JOHN ASHCROFT
Governor

G. TRACY MEHAN III
Director

Division of Energy

To:
County file

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MEMORANDUM

DATE:

TO: County file: GREEN
Facility: MASTER-JACKSON PAVING (Springfield)
Test Location: Buffalo, MO (Dallas Co.)

FROM: Doug Elley

SUBJECT: COMPLIANCE TEST RESULTS   Test Date: 7-21-94

Testing firm: AEROMET

Test team leader: Tom Scheppers
Source tested: Astec portable asphalt plant; Permit #0594-036

Pollutants tested for: PM
Opacity

	% Iso	ft^3 samp.	lb/hr	ppm	gr/dscf	gr/dscf corr.	Allowed	Opac%
Run #1	96	59			.0036			0
Run #2	97	60			.0022			0
Run #3	96	59			.0027			0
Averages					.003		.04	0%

Rated production/operation capacity: 258 ton/hr

Production/operation rate during test: 255 ton/hr

Fuel used: #2 Fuel Oil   Rate: Analysis:

Combustion Efficiency $= CE = \frac{CO_2}{CO_2 + CO} \times 100 =$ ____ $\times 100 =$ ______

Control device: Baghouse
Secondary chamber volume (measured):

Retention time: Run #1____ Run #2____ Run #3____
Av.= ____ seconds

Pressure drop(s): 4.0" H_2O
Scrubber supply line water psi:

dm/5-91

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RECEIVED

'94 SEP 13 AM 10 47

AIR POLLUTION
CONTROL PGM

PARTICULATE AND VISIBLE EMISSION TESTS FOR MASTERS-JACKSON PAVING COMPANY

ASTEC DOUBLE BARREL DRUM MIX ASPHALT PLANT BUFFALO, MISSOURI

JULY 1994

AEROMET ENGINEERING, INC.
1325 Aerotec Drive, Jefferson City, MO 65109
Testing • Monitoring • Consulting
(314) 636-6393

TEST CERTIFICATION

I certify that the enclosed test results are true, accurate, and authentic. I was personally responsible for all phases of the testing to determine the particulate and visible emissions from the Astec Double Barrel Drum Mix Asphalt Plant at the Ash Grove Aggregates facility, Buffalo, Mo., location.

The sampling equipment and procedures conformed to USEPA Method 1,2,3,5, and 9 for particulate and visible emissions from stationary sources. The results of this testing are the basis for this report.

AEROMET ENGINEERING, INC.

Tom Scheppers

Tom Scheppers, P.E.
President

TABLE OF CONTENTS

Page

<u>TABLES:</u>

<u>APPENDICES:</u>

I. INTRODUCTION

AeroMet Engineering, Inc., has been retained by Masters-Jackson Paving Company, to determine the particulate and visible emissions from a new portable Astec asphaltic concrete production plant installed at the Ash Grove Aggregates site, Buffalo, Missouri. Performance testing is required under the condition of a construction permit (# 0594-036) which was issued to Masters-Jackson Paving Company by the Missouri Department of Natural Resources. The asphalt plant is also subject to the Code of Federal Regulation (CFR) Title 40 Part 60 New Source Performance Standards (NSPS) Subpart I - Standards of Performance for Hot Mix Asphalt Facilities. USEPA Methods 5 and 9 were used for the testing with no deviations from the standard procedures. The asphalt plant is permitted to produce an emission rate of no greater than 0.04 grains/dry standard cubic foot, and less than 20 percent visible emissions.

Source testing took place on July 21, 1994. Pre-test planning was accomplished by phone conversations with the following individuals: Doug Elley of Missouri Department of Natural Resources; Dave Foreman, Permit Coordinator for Masters-Jackson; and Tom Scheppers, P.E., of AeroMet Engineering, Inc.

The project engineer and test team crew chief during the test for AeroMet Engineering was Tom Scheppers, P.E. Two other members of the test team were Mr. Darryl Meister and Mr. Jeff Broker. Mr. Broker is an EPA certified visible emissions reader and performed the Method 9 Visible Emissions Readings. Mr. Doug Elley observed the tests representing the Air Pollution Control Program, Missouri Department of Natural Resources. All aspects of the test program were coordinated with Dave Foreman, Permit Coordinator. The plant operating data was collected by the operator at 15 minute intervals. The data is presented in Appendix K.

Weather did play a factor during the testing program, causing a three hour delay in setting up the equipment, sampling for emissions and affecting the production rates of the plant. After the rain had subsided, the sky cleared up by the start of the second run. A storm front had moved into the area in the afternoon of the 20th and had rained most of the night. Asphalt production was limited due to the high moisture content of the aggregate. The temperatures were around the upper 80's to 90's.

II. SUMMARY OF RESULTS

The results are summarized in Table I. Actual emissions results are listed for particulate and visible emissions. The results of all three runs demonstrate compliance with the allowable limit of 0.04 grains per dry standard cubic foot (gr/dscf) and 20% opacity. The asphalt plant was operated at approximately 255 tons/hr of both aggregate and asphalt. A detailed description of the process is

TABLE I

Masters-Jackson Paving Company
Summary of Particulate and Visible Emission Test
Portable Astec Asphaltic Concrete Production Plant

	Run 1 07/21/94	Run 2 07/21/94	Run 3 07/21/94	Ave.
Process Conditions				
Production Rate (ton/hr)	253	256	255	255
Stack Conditions				
Stack Gas Temperature (°F)	266	265	267	266
Actual Gas Flow (ACFM)	43,007	42,822	42,411	42,747
Std. Gas Flow (DSCFM)	20,488	20,288	19,808	20,174
Isokinetics (%)	96	97	96	
Emissions, Actual				
Visible (percent)	0	0	0	0
Particulate (lb/hr)	0.63	0.39	0.46	0.49
Particulate (gr/DSCF)	0.0036	0.0022	0.0027	0.0029

found in the next section of this report. A summary of the production rates can be found in Table II within that same section.

The isokinetic sampling rate is also shown in Table I. This rate compares the stack gas velocity to the nozzle velocity of the sampling probe. A rate of 100% represents a stack gas velocity equal to the nozzle velocity. The acceptable range is 90% to 110%. EPA has determined that sampling outside this range may cause a bias in the results based on the particle size and aerodynamic properties.

The filters from all three runs were very clean and white in appearance, although appearance does not necessarily indicate weight. All three sets of samples appeared similar in light color and low density. The appearance also coincides with other samples taken from similar asphalt plants showing good combustion.

During the one-day testing period, no abnormalities were discovered to contribute to any errors in the results of the tests.

The particulate emission results should be representative of the actual concentrations within the normal accuracies of Method 5. Although no upper limits of emissions have been established for the test method, an upper limit has not been exceeded based on acceptance of the test method on significantly higher grain loadings. The estimated accuracy of Method 5 is approximately +/- 20% based on results of collaborative tests.

III. DESCRIPTION OF THE PROCESS

Masters-Jackson purchased and moved a new asphalt plant to the Ash Grove Aggregate Quarry located near Buffalo, Mo. The asphalt plant consists of a new Astec Drum Mixer. The asphalt plant is a portable plant. The Drum Mix Asphalt Plant consists of a cold feed system (five bin hopper), conveyors, a dryer drum with an integrated dryer/mixer, asphalt storage, fuel storage, and a final product storage silo.

A process description is as follows: Virgin aggregate is transported from storage piles to five independent bins by front end loader. The bins of specific sized aggregate are fed independently and continuously onto a feed belt. The feed belt supplies the correctly proportioned aggregate to the dryer drum. Feed rates are determined by automated controllers in order to blend a proper mix meeting any required specifications.

The dryer/mixer is called a "Double Barrel" drum mixer. The interior of the rotating drum, referred as the drying zone, receives the virgin aggregate at the upper end and travels countercurrent to the combustion gases. The aggregate is heated at high temperatures with combustion fuel in the rotary drum by direct contact with the combustion gases, primarily to dry and heat the aggregate. The dried material leaves the interior of the drum, at the lower end of the rotating drum, to enter a mixing zone between the exterior wall of the drum and a stationary outer shell. In the mixing zone, asphalt cement is added. The asphalt cement and aggregate is mixed thoroughly by paddles attached to the outer wall of the rotating drum. This design achieves excellent mixing and long residence time providing direct contact of the wet virgin materials with the hot combustion gases, mixing of asphalt cement away from the combustion gases, combustion of fume generated by mixing, and lower exhaust temperatures.

From the dryer/mixer, the mixed asphalt is transferred to a storage silo. Asphalt can be stored and dispensed to trucks without interruption of the production process.

Combustion products, moisture, and particulate fines from the process are pulled from the elevator, through and including the dryer drum. Asphalt fumes will undergo combustion in the first drum. All gases and fines from the operation will travel to a baghouse under negative pressure from an induced draft fan located at the outlet of the baghouse. The fan forces the air up a 22 foot rectangular stack to discharge to the atmosphere. Test ports are installed in the upper portion of the stack.

The entire facility uses the latest state-of-the-art technology available in controlling all process feeds, temperatures, blending, weighing, data recording, etc. The facility is automated to the extent that production runs are manufactured consistently and to specification.

IV. DESCRIPTION OF THE SOURCE

The asphalt plant exhaust gases are controlled by a baghouse prior to exiting through a rectangular stack. The gases discharge to atmosphere through a 22 foot 1 3/4 inch stack. Stack dimensions inside the wall are 40 1/4 Width by 27 1/8 inches, as measured at the test ports. The effective diameter is 32.4 inches.

The test ports (six equally spaced along one wall) are located 24.0 inches (0.74 diameter) from the stack exit, and 241.8 inches (7.4 diameters) from the last disturbance (Louvered damper). The damper is adjustable automatically in order to maintain proper air flow under any condition.

V. PLANT OPERATING CONDITIONS

The asphalt production process was operated in a normal operating manner. The average production rate during the test was approximately 255 tons/hour of finished asphalt product. Raw materials were consistent with normal materials used at this facility. The aggregate was obtained from the quarry and stored in uncovered piles. Moisture content of the aggregates was typical. Fuel used during the entire test duration was #2 fuel oil.

The plant operation data for the period July 21, 1994, is presented in Appendix K. This data has been recorded approximately every 15 minutes during each run. The data includes time, process input weight for both aggregate and total asphalt, and temperatures. The pressure drop across the baghouse averaged approximately 4.0 inches of water. This graph is also presented in Appendix K. A summary of the production rates and baghouse pressure drops are presented in Table II. No asphalt mix was recycled during the tests.

VI. TEST CONDITIONS

The Method 5 test samples were drawn from four points on each of six traverses of the stack. The traverse point locations were specified by USEPA Method 1. Samples were collected isokinetically for a total of one hour for each of three runs (2.5 minutes/point).

No problems of either the asphalt plant operations or the sampling were encountered during the tests. The asphalt plant was charged with typical aggregate mix, asphalt and fuel in a steady state manner.

A cyclonic flow test and preliminary velocity traverse was performed prior to the first Method 5 test. Stack flow conditions were acceptable for testing. Some sampling points were found to have flow angles as high as 35°. The average angle of rotation of the stack gases for the 24 points in the vertical plane was less than 20°. (Averages up to 20° are acceptable according to the USEPA procedures.)

VII. TEST EQUIPMENT AND METHODS

The test procedures and equipment used to determine the particulate and visible concentrations in the stack gases of the asphalt plant are described in Appendix E of this report. In brief, a Research Appliance Corporation stack sampling train was used to determine the particulate emissions according to USEPA Reference Method 5, and a certified visual emissions observer was used to determine the visible emissions according to USEPA Reference Method 9.

TABLE II

Summary of
Asphalt Plant Daily Operations Reports
Masters-Jackson Paving Company

Date	Run Number	Asphalt (TPH)	Baghouse Diff. Press. ("H_2O)
07/21/94	1	253	4.1
07/21/94	2	256	4.0
07/21/94	3	255	4.0
Averages During Tests		255	4.0

APPENDIX - A

PARTICULATE TEST ANALYSIS

Particulate Test Analysis

MASTERS & JACKSON
MAIN STACK
ASTEC ASPHALT PLANT

Run Number		1	2	3
Data Set		1	2	3
Date		07-21-94	07-21-94	07-21-94
Location		STACK	STACK	STACK
Start Time		10:54	13:11	15:17
End Time		12:02	14:19	16:25
Barometric Pressure	In. Hg	28.90	28.73	28.60
Static Pressure	In H2O	1.00	1.00	1.00
Volume of Condensate	ML	545.1	550.6	543.6
Volume Sampled	DCF	58.954	59.967	59.197
Pitot Tube Coeffecient		0.84	0.84	0.84
Meter Correction Factor		1.00	1.00	1.00
Square Root of Delta P		1.334	1.325	1.307
Orifice Pressure	In H2O	3.33	3.33	3.26
Meter Temperature	Deg. F	103.4	110.7	115.6
Flue Temperature	Deg. F	266	265	267
Percent CO2	%	5.7	5.7	5.7
Percent O2	%	13.6	13.6	13.6
Diameter of Nozzle	In.	0.252	0.252	0.252
Area of Flue	Sq Ft	7.58	7.58	7.58
Sample Time	Min	60	60	60
Weight Gain	Grams	0.0125	0.0078	0.0092
Absolute Flue Pressure	In. Hg	28.97	28.80	28.67
Corrected Sample Volume	DSCF	53.72	53.62	52.24
Moisture in Flue Gas	%	32.3	32.6	32.9
Molecular Weight	Lb/LbMole	25.75	25.72	25.69
Velocity of Flue Gas	Fps	94.54	94.13	93.23
Volume of Flue Gas	ACFM	43,007	42,822	42,411
Volume of Flue Gas	DSCFM	20,488	20,228	19,808
Dust Concentration	Lb/DSCF	5.13E-07	3.21E-07	3.88E-07
Dust Concentration	Lbs/Hour	0.63	0.39	0.46
Dust Concentration	Grs/ACF	0.00171	0.00106	0.00127
Dust Concentration	Grs/DSCF	0.00359	0.00225	0.00272
Isokinetic Rate	%	95.7	96.8	96.3

Averages:

Stack Temperature	DEGR F :	266		
Flue Gas Volume	ACFM :	42747	DSCFM :	20174
Dust Concentration	Lb/DSCF:	4.07E-07	Lb/Hour:	0.494
	Grs/ACF:	0.00135	Grs/DSCF :	0.00285

APPENDIX - B

PARTICULATE FIELD DATA SHEETS

Particulate Field Data Sheet

Client	MASTERS - JACKSON
Date	7/21/94
Page	1 Of 1
Project No.	476
Operator	TOM SCHEPPERS
Sampling Location	MAIN STACK
Run No.	1
Filter No.	8
Acetone No.	M6
Condensate	545.1
Barometric Pressure	28.90
Static Pressure	+ 1.0
Probe Number	P3
Nozzle Diameter	.252
Nozzle Number	B250
Pitot Coefficient	.84
Pitot Number	P3
Meter Corr. Factor	.996 1.83
Meter-Orifice	.176
Sample Pt. Time	2.5 min/pt 60 min
Assumed % Moisture	30 %
Leak Test Before	0.003@15"Hg
Leak Test After	0.002@6"Hg

Orsat Analysis

CO_2	$+O_2$	O_2	CO
5.7	19.3	13.6	0
5.7	19.3	13.6	0
5.7	19.3	13.6	0
5.7	19.3	13.6	0

10:54 Sample Point	ΔP	√ΔP	ΔH	Temperature °F Stack	Probe	Imp. Out	Oven	Meter In	Meter Out	Vac. Pr (in. HG)	Dry Gas Meter Reading in Cu. Ft. 579.764
A 1	1.8		3.25	257	258	67	262	80	80	2	582.250
2	2.1		3.78	262	259	67	266	86	80	3	584.790
3	2.1		3.81	263	258	65	260	94	81	4	587.521
4	1.7		3.09	266	253	64	261	100	82	3	589.888
B 1	1.5		2.75	263	250	66	248	103	83	2	592.071
2	1.7		3.13	262	253	66	248	106	84	3	594.425
3	2.0		3.69	264	251	67	264	110	86	3	597.026
4	1.6		2.96	265	249	66	261	114	87	3	599.333
C 1	1.5		2.79	264	235	66	262	115	88	2	601.560
2	1.5		2.80	263	236	61	261	115	90	3	603.811
3	1.9		3.54	266	238	61	260	117	92	3	606.331
4	1.6		2.99	266	239	57	251	120	93	3	608.610
D 1	1.3		2.43	266	237	59	266	119	94	2	610.727
2	1.7		3.19	265	242	58	251	119	96	3	613.100
3	2.0		3.75	266	246	58	237	121	96	3	615.753
4	1.8		3.39	267	246	58	243	124	98	3	618.282
E 1	1.6		3.01	267	247	58	264	123	98	3	620.650
2	1.5		2.82	269	247	56	262	123	100	3	622.883
3	2.1		3.94	270	240	57	258	123	100	4	625.489
4	2.1		3.95	271	243	57	260	125	102	4	628.254
F 1	1.6		3.01	270	246	59	261	126	102	3	630.550
2	1.6		3.02	269	250	58	258	124	103	3	632.921
3	2.1		3.96	270	237	59	255	125	103	4	635.771
4	2.6		4.90	273	242	58	261	128	104	5	638.718

Pitot Tube Leak Check: Before OK After OK

Integrated Bag Leak Check: Before OK After OK

Particulate Test
Method 5
Impinger Volumes

Run 1 **Date** 7/21/94 **Facility** Masters

	Impinger	**Final**	**Initial**	**Reagent**	**Liquid Gain**
	1 MGS	861.9 ml	620.5 100 ml	H_2O	241.4
M3	2 GS	849.6 ml	603.7 100 ml	H_2O	245.9
C4		554.6	525.6		29.0
M1	3 MGS	534.8 ml	524.7 0 ml	Empty	10.1
S4	4 MGS	1051.1 g	1032.4 g	Silica Gel	18.7

Total: 545.10

GS - Greenburg Smith

MGS - Modified Greenburg Smith

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Particulate Field Data Sheet

Client		Date	Page	Of
Masters - JACKSON		7/21/94	1	1

Project No.	Operator
476	Tom Scheppers

Sampling Location	Run No.
MAIN STACK	2

Filter No.	Acetone No.	Condensate
09	M6	550.6

Barometric Pressure	Static Pressure	Probe Number
28.73	+1.0	P3

Nozzle Diameter	Nozzle Number	Pitot Coefficient	Pitot Number
.252	B250	.84	P3

Meter Corr. Factor		Meter-Orifice
.996	1.83	.176

Sample Pt. Time	Assumed % Moisture	Leak Test Before	Leak Test After
2.5 min/pt 60 min	30	0.002 @ 17" Hg	0.003 @ 11" Hg

Orsat Analysis

CO_2	$+O_2$	O_2	CO
5.7	19.3	13.6	0
5.7	19.3	13.6	0
5.7	19.3	13.6	0
5.7	19.3	13.6	0

	13:11 Sample Point	ΔP	$\sqrt{\Delta P}$	ΔH	Temperature °F Stack	Probe	Imp. Out	Oven	Meter In	Meter Out	Vac. Pr (in. HG)	Dry Gas Meter Reading in Cu. Ft.
												639.015
2.5	A1	1.7		3.15	256	237	63	265	93	94	4	641.440
5	2	2.2		4.09	257	238	52	263	98	95	5	644.200
7.5	3	2.0		3.74	259	238	51	258	108	95	5	649.915
10	4	1.5		2.82	260	252	56	256	114	96	4	649.225
	B1	1.4		2.62	262	246	62	263	112	96	4	651.500
	2	1.8		3.38	262	255	62	268	115	97	4	653.901
	3	1.8		3.38	264	250	62	264	118	98	4	656.427
	4	1.5		2.82	266	242	61	266	121	98	4	658.682
	C1	1.3		2.45	265	250	63	265	119	100	4	660.871
	2	1.6		3.01	266	254	62	267	120	100	4	663.281
	3	1.9		3.56	270	256	60	264	122	101	4	665.626
	4	1.5		2.82	269	252	60	255	124	102	4	668.083
	D1	1.5		2.82	270	249	58	260	123	102	4	670.403
	2	1.6		3.01	269	248	56	261	122	103	4	672.660
	3	1.9		3.58	270	246	56	263	124	104	5	675.211
	4	1.7		3.22	269	250	55	260	128	104	5	677.932
	E1	1.6		3.03	268	244	58	261	126	104	4	680.159
	2	1.5		2.84	269	246	55	263	126	105	4	682.500
	3	2.0		3.80	267	242	56	248	127	106	5	685.321
	4	2.1		3.99	267	245	56	253	128	106	6	687.955
	F1	2.0		3.79	267	246	62	258	123	107	6	690.742
	2	1.6		3.04	267	245	60	259	128	106	4	693.159
	3	2.2		4.20	266	247	57	264	130	106	6	695.967
	4	2.5		4.79	266	243	55	260	134	107	7	698.982

Pitot Tube Leak Check: Before OK After OK

Integrated Bag Leak Check: Before OK After OK

Particulate Test
Method 5
Impinger Volumes

Run 2 **Date** 7/21/94 **Facility** Masters

	Impinger	Final		Initial		Reagent	Liquid Gain
M4	1 MGS	856.2	ml	624.2 ~~100~~	ml	H_2O	232.0
M3	2 GS	850.0	ml	604.9 ~~100~~	ml	H_2O	245.1
C		587.7		526.9			60.8
M1	3 MGS	530.2	ml	526.0	ml	Empty	4.2
S1	4 MGS	984.6	g	976.1	g	Silica Gel	8.5

Total: 550.6

GS - Greenburg Smith

MGS - Modified Greenburg Smith

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Particulate Field Data Sheet

Client: MASTERS - JACKSON		Date: 7/21/94	Page 1 Of 1
Project No.: 476	Operator: TOM SCHEPPERS		
Sampling Location: MAIN STACK	Run No.: 3		
Filter No.: 10	Acetone No.: M6	Condensate: 543.6	
Barometric Pressure: 28.60	Static Pressure: +1.0	Probe Number: P3	
Nozzle Diameter: .252	Nozzle Number: B250	Pitot Coefficient: .84	Pitot Number: P3
Meter Corr. Factor: .996	Meter-Orifice: .176		
Sample Pt. Time: 2.5 min/pt 60 min	Assumed % Moisture: 30 %	Leak Test Before: 0.001 @ 16" Hg	After: 0.000 @ 8" Hg

Orsat Analysis

CO_2	$+O_2$	O_2	CO
5.7	19.3	13.6	0
5.7	19.3	13.6	0
5.7	19.3	13.6	0
5.7	19.3	13.6	0

Sample Point	ΔP	$\sqrt{\Delta P}$	ΔH	Temperature °F Stack	Probe	Imp. Out	Oven	Meter In	Meter Out	Vac. Pr (in. HG)	Dry Gas Meter Reading in Cu. Ft.
15:17											699.275
A1	1.9		3.54	258	228	58	235	98	98	4	701.901
2	2.0		3.71	267	257	56	247	106	100	4	704.510
3	2.0		3.72	268	249	56	261	110	100	4	707.142
4	1.5		2.81	267	253	56	244	116	100	3	709.444
B1	1.5		2.81	268	258	59	255	117	100	3	711.700
2	1.8		3.39	267	255	58	261	120	102	4	714.180
3	1.9		3.59	267	258	57	248	124	102	5	716.421
4	1.4		2.66	266	260	57	235	126	104	3	718.956
C1	1.3		2.46	267	258	59	252	123	104	3	721.371
2	1.5		2.84	268	262	58	258	125	106	4	723.473
3	1.9		3.61	267	260	60	240	126	106	5	726.103
4	1.5		2.86	266	256	60	243	128	106	4	728.318
D1	1.3		2.47	267	269	60	248	128	107	4	730.490
2	1.4		2.67	266	244	59	252	126	108	4	732.708
3	1.9		3.61	268	246	58	257	128	108	5	735.233
4	1.7		3.25	267	242	60	264	130	109	5	737.747
E1	1.3		2.48	268	236	63	268	130	109	4	739.964
2	1.5		2.85	269	238	62	255	128	109	4	742.186
3	2.0		380	270	252	62	242	129	109	5	744.800
4	2.1		4.02	269	254	60	258	134	110	5	747.701
F1	1.8		3.45	270	252	61	264	137	111	5	750.351
2	1.5		2.88	269	256	61	243	137	112	4	752.553
3	2.1		4.04	268	253	62	248	138	112	6	755.321
4	2.5		4.83	267	256	63	255	140	113	7	758.472

Pitot Tube Leak Check: Before OK After OK

Integrated Bag Leak Check: Before OK After OK

Particulate Test
Method 5
Impinger Volumes

Run 3 Date 7/21/94 Facility Masters

Impinger	Final	Initial	Reagent	Liquid Gain
1 MGS	866.3 ml	629.0 / 100 ml	H_2O	237.3
2 GS	875.1 ml	600.3 / 100 ml	H_2O	274.8
3 MGS	539.3 / 529.7 ml	526.6 / 525.3 / 0 ml	Empty	12.7 / 4.4
4 MGS	998.2 g	983.8 ~~525.3~~ g	Silica Gel	14.4

Total: 543.6

GS - Greenburg Smith

MGS - Modified Greenburg Smith

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(314) 636-6393

METHOD 1
CYCLONIC FLOW DETERMINATION

Source Name MOSTERS

Date 7/21/94

Sampling Location ______

SAMPLE POINT	DELTA P	ANGLE (degrees)
A 1	0	0.5
2	0	0
3	0	0
4	0	0
B 1	0	5
2	0	0
3	0	0
4	0	0
C 1	0	5
2	0	0
3	0	0
4	0	0
D 1	0	30
2	0	20
3	0	5
4	0	5
E 1	0	35
2	0	20
3	0	5
4	0	0
F 1	0	30
2	0	15
3	0	5
4	0	0

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APPENDIX - C

ANALYTICAL LABORATORY REPORTS

(Particulate)

Analytical Data Sheet

Client MASTERS & JACKSON Project No. 476 Date 7/29/94

Run No. 1
Filter No. 08
Acetone No. M6
Amount liquid lost during transport 0
Acetone blank volume, ml 250
Acetone wash volume, ml
Acetone blank concentration, mg/mg (equation 5-4)** 1.5×10^{-6}
Acetone wash blank, mg (equation 5-5)** .0001

Container Number	Weight of Particulate Collected g		
	Final Weight	Tare Weight	Weight Gain
1	.6871	.6874	-.0003
2	95.1117	95.0988	+.0129
3			
		Less acetone blank	.0001
		Weight of particulate matter	0.0125

	Volume of Liquid Water Collected	
	Impinger Volume, ml.	Silica Gel Weight, g
Final		
Initial		
Liquid collected		
Total Volume Collected		g* ml

Run No. 2
Filter No. 09
Acetone No. M6
Amount liquid lost during transport 0
Acetone blank volume, ml 250
Acetone wash volume, ml
Acetone blank concentration, mg/mg (equation 5-4)** 1.5×10^{-6}
Acetone wash blank, mg (equation 5-5)** .0001

Container Number	Weight of Particulate Collected g		
	Final Weight	Tare Weight	Weight Gain
1	0.6857	0.6874	-.0017
2	98.0772	98.0676	.0096
3			
		Less acetone blank	.0001
		Weight of particulate matter	.0078

	Volume of Liquid Water Collected	
	Impinger Volume, ml.	Silica Gel Weight, g
Final		
Initial		
Liquid collected		
Total Volume Collected		g* ml

Run No. 3
Filter No. 10
Acetone No. M6
Amount liquid lost during transport 0
Acetone blank volume, ml 250
Acetone wash volume, ml
Acetone blank concentration, mg/mg (equation 5-4)** 1.5×10^{-6}
Acetone wash blank, mg (equation 5-5)** .0001

Container Number	Weight of Particulate Collected g		
	Final Weight	Tare Weight	Weight Gain
1	0.6925	0.6924	.0001
2	95.1316	95.1187	.0129
3			
		Less acetone blank	.0001
		Weight of particulate matter	0.0129

	Volume of Liquid Water Collected	
	Impinger Volume, ml.	Silica Gel Weight, g
Final		
Initial		
Liquid collected		
Total Volume Collected		g* ml

Run No. BLANK
Filter No. N/A
Acetone No. M6
Amount liquid lost during transport 0
Acetone blank volume, ml 250
Acetone wash volume, ml N/A
Acetone blank concentration, mg/mg (equation 5-4)** 1.5×10^{-6}
Acetone wash blank, mg (equation 5-5)** N/A

Container Number	Weight of Particulate Collected g		
	Final Weight	Tare Weight	Weight Gain
1	95.7882	95.7879	0.0003
2			
3			
		Less acetone blank	
		Weight of particulate matter	

	Volume of Liquid Water Collected	
	Impinger Volume, ml.	Silica Gel Weight, g
Final		
Initial		
Liquid collected		
Total Volume Collected		g* ml

*Convert weight of water to volume by dividing total weight increase by density of water (1g/ml): $\frac{\text{Increase, g}}{\text{1g/ml}}$ = Volume Water, ml

**See Federal Register, Method 5, 6.6, & 6.7.

APPENDIX - D

TEST EQUIPMENT CALIBRATIONS

EXPANDED RANGE DIGITAL THERMOMETER INSTRUCTIONS

Specifications

Digital Display: 4 LCD digits

Sampling Time: Less than 1 second

Resolution: 1 Degree

Fahrenheit Model

Accuracy Chart:

Temp. Range	Accuracy (+/-)
32 to 932 °F	0.75% + 2 °F
933 to 1382 °F	1% + 2 °F
1383 to 1832 °F	2% + 2 °F (typical)
1833 to 2000 °F	4% + 2 °F (typical)
31 to -4 °F	4 °F (typical)
-5 to -50 °F	6 °F (typical)

Celsius Model

Accuracy Chart:

Temp. Range	Accuracy (+/-)
0 to 500 °C	0.75% + 1 °C
501 to 750 °C	1% + 1 °C
751 to 1000 °C	2% + 1 °C (typical)
1001 to 1200 °C	4% + 3 °C (typical)
0 to -20 °C	2 °C (typical)
-21 to -40 °C	3 °C (typical)
-41 to -50 °C	4 °C (typical)

Case: ABS plastic

Failsafe: Low battery indicator

Power: 9 Volt alkaline battery

Probe Supplied: Ultra-fast response, naked bead type K thermocouple with operating temperature range to 482 °F or 250 °C, and short term usage to 572 °F or 300 °C, Cat. No. 4028.

Dry Gas Meter Calibration Sheet

Client ______________________ Run By ______________________

Project No. ______________________ Date 2-23-94

Module L-1 Barometric Press 29.13

Orifice .176

ΔH in. H_2O	Vw initial	Vw final	Vw $ft.^3$	Vd initial	Vd final	Vd $ft.^3$	tw °F	tdi °F	tdo °F	Pw in. H_2O	Time θ min.
.5	13.297	18.707	5.410	996.988	002.534	5.546	69	69 86	69 75	0	14
1.0	18.707	23.792	5.085	1002.534	1007.774	5.240	70	86 98	75 78	0	9
2.0	23.792	29.259	5.467	1007.774	1013.428	5.654	70	98 106	78 82	0	7
4.0	29.259	34.635	5.376	1013.428	1019.003	5.575	70	106 112	82 84	0	5
6.0	34.635	40.090	5.455	1019.003	1024688	5.685	70	112 116	84 88	0	4

ΔH	$\frac{\Delta H}{13.6}$	Mc (Y) $\frac{Vw\ Pb\ (td + 460)}{Vd\ (Pb + \Delta H/13.6)\ (tw + 460)}$	ΔHa (For Small Orifice Only) $\frac{0.0317\ \Delta H}{Pb\ (td + 460)} \cdot \left[\frac{(tw + 460)\ \theta}{Vw}\right]^2$
.5	.0368	.984	1.908
1.0	.0737	.994	1.760
2.0	.147	1.000	1.819
4.0	.294	1.001	1.902
6.0	.441	0.999	1.761
Average		.996	1.830

ΔH = Orifice Setting

Vw = Volume of Gas of Wet Test Meter

Vd = Volume of Gas of Dry Gas Meter

Pw = Pressure of Wet Test Meter

tw = Temperature of Fluid in Wet Test Meter

tdi = Inlet Temperature of Dry Gas Meter

tdo = Outlet Temperature of Dry Gas Meter

td = Average Temperature of Dry Gas Meter

θ = Time required to pull specified cubic feet

Mc = Dry Gas Meter Correction Factor

ΔHa = Orifice setting that would pull .75 cfm of air at standard conditions

Dry Gas Meter Calibration Sheet

Client ______________________ Run By TOM SCHEPPERS

Project No. ______________________ Date 7/29/94

Module L-1 Barometric Press 29.40

Orifice .176

ΔH in. H_2O	Vw initial	Vw final	Vw ft.^{3}	Vd initial	Vd final	Vd ft.^{3}	tw °F	tdi °F	tdo °F	Pw in. H_2O	Time θ min.
.5	41.588	48.701	7.113	903.784	911.161	7.377	88/	95/103	98/99	0	18
1.0	48.701	54.525	5.824	911.161	917.244	6.083	88	103/123	99/103	0	10
2.0	54.525	60.078	5.553	917.244	923.057	5.813	87	124/127	103/106	0	7
4.0	60.078	65.527	5.449	923.057	928.748	5.691	87	127/132	106/109	0	5
6.0	65.527	71.054	5.527	928.748	934.509	5.761	87	132/137	109/111	0	4

ΔH	$\frac{\Delta H}{13.6}$	Mc (Y): $\frac{Vw\ Pb\ (td + 460)}{Vd\ (Pb + \Delta H/13.6)\ (tw + 460)}$	ΔHa (For Small Orifice Only): $\frac{0.0317\ \Delta H}{Pb\ (td + 460)} \cdot \left[\frac{(tw + 460)\ \theta}{Vw}\right]^2$
.5	.0368	0.981	1.879
1.0	.0737	0.988	1.705
2.0	.147	0.998	1.807
4.0	.294	1.002	1.903
6.0	.441	1.005	1.764
Average		0.995	1.811

ΔH = Orifice Setting

Vw = Volume of Gas of Wet Test Meter

Vd = Volume of Gas of Dry Gas Meter

Pw = Pressure of Wet Test Meter

tw = Temperature of Fluid in Wet Test Meter

tdi = Inlet Temperature of Dry Gas Meter

tdo = Outlet Temperature of Dry Gas Meter

td = Average Temperature of Dry Gas Meter

θ = Time required to pull specified cubic feet

Mc = Dry Gas Meter Correction Factor

ΔHa = Orifice setting that would pull .75 cfm of air at standard conditions

AEROMET ENGINEERING

ANEROID BAROMETER CALIBRATION

Instrument Number: BM-60

Calibrated By: Tom Scheppers

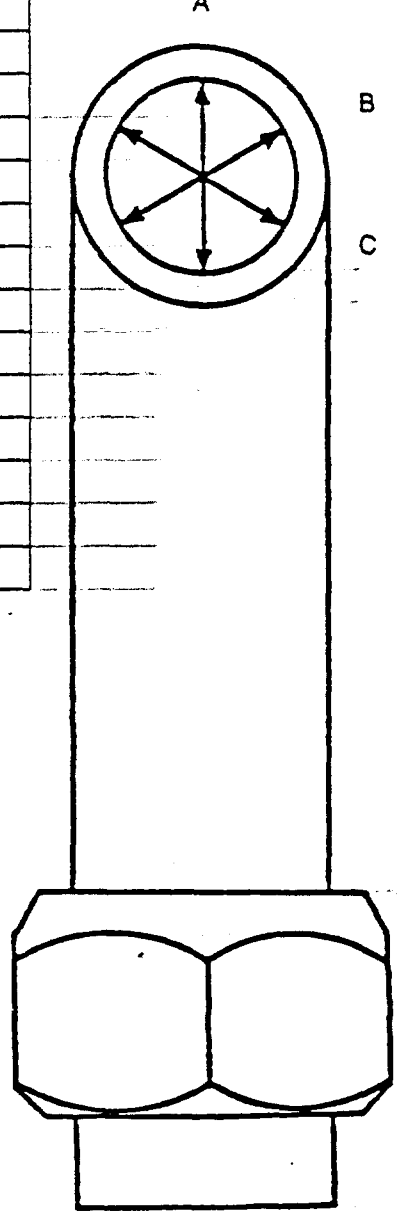
Date: 6/19/93 - 7/29/94

Date	Aneroid Barometer Reading ("Hg)	Mercury Barometer Reading ("Hg)	Deviation ("Hg)
6/19/93	29.83	29.83	0.00
2/23/94	29.13	29.13	0.00
7/29/94	29.40	29.40	0.00

Nozzle Calibration

Sized By TOM SCHEPPERS

Date	Nozzle	Dimension A	Dimension B	Dimension C	Difference	Avg. Diameter
7/20/94	A375	0.373	0.373	0.374	0.001	0.373
7/21/94	B250	0.253	0.252	0.252	0.001	0.252
7/26/94	G275	0.272	0.272	0.272	0.000	0.272



All Dimensions are in inches.

Pitot Calibration Form

Client ______
Project No. ______
Test Location ______

Run By Tom Scheppers
Date 5/5/94
Pitot No. P3

	• "A" Side Calibration			
Run No.	Δ P std cm H_2O (in. H_2O)	Δ P (s) cm H_2O (in. H_2O)	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(A)$
1	1.0	1.41	.84	0
2	1.0	1.41	.84	0
3	1.0	1.41	.84	0
	Average	$\bar{C}_p$ (Side A)	.84	0

	•• "B" Side Calibration			
Run No.	Δ P std cm H_2O (in. H_2O)	Δ P (s) cm H_2O (in. H_2O)	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(B)$
1	1.0	1.41	.84	0
2	1.0	1.41	.84	0
3	1.0	1.41	.84	0
	Average	$\bar{C}_p$ (Side B)	.84	0

Calculations:

$$C_p\ (s) = 0.99 \sqrt{\frac{\Delta\ P\ \text{(standard)}}{\Delta\ P\ (s)}}$$

$$\text{Deviation} = C_p(s) - \bar{C}_p(\text{A or B})$$

$$\text{Average Deviation} = \sigma(\text{A or B}) = \frac{\sum_{1}^{3} |C_p(s) - \bar{C}_p(\text{A or B})|}{3}$$

$|\bar{C}_p(\text{Side A}) - \bar{C}_p(\text{Side B})| =$ 0

Nozzle size used for Calibrations (inches) .500

Intercomponent Spacings During Calibrations:

Pitot - Nozzle: > 3/4"

* Pitot - Thermocouple: ~2" back

Pitot - Probe Sheath: > 3"

* or two inches from end of thermocouple to center line of pitot tube.

Thermocouple Calibrations

(Oven, Probe)

Client AEROMET 2-9-93

Project No. –

Thermocouple Identification	Trendicator	Thermometer	Thermometer Number	Date	
THT-4-780	67	67.4	NIST-C	2-9-93	DIGITAL THERMOM.
THT-4-780	157	157.3	NIST-C	2-9-93	
THT-4-780	212	211.0	NIST-C	2-9-93	
THT-4-740	67	67.4	NIST-C	2-9-93	
THT-4-740	157	157.3	NIST-C	2-9-93	
THT-4-740	211	211.0	NIST-C	2-9-93	
G8A	67	67.4	NIST-C	2-9-93	PROBES
G8A	211	211.4	NIST-C	2-9-93	
G8B	67	67.4	NIST-C	2-9-93	
G8B	211	211.2	NIST-C	2-9-93	
L-1 oven	250	248	THT-4-780	2-9-93	L-1 METER BOX
L-1 DGM In	67	67.4	NIST-C	2-9-93	
L-1 DGM out	68	67.4	NIST-C	2-9-93	
L-1 IMP out	67	67.4	NIST-C	2-9-93	
D-1 OVEN	255	253	THT-4-780	2-9-93	D1 METER BOX
D-1 DGM IN	67	67.4	NIST-C	2-9-93	
D-1 DGM OUT	67	67.4	NIST-C	2-9-93	
D-1 IMP OUT	67	67.4	NIST-C	2-9-93	

Denver Instrument Company

Certificate of Calibration

Model A-250

Serial Number B033665

Date 12-13-91

We hereby certify that the referenced instrument was manufactured in the United States and that it has been calibrated to full capacity using NBS Class S-1 weights. This instrument has been fully inspected and has passed all quality tests as specified by Denver Instrument Company quality control guidelines.

To assure proper operation, it may be necessary to recalibrate the instrument periodically using known weights.

Cari Scott
Quality Technician

Maria Szilagyi
Quality Control Manager

Denver Instrument Company
6542 Fig Street • Arvada, Colorado 80004 • 1-800-321-1135

APPENDIX - E

TEST EQUIPMENT DESCRIPTION

(Particulate)

TESTING EQUIPMENT - EPA METHOD 5 SAMPLING TRAIN

A RAC Corporation Stack Sampler was used at the sampling location(s). The particulate sampling train consisted basically of a glass or stainless steel probe; a variable-heat-controlled filter oven with a calibrated thermometer located at the impinger outlet; a 1/2-hp shaft sealed carbon vane vacuum pump assembly with a vacuum gauge; a control unit with an elapse time indicator, a temperature indicator (potentiometer), temperature controllers, gauges, a calibrated dry gas meter, and an umbilical and various interconnecting hoses, fitting and valves. An appropriately sized glass or stainless-steel nozzle, a calibrated Type K temperature sensor, a static pressure tube, a calibrated S type pitot tube and a variable-heat-controlled stainless-steel liner are integral parts of the probe assembly.

The vacuum pump was used to control gas sampling rates. The control unit was used to control probe and oven temperatures. The control unit was also used to monitor elapsed sampling times, temperatures, velocities, static pressure, gas sampling rates and sampled gas volume.

Analyzer (Orsat)

Flue gas concentrations were determined with a Gas Analyzer (Orsat) which measures the percentage of carbon dioxide, percentage of oxygen and percentage of carbon monoxide to the nearest tenth of a percent.

Programmable Calculator

A Hewlett Packard, Model HP41CX, programmable calculator was used to determine the isokinetic sampling rate at each sampling point.

Prior to the field testing, the following procedures were performed: All instruments were checked and calibrated. Gelman Spectro Grade, glass-fiber-mat filters with 99.95 percent retention of 0.3-micron particles were individually numbered, placed in similarly numbered glass petri dishes, desiccated for 24 hours and weighed on a Sartorious analytical balance to the nearest 0.1-milligram, and weighed a minimum of every six hours until two consecutive weights within +0.5 milligram were obtained, or heated for two to three hours at 220 degrees F, cooled in a desiccator and weighed. Several 250 milliliter crucibles were desiccated for a minimum of 24 hours and weighed in the same manner as the filters and petri dishes. Also, several 200-gram quantities of Type 6-16 mesh indicating silica gel were weighed on an beam balance and placed into separate airtight storage containers.

The number of sampling points and positions of the points in the flue at the sampling location(s), and the sampling time at each point were determined prior to the particulate testing. The sampling procedures were performed in accordance with the Environmental Protection Agency's Reference Method 5, "Determination of Particulate Emissions from Stationary Sources" in the July 1, 1989 Federal Register, "Standards of Performance for New Stationary Sources" and subsequent revisions.

Before each test run a particulate sampling train was prepared inpart at the sampling location(s) in the following manner: An appropriately sized sampling nozzle was installed onto the inlet of the sampling probe and capped. The probe was then dimensioned and marked at increments that corresponded with the predetermined sampling positions in the flue. A standard impinger assembly was prepared by adding 100 milliliters of distilled water to each of the first two impingers. The third impinger was left dry and the fourth was filled with approximately 200 grams of type 6-16 mesh indicating silica gel. The entire impinger assembly was then placed in an ice bath. A disc filter was removed from its petri dish and placed inside of a filter holder. The filter holder was then placed inside of a filter oven and assembled to the sampling probe outlet and the impinger unit inlet. Next, an umbilical and sampling hoses were connected to the sampling probe, filter oven, impinger unit, a vacuum pump and the control unit, accordingly. The probe and oven were then heated to and held at 248 degrees plus or minus 25 degrees.

As soon as the probe and oven termperatures had stabilized the entire sampling train assembly was leak-checked at a minimum of 15 inches of mercury vacuum for one minute and the leakage rate recorded. A leakage rate of less than .02 cfm and no vacuum loss was considered acceptable.

After the particulate sampling train had been assembled, the probe and oven heated, and the entire system leak-checked, as previously described, the particulate sampling was performed.

Three test runs were performed at the sampling location(s). The sampling data for each test run was recorded on a field test form during each of the sampling periods.

After the completion of a test run, the following procedures were performed: A final leak-check was performed at maximum vacuum or greater incurred during the test for one minute and the leakage rate recorded. The flue gas moisture collected in the first three impingers was measured and recorded. The moisture laden silica gel in the fourth impinger was weighed on site. The weight gain of the silica gel moisture collection was added to the measured moisture condensed for that test run. The sample nozzle, probe and filter holder were capped and taken to a clean area for sample recovery. At the recovery area, the disc filter was carefully removed from the filter holder and transferred to its petri dish for later weighing.

The sampling nozzle, probe and filter holder were washed with nanograde acetone, glass components were washed three times, stainless steel components were washed six times and visually inspected for cleanliness. The acetone washing and acetone blank were collected and labeled polypropylene sample bottles and retained for later evaporation, desiccation and weighing.

Flue gas concentrations (percentage of CO_2, percentage of O_2, and percentage of CO) were determined by taking several Orsat samples of the gas collected, simultaneously with the particulate sampling, throughout the test run, by an integrated gas sampling train. The integrated gas sample was collected from the discharge of the particulate control unit. The sampling train was set at a predetermined constant flow rate to obtain an adequate sample or by taking direct readings from the sampling points. The concentrations for each test run were recorded on a field test form.

APPENDIX - F

USEPA REFERENCE METHOD 5

APPENDIX - G

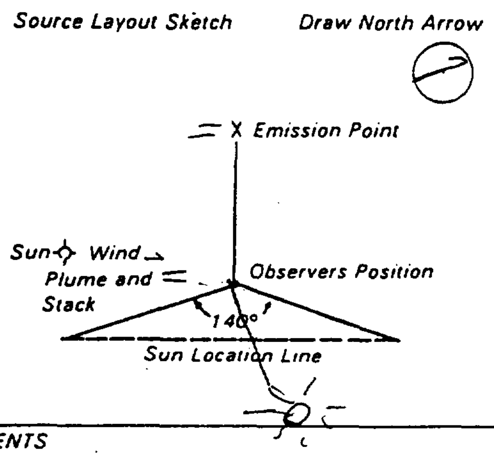
VISIBLE FIELD DATA SHEETS

Visible Emission Observation Form

SOURCE NAME	MASTERS - JACKSON PAVING
ADDRESS	P.O. Box 1187 PLANT AT BUFFALO
CITY	SPRINGFIELD
STATE	MO
ZIP	65801
PHONE	(417) 881-5581
SOURCE ID NUMBER	—
PROCESS EQUIPMENT	ASPHALT PLANT
OPERATING MODE	NORMAL
CONTROL EQUIPMENT	BAGHOUSE
OPERATING MODE	NORMAL
DESCRIBE EMISSION POINT	START MAIN STACK STOP MAIN STACK
HEIGHT ABOVE GROUND LEVEL	20'
HEIGHT RELATIVE TO OBSERVER	20'
DISTANCE FROM OBSERVER	100'
DIRECTION FROM OBSERVER	W
DESCRIBE EMISSIONS	START Clear STOP Clear
EMISSION COLOR	START Clear STOP
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 1 D STOP 1 D
DESCRIBE BACKGROUND	START cloudy sky STOP cloudy sky
BACKGROUND COLOR	START white STOP
SKY CONDITIONS	START CLD STOP CLD
WIND SPEED	START STOP
WIND DIRECTION	START S STOP S
AMBIENT TEMP.	START STOP
WET BULB TEMP.	
RH, percent	

OBSERVATION DATE	START TIME	STOP TIME
7/21/94	10:51	11:51

MIN \ SEC	0	15	30	45	MIN \ SEC	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



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)	Jeff Barker
OBSERVER'S SIGNATURE	[signature]
DATE	7/21/94
ORGANIZATION	AEROMET ENGINEERING, INC
CERTIFIED BY	AEROMET ENGR - Tom S
DATE	7/18/94
VERIFIED BY	MoDNR - DOUG ELLEY
DATE	7/18/94
COMMENTS	
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS SIGNATURE	
TITLE	
DATE	

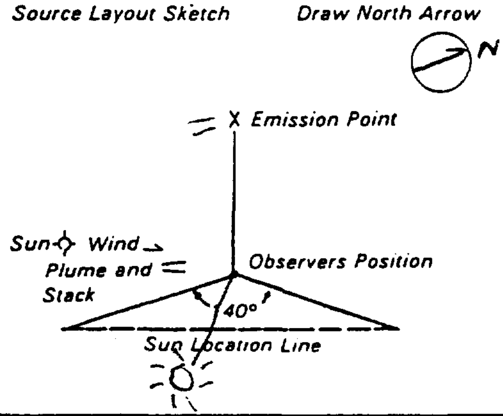
Visible Emission Observation Form

SOURCE NAME	MASTERS - JACKSON PAVING
ADDRESS	P.O. BOX 1187
	PLANT AT BUFFALO
CITY	SPRINGFIELD
STATE	MO
ZIP	65801
PHONE	(417) 881 -5581
SOURCE ID NUMBER	
PROCESS EQUIPMENT	ASPHALT PLANT
OPERATING MODE	NORMAL
CONTROL EQUIPMENT	BAGHOUSE
OPERATING MODE	NORMAL
DESCRIBE EMISSION POINT	START MAIN STACK STOP MAIN STACK
HEIGHT ABOVE GROUND LEVEL	20'
HEIGHT RELATIVE TO OBSERVER	20'
DISTANCE FROM OBSERVER	100'
DIRECTION FROM OBSERVER	W
DESCRIBE EMISSIONS	START clear STOP Clear
EMISSION COLOR	START clear STOP clear
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 ~1 Diameter STOP Same
DESCRIBE BACKGROUND	START Blue sky STOP Blue sky
BACKGROUND COLOR	START Blue STOP Blue
SKY CONDITIONS	START clear STOP clear
WIND SPEED	START 10 STOP 10
WIND DIRECTION	START S STOP S
AMBIENT TEMP.	START STOP
WET BULB TEMP.	
RH, percent	

OBSERVATION DATE	START TIME	STOP TIME
7/21/94	1:11	2:11

MIN \ SEC	0	15	30	45	MIN \ SEC	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

Source Layout Sketch Draw North Arrow



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)	Jeff Broker
OBSERVER'S SIGNATURE	[signature]
DATE	7/21/94
ORGANIZATION	AEROMET ENGR, INC.
CERTIFIED BY	AEROMET - TOM SCHEPPERS
DATE	7/18/94
VERIFIED BY	MO DNR - DOUG ELLEY
DATE	7/18/94

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE

TITLE

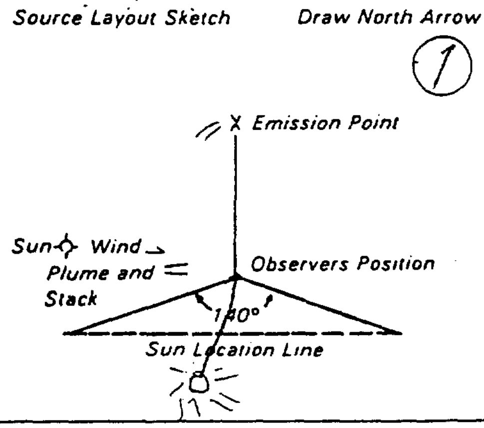
DATE

Visible Emission Observation Form

SOURCE NAME	MASTERS - JACKSON PAVING
ADDRESS	PO. Box 1187 PLANT AT BUFFALO
CITY	SPRINGFIELD
STATE	MO
ZIP	65801
PHONE	(417) 881-5581
SOURCE ID NUMBER	
PROCESS EQUIPMENT	ASPHALT PLANT
OPERATING MODE	NORMAL
CONTROL EQUIPMENT	BAGHOUSE
OPERATING MODE	NORMAL
DESCRIBE EMISSION POINT	START MAIN STACK STOP MAIN STACK
HEIGHT ABOVE GROUND LEVEL	20'
HEIGHT RELATIVE TO OBSERVER	20'
DISTANCE FROM OBSERVER	50'
DIRECTION FROM OBSERVER	NW
DESCRIBE EMISSIONS	START clear STOP CLEAR
EMISSION COLOR	START clear STOP
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 10 STOP 10
DESCRIBE BACKGROUND	START SKY STOP SKY
BACKGROUND COLOR	START Blue STOP Blue
SKY CONDITIONS	START Clear STOP Clear
WIND SPEED	START 10 mph STOP 10 mph
WIND DIRECTION	START S STOP S
AMBIENT TEMP.	START STOP
WET BULB TEMP.	
RH, percent	

Source Layout Sketch

Draw North Arrow



COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

DATE

OBSERVATION DATE: 7/21/94 START TIME: 3:19 STOP TIME: 4:19

MIN \ SEC	0	15	30	45	MIN \ SEC	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

AVERAGE OPACITY FOR HIGHEST PERIOD: 0

NUMBER OF READINGS ABOVE 0 % WERE 0

RANGE OF OPACITY READINGS MINIMUM 0 MAXIMUM 0

OBSERVER'S NAME (PRINT): Jeff Baker

OBSERVER'S SIGNATURE: [signature] DATE 7/21/94

ORGANIZATION: AEROMET ENGINEERING, INC

CERTIFIED BY: AEROMET ENGINEERING DATE 7/18/94

VERIFIED BY: MoDNR - DOUG ELLEY DATE 7/18/94

APPENDIX - H

VISIBLE EMISSIONS CERTIFICATION

AEROMET
ENGINEERING

1325 AEROTEC DRIVE
JEFFERSON CITY, MO 65109
(314) 636-6393
(314) 636-9767 FAX

July 29, 1994

Mr. Jeff Broker
AeroMet Engineering, Inc.
1325 Aerotec Drive
Jefferson City, MO 65109

Dear Mr. Broker:

AeroMet Engineering, Inc. hereby informs you that you have successfully completed Visible Emissions Observer Training held in Jefferson City on July 18, 1994. This qualifies you for certification by the State of Missouri as a Visible Emissions Observer.

Sincerely,

AEROMET ENGINEERING, INC.

Thomas Scheppers

Thomas Scheppers, P.E.
President

APPENDIX - I

USEPA REFERENCE METHOD 9

APPENDIX - J

40 CFR PART 60 SUBPART I

(Standards of Performance for Hot Mix Asphalt Facilities)

APPENDIX - K

ASPHALT PRODUCTION RECORDS

(July 21, 1994)

Time	mix Temp	stack temp	Diff. pres.	Tons Per hour	Mositure
10:50	315°	279°	4	250	5
11:05	311°	276°	4	250	5
11:20	315°	277°	4½	255	
11:35	305°	276°	4	255	
1:50	319°	282°	4	255	
Test #2					
1:10	310°	272°	4.	255	5
1 25	298°	276°	4	260	
1:40	311	275°	4	255	
1 55	312°	276°	4	255	
2:10	298°	279°	4	255	
2:25	307°	278°	4	255	
Test #3					
3:15	318°	282°	4	255	
3:30	308°	276°	4	255	
3:45	303°	274°	4	255	
4:00	312°	282°	4	255	
4:15	309°	280°	4	255	
4:					

APPENDIX - L

SAMPLE CALCULATIONS

NOMENCLATURE

acf = actual cubic feet

acfm = actual cubic feet per minute

A = effective area of flue in square feet

acm = actual cubic meters

acmm = actual cubic meters per minute

A_n = inside area of sampling nozzle in square feet

B_{ws} = water vapor in gas stream, proportion by volume

%C = percent carbon by weight, dry basis

%CO = percent carbon monoxide by volume, dry basis

$\%CO_2$ = percent carbon dioxide by volume, dry basis

C_p = pitot tube coefficient

D_I = dust loading per heat input in pounds (grams) per million Btu (calories) per Fr constant

D_I' = dust loading per heat input in pounds (grams) per million Btu (calories) per Fr calculated

dscf = dry standard cubic feet

dscfh = dry standard cubic feet per hour

dscm = dry standard cubic meters

dscmh = dry standard cubic meters per hour

fps = feet per second

F_r = ratio factor of dry flue gas volume to heat value of combusted fuel in dry standard cubic feet (meters) per million Btu (calories)

gms = grams

gm-mole = gram-mole

grs = grains

ΔH = orifice pressure drop in inches water, average

%H = percent hydrogen by weight, dry basis

H_c = heat of combustion in Btu per pound, dry basis

hr = hour

%I = percent isokinetic

in. Hg = inches mercury

lbs = pounds

lb-mole = pound-mole

%M = percent moisture by volume

mmBtu = million Btu

mmcal = million calories

mm Hg = millimeters mercury

mps = meters per second

M_s = molecular weight in pound (gram) per pound (gram) mole (wet basis)

%N = percent nitrogen by weight, dry basis

$\%N_2$ = percent nitrogen by difference, dry basis

%O = percent oxygen by difference, dry basis

$\%O_2$ = percent oxygen by volume, dry basis

P_b = barometric pressure in inches mercury

P_{std} = standard absolute pressure (29.92 in Hg)

P_s = absolute pressure in flue in inches (millimeters) mercury

P_f = static pressure in flue in inches water, average

$\sqrt{\Delta P}$ = square root of velocity head in inches water, average

%S = percent sulfur by weight, dry basis

scf = standard cubic feet

scm = standard cubic meters

T_{std} = absolute temperature of air in degrees Rankine at standard conditions (528 degrees)

T_s = absolute temperature of flue gas in degrees Rankine, average

T_m = absolute temperature at meter in degrees Rankine, average

V_s = velocity of flue gas in feet (meters) per second

V_I = volume of condensate through the impingers in milliliters

V_{lc} = volume of liquid collected in condenser in milliliters plus weight of liquid absorbed in silica gel in grams indicated as milliliters

V_m = volume of metered gas measured at meter conditions in cubic feet

V_{ms} = volume of metered gas corrected to dry standard conditions in cubic feet (meters)

V_o = volume of flue gas at actual conditions in cubic feet (meters) per minute

Q_{sd} = volume of flue gas corrected to dry standard conditions in cubic feet (meters) per hour

V_t = total volume of flue gas sampled at actual conditions in cubic feet (meters)

V_w = volume of water vapor in metered gas corrected to standard conditions in cubic feet (meters)

V_{wc} = volume of water condensed in impingers corrected to standard conditions

V_{wsg} = volume of water collected in silica gel corrected to standard conditions

W_a = total weight of dust collected per unit volume in grains (grams) per actual cubic feet (meters)

W_d = total weight of dust collected per unit volume in pounds (grams) per dry standard cubic feet (meters)

W_g = total weight of dust collected in grams

W_h = total weight of dust collected per unit volume in pounds (grams) per hour, dry basis

W_p = total weight of dust collected in pounds

W_s = total weight of dust collected per unit volume in grains (grams) per dry standard cubic feet (meters)

W_{sg} = impinger silica gel weight gain in grams

Y = metered gas volume correction factor

Θ = total elapsed sampling time in minutes

EPA DUST LOADING FORMULAS

(1) ABSOLUTE FLUE PRESSURE (in. Hg)

$$P_s = (\pm P_f \div 13.6) + P_b$$

(2) WATER VAPOR VOLUME IN METERED GAS CORRECTED TO STANDARD CONDITIONS (scf)

$$V_{wc} = .04707 \times V_l \qquad V_{wsg} = .04715 \times W_{sg}$$

$$V_w = V_{wc} + V_{wsg}$$

(3) METERED GAS VOLUME CORRECTED TO STANDARD CONDITIONS (scf)

$$V_{ms} = 17.64 \times Y \times V_m \; \frac{P_b + (\Delta H/13.6)}{T_m}$$

(4) PERCENT MOISTURE IN FLUE GAS

$$B_{ws} = \frac{V_w}{(V_{ms} + V_w)} \qquad \%M = B_{ws} \times 100$$

(5) AVERAGE RESULTS OF FLUE GAS ANALYSIS

$$\%N_2 \text{ dry} = 100 - (\%CO_2 + \%O_2 + \%CO)$$

(6) APPROXIMATE MOLECULAR WEIGHT OF FLUE GAS (WET BASIS) (lb/lb-mole)

$$M_s = (18 \times B_{ws}) + \Big((.440\,(\%CO_2) + .320\,(\%O_2) + .280\,(\%N_2 + \%CO)\Big) \times (1 - B_{ws})$$

(7) GAS VELOCITY IN FLUE (fps)

$$V_s = 85.49 \times C_p \times (\sqrt{\Delta P})\text{ avg.} \; \sqrt{\frac{T_s}{P_s \times M_s}}$$

(8) FLUE GAS VOLUME AT ACTUAL CONDITIONS (acfm)

$$V_o = V_s \times A \times 60$$

(9) FLUE GAS VOLUME CORRECTED TO DRY STANDARD CONDITIONS (dscfh)

$$Q_{sd} = \frac{T_{std}}{29.92} \times \frac{P_s}{T_s} \times V_o \times (1 - B_{ws}) \times 60$$

(10) TOTAL FLUE GAS VOLUME SAMPLED AT ACTUAL CONDITIONS (acf)

$$V_t = \left[V_m \times Y \times \frac{T_s}{T_m} \times \left(\frac{P_b + (\Delta H/13.6)}{P_s}\right)\right] + \left(0.00267 \times V_{lc} \times \frac{T_s}{P_s}\right)$$

EPA DUST LOADING FORMULAS (Continued)

(11) DUST CONCENTRATION FOR INDIRECT HEATING UNIT AT ACTUAL CONDITIONS AND STANDARD CONDITIONS

$W_g =$ gms

$W_p = 0.002205 \times W_g$ (lb)

$W_d = \frac{W_p}{V_{ms}}$ (lb/dscf)

$W_h = W_d \times Q_{sd}$ (lb/hr dry)

$W_a = \frac{7000 \times W_p}{V_t}$ (gr/acf)

$W_s = 7000 \times W_d$ (gr/dscf)

$D_l = \frac{9820 \times 20.9 \times W_d}{(20.9 - \%O_2)}$ (lb/mmBtu with constant 9820 F_r)

$F_r = \frac{10^6 \times [(3.64 \times \%H) + (1.53 \times \%C) + (0.57 \times \%S) + (0.14 \times \%N) - (0.46 \times \%O)]}{H_c}$ (dscf/mmBtu)

$D_l' = \frac{20.9 \times W_d \times F_r}{(20.9 - \%O_2)}$ (lb/mmBtu with calculated F_r)

(12) PERCENT OF ISOKINETIC SAMPLING

$$\%I = \frac{1.667 \times T_s \times \left\{0.00267 \times V_{lc} + \left[\frac{V_m \times Y}{T_m} \times \left(P_b + \Delta H/13.6\right)\right]\right\}}{\theta \times V_s \times P_s \times A_n}$$

PLANT NAME:Masters & Jackson TEST UNIT:Astec dbl.drum plant
LOCATION: Buffalo, MO DATE: 7/21/94 RUN NO: 2

NUMBER OF POINTS	24	PERCENT OXYGEN	13.60
TIME, MINUTE/POINT	2.50	PERCENT CARBON DIOXIDE	5.70
LEAK RATE, FT3/MIN	0.003	PERCENT CARBON MONOXIDE	0.00
BAR PRESS, INCH Hg	28.73	Cp (PITOT COEFFICIENT)	0.840
STATIC PRESS (in H2O)	1.00	NOZZLE DIAMETER, INCHES	0.252
STACK EXIT LENGTH IN	27.13	INITIAL METER VOL, FT3	639.015
STACK EXIT WIDTH IN	40.25	FINAL METER VOL, FT3	698.982
IMPINGER H2O, ML	550.6	METER CORR FACT, Y	0.996
SILICA GEL H2O, GM	28.0	PARTIC COLLECTED, MG	7.80

PT NO	STACK TEMP (Ts)	VELOC PRESS (dPs)	ORIFICE PRESS (dH)	METER TEMP INLET (Tmi	METER TEMP OUTLET (Tmo)	SQR ROOT VELOC PRESS
1	256	1.70	3.15	93	94	1.304
2	257	2.20	4.09	98	95	1.483
3	259	2.00	3.74	108	95	1.414
4	260	1.50	2.82	114	96	1.225
5	262	1.40	2.62	112	96	1.183
6	262	1.80	3.38	115	97	1.342
7	264	1.80	3.38	118	98	1.342
8	266	1.50	2.82	121	98	1.225
9	265	1.30	2.45	119	100	1.140
10	266	3.01	120.00	100	96	1.735
11	270	1.90	3.56	122	101	1.378
12	269	1.50	2.82	124	102	1.225
13	270	1.50	2.82	123	102	1.225
14	269	1.60	3.01	122	103	1.265
15	270	1.90	3.58	124	104	1.378
16	269	1.70	3.22	128	104	1.304
17	268	1.60	3.03	126	104	1.265
18	269	1.50	2.84	126	105	1.225
19	267	2.00	3.80	127	106	1.414
20	267	2.10	3.99	128	106	1.449
21	267	2.00	3.79	128	107	1.414
22	267	1.60	3.04	128	106	1.265
23	266	2.20	4.20	130	106	1.483
24	266	2.50	4.79	134	107	1.581
25						
26						
27						
28						
29						
30						
AVG	265.5	1.825	8.21	119.3	101.2	1.3443

STACK GAS MOL WT. WET	25.62	AVG ABS STACK TEMP (d	725.5
STACK VELOCITY (ft/sec)	95.71	AVG ABS METER TEMP (d	570.2
STD VOL SAMPLED (std ft2)	54.20	METER LEAK RATE (ft3/	0.000
AVG METER TEMP (deg F)	110.23	SAMPLE VOL LK CORR'D	59.97
PERCENT MOISTURE (%)	33.45	AVG ABS STACK PRESS (	28.80
STD STACK FLOW RATE (DSCFM)	20302.98	VOL H2O IN METER GAS	27.24
		H2O IN GAS STREAM (vo	0.334
ISOKINETIC VARIATION (%)	97.34	NOZZLE AREA (ft2)	0.00035
PARTIC EMISSION RATE (lb/hr)	0.3865	STACK AREA (ft2)	7.582
PARTICULATE CONC (gr/DSCF)	0.002221	STACK EQUIV DIAMETER	32.41
FUEL F FACTOR DRY (Fd)		POUNDS PER MILLION BTU	0

PLANT NAME:Masters & Jackson TEST UNIT:Astec dbl.drum plant