APPENDIX K/ST

OEPA Stack Test Review Summary Form

COMPANY NAME Barrett Paving Materials

COUNTY Miami DATE SENT

PREMISE/ SOURCE NO. 0855140230 SCC CODE

SOURCE DESCRIPTION Asphaltic Batch Plant #128 (Spec. Oil & RAP)

CONTROL EQUIPMENT cyclone & venturi wet wash system

MONITORING EQUIPMENT (CEM) —

TEST FIRM Hayden Env. Group DATE(S) OF TEST 6/8/94

FINAL TEST REPORT RECEIVED ON

POLLUTANT(S) TESTED PM & Lead

AUDIT SAMPLE SUBMITTED (please circle): YES or (NO) (if yes) PASSED or FAILED

EMISSION RATES*: OPERATING RATES*:

ACTUAL** 5.82 #/Hr. MAXIMUM** 240 TPH

ALLOWABLE** 60.5 #/Hr. DURING TEST PERIOD** 224.3 TPH

TEST RESULTS: (PASSED) or FAILED or RETEST

WERE ALL THE RUNS WITNESSED BY THE OEPA/ LOCAL INSPECTOR(S) (YES) or NO
IF NO, THEN EXPLAIN UNDER COMMENTS:

COMMENTS:

I HEREBY VERIFY THAT THE INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSES, AND CALCULATIONS ARE:

[X] AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY

[ ] AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY

8/31/94
Date of Review

Kelley W. Adams
Reviewed by

* Based on three run averages
** Specify applicable units

7/22/93

CONTACT REPORT

FACILITY: Barrett Paving Materials, Inc.
Asphalt Batch Plant No.138 - Troy, Ohio

PREMISES No.: 0855140230 (PTI:08-1773)

FACILITY CONTACT: Chris Zeihler, District Manager

RAPCA REPRESENTATIVES: Brian Fenner & Jon Hilty

DATE: June 8, 1994

RE: Performance Test on Air Contaminant Source: P901

The purpose of this visit was to determine compliance with OEPA particulate and lead emissions evaluation on their batch asphalt plant located in Troy, Ohio. Hayden Environmental Group, Inc. conducted the compliance emission test on the venturi wetwash system's stack using USEPA RM 5 and RM 12 for stationary source sampling. This was a standard test consisting of three one hour runs. Due to the lack of asphalt sales during the test, run number 2 and 3 were all dry runs. This means that there was no asphalt product added to the aggregate.

RUN No.1 may have been affected by malfunctioning control equipment. The scrubber drain MIGHT have clogged up, thus resulting in water droplets being thrown out of the stack by the fan. The sampling probe was not sheathed and MIGHT have resulted in moisture condensing inside the probe, thus flooding the filter. The reported moisture results should be examined in light of this information in order to determine the validity of this run.

RUN No.2 had a anisokinetic reading at 88%, thus being low. Because this reading is low, the reported mass rate would be higher than actual. At Jon Hilty's request Hayden recovered the probe and nozzle from the sampler. The appearance of the filter probe rinse indicated that this facility would probably be in compliance. Because the isokinetic result was low followed by an apparent low PM catch, Run No. 2 was considered valid.

RUN No.3 had no apparent problems during or after the run.

USEPA RM 9 was documented for each of the three runs. They are attached to this report. This Barrett facility burns waste-oil. During the test a composite

sample of waste oil was collected to be analyzed for the proper permit specifications. Also attached are the process parameters and data collected during the test. They are as follows:

	RUN No.1 (Asphalt Run)	RUN No.2 (Dry Run)	RUN No.3 (Dry Run)
START:	09:17	12:19	15:27
STOP:	10:46	13:49	16:04**
BATCH PROCESS: RATE (TPH)	226.66	194.17	252.0
PRESSURE DROP: avg. (" H_2O)	0.14	0.12	0.13
OVEN TEMP: (°F)	320.0	306.0	324.0

** this is the time that I left. The test continued until 16:44.

There were no other problems noted during the test.

Brian A. Fenner
RAPCA
August 26, 1994

RUN #1

RAPCA

HOT-MIX
ASPHALT PLANT
INSPECTION FORM

Facility Name Barrett Paving Premises # 0855140230

Contact Person Chris Zichler Phone _____

Location Troy Plant No. 138

Inspector(s) Brian Fenner Date of Inspection 6-8-94

Jon Hilty Portable: _____ Yes _____ No

Production Type: Continuous Mix _____ Batch X Drum Mix _____

Rated Capacity 240 TPH Date of Inspection 90% @ 216 TPH

Annual Production Limitation:

_____ None 110,000 TPY Projected TPY: _____

Fuel Type(s) WASTE OIL #4

Fuel burned during inspection SAME

If fuel(s) analyses recordkeeping is required by Permit Ts & Cs, are these records accessible ____ Yes ____ No; Current ____ Yes ____ No; Complete _____ Yes _____ No; Do they demonstrate compliance with limitations _____ Yes _____ No

Asphalt Cement Type: Conventional X RAP X

Type during inspection conventional

Control Equipment Type:

☐ Baghouse:

Pressure Drop _____ Max (before shutdown and correction action) _____ Day of Inspection

How is pressure drop measured? _____

Total Number of bags _____

How often are they checked? _____

Last time bags replaced _____ No. of Bags Replaced _____

Run #2

RAPCA

HOT-MIX
ASPHALT PLANT
INSPECTION FORM

Facility Name Barrett Paving Premises # 0855140280

Contact Person Chris Zielke Phone _____

Location Troy - Plant No. 138

Inspector(s) Brian Fenner Date of Inspection 6-8-94

Jon Hilty Portable: _____ Yes _____ No

Production Type: Continuous Mix _____ Batch X Drum Mix _____

Rated Capacity 240 TPH Date of Inspection 90% @ 216 TPH

Annual Production Limitation: _____ None 110,000 TPY Projected TPY: _____

Fuel Type(s) WASTE OIL #4

Fuel burned during inspection SAME

If fuel(s) analyses recordkeeping is required by Permit Ts & Cs, are these records accessible ____ Yes ____ No; Current ____ Yes ____ No; Complete _____ Yes _____ No; Do they demonstrate compliance with limitations _____ Yes _____ No

Asphalt Cement Type: Conventional X RAP X

Type during inspection conventional (Dry Run!)

Control Equipment Type:

☐ Baghouse:

Pressure Drop _____ Max (before shutdown and correction action) _____ Day of Inspection

How is pressure drop measured? _____

Total Number of bags _____

How often are they checked? _____

Last time bags replaced _____ No. of Bags Replaced _____

Run #3

RAPCA

HOT-MIX
ASPHALT PLANT
INSPECTION FORM

Facility Name Barrett Paving Premises # 0855140230

Contact Person Chris Zielden Phone _____

Location Troy Plant No. 138

Inspector(s) Brian Penner Date of Inspection 6-8-94

Jon Hilty Portable: ____ Yes X No

Production Type: Continuous Mix ____ Batch X Drum Mix ____

Rated Capacity 240 TPH Date of Inspection 90% @ 216 TPH

Annual Production Limitation:

____ None 110,000 TPY Projected TPY: ____

Fuel Type(s) WASTE OIL #4

Fuel burned during inspection SAME

If fuel(s) analyses recordkeeping is required by Permit Ts & Cs, are these records accessible ____ Yes ____ No; Current ____ Yes ____ No; Complete ____ Yes ____ No; Do they demonstrate compliance with limitations ____ Yes ____ No

Asphalt Cement Type: Conventional X RAP X

Type during inspection conventional (Dry Run)

Control Equipment Type:

☐ Baghouse:

Pressure Drop _____ Max (before shutdown and correction action) _____ Day of Inspection

How is pressure drop measured? _____

Total Number of bags _____

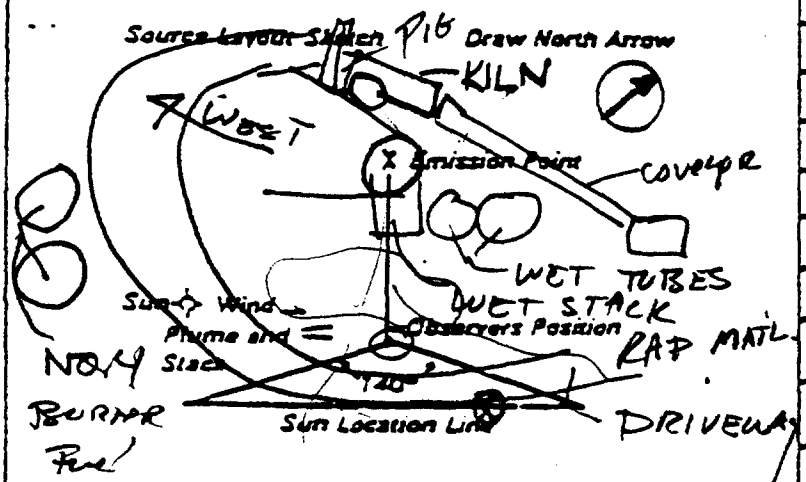
How often are they checked? _____

Last time bags replaced _____ No. of Bags Replaced ____

RUN #1

Visible Emission Observation Form

SOURCE NAME: Barrett Paving/Plant 188	OBSERVATION DATE: 6-8-94
ADDRESS: 803 South Union Street	START TIME: 09 34
CITY: Troy	STOP TIME: 09:52
STATE: OH	ZIP: 45373
PHONE: 339-4013	SOURCE ID NUMBER: P901
PROCESS EQUIPMENT: Batch Asphalt Plant	OPERATING MODE: IN
CONTROL EQUIPMENT: WET SCRUBBER	OPERATING MODE: IN
DESCRIBE EMISSION POINT: START Wet Scrubber Stack STOP Lg. Round Stack	
HEIGHT ABOVE GROUND LEVEL: START ~20' STOP SAME	HEIGHT RELATIVE TO OBSERVER: START ~20' STOP SAME
DISTANCE FROM OBSERVER: START ~50 Ft STOP SAME	DIRECTION FROM OBSERVER: START NW STOP SAME
DESCRIBE EMISSIONS: START N/A STOP N/A	
EMISSION COLOR: START white STOP SAME	PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☐ YES ☒	IF WATER DROPLET PLUME: ATTACHED ☒ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START End of dissipation STOP SAME	
DESCRIBE BACKGROUND: START Sky STOP SAME	
BACKGROUND COLOR: START Gray/Blue STOP SAME	SKY CONDITIONS: START Cloudy STOP SAME
WIND SPEED: START ~5-17 MPH STOP SAME	WIND DIRECTION: START NE STOP SAME
AMBIENT TEMP. START ~60° F STOP SAME	WET BULB TEMP. — RH percent —



SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
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2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
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10	0	0	0	0	40				
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13	0	0	0	0	43				
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16	0	0	0	0	46				
17	0	0	0	0	47				
18	0	0	0	0	48				
19					49				
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26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY FOR HIGHEST PERIOD: 0

NUMBER OF READINGS ABOVE: 0 % WERE 0

RANGE OF OPACITY READINGS: 0 MINIMUM, 0 MAXIMUM

OBSERVER'S NAME (PRINT): BRIAN FENNER

COMMENTS: RUN #1 - WET SCRUBBER

OBSERVER'S SIGNATURE: Brian Fenner

DATE: 6-8-94

ORGANIZATION: RAPCA - OEFA

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE

CERTIFIED BY: EFA

DATE: 8/94

Visible Emission Observation Form

Run #2

SOURCE NAME: Barrett Paving
ADDRESS: 803 South Union St.
CITY: Troy
STATE: OH
ZIP: 45373
PHONE: 339-4017
SOURCE ID NUMBER: 7901
PROCESS EQUIPMENT: Batch Asphalt Plant
OPERATING MODE: IN
CONTROL EQUIPMENT: wet scrubber
OPERATING MODE: IN
DESCRIBE EMISSION POINT: START Scrubber/wet STOP SAME
HEIGHT ABOVE GROUND LEVEL: START ~30 ft STOP SAME
HEIGHT RELATIVE TO OBSERVER: START ~30 STOP SAME
DISTANCE FROM OBSERVER: START 40 ft STOP Same
DIRECTION FROM OBSERVER: START NW STOP SAME
DESCRIBE EMISSIONS: START ~~Light~~ STOP N/A
EMISSION COLOR: START white STOP SAME
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☑ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☐ YES ☑
IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START dissipation STOP SAME
DESCRIBE BACKGROUND: START Grey (Sky) STOP SAME
BACKGROUND COLOR: START Grey STOP SAME
SKY CONDITIONS: START Partly STOP SAME
WIND SPEED: START ~10-20 STOP SAME
WIND DIRECTION: START NE STOP SAME
AMBIENT TEMP: START ~70°F STOP SAME
WET BULB TEMP.: —
RH percent: —

OBSERVATION DATE: 6-9-94
START TIME: 13:27
STOP TIME: 13:45

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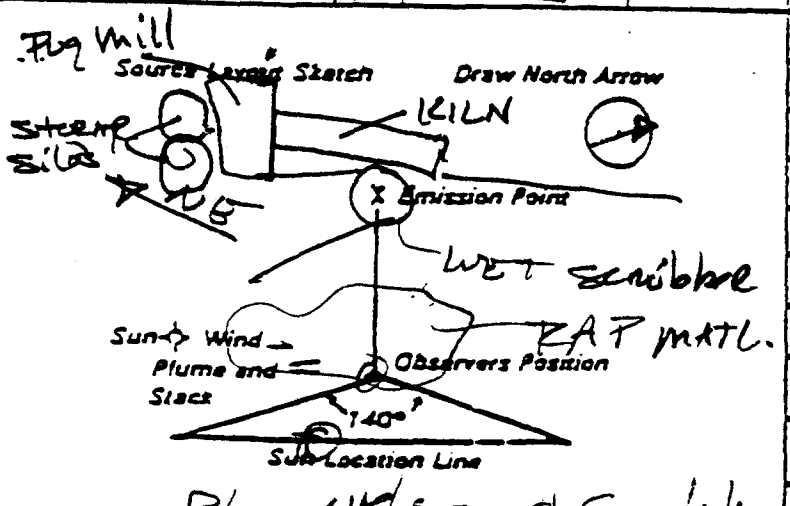
26					56				
27					57				
28					58				
29					59				
30					60				



Plume width ~30 ft from stack

AVERAGE OPACITY FOR HIGHEST PERIOD: 0
NUMBER OF READINGS ABOVE: 0 % WERE 0
RANGE OF OPACITY READINGS: 0 MINIMUM, 0 MAXIMUM
OBSERVER'S NAME (PRINT): TERIAN FENNER
OBSERVER'S SIGNATURE: Terian Fenner
DATE: 6-10-94
ORGANIZATION: RAPCA - OEPA

COMMENTS: Run # 2 - Dry Batch

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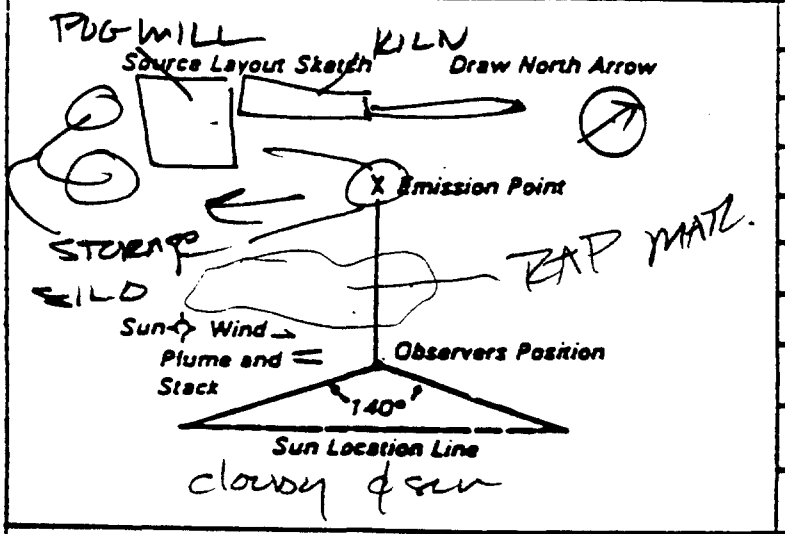
SIGNATURE

CERTIFIED BY: ETA
DATE: 3/94

Visible Emission Observation Form

SOURCE NAME: Barrett Paving
ADDRESS: 803 South Union St
CITY: Troy | STATE: OH | ZIP: 45373
PHONE: 339-4013 | SOURCE ID NUMBER: 0901
PROCESS EQUIPMENT: Batch Asphalt Plt. | OPERATING MODE: P901
CONTROL EQUIPMENT: Wet Scrubber | OPERATING MODE: IN
DESCRIBE EMISSION POINT: START Wet scrubber STOP Same
HEIGHT ABOVE GROUND LEVEL: START ~50 ft STOP Same | HEIGHT RELATIVE TO OBSERVER: START ~30' STOP Same
DISTANCE FROM OBSERVER: START ~50 ft STOP Same | DIRECTION FROM OBSERVER: START NW STOP NW
DESCRIBE EMISSIONS: START N/A STOP N/A
EMISSION COLOR: START White STOP Same | PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☑ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☐ YES ☑ | IF WATER DROPLET PLUME: ATTACHED ☑ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START After dissipation STOP Same
DESCRIBE BACKGROUND: START Sky STOP Same
BACKGROUND COLOR: START Grey STOP Same | SKY CONDITIONS: START Cloudy STOP Same
WIND SPEED: START 5-15 mph STOP Same | WIND DIRECTION: START NE STOP Same
AMBIENT TEMP: START ~68° F STOP Same | WET BULB TEMP. — | RH, percent —



OBSERVATION DATE: 6-8-94 | START TIME: 15:42 | STOP TIME: 15:54

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
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2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
5	0	0	0	0	35				
6	0	0	0	0	36				
7	0	0	0	0	37				
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13					43				
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25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

AVERAGE OPACITY FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE: 0 % WERE 0
RANGE OF OPACITY READINGS: 0 MINIMUM | 0 MAXIMUM
OBSERVER'S NAME (PRINT): Brian A. Fenner
OBSERVER'S SIGNATURE: [signature] | DATE: 6-8-94
ORGANIZATION: MVAPCA-DEPA

COMMENTS: Run #3 — Dry Batch Run

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

CERTIFIED BY: OTA | DATE: 3/94
VERIFIED BY | DATE

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PARTICULATE EMISSION TEST DATA

FACILITY :BARRETT PAVING - TROY
PROCESS/RUN NUMBER :
SOURCE/RUN :1
TEST DATE :6/8/94

****

VOLUME METERED AT STD. CONDITIONS = 38.79782752422526 DSCF

VOLUME WATER COLLECTED AT STP. = 3.403160999999999 SCF
PERCENT MOISTURE BY VOLUME = 8.064173658032756 %

MOLECULAR WEIGHT OF STACK GAS = 28.26003821976355 LB/LB-MOL
PERCENT EXCESS AIR = 412.6213592233008 %

AVERAGE STACK GAS VELOCITY = 8.523608415692628 FT/SEC
ABSOLUTE STACK PRESSURE = 29.31632352941176 IN. HG

STACK FLOW RATE AT ACTUAL COND. = 19212.90207653117 ACFM
STACK FLOW RATE AT STD. COND. = 15713.9554267665 DSCFM

STACK EMISSIONS = 4.421793975265262E-002 GR/DSCF 4.42 ~
= 6.318743590654059E-006 LB/DSCF

STACK EMISSION RATE = 5.957547308202263 LB/HR 5.90 ~

ISOKINETIC VARIATION = 91.98955465071464 % 92.9 ~

****

TIME OF TEST = 77 MIN
VOLUME METERED = 38.759 CU.FT
DRY GAS METER CALB. FACT. = 1.0241
TEST BAR. PRESSURE = 29.32 IN HG
AVERAGE DELTA H = .95
AVG. METER TEMP. = 70.40000000000001 DEG. F
VOL. H2O (IMPINGERS) = 65.09999999999999 ML
WEIGHT GAIN OF SILICA GEL = 7.2 GM
%CO2 = 3 %
%CO = 0 %
%O2 = 17 %
%N2 = 80 %
STATIC P OF STACK =-5E-002 IN. H2O
STACK TEMP. = 121.3 DEG. F
PITOT COEFFICIENT = .84
AVG. ROOT DELTA P = .1417
STACK DIAMETER = 83 IN.
MASS PARTICULATE = 111.4 MG
NOZZLE DIAMETER = .49 IN
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PARTICULATE EMISSION TEST DATA

FACILITY :BARRETT PAVING - TROY
PROCESS/RUN NUMBER :
SOURCE/RUN :2
TEST DATE :6/8/94

****

VOLUME METERED AT STD. CONDITIONS = 48.63113676244509 DSCF

VOLUME WATER COLLECTED AT STP. = 3.327849 SCF
PERCENT MOISTURE BY VOLUME = 6.404761276932588 %

MOLECULAR WEIGHT OF STACK GAS = 28.46020387969002 LB/LB-MOL
PERCENT EXCESS AIR = 320.6650831353918 %

AVERAGE STACK GAS VELOCITY = 11.06911634262853 FT/SEC
ABSOLUTE STACK PRESSURE = 29.37558823529412 IN. HG

STACK FLOW RATE AT ACTUAL COND. = 24950.68262088519 ACFM
STACK FLOW RATE AT STD. COND. = 21030.59129363462 DSCFM

STACK EMISSIONS = 2.286354122115933E-002 GR/DSCF 2.29
= 3.267200040503668E-006 LB/DSCF

STACK EMISSION RATE = 4.122668923582747 LB/HR 4.13

ISOKINETIC VARIATION = 88.48878552934067 % 88.43

****

TIME OF TEST = 72 MIN
VOLUME METERED = 48.334 CU.FT
DRY GAS METER CALB. FACT. = 1.0241
TEST BAR. PRESSURE = 29.38 IN HG
AVERAGE DELTA H = 1.81
AVG. METER TEMP. = 69.90000000000001 DEG. F
VOL. H2O (IMPINGERS) = 61.6 ML
WEIGHT GAIN OF SILICA GEL = 9.1 GM
%CO2 = 3.3 %
%CO = 0 %
%O2 = 16.2 %
%N2 = 80.5 %
STATIC P OF STACK =-6E-002 IN. H2O
STACK TEMP. = 115.4 DEG. F
PITOT COEFFICIENT = .84
AVG. ROOT DELTA P = .1858
STACK DIAMETER = 83 IN.
MASS PARTICULATE = 72.2 MG
NOZZLE DIAMETER = .5 IN
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PARTICULATE EMISSION TEST DATA

FACILITY :BARRETT PAVING - TROY
PROCESS/RUN NUMBER :
SOURCE/RUN :3
TEST DATE :6/8/94

****

VOLUME METERED AT STD. CONDITIONS = 50.26110138068599 DSCF

VOLUME WATER COLLECTED AT STP. = 6.090858 SCF
PERCENT MOISTURE BY VOLUME = 10.80860021007109 %

MOLECULAR WEIGHT OF STACK GAS = 27.95376021655607 LB/LB-MOL
PERCENT EXCESS AIR = 412.6213592233008 %

AVERAGE STACK GAS VELOCITY = 13.09341967104217 FT/SEC
ABSOLUTE STACK PRESSURE = 29.37264705882353 IN. HG

STACK FLOW RATE AT ACTUAL COND. = 29513.62588683847 ACFM
STACK FLOW RATE AT STD. COND. = 23529.15825477613 DSCFM

STACK EMISSIONS = 3.676799650693961E-002 GR/DSCF 3.68
= 5.25414670084167E-006 LB/DSCF

STACK EMISSION RATE = 7.417538953074814 LB/HR 7.42

ISOKINETIC VARIATION = 99.28049155474852 % 99.33

****

TIME OF TEST = 60 MIN
VOLUME METERED = 49.89 CU.FT
DRY GAS METER CALB. FACT. = 1.0241
TEST BAR. PRESSURE = 29.38 IN HG
AVERAGE DELTA H = 2.78
AVG. METER TEMP. = 70.5 DEG. F
VOL. H2O (IMPINGERS) = 116.5 ML
WEIGHT GAIN OF SILICA GEL = 12.9 GM
%CO2 = 3 %
%CO = 0 %
%O2 = 17 %
%N2 = 80 %
STATIC P OF STACK =-.1 IN. H2O
STACK TEMP. = 119.67 DEG. F
PITOT COEFFICIENT = .84
AVG. ROOT DELTA P = .217
STACK DIAMETER = 83 IN.
MASS PARTICULATE = 120 MG
NOZZLE DIAMETER = .497 IN
****

PARTICULATE EMISSION TEST REVIEW SHEET

1. Facility Name: [illegible] LOVING [illegible]
2. Run Number: 1 2 3
3. Test Date: [illegible]
4. Time of Test: 71 72 60 (min)
5. Volume Metered: 38.759 48.334 [illegible] (ft^3)
6. Dry Gas Meter Calb. Factor: .0241
7. Test Barometric Pressure: [illegible] [illegible] [illegible] (in. Hg)
8. Avg. Delta H: [illegible] 1.81 [illegible] (in. H_2O)
9. Avg. Meter Temp: 70.4 [illegible] 70.5 (Deg. F)
10. Volume H_2O (Impingers): 65.1 61.6 116.5 (ML)
11. Weight Gain of Silica Gel: 7.2 9.1 [illegible] (GM)
12. % CO_2: 3 3.3 3
13. % CO: 0 0 0
14. % O_2: 17 16.2 17
15. % N_2: [illegible] 20.5 [illegible]
16. Static Pressure of Stack: -.05 -0.06 [illegible] (in. H_2O)
17. Stack Temp: 121.3 115.4 [illegible] (Deg. F)
18. Pitot Coefficient: 0.84
19. Avg. Root Delta P: [illegible] 0.1858 [illegible]
20. Stack Diameter: 83" (in.)
21. Mass Particulate: 111.4 [illegible] [illegible] (mg)
22. Nozzle Diameter: [illegible] 0.42 [illegible] (in.)

Coal Data

1. % Hydrogen: _____
2. % Carbon: _____
3. % Sulfur: _____
4. % Nitrogen: _____
5. % Oxygen: _____
6. F Factor: _____
7. Gross Calorific Value: _____

9-15-94 per log

COMPLIANCE EMISSIONS TEST REPORT
DETERMINATION OF
FILTERABLE PARTICULATE AND LEAD EMISSIONS
FROM ASPHALT PLANT
BARRETT PAVING MATERIALS,INCORPORATED
TROY, OHIO

prepared for

BARRETT PAVING MATERIALS, INC.
727 East Ash Street
P.O. Box 1458
Piqua, Ohio 45356

prepared by

HAYDEN ENVIRONMENTAL GROUP, INC.
561 Congress Park Drive
Dayton, Ohio 45459

Dale L. Davidson (BS)
Written By
Dale L. Davidson
Environmental Engineer
Emissions Measurement Division

Bruce A. Sarven
Reviewed By
Bruce A. Sarven
Project Manager
Emissions Measurement Division

June 30, 1994
P.N. 266.008

EXECUTIVE SUMMARY

Hayden Environmental Group, Incorporated was retained by the Barrett Paving Materials, Incorporated to perform a compliance filterable particulate and lead emissions evaluation on their batch asphalt plant located in Troy, Ohio. The evaluation was performed to demonstrate compliance with Ohio Environmental Protection Agency regulations restricting air emissions from stationary sources. Emission samples were collected from the baghouse outlet stack using USEPA Reference Methods for stationary source sampling. The tests were conducted on June 8, 1994. The results of the evaluation are summarized below.

Summary of Emissions

Run No.	Particulate Emission Rate	Lead Emission Rate
	(lb/hr)[a]	(lb/hr)[a]
1	5.90	2.72E-03
2	4.13	7.38E-04
3	7.42	5.75E-04
Average	5.82	1.34E-03

[a] pounds per hour

TABLE OF CONTENTS

1.0 INTRODUCTION

Hayden Environmental Group, Incorporated (Hayden) was contracted by Barrett Paving Materials, Incorporated (Barrett) to perform a compliance emissions evaluation to determine the filterable particulate and lead (Pb) emissions from their batch asphalt plant located in Troy, Ohio. Emission samples were collected and stack gas parameters measured at the outlet stack of the baghouse. A composite waste fuel oil sample was collected and analyzed for arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), total halogens, polychlorinated biphenyls (PCBs), flash point, and heat content.

Testing was performed on Wednesday June 8, 1994. Triplicate tests were performed using USEPA Reference Methods 1, 2, 3, 4, 5, and 12. The emissions testing was performed by the Hayden test team of Messrs. Dale Davidson and Bert Forsyth. Messrs. James Meckstroth and Joe Callahan of Barrett coordinated test schedules with plant production and operations. Messrs. John Hilty and Brian Fenner from the Regional Air Pollution Control Agency (RAPCA) were on site to verify process conditions and witness test procedures. Analyses of the emissions and fuel oil samples were performed by Hayden Laboratories located in Miamisburg, Ohio.

2.0 PROCESS AND SAMPLING SITE DESCRIPTION

Barrett produces asphaltic paving materials at their batch mix asphalt plant located in Troy, Ohio. The plant was manufactured by Madson and rated for a maximum production of approximately 300 tons per hour and typically operated at 220-240 tons per hour.

In the asphalt production process, raw aggregate of various sizes and proportions are fed from four (4) storage bins into an oil fired rotary drum kiln where it is heated, mixed and dried. The dried material is re-sized by a vibrating screen deck and batched by weight into a pugmill mixer where asphaltic cement is added. Recycled asphalt can also be added into the pugmill. The finished product is loaded into a truck or one of two storage silos, one with a capacity of 190 tons and the other 90 tons. The drum kiln can be fired with either #4 diesel fuel or waste oil.

Exhaust emissions from the drum kiln are ducted through an emissions control system consisting of a primary cyclone followed by a venturi wetwash system. The exhaust gases from the wetwash system are vented to the atmosphere through a circular stack approximately 25 feet tall. A simplified diagram of the process and emissions control system is included in Figure 2.1.

Emissions sampling and testing were performed from two 90 degree opposing sampling ports located on the baghouse outlet stack. The sampling ports were located approximately 160 inches (1.93 stack diameters) downstream and 83 inches (0.85 stack diameters) upstream from the nearest disturbances. Twenty-four sampling and velocity traverse points, 12 per port, were utilized. A simplified diagram of the sampling site is shown in Figure 2.2.

The drum kiln was fired with used burner fuel during the emissions testing. Production rates and process operating conditions were monitored and recorded by Barrett personnel. A summary of the production rates during testing is shown in Table A.1 and included in Appendix A.

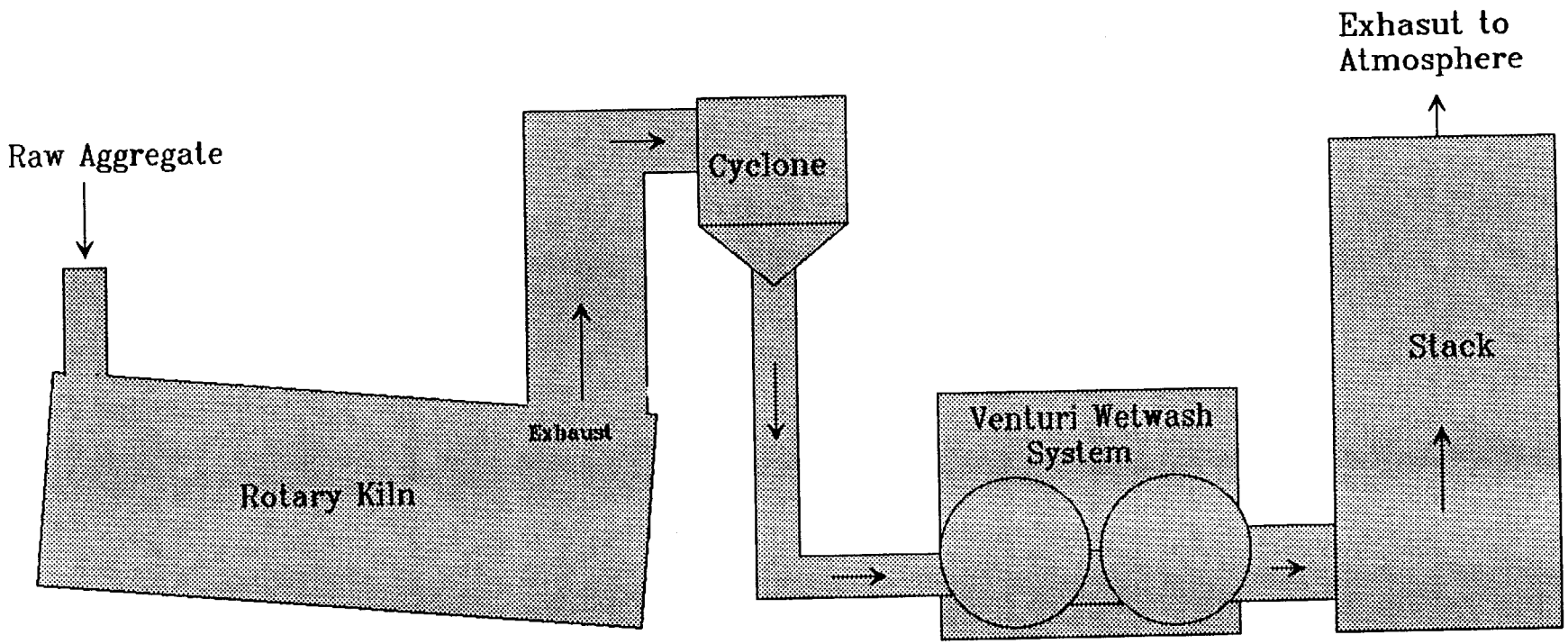

Figure 2.1 Process Diagram

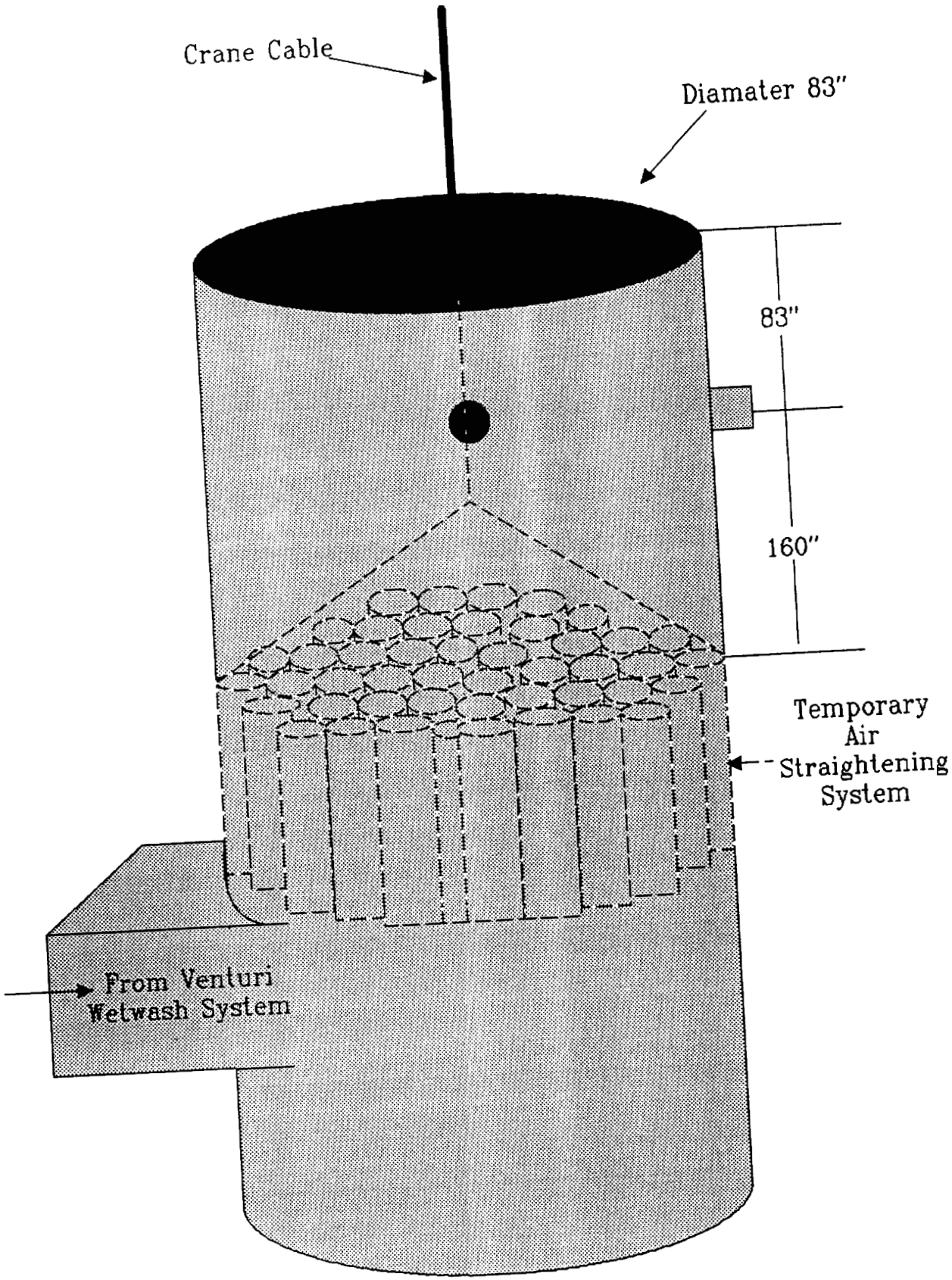

Figure 2.2. Sampling Site Detail

3.0 SAMPLING AND ANALYTICAL PROCEDURES

The sampling and analytical procedures used were performed in general conformance to the most recent revisions of the USEPA Reference Methods for stationary sources. A brief description of each procedure used is included below:

3.1 Measurement Sites (USEPA Method 1)

The location of measurement sites and the number of traverse points were determined using USEPA Reference Method 1, "Sample and Velocity Traverses for Stationary Sources."

3.2 Velocities and Volumetric Flow Rates (USEPA Method 2)

The stack gas velocity and volumetric flow rate was determined using USEPA Reference Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate." The stack gas velocity was measured on a 10 inch Dwyer oil filled manometer using a calibrated S-Type pitot tube. The stack gas temperature was measured with a calibrated type "K" thermocouple and Omega digital temperature readout.

3.3 Dry Molecular Weight (USEPA Method 3)

The stack gas dry molecular weight was determined using USEPA Reference Method 3, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight." Several grab samples were collected and analyzed during each test with Fyrite combustion gas analyzers which directly measured concentrations of O_2 and CO_2.

3.4 Moisture (USEPA Method 4)

The stack gas moisture contents were determined using USEPA Reference Method 4, "Determination of Moisture Content in Stack Gases." The samples were collected in a series of chilled impingers contained in the particulate sampling train. The moisture collected within the impingers were analyzed by gravimetric analysis.

3.5 Particulate Matter (USEPA Method 5)

The filterable particulate emissions were determined using USEPA Reference Method 5, "Determination of Particulate Emissions from Stationary Sources." The stack gas samples were collected isokinetically through a heated glass lined or stainless steel probe, a heated ($248° \pm 25°$) tared glass fiber filter, and a series of cooled impingers (to condense the moisture). The acetone from each probe rinse was transferred to a tared beaker. The acetone was evaporated at a temperature below its boiling point. The filter and the residue from the probe rinse were analyzed by gravimetric analysis.

3.6 Lead (USEPA Method 12)

The Lead (Pb) emissions were determined using USEPA Reference Method 12, "Determination of Inorganic Lead Emissions from Stationary Sources." The Pb emissions were be collected in conjunction with the particulate emissions. The impingers of the Method 5 train were charged with 0.1N nitric acid to absorb any lead passing through the filter. After the acetone rinse all of the front half glassware was rinsed with nitric acid to remove any lead that was not removed with the acetone rinse. The particulate from the filter and acetone rinse were digested and re-suspended in nitric acid after the particulate had been analyzed. The re-suspended filter and acetone rinse was combined with the 0.1N nitric acid probe rinse and impinger solution. The Pb was analyzed by an inductively coupled argon plasma spectrophotometer (ICAP). A simplified drawing of the particulate and lead sampling train is included in Figure 3.1.

3.7 Fuel Analysis

A composite sample of the fuel oil was be collected during the emissions testing by Barrett personnel. The sample was analyzed for arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), total halogens, polychlorinated biphenyls (PCBs), flash point, and heat content. The metals content of the fuel oil, except for Hg, was analyzed on an inductively coupled argon plasma spectrophotometer (ICAP). The Hg content of the fuel oil was analyzed by cold vapor atomic absorption spectroscopy (CVAAS). The total halogen content of the fuel oil was analyzed by ion chromatograph (IC). The PCBs was analyzed on a gas chromatograph (GC).

Triplicate measurements will be performed for all parameters.

The Hayden air sampling Quality Assurance Program includes procedures for equipment calibration as per USEPA and manufacturers guidelines, use of and strict adherence to standard published procedures, and traceability protocols for the recording and calculation of data. Hayden participate's in the USEPA's National Source Audit Program for Methods 3, 5, 6, 7 and 25.

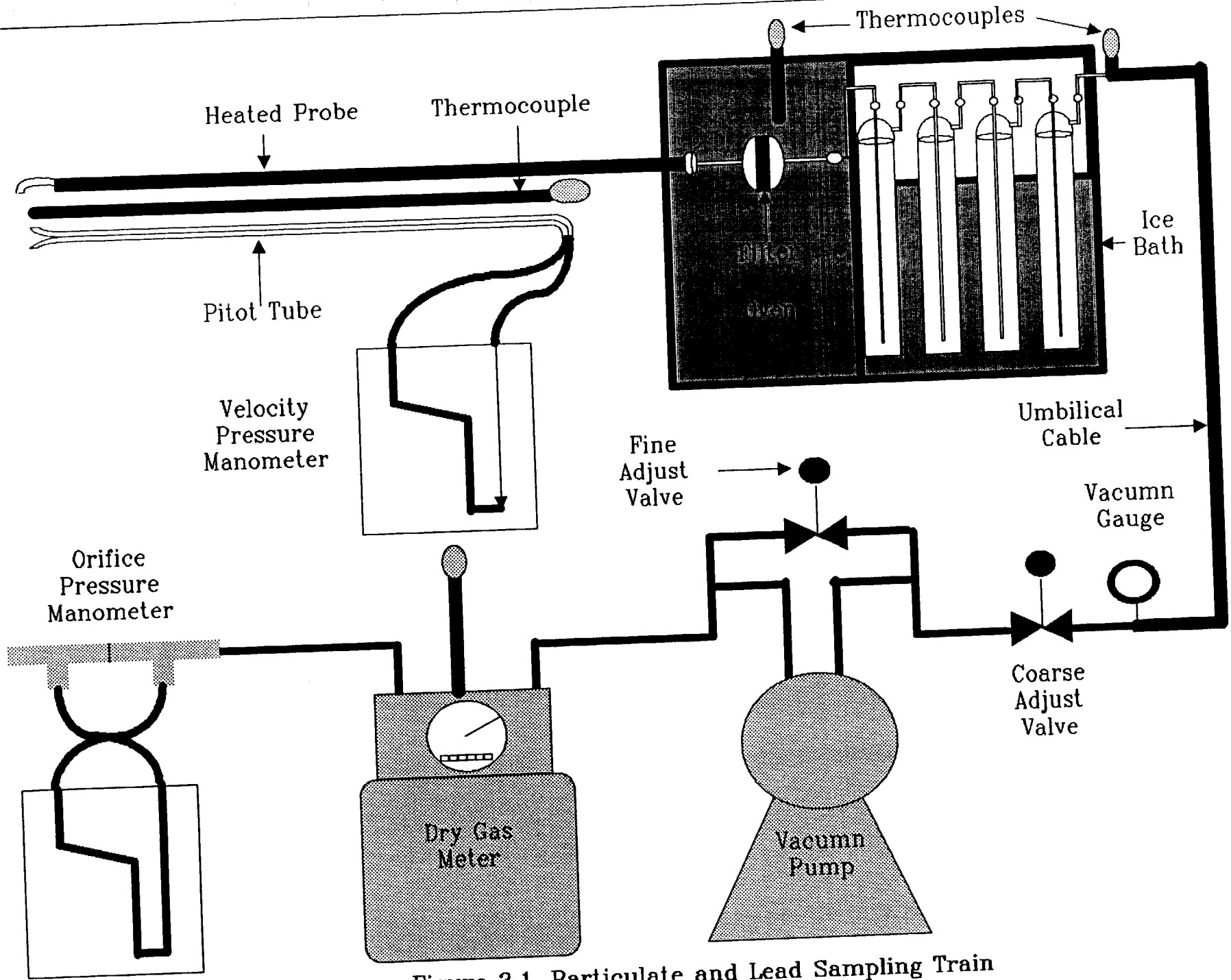

Figure 3.1. Particulate and Lead Sampling Train

4.0 TEST RESULTS

The stack gas conditions are summarized in Table 4.1. The stack gas velocity averaged 10.9 feet per second (fps). The stack gas flow rate averaged 24,880 actual cubic feet per minute (acfm) or 19,759 dry standard cubic feet per minute (dscfm) at 119°F and 8.6% moisture. The average concentrations of oxygen and carbon dioxide were 16.7% and 3.1%, respectively.

The filterable particulate and lead emissions are summarized in Table 4.2. The average filterable particulate concentration was 3.46E-02 grains per dry standard cubic foot (gr/dscf) or 4.95E-06 pounds per dry standard cubic foot (lb/dscf). The average filterable particulate emission rate was 5.82 pounds per hour (lb/hr).

The average lead concentration was 1.30E-09 lb/dscf. The average lead particulate emission rate was 1.34E-03 lb/hr.

Results from analyses of the waste fuel oil sample are contained in Appendix B, "Analytical Data".

Barrett Paving Materials, Inc. / Troy

Table 4.1 Summary of Stack Gas Conditions

Run No.	Time (6/8/94)	Velocity (fps)[a]	Flow Rate (acfm)[b]	Flow Rate (dscfm)[c]	Temp. (°F)[d]	Moisture (%)	O_2 (%)	CO_2 (%)
1	0916-1045	8.5	19,141	15,669	121	8.6[e]	17.0	3.0
2	1221-1348	11.1	25,981	20,065	115	6.4	16.2	3.3
3	1527-1644	13.1	29,519	23,542	120	10.8	17.0	3.0
Averages		10.9	24,880	19,759	119	8.6	16.7	3.1

[a] feet per second
[b] actual cubic feet per minute
[c] dry standard cubic feet per minute
[d] degrees Fahrenheit
[e] Result is average of Runs #2 and #3. See Section 5.0 for explanation.

Barrett Paving Materials / Troy

Table 4.2 Summary of Particulate and Lead Emissions

Run No.	Time (6/8/94)	Particulate Emissions			Lead Emissions		
		(gr/dscf)[a]	(lb/dscf)[b]	(lb/hr)[c]	(ppm)[d]	(lb/dscf)	(lb/hr)
1	0916-1045	4.42E-02	6.32E-06	5.93	5.42E-03	2.91E-09	2.73E-03
2	1221-1348	2.29E-02	3.27E-06	4.02	1.09E-03	5.84E-10	7.18E-04
3	1527-1644	3.68E-02	5.25E-06	7.42	7.57E-03	4.07E-10	5.75E-04
Averages		3.46E-02	4.95E-06	5.79	4.66E-03	1.30E-09	1.34E-03

[a] grains per dry standard cubic foot
[b] pounds per dry standard cubic foot
[c] pounds per hour
[d] parts per million

5.0 DISCUSSION

Production of normal asphalt material was maintained during test run #1. Much of the scheduled asphalt production for test day was canceled. Therefore, dry material (i.e. no asphaltic cement) was processed during test run #2 and #3. This operating condition was noted and approved by Mr. Jon Hilty of RAPCA.

At the conclusion of test run #1, a considerable amount of moisture was observed in the filter housing of the sampling train. The moisture could not be accurately measured without compromising the particulate sample. Therefore, the average calculated moisture of test run #2 and #3 was used in calculating the results for test run #1.

The isokinetics for test run #2 was calculated on-site to be approximately 88%. This result was discussed with Mr. Hilty. He concurred that the lower the isokinetics for an collected sample is, the higher the resulting calculated emission rates for that sample will be. Therefore, the emission rates measured and calculated for test run #2 would be higher than the actual emissions. Since the average results from all three test runs are used to ascertain compliance, the results from test run #2 should induce a positive bias. Mr. Hilty of RAPCA gave approval to accept test run #2 for the compliance determination.

Barrett Paving Materials / Troy

Table A.1 Summary of Production and Operating Conditions

Run No.	Time (6/8/94)	Asphalt Production (tph)[1]
1	0916-1045	226.7
2	1221-1348	194.2
3	1527-1644	215.1
Averages		212.0

[1] tons per hour

O_2 = 17.6/17.0/
CO_2 = 3.0/3.0/

EMISSION TESTING FIELD DATA

Client: Garratt Paving / Troy
PN: 266.068
Date: 6/8/94
Source: Asphalt Plant
Site: Outlet Stack
Sample Type: Particulate + Lead
Run: 1
Operators: DD, BE, RM
Barometric Pressure (Pb): 29.32
Static Pressure (Pg): -.05

Meter Box #: N3
Sample Box #: 1
Filter #: 0431
Probe Length/Type: 8' SS
Stack Thermocouple #: 6D
Oven Thermocouple #: OV-1
Impinger Thermocouple #: 44D
Pitot Tube #: S-type
Stack I.D.: 83"
Record Data Every 4 Minutes

Meter ΔH@: 1.85
Meter Y Factor: 1.024
C Factor: .76
Reference ΔP: .044
Nozzle I.D.: _ _ _ Avg. .490
Pre-Test Leak Rate: .005 cfm@ 10 "Hg
Post-Test Leak Rate: ___ cfm@ 6 "Hg
Pitot Tube Leak Check: Pre: ✓ Post: —
Orsat Train Leak Check: Pre: N/A Post: N/A
Page 1 of 2

* → 3 min per point at front * A6

Traverse Point Number	Sampling Time (min)	Clock Time (hr)	Meter Reading (cu ft.)	Velocity Pressure ΔP ("H2O)	Orifice Pressure ΔH@ ("H2O) Desired	Orifice Pressure ΔH@ ("H2O) Actual	Train Vacuum ("Hg)	Temperatures (°F) 2 Stack	3 Filter	Probe	4 IMP	6/7 Meter
	0	0916	578.787									
A1	4		580.540	.015	.64	.64	1	110	252	606	67	67/67
2	8		581.735	.025	1.05	1.05	2	115	262		61	66/69
3	12		584.955	.025	1.05	1.05	2	113	264		59	70/69
4	16		586.730	.015	.64	.64	1	115	262		57	72/69
5	20		588.410	.015	.64	.64	1	120	258		57	73/64
* 6	* 23		590.135	.025	1.05	1.05	2	122	259		57	73/69
7	26		591.590	.015	.64	.64	1	122	263		56	73/64
8	29		—	.005	.20	.20	1	122	264		54	74/64
9	32		593.290	.005	.20	.20	1	122	264		54	74/70
10	35		594.320	.010	.44	.44	1	114	263		52	71/69
11	38		—	.010	.44	.44	1	118	263	↓	52	69/69
12	41	0959	596.562	.010	.44	.44	1	118	255		52	69/66

*

HAYDEN
ENVIRONMENTAL GROUP, INC.

EMISSION TESTING FIELD DATA

Client: Barrett Paving/Troy Run #: 1 Date: 6/8/94 Page 2 of 2

Traverse Point Number	Sampling Time (min)	Clock Time (hr)	Meter Reading (cu ft.)	Velocity Pressure ΔP ("H2O)	Orifice Pressure ΔH@ ("H2O)		Train Vacuum ("Hg)	Temperatures (°F) 2	3		4	C./7	
					Desired	Actual		Stack	Filter	Probe	IMP	Meter	
	41	1004	596.562										
61	44		598.250	.020	~~.84~~ 1.05	~~.84~~ 1.05	2	124	260	80-90	58	70	69
2	47		599.800	.020	.84	.84	2	124	256		58	70	69
3	50		601.100	.015	.64	.62	1	125	250		57	71	69
4	53		603.570	.100	4.10	4.10	6	122	247		55	71	69
5	56		606.050	.040	1.70	1.70	3	122	261		50	76	69
6	59		—	.010	.44	.44	1	122	252		52	76	69
7	62		608.895	.020	.84	.84	2	121	245		54	74	69
8	65		—	.010 ~~.005~~	.44	.44	1	123	248		53	73	69
9	68		611.730	.030	1.25	1.25	2	127	259		54	72	69
10	71		613.460	.025	1.05	1.05	2	127	257		53	74	69
11	74		615.340	.030	1.25	1.25	2	130	257	↓	54	75	70
12	77	1045	617.546	.045	1.90	1.90	3	129	257		53	76	70
			38.754	AVG = .141		0.95		121.3				70.4	
			✓✓	✓		✓		✓✓				✓	
	KICK	→	✓	.141		✓		✓				✓	

HAYDEN ENVIRONMENTAL GROUP INC.

METHOD 3 FYRITE DATA

Client: Barrett/Troy PN: 766.008 Date: 6-8-94
Source: Asphalt Plant Site: Outlet Stack Run: 1
Operator:

	Oxygen (O2)	Carbon Dioxide (CO2)
Run 1	17.0	3.0
Run 2	17.0	3.0
Run 3	17.0	3.0
Average	17.0	3.0

SAMPLE RECOVERY DATA

Client: Everett Plant PN: 266-008 Date: 8/18/94
Source: Asphalt Mixer Site: Outlet Stack Run#: 1
Sample Date: 6/8/94 Recovery Date: 6/8/94

Filter No: 0431 Glassware Set No: _____ Sample Box No: 1

IMPINGER DATA

Gravimetric: ✓ Volumetric: _____

	#1	#2	#3	#4	#5	Total
Contents	1N HNO_3	1N HNO_3	Empty	Silica Gel		
Final	595.7	567.5	437.6	631.6		2232.4 ✓
Initial	537.9	561.3	436.5	624.4		2160.1 ✓
Net	57.8 ✓	6.2	1.1	7.2		72.3 ✓

RECOVERED SAMPLE

Description of Particulate on Filter: light brown / Fully Coated *

Color of Silica Gel: 2/3 spent

Recovered By: DDA RM

* Considerable Moisture in filter bell

HAYDEN ENVIRONMENTAL GROUP, INC.

EMISSION TESTING FIELD DATA

Client: Barrett Paving / Troy
PN: 266.008
Date: 6/8/94
Source: Asphalt Plant
Site: Outlet Stack
Sample Type: Particulate + Lead
Run: 2
Operators: DD, BF, RM
Barometric Pressure (Pb): 29.38
Static Pressure (Pg): -.060

Meter Box #: N3
Sample Box #: 3
Filter #: 7690
Probe Length/Type: 8' SS
Stack Thermocouple #: 6B
Oven Thermocouple #: OV-3
Impinger Thermocouple #: 441
Pitot Tube #: S-type
Stack I.D.: 83"
Record Data Every 3 Minutes

Meter ΔH@: 1.85
Meter Y Factor: 1.021
C Factor: .76
Reference ΔP: .042
Nozzle I.D.: _ _ _ Avg. .500
Pre-Test Leak Rate: .007 cfm@ 10 "Hg
Post-Test Leak Rate: .0001 cfm@ 3 "Hg
Pitot Tube Leak Check: Pre: ✓ Post: ✓
Orsat Train Leak Check: Pre: N/A Post: N/A
Page 1 of 2

Traverse Point Number	Sampling Time (min)	Clock Time (hr)	Meter Reading (cu ft.)	Velocity Pressure ΔP ("H2O)	Orifice Pressure ΔH@ ("H2O) Desired	Orifice Pressure ΔH@ ("H2O) Actual	Train Vacuum ("Hg)	Temperatures (°F) 2 Stack	3 Filter	3 Probe	4 IMP	6/7 Meter
	0	1221 ~~1218~~	617.907	~~.040~~ ~~.045~~	~~1.75~~ ~~1.66~~	1.75	1	115	260	80%	59	64/64
A1	3		620.040									
2	6		622.330	.045	2.00	2.00	2	117	264		61	65/65
3	9		624.280	.030	1.30	1.30	1	110	260		60	66/65
4	12		625.870	.020	.88	.88	1	124	265		60	67/65
5	15		627.040	.025	1.10	1.10	1	121	255		60	69/66
6	18		628.745	.040	1.75	1.75	2	122	263		59	70/66
7	21		631.800	.035	1.55	1.55	1	122	264		59	73/67
8	24		632.820	.005	.21	.21	1	122	266		59	73/67
9	27		633.610	.005	.21	.21	1	121	261		59	72/67
10	30		—	.005	.21	.21	1	122	257		59	70/67
11	33		635.170	.005	.21	.21	1	113	260	↓	59	70/67
12	36	1257	635.935	.005	.21	.21	1	111	264		59	70/68

Test A Tons

HAYDEN ENVIRONMENTAL GROUP INC.

EMISSION TESTING FIELD DATA

Client: Bennett/Troy Run #: 2 Date: 6/10/14 Page 2 of 2

Traverse Point Number	Sampling Time (min)	Clock Time (hr)	Meter Reading (cu ft.)	Velocity Pressure ΔP ("H2O)	Orifice Pressure ΔH@ ("H2O) Desired	Orifice Pressure ΔH@ ("H2O) Actual	Train Vacuum ("Hg)	Temperatures (°F) 2 Stack	3 Filter	3 Probe	4 IMP	6/7 Meter	
	36	13/2	635.935										
B1	39		—	.145	1.65 ΔP 6.50	6.50	3	111	264	80%	58	69	68
2	42		643.350	.120	4.30	4.30	2	111	255		59	71	68
3	45		645.710	.050	2.20	2.20	1	111	254		56	74	69
4	48		648.250	.050	2.20	2.20	1	110	265		54	74	69
5	51		650.540	.045	2.00	2.00	1	111	257		54	75	68
6	54		—	.010	.45	.45	1	112	254		54	76	69
7	57		652.910	.010	.45	.45	1	111	261		60	74	69
8	60		654.980	.040	1.75	1.75	1	112	264		59	73	69
9	63	1357.405	657.405	.055	2.45	2.45	1	112	260		59	76	69
10	66		—	.065	2.90	2.90	B2	113	264		59	79	70
11	69		663.135	.075	3.35	3.35	2	112	264		61	81	71
12	72	1348	666.241	.080	3.60	3.60	2	111	258		60	82	71
			48.334	ΔP = 0.186		1.61		115.4					69.9

HAYDEN ENVIRONMENTAL GROUP INC.

METHOD 3 FYRITE DATA

Client: Bonnot/Troy PN: 266.008 Date: 6/8/94
Source: Asphalt Plant Site: Outlet Stack Run: 2
Operator: DLD/KF/RVH

	Oxygen (O2)	Carbon Dioxide (CO2)
Run 1	16.5	~~3.5~~ 3.0 DLD
Run 2	16.0	3.5
Run 3	16.0	3.5
Average	16.2 ✓	3.3 ✓

SAMPLE RECOVERY DATA

Client: BARRETT PN: 266.008 Date: 6/7/94
Source: ASPHALT PLANT Site: OUTLET Run#: 2
Sample Date: 6.8.94 Recovery Date: 6/8/94

Filter No: 7690 Glassware Set No: _____ Sample Box No: 3

IMPINGER DATA

Gravimetric: ✓ Volumetric: _____

	#1	#2	#3	#4	#5	Total
Contents	.1N HNO_3	.1N HNO_3	empty	Sil Gel		
Final	590.1	562.9	455.1	775.1		2383.2 g
Initial	540.7	552.8	453.0	766.0		2312.5 g
Net	49.4	10.1	2.1	9.1		70.7 g

RECOVERED SAMPLE

Description of Particulate on Filter: Light Brown / pretty much totally covered

Color of Silica Gel: 1/2 spent

Recovered By: RM

EMISSION TESTING FIELD DATA

Client: Barrett / Troy
PN: 266.008
Date: 6/8/94
Source: Asphalt Plant
Site: Outlet Stack
Sample Type: Particulate + Lead
Run: 3
Operators: DP, BF, RM
Barometric Pressure (Pb): 29.38
Static Pressure (Pg): -.10

Meter Box #: #3
Sample Box #: 4
Filter #: 7697
Probe Length/Type: 8ft SS
Stack Thermocouple #: 04
Oven Thermocouple #: OV-4
Impinger Thermocouple #: 441
Pitot Tube #: 7A S-type
Stack I.D.: 63"
Record Data Every 2.5 Minutes

Meter ΔH@: 1.95
Meter Y Factor: 1.0024
C Factor: .95
Reference ΔP: .034
Nozzle I.D.: _ _ _ Avg. .447
Pre-Test Leak Rate: .005 cfm@ 12 "Hg
Post-Test Leak Rate: .002 cfm@ 7 "Hg
Pitot Tube Leak Check: Pre: — Post: ✓
Orsat Train Leak Check: Pre: N/A Post: N/A
Page 1 of 2

Traverse Point Number	Sampling Time (min)	Clock Time (hr)	Meter Reading (cu ft.)	Velocity Pressure ΔP ("H2O)	Orifice Pressure ΔH@ ("H2O)		Train Vacuum ("Hg)	Temperatures (°F)				
					Desired	Actual		Stack	Filter	Probe	IMP	Meter
	0	1527	666.284									
A1	2.5		—	.015	5.40	5.40	5	118	257	300	58	66/66
2	5.0		672.160	.10	5.20	5.20	5	116	252		54	67/66
3	7.5		674.800	.07	3.60	3.60	4	117	258		58	68/66
4	10.0		678.320	.07	1.60	1.00	2	118	254		60	70/67
5	12.5		—	.04	2.10	2.10	2	121	261		63	70/67
6	15.0		680.300	.045	2.30	2.30	3	124	260		64	72/67
7	17.5		682.080	.030	1.55	1.55	2	123	261		62	73/67
8	20.0		683.170	.010	.52	.52	1	123	262		61	73/67
9	22.5		683.890	.005	.25	.25	1	124	248		61	72/67
10	25.0		684.60	.005	.25	.25	1	127	251		60	72/68
11	27.5		685.165	.005	.25	.25	1	127	262		60	71/68
12	30.0		686.038	.005	.25	.25	1	127	258		59	70/67

HAYDEN ENVIRONMENTAL GROUP, INC.

EMISSION TESTING FIELD DATA

Client: Bowett / Tury Run #: 3 Date: 6/8/96 Page 2 of 2

Traverse Point Number	Sampling Time (min)	Clock Time (hr)	Meter Reading (cu ft.)	Velocity Pressure ΔP ("H2O)	Orifice Pressure ΔH@ ("H2O)		Train Vacuum ("Hg)	Temperatures (°F) 1	2		4	6/7	
					Desired	Actual		Stack	Filter	Probe	IMP	Meter	
	30	1614	686.038										
B1	32.5		688.00	.100	5.10 ~~4.0~~	5.10	5	~~118~~	250	300	60	69	64
2	35.0		691.930	.100	5.10	5.10	6	123	248		55	70	64
3	37.5		694.550	.070	3.60	3.60	5	126	250		53	71	69
4	40.0		696.920	.060	3.00	3.00	4	122	248		55	72	69
5	42.5		698.770	0.030	1.55	1.55	3	118	248		59	74	69
6	45.0		700.175	.020	1.05	1.05	2	118	~~254~~		61	75	~~69~~
7	47.5		702.990	.045	2.30	2.30	4	114	250		61	74	70
~~8~~	50.0		704.880	.100	5.10	5.10	6	113	251		60	77	70
9	52.5		~~70~~	.100	5.10	5.10	6	114	252		60	80	70
10	55.0		710.685	.090 ~~.080~~	4.70	4.70	5	114	259		61	80	70
11	57.5		713.545	.085	4.30	4.30	6	112	262		63	80	71
12	60.0	1644	716.174	.060	3.10	3.10	5	115	259	↓	64	80	71
			49.89 ✓✓	.217 ✓✓		2.78 ✓✓		119.67 ✓✓				70.5 ✓✓	

HAYDEN ENVIRONMENTAL GROUP, INC.

METHOD 3 FYRITE DATA

Client: Barrett Troy PN: 266.008 Date: 6/6/94
Source: Asphalt Plant Site: Outlet Stack Run: 3
Operator: DD, BF, RM

	Oxygen (O2)	Carbon Dioxide (CO2)
Run 1	17.0	3.0
Run 2	17.0	3.0
Run 3	17.0	3.0
Average	17.0	3.0

SAMPLE RECOVERY DATA

Client: BARRET / TROY PN: 266.008 Date: 6.8.94
Source: ASPHALT PLANT Site: OUTLET STACK Run#: 3
Sample Date: 6.8.94 Recovery Date: 6/8/94

Filter No: ~~7691~~ 7697 Fm Glassware Set No: _____ Sample Box No: 4

IMPINGER DATA

Gravimetric: ✓ Volumetric: _____

	#1	#2	#3	#4	#5	Total
Contents	.1N HNO_3	1.N HNO_3	Empty	SILICA		
Final	607.2	553.5	460.5	760.9		2382.1 ✓
Initial	515.3	532.2	457.2	748.0		2252.7 ✓
Net	91.9 ✓	21.3 ✓	3.3 ✓	12.9 ✓		129.4 ✓

RECOVERED SAMPLE

Description of Particulate on Filter: TAN - UNIFORM COVERAGE

Color of Silica Gel: BLUE / PINKISH WHITE - 2/3 SPENT

Recovered By: _____

HAYDEN LABORATORIES

Amended July 7, 1994
June 24, 1994

Mr. Chris Ziehler
BARRETT PAVING MATERIALS, INC.
P.O. Box 1458
727 East Ash Street
Piqua, OH 45356

Subject: HEG Lab Task # 94060118
HEG Sample Number(s) 9407362 - 9407366

Project # : 266.008
Project Name: Barrett Paving

Dear Mr. Ziehler:

We are pleased to submit the report of analysis for the sample(s) you recently submitted to our laboratory. This report contains results for samples you submitted on 6/9/94.

If you need additional information regarding these samples or if you have any questions regarding the results, please contact one of the persons listed below at 513/866-5908. We can provide additional report copies, method summaries or quality control data reports that you may require for full documentation of your samples. Please request pricing for these additional reports.

Thank you for choosing Hayden Laboratories for your environmental or industrial hygiene laboratory needs. We hope to continue to provide you with quality analytical services and support. If you have any comments on the services we have provided, we would appreciate hearing from you.

Sincerely,

HAYDEN LABORATORIES

Rebecca F. Tipps
QA/QC Officer

Sue Barto
Client Services Representative

cc: Client File

LABORATORY ANALYSIS REPORT
(Amended Report 7/7/94)

Mr. Chris Ziehler
BARRETT PAVING MATERIALS, INC.
P.O. Box 1458
727 East Ash Street
Piqua, OH 45356

Page 1
Report Date : 06/24/94
HEG Task # : 94060118
HEG P/N, Acct: 266.008

P.O. Number:
Proj Name: Barrett Paving

Date Received: 06/09/94
Proj #: 266.008

HEG Sample # : 9407362 Sample Date: 06/08/94 Sample Priority: Normal
Sample ID : Run #1

Parameter	Units	Results	Comments
EPA Method 5			99
Acetone	mg	50.9	
Filter	mg	60.5	
Sample Volume Submitted	mL	295	
Lead	mg	0.0790	
Sample Volume Submitted	mL	650	

HEG Sample # : 9407363 Sample Date: 06/08/94 Sample Priority: Normal
Sample ID : Run #2

Parameter	Units	Results	Comments
EPA Method 5			99
Acetone	mg	46.6	
Filter	mg	25.6	
Sample Volume Submitted	mL	275	
Lead	mg	0.0128	
Sample Volume Submitted	mL	1010	

HAYDEN LABORATORIES

LABORATORY ANALYSIS REPORT

Mr. Chris Ziehler
BARRETT PAVING MATERIALS, INC.
P.O. Box 1458
727 East Ash Street
Piqua, OH 45356

Report Date : 06/24/94
HEG Task # : 94060118
HEG P/N, Acct: 266.008

HEG Sample # : 9407364 Sample Date: 06/08/94 Sample Priority: Normal
Sample ID : Run #3

Parameter	Units	Results	Comments
EPA Method 5			99
Acetone	mg	69.2	
Filter	mg	50.8	
Sample Volume Submitted	mL	325	
Lead	mg	0.0161	
Sample Volume Submitted	mL	575	

HEG Sample # : 9407365 Sample Date: 06/08/94 Sample Priority: Normal
Sample ID : Blank

Parameter	Units	Results	Comments
EPA Method 5			
Acetone	mg	1.6	
Filter	mg	0.3	
Sample Volume Submitted	mL	170	
Lead	mg	< 0.0050	
Sample Volume Submitted	mL	275	

LABORATORY ANALYSIS REPORT

Mr. Chris Ziehler
BARRETT PAVING MATERIALS, INC.
P.O. Box 1458
727 East Ash Street
Piqua, OH 45356

Page 3
Report Date : 06/24/94
HEG Task # : 94060118
HEG P/N, Acct: 266.008

==========

HEG Sample # : 9407366 Sample Date: 06/08/94 Sample Priority: Normal
Sample ID : Fuel Sample

Parameter	Units		Results	Comments
Flashpoint	deg. C	>	65.6	
T.Chlorine,ASTM D808	%	<	0.01	
Heat of Combustion	BTU/lb		18757	
Arsenic	mg/kg	<	17.2	
Cadmium	mg/kg		0.56	
Chromium	mg/kg		1.77	
Lead	mg/kg		36.3	
Mercury	mg/kg		0.25	
PCB, oil				
Aroclor 1016	mg/kg	<	2.4	
Aroclor 1221	mg/kg	<	2.4	
Aroclor 1232	mg/kg	<	2.4	
Aroclor 1242	mg/kg	<	2.4	
Aroclor 1248	mg/kg	<	2.4	
Aroclor 1254	mg/kg	<	2.4	
Aroclor 1260	mg/kg	<	2.4	
Total	mg/kg	<	2.4	

99 Sample is corrected with blank

HEG / LIMS
Analysis Date Report
Report Date: 06/24/94

HEG Lab Task # 94060118
HEG Client: HAYDEN ENVIRONMENTAL GROUP

Date Received : 06/09/94 Date Reported: 06/24/94

Sample #: 9407362 Sample Date: 06/08/94
Sample ID: Run #1

Analysis Date	Analyst	Test Performed	Hold Time (Days)
06/23/94	kw	Lead total, volumesubmitted ICP	180
06/21/94	ovp	Sample Volume Submitted	
06/21/94	ovp	EPA5-Particulate	28

Sample #: 9407363 Sample Date: 06/08/94
Sample ID: Run #2

Analysis Date	Analyst	Test Performed	Hold Time (Days)
06/23/94	kw	Lead total, volumesubmitted ICP	180
06/21/94	ovp	Sample Volume Submitted	
06/21/94	ovp	EPA5-Particulate	28

Sample #: 9407364 Sample Date: 06/08/94
Sample ID: Run #3

Analysis Date	Analyst	Test Performed	Hold Time (Days)
06/23/94	kw	Lead total, volumesubmitted ICP	180
06/21/94	ovp	Sample Volume Submitted	
06/21/94	ovp	EPA5-Particulate	28

HEG / LIMS
Analysis Date Report
Report Date: 06/24/94

Sample #: 9407365 Sample Date: 06/08/94
Sample ID: Blank

Analysis Date	Analyst	Test Performed	Hold Time (Days)
06/23/94	kw	Lead total, volumesubmitted ICP	180
06/21/94	ovp	Sample Volume Submitted	
06/21/94	ovp	EPA5-Particulate	28

Sample #: 9407366 Sample Date: 06/08/94
Sample ID: Fuel Sample

Analysis Date	Analyst	Test Performed	Hold Time (Days)
06/10/94	jep	PCB Extraction(Oil)	28
06/16/94	jrw	Mercury total, solid	28
06/21/94	kw	Solid Sample Prep for metals	28
06/23/94	msn	Arsenic total, furnace, solid	180
06/23/94	msn	Cadmium total solidICP	180
06/23/94	msn	Chromium total solidICP	180
06/23/94	msn	Lead total solidICP	180
06/23/94	ovp	Flashpoint	28
06/10/94	rll	Polychlorinated Bi-phenyls-Oil	40
06/16/94	sub	Total Halogens****(as Chlorine)	28
06/10/94	sub	BTU *** Heat on Combustion	28

IN HOUSE PROJECT INFORMATION FORM

PROJECT MANAGER: NAME Dale Davidson

EMP.# 292

JOB # 266-008

SAMPLES SUBMITTED BY/DATE: 6/23/94

PRIORTIY (N/R/E): N

DUE DATE:

PROJECT CLIENT: CONTACT Chris Ziehler

COMPANY Barrett Paving

PO# —

MAIL REPORT DIRECTLY TO CLIENT: YES____ NO X

ANALYTICAL INFORMATION

OF SAMPLES: 4 / 1

DESCRIPTIONS/TEST:

(4) · Analyze for filterable particulate per USEPA Method 5 } Filters + Acetone Rinses

· Analyze for lead per USEPA Method } Filters, Acetone Rinses + Impingers Contents

(1) Fuel Oil analyses for As, Cd, Cr, Pb, Hg, PCB, total halogens, flash point, heat content

SPECIAL NOTES:

HAYDEN ENVIRONMENTAL GROUP INC.

CHAIN OF CUSTODY

Project Number:	266.008	Sealed By Signature:	Deb F. Davidson
Company:	Barrett Paving	Date Sealed:	6/8/94
City:	Troy	Time Sealed:	~~13~~ 2000
State:	OH	Seal Number:	—

Container Type (petri dish, 1000 ml polyethylene, 1000 ml glass etc.)	Sample media (acetone, 0.1N HNO_3, etc.)	Analyses	Run Numbers (Number of bottles are recorded in the squares below)								
			Run #1	Run #2	Run #3	Blank	Fuel Sample				
petri dish	filter	} Particulate per USEPA Method 5	1	1	1	1					
1000 ml poly	Acetone	} Lead per USEPA Method 12	1	1	1	1					
—	—	—	—	—	—	—	—				
1000 ml poly	.1N HNO_3	Lead per USEPA Method 12	1	1	1	1					
—	—	—									
1000 ml poly	Fuel Oil	As, Cd, Cr, Pb, Hg, PCB, total halogens, flash point, BTU	—	—	—	→	1				

Received By:		Affiliation:			Date:			Time:		
Received By:		Affiliation:			Date:			Time:		
Opened at lab by:	Virginia Kuehler	Date opened:	6/9/94	Time opened:	1553	Seal Number:	NA	Seal Intact:	Y	N

HAYDEN ENVIRONMENTAL GROUP, INC.

CLIENT/PROJECT #:	Barrett (Troy)/ 266.005		
SAMPLE LOCATION:	Baghouse Outlet		
DATE/TIME:	6/8/94; 0916-1045		
RUN #:	1		
STATIC PRESSURE("H2O):	-0.05	"HG	29.32
BAROMETRIC("HG):	29.32		
SAMPLE TIME(min):	77.00	Vm(corr)	38.759
ACTUAL METER VOLUME:	38.759	DSCF	38.809
SQ. ROOT /\P:	0.141		
AVG ORIFICE /\H:	0.95		
AVG STACK TEMP °F:	121.3	°R	581.3
AVG METER TEMP °F:	70.4		
Cp PITOT :	0.84		
NOZZLE DIA.(inches):	0.490	An(ft^2)	1.31E-03
METER GAMMA:	1.024		
LEAK RATE(IF>0.02):			
CIRC STACK? 1=Y,0=N:	1	As(ft^2)	37.57
DIA OR DIM (inches):	83.00		
% O2 :	17.00	DRY MOLE WT	29.16
% CO2 :	3.00	ST MOLE WT	28.20
VOL CONDENSATE(ml):	***	% H2O	8.61
FILTER GAIN(mg):	60.50		
RINSE GAIN(mg):	50.90	NET WT(mg)	111.40
ANALYTE #1 :	Lead		
MOLE WEIGHT:	207.19		
ug/sample :	51.4		
PPM :			

********** CALCULATED RESULTS **********

Gas Velocity (Vs):	8.49	FT/SEC
Stack Gas Flow (Qs):	19141.5	ACFM
:	15568.8	DSCFM
Stack Gas Temp :	121	Deg F
Moisture (H2O):	8.61	%
Isokinetic :	92.94	%

FILTERABLE PARTICULATE SUMMARY

Concentration (Cs):	4.42E-02	Gr/DSCF
:	6.32E-06	lb/DSCF
Emission Rate (Er):	5.90	lb/hr

LEAD EMISSIONS SUMMARY

Concentration (Cs):	2.91E-09	lb/DSCF
Emission Rate (Er):	2.72E-03	lb/hr

COMMENTS: *** Moisture sample unmeasureable. Moistue result is average of run 2 and 3.

CLIENT/PROJECT #:	Barrett (Troy)/ 266.005		
SAMPLE LOCATION:	Baghouse Outlet		
DATE/TIME:	6/8/94; 1221-1348		
RUN #:	2		
STATIC PRESSURE("H2O):	-0.06	"HG	29.38
BAROMETRIC("HG):	29.38		
SAMPLE TIME(min):	72.00	Vm(corr)	48.334
ACTUAL METER VOLUME:	48.334	DSCF	48.646
SQ. ROOT /\P:	0.186		
AVG ORIFICE /\H:	1.81		
AVG STACK TEMP °F:	115.4	°R	575.4
AVG METER TEMP °F:	69.9		
Cp PITOT :	0.84		
NOZZLE DIA.(inches):	0.500	An(ft^2)	[illegible]
METER GAMMA:	1.024		
LEAK RATE(IF>0.02):			
CIRC STACK? 1=Y,0=N:	1	As(ft^2)	37.57
DIA OR DIM (inches):	83.00		
% O2 :	16.20	DRY MOLE WT	29.18
% CO2 :	3.30	ST MOLE WT	28.46
VOL CONDENSATE(ml):	70.70	% H2O	6.40
FILTER GAIN(mg):	25.60		
RINSE GAIN(mg):	46.60	NET WT(mg)	72.20
ANALYTE #1 :	Lead		
MOLE WEIGHT:	207.19		
µg/sample :	12.9		
PPM :			

********** CALCULATED RESULTS **********

Gas Velocity (Vs):	11.08	FT/SEC
Stack Gas Flow (Qs):	24981.2	ACFM
:	21065.1	DSCFM
Stack Gas Temp :	115	Deg F
Moisture (H2O):	6.40	%
Isokinetic :	88.43	%

FILTERABLE PARTICULATE SUMMARY

Concentration (Cs):	2.29E-02	Gr/DSCF
:	3.27E-06	lb/DSCF
Emission Rate (Er):	4.13	lb/hr

LEAD EMISSIONS SUMMARY

Concentration (Cs):	5.84E-10	lb/DSCF
Emission Rate (Er):	7.38E-04	lb/hr

COMMENTS:

CLIENT/PROJECT #:	Barrett (Troy)/ 266.005
SAMPLE LOCATION:	Baghouse Outlet
DATE/TIME:	6/8/94; 1527-1644
RUN #:	3

STATIC PRESSURE("H2O):	-0.10	"HG	29.37
BAROMETRIC("HG):	29.38		
SAMPLE TIME(min):	60.00	Vm(corr)	49.890
ACTUAL METER VOLUME:	49.890	DSCF	50.276
SQ. ROOT /\P:	0.217		
AVG ORIFICE /\H:	2.78		
AVG STACK TEMP °F:	119.7	°R	579.7
AVG METER TEMP °F:	70.5		
Cp PITOT :	0.84		
NOZZLE DIA.(inches):	0.497	An(ft^2)	1.35E-03
METER GAMMA:	1.024		
LEAK RATE(IF>0.02):			
CIRC STACK? 1=Y,0=N:	1	As(ft^2)	37.57
DIA OR DIM (inches):	83.00		
% O2 :	17.00	DRY MOLE WT	29.16
% CO2 :	3.00	ST MOLE WT	27.95
VOL CONDENSATE(ml):	129.40	% H2O	10.81
FILTER GAIN(mg):	50.80		
RINSE GAIN(mg):	69.20	NET WT(mg)	120.00
ANALYTE #1 :	Lead		
MOLE WEIGHT:	207.19		
µg/sample :	9.3		
PPM :			

********** CALCULATED RESULTS **********

Gas Velocity (Vs):	13.09	FT/SEC
Stack Gas Flow (Qs):	29518.7	ACFM
:	23542.1	DSCFM
Stack Gas Temp :	120	Deg F
Moisture (H2O):	10.81	%
Isokinetic :	99.33	%

FILTERABLE PARTICULATE SUMMARY

Concentration (Cs):	3.68E-02	Gr/DSCF
:	5.25E-06	lb/DSCF
Emission Rate (Er):	7.42	lb/hr

LEAD EMISSIONS SUMMARY

Concentration (Cs):	4.07E-10	lb/DSCF
Emission Rate (Er):	5.75E-04	lb/hr

COMMENTS:

BARRETT PAVING / Troy - PN 266.008

EXAMPLE CALCULATIONS

RUN #2

1.0 Volume Metered, Standard Conditions (68°F, 29.92 In Hg)

$$V_{mstd}=(17.647)\times(V_m)\times(Y)\times\frac{(P_b)+\frac{(\Delta H)}{(13.6)}}{(T_m+460)}$$

$$V_{mstd}=(17.647)\times(48.334)\times(1.024)\times\frac{(29.38)+\frac{(1.81)}{(13.6)}}{(69.9+460)}=48.646$$

2.0 Volume Water Vapor Collected, Standard Conditions

$$V_{wstd}=(0.04707)\times(V_{lc})$$
$$V_{wstd}=(0.04707)\times(70.7)=3.328$$

3.0 Proportion Water Vapor, By Volume

$$B_{ws}=\frac{(V_{wstd})}{(V_{wstd}+V_{mstd})}$$
$$B_{ws}=\frac{(3.328)}{(3.328+48.640)}=0.064$$

4.0 Molecular Weight of Stack Gas, Dry Conditions

$$M_d=(0.44\times CO_2)+(0.32\times O_2)+(0.28\times(N_2+CO))$$
$$M_d=(0.44\times 3.3)+(0.32\times 16.2)+(0.28\times 80.5)=29.176$$

5.0 Molecular Weight of Stack Gas, Stack Conditions

$$M_s=M_d\times(1-B_{ws})+(18\times B_{ws})$$
$$M_s=29.176\times(1-0.064)+(18\times 0.064)=28.461$$

6.0 Absolute Stack Gas Pressure, inches Hg

$$P_g = P_B + \frac{(P_g)}{(13.6)}$$

$$P_g = 29.38 + \frac{(-0.06)}{(13.6)} = 29.376$$

7.0 Stack Gas Velocity, fps

$$V_s = (85.49) \times (c_p) \times (\sqrt{\Delta p}) \times \sqrt{\frac{(T_s + 460)}{(P_s) \times (M_s)}}$$

$$V_s = (85.49) \times (0.84) \times (0.186) \times \sqrt{\frac{(115.4 + 460)}{(29.376) \times (28.461)}} = 11.08$$

8.0 Stack Gas Flow Rate, acfm

$$Q_a = (60) \times (V_s) \times (5.4542E-03) \times (dia)^2$$

$$Q_a = (60) \times (11.08) \times (5.4542E-03) \times (83)^2 = 24,979$$

9.0 Stack Gas Flow Rate, dscf

$$Q_{std} = (17.647) \times (Q_a) \times (1 - B_{ws}) \times \frac{(P_s)}{(T_s + 460)}$$

$$Q_{std} = (17.647) \times (24,979) \times (1 - 0.064) \times \frac{(29.376)}{(115.4 + 460)} = 21,064$$

10.0 Isokinetic Variation, %

$$\%I = 0.0944 \frac{(T_s + 460) \times (V_{mstd})}{(P_s) \times (V_s) \times (A_n) \times (\theta) \times (1 - B_{ws})}$$

$$\%I = 0.0944 \frac{(115.4 + 460) \times (48.646)}{(29.376) \times (11.08) \times (1.363E-03) \times (72) \times (1 - 0.064)} = 88.4$$

11.0 Filterable Particulate Concentration, gr/dscf

$$C_1 = \frac{(0.0154) \times (Mn)}{(V_{mstd})}$$

$$C_1 = \frac{(0.0154) \times (72.2)}{(48.646)} = 2.29E-02$$

12.0 Filterable Particulate Concentration, lb/dscf

$$C_2 = (1.429E-04) \times (C_1)$$

$$C_2 = (1.429E-04) \times (2.29E-02) = 3.27E-06$$

13.0 Filterable Particulate Emission Rate, lb/hr

$$ER = (C_2) \times (Q_{std}) * (60)$$

$$ER = (3.27E-06) \times (21{,}065) \times (60) = 4.13$$

14.0 Lead Concentration, lb/dscf

$$C_{Pbl} = \frac{(2.20E-09) \times (Mn_{Pb})}{(V_{mstd})}$$

$$C_{Pbl} = \frac{(2.20E-09) \times (12.9)}{(48.646)} = 5.84E-10$$

15.0 Lead Emission Rate, lb/hr

$$ER = (C_{Pbl}) \times (Q_{std}) \times (60)$$

$$ER = (5.84E-10) \times (21{,}065) \times (60) = 7.38E-04$$

QUALITY ASSURANCE PROCEDURES

The sampling and analytical equipment used in this test series was calibrated in accordance with procedures outlined in the USEPA Reference Methods for stationary source sampling and also in the Quality Assurance Handbook for Air Pollution Measurement Systems. All pertinent calibration data for the equipment used in this test series are included. The following calibration procedures were employed:

a. Probe-tips (Nozzles)
Probe-tips were inspected before use to detect damage or irregularities. If the nozzle showed signs of damage, it was repaired and measured before use. The nozzle diameter was determined in the field by measuring three diameters with a precision micrometer. The average of the three measurements was the measured nozzle diameter.

b. Pitot Tubes
The S-type pitot tubes were built to the design specifications cited in reference Method 2. Standard pitot tubes are supplied from the manufacturer with a coefficient of 0.99. The pitot tubes, connecting lines, and manometers were leak-checked in the field before and after each test.

c. Thermocouples
Thermocouples were calibrated upon receipt and annually thereafter. The thermocouples were calibrated at approximately 32°F, ambient temperature, 212°F, and approximately 450°F.

d. Fyrite Analyzers
The Fyrite analyzers were leak-checked on-site and the reagents were replenished as needed.

e. Method 5 Control Consoles
The dry gas meter and the orifice in the Method 5 control console were calibrated at six (6) points from 0 to 4 inches of mercury. The dry gas meter coefficients (y-factor) and the orifice constant ($\Delta H@$) are established from this calibration. The dry gas meter is calibrated after each test series to confirm the y-factor has not changed more than plus or minus 5%. The lower of the pre-test and post-test y-factors is used in all sample volume calculations. Hayden Environmental participates in the USEPA Method 5 Dry Gas Meter Inter-Laboratory Performance Audit.

f. Barometers
The aneroid field barometers are calibrated with a stationary mercury column barometer prior to each use. The reference barometer is permanently mounted in the Hayden Environmental laboratory.

Accuracy Test Data for Calibration Test Meter

Rockwell Model #R275 Test Meter S/N 1334637

Calibrated April 4, 1993

Test Point	Flow Rate % of Max.Capacity	% Accuracy	% Error +/-
1	100	99.97	-0.03
2	66	99.98	-0.02
3	52	100.15	+0.15
4	26	100.12	+0.12
5	12	99.98	-0.02

Average % Accuracy = 100.04 %

Average % Error = +0.04 %

Y = 1 - (+0.04) = 0.9996

HEAT EQUIPMENT AND TECHNOLOGY INC.

951 NORTH BEND ROAD • CINCINNATI, OHIO 45224 • 513-591-3000 • FAX 513-591-0024

METER TEST DATA SHEET

CUSTOMER: HAYDEN ENVIRONMENTAL

METER DESCRIPTION: Rockwell R275 Test Meter

SERIAL NUMBER: 1334637

DATE: 4-7-93

TEST DATA

ACCURACY TEST

Test Point	Flow Rate CFH	Percent of Max. Cap.	Percent Accuracy	Differential Inches W.C.	Percent of Error +/-
1	272	100%	99.97	N A	-.03
2	180	66%	99.98	N.A	-.02
3	144	52%	100.15	N A	+.15
4	72	26%	100.12	.11-.14	+.12
5	35	12%	99.98	.06-.11	-.02

Average % error → 0.04%

Static Pressure Test

Test Pressure	Length of Test	Means of Testing
5 #	5 MINUTES	BUBBLE TANK

The above data has been determined from tests performed with air at atmospheric pressure and ambient temperature. The tests were done using positive displacement proving devices, dimensionally traceable to the United States National Bureau of Standards.

$$Y = 1 - 0.0004 = 0.9996$$

Dayton
1931 Cudgel Drive
Miamisburg, Ohio 45342
513-847-8064

Cleveland
8030 Deepwood Blvd.
Mentor, Ohio 44060
216-255-3000
FAX 216-255-6588

Columbus
4780 Sportsman Club Road
Johnstown, Ohio 43031
614-967-3111

DGM/ORIFICE CALIBRATION

DATE 3/21/94 METER BOX NO. N-3

BAROMETRIC PRESSURE 28.85 in. Hg REFERENCE METER NO. 1334637

CALIBRATOR B. Forsyth REFERENCE Y 0.9996

ORIFICE SETTING in. H_2O	REFERENCE METER		DRY GAS METER			TIME Θ min.	VACUUM
	GAS VOLUME V_R ft^3	TEMP. T_R °F	GAS VOLUME V_D ft^3	IN TEMP T_i °F	OUT TEMP T_o °F		
0.5	722.051	67°	557.228	74°	71°	10	5
	718.022	67°	553.261	74°	71°		
	4.029	67°	3.967	72.5°			
1.0	729.288	67°	564.373	75	72	10	5
	723.669	67°	558.822	74	71		
	5.619	67°	5.551	73°			
1.5	741.531	68°	576.432	79	74	10	5
	734.751	68°	569.758	77	73		
	6.780	68°	6.674	75.75			
2.0	752.126	70°	586.868	81	75	10	5
	744.361	69°	579.210	80	74		
	7.765	69.5°	7.658	77.5			
3.0	763.636	71°	598.198	81	76	10	5
	754.031	70°	588.734	80	75		
	9.605	70.5	9.424	78°			
4.0	778.542	72°	612.684	80	76	10	5
	767.449	72°	601.857	78	75		
	11.093	72°	10.827	77.25			

orifice leak check ✓ Boots Forsyth

Vacuum leak check ✓

HAYDEN ENVIRONMENTAL GROUP INC.

Meter Box #	N-3	N-3	N-3
Date	3/21/94	3/21/94	3/21/94
Reference Meter #	1334637	1334637	1334637
Y Reference	0.9996	0.9996	0.9996
Barometric Pressure	28.85	28.85	28.85
Orifice Setting ^ H (" H2O)	0.5	1	1.5
Total Gas Volume Reference	4.029	5.619	6.78
Average Temperature Reference	67	67	68
Total Gas Volume Dry Gas Meter	3.967	5.551	6.674
Average Temperature Dry Gas Meter	72.5	73	75.75
Time (min)	10	10	10
Vacumn	5	5	5
******* Calculations **********			
Meter Box Y	1.0245	1.0208	1.0265
Meter Box ^ H@	1.765	1.813	1.866

Meter Box #	N-3	N-3	N-3
Date	3/21/94	3/21/94	3/21/94
Reference Meter #	1334637	1334637	1334637
Y Reference	0.9996	0.9996	0.9996
Barometric Pressure	28.85	28.85	28.85
Orifice Setting ^ H (" H2O)	2	3	4
Total Gas Volume Reference	7.765	9.605	11.093
Average Temperature Reference	69.5	70.5	72
Total Gas Volume Dry Gas Meter	7.658	9.424	10.827
Average Temperature Dry Gas Meter	77.5	78	77.25
Time (min)	10	10	10
Vacumn	5	5	5
******* Calculations **********			
Meter Box Y	1.0237	1.0254	1.0238
Meter Box ^ H@	1.901	1.869	1.882

Average y	1.0241
Average delta H	1.84935

Meter Box Field Check

Meter Box #: N-3
Y: 1.024
delta H: 1.9494

Date: 3/21/94
Calibrator: B. Forsyth
Leak Check: B.F

Barometric: 28.85

Run No.	Initial Volume	Final Volume	Net Volume	Initial Temp.	Final Temp.	Avg. Temp.	Y_c Comparison
1	619.635	627.043	7.408	74/72	78/73	74.25	1.0375
2	627.043	634.463	#7.420	78/73	80/74	76.25	1.0378
3	634.463	641.911	7.448	80/74	81/75	77.5	1.0351

$$y_c = \frac{10}{Vm} \times \sqrt{\frac{(0.0319) \times (Tm)}{(Pb)}}$$

Compare with Y_c

$0.97 * Y < Y_c < 1.03 * Y$

$0.97 * Y =$ 0.9933

$1.03 * Y =$ 1.0547

Meter Post Test Calibration

Client	Barrett	P.N.	266.008	Date	6/16/94
Ref. Meter	1334637	Yr	1	Pb	29.61
Meter Box	N-3	Pre Test Y	1.0241	▲ H	2.20
Vacumn	6	Calib. Time	10		

Performed By: Bert G. Forsyth Env. Tech.

Run #	Vr(f-i)	Tr(avg)	Vd(f-i)	Td(avg)	Pb	Y
1	8.191	76.0	8.028	81.3	29.610	1.030
2	8.163	76.0	8.022	83.8	29.610	1.032
3	8.167	76.0	8.048	85.8	29.610	1.033
Average Y						1.032

$$Y = Y_r * \frac{(V_r) * (T_d + 460) * (Pb)}{(V_d) * (T_r + 460) * (Pb + \frac{\Delta H}{13.6})}$$

POST TEST METER BOX CALIBRATION

CLIENT Barrett / Fairborn Day DATE 6/16/94 Ref Meter # 1334637

PN ~~266.00~~ 266.008 Pb ("Hg) 29.61 Test Meter Y 0.9996

METER BOX N-3 PRE-TEST Y 1.0241

ΔH@	Vr (Reference)	Tr (Reference)	Vd (Meter Box)	Td (Meter Box)	Time	Vaccum
2.20	203.271	76°F	909.126	81/78	0	6
	211.462	76°F	917.154	86/80	10	6
2.20	211.462	76°F	917.154	86/80	0	6
	219.625	76°F	925.176	88/81	10	6
2.20	219.625	76°F	925.176	88/81	0	6
	227.792	76°F	933.224	91/83	10	6

HAYDEN ENVIRONMENTAL GROUP, INC.

Leak-Check ✓ Bert Faught

THERMOCOUPLE CALIBRATION

THERMOCOUPLE I. D.: 68 LENGTH: 6' DATE: 8/19/93

CALIBRATED BY: Bert G. Forsyth

REFERENCE THERMOMETER: 1248

SOURCE	REFERENCE THERMOMETER TEMPERATURE	TEST THERMOCOUPLE TEMPERATURE	TEMPERATURE DIFFERENCE
AM. AIR	25.0	24.8	0.2
ICE BATH	6.0	5.6	0.4
BOIL H_2O	100.0	99.7	0.3
HOT OIL	159.6	159.4	0.2

THERMOCOUPLE CALIBRATION

THERMOCOUPLE I.D.: 6D LENGTH: 6 DATE: 6/20/94

CALIBRATED BY: D. Michelle Comey 6/23/94

REFERENCE THERMOMETER: 402947452

Source	Reference Thermometer Temperature °F ~~°C~~ ~~R~~	Test Thermocouple Temperature °F ~~°C~~ ~~R~~	Temperature Difference °F ~~°C~~ ~~R~~	Thermocouple Simulator *Display*	*Setting*
Amb. Air	531.0	530.8	0.2 / .03%	~~558.1~~	560
Ice H_2O	490.1	490.0	0.1 / 0.1%	~~558.1~~	560
Boil H_2O	668.9	664.8	4.1 / 0.6%	~~1571.4~~	760
Hot air	918.0	915.9	2.1 / 0.2%	~~959.1~~	960

THERMOCOUPLE CALIBRATION

Thermocouple I.D.: 04 Length: 12FT Date: 8/18/93

Calibrated By: Betty Forsyth

Reference Thermometer: 1248

Source	Reference Thermometer Temperature ~~°F~~ °C	Test Thermocouple Temperature ~~°F~~ °C	Temperature Difference °F
AM AIR	28.0	26.0	2.0
ICE BATH	7.5	5.8	1.7
BOILING H_2O	100.5	99.2	1.3
HOT OIL	158.5	160.1	1.6

THERMOCOUPLE CALIBRATION

Thermocouple I.D.: OV-3 Length: Oven Therm Date: 8/19/93

Calibrated By: Betty Forsyth

Reference Thermometer: 1248

Source	Reference Thermometer Temperature °F	Test Thermocouple Temperature °F	Temperature Difference °F
AM. AIR	25.0	25.0	0.0
ICE BATH	8.0	7.7	0.3
BOILING H_2O	100.0	99.1	0.9
HOT OIL	175.5	176.2	0.7

THERMOCOUPLE CALIBRATION

Thermocouple I.D.: OV-1 Length: Oven Therm. Date: 8/19/93

Calibrated By: Brent Y. Forgy

Reference Thermometer: 1248

Source	Reference Thermometer Temperature °F	Test Thermocouple Temperature °F	Temperature Difference °F
Am. Air	24.7	24.6	0.1
Ice Bath	6.5	~~6~~ 5.7	0.8
Boiling H_2O	100.0	99.0	1.0
Hot oil	172.0	172.9	0.9

THERMOCOUPLE CALIBRATION

Thermocouple I.D.: 440 Length: Imp. Head Date: 8/19/93

Calibrated By: Brad Y. Forzyk

Reference Thermometer: 1248

Source	Reference Thermometer Temperature °F	Test Thermocouple Temperature °F	Temperature Difference °F
AM AIR	24.7	24.1	0.6
ICE BATH	6.0	5.3	0.7
BOILING H2O	100.0	98.7	1.3
HOT OIL	161.0	158.0	3.0