equation 2-9 in Method 2, 40 CFR part 60, appendix A, using data obtained from Method 5, 40 CFR part 60, appendix A, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

Y = Dry gas meter calibration factor.

ΔH = Average pressure differential across the orifice meter (see Figure 5-2 of Method 5, 40 CFR part 60, appendix A), mm H_20 (in H_20).

ρ_a = Density of acetone, 785.1 mg/ml (or see label on bottle).

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

ρ_t = Density of methylene chloride, 1316.8 mg/ml (or see label on bottle).

Θ = Total sampling time, min.

Θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.

Θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

Θ_p = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

12.3 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2 of Method 5, 40 CFR part 60, appendix A).

12.4 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions (20°C, 760 mm Hg or 68°F, 29.92 in Hg) by using Equation 315-1.

$$V = V_m Y \frac{T_{std}\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{T_m P_{std}} \quad \text{Eq. 315-1}$$

$$= V = K_1 V_m Y \frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m}$$

where

K_1 = 0.3858 °K/mm Hg for metric units,

= 17.64 °R/in Hg for English units.

NOTE: Equation 315-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 315-1 must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 315-1 with the expression:

$$[V_m - (L_p - L_a)\,\Theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation
315-1 by the expression:

$$[V_m - (L_1 - L_a)\,\Theta_1 - \sum_{i=2}^{n} (L_i - L_a)\,\Theta_i - (L_p - L_a)\,\Theta_p]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

12.5 Volume of water vapor condensed.

$$V_{w(std)} = V_{lc} \frac{\rho_w R T_{std}}{M_w P_{std}} = K_2 V_{lc} \quad \text{Eq. 315-2}$$

where

K_2 = 0.001333 m^3/ml for metric units;

= 0.04706 ft^3/ml for English units.

12.6 Moisture content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$ Eq. 315-3

NOTE: In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 315-3), and a second from the assumption of saturated conditions. The lower of the two values of B_{ws} shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in section 4.0 of Method 4, 40 CFR part 60, appendix A. For the purposes of this method, the average stack gas temperature from Figure 5-2 of Method 5, 40 CFR part 60, appendix A may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1°C (2°F).

12.7 Acetone blank concentration.

$$C_a = \frac{M_a}{V_a \rho_a}$$ Eq. 315-4

12.8 Acetone wash blank.

$$W_a = C_a V_{aw} \rho_a$$ Eq. 315-5

12.9 Total particulate weight. Determine the total PM catch from the sum of the weights obtained from Containers 1 and 2 less the acetone blank associated with these two containers (see Figure 315-1).

NOTE: Refer to section 8.5.8 of this method to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

12.10 Particulate concentration.

$$c_s = K_3 m_n / V_{m(std)}$$ Eq. 315-6

where

K = 0.001 g/mg for metric units;
= 0.0154 gr/mg for English units.

12.11 Conversion factors.

From	To	Multiply by
ft^3	m^3	0.02832
gr	mg	64.80004
gr/ft^3	mg/m3	2288.4
mg	g	0.001
gr	lb	1.429×10^{-4}

12.12 Isokinetic variation.

12.12.1 Calculation from raw data.

$$I = \frac{100\, T_s \left[K_4 V_{lc} + \left(\frac{V_m Y}{T_m} \right) \left(P_{bar} + \frac{\Delta H}{13.6} \right) \right]}{60\, \Theta\, v_s\, P_s\, A_n}$$ Eq. 315-7

where

K_4 = 0.003454 [(mm Hg)(m^3)]/[(ml)(°K)] for metric units;

= 0.002669 [(in Hg)(ft^3)]/[(ml)(°R)] for English units.

12.12.2 Calculation from intermediate values.

$$I = \frac{T_s\ V_{m(std)}\ P_{std}\ 100}{T_{std}\ v_s\ \Theta\ A_n\ P_s\ 60\ (1 - B_{ws})} \qquad \text{Eq. 315-8}$$

$$= K_5 \frac{T_s\ V_{m(std)}}{P_s\ v_s\ A_n\ \Theta\ (1 - B_{ws})}$$

where

K_5 = 4.320 for metric units;
= 0.09450 for English units.

12.12.3 Acceptable results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the PM or MCEM results are low in comparison to the standard, and "I" is over 110 percent or less than 90 percent, the Administrator may opt to accept the results. Reference 4 in the Bibliography may be used to make acceptability judgments. If "I" is judged to be unacceptable, reject the results, and repeat the test.

12.13 Stack gas velocity and volumetric flow rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in sections 5.2 and 5.3 of Method 2, 40 CFR part 60, appendix A.

12.14 MCEM results. Determine the MCEM concentration from the results from Containers 1, 2, 2M, 3W, and 3S less the acetone, methylene chloride, and filter blanks value as determined in the following equation:

$$m_{mcem} = \Sigma m_{total} - w_a - w_t - f_b$$

13.0 Method Performance. [Reserved]
14.0 Pollution Prevention. [Reserved]
15.0 Waste Management. [Reserved]
16.0 Alternative Procedures.

16.1 Dry gas meter as a calibration standard. A DGM may be used as a calibration standard for volume measurements in place of the wet test meter specified in section 16.1 of this method, provided that it is calibrated initially and recalibrated periodically as follows:

16.1.1 Standard dry gas meter calibration.

16.1.1.1. The DGM to be calibrated and used as a secondary reference meter should be of high quality and have an appropriately sized capacity, e.g., 3 liters/rev (0.1 ft^3/rev). A spirometer (400 liters or more capacity), or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should have a capacity of 30 liters/rev (1 ft^3/rev) and be capable of measuring volume to within 1.0 percent; wet test meters should be checked against a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

16.1.1.2 Set up the components as shown in Figure 5-7 of Method 5, 40 CFR part 60, appendix A. A spirometer, or equivalent, may be used in place of the wet test meter in the system. Run the pump for at least 5 minutes at a flow rate of about 10 liters/min (0.35 cfm) to condition the interior surface of the wet test meter. The pressure drop indicated by the manometer at the inlet side of the DGM should be minimized (no greater than 100 mm H_2O [4 in. H_2O] at a flow rate of 30 liters/min [1 cfm]). This can be accomplished by using large- diameter tubing connections and straight pipe fittings.

16.1.1.3 Collect the data as shown in the example data sheet (see Figure 5-8 of Method 5, 40 CFR part 60, appendix A). Make triplicate runs at each of the flow rates and at no less than five different flow rates. The range of flow rates should be between 10 and 34 liters/min (0.35 and 1.2 cfm) or over the expected operating range.

16.1.1.4 Calculate flow rate, Q, for each run using the wet test meter volume, V_w, and the run time, q. Calculate the DGM coefficient, Y_{ds}, for each run. These calculations are as follows:

$$Q = K_1 \frac{P_{bar} V_w}{(t_w + t_{std})\,\Theta} \qquad \text{Eq. 315-9}$$

$$Y_{ds} = \frac{V_w\,(T_{ds} + T_{std})\,P_{bar}}{V_{ds}\,(T_w + T_{std})(P_{bar} + \frac{\Delta p}{13.6})} \qquad \text{Eq. 315-10}$$

where

K_1 = 0.3858 for international system of units (SI);
17.64 for English units;
P_{bar} = Barometric pressure, mm Hg (in Hg);
V_w = Wet test meter volume, liter (ft^3);
t_w = Average wet test meter temperature, °C (°F);
t_{std} = 273°C for SI units; 460°F for English units;
Θ = Run time, min;
t_{ds} = Average dry gas meter temperature, °C (°F);
V_{ds} = Dry gas meter volume, liter (ft^3);
Δp = Dry gas meter inlet differential pressure, mm H_2O (in H_2O).

16.1.1.5 Compare the three Y_{ds} values at each of the flow rates and determine the maximum and minimum values. The difference between the maximum and minimum values at each flow rate should be no greater than 0.030. Extra sets of triplicate runs may be made in order to complete this requirement. In addition, the meter coefficients should be between 0.95 and 1.05. If these specifications cannot be met in three sets of successive triplicate runs, the meter is not suitable as a calibration standard and should not be used as such. If these specifications are met, average the three Y_{ds} values at each flow rate resulting in five average meter coefficients, Y_{ds}.

16.1.1.6 Prepare a curve of meter coefficient, Y_{ds}, versus flow rate, Q, for the DGM. This curve shall be used as a reference when the meter is used to calibrate other DGMs and to determine whether recalibration is required.

16.1.2 Standard dry gas meter recalibration.

16.1.2.1 Recalibrate the standard DGM against a wet test meter or spirometer annually or after every 200 hours of operation, whichever comes first. This requirement is valid provided the standard DGM is kept in a laboratory and, if transported, cared for as any other laboratory instrument. Abuse to the standard meter may cause a change in the calibration and will require more frequent recalibrations.

16.1.2.2 As an alternative to full recalibration, a two-point calibration check may be made. Follow the same procedure and equipment arrangement as for a full recalibration, but run the meter at only two flow rates (suggested rates are 14 and 28 liters/min [0.5 and 1.0 cfm]). Calculate the meter coefficients for these two points, and compare the values with the meter calibration curve. If the two coefficients are within 1.5 percent of the calibration curve values at the same flow rates, the meter need not be recalibrated until the next date for a recalibration check.

16.2 Critical orifices as calibration standards. Critical orifices may be used as calibration standards in place of the wet test meter specified in section 10.3 of this method, provided that they are selected, calibrated, and used as follows:

16.2.1 Selection of critical orifices.

16.2.1.1 The procedure that follows describes the use of hypodermic needles or stainless steel needle tubing that has been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices; i.e., a critical vacuum can be obtained, as described in section 7.2.2.2.3 of Method 5, 40 CFR part 60, appendix A. Select five critical orifices that are appropriately sized to cover the range of flow rates between 10 and 34 liters/min or the expected operating range. Two of the critical orifices should bracket the expected operating range. A minimum of three critical orifices will be needed to calibrate a Method 5 DGM; the other two critical orifices can serve as spares and provide better selection for bracketing the range of operating flow rates. The needle sizes and tubing lengths shown in Table 315-1 give the approximate flow rates indicated in the table.

16.2.1.2 These needles can be adapted to a Method 5 type sampling train as follows: Insert a serum bottle stopper, 13 x 20 mm sleeve type, into a 0.5 in Swagelok quick connect. Insert the needle into the stopper as shown in Figure 5-9 of Method 5, 40 CFR part 60, appendix A.

16.2.2 Critical orifice calibration. The procedure described in this section uses the Method 5 meter box configuration with a DGM as described in section 6.1.1.9 of this method to calibrate the critical orifices. Other schemes may be used, subject to the approval of the Administrator.

16.2.2.1 Calibration of meter box. The critical orifices must be calibrated in the same configuration as they will be used; i.e., there should be no connections to the inlet of the orifice.

16.2.2.1.1 Before calibrating the meter box, leak-check the system as follows: Fully open the coarse adjust valve and completely close the bypass valve. Plug the inlet. Then turn on the pump and determine whether there is any leakage. The leakage rate shall be zero; i.e., no detectable movement of the DGM dial shall be seen for 1 minute.

16.2.2.1.2 Check also for leakages in that portion of the sampling train between the pump and the orifice meter. See section 5.6 of Method 5, 40 CFR part 60, appendix A for the procedure; make any corrections, if necessary. If leakage is detected, check for cracked gaskets, loose fittings, worn 0-rings, etc. and make the necessary repairs.

16.2.2.1.3 After determining that the meter box is leakless, calibrate the meter box according to the procedure given in section 5.3 of Method 5, 40 CFR part 60, appendix A. Make sure that the wet test meter meets the requirements stated in section 7.1.1.1 of Method 5, 40 CFR part 60, appendix A. Check the water level in the wet test meter. Record the DGM calibration factor, Y.

16.2.2.2 Calibration of critical orifices. Set up the apparatus as shown in Figure 5-10 of Method 5, 40 CFR part 60, appendix A.

16.2.2.2.1 Allow a warm-up time of 15 minutes. This step is important to equilibrate the temperature conditions through the DGM.

16.2.2.2.2 Leak-check the system as in section 7.2.2.1.1 of Method 5, 40 CFR part 60, appendix A. The leakage rate shall be zero.

16.2.2.2.3 Before calibrating the critical orifice, determine its suitability and the appropriate operating vacuum as follows: turn on the pump, fully open the coarse adjust valve, and adjust the bypass valve to give a vacuum reading corresponding to about half of atmospheric pressure. Observe the meter box orifice manometer reading, DH. Slowly increase the vacuum reading until a stable reading is obtained on the meter box orifice manometer. Record the critical vacuum for each orifice. Orifices that do not reach a critical value shall not be used.

16.2.2.2.4 Obtain the barometric pressure using a barometer as described in section 6.1.2 of this method. Record the barometric pressure, P_{bar}, in mm Hg (in. Hg).

16.2.2.2.5 Conduct duplicate runs at a vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. The runs shall be at least 5 minutes each. The DGM volume readings shall be in increments of complete revolutions of the DGM. As a guideline, the times should not differ by more than 3.0 seconds (this includes allowance for changes in the DGM temperatures) to achieve ±0.5 percent in K'. Record the information listed in Figure 5-11 of Method 5, 40 CFR part 60, appendix A.

16.2.2.2.6 Calculate K' using Equation 315-11.

$$K' = \frac{K_1 V_m Y \left(P_{bar} + \frac{\Delta H}{13.6}\right) T_{amb}^{\frac{1}{2}}}{P_{bar} T_m \Theta} \qquad \text{Eq. 315-11}$$

where

K' = Critical orifice coefficient, $[m^3)(°K)^{1/2}]/[(mm\ Hg)(min)]$ $\{[(ft^3)(°R)^{1/2})]/[(in.\ Hg)(min)]\}$;

T_{amb} = Absolute ambient temperature, °K (°R).

16.2.2.2.7 Average the K' values. The individual K' values should not differ by more than ±0.5 percent from the average.

16.2.3 Using the critical orifices as calibration standards.

16.2.3.1 Record the barometric pressure.

16.2.3.2 Calibrate the metering system according to the procedure outlined in sections 7.2.2.2.1 to 7.2.2.2.5 of Method 5, 40 CFR part 60, appendix A. Record the information listed in Figure 5-12 of Method 5, 40 CFR part 60, appendix A.

16.2.3.3 Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations below:

$$V_{m(std)} = K_1 V_m [P_{bar} + (\Delta H/13.6)]/T_m \qquad \text{Eq. 315-12}$$

$$V_{cr(std)} = K' (P_{bar} \Theta)/T_{amb}^{1/2} \qquad \text{Eq. 315-13}$$

$$Y = V_{cr(std)}/V_{m(std)} \qquad \text{Eq. 315-14}$$

where

$V_{cr(std)}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions, dscm (dscf).

K' = 0.3858 °K/mm Hg for metric units

= 17.64 °R/in Hg for English units.

16.2.3.4 Average the DGM calibration values for each of the flow rates. The calibration factor, Y, at each of the flow rates should not differ by more than ±2 percent from the average.

16.2.3.5 To determine the need for recalibrating the critical orifices, compare the DGM Y factors obtained from two adjacent orifices each time a DGM is calibrated; for example, when checking orifice 13/2.5, use orifices 12/10.2 and 13/5.1. If any critical orifice yields a DGM Y factor differing by more than 2 percent from the others, recalibrate the critical orifice according to section 7.2.2.2 of Method 5, 40 CFR part 60, appendix A.

17.0 References.

1. Addendum to Specifications for Incinerator Testing at Federal Facilities. PHS, NCAPC. December 6, 1967.

2. Martin, Robert M. Construction Details of Isokinetic Source-Sampling Equipment. Environmental Protection Agency. Research Triangle Park, NC. APTD-0581. April 1971.

3. Rom, Jerome J. Maintenance, Calibration, and Operation of Isokinetic Source Sampling

Equipment. Environmental Protection Agency. Research Triangle Park, NC. APTD-0576. March 1972.

4. Smith, W.S., R.T. Shigehara, and W.F. Todd. A Method of Interpreting Stack Sampling Data. Paper Presented at the 63rd Annual Meeting of the Air Pollution Control Association, St. Louis, MO. June 14-19, 1970.

5. Smith, W.S., et al. Stack Gas Sampling Improved and Simplified With New Equipment. APCA Paper No. 67-119. 1967.

6. Specifications for Incinerator Testing at Federal Facilities. PHS, NCAPC. 1967.

7. Shigehara, R.T. Adjustment in the EPA Nomograph for Different Pitot Tube Coefficients and Dry Molecular Weights. Stack Sampling News 2:4-11. October 1974.

8. Vollaro, R.F. A Survey of Commercially Available Instrumentation for the Measurement of Low-Range Gas Velocities. U.S. Environmental Protection Agency, Emission Measurement Branch. Research Triangle Park, NC. November 1976 (unpublished paper).

9. Annual Book of ASTM Standards. Part 26. Gaseous Fuels; Coal and Coke; Atmospheric Analysis. American Society for Testing and Materials. Philadelphia, PA. 1974. pp. 617-622.

10. Felix, L.G., G.I. Clinard, G.E. Lacy, and J.D. McCain. Inertial Cascade Impactor Substrate Media for Flue Gas Sampling. U.S. Environmental Protection Agency. Research Triangle Park, NC 27711. Publication No. EPA-600/7-77-060. June 1977. 83 p.

11. Westlin, P.R., and R.T. Shigehara. Procedure for Calibrating and Using Dry Gas Volume Meters as Calibration Standards. Source Evaluation Society Newsletter. 3(1):17-30. February 1978.

12. Lodge, J.P., Jr., J.B. Pate, B.E. Ammons, and G.A. Swanson. The Use of Hypodermic Needles as Critical Orifices in Air Sampling. J. Air Pollution Control Association. 16:197-200. 1966.

18.0 Tables, Diagrams, Flowcharts, and Validation Data

TABLE 315-1. Flow Rates for Various Needle Sizes and Tube Lengths.

Gauge/length (cm)	Flow rate (liters/min)	Gauge/length (cm)	Flow rate (liters/min)
12/7.6	32.56	14/2.5	19.54
12/10.2	30.02	14/5.1	17.27
13/2.5	25.77	14/7.6	16.14
13/5.1	23.50	15/3.2	14.16
13/7.6	22.37	15/7.6	11.61
13/10.2	20.67	15/10.2	10.48

Particulate analysis			
Plant			
Date			
Run No.			
Filter No.			
Amount liquid lost during transport			
Acetone blank volume (ml)			
Acetone blank concentration (Eq.315-4) (mg/mg)			
Acetone wash blank (Eq.315-5) (mg)			
	Final weight (mg)	Tare weight (mg)	Weight gain (mg)
Container No. 1			
Container No. 2			
Total			
Less Acetone blank			
Weight of particulate matter			
Moisture analysis			
	Final volume (mg)	Initial volume (mg)	Liquid collected (mg)
Impingers	Note 1	Note 1	
Silica gel			
Total			

FIGURE 315-1. Particulate and MCEM Analyses

Note 1: Convert volume of water to weight by multiplying by the density of water (1 g/ml).

MCEM analysis					
Container No.	Final weight (mg)	Tare of aluminum dish (mg)	Weight gain	Acetone wash volume (ml)	Methylene chloride wash volume (ml)
1					
2+2M					
3W					
3S					
Total			$\sum m_{total}$	$\sum v_{aw}$	$\sum v_{tw}$
Less acetone wash blank (mg) (not to exceed 1 mg/l of acetone used)			$w_a = c_a \rho_a \sum v_{aw}$		
Less methylene chloride wash blank (mg) (not to exceed 1.5 mg/l of methylene chloride used)			$w_t = c_t \rho_t \sum v_{tw}$		
Less filter blank (mg) (not to exceed.... (mg/filter)			F_b		
MCEM weight (mg)			$m_{MCEOM} = \sum m_{total} - w_a - w_t - f_b$		

FIGURE 315-1 (Continued). Particulate And MCEM Analyses

* * * * *

APPENDIX H

PARTICIPANTS

PROJECT PARTICIPANTS

Affiliation	Name	Responsibility
USEPA	Michael L. Toney, EMC	Work Assignment Manager
Pacific Environmental Services, Inc.	John Chehaske	Program Manager
	Frank Phoenix	Project Manager
	Dennis P. Holzschuh	QA Coordinator
	Dennis D. Holzschuh	Site Leader/Console Operator
	Derek Hawkes	Sampling Technician
	Josh Berkowitz	Process Monitor
Atlantic Technical Services (PES Subcontractor)	Alan Lowe	Site Leader/Console Operator
	Emil Stewart	Sampling Technician/Data Reduction

TECHNICAL REPORT DATA

Please read instructions on the reverse before completing

1. REPORT NO. EPA-454/R-00-028	2.	3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE Final Report Hot Mix Asphalt Plants, Truck Loading, Manual Methods Testing, Asphalt Plant D, Barre, MA Volume 1 of 1	5. REPORT DATE May 2000 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Frank J. Phoenix	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Pacific Environmental Services, Inc. Post Office Box 12077 Research Triangle Park, North Carolina 27709-2077	10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-D-98004
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency Office of Air Quality Planning and Standards Emissions, Monitoring and Analysis Division Research Triangle Park, North Carolina 27711	13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE EPA/200/04

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The United States Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards (OAQPS) is investigating hot mix asphalt plants to identify and quantify particulate matter (PM) and methylene chloride extractable matter (MCEM) emissions from load-out operations. In support of this investigation, the OAQPS issued Pacific Environmental Services, Inc. (PES) a series of work assignments to conduct emissions testing at an asphalt plant during load-out operations.

The primary objective of the emissions testing was to characterize the uncontrolled emissions of PM and MCEM from a batch production, hot mix asphalt plant during poad-out operation Asphalt Plant D, abatch production facility in Barre, Massachusetts with the capacity to produce 1,600 tons per day of hot mix asphalt, was selected by EPA as the host facility. To capture load-out emissions, a temporary total enclosure (TTE) and exhaust system was built around the load-out bay at Plant D. During load-out, emissions were drawn off the TTE through an exhaust duct with a 15,000 cubic feet per minute (cfm) exhaust fan. Testing for load-out emissions was performed in the exhaust duct using EPA Test Methods 1,2,4, and 315. Three tests were performed over three consecutive days beginning on October 5, 1998. Each test started early in the morning, ran most of the day, and included most of the plant's production for the day. For each test, two simultaneous EPA Method 315 runs were performed, one to determine captured emissions and one to determine fugitive emissions.

In addition to the emissions testing, PES monitored and recorded process operations, collected process samples, and measured the temperature of the asphalt in the bed of selected transport trucks as the trucks left the load-out area. Also, measurements were taken to estimate the deposition of MCEM on the ceiling of the TTE and in the TTE exhaust duct.

Midwest Research Institute (MRI), another EPA contractor, was also on-site for the testing and measured total hydrocarbon emissions from the TTE simultaneous with the PM and MCEM testing. The MRI data are presented in a separate report.

The entire report consists of one volume totaling 440 pages.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTIONS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COASTI Field/Group
Methylene Chloride Extractable Matter Particulate Matter		

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 440
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE