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# Final Report

# Hot Mix Asphalt Plants, Truck Loading, Manual Methods Testing

## Asphalt Plant D
## Barre, MA

## Volume 1 of 1

Office of Air Quality
Clean Air
OAQPS
Planning and Standards

# FINAL REPORT

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

**EPA Contract No. 68-D-98-004**
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## DISCLAIMER

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## 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.

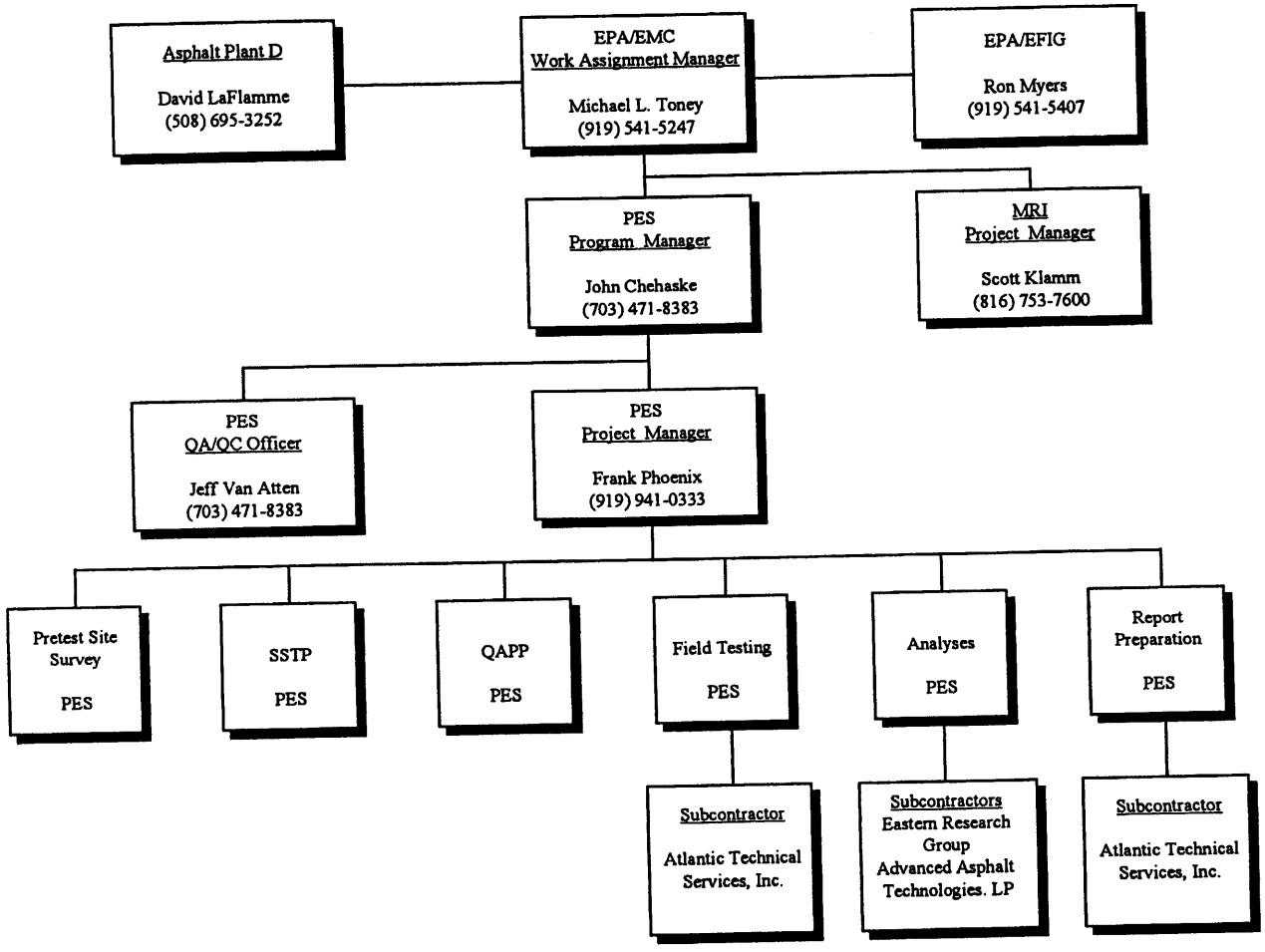



**Figure 1.1 Project Organization - US EPA Hot Mix Asphalt Load-out Operation, Asphalt Plant D, Barre, Massachusetts**

## 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

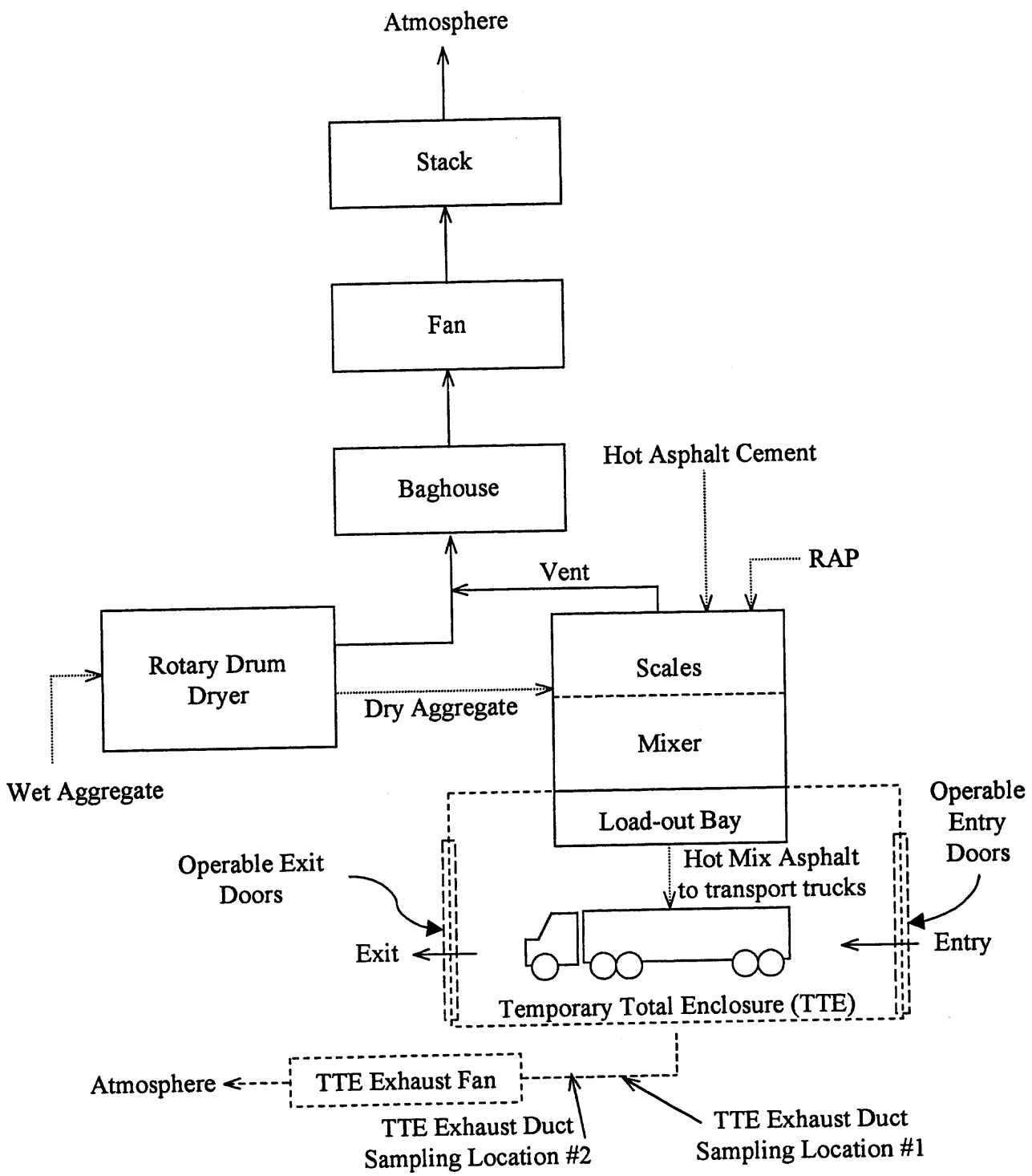



**Figure 3.1 Process Flow Schematic, Asphalt Plant D, Barre, Massachusetts**

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.

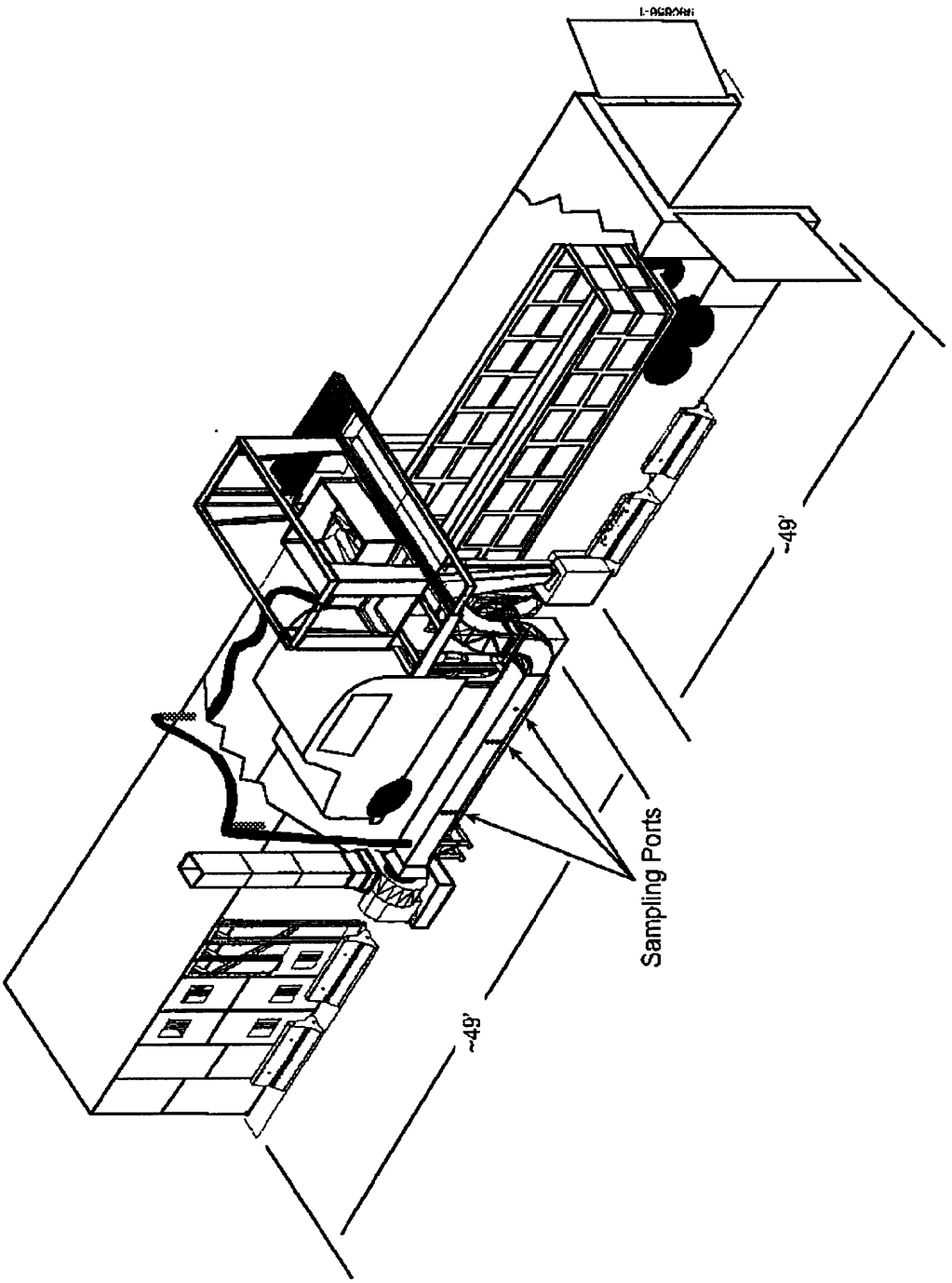



**Figure 3.2 Temporary Total Enclosure**

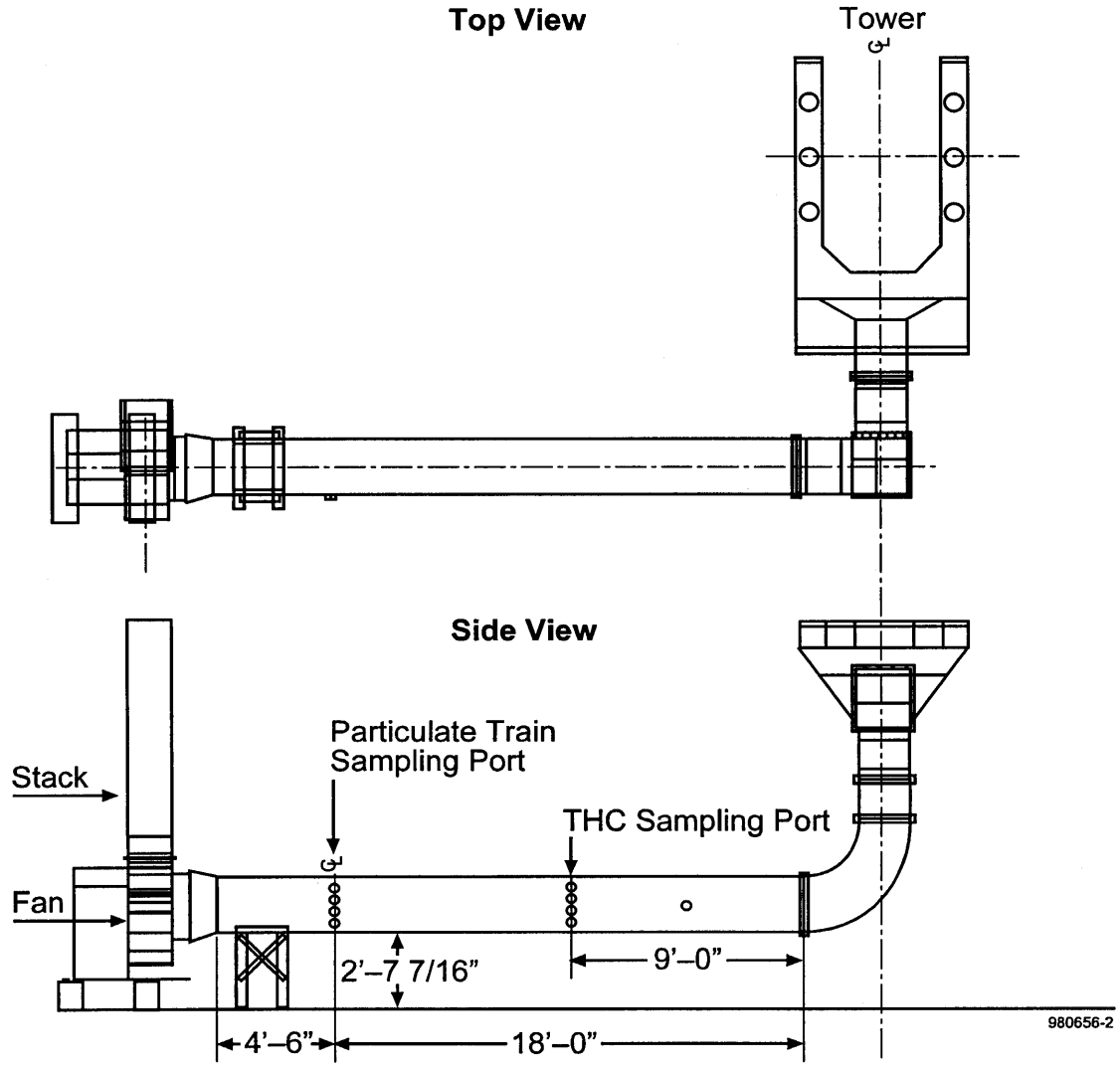



**Figure 3.3 TTE Hood and Duct System**

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°.

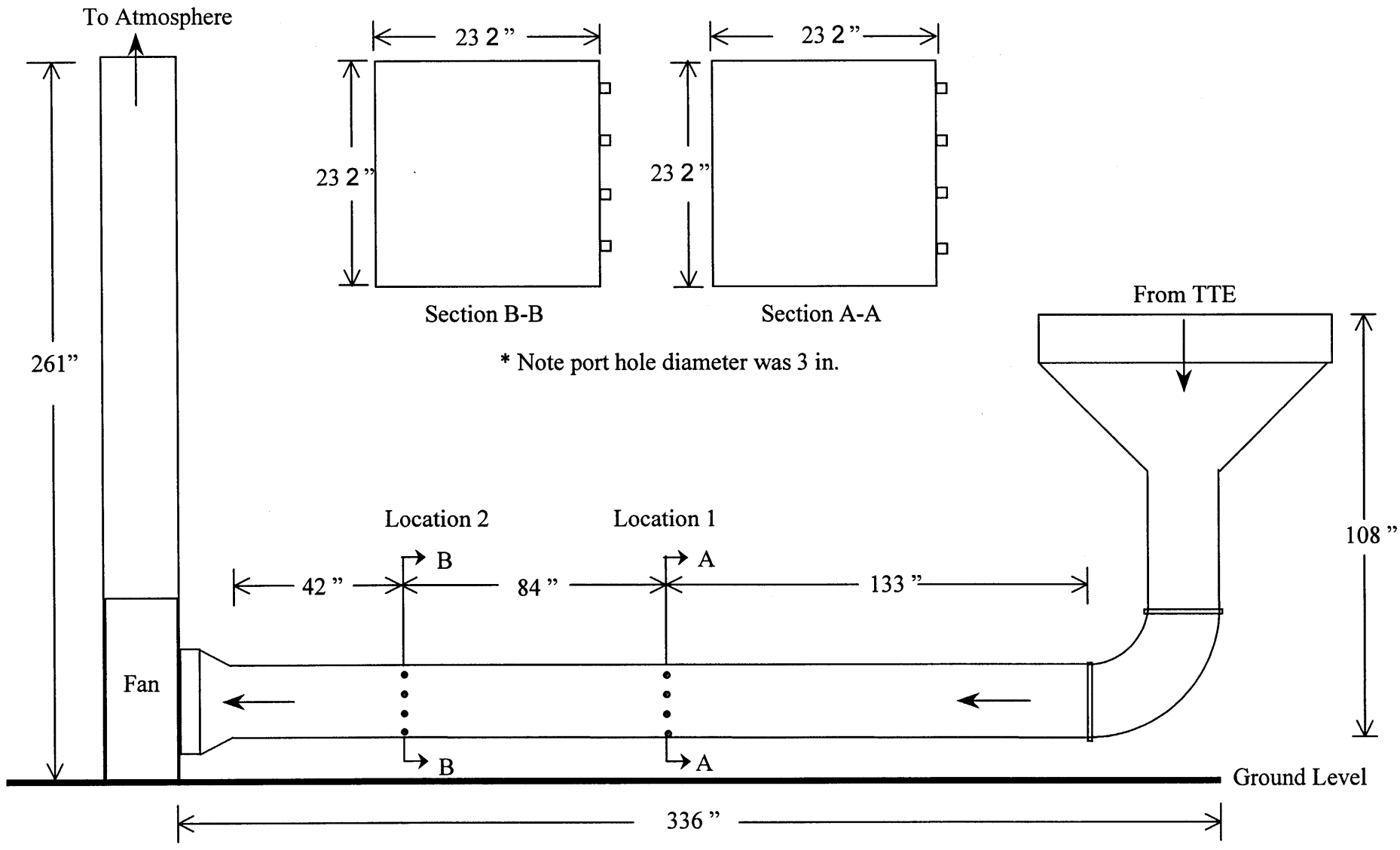
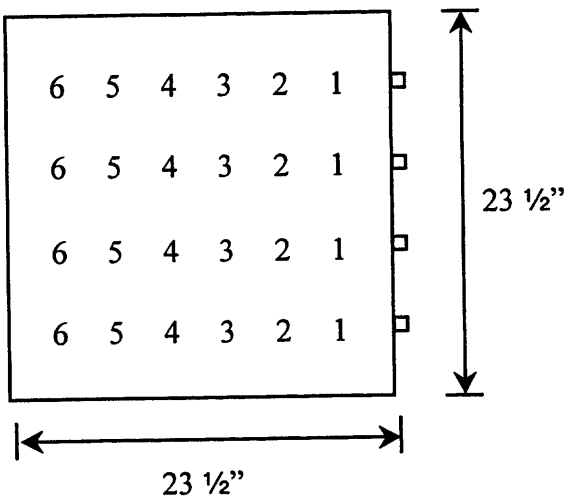


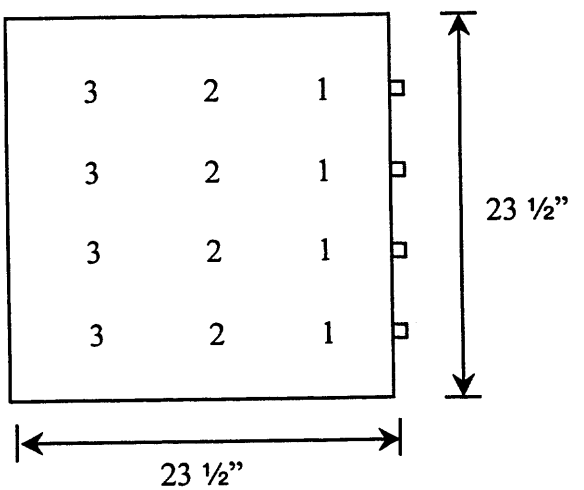

**Figure 4.1 TTE Exhaust Sampling Port Locations, Hot Mix Asphalt Plant D**




* 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 3/4 |
| 5 | 17 5/8 |
| 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 ($\Delta p$) 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.

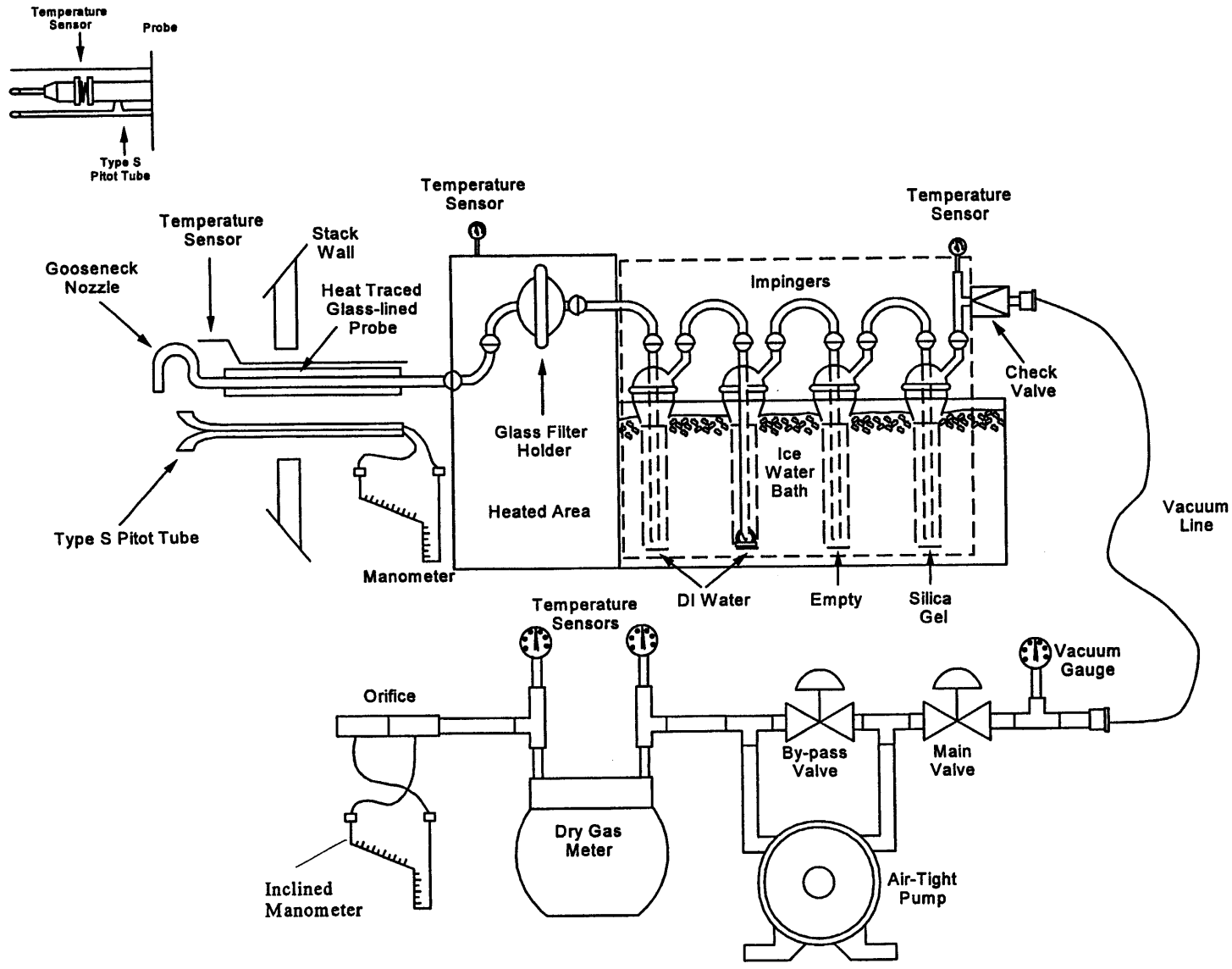



**Figure 5.1 EPA Method 315 Sampling Train Schematic**

## 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 ($\gamma$) 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 |
| $\alpha_1$ | <10° | 0 | 0 |
| $\alpha_2$ | <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, $\gamma$ | | | | 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**
**Page 1 of 2**

| | RUN NUMBER<br>RUN DATE<br>RUN TIME | M315-1<br>10/5/98<br>0721-1403 | M315-2<br>10/6/98<br>0714-1326 | M315-3<br>10/7/98<br>0636-1313 | Average |
|---|---|---|---|---|---|
| | MEASURED DATA | | | | |
| $\gamma$ | Meter Box Correction Factor | 1.001 | 1.001 | 1.001 | 1.001 |
| $\Delta H$ | 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 $\Delta p$, $(in.\ H_2O)^{1/2}$ | 1.1892 | 1.0852 | 1.0719 | 1.1154 |
| $\Theta$ | 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**
**Page 2 of 2**

| | 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 | | | | | QC limit |
| $M_a$ | Mass of residue of acetone, mg | | | 0.2 | |
| $\rho_A$ | 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 |

| | | 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 | | |
| $\rho_T$ | 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 | | |
| $\rho_A$ | 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 | | |
| $\rho_T$ | 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 | |
| $\rho_A$ | 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 | | |
| $\rho_T$ | 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<br>RUN DATE<br>RUN TIME | M315-6<br>10/5/98<br>0721-1403 | M315-7<br>10/6/98<br>0714-1326 | M315-8<br>10/7/98<br>0636-1313 | Average |
|---|---|---|---|---|---|
| | MEASURED DATA | | | | |
| $\gamma$ | Meter Box Correction Factor | 0.9802 | 0.9802 | 0.9802 | 0.980 |
| $\Delta H$ | 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 $\Delta p$, (in. $H_2O)^{1/2}$ | 1.1983 | 1.1250 | 1.0328 | 1.1187 |
| $\Theta$ | 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 | |
| $\rho_A$ | 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 | | |
| $\rho_T$ | 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 | |
| $\rho_A$ | 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 | | |
| $\rho_T$ | 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 | |
| $\rho_A$ | 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 | | |
| $\rho_T$ | 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.

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

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

$$\%I = 90.0$$

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

| | |
|---|---|
| $\gamma$ | Meter Box Correction Factor |
| $\Delta H$ | 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 $\Delta p$, (in. $H_2O)^{1/2}$ |
| $\Theta$ | 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 | | 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 | | |
| 12:40 | 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.

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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 | 48,358 | | |
| 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.

# Datasheet

ASPHALT PLANT D
BARRE, MA

RUN #1
Date: 10-5-98
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 | COS | 201 | 115 | 30 |
| 6 | 8:17 | 8:23 | 3089 | WAD | 340 | 297 | 30 |
| 7 | 8:25 | 8:33 | 3089 | 5G | 401 | 249 | 30 |
| 8 | 8:37 | 8:45 | 3089 | LC 542 | 375 | 239 | 30 |
| 9 (SAME TRUCK) | 8:47 | 8:50 | 3089 | LC 542 | 407 | 230 | 30 |
| 10 | 9:06 | 9:12 | 3089 | LC 752 | 400 | 212 | → TRUCK NOT DAMPERED |
| 11 | 9:14 | 9:20 | 3089 | LC752 | 364 | 229 | 30 |
| 12 (9:22) | ~~9:20~~ → | 9:27 | 2959 | ~~20~~ YOU | 385 | 220 | 16 (321) |
| 13 | 9:28 | 9:34 | 3089 | LC757 | 364 | 248 | 30 ← 320 |
| 14 | 9:35 | 9:41 | 3089 | WAD | 355 | 283 | 30 (290) |
| 15 | 9:42 | 9:43 | 9999 | 3 | 377 | 247 | 8 → NO EXH STACK |
| 16 | 9:45 | 9:51 | 3089 | 5G | 370 | 249 | 30 |
| 17 | 9:52 | 10:00 | 3089 | LC542 | 391 | 248 | 30 |
| 18 | 10:01 | 10:09 | 3089 | LC543 | 373 | 245 | 30 |
| 19 | 10:10 | 10:17 | 3089 | LC 751 | 378 | 245 | 30 (280) |
| 20 (10:33) | 10:25 | 10:31 | 3089 | BLK | 367 | 231 | 30 (290) |
| 21 | 10:33 | 10:38 | 3089 | LC 757 | 383 | 241 | 30 |
| 22 | 10:46 | 10:51 | 3089 | WAD | 387 | 230 | 30 (294) |
| | 10:54 | 11:02 | 3089 | 5G | 270 | 137 | 30 → PLANT PROBLEM |
| | 10:05 | 10:06 | 3089 | WAD | 326 | 210 | 30 |
| 23 | 10:08 | 10:17 | 3089 | LC 542 | 379 | 254 | 30 (290) |
| 24 | 10:18 | 10:28 | 3089 | LC 543 | 385 | 253 | 30 |
| 25 | 11:29 | 11:35 | 3089 | LC 751 | 392 | 251 | 30 (299) |
| 26 | 11:36 | 11:41 | 3089 | LC752 | 387 | 246 | 30 |
| 27 (Part change) | 11:42 | 11:48 | 3089 | LC757 | 407 | 244 | 30 (308) |
| 28 | 11:56 | 11:59 | 8888 | 4 WAD | 396 | 270 | 67 |
| 29 | 12:00 | 12:06 | 3089 | WAD ~~[illegible]~~ ? | 385 | 285 | 30 (316) |
| 30 | 12:07 | 12:13 | 3089 | 5G | 396 | 286 | 30 (310) |
| 31 | 12:14 | 12:22 | 3089 | LC 542 | 424 | 263 | 30 |
| 32 | 12:23 | 12:30 | 3089 | LC543 | 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 | 383 | 259 | 30 |
| 37 (ONE LAST JOB) | 13:52 | 14:03 | 9999 | 3 | — | — | 3 |
| | | | | PRODUCTION OFF LINE | PLANT | | |

→ confusion in control room problem releasing material to mixer! Bin [illegible] lower [illegible] expected

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 | | 2700 | 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 |

25

Truck #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# LC 543
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 | | 2700 | 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
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# 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 |

28

Truck 5

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# COS
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
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# 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 |

31

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 |

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 | 748 | 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
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# 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 | 748 | 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 |

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

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 |

19

TRUCK #19

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# BLK
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 | 748 | 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

20

TRUCK # 20

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# 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 |

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 | 748 | 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
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# 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 |

46

23

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 |

Truck # 24

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# 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 |

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 |

49

Truck # 26

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# 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 # 28

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 |

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 |

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 | 748 | 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

3

Truck # 33

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# 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

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 |

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

Datasheet

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 | LC757 | 30 | 9382 | | | | 49054 |
| 6:36 | 6:41 | 9999 | 2 | 16 | 9383 | | | | 48291 |
| 6:48 | 6:54 | 3089 | WAD | 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 | LC543 | 30 | 9396 | | | | 64143 |
| 10:16 | 10:22 | 3089 | LC751 | 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
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# 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
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# 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 | | 2700 | 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# 5G 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 |

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 |

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X

NO M315 TESTING FOR 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 543
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 | 748 | 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# 30A9
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 |

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X

SMALL LOAD - DID NOT TEST TRUCK

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# 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 |

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 |

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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 # | — TEST TIME — START (16) | STOP | TRUCK # | MIX/TICKET # | °F (10) MIX TEMP | °F (11) STACK TEMP | BATCH (lbs) TOTAL ~~TONS~~ | Asphalt Temp °F |
|---|---|---|---|---|---|---|---|---|
| 1 | 7:14 | 7:20 | WAD | 24 | 387 | 351 | 48114 | |
| 2 | 7:21 | 7:27 | BLK | 9434/~~24~~ 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 | |
| 8 | 8:10 | 8:15 | 3 | 8-9440 | 402 | 316 | 40226 | |
| 9 | 8:16 | 8:26 | LC 543 | 24-9441 | 404 | 342 | 63645 | (3) |
| PORT CHANGE → 10 | 8:37 | 8:43 | LC 752 | 24-9443 | 386 | 359 | 48094 | (4) |
| (5) → 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 | |
| 13 | 9:07 | 9:13 | LC 757 | 24-9447 | 391 | 370 | 47960 | 325 |
| (6) → 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 | 65,766 | |
| 19 | 10:08 | 10:16 | LC 542 | 24-9455 | 416 | 302 | 65,858 | 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 |
| (16) 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 | 13:08 | 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 15 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, ~~SH~~ 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

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
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# 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 |

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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 |

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 |

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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 |

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 |

0

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 | 2508 | | | 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 |

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9

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

M B. [illegible]
M 7 1p

| 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 |

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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# 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 |

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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 |

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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# 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

13

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# 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 |

890

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# PER
Mix# 1B
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 |

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 |

16

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# 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
CONN. 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

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 |

20

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# 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

21

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 36 |
| 02762 | | 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 2/D

97 90

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

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

Cust# 1
Job# 2948
Truck# R S
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

24

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# 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 |

M. B. Doy
Mt

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

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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
CHARGE SALE
ACCT.ON FILE

Job
MUNICIPAL PAVING

Cust# 8888
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

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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

| 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 |

MB

MD

104

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# 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 |

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# 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 |

1106

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# 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

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# 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 |

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
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# 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 |

11P

36

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# 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 |

112

ASPHALT PLANT D
BARRE, MA
RUN #2

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

| Truck ID | — computer time — START | STOP | TRUCK # | MIX # | TICKET # | TICKET PRINTED CLOCK TIME | POUNDS ~~TONS~~ 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 |
| | | | | | | | |
| | Before or after testing | | | | | | |
| 10 SECOND THK TEST | 6:29 | | LC 757 | 24 | 9430 | | 7895 |
| | 13:58 | | 3 | 8 | 9477 | | 14109 |
| | 14:11 | | 3 | 33 | 9478 | | 8026 |
| | 14:51 | | 3 | 33 | 9479 | | 22264 |
| | 15:~~24~~19 | 3:24 | 3 | 15 | 9481 | | 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 Fowler
MND
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
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

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

Cust# 1
Job# 2948
Truck# R S
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 |

Ex1 + Ex3 → YTB to TTE

P15, P16, P9 → PTE

Ex2, L9, L12

116

D

A

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

E

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 |

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 |

H

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# 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

I

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~~ | 13:39:18 10/06/98 | F | 2 |

987.98

M B. Dowd
m 1+D

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 |

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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

| 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 | 66248 | |
| (3) 6 | 7:21 | 7:27 | SG 22 | 25 - 9488 | 407 | 331 | 48289 | |
| 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 | 325/325 |
| 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 | 340/340 |
| 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 | 330/330 |
| (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 | |
| 17 | 9:10 | 9:16 | WAD | 25 - 9500 | 253 | 129 (13) | 48,237 | |
| (8) → (7) → 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 | 66,886 | |
| (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 (9) TRUCK W/O EXHAUST (10) MISSED FIRST PART OF FIRST DUMP (11) EXTEND TEST
10:45 – 10:56 (1.9 ppm)

Barre Plant Data Sheets

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# 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

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE, MASS.
01005
508-355-2958

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

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# WAD
Mix# 30
Name STATE BINDER 10% RAP
Operator
Ticket# 9484

| 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 | 2320 | | | 352 | | 8000 |
| 6:43:36 | 30 | 2840 | 870 | 730 | 750 | 2480 | 7670 | 11 | 353 | 353 | 8023 |
| 6:44:38 | 70 | 2830 | 830 | 760 | 820 | 2440 | 7740 | 17 | 350 | 350 | 16113 |
| 6:45:44 | 70 | 3010 | 810 | 750 | 830 | 2480 | 7880 | 16 | 349 | 349 | 24342 |
| 6:46:51 | 40 | 2750 | 720 | 790 | 810 | 2520 | 7590 | 16 | 353 | 353 | 32285 |
| 6:47:56 | 70 | 2700 | 780 | 730 | 790 | 2500 | 7500 | 15 | 349 | 349 | 40134 |
| 6:49:03 | 50 | 2940 | 810 | 780 | 840 | 2500 | 7870 | 16 | 354 | 354 | 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 |
|---|---|---|---|---|
| 2 | 48.25 | 08:49:55 10/07/98 | F | 2 |

CENTRAL MASS. ASPHALT CO.
OLD COLDBROOK RD.
BARRE,MASS.
01005
508-355-2332

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

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3037
Truck# WE 7
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 | ASP A | Asp Total | Batch Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Target | | 1155 | 825 | 2508 | 3300 | | | 462 | | 8250 |
| 6:50:59 | 30 | 1120 | 880 | 2490 | 3240 | 7730 | 9 | 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 | 8000 | 15 | 460 | 460 | 33290 |
| 6:55:04 | 70 | 1160 | 780 | 2530 | 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 | Fob/Del | Location |
|---|---|---|---|---|
| 1 | 33.06 | 06:59:15 10/07/98 | 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
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 | 2500 | 3300 | | | 462 | | 8250 |
| 7:00:01 | 40 | 1170 | 850 | 2530 | 3330 | 7680 | 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 | 80 | 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 |

5

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# COMO
Mix# 25
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 | 2500 | 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 | 60 | 1150 | 850 | 2520 | 3330 | 7850 | 14 | 464 | 464 | 25038 |
| 7:14:09 | 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 | 58084 |
| 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 | 99.25 | 07:19:26 10/07/98 | 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
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# 56 22
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 |
| 7:21:30 | 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 | 840 | 2430 | 3260 | 7680 | 12 | 446 | 446 | 32352 |
| 7:24:49 | 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 |

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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 | | | 448 | | 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 |

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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 | 13 | 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 |

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 | 08:09:17 10/07/98 | 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
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# R 5
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 | 9 | 468 | 468 | 24780 |
| 8:13:24 | 50 | 1170 | 760 | 2450 | 3250 | 7630 | 8 | 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 | 8 | 464 | 464 | 49307 |
| 8:16:42 | 60 | 1170 | 780 | 2540 | 3290 | 7780 | 8 | 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 |

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 | 8 | 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 | 49581 |
| 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 | Fob/Del | Location |
|---|---|---|---|---|
| 8 | 245.62 | 08:28:31 10/07/98 | F | 2 |

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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# 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 | 8 | 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 | 8 | 446 | 446 | 40088 |
| 8:34:46 | 40 | 1110 | 780 | 2470 | 3180 | 7540 | 9 | 450 | 450 | 48078 |

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 |

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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 757
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 |

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# 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 |

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 |

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 |

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 | 2500 | 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 |

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 |

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# COMO
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 |

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 |

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22

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# 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 |

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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 |

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24

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

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 |

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

Customer
CASH SALE
CUST. ON FILE

Job
DRIVE[redacted]

Cust# 9999
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 |

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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 |

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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# 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 |

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# 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 |

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 757
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 |

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 |

1160

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 |

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 |

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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# 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 |

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# Datasheet

ASPHALT PLANT D
BARRE, MA
RUN # 3

FRANK PHOENIX
Date: 10-7-98
TRUCK

| Truck ID | — Computer Time — Start | Stop | Truck # | Mix # | Ticket # | Ticket Printed Clock Time | Pounds Batch Total |
|---|---|---|---|---|---|---|---|
| A | 6:26:38 | 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
LORUSSO CORP.
3 BELCHER ST.
PLAINVILLE, MASS.
02762

Job
TOWN OF ERVING
VARIOUS STREETS

Cust# 1
Job# 3057
Truck# LC 757
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

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 | 179.68 | 08:05:40 10/07/98 | F | 2 |

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C

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:**<br>**Pacific Environmental Services, Inc.**<br>**560 Herndon Parkway, Suite 200**<br>**Herndon Virginia 20170-5240** | **Project No.:** WO#384<br>**Description:** Mass Loss Study for Pacific Environmental |
| **Report Distribution:** Mr. Frank Phoenix | |
| **Sample No.:** AC601<br>AC602<br>FS403<br>FS494 | **Date Received:** 9/2/98 |
| **Sample Description:** "Plainville Plant, AC, 8/18/98" - AAT# AC601<br>"Barre Plant, AC, 8/18/98" -AAT# AC602<br>"Plainville Plant, RAP, 8/18/98" -AAT# FS493<br>"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:** | William Pennington | **Signature:** | Kevin J. Knechtel |
| **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°F** | ASTM D 1754 | **-0.372** | **-0.197** | | |
| **Mass Change,** using the **Rolling Thin Film Oven Test (RTFOT) at 325°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

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PH (703) 444 4200
FX (703) 444 4368

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ADVANCED ASPHALT TECHNOLOGIES

LABORATORY AND TECHNICAL SERVICES

# TEST REPORT

**Test Report No.:** 03840006.DOC



**Report Date:** 10/05/98 [X] **Original** [ ] **Amended**

| | |
|---|---|
| **Client:**<br>**Pacific Environmental Services, Inc.**<br>**560 Herndon Parkway, Suite 200**<br>**Herndon Virginia 20170-5240** | **Project No.:** WO#384<br>**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<br>"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:** | |
| **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 |

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FX (703) 444 4368

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ADVANCED ASPHALT TECHNOLOGIES

LABORATORY AND TECHNICAL SERVICES

# TEST REPORT

**Test Report No.:** 03840009.DOC



**Report Date:** 11/05/98 [X] **Original** [ ] **Amended**

| | |
|---|---|
| **Client:** | **Project No.:** WO#384 |
| **Pacific Environmental Services, Inc.**<br>560 Herndon Parkway, Suite 200<br>Herndon Virginia 20170-5240 | **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:** William Pennington | **Signature:** Kevin J. Knechtel |
| **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

| | | Mass Change of Asphalt Samples, % | | | | | |
|---|---|---|---|---|---|---|---|
| | | *Rolling Thin FilmOven Test* ASTM D 1754 | | | *Thin Film Oven Test* ASTM D 2872 | | |
| PES Sample | *AAT Sample* | Temperature (F) | | | Temperature (F) | | |
| ID# | *ID#* | 300 | 325 | 350 | 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 | |

# 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.

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# 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...

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

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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

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 chloridewas 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 |

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**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 |

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**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 |

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**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 |

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**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 |

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**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 |

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# APPENDIX D

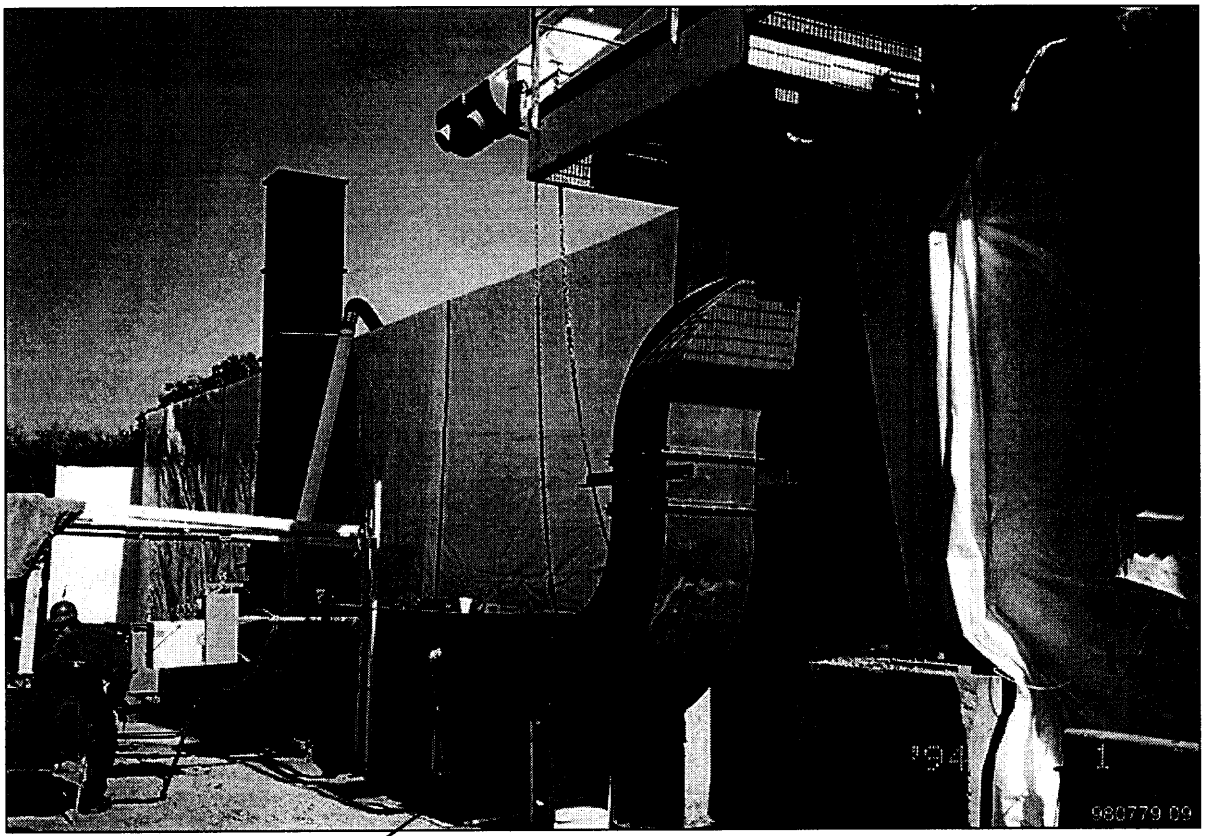
# MCEM DEPOSITION DATA

## 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**




THE EXHAUST DUCTWORK - INCLUDES 2 ELBOWS AND A SECTION OF STRAIGHT RUN

NOTE E1 = TOP ELBOW
E2 = BOTTOM ELBOW

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## 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, $ft^2$ | | Ratio of areas | Total MCEM Deposition based on ratio of areas, g |
|---|---|---|---|---|---|---|---|---|
| | | | | | Total Section | Test Channel | | |
| 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.

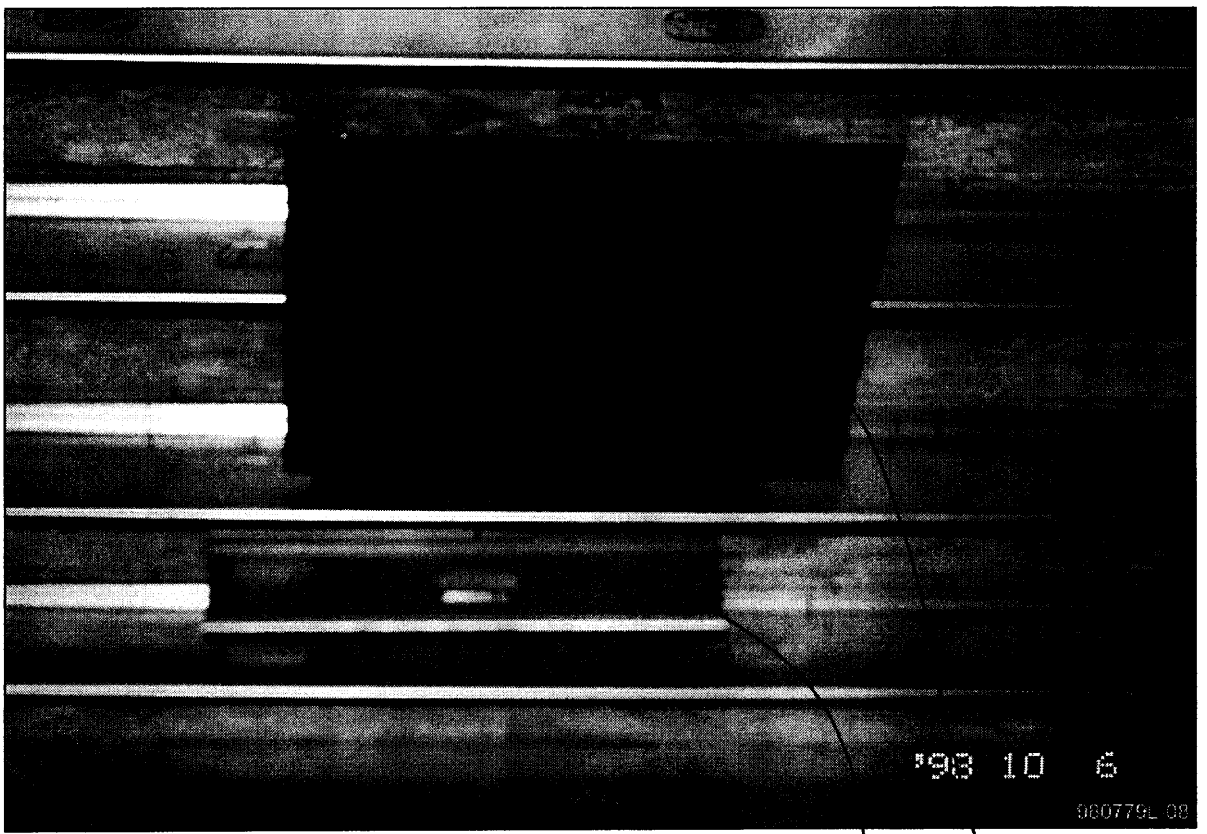
| Ceiling Plate No. | MCEM Catch, g | Length of Ceiling Section, ft | Width of Ceiling Section, ft | Total Ceiling Section surface Area, $ft^2$ | Length of each C-Channel, ft | Cross-sectional surface area of C-Channel, $ft^2/ft$ | Surface area of each C-Channel in contact with ceiling, ft | No. of C-Channels 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

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# APPENDIX E

# FIELD DATA

# TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

Plant: Asphalt Plant D

Date: 10/08/98

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 3/8"

Stack I.D.: 23 1/2"

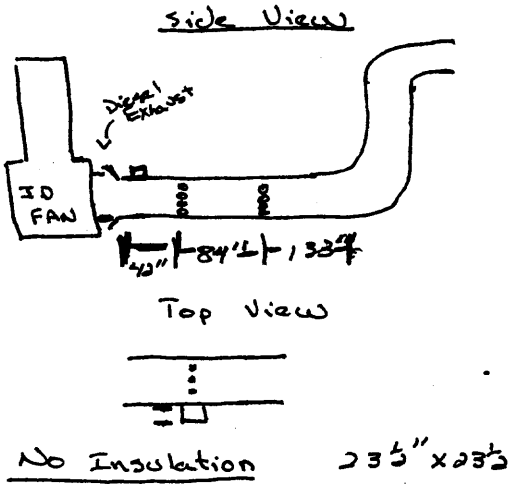
Distance Downstream from Flow Disturbance (Distance B):

_____ inches / Stack I.D. = _____ dd

Distance Upstream from Flow Disturbance (Distance A):

_____ inches / Stack I.D. = _____ dd

Calculated By: Dennis D. Holeschuh




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 | | 23 1/2" | 3.91 | 1 5/8" | 5 1/2" |
| 2 | | 23 1/2" | 11.75 | 1 5/8" | 13 3/8" |
| 3 | | 23 1/2 | 19.58 | 1 5/8" | 21 1/4" |
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# 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° | |
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| | | |
| | $\overline{\sqrt{\Delta P}}$ = | $\overline{Ts}$ = |

$Md = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$

$Md = (0.44 \times \quad) + (0.32 \times \quad) + (0.28 \times \quad)$

$Md =$

$Ms = Md \times (1 - \frac{\%H_2O}{100}) + 18 (\frac{\%H_2O}{100})$

$Ms = (\quad) \times (1 - \frac{\quad}{100}) + 18 (\frac{\quad}{100})$

$Ms =$

$\overline{Ts} =$ °F = °R (°F + 460)

$Ps = Pb + \frac{S.P.}{13.6} = (\quad) + \frac{\quad}{13.6}$

$Ps =$ in. Hg

$\overline{\sqrt{\Delta P}} =$

$Vs = 85.49 \times Cp \times \overline{\sqrt{\Delta P}} \times \sqrt{\frac{Ts\,(°R)}{Ps \times Ms}}$

$Vs = 85.49 \times (\quad) \times (\quad) \times \sqrt{\quad}$

$Vs =$ ft/s

$As =$ $ft^2$

$Qs = Vs \times As \times 60$ s/m

$Qs = \quad \times \quad \times 60$

$Qs =$ 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

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# FIELD DATA SHEET

Plant: Asphalt Plant D
Sampling Location: Tunnel Exhaust Duct
Run Number: M315-1 Date: 10-05-98
Pretest Leak Rate: 0.009 cfm @ 15 in. Hg.
Pretest Leak Check: Pitot: ✓ Orsat: N/A

Sample Type: 315 Operator: DDH
Pbar: 30.30 Ps: -7.0
CO2: 0 O2: 20.9
Probe Length/Type: 4'/Glass Pitot #: RP-19
Stack Diameter: 23½ x 23½ As: Cp = .84 NPH
K = 1.349 1.325

GL1
Nozzle ID: (GLD).188 Thermocouple #: RT 6
Assumed Bws: 2 Filter #: 100198-05.3409
Meter Box #: RMB-15 Y: 1.001 ΔH@: 1.830
Post-Test Leak Rate: 12" cfm @ .005 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 | 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 | 50 | 5 |
| | 15 | 0739 | 791.000 | 1.40 | 1.86 | 1.86 | 42 | 255 | 252 | 48 | 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 | 45 | 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 | 44 | 40 | 35 | 5 |
| B 1 | 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 | 1.70 | 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 |

.83
821.330
822.500
10" - 0.000

856.170
856.200
10" - 0.00

ΔVm= _____ $\overline{\sqrt{\Delta p}}$= _____ $\overline{\Delta H}$= _____ $\overline{Ts}$= _____ $\overline{Tm}$= _____

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**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 ($\Delta P_s$) in. $H_2O$ | Orifice Pres. Differential ($\Delta H$) in. $H_2O$ Desired | Orifice Pres. Differential ($\Delta H$) 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 135 | 1052 | 865.000 | 1.20 | 1.56 | 1.56 | 67 | 252 / 251 | 46 | 54 | 52 | 5 |
| 2 | 140 | 1059 | 867.560 | 1.20 | 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 | 50 | 5 |
| | 150 | 1115 | 873.100 | 1.30 | 1.68 | 1.68 | 67 | 253 / 251 | 47 | 52 | 51 | 5 |
| | 155 | 1120 | 875.500 | 1.20 | 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.: FED-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 | ~~530.7~~ 373.4 | -29.2 |
| 2 | DI | 100 ml. | 394.7 | ~~651.2~~ 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 |

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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 Fan OFF

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 | ~~2.33~~ 2.7 | 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~~ 1.56 | 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~~ 6 | 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 | | 59.0 | | | |

205

206

# FIELD DATA SHEET

Plant: Asphalt Plant D
Sampling Location: Tunnel Exhaust Duct
Run Number: M315-2 Date: 10-6-98
Pretest Leak Rate: .011 cfm @ 15 in. Hg.
Pretest Leak Check: Pitot: ✓ Orsat: N/A

Sample Type: 315 Operator: DDH
Pbar: 30.45 Ps: -7.0
CO2: 0 O2: 20.9
Probe Length/Type: 4' / Glass Pitot #: RP-F1
Stack Diameter: 23½ x 23½ As: ~~approx 4 sq ft~~
K = 1.300

Nozzle ID: GL1 - ~~.196~~ .188 DH Thermocouple #: RT 6
Assumed Bws: 1 Filter #: 100198-09 .3363
Meter Box #: RMB-15 Y: 1.001 ΔH@: 1.830
Post-Test Leak Rate: .001 cfm @ 5 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 | 0714 | 943.492 DH | | | | | | | | | | |
| | 5 | 0719 | 946.401 | 1.00 DH | ~~1.32~~ 1.36 | ~~1.62~~ 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 → | 55 | 0815 | 978.830 | 1.80 | 2.31 | 2.31 | 51 | 254 | 253 | 48 | 37 | 36 | 4 |
| 4:58 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 → | 115 | 1010 | 1022.550 | 1.40 | 1.79 | 1.79 | 59 | ~~253~~ | ~~252~~ | 46 | 44 | 43 | 4 |
| 1:33 C 4 | 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 |

986.285
986.285
5"
.005

1027.345
1027.345
5" .005

ΔVm= _____ $\overline{\sqrt{\Delta p}}$= _____ $\overline{\Delta H}$= _____ $\overline{Ts}$= _____ $\overline{Tm}$= _____

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**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 ($\Delta P_s$) in. $H_2O$ | Orifice Pres. Differential ($\Delta H$) in. $H_2O$ Desired | Orifice Pres. Differential ($\Delta H$) 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 1041.800 | 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 | 52 | 48 | 4 |
| | 185 | 1159 | 1069.000 | .90 | 1.16 | 1.16 | 63 | 254 / 251 | 50 | 50 | 48 | 4 |
| | 190 | 1205 | 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 | 1.28 | 1.28 | 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 | 1100.92 | 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 |
| | 7.5 | | | | | | | | | | | |
| + Extra Time | | | | | | | | | | | | |

= 247.5 min

1066.000
1066.020
4" - .005

# 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-Flt-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

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# Isokinetic Sampling Data Reduction Spreadsheet
## TTE Exhaust
HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

2

### *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, ($\Delta P$)*

| | M315-2 | | | meter temp tm | |
|---|---|---|---|---|---|
| Pt | $\Delta p$ | $\Delta H$ | $T_S$ | 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 | |

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# FIELD DATA SHEET

.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: 30.43 Ps: -7.2
CO2: 0 O2: 20.9
Probe Length/Type: 4'/Glass Pitot #: RP-19
Stack Diameter: 23.5" x 23.5" As: approx 4 ft² K = 1.300

Nozzle ID: GL-1 .188 Thermocouple #: RT-6
Assumed Bws: 1 Filter #: 100 0198-07
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 | 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 | 0636 | 104.562 | | | | | | | | | | |
| | 5 | 0640 | 107.910 | 1.0 | 1.30 | 1.30 | 37 | 252 | 252 | 39 | 30 | 37 | 2 |
| | 10 | 0647 | 111.123 | 1.0 | 1.30 | 1.30 | 37 | 252 | 252 | 41 | 30 | 37 | 4 |
| | 15 | 0653 | 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 | 252 | 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 | 0818 | 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 | | 165.200 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 |

4:19 over clock timer off by 7 min starting 0748

5:25 over

147.765
147.765
5" - 0.005

187.762
187.787
5" - 0.00

ΔVm= _____ $\overline{\sqrt{\Delta p}}$= _____ $\overline{\Delta H}$= _____ $\overline{Ts}$= _____ $\overline{Tm}$= _____

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**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 ($\Delta P_s$) in. $H_2O$ | Orifice Pres. Differential ($\Delta H$) in. $H_2O$ Desired | Orifice Pres. Differential ($\Delta H$) 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 135 | 1029 | 197.231 | .99 | 1.29 | 1.29 | 53 | 253 / 252 | 49 | 47 | 47 | 5 |
| 2 | 140 | 1034 | 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 | 206.989 | 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 ~~222.116~~ 226.903 | 1.3 | 1.65 | 1.65 | 73 | 245 / 234 | 50 | 53 | 50 | 5 |
| | 185 | 1143 | 230.132 | 1.0 | 1.29 | 1.29 | 74 | 245 / 244 | 50 | 60 | 58 | 5 |
| | 190 | 1148 | 233.400 | .95 | 1.22 | 1.22 | 74 | 245 / 244 | 50 | 60 | 58 | 5 |
| | 195 | 1203 | 236.265 | 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 | 250.000 | 1.20 | 1.56 | 1.56 | 64 | 249 / 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 | | | | | | | | | | | |

226.905
226.933
5" - 0.005

# SAMPLE RECOVERY DATA

Plant: Asphalt Plant D  Run No.: M315-3

Date: 10-07-98  Sample Box No.: 1  Job No.: 5517-002 ~~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

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# Isokinetic Sampling Data Reduction Spreadsheet
## TTE Exhaust
HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

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### *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, ($\Delta P$)*

| | M315-3 | | | meter temp tm | |
|---|---|---|---|---|---|
| Pt | $\Delta p$ | $\Delta H$ | $T_S$ | 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 | |

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M315-FB-1

# FIELD DATA SHEET

Plant: Asphalt Plant D
Sampling Location: Tunnel Exhaust Duct
Run Number: M315-FB 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-15Y: 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= _____ $\overline{\sqrt{\Delta p}}$= _____ $\overline{\Delta H}$= _____ $\overline{Ts}$= _____ $\overline{Tm}$= _____

# 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: [illegible]

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, BWS
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° | 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 |
| | | $\overline{\sqrt{\Delta P}}$ = 1.219 | $\overline{Ts}$ = 62 |

$Md = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times \%N_2)$

$Md = (0.44 \times \quad) + (0.32 \times \quad) + (0.28 \times \quad)$

$Md = 28.84$

$Ms = Md \times (1 - \frac{\%H_2O}{100}) + 18 (\frac{\%H_2O}{100})$

$Ms = (28.84) \times (1 - \frac{\quad}{100}) + 18 (\frac{\quad}{100})$

$Ms =$

$\overline{Ts} =$ °F = °R (°F + 460)

$Ps = Pb + \frac{S.P.}{13.6} = (\quad) + \frac{\quad}{13.6}$

$Ps =$ in. Hg

$\overline{\sqrt{\Delta P}} =$

$Vs = 85.49 \times Cp \times \overline{\sqrt{\Delta P}} \times \sqrt{\frac{Ts\,(°R)}{Ps \times Ms}}$

$Vs = 85.49 \times (1.219) \times (0.84) \times \sqrt{\frac{522}{812}}$

$Vs = 70.18$ ft/s

$As = 3.835$ ft²

$Qs = Vs \times As \times 60$ s/m

$Qs = 70.18 \times 3.835 \times 60$

$Qs = 16{,}148$ acfm

$Qs_{std} = Qs \times 17.647 \times \frac{Ps}{Ts} \times (1 - \frac{\%H_2O}{100})$

$Qs_{std} = \quad \times 17.647 \times \frac{\quad}{\quad} \times (1 - \frac{\quad}{100})$

$Qs_{std} =$ dscfm

— = counter clockwise

216  ~~12.6~~ 14.626  87.52

# FIELD DATA SHEET

1.5

0.189

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 #: ES1
Stack Diameter: 23.5×23.5 As: ~4 ft
CP = 1.84

Nozzle ID: 6 2 Thermocouple #: ES1
Assumed Bws: Filter #: 100198-01
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

Tare Wts: 0.3403, 0.3362

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | 0 | 0721 | 685.191 | | | | | | | | | | |
| 1 | 5 | 0726 | 688.63 | 1.3 | 1.95 | 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 | 2.34 | 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 R | 70 | | 735.77 | 1.2 | 1.69 | 1.7 | 48 | 247 | 242 | 42 | 44 | 39 | 2 |
| 2 R | 75 | | 739.05 | 1.2 | 1.69 | 1.7 | 50 | 243 | 243 | 43 | 46 | 40 | 2 |
| 2 3 | 80 | | 742.35 | 1.35 | 1.9 | 1.9 | 50 | 248 | 243 | 44 | 46 | 41 | 2 |
| 3 3 | 85 | | 745.90 | 1.4 | 1.95 | 1.95 | 58 | 249 | 246 | 43 | 48 | 43 | 2 |
| 3 4 | 90 | | 749.35 | 1.35 | 1.9 | 1.9 | 57 | 248 | 246 | 44 | 50 | 44 | 2 |
| 4 4 | 95 | | 753.05 | 1.45 | 2.02 | 2.0 | 61 | 245 | 246 | 47 | 53 | 46 | 2 |
| 4 5 | 100 | 0957 | 756.71 | 1.45 | 2.02 | 2.0 | 65 | 243 | 247 | 48 | 54 | 48 | 2 |
| 5 5 | 105 | 1002 | 760.23 | 1.45 | 2.02 | 2.0 | 64 | 241 | 244 | 48 | 55 | 49 | 2 |
| 5 6 | 110 | | 763.90 | 1.5 | 2.106 | 2.1 | 62 | 246 | 247 | 50 | 56 | 51 | 2 |
| 6 6 | 115 | | 768.02 | 1.7 | 2.37 | 2.5 | 66 | 240 | 247 | 50 | 58 | 52 | 2 |
| 6 | 120 | | 772.0 | 1.7 | 2.37 | 2.5 | 63 | 238 | 242 | 48 | 58 | 53 | 2 |

ΔVm= _____ $\overline{\sqrt{\Delta p}}$= _____ $\overline{\Delta H}$= _____ $\overline{Ts}$= _____ $\overline{Tm}$= _____

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**Plant Name:** Asphalt Plant D **Test Date:** 10/5/98

**Run Number:** M3/5-6 **Operator:** AFL

| Traverse Point Number | Sampling Time, (min.) | Clock Time (24-hour clock) | Gas Meter Reading ($V_m$) ft³ | Velocity Head ($P_s$) in. $H_2O$ | Orifice Pres. Differential ($\Delta H$) in. $H_2O$ Desired | Orifice Pres. Differential ($\Delta H$) 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1772.0 | ~~[illegible]~~ | ~~[illegible]~~ | | | | / | | | | |
| B 1 | 125 | / ~~[illegible]~~ | 775.3 | 1.2 | 1.69 | 1.7 | 61 | 241 / 244 | 47 | 57 | 54 | 2 |
| 1 | 130 | / ~~[illegible]~~ | 778.68 | 1.2 | 1.69 | 1.7 | 60 | 242 / 243 | 48 | 59 | 55 | 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 | ~~[illegible]~~ | 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 | / ~~[illegible]~~ | 854.03 | 1.55 | 2.21 | 2.2 | 74 | 243 / 247 | 57 | 72 | 70 | 2 |
| 6 | ~~[illegible]~~ 235 | 8~~[illegible]~~10 | ~~854.9~~ ~~[illegible]~~ | 1.55 | 2.21 | 2.2 | 77 | 242 / 245 | 57 | 73 | 70 | 2 |
| ~~[illegible]~~ 6 | ~~[illegible]~~ 240 | ~~231.08~~ 1400 | 862.208 | 1.60 | 2.34 | 2.34 | 74 | 241 / 247 | 54 | 77 | 73 | 2 |

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: TTE Exhaust
Sample Type: m315
Sample Recovery Person: AFL
Comments: 95% spent silica gel

Run No.: m315-6
Job No.: 5517-002
Filter No.: 100198-01, 04

## 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 (1.556 x Final − Initial) |
|---|---|---|---|---|---|
| 1 | DI Water | 100ml | 399.7 | 379.2 | -32.9 |
| 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 | | | | | |

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Description of Impinger Catch: Cloudy

27 dwt = 42 gm

# Isokinetic Sampling Data Reduction Spreadsheet
## TTE Exhaust
HOT MIX ASPHALT PLANT D - BARRE, MASSACHUSETTS

6

***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 | 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

# FIELD DATA SHEET

222

Plant: Asphalt Plant B
Sampling Location: TTE Exhaust
Run Number: M315-7 Date: 12/6/98
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"x23.5" As: ~4 sq ft

Nozzle ID: 0.185 6/3 Thermocouple #: ES-1
Assumed Bws: 0.01 Filter #: 100198-08 / 0.8378
Meter Box #: 11 Y: 0.9802 ΔH@: 1.94
Post-Test Leak Rate: 0.003 cfm @ 3 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 | | | | | | | | | | |
| D 1 | 5 | 0719 | 865.97 | 1.53 | 1.967 | 1.7 | 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 | 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 | 1.67 | 2.0 | 42 | 248 | 249 | 35 | 34 | 30 | 2 |
| 3 | 30 | 0748 | 882.95 | 1.3 | 1.67 | 2.0 | 43 | 256 | 248 | 35 | 36 | 32 | 2 |
| 4 | 35 | 0754 | 886.42 | 1.3 | 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 |
| C 1 | 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 ★ | 1020 | 949.132 | 1.4 | 1.79 | 2.2 | 60 | 247 | 246 | 45 | 47 | 45 | 2 |
| B 1 | 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 ($\Delta P_s$) in. $H_2O$ | Orifice Pres. Differential ($\Delta H$) 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 | 1.54 | 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 | 246/246 | 48 | 56 | 54 | 2 |
| A 1 | 185 | 1200 | 993.14 | 1.0 | 1.28 | 1.4 | 69 | 246/247 | 50 | 56 | 55 | 1 |
| 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 | 1031.998 | 1.4 | 1.81 | 2.2 | 71 | 245/250 | 59 | 65 | 61 | 2 |
| * xtra time | 6.91 | | | | | | | | | | | |
| | 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. 100198-08

TRAIN PREPARER GTJ

SAMPLE RECOVERY PERSON GTJ

COMMENTS 90% Sil Gel

**FRONT HALF** M315-7-FH-A

Acetone Container No. ~~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, ($\Delta P$)*

| | M315-7 | | | Meter tm | |
|---|---|---|---|---|---|
| Pt | $\Delta p$ | $\Delta H$ | $T_S$ | 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 |

225

# FIELD DATA SHEET

Cp = 0.84

0.187

Plant: Asphalt Plant D
Sampling Location: TTE Exhaust
Run Number: M315-3 Date: 10/7/98
Pretest Leak Rate: 0.001 cfm @ 10 in. Hg.
Pretest Leak Check: Pitot: ✓ Orsat: N/A

Sample Type: M315 Operator: AFL
Pbar: 30.43 Ps: ~~30.43~~ 0.72
CO2: 0 O2: Ambient
Probe Length/Type: 5' glass Pitot #: ES-1
Stack Diameter: 23.5×23.5 As: ~4 sq ft

Nozzle ID: Gl 4 Thermocouple #: ES-1
Assumed Bws: 0.01 Filter #: 100198-06 63390
Meter Box #: 11 Y: 0.9802 ΔH@: 1.94
Post-Test Leak Rate: 0.001 @ 10 cfm @ 10 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| — | 0 | 0636 | 31.881 | | | | | | | | | | |
| D1 | 5 | 0641 | 34.83 | 0.9 | 1.18 | 1.3 | 36 | 260 | 257 | 30 | 33 | 33 | 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 | 1.9 | 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 | 38 | 35 | 9 |
| 5 | 50 | 0741 | 63.65 | 1.15 | 1.49 | 1.9 | 48 | 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 | 0 5 | 0813 | 76.2 | 0.90 | 1.18 | 1.3 | 44 | 252 | 245 | 34 | 36 | 36 | 7 |
| 1 | 5 10 | 0819 | 79.0 | 0.88 | 1.18 | 1.3 | 44 | 246 | 245 | 36 | 38 | 36 | 7 |
| 2 | 10 15 | 0825 | 81.97 | 0.83 | 1.11 | 1.3 | 47 | 245 | 245 | 35 | 37 | 34 | 7 |
| 2 | 15 20 | 0830 | 84.80 | 0.80 | 1.07 | 1.3 | 48 | 249 | 245 | 35 | 38 | 35 | 6 |
| 3 | 20 25 | 0836 | 87.46 | 0.91 | 1.18 | 1.3 | 54 | 248 | 244 | 37 | 40 | 37 | 7 |
| 3 | 25 30 | 0842 | 90.33 | 0.88 | 1.18 | 1.3 | 50 | 249 | 244 | 36 | 41 | 37 | 6 |
| 4 | 30 35 | 0849 | 93.20 | 0.90 | 1.18 | 1.3 | 48 | 244 | 245 | 36 | 38 | 37 | 7 |
| 4 | 35 40 | 0855 | 96.08 | 0.87 | 1.17 | 1.3 | 48 | 247 | 248 | 34 | 39 | 37 | 7 |
| 5 | 40 45 | 0911 | 98.55 | 0.93 | 1.24 | 1.35 | 52 | 246 | 246 | 35 | 39 | 37 | 7 |
| 5 | 45 50 | 0916 | 101.96 | 0.87 | 1.17 | 1.3 | 49 | 244 | 246 | 35 | 39 | 36 | 7 |
| 6 | 50 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= _____ $\overline{\sqrt{\Delta p}}$= _____ $\overline{\Delta H}$= _____ $\overline{Ts}$= _____ $\overline{Tm}$= _____

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**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 ($\Delta P_s$) in. $H_2O$ | Orifice Pres. Differential ($\Delta H$) in. $H_2O$ Desired | Orifice Pres. Differential ($\Delta H$) 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: 10/7/98  Sample Box No.: 2  Job No.: 5517002

Sample Location: ITF Exhaust

Sample Type: M315  Filter No.: 100198-06

Sample Recovery Person: AGL

Comments: 80% spent silica gel

**FRONT HALF** M315-8-FH-A

Acetone Container No.: ~~N/A~~ AGL  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~~ AGL 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 ~~100~~ AGL | 567.6 | 569.0 | 1.4 |
| 4 | Sil Gel | ~~1 kilogram~~ AGL | ~~737.4~~ 887.4 | 914.4 | 27.0 |
| 5 | | | | | |
| 6 | | | | | |
| TOTAL | | | | | 24.3 |

Description of Impinger Catch: Cloudy

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# 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)*

| | M315-8 | | | Meter tm | |
|---|---|---|---|---|---|
| Pt | Δp | ΔH | $T_S$ | Inlet | 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

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FB-2

# FIELD DATA SHEET

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Plant: Asphalt Plant D
Sampling Location: TTE Exhaust
Run Number: M315 FB2 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: N/A
CO2: 0 O2: Ambient
Probe Length/Type: 5' Glass Pitot #: ES-1
Stack Diameter: — As: —

Nozzle ID: GL4 (0.187) Thermocouple #: ES-1
Assumed Bws: 0.001 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: N/A 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1516 | 267.322 | | | | | | | | | | |
| | | 1518 | 267.438 | N/A | N/A | N/A | 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= _____ $\overline{\sqrt{\Delta p}}$= _____ $\overline{\Delta H}$= _____ $\overline{Ts}$= _____ $\overline{Tm}$= _____

ERG
EASTERN RESEARCH GROUP, INC.

# Eastern Research Group
# Sample Chain of Custody

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## 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: _____
Date: 10/2/98

Received by: _____
Date: _____

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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: Dennis D Hofgesh

PROJECT NO.: S517.002
SAMPLERS: Dennis D Hofgesh

| 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 | | |
| | | | | | | |
| | | | | | | |
| Relinquished by: Frank J. Phoenix | Frank J. Phoenix | | Date 10/13/98 | Time 4:40 | | |
| ~~Relinquished by:~~ Received by: Linh Nguyen | Linh Nguyen | | Date 10/13/98 | Time 4:42 | | |

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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: AFL | 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 250ml jar | 1 | yes | yes | ✓ | 250ml 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 | | |
| | | | | | | |
| | | | | | | |
| Relinquished by: Frank Phoenix | Frank Phoenix | | Date 10/13/98 | Time 4:40 | | |
| ~~Relinquished~~ Received by: Linh Nguyen | | | Date 10/13/98 | Time 4:42 | | |

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Central Park West
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(919) 941-0333 FAX: (919) 941-0234

## Sample Chain of Custody Record

PLANT: Asphalt Plant D
RECOVERY PERSON: Dennis D Hofgrichter

PROJECT NO.: S517.002
SAMPLERS: Dennis D Hofgrichter

| 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: | Date | Time |
|---|---|---|
| Frank J. Phoenix | 10/13/98 | 4:40 |
| ~~Relinquished by:~~ received by: Linh Nguyen | 10/13/98 | 4:42 |

Custody

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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 | ✓ | |

| | | 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 | | |

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# APPENDIX F

# QA/QC DATA

# NOZZLE CALIBRATION SHEET

DATE: 8-5-98 CALIBRATION BY: Dennis Wlyschuch

| Nozzle Identification Number | $D_1$, in. | $D_2$, in. | $D_3$, in. | $\Delta D$, 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.

$\Delta D$ = 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. | $\Delta D$, in. | $D_{avg}$ |
|---|---|---|---|---|---|
| GL-2 | .189 | .190 | .190 | .002 | .189 |

Where:

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

$\Delta D$ = 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. | $\Delta D$, 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.

$\Delta D$ = 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. | $\Delta D$, in. | $D_{avg}$ |
|---|---|---|---|---|---|
| GL-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.

$\Delta D$ = 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 | | | | | | |

$$\%\ Temp.\ Diff = \frac{(Ref.\ Temp + 460) - (Test\ Temp. + 460)}{(Ref.\ Temp. + 460)} \times 100 \leq 1.5\ \%$$

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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 | 624.565 | 625.560 | 1.995 | 77 | 77 | 77 | 77 | 77 | 77 |
| 2 | 5.0 | 625.560 | 630.560 | 2.000 | 77 | 78 | 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 ΔH@ (in. $H_2O$) | γ | ΔH@ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 787.701 | 789.648 | 1.947 | 79 | 79 | 79 | #DIV/0! | #DIV/0! | .9711 | 1.922 |
| 2 | 787.648 | 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 |

$\bar{\gamma}$ .9910 $\overline{\Delta H@}$ 1.901

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 ΔH@ (in. $H_2O$) | γ | ΔH@ |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

$\bar{\gamma}$ .9645 $\overline{\Delta H@}$ 1.888

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 | 84 | 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 |

| 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 ΔH@ (in. H₂O) | γ | ΔH@ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | .9679 | 1.932 |
| 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

| 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 | 656.090 | 659.958 | 3.868 | 88 | 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 |

| 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 ΔH@ (in. H₂O) | γ | ΔH@ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | .9777 | 2.005 |
| 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

| 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 | 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 |

| 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 ΔH@ (in. H₂O) | γ | ΔH@ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 1.000 | 1.978 |
| 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! | 1.004 | 1.965 |
| 3 | 838.240 | 843.572 | 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

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## 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 ($ft^3$) | Final ($ft^3$) | Net ($ft^3$) | 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 ($ft^3$) | Final ($ft^3$) | Net ($ft^3$) | 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% | |

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# 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 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. $H_2O$) |
| 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 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. $H_2O$) |
| 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 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. $H_2O$) |
| 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 |

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ΔH = 2.0

| | | 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 | 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 |

| | 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. $H_2O$) |
| 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 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 | 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 |

| | 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. $H_2O$) |
| 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** |

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# 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 | $ΔH_@$ (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% | |

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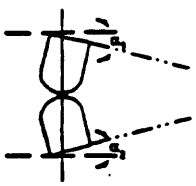
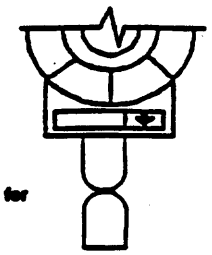
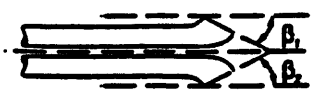
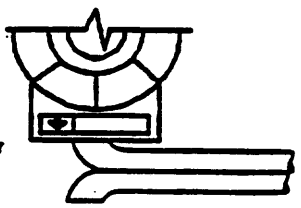
# CALIBRATION DATA SHEET 2
## Type S Pitot Tube Inspection



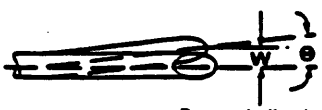



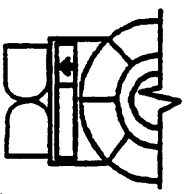
Degree indicating level position for determining $\alpha_1$ and $\alpha_2$.



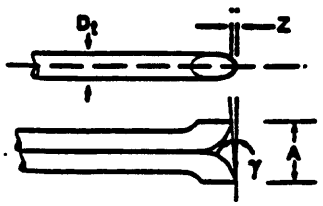



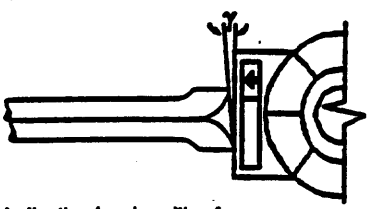
Degree indicating level position for determining $\beta_1$ and $\beta_2$.



Degree indicating level position for determining $\theta$.




Degree indicating level position for determining $\gamma$ then calculate Z.

| | |
|---|---|
| Level and Perpendicular? | YES |
| Obstruction? | NO |
| Damaged? | NO |
| $\alpha_1$ ($-10° \le \alpha_1 \le +10°$) | 0 |
| $\alpha_2$ ($-10° \le \alpha_2 \le +10°$) | 1 |
| $\beta_1$ ($-5° \le \beta_1 \le +5°$) | 0 |
| $\beta_2$ ($-5° \le \beta_2 \le +5°$) | 1 |
| $\gamma$ | 0 |
| $\theta$ | 0 |
| $z = A \tan \gamma$ ($\le 0.125"$) | 0 |
| $w = A \tan \theta$ ($\le 0.03125"$) | 0 |
| $D_t$ ($3/16" \le D_t \le 3/8"$) | 3/8 |
| A | .938 |
| $A/2D_t$ ($1.05 \le P_A/D_t \le 1.5$) | 1.25 |

***QA/QC Check***

Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Reasonableness ____

***Certification***

I certify that the Type S pitot tube/probe ID# RP-19 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: J. D Brown 7-14-98

Personnel (Signature/Date) Team Leader (Signature/Date)

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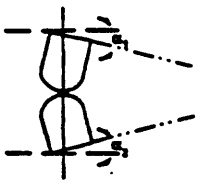
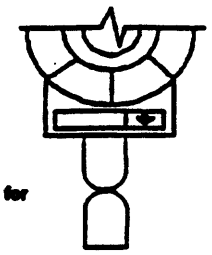
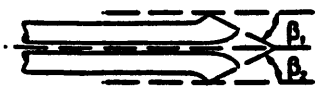
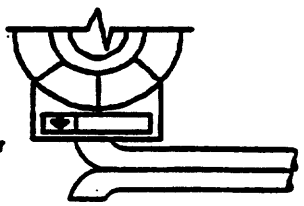
# CALIBRATION DATA SHEET 2
## Type S Pitot Tube Inspection



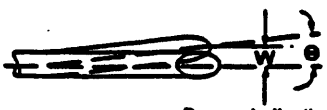



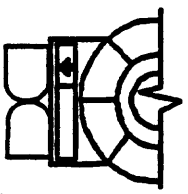
Degree indicating level position for determining $\alpha_1$ and $\alpha_2$.



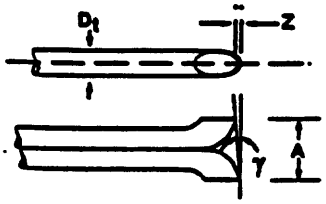



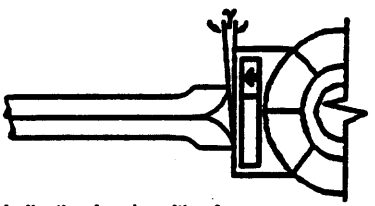
Degree indicating level position for determining $\beta_1$ and $\beta_2$.



Degree indicating level position for determining $\theta$.



Degree indicating level position for determining $\gamma$ then calculate Z.

| | |
|---|---|
| Level and Perpendicular? | Yes |
| Obstruction? | No |
| Damaged? | No |
| $\alpha_1$ ($-10° \le \alpha_1 \le +10°$) | 0 |
| $\alpha_2$ ($-10° \le \alpha_2 \le +10°$) | 1 |
| $\beta_1$ ($-5° \le \beta_1 \le +5°$) | 0 |
| $\beta_2$ ($-5° \le \beta_2 \le +5°$) | 0 |
| $\gamma$ | 1 |
| $\theta$ | 1 |
| $z = A \tan \gamma$ ($\le 0.125"$) | .0175 |
| $w = A \tan \theta$ ($\le 0.03125"$) | .0175 |
| $D_t$ ($3/16" \le D_t \le 3/8"$) | 3/8" |
| A | 1 1/32" |
| $A/2D_t$ ($1.05 \le P_A/D_t \le 1.5$) | 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 Hohsetler

Personnel (Signature/Date)

Team Leader (Signature/Date)

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# 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 | | | | | | |
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| | 1 | | | | | | |
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| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |

$$\%\ Temp.\ Diff = \frac{(Ref.\ Temp + 460) - (Test\ Temp. + 460)}{(Ref.\ Temp. + 460)} \times 100 \leq 1.5\ \%$$

# 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 | | | | | | |
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| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |

$$\%\ Temp.\ Diff = \frac{(Ref.\ Temp + 460) - (Test\ Temp. + 460)}{(Ref.\ Temp. + 460)} \times 100 \leq 1.5\ \%$$

# TEMPERATURE SENSOR CALIBRATION FORM

Temperature Sensor No. MB-11 DGM-10 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 | | Temp. Diff. % | Within Limits Y/N | Calibrated By |
|---|---|---|---|---|---|---|---|
| | | | Ref. Sensor | Test Sensor | | | |
| 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 | | | | | | |
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| | 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. 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 H2O | 33 | 34 | | | |
| " | 2 | AMB. AIR | 76 | 76 | 0 | | |
| " | 3 | BOIL. H2O | 206 | 205 | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

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# TEMPERATURE SENSOR CALIBRATION FORM

DGM-OUT

**Temperature Sensor No.** 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 $H_2O$ | 32 | 34 | .406 | Y | WB |
| " | 2 | AMB. AIR | 76 | 77 | .186 | Y | WB |
| " | 3 | BOIL $H_2O$ | 206 | 205 | .150 | Y | WB |
| | 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. 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 | | Temp. Diff. % | Within Limits Y/N | Calibrated By |
|---|---|---|---|---|---|---|---|
| | | | Ref. Sensor | Test Sensor | | | |
| 3-18-98 | 1 | ICE $H_2O$ | 33 | 35 | .406 | Y | JWB |
| " | 2 | AMB. AIR | 74 | 74 | 0 | Y | JWB |
| " | 3 | Boil. $H_2O$ | 208 | 210 | .299 | Y | JWB |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

# 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 | WB |
| " | 2 | AMB AIR | 74 | 75 | .187 | Y | WB |
| " | 3 | BOIL. $H_2O$ | 208 | 208 | 0 | Y | WB |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

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# 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 | ICF | 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 | | | | | | |

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

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# TEMPERATURE SENSOR CALIBRATION FORM

**Temperature Sensor No.** T-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 | | | | | | |
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| | 3 | | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |

$$\% \text{ Temp. Diff} = \frac{(\text{Ref. Temp} + 460) - (\text{Test Temp.} + 460)}{(\text{Ref. Temp.} + 460)} \times 100 \leq 1.5\ \%$$

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# Emission Test
# Hot Asphalt Plant D
# Barre, Massachusetts

Tonnel Exhaust
Method 315
MB operator Dennis Holzschuh

Date 10-5-98


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

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| 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 | Setting 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 h |
| 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
Page 1 of 2

MB Operator Allan Howe

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 M13 # 11
y = .9802
ΔH = 1.99
K Factor 1.5

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| 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 set 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 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 Ca |

Oct 5, 1998

# Emission Test
# Hot Asphalt Plant D
# Barre, Massachusetts



Tunnel Exhaust

## I. Test Run Observations

R = Recommended
M = Mandatory

| | | | Date | 10-5-98 | 10-5-98 | | |
|---|---|---|---|---|---|---|---|
| | | | | Test Run 1 M-315 | Test Run ~~2~~ 6 M-315 | Test Run 3 | Test Run 4 |
| 1. Train set up | filter ID | | | 100198-05 | 100198-01 | 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 | .008 | | |
| | | VAC | | 15" Hg | 10" Hg | | |
| | intermediate (R) | LC | | | .004 | ok | |
| | | VAC | | | 15" Hg | | |
| | 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 | | |

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1* Changed out Filters & holders

2* Exhaust gas is ambient Air, so it has been assigned dry molecular wt of ambient Air 28.84 g/g-mol

| R = Recommended<br>M = Mandatory | Date | 10-5-98<br>Test Run 1<br>M-315 | 10-5-98<br>Test Run ~~2~~ 6<br>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 | | |
| 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 | | 2:06PM | 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 | 882.208 | | |
| 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 | 53.2°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 | | |

| R = Recommended<br>M = Mandatory | Date 10-5-98<br>Test Run 1<br>M-315 | 10-5-98<br>Test Run ~~2~~ 6<br>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 | | |
| Accurate reading of: ΔP Average Square Rt. ΔP | 1.1892 | ~~[illegible]~~ | 1.2004 | |
| 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 2"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<br>Minimum sample volume of 60 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 | | |
| grad cyl. weighed | | .6% | | |
| water measured mL gms | 24.3 | 23.8 | | |
| - 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 @ 2"Hg the remainder of test.

| R = Recommended<br>M = Mandatory | Date | 10-5-98 | 10-5-98 | | |
|---|---|---|---|---|---|
| | | 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% | | | | | |
| Fo = $\frac{20.9 - \% O_2}{\% CO_2}$ | | N/A | N/A | | |
| Fuel | | | | | |
| $F_o$ range for fuel | | N/A | N/A | | |
| 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 trains, we were getting high Vaccum 15"+ at the port change (1 hour) we investigated the Filter housing & fit 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 + fit & Filter housing. With the new fit we increase emission distribution & we did not ~~have~~ 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 Holeschuh

Date 10-6-98
Page 1 of 2
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

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| 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 0 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 DPH

| 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
$y = .9802$
$\Delta H = 1.99$
K Factor = 1.318

-273

Date 10-6-98
Page 2 of 2

| 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 | Set amongst 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 | A L |
| Analytical parameter | Particulate & Extracable Organic Matter |
| Preservative required | All Samples sealed & handled with Care |

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Oct 6, , 1998

# Emission Test
# Hot Asphalt Plant D
# Barre, Massachusetts



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 | | | 100RR-09 | 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 | [illegible] | | |
| | 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 | | .014 | .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) | | | >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 | | |

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| | Date | 10-6-98 | 10-6-98 | | |
|---|---|---|---|---|---|
| R = Recommended<br>M = Mandatory | | Test Run ~~1~~ 2 | Test Run ~~2~~ 7 | 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 | | 7:14 AM | 7:14 AM | | |
| Time test ended | | 1:26 PM | 1:26 PM | | |
| 6. Dry gas meter volume: | ( ) port initial | 943.492 | 862.757 | | |
| | final | | | | |
| | ( ) port initial | | | | |
| | final | | | | |
| | ( ) port initial | | | | |
| | final | | | | |
| | ( ) port initial | | | | |
| | final | 943.492 | 1031.778 | | |
| 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 | | |

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Oct 6 , 1998



| R = Recommended<br>M = Mandatory | Date | 10-6-98 | 10-6-98 | | |
|---|---|---|---|---|---|
| | | Test Run x 2 M-315 | Test Run x 7 M-315 | Test Run 3 | Test Run 4 |
| 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 | 1.0852 | 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 | <~~80°F~~ | <60°F | | |
| | filter box temperature | 250±25 | 250±25 | | |
| Minimum sample time of _____ min met<br>Minimum sample volume of _____ dscf collected | | 172.039 | 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 | | |
| | grad cyl. weighed<br>water measured mL gms | 27.1 | 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 | | |
| 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<br>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 N/A.)

Dennis P Holzschuh
Signature of Observer

PES
Affiliation of Observer

10-6-98
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

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, Mass |
| 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 Howe

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
$y = .9802$
$\Delta H = 1.99$
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 Howe |
| 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 |

Oct 7, 1998

# Emission Test
# Hot Asphalt Plant D
# Barre, Massachusetts



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: (≤0.02 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 | | .005 | .001 | | |
| | | VAC | | 10" 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 | | |

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| R = Recommended<br>M = Mandatory | Date 10-7-98<br>Test Run ~~2~~ 3<br>M-315 | 10-7-98<br>Test Run ~~2~~ 8<br>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 | | |
| 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 | 206.819 | 192.639 | | |
| 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 | 55.2 | | |
| 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 | | |

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| R = Recommended<br>M = Mandatory | Date 10-7-98 | 10-7-98 | | |
|---|---|---|---|---|
| | Test Run ~~2~~ 3 M-315 | Test Run ~~2~~ 8 M-315 | Test Run 3 | Test Run 4 |
| 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 | <5" | <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<br>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. weighed gms | 23.2 | 24.3 | | |
| - silica gel weighed, net gms | 25.7 | 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 | | |

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| R = Recommended<br>M = Mandatory | Date | 10-7-98 | 10-7-98 | | |
|---|---|---|---|---|---|
| | | Test Run ~~2~~ 3 M-315 | Test Run ~~1~~ 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%

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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 Hobschuh
Signature of Observer

PES
Affiliation of Observer

10-7-98
Date

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# 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<br>100198-04 | .3403<br>.3362 | .3403<br>.3362 | .3403<br>.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 |
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* While observing analytical procedures at ERG Labs for Hot Mix Plant D MCEM analysis on 11-2-98, Trish allow me to copy the Analytical Tare Wts from his original Filter Pre-weights data sheet.

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# Nozzle Calibration Worksheet

**Plant:** Hot Asphalt Mix Plant D **City, State:** Barre, Mass

**Date:** 10-5-98 **Initials:** DPH

| RUN ID ~~M315-1~~ | NOZZLE ID | CALIBRATION DIAMETER | DATA SHEET DIAMETER | CALIBRATION DATE | TEST DATE |
|---|---|---|---|---|---|
| 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 |
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# Corrective Action Report

**Plant:** Hot Asplatt 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<br>(Give Date and Time Identified) 10-5-98<br>On 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<br>Filter housing configuration was a T or cross pattern<br>we went to a star pattern which increased the the area of collection 10 times |
| State Corrective Action Planned<br>(Include Persons Involved in Action)<br>changing out Filter & Filter housing | QA Officer Comments:<br>Decision made was the right one. It did not hinder or interfere with the outcome of the test run |
| Signatures | Project Manager Comments: |
| QA Officer Dennis P Holzschuh | |
| Project Manager Frank J Rovero | |
| Originator Dennis P. Holzschuh | |
| | |
| | |

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# 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@5"Hg | >3" Pos ok Neg ok | 7:21 AM 2:03 PM | RP-19 |
| M315-6 | GL-2 | 100198-04 -01 | .004@10"Hg | >3" Pos ok Neg ok | 7:21 AM 2:00 PM | ES1 |
| M315-2 | GL-1 | 100198-09 | .001@5"Hg | >3" Pos ok Neg ok | 7:14 AM 1:26 PM | RP-19 |
| M315-7 | GL-3 | 100198-08 | .003@3"Hg | >3" Pos ok Neg ok | 7:14 AM 1:26 PM | ES1 |
| M315-3 | GL-1 | 100198-07 | .005@6"Hg | >3" Pos ok Neg ok | 6:36 AM 1:13 PM | RP-19 |
| M315-8 | GL-4 | 100198-06 | .001@10"Hg | >3" Pos ok Neg ok | 6:36 AM 1:13 PM | ES1 |

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# 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 |
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# 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 ($\Delta p$) 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 ($\alpha$) to the nearest degree. After the null technique
has been applied at each traverse point, calculate the average of the absolute values of $\alpha$; assign $\alpha$ values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of $\alpha$ 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.) $H_2O$ 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:

$$\overline{R} = \frac{\Sigma R_i}{n}$$

Eq. 1-3

Where:

$R_{avg}$ = average resultant angle, degree.
n = total number of traverse points.

**2.5.4.3** Calculate the standard deviations:

$$S_d = \sqrt{\frac{\sum_{i=1}^{n} (R_i - \overline{R})^2}{(n-1)}}$$

Eq. 1-4

Where:

$S_d$ = standard deviation, degree.

**2.5.5** The measurement location is acceptable if $R_{avg} \leq 20°$ and $S_d \leq 10°$.

**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.

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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 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

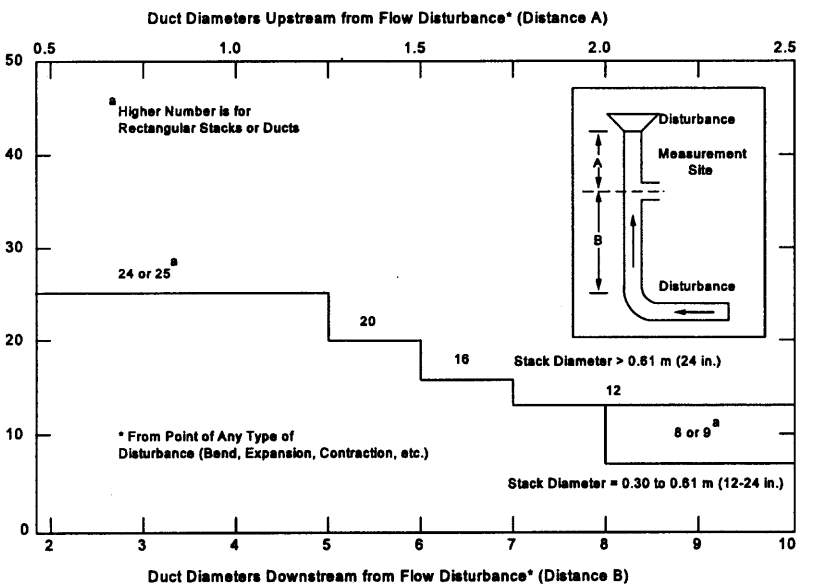


Figure 1-1. Minimum number of traverse points for particulate traverses.

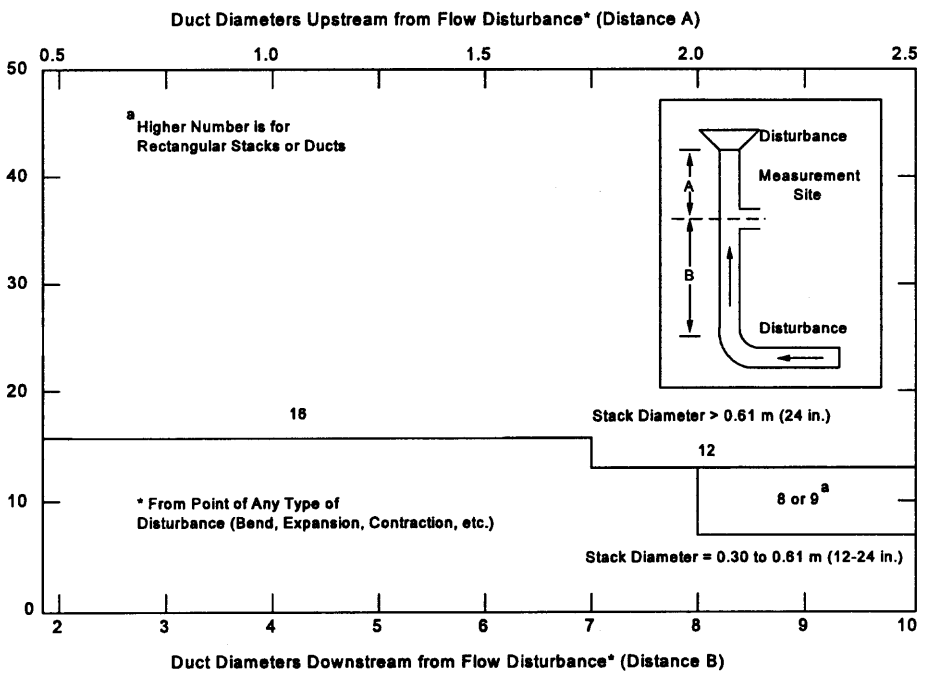


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

| Traverse Point | Distance % of diameter |
|---|---|
| 1 | 4.4 |
| 2 | 14.7 |
| 3 | 29.5 |
| 4 | 70.5 |
| 5 | 85.3 |
| 6 | 95.6 |

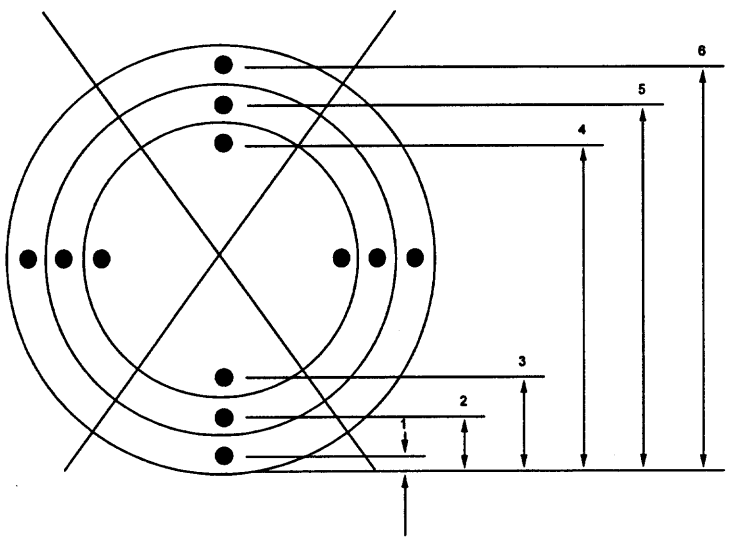


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

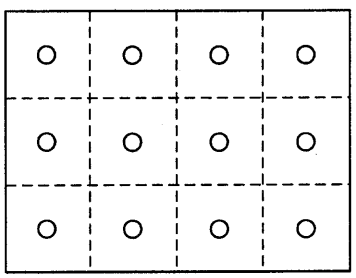

Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

# 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 ($\Delta p$) 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 $\Delta p$ reading. If the $\Delta p$ readings made before and after the air purge are the same (±5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if $\Delta p$ 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 $\Delta p$ readings shall be taken, as above, for the last two back purges at which suitably high $\Delta p$ 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 $\Delta p$ 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 $\Delta p$ 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 $\Delta p$ readings are below 1.3 mm (0.05 in.) $H_2O$; (3) for traverses of fewer than 12 points, more than one $\Delta p$ 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:

$\Delta p_i$ = 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 $\Delta p$ readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of $\Delta p$ values in the stack. If, at each point, the values of $\Delta p$ 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 $\Delta p$ 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 $\Delta p$ 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 $\Delta p$ values above 25 mm (1.0 in.) $H_2O$. A special, more sensitive gauge will be required to read $\Delta p$ 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 $\Delta p$ 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 $\Delta p$ values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the $\Delta p$ 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

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 $\Delta p_{std}$, 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 $\Delta p_s$, 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 $\Delta p$ 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 $\Delta p$ 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.

$\Delta p_{std}$ = Velocity head measured by the standard pitot tube, cm (in.) $H_2O$.

$\Delta p_s$ = Velocity head measured by the Type S pitot tube, cm (in.) $H_2O$.

**4.1.4.2** Calculate $\overline{C}_p$ (side A), the mean A-side coefficient, and $\overline{C}_p$ (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 $\overline{C}_p$ (side A), and the deviation of each B-side values of $C_{p(s)}$ from $\overline{C}_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p_{(s)}} - \overline{C}_p(\text{A or B})$$

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:

$$\sigma(\text{side A or B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \overline{C}_p(\text{A or B}) \right|}{3}$$

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 $\overline{C}_p$ (A) and $\overline{C}_p$ (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., $\overline{C}_p$ (side A) and $\overline{C}_p$ (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).

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**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 ($\sigma$) 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.**

$A$ = 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).

$t_s$ = 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).

$\Delta p$ = 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

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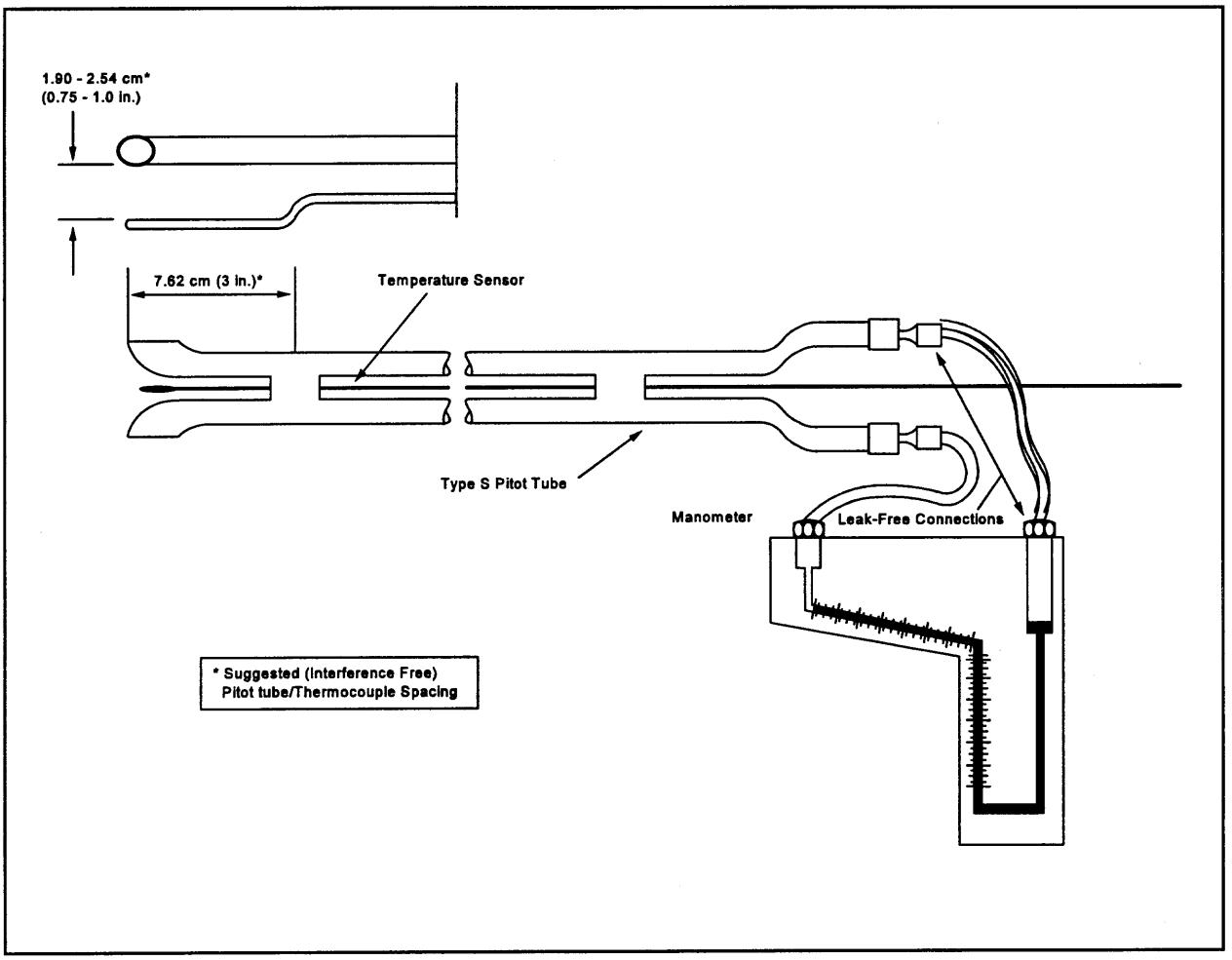


Figure 2-1. Type S pitot tube manometer assembly.

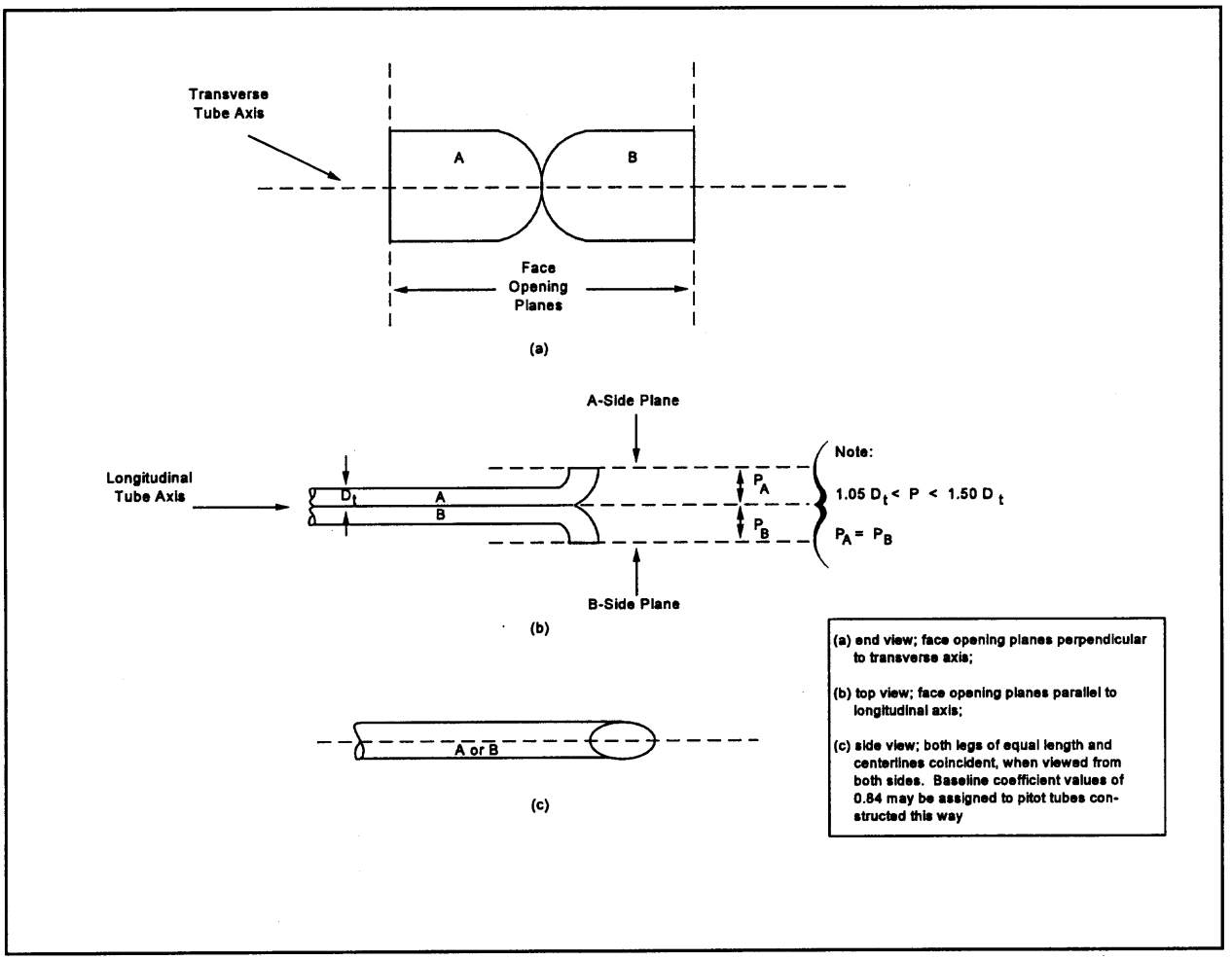


Figure 2-2. Properly constructed Type S pitot tube.

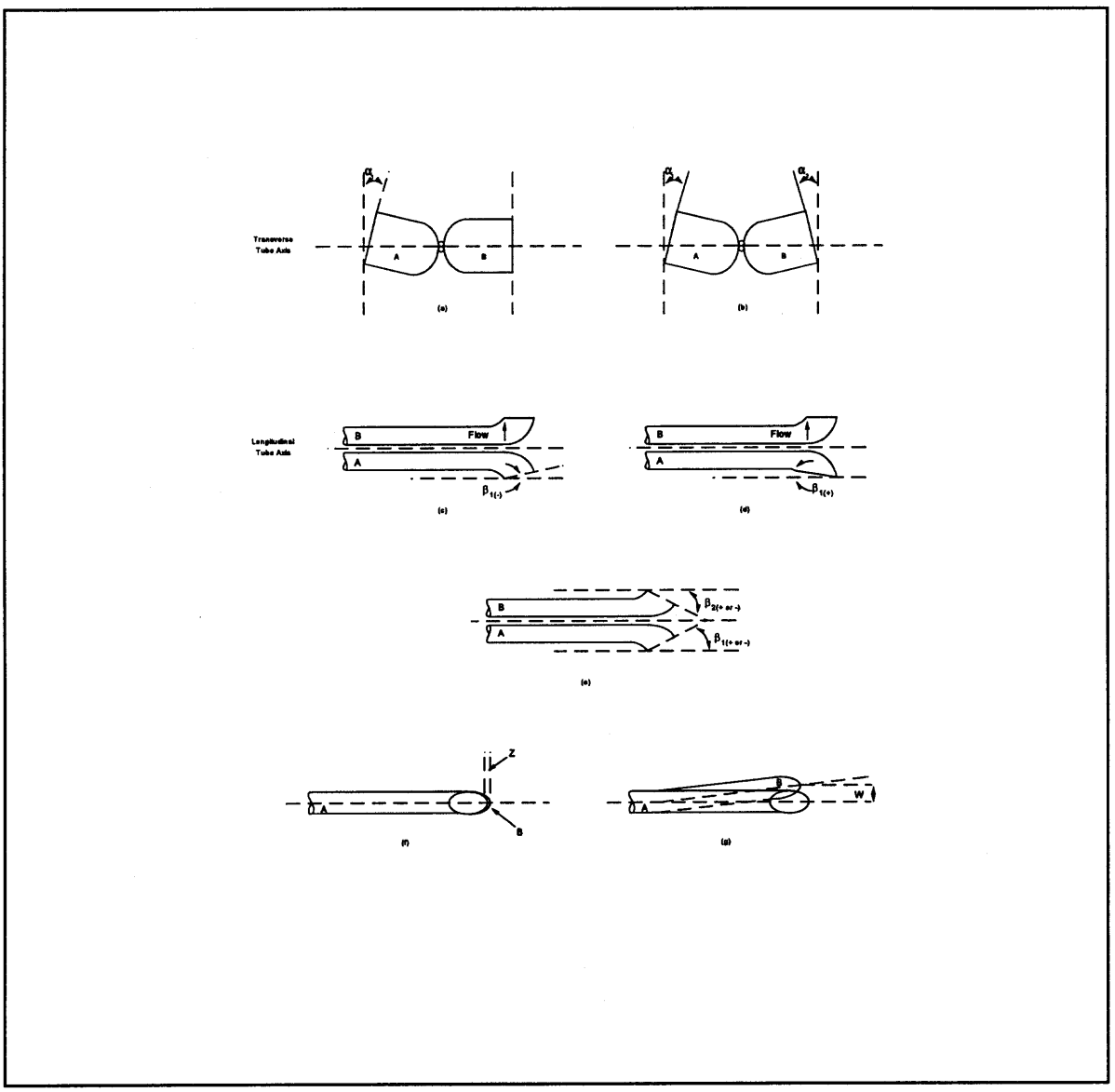


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of Cp(s) so long as $\alpha^1$ and $\alpha^2$ ≤10°, $\beta^1$ and $\beta^2$ ≤5°, z ≤0.32 cm (1/8 in.) and w ≤0.08 cm (1/32 in.) (citation 11 in Bibliography).

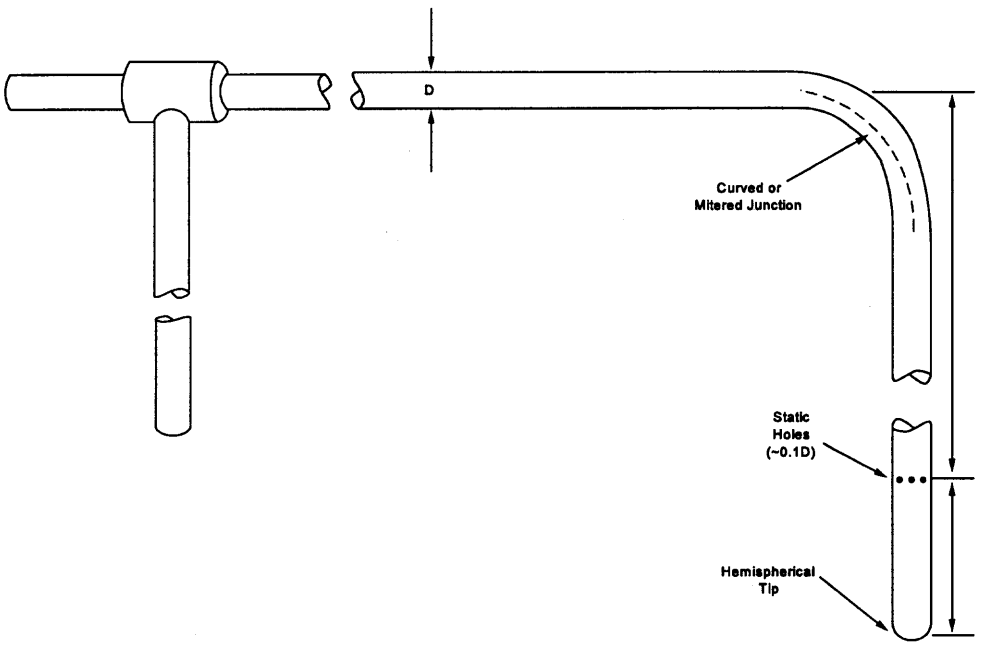


Figure 2-4. Standard pitot tube design specifications.

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., $\Delta p$ mm (in.) $H_2O$ | Stack Temperature | | $P_g$ mm Hg (in.Hg) | $(\Delta p)^{1/2}$ |
|---|---|---|---|---|---|
| | | $T_s$, °C (°F) | $T_s$, °K (°R) | | |
| | | | | | |
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| | | | | | |
| | | Average | | | |

Figure 2-5. Velocity traverse data.

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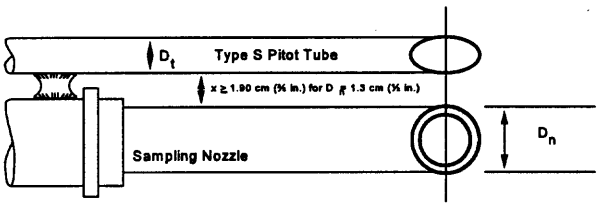
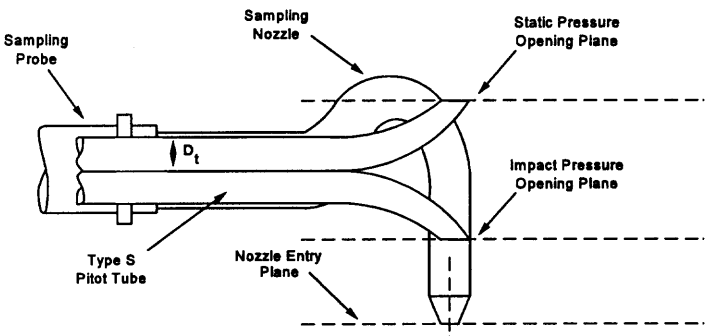



A. Bottom View; showing minimum pitot tube-nozzle separation.




B. Side View; to prevent pitot tube from interfering with gas flow streamlines approaching the nozzle, the impact pressure opening plane of the pitot tube shall be even with or above the nozzle entry plane.

Figure 2-6. Proper pitot tube-sampling nozzle configuration to prevent aerodynamic interference; 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.).

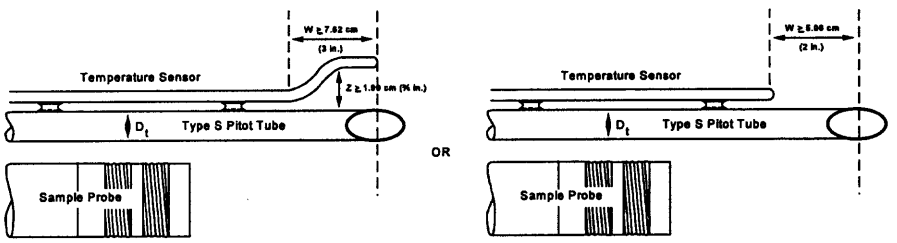



Figure 2-7. Proper thermocouple placement to prevent interference; $D_t$ between 0.48 and 0.95 cm (3/16 and 3/8 in.).

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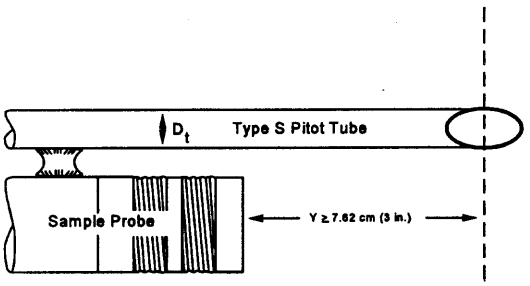


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; $D_t$ between 0.48 and 0.95 cm (3/16 and 3/8 in.).

PITOT TUBE IDENTIFICATION NUMBER: _____ DATE: _____CALIBRATED BY: _
_____

| | "A" SIDE CALIBRATION | | | |
|---|---|---|---|---|
| RUN NO. | $\Delta P_{std}$ 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. | $\Delta P_{std}$ 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.

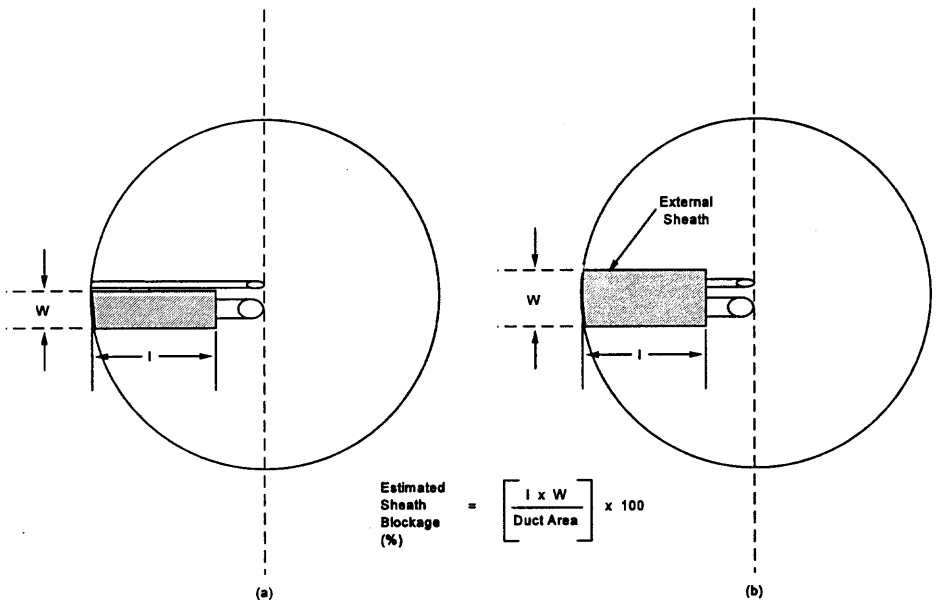


Figure 2-10. Projected-area models for typical pitot tube assemblies.

# METHOD 315

APPENDIX A TO PART 63--TEST METHODS

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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.

<u>NOTE</u>: 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 l, 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)$^2$;

$\Delta H$ = Average pressure differential across the orifice meter, in. $H_20$;

$T_m$ = Absolute average DGM temperature, °R;

$\Theta$ = 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, l8.0 g/g-mole (l8.0 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.

$\Delta H$ = Average pressure differential across the orifice meter (see Figure 5-2 of Method 5, 40 CFR part 60, appendix A), mm $H_20$ (in $H_20$).

$\rho_a$ = Density of acetone, 785.1 mg/ml (or see label on bottle).

$\rho_w$ = Density of water, 0.9982 g/ml (0.00220l lb/ml).

$\rho_t$ = Density of methylene chloride, 1316.8 mg/ml (or see label on bottle).

$\Theta$ = Total sampling time, min.

$\Theta_1$ = Sampling time interval, from the beginning of a run until the first component change, min.

$\Theta_i$ = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

$\Theta_p$ = 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.

$$V = V_m Y \frac{T_{std}\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{T_m P_{std}} \qquad \text{Eq. 315-1}$$

$$= V = K_1 V_m Y \frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m}$$

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.

$$V_{w(std)} = V_{lc} \frac{\rho_w R T_{std}}{M_w P_{std}} = K_2 V_{lc} \qquad \text{Eq. 315-2}$$

where

$K_2$ = 0.001333 $m^3$/ml for metric units;

= 0.04706 $ft^3$/ml for English units.

12.6 Moisture content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}} \qquad \text{Eq. 315-3}$$

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.

$$C_a = \frac{M_a}{V_a \rho_a} \qquad \text{Eq. 315-4}$$

12.8 Acetone wash blank.

$$W_a = C_a V_{aw} \rho_a \qquad \text{Eq. 315-5}$$

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.

$$c_s = K_3 m_n / V_{m(std)} \qquad \text{Eq. 315-6}$$

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 | $1.429 \times 10^{-4}$ |

12.12 Isokinetic variation.

12.12.1 Calculation from raw data.

$$I = \frac{100\, T_s \left[ K_4\, V_{lc} + \left( \frac{V_m\, Y}{T_m} \right) \left( P_{bar} + \frac{\Delta H}{13.6} \right) \right]}{60\, \Theta\, v_s\, P_s\, A_n} \qquad \text{Eq. 315-7}$$

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;

$\Theta$ = Run time, min;

$t_{ds}$ = Average dry gas meter temperature, °C (°F);

$V_{ds}$ = Dry gas meter volume, liter ($ft^3$);

$\Delta p$ = 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.

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## 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 |

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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<br>Particulate Matter | | |
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