AP42 Section: 11.1

Reference Number: 77

Title: Results Of A Source Emission Compliance Test On An Asphalt Plant Operated By Mid-Minnesota Hot Mix, Inc., Annandale, Minnesota,

MMT Environmental Services, Inc., St. Paul, MN,

June 23, 1994.

192

MMT Environmental Services, Inc.
4610 North Churchill Street
St. Paul, MN 55126-5892
Phone (612) 483-9595 Fax (612) 483-2699

RESULTS OF A SOURCE EMISSION COMPLIANCE TEST ON AN ASPHALT PLANT OPERATED BY MID-MINNESOTA HOT MIX, INC. ANNANDALE, MINNESOTA May 24, 1994

Submitted to:

Mid-Minnesota Hot Mix
P.O. Box 239
Annandale, MN 55302
Attn: Mr. David Ferrell

Prepared by:

Ted Gibbons
Sampling Team Leader

Approved by:

Alan L. Trowbridge
Director of Technical Services

MMT Report Number: 10072
MMT Project Number: 9587
Report Issued: June 23, 1994

TABLE OF CONTENTS

REPORT CERTIFICATIONS

1. **Certification of sampling procedures by the sampling team leader:**
I certify under penalty of law that the sampling procedures were performed in accordance with the approved test plan and that the data presented in this test report are, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained in the report.

Name: Ted M. Gibbons Signature: Ted M. Gibbons

Title: Technical Services Technician Date: 6/23/94

2. **Certification of analytical procedures by the responsible sample analyst:**
I certify under penalty of law that the analytical procedures were performed in accordance with the requirements of the test methods and that the data presented in this test report are, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained in the report.

Name: Ted M. Gibbons Signature: Ted M. Gibbons

Title: Technical Services Technician Date: 6/23/94

3. ***Certification of test report by testing department senior staff:***
I certify under penalty of law that this report and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed the sampling and analyses relating to the performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained in the report.

Name: Alan L. Trowbridge Signature: Alan L. Trowbridge

Title: Director of Technical Services Date: 6/23/94

4. **Certification of test report by the emission facility Owner or Operator:**
I certify under penalty of law that the information submitted in this report accurately reflects the operating conditions at the emission facility during this performance test and describes the date and nature of all operational and maintenance activities that were performed on the process and control equipment during the month prior to the performance test. Based on my inquiry of the person or persons who performed the operational and maintenance activities, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained in the cover letter or attachments submitted with this report.

Name: David Ferrell Signature: David Ferrell

Title: CEO Date: 6-30-94

RESULTS OF A SOURCE EMISSION COMPLIANCE TEST ON AN ASPHALT PLANT OPERATED BY MID-MINNESOTA HOT MIX, INC. ANNANDALE, MINNESOTA, MAY 24, 1994

MMT Report Number: 10072
MMT Project Number: 9587
Report Issued: June 23, 1994

1 INTRODUCTION

MMT Environmental Services, Inc. (MMT) was contracted by Mid-Minnesota Hot Mix, Inc. to perform a source emission compliance test on a single source at Mid-Minnesota's asphalt facility in Annandale, Minnesota. Testing of the asphalt plant's emissions was required by the Minnesota Pollution Control Agency as part of their permitting requirements (MPCA file 1933). The plant consists of a Barber-Greene model 858 conventional batch unit and a Barber-Greene model 838 aggregate dryer. Emissions generated by the plant's operation are controlled by a Barber-Greene wet wash scrubber. The scrubber exhaust was tested for particulate and visible emissions on May 24, 1994. This report presents the results of the test program along with all substantiating documentation.

The MMT sampling team consisted of Messrs. Ted Gibbons, Bill Anderson and Alan Trowbridge. Messrs. David Ferrell and Ronald Karie represented Mid-Minnesota Hot-Mix, Inc. throughout the test period. Mr. Craig Averman of the Minnesota Pollution Control Agency witnessed portions of the test proceedings.

2 TEST RESULTS

The results of the particulate emission test are presented in Table 2.1. The data indicates an average effluent particulate concentration of 0.182 grains per dry standard cubic foot and an average source particulate emission rate of 21.68 pounds per hour.

The asphalt plant source emissions are regulated by Minnesota Rule 7011.0905. In order to be in compliance with this rule, the effluent particulate concentration must be less than 0.30 grains per dry standard cubic foot **and** the particulate emissions must also satisfy at least **one** of the following:

1) Particulate concentration less than 0.080 grains per dry standard cubic foot;
   Based on Minnesota Rule 7011.0735 and a volumetric flow rate of 13,967 dscfm.
2) Particulate mass emission rate less than 38.05 pounds per hour;
   Based on Minnesota Rule 7011.0730 and a process weight rate of 137.3 tons per hour.

The scrubber emissions, as tested, were in compliance with this particulate emission standard.

The visible emission test was performed concurrent with the particulate test run #1. The maximum observed plume opacity was zero (0) percent; i.e. no visible emissions were observed during the test period. Minnesota Rule 7011.0905 states that the asphalt concrete plant shall not discharge into the atmosphere any gases which exhibit greater than 20 percent opacity, except that a maximum of 40 percent opacity shall be permissible for not more than four minutes within any 30-minute period and a maximum of 60 percent opacity shall be permissible for not more than four minutes in any 60-minute period. The scrubber visible emissions, as tested, were in compliance with this standard.

Problems with the sampling platform lift truck caused a forty minute delay during the port change of test run #1. A second delay during run #1 occurred when the silo filled due to a lack of available trucks. Neither delay should have had any significant impact on the test results.

No other problems were encountered during sample acquisition or analysis. Based on a review of the entire test proceedings, it is MMT's opinion that the results presented herein are accurate and can be used for compliance status determination.

Table 2.1
Particulate Emission Test Results
Mid-Minnesota Hot Mix, Inc., Annandale, Minnesota
Asphalt Plant Scrubber Exhaust, May 24, 1994

Parameter	Run #1	Run #2	Run #3	Average
Time of Test;				
Start Time, hr	1028	1315	1517	---
Finish Time, hr	1221	1426	1620	---
Effluent Temperature, °F	147	145	139	144
Effluent Moisture Content, % v/v	24.8	23.7	20.5	23.0
Effluent Composition Parameters;				
Carbon Dioxide, % v/v dry	4.9	5.8	5.8	5.5
Oxygen Content, % v/v dry	14.8	13.6	13.8	14.1
Effluent Volumetric Flow Rate;				
Actual Conditions, acfm	21,747	21,597	22,525	21,956
Standard Conditions, scfm	17,917	17,808	18,674	18,133
Dry Standard Conditions, dscfm	13,465	13,584	14,853	13,967
Effluent Particulate Concentration;				
Front Catch Only, gr/dscf	0.2438	0.1264	0.1696	0.1799
Back Catch Only, gr/dscf	0.0023	0.0016	0.0023	0.0021
Total Catch, gr/dscf	0.2461	0.1280	0.1719	**0.1820**
Source Particulate Emission Rate;				
Classical Method, lb/hr	28.43	14.92	21.90	21.75
Ratio of Areas Method, lb/hr	28.78	14.75	21.27	21.60
Average of Two Methods, lb/hr	28.61	14.84	21.59	**21.68**
Test Quality Control Parameters;				
Total Sampling Time, min.	60.0	60.0	60.0	60.0
Total Volume Sampled, dscf	42.747	42.114	45.236	43.366
Total Particulate Mass Collected, g	0.6823	0.3497	0.5043	0.5121
Average Isokinetic Variation, %	101.3	98.9	97.2	99.1

Standard Conditions: 68°F, 29.92 in. Hg

3 PROCESS DATA

Production data is presented in Appendix E and summarized in Table 3.1.

During the test period the burner on the plant's aggregate drum dryer was fired with used oil. The results of the fuel analysis (as received basis) are as follows:

Gross Heating value;
- BTU/lb.....18,996
- BTU/gallon.....139,887

Sulfur (S) content, % wt. 0.45
Ash content, % wt..... 0.73
Moisture content, % wt..... 1.33
Lead (Pb) content, µg/g 75
PCB content, µg/g .....<5
Total halogens, ppm..... 1122
pH 5.02

Table 3.1
Summary of Process Data
Mid-Minnesota Hot Mix, Inc., Annandale, Minnesota
Asphalt Plant Scrubber Exhaust, May 24, 1994

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1028	1315	1517	---
Finish	1221	1426	1620	---
Process Weight Rate;				
Aggregate Usage, ton/hr	131.22	117.28	140.34	129.61
Asphalt Usage, ton/hr	7.83	6.94	8.30	7.69
Total Process Weight Rate, ton/hr	139.06	124.23	148.63	137.31
Aggregate Moisture Content, %	4.1	3.2	3.2	3.5
Dryer Gas Temperature, °F	338	353	350	347
Scrubber Parameters;				
Pressure Drop, in WC	4.0	4.0	4.1	4.0
Water Flow, gpm	80	79	79	79
Water Pressure, psi	70	70	70	70

4 TEST PROCEDURES

In order to determine the pollutant emission rate from stationary sources, the Environmental Protection Agency (EPA) has established a series of reference methods which specify the manner in which tests must be performed. These reference methods are found in the Code of Federal Regulations (40 CFR 60) under Title 40 "Protection of the Environment"; Chapter 1 "Environmental Protection Agency"; Subchapter C "Air Programs"; Part 60 "Standards of Performance for New Stationary Sources"; Appendix A "Reference Methods". Unless otherwise noted, the tests presented in this report were performed according to the EPA Reference Methods as revised on July 1, 1993. A brief description of the test procedures used follows.

4.1 SAMPLING POINTS

The number of sampling points and their location with in the source stack/duct was determined per EPA Method 1 which is entitled "Sample and velocity traverses for stationary sources". In this method the number of sampling points is based on the length of straight, undisturbed flow both before and after the sampling port location. Site specific data is presented in Figure 4.1.

A test for cyclonic flow was performed using the S-tube null-reading technique of EPA Method 1, Section 2.4. The test yielded an average yaw angle of 8.8 degrees. This indicates that the sampling location was acceptable as the yaw angle criteria of less than 20 degrees was met.

4.2 EFFLUENT VOLUMETRIC FLOW RATE

The effluent volumetric flow rate was determined per EPA Method 2 which is entitled "Determination of stack gas velocity and volumetric flow rate (Type S pitot tube)". Gas velocity pressure (head) and temperature data were obtained during each EPA Method 5 particulate test run by traversing each of the sampling points defined by EPA Method 1. This data, along with gas density (EPA Method 3) and moisture content (EPA Method 4), was used to calculate the gas velocity at each sampling point. The source volumetric flow rate was calculated by multiplying the average gas velocity by the stack/duct cross-sectional area at the point of measurement.

4.3 EFFLUENT COMPOSITION AND MOLECULAR WEIGHT

The density of the effluent was determined per EPA Method 3 which is entitled "Gas analysis for the determination of dry molecular weight". One gas sample was collected during each EPA Method 5 particulate test run. The gas samples were analyzed for carbon dioxide and oxygen concentrations with a standard Orsat analyzer using commercially prepared solutions. For calculations of gas density the balance of the gas was assumed to be nitrogen and carbon monoxide.

4.4 EFFLUENT MOISTURE CONTENT

The effluent moisture content was determined per EPA Method 4 which is entitled "Determination of moisture content in stack gases". Data for making the gas moisture content determinations was collected simultaneously with each EPA Method 5 particulate test run. The gas moisture content was calculated from the mass and/or volume of liquid collected in the Method 5 sampling train cold box impingers and the volume of gas sampled.

Figure 4.1 Site Description Form
Mid-Minnesota Hot Mix, Inc., Annandale, Minnesota
Asphalt Plant Scrubber Exhaust Test
May 24, 1994

SAMPLING LOCATION DATA

Duct Cross-Sectional Dimension;
- Traverse Diameter, inch 41.5

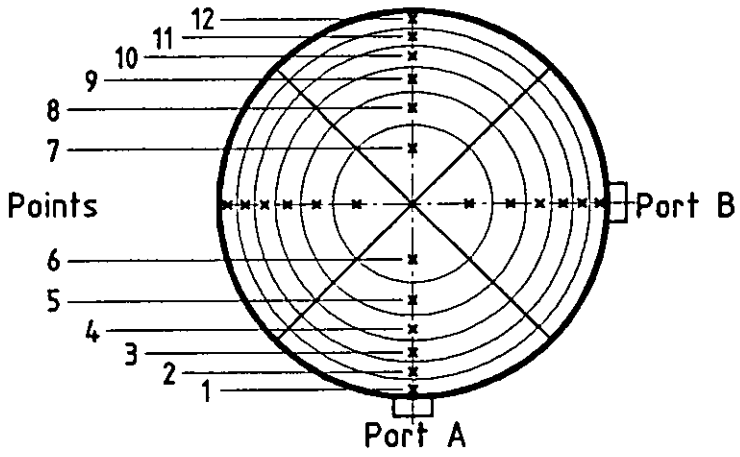
Length of straight, undisturbed flow;
- Before ports, inch 170.5
- After ports, inch 78.5
- Before ports, stack diameters 4.1
- After ports, stack diameters 1.9

Number of sampling points;
- Required by EPA Method 1 24
- Actually used 24
  - Number of ports 2
  - Number of points per port 12

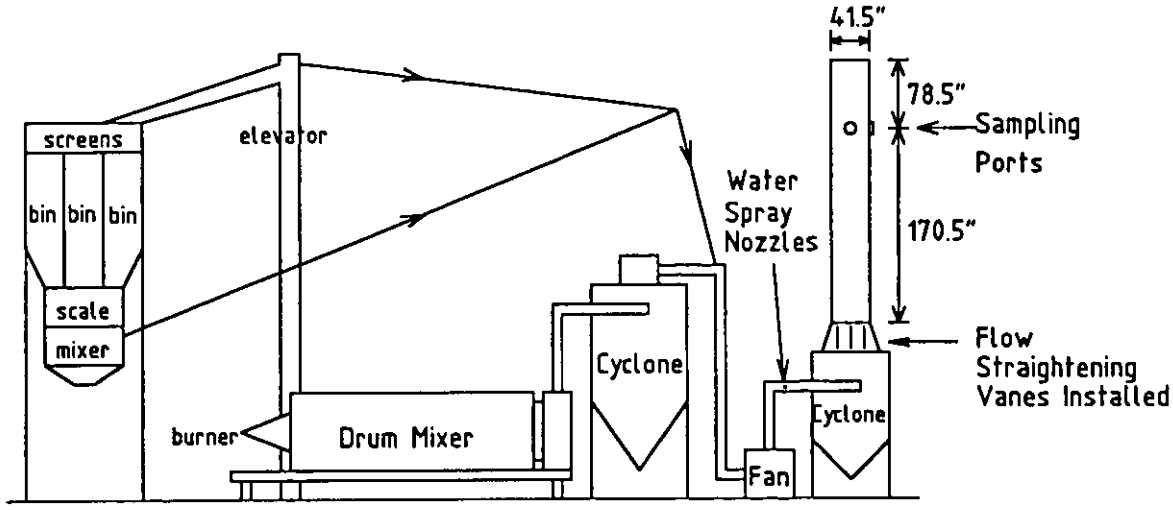
Particulate test sampling time;
- Minutes per point 2.5
- Minutes per test run 60.0

SAMPLING POINT LOCATION WITHIN DUCT CROSS-SECTION

Point Number	Percent of Traverse	Inches from Inside Wall
1	2.1	1.0
2	6.7	2.8
3	11.8	4.9
4	17.7	7.3
5	25.0	10.4
6	35.6	14.7
7	64.4	26.8
8	75.0	31.1
9	82.3	34.2
10	88.2	36.6
11	93.3	38.7
12	97.9	40.5



SAMPLING SITE SCHEMATIC



4.5 EFFLUENT PARTICULATE CONCENTRATION

The effluent particulate concentration was determined per EPA Method 5 which is entitled "Determination of particulate emissions from stationary sources". For each test run, particulate matter was isokinetically withdrawn from the gas stream at each of the EPA Method 1 defined sampling points and collected on a glass fiber filter which was maintained at constant temperature (248±25°F). Water vapor, organic vapors and inorganic vapors which passed through the filter were collected in an impinger trap which was ice-cooled to maintain an exit temperature of not more than 68°F.

The EPA Method 5 sampling train (Figure 4.2) includes a heated sampling probe with attached nozzle, thermocouple and S-type pitot tube. The probe attaches to the front sample case (hot box) which houses a glass cyclone (optional) and an all-glass in-line filter holder in a temperature controlled environment. The front sample case is connected to the back sample case (cold box) which houses a series of glass impingers and a desiccant column in an ice bath. The back sample case is connected to the control unit which contains the sample vacuum pump, gas meter, pressure and temperature indicators and all operating controls.

A representative particulate sample was acquired by sampling for equal periods of time at the center of a number of equal area regions within the stack/duct. At each sampling point the gas velocity head and temperature were measured and the sampling rate rapidly adjusted to isokinetic conditions with the aid of a nomograph or programmable computing device. Sample gas drawn into the nozzle flowed through the probe to the glass fiber filter where the solid particulate matter was collected. The gases then passed through the ice-cooled condenser (impingers and desiccant column) which quantitatively removed all moisture and condensable particulate matter from the gas stream. The gas then passed through the vacuum pump, the dry test gas meter and the calibrated orifice.

Leak checks to detect any dilution air being pulled into the sampling line were performed at the beginning and end of each test run and also when and if any sample line connections were broken.

After completion of each test run, the sampling train was removed to the clean-up area for sample recovery. The filter was removed from the filter holder and placed in Container #1. Particulate matter collected in the nozzle, probe and all connecting glassware in front of the filter was quantitatively transferred to Container #2 by means of a distilled water wash followed by an acetone wash. A stiff brush was used in the probe cleaning step to help dislodge deposits.

The liquid collected in impingers #1, #2 and #3 was measured and transferred to Container #3. These impingers and all connecting pieces between the filter paper and the desiccant column were then rinsed with distilled water and these rinsings were added to Container #3. These same pieces were then rinsed with acetone and these rinsings were placed in Container #4.

The desiccant column was then weighed and its contents transferred to a waste desiccant container. Samples of the rinse solutions (water and acetone) were retained as analytical blanks.

Sample particulate analysis was performed at MMT's laboratory. The filter was dried in a 105°C oven for three hours and then desiccated to a constant weight. The contents of Container #2 were quantitatively transferred to a tared beaker, evaporated at ambient temperature and pressure to near dryness and then desiccated to a constant weight.

Figure 4.2 Particulate Sampling Train Description
Mid-Minnesota Hot Mix, Inc., Annandale, Minnesota
Asphalt Plant Scrubber Exhaust Test
May 24, 1994

PARTICULATE SAMPLING TRAIN IDENTIFICATION

Sampling Train Manufacturer: ..... MMT Environmental Services, Inc.
Sampling Train Model: ..... Universal Stack Sampler, unit #4

Hot Box Set-up and Operating Temperature;
- Cyclone used: ..... No
- Filter Media: ..... Glass Fiber Filter, Whatman GF/C, 11.0 cm diameter
- Filtration Temperature: ..... 248 ± 25 degrees Fahrenheit

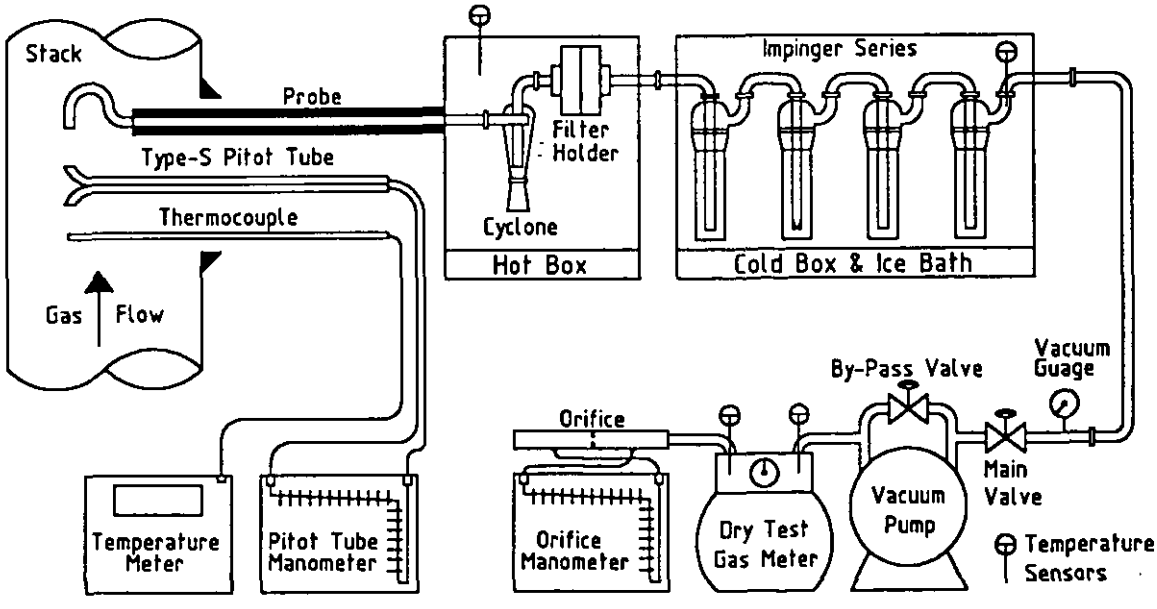
Cold Box Set-up; Impinger Type and Initial Contents
- Impinger #1: ..... Modified Greenburg-Smith design, 100 ml deionized, distilled water
- Impinger #2: ..... Standard Greenburg-Smith design, 100 ml deionized, distilled water
- Impinger #3: ..... Modified Greenburg-Smith design, empty
- Impinger #4: ..... Modified Greenburg-Smith design, ≈ 250 grams silica gel, indicating type

Nozzles Used: ..... MMT #L6, 0.300" diameter, stainless steel

Sampling Probe Used: .... MMT #75, stainless steel liner

Pitot Tube Used: ..... MMT #67, S-type

PARTICULATE SAMPLING TRAIN SCHEMATIC



The contents of Container #3 were analyzed for condensable organic compounds using the chloroform/ethyl ether extraction procedure described in Minnesota Rule 7011.0725. The collected extract was transferred to a tared beaker, evaporated at ambient temperature and pressure to near dryness and then desiccated to a constant weight. The contents of Container #4 were quantitatively transferred to a tared beaker, evaporated at ambient temperature and pressure to near dryness and then desiccated to a constant weight.

The mass of particulate matter collected and the volume of gas sampled were used to calculate the effluent particulate concentration. The source particulate mass emission rate was calculated by multiplying the effluent particulate concentration by the source volumetric flow rate. Separate calculations were performed for total catch, front catch only (Containers 1 & 2) and back catch only (Containers 3 & 4).

4.6 SOURCE PLUME OPACITY

The source visible emissions were determined by the visual observations of a certified visible emissions evaluator per EPA Method 9 which is entitled "Visual determination of the opacity of emissions from stationary sources".

In this procedure, the observer positions himself at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140 degree sector to his back. Consistent with this requirement, the observer's line of site was, as much as possible, perpendicular to the plume's direction.

Opacity observations were made at the point of greatest opacity in that portion of the plume where condensed water vapor was not present. Observations were made at 15-second intervals and recorded to the nearest 5 percent opacity.

5 QUALITY ASSURANCE

The project manager is responsible for implementation of the quality assurance program as applied to any specific project.

5.1 SAMPLING QUALITY ASSURANCE

Source sampling quality assurance procedures are implemented to ensure work is performed:

- by competent, trained individuals experienced on the specific methodologies being used
- using properly calibrated equipment
- using approved procedures for sample handling and documentation

All measuring devices (pitot tubes, dry gas meters, thermocouples, portable gas analyzers, etc.) are uniquely identified and calibrated with documented procedures and acceptance criteria before and after each field effort. Records of all calibration data are maintained in the files. Prior to the test program, MMT provides the following:

- filter numbers and tare weights of all filters available for the test
- results of an acetone residue analysis on the acetone to be used during the test
- calibrations of all pitot tubes, dry gas meters, orifice meters, thermocouples and probes

Specific details of MMT's QA program for stationary air pollution sources may be found in "Quality Assurance Handbook for Air Pollution Measurement Systems", Volume III (EPA-600/4-7-027b).

5.2 ANALYTICAL QUALITY CONTROL

MMT maintains a vigorous quality control program for all sample analyses. This program is based on the general guidelines given in "Handbook for Analytical Quality Control in Water and Waste water Laboratories" (EPA-600/4-79-019); March 1979 . This program suggests guidelines in the areas of:

- Laboratory services
- Glassware
- Solvents
- Analytical performance
- Instrument selection
- Reagents
- Gases
- Laboratory safety

Standards and curves are determined for each analysis using the appropriate standard. Least square linear regression calculations are used in determining "best fit" to the data. Correlation coefficients are also calculated.

5.3 CALIBRATION GASES

MMT uses either EPA Protocol 1 or Acublend Certified Master gases (Scott Specialty Gases) when performing all calibrations in order to ensure tolerances on gas concentrations have been verified and are negligible. Certifications of all calibration gas bottles used during testing are presented in each report.

APPENDIX A: CALCULATIONS

DEFINITION OF UNIT ABBREVIATIONS

ACFM ..... ACTUAL CUBIC FEET PER MINUTE

DEG F ..... DEGREES FAHRENHEIT

DCF ..... DRY CUBIC FEET

DSCF ..... DRY STANDARD CUBIC FEET

DSCFM ..... DRY STANDARD CUBIC FEET PER MINUTE

FPS ..... FEET PER SECOND

G ..... GRAMS

GR/ACF ..... GRAINS PER ACTUAL CUBIC FOOT

GR/DSCF ..... GRAINS PER DRY STANDARD CUBIC FOOT

GR/SCF ..... GRAINS PER STANDARD CUBIC-FOOT

IN ..... INCHES

IN HG ..... INCHES OF MERCURY

IN WC ..... INCHES OF WATER

LB/HR ..... POUNDS PER HOUR

LB/LB-MOLE .. POUND PER POUND-MOLE

MIN ..... MINUTES

ML ..... MILLILITERS

SCF ..... STANDARD CUBIC FEET

SCFM ..... STANDARD CUBIC FEET PER MINUTE

SF ..... SQUARE FEET

% V/V DRY ... PERCENT BY VOLUME, DRY BASIS

DEFINITION OF STANDARD CONDITIONS

STANDARD TEMPERATURE ..... 68 DEGREES FAHRENHEIT

STANDARD PRESSURE ..... 29.92 INCHES OF MERCURY

DEFINITION OF VARIABLES

An .... CROSS-SECTIONAL AREA OF NOZZLE, SF
As .... CROSS-SECTIONAL AREA OF STACK, SF
Bwp ... EFFLUENT MOISTURE CONTENT, PERCENT BY VOLUME
Bws ... EFFLUENT MOISTURE CONTENT, PROPORTION BY VOLUME
Ca* ... EFFLUENT PARTICULATE CONCENTRATION AT ACTUAL CONDITIONS, GR/ACF; *=f,b,t; Caf: FRONT CATCH ONLY; Cab: BACK CATCH ONLY; Cat: TOTAL CATCH
CD .... EFFLUENT CARBON DIOXIDE CONCENTRATION, % V/V DRY
CM .... EFFLUENT CARBON MONOXIDE CONCENTRATION, % V/V DRY
Cp .... PITOT TUBE COEFFICIENT, DIMENSIONLESS
Cs* ... EFFLUENT PARTICULATE CONCENTRATION AT DRY STANDARD CONDITIONS, GR/DSCF; *=f,b,t; Csf: FRONT CATCH ONLY; Csb: BACK CATCH ONLY; Cst: TOTAL CATCH
Cw* ... EFFLUENT PARTICULATE CONCENTRATION AT STANDARD CONDITIONS, GR/SCF; *=f,b,t; Cwf: FRONT CATCH ONLY; Cwb: BACK CATCH ONLY; Cwt: TOTAL CATCH
Dn .... NOZZLE DIAMETER, IN
I ..... ISOKINETIC VARIATION, %
Md .... EFFLUENT MOLECULAR WEIGHT, LB/LB-MOLE, DRY BASIS
Ms .... EFFLUENT MOLECULAR WEIGHT, LB/LB-MOLE, WET BASIS
NI .... EFFLUENT NITROGEN CONCENTRATION, % V/V DRY
OX .... EFFLUENT OXYGEN CONCENTRATION, % V/V DRY
Pb .... BAROMETRIC PRESSURE, IN HG
Pg .... STACK STATIC PRESSURE, IN WC
Po .... AVERAGE PRESSURE DROP ACROSS THE METERING ORIFICE, IN WC
Ps .... STACK ABSOLUTE PRESSURE, IN HG
Pv .... AVERAGE SQUARE-ROOT VELOCITY PRESSURE, IN WC
Qa .... EFFLUENT FLOW RATE AT ACTUAL CONDITIONS, ACFM
Qs .... EFFLUENT FLOW RATE AT STANDARD CONDITIONS, SCFM
Qsd ... EFFLUENT FLOW RATE AT STANDARD CONDITIONS, DRY BASIS, DSCFM
Rc* ... SOURCE PARTICULATE EMISSION RATE, CLASSICAL METHOD, LB/HR; *=f,b,t; Rcf: FRONT CATCH ONLY; Rcb: BACK CATCH ONLY; Rct: TOTAL CATCH
Rr* ... SOURCE PARTICULATE EMISSION RATE, RATIO OF AREAS METHOD, LB/HR; *=f,b,t; Rrf: FRONT CATCH ONLY; Rrb: BACK CATCH ONLY; Rrt: TOTAL CATCH
Sl .... STACK DIAMETER OR LENGTH, IN
Sw .... STACK WIDTH, IN
Ti .... TOTAL SAMPLING TIME, MIN
Tm .... AVERAGE DRY GAS METER TEMPERATURE, DEG F
Ts .... AVERAGE EFFLUENT TEMPERATURE, DEG F
Vl .... VOLUME OF LIQUID COLLECTED, ML
Vm .... VOLUME OF GAS SAMPLED AT METER CONDITIONS, DCF
Vms ... VOLUME OF GAS SAMPLED AT STANDARD CONDITIONS, DSCF
Vs .... AVERAGE EFFLUENT VELOCITY, FPS
Vw .... VOLUME OF WATER VAPOR COLLECTED AT STANDARD CONDITIONS, SCF
Wb .... MASS OF PARTICULATE MATTER COLLECTED IN THE BACK (WET) CATCH, G
Wf .... MASS OF PARTICULATE MATTER COLLECTED IN THE FRONT (DRY) CATCH, G
Wt .... TOTAL MASS OF PARTICULATE MATTER COLLECTED, G
Y ..... DRY GAS METER COEFFICIENT, DIMENSIONLESS

EQUATIONS USED TO CALCULATE PARTICULATE EMISSIONS

```
An = 0.005454154 * Dn * Dn

As = 0.005454154 * Sl * Sl      (FOR ROUND STACKS)

As = Sl * Sw / 144.0      (FOR RECTANGULAR STACKS)

Ps = Pb + Pg/13.6

NI = 100.0 - CD - OX - CM

Wt = Wf + Wb

Vms = (528/29.92) * Vm * Y * (Pb + Po/13.6) / (Tm + 460.0)

Vw = 0.04707 * Vl

Bws = Vw / (Vw + Vms)

Bwp = 100.0 * Bws

Md = 0.440 * CD  +  0.320 * OX  + 0.280 * (NI + CM)

Ms = Md * (1.0 - Bws)  +  18.0 * Bws

Vs = 85.49 * Cp * Pv * SQRT( (Ts+460.0)/(Ms*Ps) )

Qa = 60.0 * Vs * As

Qs = Qa * (528/29.92) * Ps / (Ts + 460.0)

Qsd = Qs * (1.0 - Bws)

I = 0.09450 * (Ts+460.0) * Vms / (Ps * Vs * An * Ti * (1.0-Bws) )

Csf = 15.42 * Wf / Vws
Csb = 15.42 * Wb / Vws
Cst = 15.42 * Wt / Vws

Cwf = Csf / (1.0 - Bws)
Cwb = Csb / (1.0 - Bws)
Cwt = Cst / (1.0 - Bws)

Caf = Cwf * (29.92/528.0) * (Ts+460.0) / Ps
Cab = Cwb * (29.92/528.0) * (Ts+460.0) / Ps
Cat = Cwt * (29.92/528.0) * (Ts+460.0) / Ps

Rcf = 0.008578 * Csf * Qsd
Rcb = 0.008578 * Csb * Qsd
Rct = 0.008578 * Cst * Qsd

Rrf = 0.008578 * Csf * (Vms/Ti) * (As/An)
Rrb = 0.008578 * Csb * (Vms/Ti) * (As/An)
Rrt = 0.008578 * Cst * (Vms/Ti) * (As/An)
```

TABLE SUMMARY OF PARTICULATE EMISSION TEST RESULTS

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET

TEST PARAMETER	RUN 1	RUN 2	RUN 3
TEST DATE	5/24/94	5/24/94	5/24/94
TIME OF TEST, HR;			
START	1028	1315	1517
FINISH	1221	1426	1620
EFFLUENT TEMPERATURE, DEGREES F	147	145	139
BAROMETRIC PRESSURE, IN HG	28.36	28.26	28.13
EFFLUENT MOISTURE CONTENT, % V/V	24.8	23.7	20.5
EFFLUENT COMPOSITION, % V/V DRY;			
CARBON DIOXIDE	4.9	5.8	5.8
OXYGEN	14.8	13.6	13.8
CARBON MONOXIDE	0.0	0.0	0.0
EFFLUENT VOLUMETRIC FLOW RATE;			
ACTUAL CONDITIONS, ACFM	21747	21597	22525
STANDARD CONDITIONS, SCFM	17917	17888	18674
DRY STANDARD CONDITIONS, DSCFM	13465	13584	14853
ISOKINETIC VARIATION, %	101.3	98.9	97.2
EFFLUENT PARTICULATE CONCENTRATION;			
EFFLUENT FRONT HALF PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.1510	0.0795	0.1118
STANDARD CONDITIONS, GR/SCF	0.1832	0.0964	0.1349
DRY STANDARD CONDITIONS, GR/DSCF	0.2438	0.1264	0.1696
EFFLUENT BACK HALF PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.0014	0.0010	0.0015
STANDARD CONDITIONS, GR/SCF	0.0017	0.0012	0.0018
DRY STANDARD CONDITIONS, GR/DSCF	0.0023	0.0016	0.0023
EFFLUENT TOTAL PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.1524	0.0805	0.1134
STANDARD CONDITIONS, GR/SCF	0.1850	0.0977	0.1367
DRY STANDARD CONDITIONS, GR/DSCF	0.2461	0.1280	0.1719
SOURCE PARTICULATE EMISSION RATE;			
CLASSICAL METHOD, LB/HR	28.43	14.92	21.90
RATIO OF AREAS METHOD, LB/HR	28.78	14.75	21.27

PARTICULATE CONCENTRATION AND EMISSION RATES BASED ON ANALYSIS OF THE SAMPLING TRAIN FRONT AND BACK CATCHES.

STANDARD CONDITIONS: 68 DEGREES FAHRENHEIT, 29.92 INCHES OF MERCURY.

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 1 TIME: 5/24/94 1028-1221

SAMPLING LOCATION PORT	POINT	TRAVERSE POINT DATA: VELOCITY PRESSURE IN WC	ORIFICE PRESSURE IN WC	TEMPERATURE, DEG.F: STACK GAS	METER INLET	METER OUTLET	VELOCITY PROFILE: SQRT VELOCITY PRESSURE	GAS VELOCITY FT/SEC
A	1	0.3500	1.740	146	64	64	0.592	38.48
A	2	0.3800	1.900	148	66	64	0.616	40.17
A	3	0.4100	2.000	151	67	64	0.640	41.82
A	4	0.4200	2.100	149	69	64	0.648	42.26
A	5	0.4300	2.100	149	70	64	0.656	42.76
A	6	0.4200	2.100	148	71	64	0.648	42.23
A	7	0.3800	1.900	151	71	65	0.616	40.27
A	8	0.3700	1.850	151	72	65	0.608	39.73
A	9	0.3800	1.900	152	73	65	0.616	40.30
A	10	0.3500	1.700	150	73	66	0.592	38.61
A	11	0.3700	1.800	150	73	66	0.608	39.70
A	12	0.3800	1.900	151	73	66	0.616	40.27
B	1	0.1600	0.800	146	67	67	0.400	26.02
B	2	0.2400	1.200	148	69	67	0.490	31.92
B	3	0.2600	1.300	147	70	67	0.510	33.20
B	4	0.2700	1.300	143	72	67	0.520	33.72
B	5	0.2800	1.400	147	73	67	0.529	34.45
B	6	0.2800	1.400	144	74	68	0.529	34.36
B	7	0.3900	1.900	145	75	68	0.624	40.59
B	8	0.4000	2.000	145	75	68	0.632	41.11
B	9	0.4200	2.100	139	70	67	0.648	41.91
B	10	0.4100	2.000	143	71	68	0.640	41.55
B	11	0.4000	2.000	144	72	68	0.632	41.07
B	12	0.3700	1.800	146	73	68	0.608	39.57
AVERAGE		0.3550	1.758	147	71	66	0.593	38.59

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 1 TIME: 5/24/94 1028-1221

Excess Moisture Collected, Reduced from 353.9 to 300.3 for maximum theoretical Moisture

TEST DATA

GAS METER COEFFICIENT	1.0018 Y	VOLUME OF LIQUID COLLECTED, ML	300.3 Vl
PITOT TUBE COEFFICIENT	0.848 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.300 Dn	CARBON DIOXIDE	4.90 CD
AREA, SF	0.000491 An	OXYGEN	14.80 OX
		CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	80.30 NI
STACK DIMENSIONS;			
DIAMETER/LENGTH, IN	41.50 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	0.00 Sw	STACK TEMP., DEG F	147 Ts
AREA, SF	9.393 As	METER TEMP., DEG F	69 Tm
		ORIFICE PRESSURE, IN WC	1.758 Po
BAROMETRIC PRESSURE, IN HG	28.36 Pb	SQRT VELOCITY P., IN WC	0.593 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	-0.15 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.35 Ps	FRONT CATCH (99.1%)	0.6759 Wf
		BACK CATCH (0.9%)	0.0064 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.6823 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	44.859 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	42.747 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.38 Md
		WET BASIS, LB/LB-MOLE	26.55 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	14.135 Vw	AVERAGE GAS VELOCITY, FPS	38.59 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.2485 Bws	ACTUAL, ACFM	21747 Qa
PERCENT BY VOLUME	24.85 Bwp	STANDARD, SCFM	17917 Qs
		DRY STANDARD, DSCFM	13465 Qsd
		ISOKINETIC VARIATION, %	101.31 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.1510 Caf	0.0014 Cab	0.1524 Cat
STANDARD, GR/SCF	0.1832 Csf	0.0017 Csb	0.1850 Cst
DRY STANDARD, GR/DSCF	0.2438 Csf	0.0023 Csb	0.2461 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	28.16 Rcf	0.27 Rcb	28.43 Rct
RATIO OF AREAS METHOD	28.51 Rrf	0.27 Rrb	28.78 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 2 TIME: 5/24/94 1315-1426

SAMPLING LOCATION PORT	POINT	TRAVERSE POINT DATA: VELOCITY PRESSURE IN WC	ORIFICE PRESSURE IN WC	TEMPERATURE, DEG.F STACK GAS	METER INLET	METER OUTLET	VELOCITY PROFILE: SQRT VELOCITY PRESSURE	GAS VELOCITY FT/SEC
A	1	0.2000	1.000	142	69	69	0.447	28.93
A	2	0.2300	1.100	144	72	69	0.480	31.08
A	3	0.2600	1.300	142	74	69	0.510	32.99
A	4	0.2900	1.400	142	76	70	0.539	34.84
A	5	0.3200	1.600	141	77	70	0.566	36.57
A	6	0.3400	1.700	142	78	70	0.583	37.73
A	7	0.4100	2.000	141	79	70	0.640	41.39
A	8	0.4200	2.100	146	79	70	0.648	42.07
A	9	0.4000	2.000	146	79	70	0.632	41.05
A	10	0.3800	1.900	145	78	70	0.616	39.98
A	11	0.3700	1.800	144	79	71	0.608	39.42
A	12	0.3500	1.700	145	80	72	0.592	38.37
B	1	0.2900	1.500	145	77	72	0.539	34.93
B	2	0.3500	1.800	145	74	73	0.592	38.37
B	3	0.4100	2.100	146	75	73	0.640	41.56
B	4	0.4000	2.100	147	75	72	0.632	41.09
B	5	0.4200	2.200	147	76	73	0.648	42.10
B	6	0.4000	2.100	146	76	73	0.632	41.05
B	7	0.3500	1.800	143	76	72	0.592	38.31
B	8	0.3300	1.700	144	77	72	0.574	37.23
B	9	0.3600	1.900	146	77	73	0.600	38.95
B	10	0.3800	2.000	147	77	73	0.616	40.05
B	11	0.3900	2.000	147	76	73	0.624	40.57
B	12	0.4000	2.100	147	76	73	0.632	41.09
AVERAGE		0.3521	1.788	145	76	71	0.591	38.32

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 2 TIME: 5/24/94 1315-1426

TEST DATA

GAS METER COEFFICIENT	1.0018 Y	VOLUME OF LIQUID COLLECTED, ML	278.2 Vl
PITOT TUBE COEFFICIENT	0.848 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.300 Dn	CARBON DIOXIDE	5.83 CD
AREA, SF	0.000491 An	OXYGEN	13.63 OX
		CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	80.54 NI
STACK DIMENSIONS;			
DIAMETER/LENGTH, IN	41.50 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	0.00 Sw	STACK TEMP., DEG F	145 Ts
AREA, SF	9.393 As	METER TEMP., DEG F	74 Tm
		ORIFICE PRESSURE, IN WC	1.788 Po
BAROMETRIC PRESSURE, IN HG	28.26 Pb	SQRT VELOCITY P., IN WC	0.591 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	-0.14 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.25 Ps	FRONT CATCH (98.7%)	0.3453 Wf
		BACK CATCH (1.3%)	0.0044 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.3497 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	44.791 Vm		

Excess Moisture Collected, Reduced from 295.2 to 278.2 for maximum theoretical moisture

CALCULATED RESULTS.

VOLUME OF GAS SAMPLED AT METER, DSCF	42.114 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.48 Md
		WET BASIS, LB/LB-MOLE	26.76 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	13.095 Vw	AVERAGE GAS VELOCITY, FPS	38.32 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.2372 Bws	ACTUAL, ACFM	21597 Qa
PERCENT BY VOLUME	23.72 Bwp	STANDARD, SCFM	17808 Qs
		DRY STANDARD, DSCFM	13584 Qsd
		ISOKINETIC VARIATION, %	98.93 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0795 Caf	0.0010 Cab	0.0805 Cat
STANDARD, GR/SCF	0.0964 Csf	0.0012 Csb	0.0977 Cst
DRY STANDARD, GR/DSCF	0.1264 Csf	0.0016 Csb	0.1280 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	14.73 Rcf	0.19 Rcb	14.92 Rct
RATIO OF AREAS METHOD	14.57 Rrf	0.19 Rrb	14.75 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 3 TIME: 5/24/94 1517-1620

SAMPLING LOCATION PORT	POINT	TRAVERSE POINT DATA: VELOCITY PRESSURE IN WC	ORIFICE PRESSURE IN WC	TEMPERATURE, DEG.F STACK GAS	METER INLET	METER OUTLET	VELOCITY PROFILE: SQRT VELOCITY PRESSURE	GAS VELOCITY FT/SEC
A	1	0.3600	1.900	137	72	71	0.600	38.48
A	2	0.4500	2.300	133	74	71	0.671	42.88
A	3	0.4600	2.400	135	74	71	0.678	43.43
A	4	0.4400	2.300	137	76	71	0.663	42.54
A	5	0.4500	2.300	132	77	71	0.671	42.84
A	6	0.4600	2.400	138	78	72	0.678	43.54
A	7	0.4100	2.100	143	78	72	0.640	41.27
A	8	0.4400	2.300	136	79	73	0.663	42.51
A	9	0.4200	2.200	135	78	73	0.648	41.49
A	10	0.4400	2.300	139	79	73	0.663	42.61
A	11	0.4300	2.200	142	79	73	0.656	42.23
A	12	0.4200	2.200	142	78	73	0.648	41.74
B	1	0.2200	1.100	138	76	73	0.469	38.11
B	2	0.2800	1.500	138	79	73	0.529	33.97
B	3	0.2900	1.500	139	79	73	0.539	34.60
B	4	0.3300	1.700	139	81	73	0.574	36.90
B	5	0.3400	1.800	139	82	73	0.583	37.46
B	6	0.3700	1.900	139	83	74	0.608	39.08
B	7	0.3600	2.000	139	84	74	0.600	38.55
B	8	0.4100	2.300	139	82	74	0.640	41.14
B	9	0.4200	2.300	139	81	74	0.648	41.63
B	10	0.4000	2.200	142	81	74	0.632	40.73
B	11	0.3800	2.100	142	79	74	0.616	39.70
B	12	0.3800	2.100	143	79	74	0.616	39.73
AVERAGE		0.3900	2.058	139	79	73	0.622	39.97

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 3 TIME: 5/24/94 1517-1620

Excess Moisture Collected, Reduced from 285.0 to 247.2 for maximum theoretical Moisture

TEST DATA

GAS METER COEFFICIENT	1.0018 Y	VOLUME OF LIQUID COLLECTED, ML	247.2 Vl
PITOT TUBE COEFFICIENT	0.848 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.300 Dn	CARBON DIOXIDE	5.77 CD
AREA, SF	0.000491 An	OXYGEN	13.83 OX
		CARBON MONOXIDE	0.00 CM
STACK DIMENSIONS;		NITROGEN (BY DIFFERENCE)	80.40 NI
DIAMETER/LENGTH, IN	41.50 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	0.00 Sw	STACK TEMP., DEG F	139 Ts
AREA, SF	9.393 As	METER TEMP., DEG F	76 Tm
		ORIFICE PRESSURE, IN WC	2.058 Po
BAROMETRIC PRESSURE, IN HG	28.13 Pb	SQRT VELOCITY P., IN WC	0.622 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	-0.17 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.12 Ps	FRONT CATCH (98.7%)	0.4976 Wf
		BACK CATCH (1.3%)	0.0067 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.5043 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	48.470 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	45.236 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.48 Md
		WET BASIS, LB/LB-MOLE	27.13 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	11.636 Vw	AVERAGE GAS VELOCITY, FPS	39.97 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.2046 Bws	ACTUAL, ACFM	22525 Qa
PERCENT BY VOLUME	20.46 Bwp	STANDARD, SCFM	18674 Qs
		DRY STANDARD, DSCFM	14853 Qsd
		ISOKINETIC VARIATION, %	97.19 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.1118 Caf	0.0015 Cab	0.1134 Cat
STANDARD, GR/SCF	0.1349 Cwf	0.0018 Cwb	0.1367 Cwt
DRY STANDARD, GR/DSCF	0.1696 Csf	0.0023 Csb	0.1719 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	21.61 Rcf	0.29 Rcb	21.90 Rct
RATIO OF AREAS METHOD	20.99 Rrf	0.28 Rrb	21.27 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

VOLUMETRIC FLOW RATE CALCULATION

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST DATE: 5-24-94 SOURCE: SCRUBBER OUTLET

Preliminary flowrate Determination

DUCT DIMENSIONS:		
DIAMETER, INCHES	41.50	DM
CROSS-SECTIONAL AREA, SQ FT	9.393	AR
EFFLUENT TEMPERATURE, DEG F	150	TS
MOISTURE CONTENT DETERMINATION:		
EFFLUENT WET BULB TEMPERATURE, DEG F	145	TW
EFFLUENT DEW POINT TEMPERATURE, DEG F	145	TD
EFFLUENT RELATIVE HUMIDITY, %	88.3	RH
EFFLUENT MOISTURE CONTENT, % V/V	23.4	MC
DUCT PRESSURES;		
BAROMETRIC PRESSURE, IN HG	28.40	PB
STATIC PRESSURE, IN WC	-0.21	PS
ABSOLUTE PRESSURE, IN WC	28.38	PA
EFFLUENT COMPOSITION;		
CARBON DIOXIDE CONTENT, % V/V DRY	5.0	CD
OXYGEN CONTENT, % V/V DRY	15.0	OX
EFFLUENT MOLECULAR WEIGHT;		
DRY BASIS, LB/LB-MOLE	29.40	MD
WET BASIS, LB/LB-MOLE	26.74	MS
PITOT TUBE COEFFICIENT	0.840	CP

EFFLUENT VELOCITY PRESSURES, IN WC;

POINT	PORT A	PORT B
1	0.370	0.260
2	0.440	0.270
3	0.430	0.270
4	0.410	0.290
5	0.350	0.300
6	0.310	0.310
7	0.290	0.340
8	0.330	0.340
9	0.350	0.350
10	0.370	0.380
11	0.380	0.380
12	0.380	0.370

AVE. SQUARE-ROOT VELOCITY PRESSURE, IN WC ..	0.59	PV
EFFLUENT AVERAGE VELOCITY, FT/SEC	37.693	VS
EFFLUENT VOLUMETRIC FLOW RATE;		
ACTUAL, ACFM	21243	FA
STANDARD, SCFM	17447	FW
DRY STANDARD, DSCFM	13373	FD

EQUATIONS USED TO CALCULATE THE VOLUMETRIC FLOW RATE

AR = 0.004545 * DM • DM

PA = PB + PS/13.6

MD = 0.44*CD + 0.32*OX + 0.28*(100-CD-OX)

MS = MD*(1-MC/100) + 0.18*MC

VS = 85.48 • CP • PV * SQRT((460+TS)/(MS*PA))

FA = 60 • VS * AR

FW = 17.65 • FA * PA / (TS+460)

FD = FW * (1-MC/100)

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG

TABLE ANALYSIS OF VISIBLE EMISSION TEST DATA

PROJECT NUMBER: 9587
DATE TESTED: 5-24-94
TIME OF TEST: 1030

COMPANY: MID MN HOT MIX
SOURCE: SCRUBBER OUTLET
OBSERVER: MR. ALAN L. TROWBRIDGE
RE-CERTIFICATION DATE: 10-6-94

Concurrent with Test-Run # 1-1

PLUME OPACITY OBSERVATIONS

MIN-UTE	** 00	SECONDS 15	30	** 45	MIN-UTE	** 00	SECONDS 15	30	** 45	MIN-UTE	** 00	SECONDS 15	30	** 45
0	0	0	0	0	20	0	0	0	0	40	0	0	0	0
1	0	0	0	0	21	0	0	0	0	41	0	0	0	0
2	0	0	0	0	22	0	0	0	0	42	0	0	0	0
3	0	0	0	0	23	0	0	0	0	43	0	0	0	0
4	0	0	0	0	24	0	0	0	0	44	0	0	0	0
5	0	0	0	0	25	0	0	0	0	45	0	0	0	0
6	0	0	0	0	26	0	0	0	0	46	0	0	0	0
7	0	0	0	0	27	0	0	0	0	47	0	0	0	0
8	0	0	0	0	28	0	0	0	0	48	0	0	0	0
9	0	0	0	0	29	0	0	0	0	49	0	0	0	0
10	0	0	0	0	30	0	0	0	0	50	0	0	0	0
11	0	0	0	0	31	0	0	0	0	51	0	0	0	0
12	0	0	0	0	32	0	0	0	0	52	0	0	0	0
13	0	0	0	0	33	0	0	0	0	53	0	0	0	0
14	0	0	0	0	34	0	0	0	0	54	0	0	0	0
15	0	0	0	0	35	0	0	0	0	55	0	0	0	0
16	0	0	0	0	36	0	0	0	0	56	0	0	0	0
17	0	0	0	0	37	0	0	0	0	57	0	0	0	0
18	0	0	0	0	38	0	0	0	0	58	0	0	0	0
19	0	0	0	0	39	0	0	0	0	59	0	0	0	0

SUMMARY OF TEST DATA

PLUME OPACITY %	PERCENT OF TIME AT OPACITY	PERCENT OF TIME OPACITY EXCEEDED
0	100.00	0.00
5	0.00	0.00
10	0.00	0.00
15	0.00	0.00
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
40	0.00	0.00
45	0.00	0.00
50	0.00	0.00
55	0.00	0.00
60	0.00	0.00
65	0.00	0.00
70	0.00	0.00
75	0.00	0.00
80	0.00	0.00
85	0.00	0.00
90	0.00	0.00
95	0.00	0.00
100	0.00	0.00

OPACITY RANGE,%	TIME OPACITY IN RANGE % OF TIME	MIN/HR
0 - 20	100.00	60.00
25 - 40	0.00	0.00
45 - 60	0.00	0.00
> 60	0.00	0.00

MAXIMUM OBSERVED OPACITY, %: 0
MINIMUM OBSERVED OPACITY, %: 0
ARITHMETIC MEAN OPACITY, %: 0.0

SIX-MINUTE AVERAGE OPACITY, %

MAXIMUM:	0.0	(54:00-59:45)
2nd LARGEST:	0.0	(48:00-53:45)
3rd LARGEST:	0.0	(42:00-47:45)
4th LARGEST:	0.0	(36:00-41:45)
5th LARGEST:	0.0	(30:00-35:45)

APPENDIX B: FIELD DATA FORMS

mmt environmental services, inc.

VELOCITY PROFILE FIELD DATA FORM

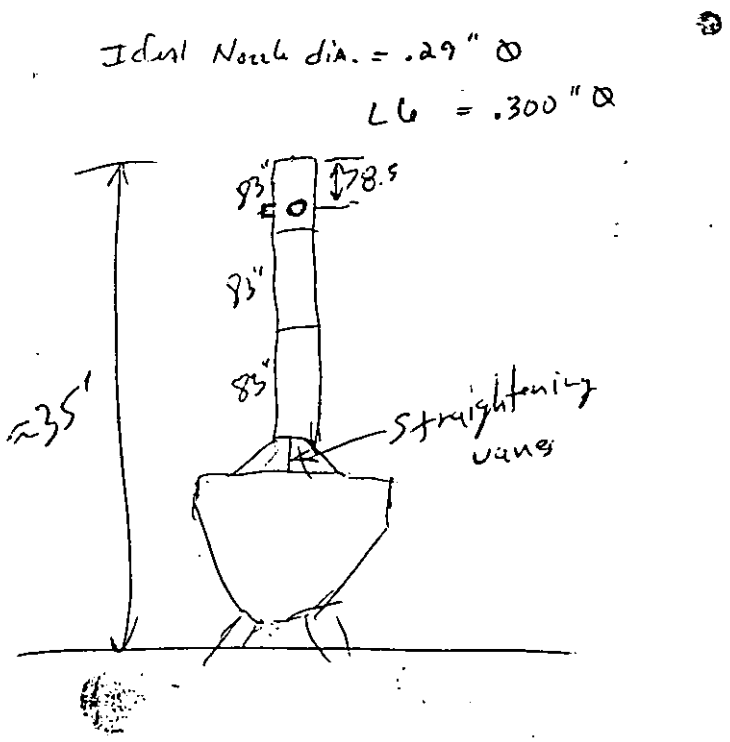
Project No: 9587
Test Date: 5-24-94
Company: Mid-MN Hot Mix
Location: Annandale, MN
Source: TG BA AT
Test Team: Asphalt Plant

Ambient temperature, °F: 62
Barometric pressure, in Hg: 28.40
Static pressure, in WC: -.21
Dry bulb temperature, °F: 150
Wet bulb temperature, °F: 145 - 150
Moisture content, % v/v: 23.3 → 26.6

Duct Cross-Sectional Dimensions		Traverse Point Location			Pitot Tube		Traverse Data 940		
Diameter or depth, inch:	41.5	% of traverse length	inches from wall	inches from port	No: 59		Velocity Pressure in WC	Gas Temp. °F	Yaw Angle degrees
Rectangular width, inch:	—				C_p: .84				
Equivalent diameter, inch:	41.5				Point				
Length of straight, undisturbed flow			1.0		1	A-1	.37		8
Upstream of ports, inch:	170.5"		2.8		2	2	.44		8
Equivalent duct diameters:	4.1		4.9		3	3	.43		6
Downstream of ports, inch	78.5"		7.3		4	4	.41		6
Equivalent duct diameters:	1.89		10.4		5	5	.35		6
Number of Sampling Points			14.7		6	6	.31		2
Required EPA 1 velocity:	16		26.8		7	7	.29		4
Required EPA 1 particulate:	24		31.1		8	8	.33		8
Number actually used:	24		34.2		9	9	.35		7
Sampling Point Distribution			36.6		10	10	.37		7
Number of Ports:	2		38.7		11	11	.38		12
Number of points/port:	12		40.5		12	12	.38		11
					13				
					14				
					15	B-1	~~.04~~	.26	5
					16	2	.27		6
					17	3	.27		6
					18	4	.29		7
					19	5	.30		6
					20	6	.31		8
					21	7	.34		13
					22	8	.34		12
					23	9	.35		12
					24	10	.38		13
					25	11	.38		15
					26	12	.37		22
					27				
					28				
					29				
					30				
					Maximum		.44		22
					Minimum		.26		2
					Average		.345		8.25 = 4.3

EPA Method 1, Sec. 2.4 Cyclonic Flow Check
The sampling site is not acceptable if the average yaw angle is greater than 20 degrees.

Comments / Site Sketch



MMT form: S-FD-2a 5/18/94

delay between pts 1 & 2 because of problems with lift truck

SOURCE EMISSION TEST FIELD DATA SHEET

TEST: 1	RUN: 1
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETER
MMT Job Number: 9587	Control Unit No.: 4	ΔH@ 1.87
Date: Tuesday 5.24.94	Gas Meter Coefficient: 1.01	TM 70
Company: Mid Mo Hot Mix	Sample Box No.: 4	MC 24
Source: Scrubber outlet	Probe No.: 75 Length: 75"	PS/PM ≈ 1.0
Source Dimensions: 41.5" ⌀	Pitot No.: 67 Coefficient: A=.848	C 1.01
Test Team: AT-TG-BA	Nozzle No.: L6 Diameter: .300" ⌀	TS 150
Test Procedure: EPA 1-5	Filter No.: 8870	R
Ambient Temp., °F: 68	Barometric Pressure, in.Hg: 28.40 (End 28.32, Σ Bar. = 28.36)	Static Pressure, in.WC: -.15

theor. ref def	CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMP STACK GAS	TEMP GAS METER IN	TEMP GAS METER OUT	TEMP OVEN	TEMP PROBE	TEMP LAST IMP
X	1028	1	0	677.859	.35	1.74	1.74	11	146	64	64	242	233	72
679.7		2 West	2.5	679.9	.38	1.88	1.90	11.5	148	66	64	246	253	68
681.6	1033	3	5	681.8	.41	2.03	2.0	13	151	67	64	246	251	66
683.7		4	7.5	683.8	.42	2.08	2.1	13	149	69	64	251	250	65
685.7	1038	5	10	685.7	.43	2.13	2.1	14	149	70	64	252	252	65
687.7		6		687.8	.42	2.08	2.1	14	148	71	64	253	251	64
689.8	1043	7	15	689.8	.38	1.88	1.9	13	151	71	65	247	251	65
691.7		8		691.7	.37	1.84	1.85	13	151	72	65	250	249	65
693.6	1048	9	20	693.7	.38	1.88	1.9	13	152	73	65	254	250	65
695.5		10		695.6	.35	1.74	1.7	12.8	150	73	66	255	252	65
697.4	1053	11	25	697.5	.37	1.84	1.8	13	150	73	66	253	252	65
699.3		12		699.4	.38	1.88	1.9	13	151	73	66	252	250	65
701.2	~~1058~~	End	30	701.3										
X	1145	1	30	X	.16	.75	.80	7	146	67	67	251	248	66
702.5		2		702.9	.24	1.19	1.2	9	148	69	67	251	250	67
704	1150	3 South	35	704.3	.26	1.29	1.3	10	147	70	67	250	253	65
705.6		4		705.9	.27	1.34	1.3	10	143	72	67	251	252	65
707.2	1155	5	40	707.5	.28	1.39	1.4	11	147	73	67	258	253	65
708.9		6		709.2	.28	1.39	1.4	11	144	74	68	252	255	65
710.5	1200	7	45	710.8	.39	1.94	1.9	13	145	75	68	251	256	65
712.3		8	49 mm Sscfm	712.7	.40	1.99	2.0	15	145	75	68	253	244	65
714.5	1205	9 stop @ 1210	50	714.7	.42	2.08	2.1	16	139	70	67	251	250	65
716.5		10		716.7	.41	2.07	2.0	15	143	71	68	253	248	65
718.5	~~1210~~	11 1216	55	718.8	.40	1.99	2.0	15	144	72	68	253	254	65
720.5		12		720.8	.37	1.84	1.8	15	146	73	68	253	257	66
722.41	1221	End 1224	60	722.718										

1205 Silo Full - No Trucks Available Restart at 1210

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	744.5	Not Applied
Difference					
Total Moisture Collected: 353.9					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1007	.001	21
1224	.002	24

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id: 1-1	Replicate 1		Replicate 2		Replicate 3		Average	
	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide							CO_2	4.90
Oxygen							O_2	14.80
Carbon Monoxide							CO	

FORM: S-FD-5

Total Sampling Time, min.: 60

Volume of Gas Sampled, DCF: 44.859

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 2
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9587	Control Unit No.: 4	ΔH@ 1.87
Date: Tuesday 5.24.94	Gas Meter Coefficient: 1.01	TM 70
Company: Mid Mo Hot Mix	Sample Box No.: 4	MC 24
Source: Scrubber outlet	Probe No.: 75 Length: 75"	PS/PM = 1.0
Source Dimensions: 41.5" ⌀	Pitot No.: 67 Coefficient: A = .848	C 1.01
Test Team: AT-TG-BA	Nozzle No.: 26 Diameter: .300" ⌀	TS 150
Test Procedure: EPA 1-5	Filter No.: 8871	R
Ambient Temp., °F: 72	Barometric Pressure, in.Hg: 28.26	Static Pressure, in.WC: -.14

CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAST IMP.
1315	1	0	723.223	.20	.99	1.0	7	142	69	69	251	231	68
724.6	2		724.7	.23	1.14	1.10	8	141	72	69	252	250	67
726.1	3	5	726.2	.26	1.29	1.3	8.5	142	74	69	249	253	66
727.7	4		727.7	.29	1.44	1.4	9	142	76	70	248	253	66
729.4	1325 5	10	729.4	.32	1.59	1.6	10.5	141	77	70	247	255	65
731.2	6		731.2	.34	1.69	1.7	11	142	78	70	244	253	65
732.9	1330 7	15	732.9	.41	2.04	2.0	13	141	79	70	245	253	65
734.1	8		734.9	.42	2.09	2.1	15	146	79	70	248	251	66
737.1	1335 9	20	737.0	.40	1.99	2.0	15	146	79	70	252	250	66
739.1	10		739.1	.38	1.89	1.9	14.5	145	78	70	255	252	67
741.0	1340 11	25	741.0	.37	1.84	1.8	14	144	79	71	254	251	66
743	12		743.0	.35	1.74	1.7	12.5	145	80	72	251	250	67
744.8	1345 End	30	744.7	~~~	~~~	~~~	~~~	~~~	~~~	~~~	~~~	~~~	~~~
X	~~1350~~ 1 1350	30	X	.29	1.5	1.5	15	145	77	72	250	248	68
746.5	2		746.6	.35	1.81	1.8	14	145	74	73	252	247	67
748.4	~~1355~~ 3 1401	35	748.2	.41	2.12	2.1	15	146	75	73	254	248	67
750.5	4		750.2	.40	2.07	2.1	15	147	75	72	253	251	67
752.5	1406 5	40	752.1	.42	2.17	2.2	17	147	76	73	251	249	66
754.6	6 Wet		754.2	.40	2.07	2.1	16	146	76	73	248	244	67
756.7	1411 7	45	756.3	.35	1.81	1.8	15	143	76	72	249	247	67
758.6	8		758.2	.33	1.71	1.7	14	144	77	72	253	243	68
760.4	1416 9	50	760.0	.36	1.86	1.9	15	146	77	73	251	238	68
762.4	10		761.9	.38	1.97	2.0	16	147	77	73	250	239	68
764.3	1421 11	55	764.0	.39	2.02	2.0	16	147	76	73	251	238	68
766.3	12		766.0	.40	2.07	2.1	17	147	76	73	254	239	68
768.4	1426 End	60	768.014	~~~	~~~	~~~	~~~	~~~	~~~	~~~	~~~	~~~	~~~

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					Not Applied
Initial	100	100	0	702.9	
Difference					
Total Moisture Collected: 295.2					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1256	.003	23
1429	.002	23

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	Replicate 1		Replicate 2		Replicate 3		Average	
1-2	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide							CO_2	5.83
Oxygen							O_2	13.63
Carbon Monoxide							CO	

Total Sampling Time, min.: 60

FORM: S-FD-5

Volume of Gas Sampled, DCF: 44.791 44.291

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 3
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9587	Control Unit No.: 4	ΔH@ 1.87
Date: Tuesday 5.24.94	Gas Meter Coefficient: 1.01	TM 75
Company: Mid Mo Hot Mix	Sample Box No.: 4	MC 23-20
Source: Scrubber outlet	Probe No.: 75 Length: 75"	PS/PM = 1.0
Source Dimensions: 41.5" ⌀	Pitot No.: 67 Coefficient: A=.848	C 1.01
Test Team: AT-TG-BA	Nozzle No.: 46 Diameter: .300" D	TS 144-1
Test Procedure: EPA 1-5	Filter No.: ~~8855~~ 8872	R
Ambient Temp., °F: 76	Barometric Pressure, in.Hg: ~~28.30~~ End 27.95 + Bar. = 28.13	Static Pressure, in.WC: -.17

Theor. vol dcf	CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAS IMP
X	1517	1	0	770.133	.36	1.86	1.9	11	137	72	71	242	231	71
772.1		2		772.2	.45	2.32	2.3	16	133	74	71	253	239	67
774.2	1522	3	5	774.2	.46	2.38	2.4	16	135	74	71	252	241	67
776.4		4		776.3	.44	2.27	2.3	15	137	76	71	251	244	67
778.5	1527	5 West	10	778.6	.45	2.32	2.3	15.5	132	77	71	250	247	67
780.7		6		780.8	.46	2.38	2.4	16	138	78	72	252	249	67
782.9	1532	7	15	782.9	.41	2.12	2.1	15	141	78	72	251	250	66
784.9		8		785.0	.44	2.27	2.3	15	136	79	73	253	249	66
787.1	1537	9	20	787.2	.42	2.17	2.2	15	135	78	73	251	249	66
789.2		10		789.3	.44	2.27	2.3	15	139	79	73	252	250	66
791.3	1542	11	25	791.4	.43	2.22	2.2	15	142	79	73	251	252	66
793.4		12		793.4	.42	2.17	2.2	15	142	78	73	254	247	67
795.5	1547	End	30	795.6										
X	1550	1	30	X	.22	1.14	1.1	10	138	76	73	251	255	68
797.0		2		797.2	.28	1.45	1.5	11	138	79	73	252	257	67
798.7	1555	3 South	35	798.9	.29	1.5	1.5	11	139	79	73	251	251	66
800.4		4		800.5	.33	1.7	1.7	12	139	81	73	250	254	66
802.3	1600	5	40	802.5	.34	1.76	1.8	12.5	139	82	73	251	253	67
804.2		6		804.4	.37	1.91	1.9	14	139	83	74	250	247	66
806.1	1605	7	45	806.3	.36	2.0	2.0	14.5	139	84	74	255	246	67
808.1		8		808.3	.41	2.28	2.3	155	139	82	74	253	247	68
810.2	1610	9	50	810.3	.42	2.33	2.3	16	139	81	74	252	249	67
812.4		10		812.6	.40	2.22	2.2	15	142	81	74	251	250	66
814.5	1615	11	55	814.7	.38	2.11	2.10	16	142	79	74	250	246	67
816.6		12		816.8	.38	2.11	2.1	16	143	79	74	251	247	68
818.6	1620	End	60	818.603										

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	780.3	Not Applied
Difference					
Total Moisture Collected: 285.0					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1455	.008	27
1625	.009	27

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id: 1-3	Replicate 1		Replicate 2		Replicate 3		Average	
	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide							CO_2	5.77
Oxygen							O_2	13.83
Carbon Monoxide							CO	

FORM: S-FD-5

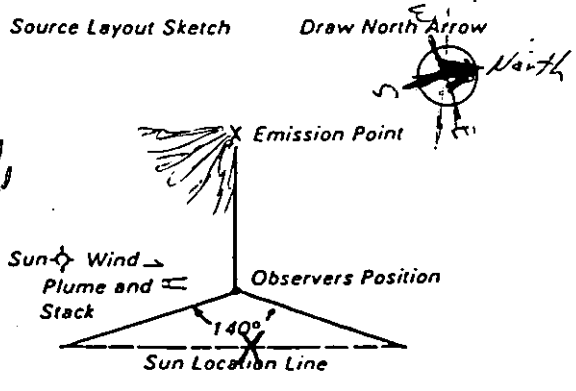
Total Sampling Time, min.: 60
Volume of Gas Sampled, DCF: 48.470

Pr #9587 1-1

Visible Emission Observation Form

SOURCE NAME	Mid-MN Hot Mix
ADDRESS	¼ mile South of Hwy 55 on Cty Rd 3
CITY	Annandale
STATE	MN
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Asphalt Plant
OPERATING MODE	Normal
CONTROL EQUIPMENT	Venturi Scrubber
OPERATING MODE	Normal
DESCRIBE EMISSION POINT START	circular steel stack
DESCRIBE EMISSION POINT STOP	same
HEIGHT ABOVE GROUND LEVEL START	≈35'
HEIGHT ABOVE GROUND LEVEL STOP	≈35'
HEIGHT RELATIVE TO OBSERVER START	≈30'
HEIGHT RELATIVE TO OBSERVER STOP	≈30'
DISTANCE FROM OBSERVER START	≈220'
DISTANCE FROM OBSERVER STOP	≈220'
DIRECTION FROM OBSERVER START	WNW
DIRECTION FROM OBSERVER STOP	WNW
DESCRIBE EMISSIONS START	Steam plume none after dissipation
DESCRIBE EMISSIONS STOP	same
EMISSION COLOR START	clear
EMISSION COLOR STOP	clear
PLUME TYPE	CONTINUOUS X FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☐ YES X
IF WATER DROPLET PLUME	ATTACHED X DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED START	Point at which water vapor dissipated
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED STOP	same
DESCRIBE BACKGROUND START	SKY
DESCRIBE BACKGROUND STOP	SKY
BACKGROUND COLOR START	Mostly cloudy blue sky
BACKGROUND COLOR STOP	Partly cloudy
SKY CONDITIONS START	Mostly cloudy blue patches
SKY CONDITIONS STOP	
WIND SPEED START	5-12 MPH
WIND SPEED STOP	5-12
WIND DIRECTION START	N & W
WIND DIRECTION STOP	N & W
AMBIENT TEMP. START	
AMBIENT TEMP. STOP	
WET BULB TEMP.	
RH. percent	

Source Layout Sketch



Plume Height aerial 30-150' above grade
Plume dissipated 0-200' downwind of stack

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

OBSERVATION DATE	5/24/94
START TIME	1030
STOP TIME	1130
AVERAGE OPACITY FOR HIGHEST PERIOD	0
NUMBER OF READINGS ABOVE	0 % WERE 0
RANGE OF OPACITY READINGS MINIMUM	0
RANGE OF OPACITY READINGS MAXIMUM	0
OBSERVER'S NAME (PRINT)	Allen L. Trowbridge
OBSERVER'S SIGNATURE	Allen L. Trowbridge
DATE	5/24/94
ORGANIZATION	MPP Environmental Services
CERTIFIED BY	ETA
DATE	4/6/94
VERIFIED BY	
DATE	

COMMENTS: Erratic wind Hazy sky background Sun in out Tough to read accurately but probably 5% Maximum

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE
TITLE
DATE

APPENDIX C: LABORATORY REPORTS

SUMMARY OF PARTICULATE EMISSION TEST LABORATORY DATA

PROJECT NUMBER: 9587 COMPANY: MID MN HOT MIX
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET

	MASS OF PARTICULATE MATTER COLLECTED, GRAMS							
	FRONT CATCH				BACK CATCH			TOTAL PARTICULATE MASS COLLECTED
RUN NUMBER	FRONT WASH	CYCLONE CATCH	FILTER CATCH	FRONT TOTAL	IMPINGER CATCH **	IMPINGER WASH	BACK TOTAL	
1	0.3305	0.0000	0.3454	0.6759	0.0041	0.0023	0.0064	0.6823
2	0.0755	0.0000	0.2698	0.3453	0.0027	0.0017	0.0044	0.3497
3	0.1580	0.0000	0.3396	0.4976	0.0047	0.0020	0.0067	0.5043

* NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

LABORATORY REPORT: EPA Method 5

Project Number: 9587 Company: Mid Minnesota Hot Mix

Frontwashes 400 ml Acetone				
Test-Run	1-1	1-2	1-3	Date
Dish #	1095	1098	1101	- - - - -
1	2.6260	2.3658	2.4775	5.26.94
2	2.6257	2.3660	2.4771	5.27.94
3	2.6260	2.3660	2.4774	5.27.94
Tare	2.2949	2.2900	2.391	4.22.94
Blank	.0007	.0003	.0003	- - - - -
Net	.3305	.0755	.1580	- - - - -

Solvent Blanks				
Solvents	400 ml Acetone	150 ml Chloroform	150 ml Ether	Date
Dish #	1092	1093	1094	- - - - -
1	2.2954	2.3022	2.2750	5.26.94
2	2.2953	2.3020	2.2747	5.27.94
3	2.2954	2.3020	2.2748	5.27.94
Tare	2.2950	2.3018	2.2744	4.22.94
Net	.0003	.0002	.0003	- - - - -

Backwashes 400 ml Acetone				
Test-Run	1-1	1-2	1-3	Date
Dish #	1096	1099	1102	- - - - -
1	2.3073	2.3033	2.3022	5.26.94
2	2.3075	2.3030	2.3022	5.27.94
3	2.3073	2.3032	2.3022	5.27.94
Tare	2.3047	2.3010	2.2999	4.22.94
Blank	.0003	.0003	.0003	- - - - -
Net	.0023	.0017	.0020	- - - - -

Glass Filters				
Test-Run	1-1	1-2	1-3	Date
Filter #	8870	8871	8872	- - - - -
1	.8477	.7724	.8296	5.26.94
2	.8476	.7723	.8295	5.27.94
3	.8478	.7721	.8293	5.27.94
Tare	.5022	.5023	.4897	2.2.94
Net	.3454	.2698	.3396	- - - - -

Extractions 150 ml of Chloroform - 150 ml Ethyl Ether				
Test-Run	1-1	1-2	1-3	Date
Dish #	1097	1100	1103	- - - - -
1	2.2949	2.2984	2.2880	5.26.94
2	2.2947	2.2983	2.2880	5.27.94
3	2.2949	2.2982	2.2878	5.27.94
Tare	2.2901	2.2950	2.2836	4.22.94
Blank	.0005	.0005	.0005	- - - - -
Net	.0041	.0027	.0047	- - - - -

COMMENTS

Lowest Final Weight
- Tare
- Blank(if applicable)

= Sample Net Gain (grams)

Signature Ted Gibbons Date 5.27.94

Laboratory Report: EPA Method 24

Project Number 9587 Company Mid Minnesota Hot Mix

Test-Run # 1-1

Trial #	1	2	3	4
Dish #	1104	1105	1106	1107
Tare	2.2912	2.3094	2.3185	2.3157
Wet + Tare	40.4231	40.4763	40.6385	40.8360
Wet	38.1319	38.1669	38.3200	38.5203
Dry	36.5628	36.6723	36.8090	36.8453
Dry + Tare	38.8540	38.9817	39.1275	39.1610
% Moisture	4.11	3.92	3.94	4.35

Trial #	1	2	3	Date
Dish #				
Tare				
Wet + Tare				
Wet				
Dry				
Dry + Tare				
% Volatiles				

Test-Run # 1-2

Trial #	1	2	3	4
Dish #	1108	1109	1110	1111
Tare	2.2920	2.2826	2.2887	2.2918
Wet + Tare	40.6641	40.3206	40.4390	40.1786
Wet	38.3721	38.0380	38.1503	37.8868
Dry	36.9790	36.9466	37.0314	36.5830
Dry + Tare	39.2710	39.2292	39.3201	38.8748
% Moisture	3.63	2.87	2.93	3.44

Results Summary % Moisture of Aggregate

	Mean	Deviation	% Error	
1-1	4.08	.20	4.88	
1-2	3.22	.38	11.70	
1-3	3.22	.28	8.65	
All 12 samples	3.51	.50	14.3	

Test-Run # 1-3

Trial #	1	2	3	4
Dish #	1112	1113	1114	1115
Tare	2.2869	2.2952	2.2791	2.2963
Wet + Tare	40.2630	40.7220	40.6284	40.3190
Wet	37.9761	38.4268	38.3493	38.0227
Dry	36.6906	37.3368	37.0214	36.8147
Dry + Tare	38.9775	39.6320	39.3005	39.1110
% Moisture	3.39	2.84	3.46	3.18

Comments

$\frac{\text{Dry}}{\text{Wet}} * 100 = \%$ Solids

100- % Solids = %

Wet+Tare on 5.25.94
Dry-Tare on 5.26.94
Tares on 4.22.94

Signature T.D. Gibbons Date 5.26.94

mmt environmental services, inc.

EPA METHOD 4 MOISTURE ANALYSIS

Sampling Train* Cold Box Setup		
Impinger	Type**	Initial Contents
1	M	100 ml H_2O
2	S	100 ml H_2O
3	M	empty
4	M	silica gel
5	---	not used
6	---	not used
7	---	not used

MMT Project Number: 9587
Company: Mid Minnesota Hot Mix
Source: Scrubber Outlet
Sample Acquisition:
Dates: Tue May 24, 1994
Technicians: BA - TG
Sample Recovery:
Date:
Technician:

* EPA Method 5 sampling train ** S: Standard (with orifice) M: Modified (straight tube)

Test-Run 1-1 (Cold) Box No: 7 Filter No: 8870

Impinger Number	Mass (g) or Volume (ml) Initial	Final	Net Gain
1	100	292	192
2	100	236	136
3	0	6	6
4	744.5	764.4	19.9
5	---	---	0
6	---	---	0
7	---	---	0
Total mass of liquid collected, g			353.9

Description of liquid collected: slightly white mostly clear 353.9

Test-Run 1-2 (Cold) Box No: 8 Filter No: 8871

Impinger Number	Mass (g) or Volume (ml) Initial	Final	Net Gain
1	100	331	231
2	100	137	37
3	0	2	2
4	762.9	788.1	25.2
5	---	---	0
6	---	---	0
7	---	---	0
Total mass of liquid collected, g			295.2

Description of liquid collected: slightly cloudy white mostly clear

Test-Run 1-3 Box No: 3 Filter No: 8872 NV

Impinger Number	Mass (g) or Volume (ml) Initial	Final	Net Gain
1	100	405	305
2	100	54	-46
3	0	8	8
4	780.3	798.3	18
5	---	---	0
6	---	---	0
7	---	---	0
Total mass of liquid collected, g			285

Description of liquid collected: slightly cloudy white mostly clear

Test-Run Box No: Filter No:

Impinger Number	Mass (g) or Volume (ml) Initial	Final	Net Gain
1	100		
2	100		
3	0		
4			
5	---	---	0
6	---	---	0
7	---	---	0
Total mass of liquid collected, g			

Description of liquid collected:

MMT form: S-LB-4b 5/9/84

mmt environmental services, inc.

EPA METHOD 3 LABORATORY REPORT
ORSAT ANALYSIS

Project Number: 9587

Company: Mid Minnesota Hot Mix

Sample Identification		Gas Parameter Measured	Replicate #1 Buret ml Reading	Replicate #1 Percent Volume	Replicate #2 Buret ml Reading	Replicate #2 Percent Volume	Replicate #3 Buret ml Reading	Replicate #3 Percent Volume	Average Percent Volume	Fuel Factor Fo
Bag Id:	Submitted by: BA	Initial Reading	0.00		0.00		0.00			
1-1	Submittal Date: 5.24.94 Time: 1050 1215 1220	Carbon Dioxide	5.80	5.80	4.20	4.20	4.70	4.70	4.90	1.244
	Analyzed by: TG	Oxygen	19.80	14.00	20.00	15.80	19.30	14.60	14.80	
	Analysis Date: 5.24.94 Time: 1250	Carbon Monoxide	/	/					/	
Bag Id:	Submitted by: BA	Initial Reading	0.00		0.00		0.00			
1-2	Submittal Date: 5.24.94 Time: 1320 1340 1430	Carbon Dioxide	5.80	5.80	5.90	5.90	5.80	5.80	5.83	1.247
	Analyzed by: TG	Oxygen	19.40	13.60	19.50	13.60	19.50	13.70	13.63	
	Analysis Date: 5.24.94 Time: 1530	Carbon Monoxide								
Bag Id:	Submitted by: BA	Initial Reading	0.00		0.00		0.00			
1-3	Submittal Date: 5.24.94 Time: 1520 1540 1600	Carbon Dioxide	5.70	5.70	5.80	5.80	5.80	5.80	5.77	1.225
	Analyzed by: TG	Oxygen	19.70	14.00	19.50	13.70	19.60	13.8	13.83	
	Analysis Date: 5.24.94 Time: 1640	Carbon Monoxide								
Bag Id:	Submitted by:	Initial Reading								
	Submittal Date: Time:	Carbon Dioxide								
	Analyzed by:	Oxygen								
	Analysis Date: Time:	Carbon Monoxide								

Percent Volume Calculations:
$\%CO_2 = 100 * (CO_2 - IR) / (100 - IR)$
$\%O_2 = 100 * (O_2 - CO_2) / (100 - IR)$
$\%CO = 100 * (CO - O_2) / (100 - IR)$
where IR, CO_2, O_2 & CO are buret ml values

$Fo = (20.9 - \%O_2 + 0.5 * \%CO) / (\%CO_2 + \%CO)$
Fuel factor Fo is a quality control check which is only valid for pure combustion sources. The EPA Method 3B list of acceptable Fo ranges for various fuels is presented to the right.

Anthracite coal:	1.016 - 1.130
Bituminous coal:	1.083 - 1.230
Lignite coal:	1.016 - 1.130
Wood:	1.000 - 1.120
Wood bark:	1.003 - 1.130
Distillate oil:	1.260 - 1.413
Residual oil:	1.210 - 1.370
Natural gas:	1.600 - 1.836
Propane gas:	1.434 - 1.586
Butane gas:	1.405 - 1.553

MMT form: S-LB-3a 5/9/94

Record buret readings to the nearest 0.1 ml.

Record percent volume values to the nearest 0.01 percent.

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 708-953-9300 FAX: 708-953-9306

SINCE 1908

Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 127, SOUTH HOLLAND, IL 60473
TEL: (708) 331-2900
FAX: (708) 333-3060

June 15, 1994

MMT ENVIRONMENTAL SERVS, INC.
4610 N. Churchill Street
St. Paul, MN 55126
Attn: Alan Trowbridge

Sample identification by
Mid Minnesota Hot Mix

Kind of sample reported to us	Waste Oil	Composite Waste Oil Sample from Mid Minnesota Hot Mix.
Sample taken at	Mid Minnesota Hot Mix	
Sample taken by	Mid Minnesota Hot Mix	
Date sampled	May 24, 1994	
Date received	June 1, 1994	P.O. No. 8542

Analysis Report No. 71-75433 Page 1 of 2

	As Received
GRAVITY	
Specific at 60/60°F	0.8844
Lb/gallon at 60°F	7.364
°API	28.5
HEATING VALUE	
Btu/lb	18,996
Btu/gal at 60°F	139,887
ASH, % Wt.	0.73
SULFUR, % Wt.	0.45
WATER, % Wt.	1.33
TOTAL HALOGENS, ppm	1122
ACIDITY	Pass
LEAD, ug/g	75
pH	5.02

METHODS

Gravity: ASTM D 287; Heating Value: ASTM D 240; Ash: ASTM D 482; Sulfur: ASTM D 1552
Water: ASTM D 95; Total Halogens: ASTM D 4208; Acidity: ASTM D 664; Lead: ASTM D 3683

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, South Holland Laboratory

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 708-953-9300 FAX: 708-953-9306

SINCE 1908

Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 127, SOUTH HOLLAND, IL 60473
TEL: (708) 331-2900
FAX: (708) 333-3060

June 15, 1994

MMT ENVIRONMENTAL SERVS, INC.
4610 N. Churchill Street
St. Paul, MN 55126
Attn: Alan Trowbridge

Sample identification by
Mid Minnesota Hot Mix

Kind of sample reported to us	Waste Oil	Composite Waste Oil Sample from Mid Minnesota Hot Mix.
Sample taken at	Mid Minnesota Hot Mix	
Sample taken by	Mid Minnesota Hot Mix	
Date sampled	May 24, 1994	
Date received	June 1, 1994	P.O. No. 8542

POLYCHORINATED BIPHENYLS (PCB's)

PARAMETER	RESULTS	MDL	METHOD
PCB, ug/g	<5	1.0	SW8080

ND: Non detected

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, South Holland Laboratory

APPENDIX D: CALIBRATION DATA

CALIBRATION
DRY TEST METER/ORIFICE METER

Date: Monday 5.16.94 Barometric Pressure, in. Hg. (Pb): 28.80

EQUIPMENT IDENTIFICATION			
Control Unit 4	Dry Test Meter	Wet Test Meter	Calibration Type
Mfg: Andersen	Mfg: rockwell	Mfg: GCA Corporation	General: x
Model: Universal	Model: S-175	Model: Precision	Post-test: x
SN: 591-544	SN: 83	SN: 11 AH 12	

EQUIPMENT CALIBRATION

Orifice Pressure Drop in. WC H	Pump Vac. in.Hg	Wet Test Meter Volume, CF Initial Vwi	Wet Test Meter Volume, CF Final Vwf	Wet Test Meter Temp. °F Tw	Dry Test Meter Volume, CF Initial Vdi	Dry Test Meter Volume, CF Final Vdf	Dry Test Meter Temperature, °F Inlet Initial Tii	Dry Test Meter Temperature, °F Inlet Final Tif	Dry Test Meter Temperature, °F Outlet Initial Toi	Dry Test Meter Temperature, °F Outlet Final Tof	Elapsed Time, min. Q
2.4	14.5	ZERO	8.612	71	650.552	661.163	83	74	84	74	10
2.4	14.5	8.612	17.200	71	661.163	668.74	82	74	74	85	10
2.4	14.5	17.200	24.977	71	668.74	677.406	74	81	85	71	9

COMPUTER PRINTOUT

≠ Orifice P. = 2.4 in. W.C. at 14 or 15 in Hg Vacuum
Post Test Calibration Test #4

H	Vw	Tw	Vd	Td	Q	C	Ha
2.4	8.612	71	8.611	78.8	10.0	1.0085	1.8641
2.4	8.588	71	8.577	78.8	10.0	1.0097	1.8745
2.4	7.747	71	7.666	78.5	9.0	1.0186	1.8668

AVERAGE CORRECTION FACTOR: C = 1.0123
AVERAGE ORIFICE CONSTANT: Ha = 1.8685

EQUATIONS:
Vw = Vwf - Vwi
Vd = Vdf - Vdi
Td = (Tii + Tif + Toi + Tof) / 4
C = Vw * Pb * (Td+460) / (Vd * (Pb+H/13.6) * (Tw+460))
Ha = 0.0317 * H * ((Tw+460)*Q/Vw)^2 / (Pb * (Td+460))

Calibration Performed by:
(Print) Ted Gibbons Ted Gibbons

CALIBRATION
DRY TEST METER/ORIFICE METER

Date: Wednesday 5-25-94 Barometric Pressure, in. Hg. (Pb): 28.39

EQUIPMENT IDENTIFICATION			
Control Unit 4	Dry Test Meter	Wet Test Meter	Calibration Type
Mfg: Andersen	Mfg: rockwell	Mfg: GCA Corporation	General: x
Model: Universal	Model: S-175	Model: Precision	Post-test: x
SN: 591-544	SN: 83	SN: 11 AH 12	

EQUIPMENT CALIBRATION

Orifice Pressure Drop in. WC H	Pump Vac. in.Hg	Wet Test Meter Volume, CF Initial V_{wi}	Wet Test Meter Volume, CF Final V_{wf}	Wet Test Meter Temp. °F T_w	Dry Test Meter Volume, CF Initial V_{di}	Dry Test Meter Volume, CF Final V_{df}	Dry Test Meter Temperature, °F Inlet Initial T_{ii}	Dry Test Meter Temperature, °F Inlet Final T_{if}	Dry Test Meter Temperature, °F Outlet Initial T_{oi}	Dry Test Meter Temperature, °F Outlet Final T_{of}	Elapsed Time, min. Q
1.9	17	ZERO	10.215	75	822.743	832.938	71	70	75	71	13
1.9	17	10.215	19.629	75	832.938	842.382	74	71	76	71	12
1.9	17	19.629	30.615	75	842.382	853.366	76	71	79	72	14

COMPUTER PRINTOUT

Average orifice Pressure = 1.9 inches water column
Maximum pump Vacuum observed = 17 inches Mercury
per Method 5 Section 5.3.2, post-test calibration for Project #9587

H	Vw	Tw	Vd	Td	Q	C	Hø
1.9	10.215	75	10.195	71.8	13.0	0.9910	1.8495
1.9	9.414	75	9.444	73.0	12.0	0.9882	1.8512
1.9	10.986	75	10.984	74.5	14.0	0.9944	1.8449

AVERAGE CORRECTION FACTOR: C = 0.9912
AVERAGE ORIFICE CONSTANT: Hø = 1.8485

EQUATIONS:
Vw = Vwf - Vwi
Vd = Vdf - Vdi
Td = (Tii + Tif + Toi + Tof) / 4
C = Vw * Pb * (Td+460) / (Vd * (Pb+H/13.6) * (Tw+460))
Hø = 0.0317 * H * ((Tw+460)*Q/Vw)^2 / (Pb * (Td+460))

Pre & Post Test $\bar{x}$ C = 1.0018

1.01
1.87

Calibration Performed by:

(Print) Ted Gibbons Ted Gibbons

CALIBRATION

S-TYPE PITOT TUBE

Probe ID: 75"

Date: 3-29-94

S-Type Pitot Tube ID No.: 67 inches

Ambient Temperature, °F: 107

Standard Pitot Tube ID No.: 1.5"

Barometric Pressure, in. Hg.: 28.83

Standard Pitot Tube Coefficient: .990

Stick thermocouple 61" Inflex + 18" flexible

PITOT TUBE EXAMINATION

Alignment Check	Pitot Tube Dimensions	Pitot Assembly Intercomponent Spacings
✓ $\alpha_1 < 10°$ ✓ $\alpha_2 < 10°$ ✓ $\beta_1 < 5°$ ✓ $\beta_2 < 5°$ ✓ Q<1/8 in. ✓ R<1/32 in.	External tubing diameter (D_t): 3/8 Base to Side A opening plane (P_A): .53 Base to Side B opening plane (P_B): .52	Pitot to _____ nozzle (X): NA Pitot to probe sheath (Y): NA Pitot to thermocouple, along probe (W): NA Pitot to thermocouple, perpendicular to probe (Z): NA

DAMAGE ON SIDE B

DESIRED CALIBRATION POINT		SIDE A CALIBRATION		SIDE B CALIBRATION	
Velocity ft/sec	P_{std} in. WC	P_{std} in. WC	P_s in. WC	P_{std} in. WC	P_s in. WC
20	0.09	.11	.15	.11	.16
40	0.37	.33	.45	.39	.55
60	0.82	.81	1.1	.84	1.2
80	1.45	1.5	2.05	1.45	2.1
100	2.30				

COMPUTER PRINTOUT

SIDE A CALIBRATION				SIDE B CALIBRATION			
Pstd	Ps	Cp	Cp-Cp(A)	Pstd	Ps	Cp	Cp-Cp(B)
0.110	0.150	0.848	-0.000	0.110	0.160	0.821	-0.005
0.330	0.450	0.848	-0.000	0.390	0.550	0.834	0.007
0.810	1.100	0.850	0.002	0.840	1.200	0.828	0.002
1.500	2.050	0.847	-0.001	1.450	2.100	0.823	-0.004
Cp(A) = 0.848				Cp(B) = 0.826			

Side A σn = .001

Side B σn = .005

Calibration Performed by:

(Print) Bill & Ted

(Signature) Bill & Ted

CALIBRATION

NOZZLE DIAMETER

Nozzle Number	Nominal Diameter, in.	Measured Diameter, in. D1	D2	D3	Nozzle* Diameter, in.
L-1		.174	.175	.175	.175
L-2		.249	.248	.249	.249
L-3		.355	.355	.355	.355
L-4		.489	.488	.489	.489
L-5		.125	.125	.125	.125
L-6		.300	.300	.300	.300
L-7		.175	.175	.176	.175
L-8		.489	.490	.491	.490
L-10		.245	.246	.245	.245
L-11		.250	.250	.250	.250
L-12		.247	.248	.248	.248
L-13		.240	.240	.239	.240
L-14		.199	.199	.199	.199

* Nozzle diameter = (D1 + D2 + D3)/3

Calibration Performed by:

(Print) Bill Anderson

(Signature) Bill Anderson

Date: 3-18-94

FORM: SSQA-3

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Alan Throwbridge

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

Thomas Rose
President

243029
Certificate Number

Vice President

Minneapolis
Location

David B. Savage, Jr.
Program Manager

April 6, 1994
Date of Issue

APPENDIX E: PROCESS DATA

ASPHALT PLANT OPERATING CONDITIONS DURING PERFORMANCE TEST

Project No: 9587 Date: 5/24/94

Company: Mid-Minnesota Hot Mix, Inc.

Location: Annandale, MN

The Minnesota Pollution Control Agency requires that the following information be included in the performance test report. The agency may reject any report without this completed form duly certified by a company representative.

Asphalt Plant Description

Mfg: Barber - Greene

Model: 858 Batch

Type: ☒ Drum Mix ☐ Conventional ☐ Other (specify):

Class: ☒ Stationary ☐ Portable

Pollution Control Equipment

Mfg: Barber - Greene

Model: 838 Dryer

Type: ☐ Baghouse ☒ Cyclone ☐ Multiclone ☒ Venturi Scrubber ☒ Wet Scrubber ☐ Other:

Fuel Description

Itemize all fuels and materials added to the combustion process during the test period (if oil specify type):

Waste Oil

Is the above listed fuel the "dirtiest" that the plant is allowed to burn? ☒ Yes ☐ No

Is the above fuel substantially the highest sulfur containing fuel normally burned? ☒ Yes ☐ No

Production specific fuel usage determination method:

☐ Measured _____ cu.ft./ton hot mix

☒ Calculated 1.5 gal/ton hot mix

Number of burners in system dryer: _____

Burner rating: _____ 10^6Btu = 100% control setting

Control Equipment Operating Paramaters

Was control equipment operating normal during the test period? ☒ Yes ☐ No

Normal system pressure drop, in WC: 4.1"

Normal system air flow rate, acfm:

For Baghouse systems:	Design	At Test
Cleaning cycles	X	X
Air-to-Cloth Ratio	X	X
For Wet Scrubbing systems:		
% scrubbing water recycled		100 %?
Number of spray bars	3	
Water delivery pressure, psi		70
Water flow rate, gpm		79

Heat Input Data (specify units)

Test Run Number	Fuel Usage Rate gal/Hr	Fuel Heat Content Btu/gal	Total Heat Input Rate 10^6Btu/Hr
1	205	139,887	
2	180	139,887	
3	210	139,887	

Control Equipment Cleaning/Maintenance

Date and procedure of last maintenance or cleaning of the pollution control equipment:

Every Monday Morning Check and Clean Scrubber

Aggregate and Recycle Material Usage

Test Number	Virgin Aggregate ton/hr	Recycle Material ton/hr	Liquid Asphalt ton/hr	Process Weight Rate* ton/hr	Recycle Percentage %**
1	131.22	0	7.83	139.06	0
2	117.28	0	6.94	124.23	0
3	140.34	0	8.30	148.63	0

Aggregate & Recycle Moisture Content

Test Number	Virgin Aggregate % moisture	Recycle Material % moisture	Combined Material % moisture
1	4.1	X	X
2	3.2	X	X
3	3.2	X	X

* Process Weight Rate = Total of all materials introduced into the process equipment = Aggregate + Recycle + Asphalt

** % Recycle = 100 x Recycle / (Aggregate + Recycle) - Asphalt excluded as per Minn. Dept. of Transportation mix best calculation

Describe location of the thermocouples reading the dryer gas exit temperature:

Affidavit: I certify that the information recorded above is accurate and correctly describes the plant equipment and operating conditions during the indicated performance test period.

By (print): David FERRELL Position: CEO

Signature: [signature] Phone: 612-274-3037

END

Mid-Minnesota Hot Mix, Inc.
Process Weight Rate Calculation

Test Run #1		Total All	Liquid	Aggregate
	Load	Materials	Asphalt	Material
Time	Number	lb	lb	lb
1025	Start			
1032	A1	30,127	1,734	28,393
1038	A2	30,230	1,721	28,509
1042	A3	16,106	916	15,190
1048	A4	30,231	1,691	28,540
1054	A5	31,450	1,733	29,717
1100	A6	30,188	1,708	28,480
Break due to problem with lift truck				0
1145	Re-start			0
1150	A7	29,963	1,685	28,278
1154	A8	30,292	1,693	28,599
Break due to full silo				0
1205	Re-start			0
1215	A9	30,150	1,694	28,456
1222	A10	24,010	1,354	22,656
End Test				
		Total	Total	Total
Elapsed		Product	Asphalt	Aggregate
Time, min		lb	lb	lb
61		282,747	15,929	266,818
	tons/hr=	**139.06**	**7.83**	**131.22**

Test Run #2		Total All	Liquid	Aggregate
	Load	Materials	Asphalt	Material
Time	Number	lb	lb	lb
1315	Start			
1320	B1	30,142	1,720	28,422
1327	B2	30,378	1,690	28,688
1333	B3	30,293	1,686	28,607
1342	B4	30,358	1,683	28,675
1349	B5	30,345	1,689	28,656
1400	B6	30,303	1,685	28,618
1406	B7	30,010	1,687	28,323
1414	B8	30,112	1,680	28,432
1420	B9	30,111	1,685	28,426
1428	B10	30,231	1,689	28,542
End Test				
		Total	Total	Total
Elapsed		Product	Asphalt	Aggregate
Time, min		lb	lb	lb
73		302,283	16,894	285,389
	tons/hr=	**124.23**	**6.94**	**117.28**

Test Run #3		Total All	Liquid	Aggregate
	Load	Materials	Asphalt	Material
Time	Number	lb	lb	lb
1519	Start			
1525	C1	30,321	1,684	28,637
1531	C2	30,261	1,680	28,581
1537	C3	30,301	1,689	28,612
1543	C4	30,136	1,685	28,451
1550	C5	30,201	1,682	28,519
1555	C6	30,062	1,685	28,377
1600	C7	30,067	1,716	28,351
1607	C8	30,070	1,680	28,390
1614	C9	29,840	1,684	28,156
1620	C10	30,964	1,689	29,275
End Test				
		Total	Total	Total
Elapsed		Product	Asphalt	Aggregate
Time, min		lb	lb	lb
61		302,223	16,874	285,349
	tons/hr=	**148.63**	**8.30**	**140.34**

mmt environmental services, inc.

ASPHALT PLANT OPERATING DATA LOG

(Record Data at 15 Minute Intervals)

Project No: 9587 Date: 5-24-94

Company: Mid MN. Hot Mix

Location: Annandale MN.

Time of Day Hr : Min	Burner Setting %	Material Processing Rate, Tons Per Hour: Aggregate Material	~~Recycle~~ Material	Total Solid Materials	Liquid Asphalt	Total All Materials	Dryer Exhaust Gas Temp. °F	Dust Collector Pressure Drop inches water	Wet Scrubber Water: Flow Rate gpm	Wet Scrubber Water: Pressure psi		
9:26		5700	[illegible]	[illegible]	342	6043	350		77	70		
9:28		4672	1220		344	6238						
9:29		4640	1144		350	6134						
9:30		4668	1242		339	6149						
9:31		4530	1160		351	6043						
9:32		4524	1160		350	6036						
9:33		4518	1240		343	6107						
9:34		4506	1228		339	6071						
9:35		4404	1194		347	5944						
9:36	Load	4584	1168		342	6095						
10:30					1710	30071						
10:32	A1				1734	30127						
10:38	A2				1721	30230	335					
10:42	A3				916	16106						
10:48	A4				1691	30231						
10:54	A5				1733	31450			80	70		
11:00	A6				1708	30188						
11:07					1691	30285		4"				

Start Test 1

55

Affidavit: I certify that the information recorded above is accurate and correctly describes plant operating conditions during the indicated period. I also certify that the above data was recorded by myself or by personnel under my direct supervision.

By (print): _____ Position: _____

Signature: Ronald Kane Phone: _____

MMT form: S-PD-1a Rev.5/20/94

mmt environmental services, inc.

ASPHALT PLANT OPERATING DATA LOG

(Record Data at 15 Minute Intervals)

Project No: 9587 Date: 5-24-94

Company: Mid MN. Hot Mix

Location: Annandale MN

Time of Day Hr : Min	Burner Setting %	Material Processing Rate, Tons Per Hour: Aggregate Material	Recycle Material	Total Solid Materials	Liquid Asphalt	Total All Materials	Dryer Exhaust Gas Temp. °F	Dust Collector Pressure Drop inches water	Wet Scrubber Water: Flow Rate gpm	Pressure psi		
11:15	Load				1686	28912		4"				
11:21					1692	30094	340		79 gal	70		
11:26					1688	30176						
11:45					1701	30200			80 gal	70		
11:50	A7				1685	29963						
11:54	A8				1693	30292						
12:05					1705	30019						
12:15	A9				1694	30150						
12:22	A10				1354	24010						
1:15	[redacted]				1377	24670						
1:20	B-1				1720	30142	355					
1:27	B-2				1690	30378		4"	79 gal	70		
133	B-3				1686	30293						
142	B-4				1683	30358						
149	B-5				1689	30345		4"	79 gal	70		
2:00	B-6				1685	30303						
2:06	B-7				1687	30010						
2:14	B-8				1680	30112		4"	80 gal	70		

5 to end

Start 2

Affidavit: I certify that the information recorded above is accurate and correctly describes plant operating conditions during the indicated period. I also certify that the above data was recorded by myself or by personnel under my direct supervision.

By (print): _____ Position: _____

Signature: Ronald Koerner Phone: _____

MMT form: S-PD-1a Rev.5/2094

mmt environmental services, inc.

ASPHALT PLANT OPERATING DATA LOG

(Record Data at 15 Minute Intervals)

Project No: 9587 Date: 5-24-94

Company: Mid MN. Hot Mix

Location: Annandale MN.

Time of Day Hr : Min	Burner Setting %	Material Processing Rate, Tons Per Hour: Aggregate Material	Recycle Material	Total Solid Materials	Liquid Asphalt	Total All Materials	Dryer Exhaust Gas Temp. °F	Dust Collector Pressure Drop inches water	Wet Scrubber Water: Flow Rate gpm	Pressure psi		
2:20	load B9				1685	30111		4"	79 gal	70		
end 2 2:28	~~B10~~				1689	30231						
start 3 3:19	~~1~~				1685	30164						
3:25	C1				1684	30321	350	4.2"	80 gal	70		
3:31	C2				1680	30261						
3:37	C3				1689	30301						
3:43	C4				1685	30136						
3:50	C5				1682	30201		4"	79 gal	70		
3:55	C6				1685	30062						
4:00	C7				1716	30067						
4:07	C8				1680	30070						
4:14	C9				1684	29840		4"	79 gal	70		
End 3 4:20	C10				1689	30964						

57

Affidavit: I certify that the information recorded above is accurate and correctly describes plant operating conditions during the indicated period. I also certify that the above data was recorded by myself or by personnel under my direct supervision.

By (print): Ronald Kania Position: plant operator

Signature: Ronald Kania Phone: 274-3037

MMT form: S-PD-1a Rev.5/20/94

APPENDIX F: TEST PLAN

Minnesota Pollution Control Agency

May 20, 1994

Mr. David Ferrell
CEO
Mid Minnesota Hot Mix, Inc.
P.O. Box 239
Annandale, Minnesota 55302

RE: November 5, 1994, Test Plan Submittal for the May 24, 1994, Performance Test on the Barber-Greene, Model 858, Conventional Batch with a Barber-Greene, Model 838, Dryer and a Barber-Greene Wet Wash Scrubber

Dear Mr. Ferrell:

This letter and its enclosures conclude the pretest requirements for the Mid Minnesota Hot Mix, Inc. (Company) facility located near Annandale, Minnesota, as discussed during our telephone conversation of May 19, 1994.

The Air Quality Division (AQD) staff of the Minnesota Pollution Control Agency (MPCA) has reviewed the submittal, and has approved the test plan. During our telephone conversation the following items were mentioned as follow up to the letter dated April 25, 1994:

1. This test is for initial compliance, but is not subject to New Source Performance Standards. Subsequently, one (1) sixty-minute test of opacity readings will be taken concurrently with a particulate run.

2. Port locations are acceptable from submitted schematic and are to be installed on Monday, May 23, 1994.

3. The number of traverse points that will be sampled during the testing will be 24 (or 12 per port).

4. The "dirtiest" fuel to be tested with will be used oil.

5. The applicable emission limit includes reporting condensibles for the particulate testing.

6. Production and operational limits are applicable and will be established when compliance has been determined by AQD staff.

520 Lafayette Rd. N.; St. Paul, MN 55155-4194; (612) 296-6300 (voice); (612) 282-5332 (TTY)
Regional Offices: Duluth • Brainerd • Detroit Lakes • Marshall • Rochester

The above listed items are modifications to the test plan, and are to be incorporated into the proposed test.

Copies of the Operating Data Summary For Process Sources, Certifications Required For Performance Test Reports, Microfiche Submittal, and the recently revised Asphalt Plant Operating Conditions During Stack Testing forms are enclosed.

These forms will help you to comply with the submittal requirements of Minn. Rules pt. 7017.2035 and 7017.2040. A copy of the test plan, including this letter, must be included as part of the performance test report.

Remember, it is not the Testing Consultant's responsibility to submit the Company report or microfiche or to certify that the microfiche submitted is an exact copy of the original test report by the deadlines specified in the applicable compliance document (i.e., Permit, Stipulation Agreement, Administrative Penalty Order, etc.). The responsibility for these submittals lies solely with the Company.

If you have any questions or comments on the content of this letter, please contact me at (612)297-8301.

Sincerely,

Craig D. Averman
Performance Test Coordinator
Compliance Determination Unit
Compliance and Enforcement Section
Air Quality Division

CDA:bab

Enclosures

cc: Alan Trowbridge, MMT Environmental
Julie Hendricks, MPCA Brainerd Regional Office
John Elling, AQD
Mary Jean Fenske, AQD
AQD File No. 1933

APR 29 REC'D

Minnesota Pollution Control Agency

April 25, 1994

Mr. David Ferrell, CEO
Mid Minnesota Hot Mix, Inc.
P.O. Box 239
Annandale, Minnesota 55302

RE: November 5, 1994, Test Plan Submittal for the Performance Test Required by The January 25, 1994, Notice of Violation, For the Stationary Asphalt Plant

Dear Mr. Ferrell:

This letter and its enclosures include some pretest requirements for the Mid Minnesota Hot Mix (Company) facility located in Annandale, Minnesota, as discussed during our preliminary meeting of November 17, 1993. Please contact Craig Avermann at (612)297-8301 with any future questions regarding performance testing.

The Air Quality Division (AQD) staff of the Minnesota Pollution Control Agency (MPCA) has reviewed the submittal, and will not approve the test plan until a follow up meeting is conducted with Craig Avermann to ensure any and all issues are resolved before testing commences. Below, is a summary of the items discussed during our November 17, 1993, preliminary meeting for the proposed May 1994 test month:

1. The meeting is a preliminary meeting, and is to be followed by a meeting before testing. Please schedule your meeting as soon as possible.

2. Testing is for initial compliance, however, the source is not subject to New Source Performance Standards.

3. The test plan states waste oil is to be used. The fuel you test with must be the "dirtiest" fuel you are allowed to use. This must be clarified.

4. The port locations appear acceptable from the schematic provided.

6. The applicable emission limit includes condensibles.

7. Production limits are applicable. You must test at the highest production rate you would like to operate at and you must demonstrate compliance with all applicable limits.

8. Documentation of scrubber operating conditions during testing is required as operating restrictions may be set.

9. The Company must give the MPCA a minimum of two weeks notification before the proposed test date to ensure the Agency can witness the test.

Please refer to the January 25, 1994, Notice of Violation for other applicable requirements and timelines. These provisions are modifications to the test plan, and are to be incorporated into the proposed test with any other changes discussed at the follow up meeting before testing. Please contact Craig at (612)297-8301 to schedule your follow up meeting with him.

Copies of the Certifications Required For Performance Test Reports, and Microfiche Submittal forms are enclosed. The Asphalt Plant Operating Conditions During Stack Testing is part of the test plan, and is provided as part of this letter.

These forms will help you to comply with the submittal requirements of Minn. Rules pt. 7017.2035 and 7017.2040. A copy of the test plan, including the test plan approval letter, must be included as part of the performance test report.

Remember, it is not the Testing Consultant's responsibility to submit the Company report or microfiche or to certify that the microfiche submitted is an exact copy of the original test report by the deadlines specified in the applicable compliance document (i.e., Permit, Stipulation Agreement, Administrative Penalty Order, etc.). The responsibility for these submittals lies solely with the Company.

If you have any questions or comments on the content of this letter, please contact me at (612)296-8374.

Sincerely,

Yolanda Hernandez

Yolanda Hernandez
Performance Test Coordinator
Compliance Determination Unit
Compliance and Enforcement Section
Air Quality Division

YH:jmr

Enclosures

cc: Julie Hendricks, MPCA Brainerd Regional Office
Mary Jean Fenske, AQD
AQD File No. 1933

mnt environmental services, inc.

November 5, 1993

Ms. Yolanda Hernandez
Air Quality Division
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155

Re: Intent-to-Test Notification - Mid-Minnesota Hot Mix, Inc.

Dear Yolanda:

Enclosed is the proposed test plan for Mid-Minnesota Hot Mix, Inc., Annandale, Minnesota. The pre-test meeting is set for 9:00 AM, Monday, November 15, 1993. The test itself will not be performed until sometime after the start of the 1994 paving season.

Please contact either David Ferrell of Mid-Minnesota Hot Mix, Inc. (612-274-3037) or myself (483-9595) if you have any questions or comments.

Sincerely,

Alan L. Trowbridge

Alan L. Trowbridge
Director of Technical Services

enclosure
cc: David Ferrell, Mid-Minnesota Hot Mix, Inc.

4610 N. Churchill St. • St. Paul, MN 55126-5892 • 612 / 483-9595 • FAX 612 / 483-2699

mmt environmental services, inc.

SOURCE EMISSION COMPLIANCE TEST
MMT TEST PLAN #10026 (DRAFT)

November 5, 1993

Spring Pre-test Meeting with Annette Elliott

1) GENERAL INFORMATION

A: Client: ..... Mid-Minnesota Hot Mix, Inc.
P.O. Box 239
Annandale, MN 55302

B: Client contact person: ..... David Ferrell
Phone: (612) 274-3037 Fax: (612) 274-2033

C: Regulatory agency: ..... Minnesota Pollution Control Agency
Air Quality Division
520 Lafayette Road
St. Paul, MN 55155

D: Regulatory agency contact person: ..... Yolanda Hernandez
Phone: (612) 296-8374 Fax: (612) 297-7709

E: Regulatory agency file/permit number:: 1933

F: Pre-test meeting: ..... Monday, November 15, 1993, 9:00 AM

G: Test plan prepared by: ..... Alan Trowbridge
MMT Environmental Services, Inc.
4610 N. Churchill Street, St. Paul, MN 55126-5892
Phone: (612) 483-9595 Fax: (612) 483-2699

2) SOURCES

This test plan is applicable to the following source located at the above facility:

Scrubber on asphalt plant aggregate drum mixer

3) PROCESS UNIT INFORMATION

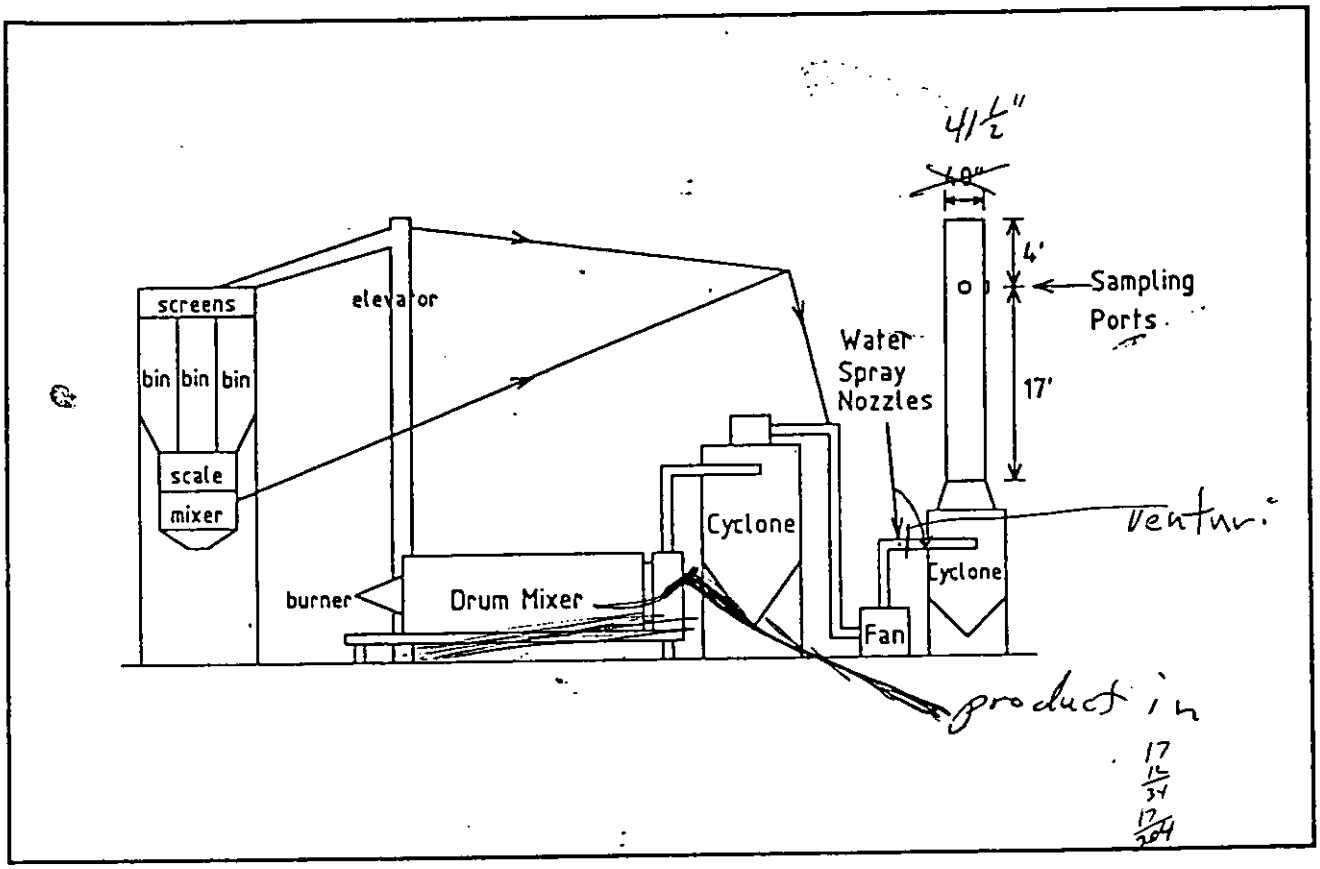
The information in this section applies to each of the sources listed in section 2.

A: Pollutants to be Quantified: ..... Particulates and opacity
B: Applicable Regulations: ..... Minn Rule 7005.2010
C: Special averaging times: ..... none
D: Steady-state or batch operation: ..... continuous batch
E: Type of pollution control equipment: ..... scrubber
F: Reason for testing: ..... compliance demonstration
G: Is this test for initial compliance demonstration: ..... yes
H: Is this a NSPS source ..... No
I: Testing Schedule: ..... Spring, 1994 — May, 94
J: Testing Firm: ..... MMT Environmental Services, Inc.
K: Regulatory agency personnel to witness the test: ..... to be determined

4) EMISSION POINT INFORMATION

Sampling is scheduled to be performed in the 40" diameter exhaust stack. Figure 1 presents a schematic of the process and the proposed sampling port location.

Figure 1: Process and sampling site schematic



5) TEST PLAN (Asphalt Plant Drum Mixer with Wet Scrubber)

A: The process equipment, pollution control equipment and all related equipment must be operated by the facilities regular operators using their normal operating procedures.

B: Process Operating Conditions Under Which Test is to be Conducted

1) Process rates;
   - Virgin aggregate, tph: 141
   - Recycled material, tph: ..... N/A
   - Asphalt, tph: 9
   - Total, tph: 150

2) Component moisture content:
   - Virgin aggregate, % moisture: 4
   - Recycled material, % moisture: ..... N/A

3) Fuels used: ..... ~~Waste oil~~ Used Oil
4) Fuel usage rates: ..... 1.5 gallons per ton
5) Burner setting, %: .....
6) Drum mix temperature, °F: .....
7) Special conditions: .....

C: Scrubber Operating Conditions Under Which Test is to be Conducted

1) Pressure drop across scrubber, in WC: 4.5
2) Scrubbing solution: ..... water
3) Quantity of solution recycled, %: 100
4) Solution flow rate, gpm: 80
5) Solution delivery pressure, psi: 70
6) Special conditions: .....

D: Operating data to be recorded during the test period

1) Operating conditions of the process being tested and its associated pollution control equipment must be documented in the test report. The data must be collected by plant personnel and must be signed/certified by a responsible party. The regulator agency may reject any test report submitted without complete documentation of the process conditions during the test period. General documentation requirements include:
   a) Record keeping of operational parameters as measured during the entire test period. For continuous recorders, provide properly labeled copies of strip charts. For discrete data, provide data taken at intervals of no greater than 15 minutes.
   b) Calculations.
   c) Certification of the data by a responsible representative of the plant.
   d) Brief explanation of how the parameters are measured. Indicate if it is a routine measurement, or a special procedure followed for purposes of the test only.

2) Specific parameters which must be documented:
   a) Process operating parameters; including those listed in paragraph 5B above.
   b) Control equipment operating parameters; including those listed in paragraph 5C above.
   c) Strip charts from any/all continuous emission monitors.
   d) Include a description of the most recent maintenance/cleaning to the process and pollution control system and note how frequently such cleaning is required. A frequency of cleaning schedule may be included as a permit condition.

3) Required regulatory agency forms form must be completed, signed and included in the test report.
   a) MPCA "Asphalt Plant Operating Condition During Stack Testing" form

E: Fuel Sample Analysis

A fuel analysis may be required as part of the compliance demonstration program. If such an analysis is required, then the following procedures must be followed and the subsequent analytical results must be included in the compliance test report.

1) Fuel Sample Collection: Fuel samples are to be collected during each particulate test run. In order to be representative of the fuel burned at the time of the test, the fuel samples must be collected as close to the burner as possible. The samples should be collected per ASTM or other recognized methodologies.

2) Fuel Sample Analysis: Sample analysis must be performed per ASTM or other methodologies required by the regulatory agency. The individual fuel samples are to be combined together into a single composite sample which is to be analyzed for:
   a) Gross heating value, BTU/gal or BTU/lb
   b) Sulfur, percent by weight
   c) Ash, percent by weight
   d) Moisture content, percent by weight
   e) If fuel is used/waste oil, then analysis for the following must also be included:
      Lead, percent by weight
      Polychlorinated biphenyls (PCBs), ppm by weight
      Organic halogens, percent by weight
      Acidity, pH
   f) Other

F: Raw Material Moisture Content Determination

Aggregate and recycled material (if applicable) moisture content determinations are required as part of the compliance demonstration program. The following procedures must be followed and the subsequent analytical results must be included in the compliance test report.

1) Sampling Procedure: One composite sample is to be collected during each particulate test run. Take two samples of raw material or product during each test run. In order to be representative of the material processed during the test period, the samples must be collected as close to the process as possible. For each particulate test run, mix the two individual samples into a single composite.

2) Analysis - Each composite sample is to be analyzed for moisture content per ASTM or other recognized methodologies.

6) STACK TESTING PROTOCOL

The following test methodology applies to each source listed in section 2.

A: EPA Method 1 for the location of sampling ports and sampling points. Location of the sampling ports must be approved by the MPCA before the test.

A check for cyclonic flow must be done whenever there is a cyclonic type of device directly upstream of the sampling location. The check must be performed even if flow straightening vanes have been installed.

B: EPA Method 2 for velocity and volumetric flow rate determination. Three (3) test runs are required; one concurrent with each EPA Method 5 particulate emission test run.

C: EPA Method 3 for gas analysis (CO_2 & O_2). Three (3) determinations are required; one integrated sample concurrent with each EPA Method 5 particulate emission test run.

D: EPA Method 4 for determination of moisture in the flue gases. Three (3) test runs are required; one concurrent with each EPA Method 5 particulate emission test run.

E: EPA Method 5 as amended in MPCA Exhibit C and Minnesota Rule 7005.0500 for the determination of particulate matter emissions. Three (3) one-hour test runs are required. Each run must represent a minimum sample volume of 30 dry standard cubic feet.

F: EPA Method 9 as amended in Minnesota Rule 7005.1860 for the determination of visible emissions. Normally one (1) sixty-minute test is required. However, for NSPS sources, three (3) sixty-minute tests are required if the purpose is to demonstrate initial compliance. Except as noted below, the test(s) must be performed concurrent with one (or all three) of the EPA Method 5 particulate emission test runs.

Note: Weather conditions may make it impossible to perform the visible emission test concurrent with a particulate test. If such circumstances exist, the visible emission test will be rescheduled for a later time/date and will be performed at similar load conditions.

60 min opacity

Don Bern