shell engineering and associates, inc.

2503 west ash columbia, mo 65203 314-445-0106

July 25, 1990

Mr. Dave Krehbiel
County Commissioner
Camden County Courthouse
#1 Court Circle
Camdenton, Missouri 65020

Re: Particulate Emissions Tests
at Camdenton, Mo. June 12, 1990

Dear Mr. Krehbiel:

Attached is our report entitled "Particulate and Visible Emission Tests for Camdenton County Asphalt Production at Camdenton, Mo. The report describes the emissions testing program conducted at that facility on June 12, 1990, and details the results of the three USEPA Method 5 and Method 9 tests performed to determine the particulate and visible emissions from the Asphalt Drum Mixers Model 6026.

The results do demonstrate compliance with the Missouri State regulation and the USEPA New Source Performance Standards regarding Asphalt Production. The average particulate emission rate was calculated as 0.013 grains per dry standard cubic foot. The allowable emission rate is 0.04 grains per dry standard cubic foot.

You will need to forward a copy of this report to the Missouri Department of Natural Resources after your review.

We appreciate this opportunity to have been of service to you and your company, and will hope that we can be of assistance again at sometime in the future.

Sincerely,

Shell Engineering & Associates, Inc.

HD Shell

Harvey D. Shell, P.E.
President

Attachment
HDS/djb

PARTICULATE AND VISIBLE EMISSION TESTS FOR CAMDENTON COUNTY ASPHALT PRODUCTION

ASPHALT DRUM MIXERS
MODEL 6026

CAMDENTON, MISSOURI

June 12, 1990

TEST CERTIFICATION

We certify that the enclosed test results are true, accurate, and authentic. We were personally responsible for all phases of the testing to determine the particulate and visible emissions from the Asphalt Drum Mixers Model 6026 Asphalt Plant at the Camdenton County.

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.

SHELL ENGINEERING & ASSOCIATES, INC.

Harvey D. Shell, P.E.
President

Tom Scheppers, P.E.
Project Engineer

TABLE OF CONTENTS

I. INTRODUCTION

Shell Engineering & Associates, Inc., of Columbia, Missouri, has been retained by Camdenton County to determine the particulate and visible emissions from a new Model 6026 asphalt plant installed at the Camdenton County, south on Highway 5 from Camdenton, Missouri. Performance testing is required under the condition of an operating permit which was issued to Camdenton County 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). USEPA Methods 5 and 9 were used for the testing with no deviations from the standard procedures. The asphalt plant was permitted to operate at a production rate of 100 ton/hr, emission rate of no greater than 0.04 grains/dry standard cubic foot, and less than 20 percent visible emissions.

Source testing took place during the period of June 12, 1990. Pre-test planning was accomplished by phone conversations with the following individuals; Mr. Doug Elley of Missouri Department of Natural Resources, Mr. Dave Krehbiel and Mr. Phil Jones of Camdenton County, and Mr. Tom Scheppers of Shell Engineering & Associates.

The project engineer during the test for Shell Engineering & Associates was Mr. Tom Scheppers. The test-team leader was Mr. Terry C. Shackelford. Other members of the Method 5 test team were Mr. Frank Witt and Mr. Charles Scott. Mr. Scheppers performed the Method 9 Visible Emissions Readings. Mr. Doug Elley observed a portion of the tests representing the Air Pollution Control Program, Missouri Department of Natural Resources. While onsite Mr. Elley videotaped portions of the testing and asphalt production. Other individuals present for portions or all of the tests were Mr. W. Boyd, Field Service Representative of Asphalt Drum Mixers and Mr. Phil Jones, Camdenton County.

Weather was not a major factor during the testing program, as clear skies predominated. The temperatures were around the 90's.

II. SUMMARY OF RESULTS

The results are summarized in Table I. Actual emissions data is listed for particulate. The results demonstrate compliance with the allowable of 0.04 grains per dry standard cubic foot (gr/dscf).

The asphalt plant was operated at approximately 90 ton/hr of both aggregate and asphalt. A detailed description of the process is 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 filters from all three runs were clean and near 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 results are accurate within the variations described by USEPA Method 5.

III. DESCRIPTION OF THE PROCESS

Aspalt is produced at property owned by Camdenton County for road maintenance. The asphalt plant is a Asphalt Drum Mixers Model 6026 asphalt plant. The aggregate is purchased as premixed according to State Highway specifications. Therefore, unlike most asphalt plants, only one aggregate mix is fed to the kiln. Most plants maintain individual hoppers of each feed material and perform blending on the feed belt at the entrance to the kiln.

The Model 6026 asphalt plant has a design capacity of up to 100 tons/hour. Fuel used during the entire test duration was #2 fuel oil.

Aggregate is fed on a continuous basis. The aggregate is heated with combustion fuel in a rotary kiln by direct contact with the combustion gases. After leaving the kiln, asphalt is mixed with the aggregate. The mix is transferred to trucks for hauling to the construction site for laying.

TABLE I

Camdenton County
Summary of Particulate and Visible Emission Test
Asphalt Drum Mixers Model 6026 Asphalt Plant

	Run 1 6/12/90	Run 3 6/12/90	Run 4 6/12/90	AVG
Process Conditions				
Feed Rate (ton/hr)	90	90	90	90
Stack Conditions				
Stack Gas Temperature (°F)	263	251	255	256
Actual Gas Flow (ACFM)	19915	20177	20953	20348
Std. Gas Flow (DSCFM)	10169	10714	10761	10548
Emissions, Actual				
Visible (percent)	0	0	0	0
Particulate (gr/DSCF)	0.0178	0.0144	0.0075	0.013
Particulate (lb/hr)	1.55	1.32	0.69	1.19

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 66 inch stack. Stack dimensions inside the wall is 24 5/8 Length by 22 3/8 Width, inches as measured at the test ports. The effective diameter is 23.4 inches.

The test ports (four equally spaced along one wall) are located 15 inches (0.64 diameters) from the stack exit, and 51 inches (2.18 diameters) from the last disturbance.

V. PLANT OPERATING CONDITIONS

The "Asphalt Plant Operations Data" for the period June 12, 1990, are included in Appendix K. This data has been recorded every 15 minutes during each run. The data includes process input weight for both aggregate and asphalt, mix temperatures, fuel flows, and the pressure drop across the baghouse. A summary of these conditions can be found on Table II.

The operation data was collected by W. Boyd. The asphalt plant was operated in a normal manner near maximum rated production consistent with the amount of moisture contained in the aggregate. No asphalt mix was recycled during the tests.

VI. TEST CONDITIONS

The Method 5 test samples were drawn from six points on each of four traverses of the stack. (The traverse point locations specified by USEPA Method 1 is usually 25 points on 5 ports for rectangular stacks and 24 points on two ports for circular stacks). Due to the limited space along the stack wall, only four test ports could be installed in equal areas. Therefore, 24 points were sampled. Samples were collected isokinetically for a total of one hour for each of three runs (2.5 minutes/point).

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

TABLE II

Summary of
Asphalt Plant Daily Operations Reports
Camdenton County, Missouri

Date	Run Number	Aggregate (TPH)	Asphalt (TPH)	Fuel Oil (GPM)	Mix Temp (°F)	Baghouse Diff. Press. ("H_2)
6/12/90	1	86	4.0	1.9	211	3.9
6/12/90	2	86	4.0	1.7	204	3.6
6/12/90	3	86	4.0	1.7	201	3.7
Averages During Tests		86	4.0	1.8	205	3.7

A cyclonic flow test and preliminary velocity traverse was performed prior to the first Method 5 test. Stack flow conditions were acceptable for testing, as the average angle of rotation of the stack gases for the 24 points in the vertical plane was 10.9°. (Averages up to 20° are acceptable according to the USEPA procedures.) The velocity profile in the stack was reasonably smooth, indicating a lack of turbulent flow.

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 J of this report. In brief, a Nutech Model 2010 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.

APPENDIX - A

PARTICULATE TEST ANALYSIS

(Computer Reports)

SAMPLING LOCATION DIMENSIONS
ADM PORTABLE DRUM MH PLANT
BAGHOUSE OUTLET

Inside Dimension(s): 24 5/8" L x 22 3/8" W

Total Inside Effective Area: 3.83 ft^2

Equivalent Diameter: 23.4"

Total Effective Length: 66"

Upstream Distance (A): 15"

Downstream Distance (B): 51"

Number of Diameters Upstream (A): 0.6

Number of Diameters Downstream (B): 2.2

Total Number of Test Ports: 4

Total Number of Traverse Points: 24

Sampling Point Dimensions:

(1) 1.865"
(2) 5.594"
(3) 9.323"
(4) 13.052"
(5) 16.781"
(6) 20.510"

Particulate Test Analysis

CAMDEN COUNTY MAINTENANCE
CAMDENTON, MISSOURI
ADM PDM PLANT
90-089

Run Number		1	2	3
Data set		(01)	(02)	(03)
Date		6-12-90	6-12-90	6-12-90
Location		STACK (B.O.)	STACK (B.O.)	STACK (B.O.)
Start time		08:54	11:00	13:28
End time		10:03	12:07	14:35
Barometric Pressure	In. Hg	29.14	29.14	29.14
Static Pressure	In. H2O	-0.82	-0.82	-0.82
Volume of Condensate	Mls	369	288	324
Volume Sampled	DCF	46.617	39.972	40.909
Meter Correction Factor		1.01	1.01	1.01
Square Root of Delta P		1.240	1.270	1.310
Orifice Pressure	In. H2O	2.18	1.59	1.69
Meter Temperature	Deg. F	86	92	96
Flue Temperature	Deg. F	263	251	255
Percent CO2	%	6.05	5.15	5.60
Percent O2	%	12.40	14.00	13.05
Diameter of Nozzle	In	0.212	0.212	0.212
Area of Flue	Sq Ft	3.83	3.83	3.83
Sample Time	Min	60	60	60
Weight Gain	Grams	0.0515	0.0354	0.0187
Absolute Flue Pressure	In. Hg	29.08	29.08	29.08
Corrected Sample Volume	DSCF	44.57	37.75	38.36
Moisture in Flue Gas	%	28.0	26.4	28.4
Molecular Weight	Lb/LbMole	26.25	26.38	26.17
Velocity of Flue Gas	FpS	86.66	87.80	91.18
Volume of Flue Gas	ACFM	19,915	20,177	20,953
Volume of Flue Gas	DSCFM	10,169	10,714	10,761
Dust Concentration	Lb/DSCF	2.54E-06	2.06E-06	1.07E-06
Dust Concentration	Lbs/Hour	1.55	1.32	.69
Dust Concentration	Grs/ACF	9.23E-03	7.73E-03	3.92E-03
Dust Concentration	Grs/DSCF	1.78E-02	1.44E-02	7.52E-03
Isokinetic Rate	%	114.0	91.6	92.7

Averages:

Stack Temperature	:	256.3	Percent O2	:	13.2
Vol Flue Gas	ACFM :	20,348	DSCFM	:	10,548
Part Emis	Lb/DSCF :	1.89E-06	Lb/Hour	:	1.19
	Grs/ACF :	6.97E-03	Grs/DSCF	:	1.32E-02
	Lbs/MBtu :	0			

APPENDIX - B

PARTICULATE FIELD DATA SHEETS

(Includes Cyclonic Flow Test)

CYCLONIC FLOW DETERMINATION DATA

Client Camden County Maintenance — Operator ZLS
Project No. 90-089 — Date 6-12-90
Location ADM PDM Plant - Engineer Outlet — Checked By

STACK ☑ DUCT ☐

CIRCULAR ☐ RECTANGULAR ☑ SQUARE ☐

Inside Dimension(s): Diameter — Length 24.625" Width 22.375"
Equivalent Diameter 23.446" Upstream Distance 15" Downstream Distance 51"
Number of Diameters Upstream (A) 0.6 Number of Diameters Downstream (B) 2.2
Total Number of Traverse Points 24 Total Number of Test Ports 4

ROTATION ANGLE, α
(± 90° Yaw Angle)

Traverse Point Number	Test Ports A	B	C	D			
1	-10	+2	+6	-8			
2	-6	-2	-2	+2			
3	+3	-10	-12	-15			
4	-10	-14	-17	-15			
5	-15	-18	-18	-12			
(6)	-19	-10	-20	-15			
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

Absolute α Value, Average (≤ 20°) 10.9 °

Particulate Field Data Sheet

Client: Camden County Maintenance											Date: 6-12-90	Page 1 Of 2	
Project No.: 90-089			Operator: J. Shackelford								Orsat Analysis		
Sampling Location: ADM PDM Plant - Stack (B.O.)								Run No.: 1			CO_2	$+O_2$	O_2 / CO
Filter No.: 90-121		Acetone No.: A01			Condensate:						6.0	16.4	12.4 / 0
Barometric Pressure: 29.14			Static Pressure: -.82		Probe Number: NB-2						6.1	18.5	12.4 / 0
Nozzle Diameter: .212		Nozzle Number: N2-45	Pitot Coefficient: 0.84		Pitot Number: NB-2 (A)								
Meter Corr. Factor: 1.01			Meter-Orifice: 20-10 (3.45)										
Sample Pt. Time: 2.5 min.			Assumed % Moisture: 12.5 15.0								Leak Test: Before .00125"Hg	After .006 @ 12"Hg	

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.
0854 start											128.550
A 1	2.47	1.572	3.20	271	254	57	242	84	83	7.4	130.948
2	2.61	1.616	3.34	271	254	62	240	83	83	8.0	133.420
3	3.32	1.822	4.32	270	251	56	241	86	84	11.0	136.089
4	3.09	1.758	4.04	268	250	60	245	85	83	10.4	138.810
5	2.92	1.709	3.83	266	252	64	250	85	83	9.8	141.434
6	1.01	1.005	1.34	261	252	67	251	87	85	4.0	143.284
B 1	2.14	1.463	2.81	264	251	67	252	85	84	7.0	145.532
2	2.25	1.500	2.96	264	254	63	253	86	84	7.9	147.834
3	2.20	1.483	2.89	266	252	65	253	87	84	7.5	150.141
4	1.82	1.349	23.9	267	254	67	257	88	85	6.4	152.231
5	1.39	1.179	1.84	266	254	67	258	89	85	5.3	154.171
6	.47	.686	.63	260	252	69	252	88	85	2.6	155.364
C 1	1.89	1.375	2.49	265	252	68	252	87	85	6.0	157.422
2	1.72	1.311	2.26	266	252	67	253	90	87	6.1	159.420
3	2.20	1.483	2.93	265	252	68	253	90	87	7.6	161.714
4	1.29	1.136	1.72	263	251	70	253	90	87	5.2	163.587
5	.94	.970	1.26	259	248	70	251	89	86	4.1	165.164
6	.54	.735	.73	252	249	70	250	88	86	3.0	166.328
D 1	1.53	1.237	2.03	263	250	71	251	87	86	5.6	168.320
2	1.04	1.020	1.38	263	251	67	253	88	86	4.2	169.931
3	.90	.949	1.20	263	252	68	257	89	87	4.0	171.433
4	.78	.883	1.04	261	251	70	255	89	88	3.9	172.788
5	.57	.755	.77	251	251	71	252	89	88	3.3	173.957
6	.59	.768	.80	251	252	71	254	90	88	3.5	175.167
1003 Stop											
											46.617

Pitot Tube Leak Check: Before ok After ok

Integrated Bag Leak Check: Before ok After ok

Particulate Field Data Sheet

Client: Camden County Maintenance										Date: 6-12-90	Page 1 Of 2	
Project No.: 90-089		Operator: C. Stockford								Orsat Analysis		
Sampling Location: ADM PDM Plant - Stack (B.O.)					Run No.: 2					CO_2	$+O_2$	O_2 / CO
Filter No.: 90-110		Acetone No.: A02		Condensate:						5.1	19.2	14.1 / 0
Barometric Pressure: 29.14		Static Pressure: -.82		Probe Number: N3-2						5.2	19.1	13.9 / 0
Nozzle Diameter: .242	Nozzle Number: N2-45	Pitot Coefficient: 0.84		Pitot Number: N3-2 (A)								
Meter Corr. Factor: 1.01		Meter-Orifice: 201-10 (3.45)										
Sample Pt. Time: 2.5 min.		Assumed % Moisture: 30.0		Leak Test: Before .001 @ 15" Hg, .02 @ 6" Hg					After			

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.
1100	Start										175.568
A 1	3.24	1.792	3.00	244	243	69	241	90	89	5.0	177.998
2	3.67	1.916	3.38	251	248	59	245	89	89	5.6	180.472
3	3.24	1.800	3.00	255	250	62	251	92	91	5.0	182.745
4	1.09	1.044	1.01	252	251	65	255	91	90	2.2	184.300
5	1.07	1.034	.99	251	251	67	254	91	90	2.2	185.673
6	.94	.970	.87	252	249	69	248	90	90	2.0	186.927
B 1	2.19	1.480	2.02	257	253	69	253	92	92	3.9	188.863
2	2.63	1.62	2.41	260	250	65	252	92	90	5.0	190.976
3	1.99	1.411	1.84	258	248	66	248	93	91	3.8	192.879
4	.80	.894	.74	253	251	70	250	93	91	1.9	194.177
5	.82	.906	.77	249	250	71	253	92	91	1.9	195.161
6	.99	.995	.93	247	251	72	254	91	91	2.1	196.362
C 1	2.00	1.414	1.85	255	248	69	248	92	91	3.9	198.261
2	2.19	1.480	2.03	253	252	68	252	92	91	4.0	200.170
3	2.22	1.490	2.06	255	249	69	252	93	91	4.1	202.131
4	1.56	1.249	1.44	255	249	69	253	93	92	3.1	203.726
5	1.04	1.020	.99	248	251	70	255	94	92	2.5	205.131
6	.99	.995	.93	244	251	71	255	94	92	2.2	206.420
D 1	1.83	1.352	1.71	250	249	70	251	93	92	3.7	208.271
2	1.92	1.386	1.80	249	249	68	252	93	91	3.7	210.019
3	1.31	1.145	1.23	248	250	69	253	93	92	2.4	211.495
4	1.25	1.118	1.18	246	251	70	256	94	93	3.0	212.964
5	1.05	1.025	.99	244	248	70	251	93	92	2.8	214.272
6	.95	.975	.90	240	249	71	249	94	93	2.5	215540
1207	Stop										—
		1.27	1.59	251				92			39.972

Pitot Tube Leak Check: Before OK After OK

Integrated Bag Leak Check: Before OK After OK

Particulate Field Data Sheet

Client: Camden County Maintenance										Date: 6-12-90	Page 1 Of 2		
Project No.: 90-089		Operator: T. Stanford								Orsat Analysis			
Sampling Location: ADM PDM Plant - Stack (B.O.)								Run No.: 3		CO_2	$+O_2$	O_2	CO
Filter No.: 90-156		Acetone No.: A03			Condensate:					5.6	8.6	13.0	0
Barometric Pressure: 29.14			Static Pressure: -.82		Probe Number: K3-2					5.6	18.7	13.1	0
Nozzle Diameter: .242		Nozzle Number: K2-45	Pitot Coefficient: 0.84		Pitot Number: K3-2 (A)								
Meter Corr. Factor: 1.01			Meter-Orifice: 20/-10 (3.45)										
Sample Pt. Time: 2.5 min.			Assumed % Moisture: 30.0					Leak Test: Before .003@15"Hg		After .007@6"Hg			

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.
B2 Start											216.294
A 1	3.00	1.732	2.83	245	251	69	260	93	93	5.0	218.624
2	2.94	1.715	2.76	250	251	62	258	94	94	5.0	220.850
3	2.79	1.670	2.61	253	251	64	248	95	94	5.0	223.049
4	2.25	1.500	2.10	257	251	64	248	96	94	4.0	225.061
5	1.21	1.100	1.13	257	250	66	247	97	95	2.5	226.635
6	1.20	1.095	1.13	254	248	68	250	97	95	2.6	228.057
B 1	2.64	1.625	2.46	260	250	70	254	96	94	5.0	230.154
2	2.98	1.726	2.77	262	250	69	254	95	94	5.5	232.470
3	2.92	1.709	2.70	263	250	68	253	96	95	5.3	234.695
4	2.14	1.462	1.99	262	249	70	252	97	95	4.4	236.421
5	.73	.854	.69	254	250	70	253	96	96	2.2	237.757
6	.41	.781	.58	249	251	71	256	96	95	2.0	238.676
C 1	2.38	1.543	2.22	260	251	70	257	97	95	4.5	240.746
2	2.40	1.549	2.24	260	249	69	256	97	96	4.4	242.685
3	2.15	1.466	2.02	256	249	67	252	97	95	4.1	244.525
4	1.51	1.229	1.42	254	250	66	254	97	95	3.6	246.074
5	.49	.700	.46	252	250	66	256	97	96	2.0	246.998
6	.69	.831	.66	247	249	68	251	97	96	2.2	248.072
D 1	2.24	1.497	2.07	256	250	69	254	97	95	4.1	250.011
2	2.41	1.552	2.26	257	253	68	256	98	96	5.0	252.019
3	1.91	1.382	1.80	257	252	69	256	98	96	4.0	253.837
4	.93	.964	.88	254	251	69	255	98	96	2.8	255.135
5	.82	.906	.78	253	252	70	256	99	97	2.4	256.266
6	.69	.831	.66	248	253	70	254	99	97	2.0	257.303
1425 Stop											
		1.309	1.69	255				96			40.909

Pitot Tube Leak Check: Before ok After ok

Integrated Bag Leak Check: Before ok After ok

APPENDIX - C

ANALYTICAL LABORATORY REPORTS
(Particulate)

Analytical Data Sheet

Client CCM (Shell) Project No. 90-089 Date 6-14-90

Run No. 1
Filter No. 90-121
Acetone No. A01
Amount liquid lost during transport 0
Acetone blank volume, ml 200
Acetone wash volume, ml 250
Acetone blank concentration, mg/mg (equation 5-4)** 1.3×10^{-6}
Acetone wash blank, mg (equation 5-5)** 0.26

Container Number	Weight of Particulate Collected, g		
	Final Weight	Tare Weight	Weight Gain
1	0.3458	0.3444	.0014
2	2.5319	2.4815	.0504
Total			.0518
Less acetone blank			0.0003
Weight of particulate matter			.0515

	Volume of Liquid Water Collected		
	Impinger Volume, ml.	Silica Gel Weight, g	
Final	540	268.8	
Initial	200	250.0	
Liquid collected	340	18.8	
Total Volume Collected	358.8	g*	ml

Run No. 2
Filter No. 90-110
Acetone No. A02
Amount liquid lost during transport 0
Acetone blank volume, ml 200
Acetone wash volume, ml 250
Acetone blank concentration, mg/mg (equation 5-4)** 1.3×10^{-6}
Acetone wash blank, mg (equation 5-5)** 0.26

Container Number	Weight of Particulate Collected, g		
	Final Weight	Tare Weight	Weight Gain
1	0.3498	0.3494	.0004
2	5.0543	5.0190	.0353
Total			.0357
Less acetone blank			0.0003
Weight of particulate matter			.0354

	Volume of Liquid Water Collected		
	Impinger Volume, ml.	Silica Gel Weight, g	
Final	480	257.7	
Initial	200	250.0	
Liquid collected	280	7.7	
Total Volume Collected	287.7	g*	ml

Run No. 3
Filter No. 90-156
Acetone No. A03
Amount liquid lost during transport 0
Acetone blank volume, ml 200
Acetone wash volume, ml 250
Acetone blank concentration, mg/mg (equation 5-4)** 1.3×10^{-6}
Acetone wash blank, mg (equation 5-5)** 0.26

Container Number	Weight of Particulate Collected, g		
	Final Weight	Tare Weight	Weight Gain
1	0.3436	0.3417	.0019
2	62.7239	62.7068	.0171
Total			.0190
Less acetone blank			0.003
Weight of particulate matter			.0197

	Volume of Liquid Water Collected		
	Impinger Volume, ml.	Silica Gel Weight, g	
Final	505	268.5	
Initial	200	250.0	
Liquid collected	305	18.5	
Total Volume Collected	323.5	g*	ml

Run No. 1, 2 & 3
Filter No. N/A
Acetone No. Blank
Amount liquid lost during transport N/A
Acetone blank volume, ml 200
Acetone wash volume, ml N/A
Acetone blank concentration, mg/mg (equation 5-4)** 1.3×10^{-6}
Acetone wash blank, mg (equation 5-5)** N/A

Container Number	Weight of Particulate Collected, g		
	Final Weight	Tare Weight	Weight Gain
1	62.7070	62.7068	0.0002
2	—	—	—
Total			0.0002
Less acetone blank			—
Weight of particulate matter			0.0002

	Volume of Liquid Water Collected		
	Impinger Volume, ml.	Silica Gel Weight, g	
Final			
Initial			
Liquid collected	N/A		
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

Thermocouple Calibrations

(Oven, ~~Probe~~) STACK

Client _____ Barometric Press 29.50

Project No. _____

Nutech

Thermocouple Identification	Trendicator	Thermometer	Thermometer Number	Date
(Probes)		GCA/PS	30755	3-23-90
N3-1	247	247		
N3-2	247	247		
N5-1	246	246		
N5-2	246	246		
N5-3	249	249		
N5-4	249	249		
N7-1	250	250		
N7-2	250	250		
N7-3	252	252		
N10-1	252	252		
N10-2	248	248		
N10-3	248	248		
N15-1	249	249		
N15-2	250	250		
(OVENS)				
N-1	250	250		
N-2	250	250		
N-3	241	241		
N-4	262	262		
N-5	244	244		
N-6	280	280		

Thermocouple Calibrations

(~~Oven~~, Probe)

Client _____ Barometric Press 29.50

Project No. _____

Nutech Probe Heater

Thermocouple Identification	Trendicator	Thermometer	Thermometer Number	Date
		GCA/PS	30755	3-23-90
N3-1	240	240		
N3-2	251	251		
N5-1	245	245		
N5-2	266	266		
N5-3	240	240		
N5-4	260	260		
N7-1	300	300		
N7-2	264	264		
N7-3	305	305		
N10-1	244	244		
N10-2	262	262		
N10-3	271	271		
N15-1	23?	23?		
N15-2	24?	245		

Dry Gas Meter Calibration Sheet

Client _____ Run By C. Scott

Project No. _____ Date 5-18-90

Module Meter 10 Barometric Press 29.08

Orifice 1

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	662.631	666.584	3.953	975.804	979.800	3.996	64	73	70	—	10 min
1.0	667.290	672.829	5.539	980.587	986.194	5.607	64	74	70	—	10 min
2.0	673.339	681.100	7.761	986.617	994.436	7.819	64	76	72	—	10 min
4.0	681.608	692.569	10.961	994.950	1006.018	11.068	64	81	73	—	10 min
6.0	692.927	706.277	13.350	6.383	19.819	13.436	64	81	74	—	10 min

ΔH	ΔH / 13.6	Mc (Y) Vw Pb (td + 460) / Vd (Pb + ΔH/13.6) (tw + 460)	ΔHa (For Small Orifice Only) 0.0317 ΔH / Pb (td + 460)	(tw + 460) Θ² / Vw
.5	.0368	1.00	.0136	
1.0	.0737	.99	.0084	
2.0	.147	1.03	.0276	
4.0	.294	1.01	.0387	
6.0	.441	1.01	.0476	
Average		1.01	.0272	

ΔH = Orfice 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 = Orfice setting that would pull .75 cfm of air at standard conditions

Pitot Calibration Form

Client _____ Run By Bruce Woods

Project No. _____ Date 5-25-90

Test Location _____ Pitot No. N3-2 (Three ft)

	● "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	—
2	1.0	1.41	.84	—
3	1.0	1.41	.84	—
Average		$\bar{C}_p$ (Side A)	.84	—

	●● "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	—
2	1.0	1.41	.84	—
3	1.0	1.41	.84	—
Average		$\bar{C}_p$ (Side B)	.84	—

Calculations:

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

Deviation = $C_{p(s)} = \bar{C}_p$ (A or B)

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

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

Nozzle size used for Calibrations (inches) .490

Intercomponent Spacings During Calibrations:

Pitot - Nozzle: ½ Z

Pitot - Thermocouple: ½ Z

Pitot - Probe Sheath: 6

APPENDIX - E

TEST EQUIPMENT DESCRIPTION
(Particulate)

TESTING EQUIPMENT - EPA METHOD 5 SAMPLING TRAIN

A Nutech 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 Type K (Chromel/Alumel) thermocouple 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 selector switch, 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 with a calibrated Type K (Chromel/Alumel) thermocouple 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 32S, 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 Ohaus beam balance and placed into separate airtight polypropylene storage bottles.

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 with glass-cloth tape 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 of minus 25 degrees.

As soon as the probe and oven temperatures 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 transferred to an appropriately marked, airtight polypropylene bottle and retained for later weighing. 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.

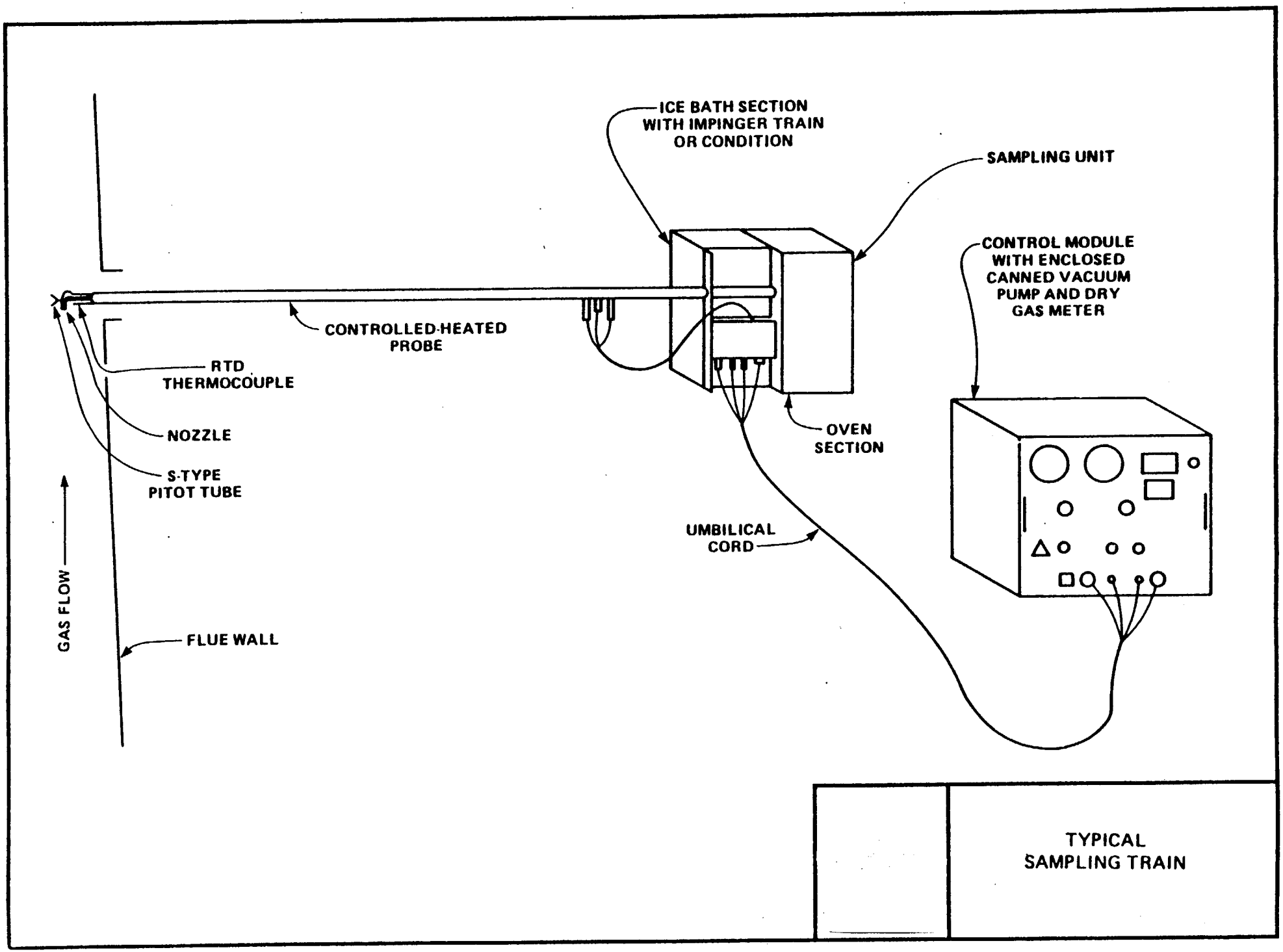
The sampling nozzle, probe and filter holder were washed with nanograde acetone, glass components were washed three times, stainless steel components were washed six times and visually inspected for cleanliness. The acetone washing and acetone blank were collected and labeled polypropylene sample bottles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

ANALYTICAL PROCEDURES - EPA REFERENCE METHOD 5 (PARTICULATE)

After the field testing was completed, the following procedures were performed: Each silica gel moisture collection was weighed in it's storage bottle on an Ohaus beam balance with sensitivity of 0.1-gram. Each disc filter and petri dish was oven dried at 220 degrees Fahrenheit for two to three hours and cooled in a dessicator for two hours before weighing. Each acetone washing and acetone blank was transferred from its sample bottle to a preweighed crucible for evaporation. When the acetone in a crucible had completely evaporated, the crucible was transferred to a desiccator for further drying at room temperature. Each acetone blank collected was used to determine the amount of residual weight each crucible retained due to acetone impurities. Each disc filter and petri dish, acetone washing and acetone blank was weighed on a Sartorious analytical balance with a sensitivity of 0.1-milligram.

All test instruments were recalibrated to determine the deviation percentage.


ICE BATH SECTION WITH IMPINGER TRAIN OR CONDITION
SAMPLING UNIT
CONTROL MODULE WITH ENCLOSED CANNED VACUUM PUMP AND DRY GAS METER
CONTROLLED-HEATED PROBE
RTD THERMOCOUPLE
NOZZLE
S-TYPE PITOT TUBE
OVEN SECTION
UMBILICAL CORD
GAS FLOW
FLUE WALL
TYPICAL SAMPLING TRAIN

APPENDIX -F

USEPA REFERENCE METHOD 5

APPENDIX - G

VISIBLE FIELD DATA SHEETS

Visible Emissions Evaluation Data Sheet

Client: Camdenton County
Observer: TOM SCHEPPERS
Project No.:
Date: 6/12/90
Plant Name: Camdenton County
Observation began: 9:14 00 12:00 00
Location: Camdenton, Mo
ended: 10:12 00 12:02 00
Type of Facility: Asphalt Plant

Source Identification (Stack, Duct, etc.): Stack
9:14
Asphalt Plant with Baghouse

Observer Location
(Diagram on back of sheet)
Distance from Observer to source: 80'
Height of Source (above ground): 18'

Weather Conditions
Wind Direction:
Wind Speed: 5-10
Temperature: 90's
Position of Sun: Back
Sky Condition: Clear Blue
(clear, overcast, %clouds, color of clouds, etc.)
Blue Sky

Plume Description
Color: Clear with white trail (detached)
Background: Blue Sky
Type (wet or dry): Wet Dist.:

Comments: Detached Plume - Clear near stack - consibles downstream of plume variable from two to six diameters from exit.
Plant Shutdown at 10:12

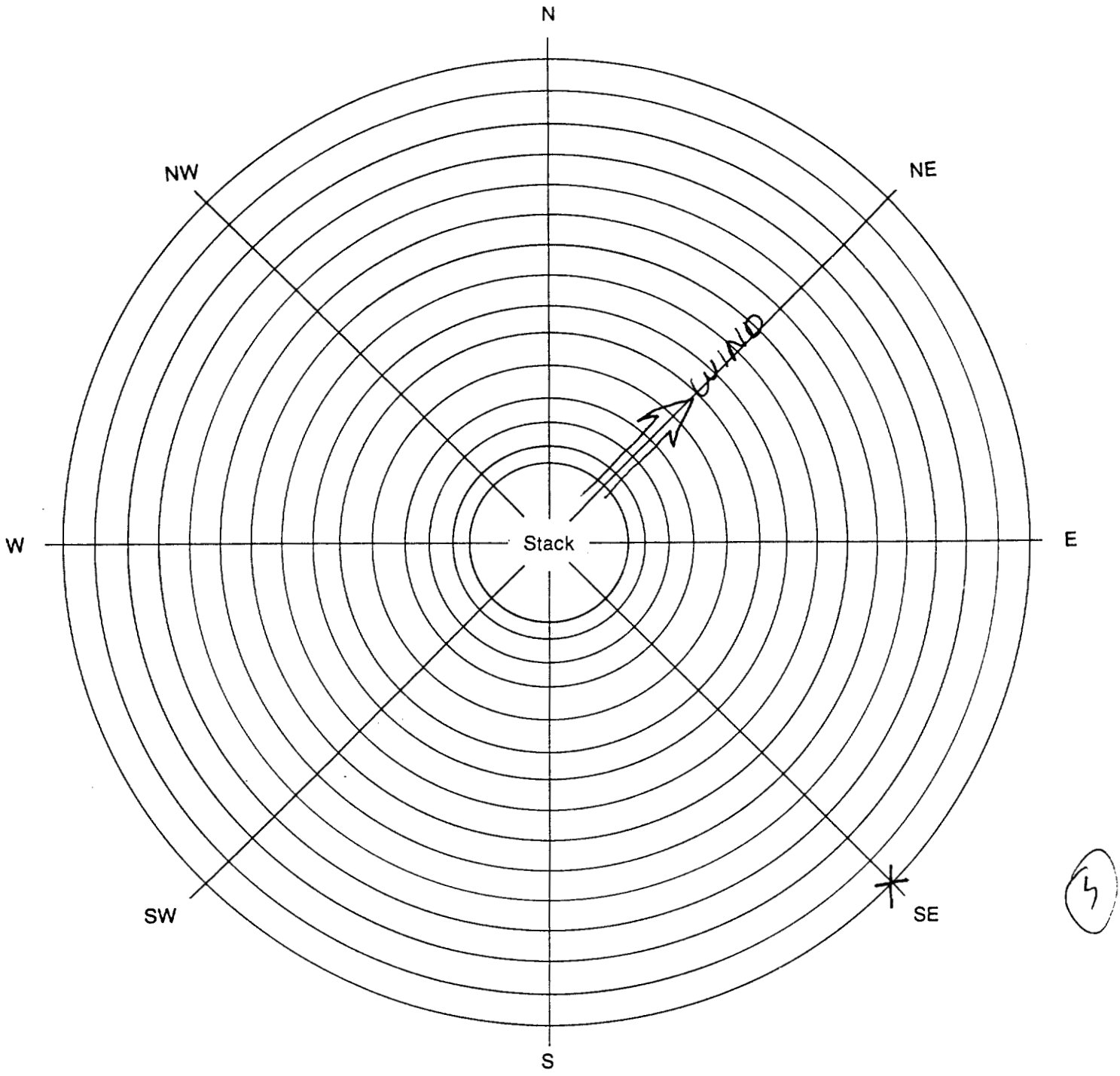
Observers Signature
Tom Scheppers

Date of Last EPA Method 9 Examination
May 90

Examination Passed in EPA Region
VII

Min.	Seconds 0	15	30	45	Min.	Seconds 0	15	30	45
0	0	0	0	0	30	0	0	0	0
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

*If wet, distance (ft.) from plume outlet to point in plume where observations made



LOCATE THE FOLLOWING ON THE DIAGRAM

1. The stack configuration with the stack under observation in the center
2. Observer's position using X to indicate position.
3. Arrow pointing direction wind is blowing.
4. Dotted line between observer and plume indicating observers line of sight when making readings.
5. Circle with S in center to indicate sun location.
6. Any large structures or significant topographical features.

NOTE: Stack configuration is not proportional to distances in feet from stack in the diagram.

Visible Emissions Evaluation Data Sheet

Client: Camdenton County
Observer: Tom Schoppers
Project No.:
Date: 6/12/90
Plant Name: Camdenton County
Observation began: 11:00 00
Location: Camdenton, Mo
ended: 12:00 00
Type of Facility: ASPHALT PLANT

Source Identification (Stack, Duct, etc.): STACK
ASPHALT PLANT WITH BAGHOUSE

Observer Location (Diagram on back of sheet)
Distance from Observer to source: 80'
Height of Source (above ground): 18'

Weather Conditions
Wind Direction:
Wind Speed: 5-10
Temperature: 90's
Position of Sun: overhead
Sky Condition: Clear
(clear, overcast, %clouds, color of clouds, etc.)
BLUE SKY

Plume Description
Color: Clear with White trail (condensible) detached
Background: Blue Sky
Type (wet or dry): wet Dist.:

Comments: at 11:38 mix temperature was reduced and plume trail was eliminated

Observers Signature
Tom Schoppers

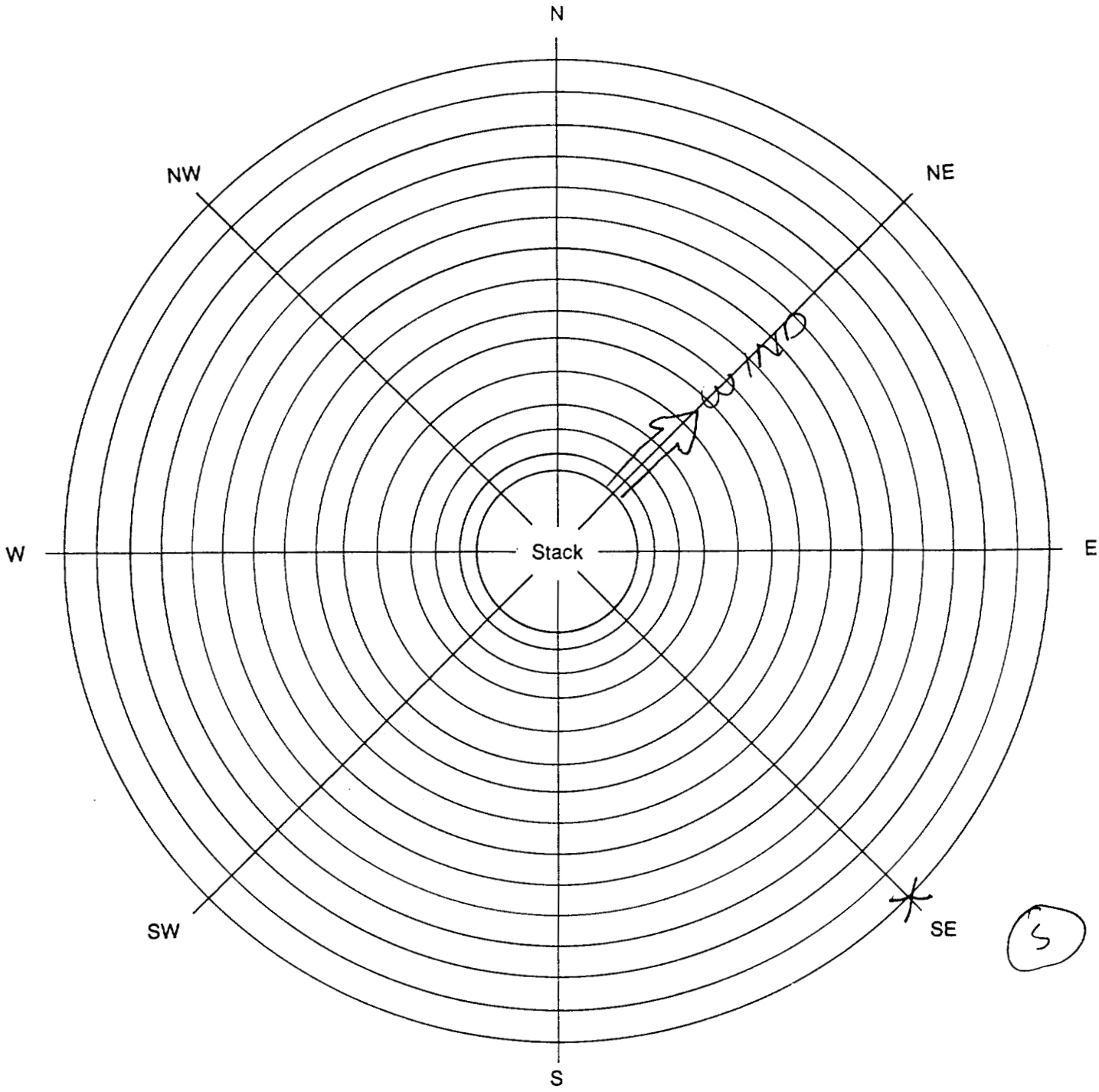
Date of Last EPA Method 9 Examination
May 90

Examination Passed in EPA Region
VII

Min.	Seconds 0	15	30	45	Min.	Seconds 0	15	30	45
0	0	0	0	0	30	0	0	0	0
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

No trail

*If wet, distance (ft.) from plume outlet to point in plume where observations made



LOCATE THE FOLLOWING ON THE DIAGRAM

1. The stack configuration with the stack under observation in the center
2. Observer's position using X to indicate position.
3. Arrow pointing direction wind is blowing.
4. Dotted line between observer and plume indicating observers line of sight when making readings.
5. Circle with S in center to indicate sun location.
6. Any large structures or significant topographical features.

NOTE: Stack configuration is not proportional to distances in feet from stack in the diagram.

Visible Emissions Evaluation Data Sheet

Client Camdenton County
Project No.
Plant Name Camdenton County
Location Camdenton, Mo
Type of Facility ASPHALT Plant

Observer TOM SCHEPPERS
Date 6/12/90
Observation began 13:30 00
ended 14:30 00

Source Identification
(Stack, Duct, etc.) STACK

Observer Location
(Diagram on back of sheet)
Distance from Observer to source 120'
Height of Source (above ground) 18'

Weather Conditions
Wind Direction ~~S-10~~
Wind Speed S-10
Temperature 90's
Position of Sun overhead - back
Sky Condition Clear
(clear, overcast, %clouds, color of clouds, etc.)
Clear Blue Sky

Plume Description
Color Clear - White
Background Trees
Type (wet or dry) _____ Dist. _____

Comments Detached plume occurs at random. Downwash may contribute to my readings of 5% opacity

Observers Signature
Tom Schippers

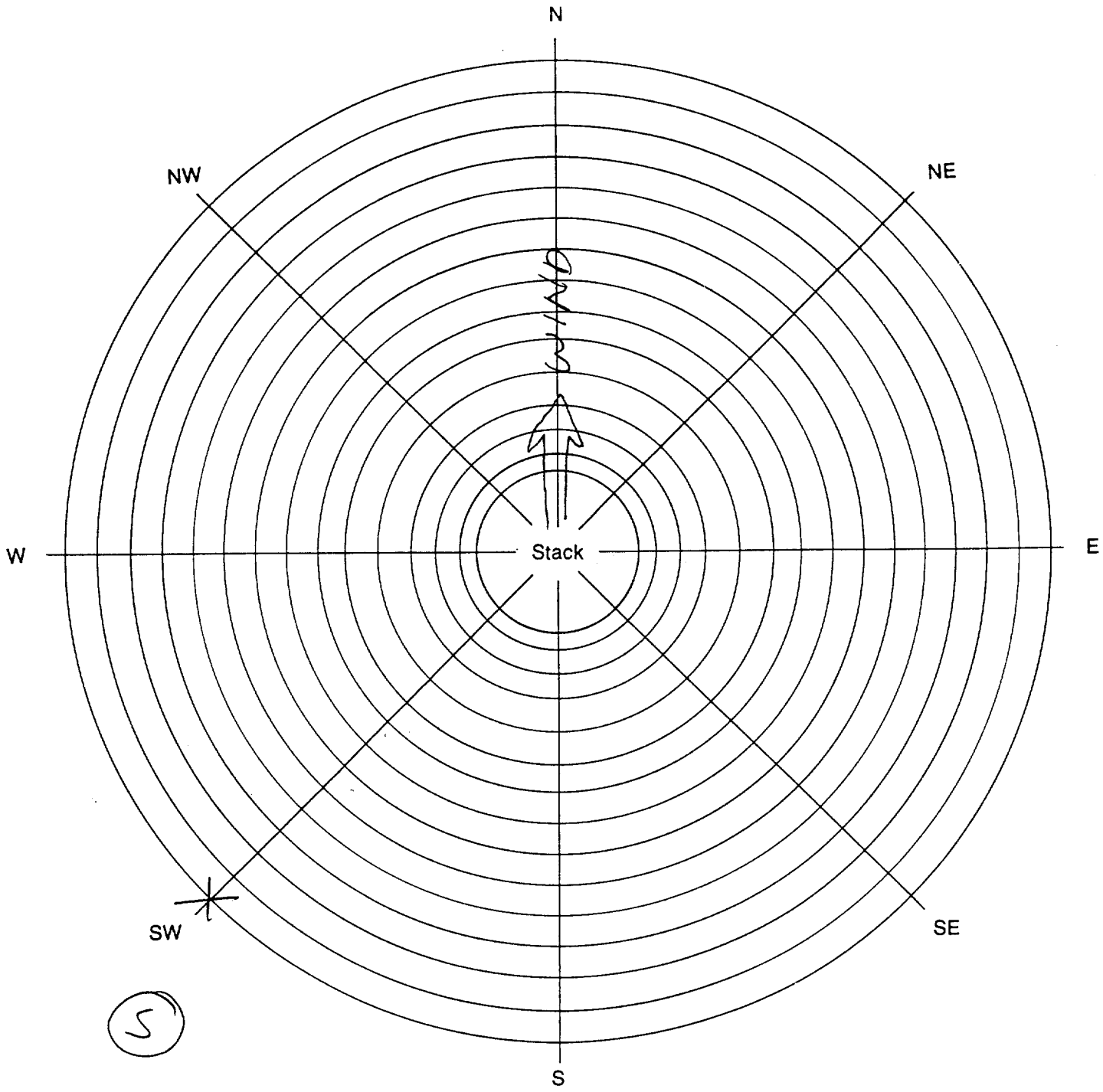
Date of Last EPA Method 9 Examination
May 90

Examination Passed in EPA Region
VII

Min.	Seconds 0	15	30	45	Min.	Seconds 0	15	30	45
0	0	0	0	0	30	0	0	0	0
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	5	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	5
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

14:

*If wet, distance (ft.) from plume outlet to point in plume where observations made



LOCATE THE FOLLOWING ON THE DIAGRAM

1. The stack configuration with the stack under observation in the center
2. Observer's position using X to indicate position.
3. Arrow pointing direction wind is blowing.
4. Dotted line between observer and plume indicating observers line of sight when making readings.
5. Circle with S in center to indicate sun location.
6. Any large structures or significant topographical features.

NOTE: Stack configuration is not proportional to distances in feet from stack in the diagram.

APPENDIX - H

VISIBLE EMISSIONS CERTIFICATION

JOHN ASHCROFT
Governor

G. TRACY MEHAN III
Director

Division of Energy
Division of Environmental Quality
Division of Geology and Land Survey
Division of Management Services
Division of Parks, Recreation,
and Historic Preservation

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL QUALITY
P.O. Box 176
Jefferson City, MO 65102

June 18, 1990

Mr. Tom Scheppers
Shell Engineering & Associates
2503 W. Ash
Columbia, MO 65203

Dear Mr. Scheppers:

The Air Pollution Control Program hereby informs you that you have successfully completed the Kansas City Air Quality Section's Visible Emissions Observer Training and have met all the requirements for certification by the State of Missouri as a Visible Emissions Observer.

Sincerely,

AIR POLLUTION CONTROL PROGRAM

Steven Feeler
Environmental Engineer

SF/bak

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
(June 12, 1990)

PLANT DATA

Sheet 1 of 3

CLIENT CAMDEN COUNTY ROAD DEPT. RECORDED BY W. Boyd

PROJECT NO. _____ DATE JUNE 12, 1990 CHECKED BY _____

DATA SOURCE ASPHALT PLANT RUN NO. 1

PLANT LOCATION CAMDENTON, MO.

PLANT MANUFACTURER ADM PLANT MODEL NO. B6026P PLANT TYPE DRUM

MIX SPECIFICATION NO. _____ OIL SPECIFICATION NO. MC-800

AGGREGATE PROPORTIONS _____

TIME: START 7:15AM STOP _____ A.T. ____ °F R.H. ____ %

	TIME 24 HOUR	☒ FUEL OIL ☐ NATURAL GAS ☐ PROPANE	BURNER SETTING	AGGREGATE TPH	RECYCLE TPH	ASPHALT	MIX TEMPERATURE °F	☐ VENTURI ☐ COLLECTOR ☒ DIFFERENTIAL
#1	7:15	#2 - 1.9GPM	32%	86	-0-	4.0	210	4.5"
	8:00	#2 - 1.9GPM	32%	86	-0-	4.0	210	4.5"
	8:15	#2 - 1.9GPM	33%	86	-0-	4.0	210	4.1"
	8:30	#2 - 1.9GPM	35%	86	-0-	4.0	205	3.9"
	8:45	#2 - 1.9GPM	33%	86	-0-	4.0	215	3.9"
	9:00	#2 - 1.9GPM	32%	86	-0-	4.0	220	3.9"
	9:15	#2 - 1.9GPM	33%	86	-0-	4.0	210	3.9"
	9:30	#2 - 1.9GPM	32%	86	-0-	4.0	210	3.7
	9:45	#2 1.9GPM	32%	86	-0-	4.0	210	3.6
	10:00	#2 1.9GPM	32%	86	-0-	4.0	210	3.5
#2	10:45	#2 - 1.8GPM	30%	86	-0-	4.0	210	4.0
	11:00	#2 - 1.8GPM	30%	86	-0-	4.0	210	3.8
	11:15	#2 - 1.7GPM	30%	86	-0-	4.0	205	3.7
	11:30	#2 - 1.8GPM	30%	86	-0-	4.0	210	3.8
	11:45	#2 - 1.7GPM	31%	86	-0-	4.0	195	3.4
	12:00	#2 - 1.8GPM	32%	86	-0-	4.0	200	3.4
	12:15	#2 1.8GPM	32%	86	-0-	4.0	200	3.4
#3	13:30	#2 - 1.8GPM	32%	86	-0-	4.0	200	3.7
	13:45	#2 - 1.7GPM	30%	86	-0-	4.0	200	4.0
	14:00	#2 - 1.9GPM	30%	86	-0-	4.0	205	3.7
	14:30	#2 - 1.7GPM	30%	86	-0-	4.0	200	3.6

REMARKS:

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 coeffecient
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 = orfice 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 pounds (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 Rankin, average
T_m = absolute temperature at meter in degrees Rankine, average
V_S = velocity of flue gas in feet (meters) per second
V_l = 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 (meters)
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

Submitted to: Missouri Air Pollution Control Program (APCP)
Attention: Doug Elley
Date: _____

PROPOSED TEST PLAN

1. Facility Information

Name: Camden County

Address: #1 Court Circle, Box 960, Camdenton, MO 65020

Name and title of contact: David G. Krehbiel

Telephone number of contact: 314-346-4440

2. Air Pollution Source Information

Type of source: ASPHALT CONCRETE PLANT

Permit number of source to be tested: _____

Address of source: above

Directions to source (or map attached): _____

Initial start-up date: JUNE 1, 1990

3. Testing Firm Information

Name of firm: SHELL ENGINEERING & ASSOCIATES

Address: 2503 WEST ASH
COLUMBIA, MO 65203

Name and title of contact: TOM SCHEPPERS

Telephone number of contact: (314) 445-0106

Number of employees of firm: 20

Number of employees actually engaged in air pollution source testing: 6

Location and description of laboratory facilities: MULTIPLE SITE IN USA

Subcontractor(s) utilized by firm for source testing activities: NONE

Number of air pollution sources previously tested by firm: 100+

Sources tested by firm in Missouri in past 3 years (source, test, date):

St John's Regional Medical Center Feb 90
Alloy Research May 89
Hannibal Healthcare April 90
Syntex Agribusiness Feb 90

4. Performance Test Information

Pollutants to be sampled:

	Pollutant	Number of Sampling Points	Total Time Per Test Run	Number of Test Runs	Test Method to be Used
1	Particulate	≥ 12	≥60 min	3	5
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

6. Source Operation

A description of the source operation including as a minimum the following:

For Asphalt Concrete Plants

a. Type of plant (continuous, batch, portable, permanent)
Specify if drum mix plant and give name of manufacturer and model;

b. Manufacturer and model of dryer and other major components;
ASPHALT DRUM MIXERS model 6026

c. Rated capacity of unit, tons/hr (specify aggregate moisture content);
100 TPH @ 4% MOISTURE.

d. Normal production rate, tons/hr;
WHAT EVER DESIRED UP TO 100TPH

e. Number of burners;
1

f. Type(s) of fuel (Indicate percentages of each when more than one type is burned); PROPANE PILOT
#2 FUEL OIL FOR RUN CONDITION

g. Normal fuel consumption rate;
1.5 GPM @ 100 TPH

h. Pugmill batch size, lb;

i. Description of scavenger system;

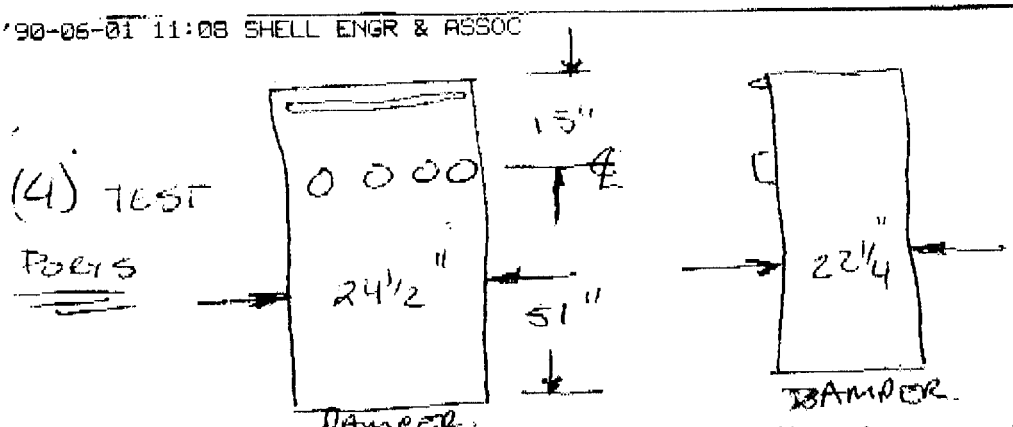
j. Aggregate source;

k. Size distribution of feed for mixes with maximum percentage of fines (material passing number 200 sieve);

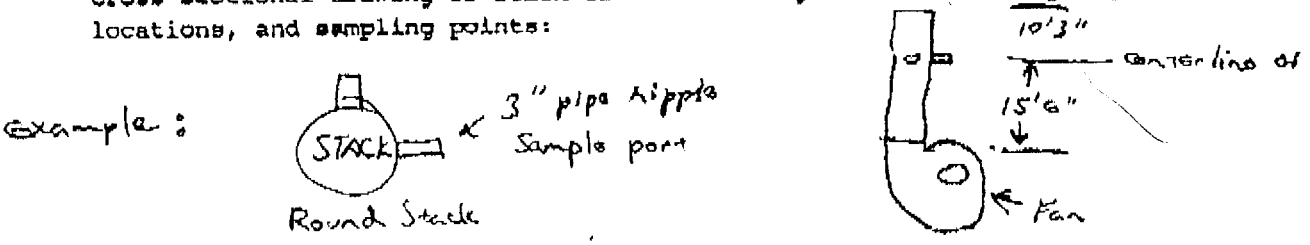
l. Normal operating schedule;

m. Normal maintenance schedule for plant, along with a description of the operating difficulties encountered thus far; and

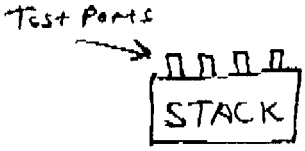
n. Process flow diagram showing flow of feed, asphalt, product, stack gases, fly ash, and air pollution control device liquid, where applicable.



Cross sectional drawing of stack or duct showing dimensions, sampling port locations, and sampling points:



Stack Diameter _____

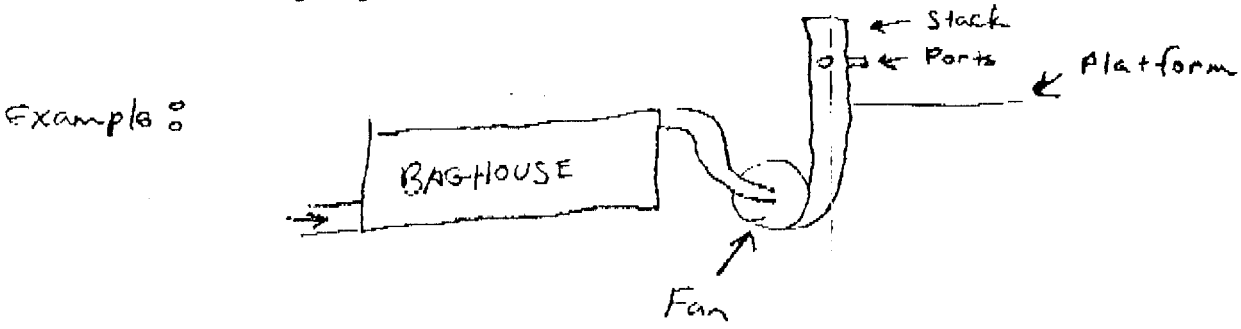


(4) Port Diameter 4"

or

rectangular Stack

Drawing of sampling location showing stack or duct dimensions, air pollution control equipment, fans, and location(s) of disturbances which affect sampling location determination:



Distance from port to platform 6'-3"

2(24.5)(22.25) = 233

5. General

A. Sampling Equipment Information:

The manufacturer and model of the sampling equipment to be used by the tester for the performance tests, along with a description of any equipment which may differ from that required by the specified method(s).

NUTECH METHOD

B. Test Procedures:

A description of any test procedures to be used in the conduct of the performance tests which may differ from the specified method(s).

STRAIGHT METHOD 5

C. Analytical Procedures:

A description of any analytical procedures which differ from the specified method(s).

NO DIFFERENCE

D. Data Sheets:

A sample of all field data sheets which do not provide the data shown on the example sheets in 40 CFR 60 for the specified method(s).

E. Air Pollution Control Equipment:

Types and manufacturers of all control equipment;

BAG HOUSE -

ASPHALT DRUM MIXERS, INC.

Design or guarantee efficiency; _____

Design gas volume at full load (acfm); _____

Design pressure drop; _____

Maintenance schedule and method of recordkeeping; _____

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 ACTUAL CONDITIONS AND STANDARD CONDITIONS

W_g = gms

$W_p = 0.002205 \times W_g$ (lb)

$W_d = \frac{V_p}{V_{ms}}$ (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 Fr)

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

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

METHOD 5 - PARTICULATE EMISSIONS

We agree. I made a mistake in weight gain, see arrows for decimal place Peter Y.

PLANT NAME: Camden County Maintenance
UNIT TESTED: ADM PDM pLANT
RUN NUMBER: 1
DATE TESTED: ENTER NAME OF UNIT TESTED: ? ADM PDM Plant

NO. OF POINTS	24	PERCENT OXYGEN	12.4
TIME PER POINT	2.50	PERCENT CARBON DIOXIDE	6.1
LEAK RATE	0.0010	PERCENT CARBON MONOXIDE	0.0
Y (METER CORR FACT)	1.010	Cp (PITOT COEFF)	0.840
As (STACK AREA)	3.83	Dn (NOZZLE DIAM)	0.212
Pbar (BAR PRESS)	29.14	Vinitial	128.550
Mn (WT PARTICULATE)	5.1500	Vfinal	175.167
Vc	368.8		
Wsg	0.0		

POINT NUMBER	STATIC PRESSURE (Ps)	STACK TEMP (Ts)	VELOCITY PRESSURE (delta Ps)	ORIFICE PRESS DIFF (delta H)	DRY GAS METER TEMP INLET (Tmi)	DRY GAS METER TEMP OUTLET (Tmo)
1	-0.82	271.0	2.47	3.20	84.0	83.0
2	-0.82	271.0	2.61	3.39	83.0	83.0
3	-0.82	270.0	3.32	4.32	86.0	84.0
4	-0.82	268.0	3.09	4.04	85.0	83.0
5	-0.82	266.0	2.92	3.38	85.0	83.0
6	-0.82	261.0	1.01	1.34	87.0	85.0
7	-0.82	264.0	2.14	2.81	85.0	84.0
8	-0.82	264.0	2.25	2.96	86.0	84.0
9	-0.82	266.0	2.20	2.89	87.0	84.0
10	-0.82	267.0	1.82	2.39	88.0	85.0
11	-0.82	266.0	1.39	1.84	89.0	85.0
12	-0.82	260.0	0.47	0.63	88.0	85.0
13	-0.82	265.0	1.89	2.49	87.0	85.0
14	-0.82	266.0	1.72	2.26	90.0	87.0
15	-0.82	265.0	2.20	2.93	90.0	87.0
16	-0.82	263.0	1.29	1.72	90.0	87.0
17	-0.82	259.0	0.94	1.26	89.0	86.0
18	-0.82	252.0	0.54	0.73	88.0	86.0
19	-0.82	263.0	1.53	2.03	87.0	86.0
20	-0.82	263.0	1.04	1.38	88.0	86.0
21	-0.82	263.0	0.90	1.20	89.0	87.0
22	-0.82	261.0	0.78	1.04	89.0	88.0
23	-0.82	257.0	0.57	0.77	89.0	88.0
24	-0.82	251.0	0.59	0.80	90.0	88.0
AVG	-0.82	263.4	1.24	2.16	87.5	85.4

av 256.4

STACK VELOCITY	86.69 (ft/sec)	av 88.56
STANDARD VOLUME SAMPLED	44.53 (SCF)	
AVERAGE DRY GAS METER TEMP	86.4 (°F)	
PERCENT MOISTURE	28.05 (%)	
STANDARD STACK FLOW RATE	10168.60 (DSCFM)	av 10553.27
ISOKINETIC SAMPLING RATE	113.99 (%)	
PARTICULATE EMISSION RATE	0.156 (lb/hr)	~~av .119~~ av 1.19
PARTICULATE EMISSION RATE	0.0018 (gr/dscf)	13.3×10^{-2}

i.e. .018

METHOD 5 - PARTICULATE EMISSIONS

PLANT NAME: Camden County Maintenance
UNIT TESTED: ADM PDM pLANT
RUN NUMBER: 2
DATE TESTED: ENTER NAME OF UNIT TESTED: ? ADM PDM Plant

NO. OF POINTS	24	PERCENT OXYGEN	14.1
TIME PER POINT	2.50	PERCENT CARBON DIOXIDE	5.1
LEAK RATE	0.0010	PERCENT CARBON MONOXIDE	0.0
Y (METER CORR FACT)	1.010	Cp (PITOT COEFF)	0.840
As (STACK AREA)	3.83	Dn (NOZZLE DIAM)	0.212
Pbar (BAR PRESS)	29.14	Vinitial	175.568
Mn (WT PARTICULATE)	3.5400	Vfinal	215.540
Vc	280.0		
Vsg	7.7		

POINT NUMBER	STATIC PRESSURE (Ps)	STACK TEMP (Ts)	VELOCITY PRESSURE (delta Ps)	ORIFICE PRESS DIFF (delta H)	DRY GAS METER TEMP INLET (Tmi)	DRY GAS METER TEMP OUTLET (Tmo)
1	-0.82	244.0	3.21	3.00	90.0	89.0
2	-0.82	251.0	3.67	3.38	89.0	89.0
3	-0.82	255.0	3.24	3.00	92.0	91.0
4	-0.82	252.0	1.09	1.01	91.0	90.0
5	-0.82	251.0	1.07	0.99	91.0	90.0
6	-0.82	252.0	0.94	0.87	90.0	90.0
7	-0.82	257.0	2.19	2.02	92.0	92.0
8	-0.82	260.0	2.63	2.41	92.0	90.0
9	-0.82	258.0	1.99	1.84	93.0	91.0
10	-0.82	253.0	0.80	0.74	93.0	91.0
11	-0.82	249.0	0.82	0.77	92.0	91.0
12	-0.82	247.0	0.99	0.93	91.0	91.0
13	-0.82	255.0	2.00	1.85	92.0	91.0
14	-0.82	253.0	2.19	2.03	92.0	91.0
15	-0.82	255.0	2.22	2.06	93.0	91.0
16	-0.82	255.0	1.56	1.44	93.0	92.0
17	-0.82	248.0	1.06	0.99	94.0	92.0
18	-0.82	244.0	0.99	0.93	94.0	92.0
19	-0.82	250.0	1.83	1.71	93.0	92.0
20	-0.82	249.0	1.92	1.80	93.0	91.0
21	-0.82	246.0	1.31	1.23	93.0	92.0
22	-0.82	246.0	1.25	1.18	94.0	93.0
23	-0.82	244.0	1.05	0.99	93.0	92.0
24	-0.82	240.0	0.95	0.90	94.0	93.0
AVG	-0.82	250.6	1.27	1.59	92.3	91.1

STACK VELOCITY	87.90 (ft/sec)
STANDARD VOLUME SAMPLED	37.77 (SCF)
AVERAGE DRY GAS METER TEMP	91.7 (°F)
PERCENT MOISTURE	26.39 (%)
STANDARD STACK FLOW RATE	10737.18 (DSCFM)
ISOKINETIC SAMPLING RATE	91.55 (%)
PARTICULATE EMISSION RATE	0.133 (lb/hr)
PARTICULATE EMISSION RATE	0.0014 (gr/dscf)

.014

METHOD 5 - PARTICULATE EMISSIONS

PLANT NAME: Camden County Maintenance
UNIT TESTED: ADM PDM pLANT
RUN NUMBER: 3
DATE TESTED: ENTER NAME OF UNIT TESTED: ? ADM PDM Plant

NO. OF POINTS	24	PERCENT OXYGEN	13.0
TIME PER POINT	2.50	PERCENT CARBON DIOXIDE	5.6
LEAK RATE	0.0030	PERCENT CARBON MONOXIDE	0.0
Y (METER CORR FACT)	1.010	Cp (PITOT COEFF)	0.840
As (STACK AREA)	3.83	Dn (NOZZLE DIAM)	0.212
Pbar (BAR PRESS)	29.14	Vinitial	216.394
Mn (WT PARTICULATE)	1.8700	Vfinal	257.303
Vc	305.0		
Wsg	18.5		

POINT NUMBER	STATIC PRESSURE (Ps)	STACK TEMP (Ts)	VELOCITY PRESSURE (delta Ps)	ORIFICE PRESS DIFF (delta H)	DRY GAS METER TEMP INLET (Tmi)	DRY GAS METER TEMP OUTLET (Tmo)
1	-0.82	245.0	3.00	2.83	93.0	93.0
2	-0.82	250.0	2.94	2.76	94.0	94.0
3	-0.82	253.0	2.79	2.01	95.0	94.0
4	-0.82	257.0	2.25	2.10	96.0	94.0
5	-0.82	257.0	1.21	1.13	97.0	95.0
6	-0.82	254.0	1.20	1.13	97.0	95.0
7	-0.82	260.0	2.64	2.46	96.0	94.0
8	-0.82	262.0	2.98	2.77	95.0	94.0
9	-0.82	263.0	2.92	2.70	96.0	95.0
10	-0.82	262.0	2.14	1.99	97.0	95.0
11	-0.82	254.0	0.73	0.69	98.0	96.0
12	-0.82	249.0	0.61	0.58	96.0	95.0
13	-0.82	260.0	2.38	2.22	97.0	95.0
14	-0.82	260.0	2.40	2.24	97.0	96.0
15	-0.82	256.0	2.15	2.02	97.0	95.0
16	-0.82	256.0	1.51	1.42	97.0	95.0
17	-0.82	252.0	0.49	0.46	97.0	96.0
18	-0.82	247.0	0.69	0.66	97.0	96.0
19	-0.82	256.0	2.21	2.07	97.0	95.0
20	-0.82	257.0	2.41	2.26	98.0	96.0
21	-0.82	257.0	1.91	1.80	98.0	96.0
22	-0.82	256.0	0.93	0.88	98.0	96.0
23	-0.82	253.0	0.82	0.78	99.0	97.0
24	-0.82	248.0	0.69	0.66	99.0	97.0
AVG	-0.82	255.2	1.31	1.69	96.7	95.2

STACK VELOCITY	91.10 (ft/sec)
STANDARD VOLUME SAMPLED	38.37 (SCF)
AVERAGE DRY GAS METER TEMP	95.9 (°F)
PERCENT MOISTURE	28.41 (%)
STANDARD STACK FLOW RATE	10754.03 (DSCFM)
ISOKINETIC SAMPLING RATE	92.86 (%)
PARTICULATE EMISSION RATE	0.069 (lb/hr) 1.19
PARTICULATE EMISSION RATE	0.0008 (gr/dscf)

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