AP42 Section: 11.1

Reference Number: 342

Title: Stack Emission Test, Payne & Dolan, Inc., Control 6 Asphalt Plant, Vienna, WI,

Environmental Technology and Engineering Corp., Elm Grove, WI,

July 18, 1995.

Benzene Sec. 11-1 Ref. 342

Report to

PAYNE & DOLAN, INC.
Waukesha, Wisconsin

for

STACK EMISSION TEST
CONTROL 6 ASPHALT PLANT
Vienna, Wisconsin

July 18, 1995

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION
13020 West Bluemound Road
Elm Grove, Wisconsin 53122
414-784-2434

SUMMARY

On July 18, 1995, Environmental Technology & Engineering Corporation personnel performed a stack emission test on the Payne & Dolan, Inc. Control 6 asphalt plant located in Vienna, Wisconsin. The average of the three particulate tests show the emissions to be well below the limit of 0.04 grains of particulate matter per dry standard cubic foot (gr/dscf) as specified by the State of Wisconsin Department of Natural Resources (DNR) by permit. The numerical test results are summarized below:

Test	Emissions	% of Allowable
1	0.003 gr/dscf	7.5 %
2	0.003	7.5
3	0.003	7.5
AVG	0.003 gr/dscf	7.5 %

In addition, the permit also required testing for formaldehyde emissions. The following table presents the numerical results:

Test	LB/HR	LB/TON
1	1.04 lb/hr	0.0026 lb/ton
2	0.76	0.0019
3	0.70	0.0018
AVG	0.83 lb/hr	0.0021 lb/ton

PAYNE & DOLAN
CONTROL 6 JULY 18, 1995
STACK TEST RESULTS SUMMARY

COUNTERFLOW DRUM PL
GAS FIRED
20 % RECYCLE

TEST 1		CO	NOX	FORM	PRODUCTION RATE, TPH
PPM		250	29.5	5.92	395
MG/M3		288	55	7.38	
LB/HR		40.50	7.81	1.04	
LB/TON		.1025	.0198	.0026	
FLOW	SCFM		37605		
	M3/HR		63899		

TEST 2		CO	NOX	FORM	PRODUCTION RATE, TPH
PPM		182	31.5	4.22	395
MG/M3		209	59	5.27	
LB/HR		30.03	8.50	.76	
LB/TON		.0760	.0215	.0019	
FLOW	SCFM		38304		
	M3/HR		65086		

TEST 3		CO	NOX	FORM	PRODUCTION RATE, TPH
PPM		175	38	3.71	395
MG/M3		201	71	4.63	
LB/HR		30.20	10.72	.69	
LB/TON		.0765	.0271	.0018	
FLOW	SCFM		40064		
	M3/HR		68077		

AVERAGE	CO	NOX	FORM
LB/HR	33.58	9.01	.83
LB/TON	.0850	.0228	.0021

PAYNE & DOLAN
CONTROL 6 JULY 18, 1995
STACK TEST RESULTS SUMMARY

COUNTERFLOW DRUM PL
GAS-FIRED
20 % RECYCLE

TEST 1		BENZ	CL-BENZ	CL2-BENZ	PRODUCTION RATE, TPH
					395
MG/M3		1.30	<.2400	<.2400	
LB/HR		.1831	<.0338	<.0338	
LB/TON		.00046	<.00009	<.00009	
FLOW	SCFM		37605		
	M3/HR		63899		

TEST 2		BENZ	CL-BENZ	CL2-BENZ	PRODUCTION RATE, TPH
					395
MG/M3		.82	<.1000	<.1000	
LB/HR		.1177	<.0143	<.0143	
LB/TON		.00030	<.00004	<.00004	
FLOW	SCFM		38304		
	M3/HR		65086		

TEST 3		BENZ	CL-BENZ	CL2-BENZ	PRODUCTION RATE, TPH
					395
MG/M3		.84	<.1200	<.1200	
LB/HR		.1261	<.0180	<.0180	
LB/TON		.00032	<.00005	<.00005	
FLOW	SCFM		40064		
	M3/HR		68077		

AVERAGE	BENZ	CL-BENZ	CL2-BENZ
LB/HR	.1423	<.0221	<.0221
LB/TON	.00036	<.00006	<.00006

Method 18

N 6
CF Drum
20% RAP

1.0 GENERAL

On Tuesday, July 18, 1995, Environmental Technology and Engineering Corporation personnel performed a stack emission test on the Payne & Dolan, Inc. Control 6 counterflow drum mix asphalt plant located in Vienna, Wisconsin. The test was a provision of Air Pollution Control Permit No. 94-RPS-909. The State of Wisconsin Department of Natural Resources (DNR) has established a particulate emission limit of 0.04 grains per dry standard cubic foot (gr/dscf). The purpose of this test was to demonstrate the compliance status of this plant with the particulate limits set by the DNR. In addition, the permit also required a test to determine the formaldehyde emissions.

The plant tested was a Gencor counterflow drum mix asphalt plant equipped with a baghouse for particulate control. During the test period, the plant production rate was approximately 395 tons per hour and the mix was composed of 80 % virgin material and 20 % recycled material. The plant was fired with natural gas. The field tests, corresponding laboratory analysis and report preparation were coordinated by Bill Dick of ETE Corp. The test procedures, plant operating conditions, and stack opacity were witnessed by Rob Bovy of the Wisconsin DNR Southern District Office.

The following sections of this report document the activities and results of the test program. The report presents all of the relevant data collected and discussions on the interpretation of the data are provided where appropriate. The report, therefore, includes much necessary detail. The results, however, have been summarized in the SUMMARY section at the beginning of this report for those readers not wishing to be burdened by the details.

2.0 RESULTS

2.1 Particulate Emissions

Isokinetic sampling for particulate matter was performed in accordance with the procedures outlined in EPA Method 17 - "Determination of Particulate Emissions from Stationary Sources" - as published in the Federal Register. A brief summary of this method is included in section 3.0 of this report. The tests were performed in the final discharge stack at the location shown in Figure 2-1. This same figure also depicts the location of the exact test points relative to the stack wall. The stack flow parameters recorded during testing and the weights of particulate collected were used to compute the emissions for each test of the three-test sequence. These data were then entered into a computer and printouts showing detailed results are included as Tables 2-1, 2-2, and 2-3.

The results of each of the three individual tests show the emissions to be well below the limit of 0.04 grains of particulate matter per dry standard cubic foot (gr/dscf) as specified by the State of Wisconsin Department of Natural Resources (DNR). The numerical test results are summarized below:

Test	Emissions	% of Allowable
1	0.003 gr/dscf	7.5 %
2	0.003	7.5
3	0.003	7.5
AVG	0.003 gr/dscf	7.5 %

PAYNE & DOLAN
CONTROL 6 PLANT
VIENNA

ROUND STACK POINT CALCULATIONS

DIAMETER, IN	60.0
STACK AREA, SQ FT	19.63
NO. OF POINTS PER TRAVERSE	

POINT	12
1	1.3
2	4.0
3	7.1
4	10.6
5	15.0
6	21.4
7	38.6
8	45.0
9	49.4
10	52.9
11	56.0
12	58.7

PAYNE & DOLAN CONTROL 6 TEST 1 7-18-95 TABLE 2-1

BAROMETRIC PRESSURE, in Hg = 29.250
TIP DIAMETER, in = .2500
STACK AREA, sq ft = 19.635
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 40.21
WATER COLLECTED, ml = 361
PARTICULATE COLLECTED, grams = 0.0080
ORSAT RESULTS
CO2 = 4.60 O2 = 12.00 CO = 0.00 N2 = 83.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	240	0.940	1.80	74	66.93
2	245	0.940	1.80	74	67.17
3	245	0.950	1.85	74	67.52
4	245	0.860	1.65	75	64.25
5	245	0.730	1.40	75	59.19
6	245	0.660	1.28	76	56.28
7	245	0.600	1.13	77	53.66
8	245	0.650	1.24	79	55.85
9	245	0.760	1.48	80	60.40
10	245	0.900	1.72	80	65.72
11	245	1.000	1.90	81	69.28
12	245	0.930	1.78	82	66.81
13	245	1.100	2.10	86	72.66
14	245	1.100	2.10	88	72.66
15	245	1.040	2.00	89	70.65
16	245	0.870	1.66	90	64.62
17	245	0.750	1.43	90	60.00
18	245	0.640	1.22	91	55.42
19	245	0.600	1.12	92	53.66
20	245	0.640	1.22	93	55.42
21	245	0.730	1.40	94	59.19
22	245	0.800	1.51	94	61.96
23	245	0.840	1.60	95	63.49
24	245	0.710	1.38	96	58.37
AVG VALUES	245		1.574	84	62.55

TOTAL GAS WITHDRAWN, scf = 56.29
DRY GAS WITHDRAWN, scf = 39.30
WATER VAPOR WITHDRAWN, scf = 16.99
PERCENT WATER VAPOR = 30.19
ACTUAL WET FLOW RATE, acfm = 73,689
STANDARD DRY FLOW RATE, scfm = 37,606
, m3/hr = 63,899
PARTICULATE CONCENTRATION, grains/dscf = 0.003
PARTICULATE EMISSION RATE, lb/hr = 1.01
LB PARTICULATE PER 1000 LB GAS = 0.005
PERCENT OF ISOKINETIC SAMPLING = 100.3

PAYNE & DOLAN CONTROL 6 TEST 2 7-18-95 TABLE 2-2

BAROMETRIC PRESSURE, in Hg = 29.250
TIP DIAMETER, in = .2500
STACK AREA, sq ft = 19.635
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 40.13
WATER COLLECTED, ml = 364
PARTICULATE COLLECTED, grams = 0.0066
ORSAT RESULTS
CO2 = 4.70 O2 = 12.40 CO = 0.00 N2 = 82.90

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	245	1.100	2.10	98	72.66
2	245	1.100	2.10	98	72.66
3	250	1.040	2.00	97	70.90
4	250	1.000	1.90	96	69.52
5	250	0.950	1.83	97	67.76
6	250	0.760	1.48	98	60.61
7	246	0.740	1.42	98	59.64
8	246	0.770	1.50	98	60.83
9	246	0.830	1.60	98	63.16
10	246	0.850	1.64	99	63.92
11	246	0.910	1.75	99	66.13
12	246	0.820	1.58	100	62.78
13	246	1.050	2.00	100	71.04
14	246	0.970	1.85	102	68.28
15	246	0.820	1.57	102	62.78
16	246	0.770	1.48	102	60.83
17	246	0.700	1.32	104	58.00
18	246	0.690	1.31	106	57.59
19	246	0.640	1.22	108	55.46
20	246	0.690	1.31	108	57.59
21	246	0.820	1.57	108	62.78
22	246	0.960	1.84	109	67.93
23	246	0.870	1.67	110	64.66
24	246	0.730	1.40	111	59.23
AVG VALUES	247		1.643	102	64.03

TOTAL GAS WITHDRAWN, scf = 56.44
DRY GAS WITHDRAWN, scf = 39.31
WATER VAPOR WITHDRAWN, scf = 17.13
PERCENT WATER VAPOR = 30.36
ACTUAL WET FLOW RATE, acfm = 75,434
STANDARD DRY FLOW RATE, scfm = 38,304
, m3/hr = 65,086
PARTICULATE CONCENTRATION, grains/dscf = 0.003
PARTICULATE EMISSION RATE, lb/hr = 0.84
LB PARTICULATE PER 1000 LB GAS = 0.004
PERCENT OF ISOKINETIC SAMPLING = 98.5

PAYNE & DOLAN CONTROL 6 TEST 3 7-18-95 TABLE 2-3

BAROMETRIC PRESSURE, in Hg = 29.250
TIP DIAMETER, in = .2500
STACK AREA, sq ft = 19.635
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 39.42
WATER COLLECTED, ml = 325
PARTICULATE COLLECTED, grams = 0.0065
ORSAT RESULTS
CO2 = 4.50 O2 = 12.50 CO = 0.00 N2 = 83.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	230	1.000	1.90	108	68.26
2	230	0.990	1.89	108	67.91
3	230	0.870	1.66	108	63.67
4	230	0.860	1.65	108	63.30
5	230	0.810	1.53	108	61.43
6	234	0.830	1.59	109	62.36
7	236	0.630	1.20	109	54.41
8	238	0.710	1.36	110	57.85
9	240	0.760	1.48	110	59.93
10	240	0.900	1.71	110	65.22
11	240	0.880	1.60	110	64.49
12	240	0.920	1.66	112	65.94
13	240	1.120	2.16	112	72.76
14	240	1.140	2.20	113	73.40
15	240	1.100	2.10	114	72.10
16	240	1.060	2.01	115	70.78
17	240	0.920	1.75	116	65.94
18	245	0.780	1.49	117	60.93
19	245	0.670	1.29	118	56.47
20	245	0.690	1.32	119	57.31
21	245	0.810	1.53	119	62.10
22	245	0.880	1.68	119	64.72
23	245	0.990	1.89	120	68.65
24	245	0.890	1.70	120	65.09
AVG VALUES	239		1.681	113	64.38

TOTAL GAS WITHDRAWN, scf = 53.97
DRY GAS WITHDRAWN, scf = 38.67
WATER VAPOR WITHDRAWN, scf = 15.30
PERCENT WATER VAPOR = 28.35
ACTUAL WET FLOW RATE, acfm = 75,842
STANDARD DRY FLOW RATE, scfm = 40,064
, m3/hr = 68,077
PARTICULATE CONCENTRATION, grains/dscf = 0.003
PARTICULATE EMISSION RATE, lb/hr = 0.86
LB PARTICULATE PER 1000 LB GAS = 0.004
PERCENT OF ISOKINETIC SAMPLING = 92.7

Benzene

Sampling for benzene was performed in accordance with EPA Method 18 - "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography." Samples were drawn from the exhaust gas stream onto solid sorbent tubes (charcoal for benzene) using an SKC pump with a stroke counter to measure the sample volume. A minimum of two tubes were placed in series. A "drip" impinger was used prior to the tubes to eliminate moisture. At the completion of the tests the tubes were desorbed and analyzed by a gas chromatograph equipped with a flame ionization detector.

Standard concentrations of the benzene were prepared by injecting a known quantity into a tube and then desorbing and analyzing the tube in the same manner as the samples. Recovery studies have previously been done for these compounds and found to be acceptable.

The concentrations of the exhaust gas stream were then determined by comparing the response of the standards to the response to the exhaust stack samples. Sample retention times and peak heights were used to quantify both the benzene and chlorobenzene emissions. The compound concentrations were then used in conjunction with the exhaust gas flow rates to determine organic compound emission rates in units of pounds per hour (lb/hr).

2.2 Formaldehyde Emissions

The formaldehyde emissions were determined concurrently with the particulate testing using EPA Method 0011 (non-isokinetic). A brief description of the method is included in section 3.0 of this report. The numerical results are presented below:

Test	LB/HR	LB/TON
1	1.04 lb/hr	0.0026 lb/ton
2	0.76	0.0019
3	0.70	0.0018
AVG	0.83 lb/hr	0.0021 lb/ton

A summary of the field and lab data is included as Table 2-4.

3.0 METHOD OF TEST

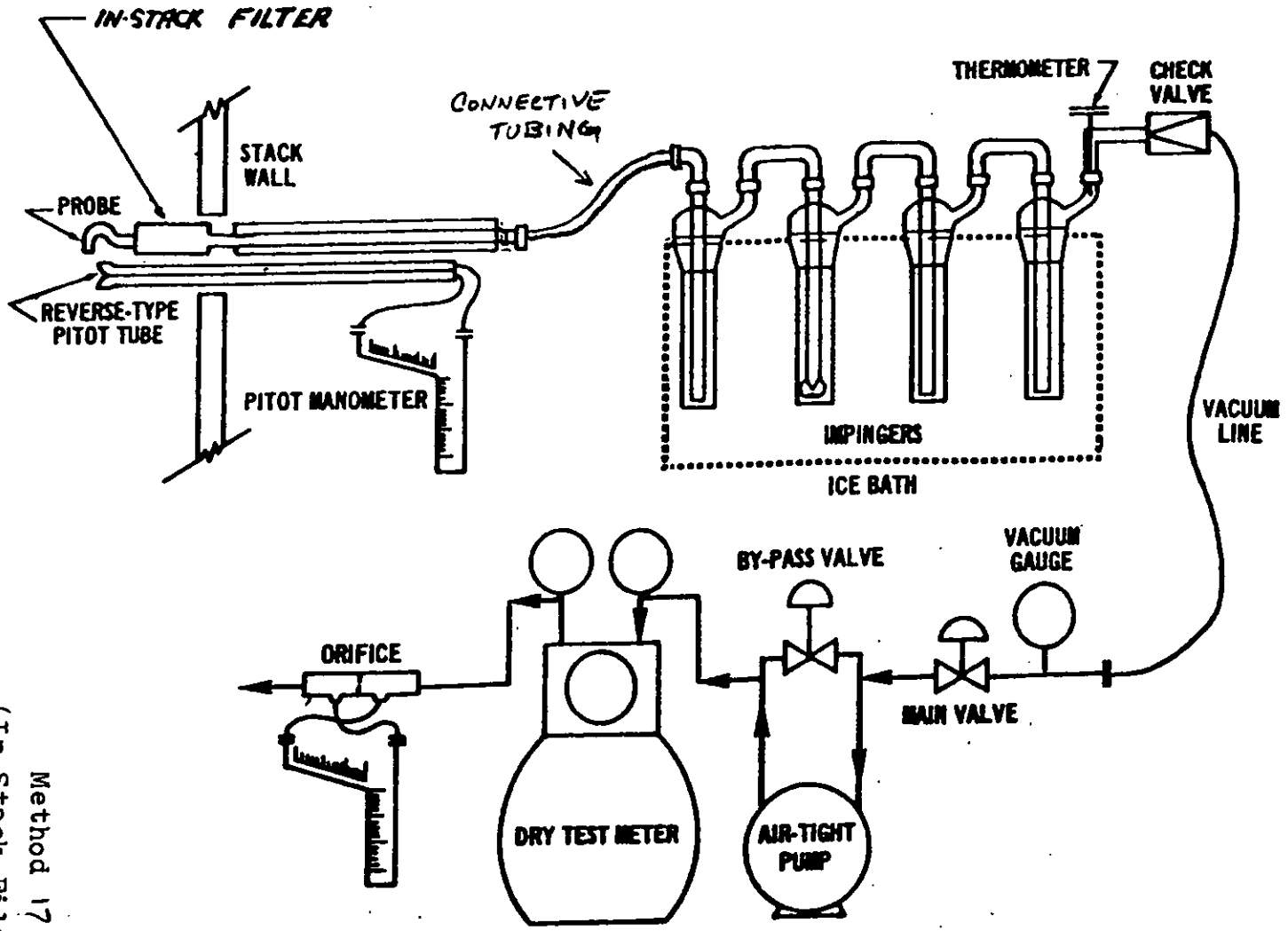
3.1 Particulate Matter

The equipment used to sample was the Western Precipitation Division of the Joy Manufacturing Company Emission Parameter Analyzer. Samples were collected and analyzed in accordance with procedures outlined in 40 CFR 60 Appendix A, Method 17 - Determination of Particulate Emissions from Stationary Sources.

The sampling train consisted of a stainless steel probe tip, an in-stack filter, a heated stainless steel lined probe, a glass cyclone and flask, and a heated 125 millimeter Whatman 934-AH fiberglass back-up filter. A series of four impingers followed in an ice bath. The first was a modified Greenburg-Smith impinger with 100 ml of distilled water; the second was a Greenburg-Smith impinger with 100 ml water; the third was a modified Greenburg-Smith impinger dry; the fourth was also a modified Greenburg-Smith impinger containing a tared quantity of silica gel. The gas then passed through a vacuum pump, calibrated dry gas meter, and a calibrated orifice. A schematic drawing of the sampling train is included.

PAYNE & DOLAN CONTROL 6 PLANT
FORMALDEHYDE RESULTS JULY 18, 1995
TABLE 2-4

TEST NO	METER VOLUME Vm	METER TEMP Tm	STD DRY VOLUME VmSTD	METER FACTOR GAMA	BAR PRESS IN HG	FORM ug	FORM CONC ug/m3	FLOW RATE m3/hr	FORM ER lb/hr	PROD RATE tph	FORM EM lb/ton
1	2.14	534	2.12	1.026	29.25	443.5	7.38	63899	1.04	395	.0026
2	2.72	538	2.68	1.026	29.25	399.9	5.27	65086	.76	395	.0019
3	2.60	547	2.52	1.026	29.25	330.4	4.63	68077	.70	395	.0018
					AVERAGE RESULTS		5.76	65687	.83	395	.0021



Particulate sampling train.

Method 17
(In-Stack Filter)

The temperatures at strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

The initial gas stream velocity was obtained from a preliminary traverse using an "S" type pitot tube. The initial moisture was estimated from previous tests of similar processes. This data, along with the stack temperature, was used to set a nomograph so that rapid calculations of isokinetic sampling conditions could be made.

The principle of the method was to collect the sample representative of the exhaust by adjusting the sample collection velocity to match the exhaust gas stream velocity at the point of collection. The velocity at the point of collection was measured with an "S" type pitot tube attached to the probe and the collection velocity was matched to the stack gas velocity by adjusting the flow as indicated by the calibrated orifice.

To determine the molecular weight of the stack gas, samples were drawn into an Orsat analyzer and analyzed for percentage CO2, O2, CO, and N2.

At the completion of the test, the probe tip preceding the filter was washed with acetone which was placed in a tared beaker and evaporated to dryness at room temperature. The filter and beaker were then desiccated to the tared humidity conditions and weighed. The impinger contents were measured and weighed for determination of the actual moisture content of the exhaust gas stream.

The combined weight of the filter catch and the probe tip washing residue was used to determine the particulate emission rates.

A computer was used to calculate the stack velocities, emission concentrations, emission rates and volumetric flow rates using the field and laboratory data.

3.2 Formaldehyde

The sampling and analysis were performed using procedures outlined in EPA Method 0011, the method required by the Wisconsin Department of Natural Resources for determining formaldehyde emissions.

Sampling was performed by drawing a known quantity of stack exhaust through appropriate sampling media by means of a battery operated pump. The media consisted of a train of three midget impingers; the first two contained 10 ml of a DNPH solution and were followed by an empty impinger and a water trap. The impingers were set in an ice water bath to accommodate the temperature of the gas stream sampled. The sampling volumes were determined through the use of a calibrated dry gas meter.

Following the sampling, the samples were sealed and returned to the lab for analysis. The samples were analyzed via HPLC methods as described by the EPA. A blank was handled in the field in a method identical to the samples and also submitted for analysis.

4.0 CALIBRATIONS

The probe tip, pitot tube, dry gas meter, and orifice were calibrated prior to the test according to procedures outlined in the Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment as published by the EPA. The values obtained were:

Probe tip diameter	d =	0.250"
Pitot tube coeff.	Cp =	0.84
Orifice coeff.	dH@ =	1.842

The dry gas meter presently installed in the control box is a temperature compensating meter. The correction factor for this dry gas meter is represented by:

$$\text{Gama} = 0.994 + (Td - 70) \times .00012$$

where: Td = Dry Gas Meter Temperature

The most recent calibration was performed July 17, 1995.

Benzene

Sampling for benzene was performed in accordance with EPA Method 18 - "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography." Samples were drawn from the exhaust gas stream onto solid sorbent tubes (charcoal for benzene and chlorobenzenes) using an SKC pump with a stroke counter to measure the sample volume. A minimum of two tubes were placed in series. A "drip" impinger was used prior to the tubes to eliminate moisture. At the completion of the tests the tubes were desorbed and analyzed by a gas chromatograph equipped with a flame ionization detector.

Standard concentrations of the benzene were prepared by injecting a known quantity into a tube and then desorbing and analyzing the tube in the same manner as the samples.

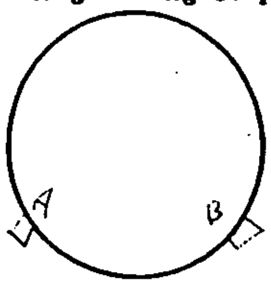
The concentrations of the exhaust gas stream were then determined by comparing the response of the standards to the response to the exhaust stack samples. Sample retention times and peak heights were used to quantify both the benzene and chlorobenzene emissions. The compound concentrations were then used in conjunction with the exhaust gas flow rates to determine organic compound emission rates in units of pounds per hour (lb/hr).

APPENDIX A

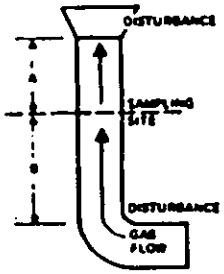
FIELD & LABORATORY DATA SHEETS

Environmental Technology & Engineering Corp.

PARTICULATE FIELD DATA



CROSS SECTION



PLANT [illegible]
DATE 7-18-95
LOCATION [illegible]
OPERATOR [illegible]
STACK NO. [illegible]
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 1

AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE [illegible]
ASSUMED MOISTURE, % 25%
PROBE LENGTH, in. 6'
NOZZLE DIAMETER, in. 1/2"
STACK DIAMETER, in. 60
PROBE HEATER SETTING —
HEATER BOX SETTING —

METER ΔH@ [illegible]
C FACTOR [illegible]
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2 9.6
O2 12.0
CO
N2 83.7

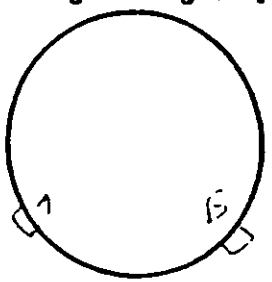
T-596

LEAK CHECKS
Pre ✓
Pitot ✓
Post ✓
Pitot ✓

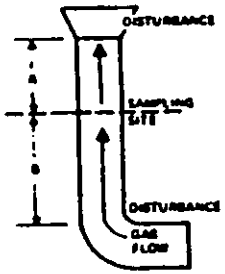
TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SKC #8 0 619 SAMPLE BOX TEMPERATURE °F	Y-1.026 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	2335,00		240	.94		1.80		613.00		74	409819	432.12/72	[illegible]	
2	[illegible]		245	.94		1.90		614.8		74	419584	434.24 76		
3	40	-.75	245	.95		1.35		16.6		74	[illegible]	0.11/74	2	
4			245	.86		1.65		18.5		75	1.5[illegible]			
5	45		245	.73		1.40		20.2		75				
6			245	.66		1.28		21.9		76				
7	50		245	.60		1.13		23.4		77				
8			245	.65		1.24		24.8		79				
9	55		245	.76		1.48		26.3		80				
10			245	.90		1.72		28.0		80			2	
11	00		245	1.00		1.90		29.8		81				
12			245	.93		1.78		31.6		82				
D 1	05/07		245	1.10		2.10		33.3		86				
2	10		245	1.10		2.10		35.2		88				
3			245	1.04		2.00		37.2		89				
4	15		245	.87		1.65		39.1		90				
5			245	.75		1.43		40.8		90				
6	20		245	.64		1.22		42.5	H₂O	91				
7			245	.60		1.12		44.0		92			2	
8	25		245	.64		1.22		45.4		93				
9			245	.73		1.40		46.8		94				
10	30		245	.80		1.51		48.2		94				
11			245	.84		1.60		49.9		95				
12	35		245	.71		1.38		51.5		96				
	37+							53.21						

Environmental Technology & Engineering Corp.

PARTICULATE FIELD DATA



CROSS SECTION



PLANT [illegible]
DATE 7-[illegible]-95
LOCATION [illegible]
OPERATOR [illegible]
STACK NO. [illegible]
RUN NO. [illegible]
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE [illegible]
ASSUMED MOISTURE, % 25%
PROBE LENGTH, in. 6'
NOZZLE DIAMETER, in. [illegible]
STACK DIAMETER, in. 60"
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH [illegible]
C FACTOR 1 → 1.9
PROCESS WEIGHT RATE 420 TPH

ORSAT RESULTS
CO2 [illegible]
O2 [illegible]
CO
N2 [illegible]

LEAK CHECKS
Pre ✓
Pitot ✓
Post ✓
Pitot ✓

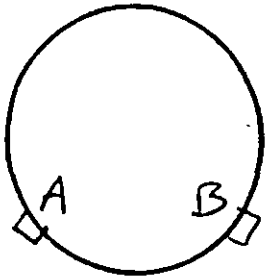
T-597

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), F	SKC #8 SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
B 1	10 20 00		245	1.10	2.10		555.00		98	419584	434.24/73	2	
2			245	1.10	2.10		56.9		98	443456	436.96/84		
3	35		250	1.04	2.00		56 3		97	[illegible]	2.72/78		
4		-.78	250	1.00	1.90		60.7		96				
5	40		250	.95	1.83		62.5		97	1.1.1			
6			250	.76	1.43		64.4		98				
7	45		246	.74	1.42		65.9		99				
8			246	.77	1.60		67.5		98				
9	50		246	.83	1.60		69.1		98			2	
10			246	.85	1.64		70.8		99				
11	55		246	.91	1.75		72.5		99				
12			246	.82	1.58		74.2		100				
A 1	00/01		246	1.05	2.00		75.8		100				
2	06		246	.97	1.85		77.4		102				
3	06		246	.82	1.57		79.1	40.13	102				
4			246	.77	1.48		80.7		102				
5	11	-.76	246	.70	1.32		82.3		104				
6			246	.69	1.31		83.8		106			2	
7	16		246	.64	1.22		85.3		108				
8			246	.69	1.31		86.1		108				
9	21		246	.82	1.57		88.1		108				
10			246	.96	1.84		89.8		109				
11	26		246	.87	1.67		91.5		110				
12			246	.73	1.40		93.7		111				
	31						95.13						

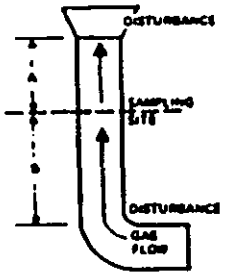
1

Environmental Technology & Engineering Corp.

PARTICULATE FIELD DATA



CROSS SECTION



PLANT P.D #6

DATE 7.13.95

LOCATION Yuma

OPERATOR [illegible]

STACK NO. Baghouse

RUN NO. 3

SAMPLE BOX NO. 3

METER BOX NO. 1

AMBIENT TEMPERATURE 80

BAROMETRIC PRESSURE

ASSUMED MOISTURE, % 25 30

PROBE LENGTH, in. 6'

NOZZLE DIAMETER, in. 1/4"

STACK DIAMETER, in. 60"

PROBE HEATER SETTING –

HEATER BOX SETTING –

METER ΔH [illegible] 7.19

C FACTOR 1.7 1.9

PROCESS WEIGHT RATE 400 TPH

ORSAT RESULTS

CO2 1.0

O2 17.1

CO

N2 [illegible]

T.598

LEAK CHECKS

Pre ✓

Pitot ✓

Post

Pitot ✓

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), °F	SAC #8 SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	120500		230	1.00	1.90		697.00		108	443456	426 96/84		
2			230	99	1.89		98.60		108	463306	439.30 90		
3	10		230	87	1.66		00.5		108	[illegible]	[illegible]	2	
4			230	.86	1.65		02.1		108				
5	15	-.70	230	.81	1.53		03.8		108	[illegible]			
6			234	.83	1.59		05.4		109				
7	20		236	.63	1.20		07.1		109				
8			238	.71	1.36		09.5		110				
9	25		240	.76	1.43		09.9		110				
10			240	.90	1.81		11.3		110				
11	30		240	.88	1.68		12.8		110				
12	1		240	.92	1.66		14.4		112			2	
B 1	35/36		240	1.12	2.16		16.0		112				
2	1		240	1.14	2.20		17.9		113				
3	41		240	1.10	2.10		19.9		114				
4		-.73	240	1.06	2.01		21.6	39.42	115				
5	46		240	.92	1.75		23.4		116				
6			245	.78	1.49		25.1		117			2	
7	51		245	.67	1.29		76.7		118				
8			245	.69	1.32		28.1		119				
9	56		245	.81	1.53		29.6		119				
10			245	.68	1.68		31.2		119				
11	01		245	.99	1.89		32.8		120				
12			245	.89	1.70		34.6		120				
	06						36.4						

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne & Dolan #6 DATE OF TEST 7-18-95

JOB NO. _____ TEST ENGINEER CSH

RUN NO. 1 STACK Baghouse

Sample Box 1 Filter T-596 Wash Bottle —

Beaker No. 1

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	317	100	217
2	238	100	138
3	2	0	2
SIL GEL	634	630	4
		TOTAL	361

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.1369	1.1322	0.0047
Washings (0.0003)	96.5806	96.5770	0.0033
		TOTAL	0.0080

WATER COLLECTED 361 GRAMS

PARTICULATE COLLECTED _____ GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Payne & Dolen #6 DATE OF TEST 7-18-95

JOB NO. _____ TEST ENGINEER CSH

RUN NO. 2 STACK Baghouse

Sample Box 2 Filter T-597 Wash Bottle —

Beaker No. 2

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	356	100	256
2	201	100	101
3	3	0	3
SIL GEL	612	608	4
		TOTAL	364

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.1372	1.1335	0.0037
Washings (0.0003)	110.5819	110.5787	0.0029
		TOTAL	0.0066

WATER COLLECTED [364] GRAMS

PARTICULATE COLLECTED [ ] GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Pasqua + Dolan #6 DATE OF TEST 7-18-95

JOB NO. _____ TEST ENGINEER CSH

RUN NO. 3 STACK Baghouse

Sample Box 3 Filter T-598 Wash Bottle —

Beaker No. 3

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	242	100	142
2	192	100	92
3	78	0	78
SIL GEL	619	606	13
		TOTAL	325

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	1.0420	1.0368	0.0052
Washings (0.0003)	94.1788	94.1772	0.0013
		TOTAL	0.0065

WATER COLLECTED [325] GRAMS

PARTICULATE COLLECTED [0.0065] GRAMS

NOTES:

ASPHALT PLANT STACK TEST DATA

Plant Location Vienna - Control 6

Date 7-18-95

FID # 113 241 150

Time*	Production TPH	Aggregate TPH	RAP TPH	Aggregate Moisture %	~~VOC Type~~	~~VOC Feed Rate~~	Mix Temp	Stack Temp	Photo-helic	Magne-helic	Fuel Flow Rate	~~CO ppm~~	~~CO2 ppm~~	~~O2 %~~
830	390	[redacted]	20%	4.9			300	240	~~.16~~	~~3.2~~				
840	395		20%	4.9			300	245	.18	3.8				
900	395		20%	4.9			300	247	.18	3.9				
915	395		20%	4.9			300	250	.18	3.5				
930	395		20%	4.9			300	250	.18	3.5				
1030	390		20%	4.9			295	250	.20	3.2				
1045	395		20%	4.9			300	250	.19	3.0				
1100	395		20%	4.9			300	250	.19	3.0				
1115	395		20%	4.9			300	250	.19	3.1				
1130	395		20%	4.9			305	254	.18	3.2				
1210	395		20%	4.9			302	255	.18	3.2				
1230	395		20%	4.9			304	259	.18	3.3				
1245	395		20%	4.9			301	258	.14	3.5				
100	395		20%	4.9			302	260	.18	3.9				

Fuel Type Natural Gas

VOC Addition Location N/A

Sulfur in Fuel N/A %

Plant Drum Type Counterflow Drum

* Record time in 15-minute intervals during stack test runs.

COMPLTVOCDATA1.WK1

APPENDIX B

SAMPLE CALCULATIONS

SAMPLE CALCULATION

BAROMETRIC PRESSURE, in Hg (Pb) = 29.200
STACK PRESSURE, in Hg (Pb + Pg/13.6) = 29.178
TIP DIAMETER, in (An = PI*D^2/576) = .2450
STACK AREA, sq ft (A) = 10.560
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf (Vm) = 66.06
WATER COLLECTED, ml (Vf - Vi) = 86.00
PARTICULATE COLLECTED, grams (Mn) = 0.0755
CO2 = 0.60 O2 = 21.00 CO = 0.00 N2 = 78.40
WET MOLECULAR WEIGHT, lb/mole (Ms) = 28.45

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE DEL H inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	110	1.450	4.05	32	72.51
2	110	1.350	3.75	32	69.97
3	110	1.350	3.75	32	69.97
4	110	1.300	3.70	32	68.66
5	110	1.250	3.60	32	67.33
6	110	1.250	3.60	32	67.33
7	110	1.050	2.95	32	61.71
8	110	1.000	2.85	32	60.22
9	110	1.000	2.85	34	60.22
10	110	1.050	2.95	34	61.71
11	110	0.950	2.75	38	58.69
12	115	0.950	2.75	38	58.95
13	115	1.300	3.70	42	68.96
14	115	1.250	3.60	42	67.62
15	115	1.200	3.40	42	66.26
16	115	1.200	3.40	42	66.26
17	115	1.150	3.30	44	64.86
18	115	1.150	3.30	46	64.86
19	115	1.050	2.95	48	61.98
20	115	1.150	3.30	48	64.86
21	115	1.000	2.85	50	60.48
22	115	1.100	3.15	50	63.43
23	115	1.050	2.95	50	61.98
24	115	0.900	2.55	50	57.38
AVG VALUES	113		3.250	40	64.42

TOTAL GAS WITHDRAWN, scf = 69.39
DRY GAS WITHDRAWN, scf (Vmstd) = 65.35
WATER VAPOR WITHDRAWN, scf (Vwstd) = 4.05
PERCENT WATER VAPOR (%H2O) = 5.83
ACTUAL WET FLOW RATE, acfm = 40,819.39
STANDARD DRY FLOW RATE, scfm (Qs) = 34,558.69
PARTICULATE CONCENTRATION, grains/dscf (Cs) = 0.018
PARTICULATE EMISSION RATE, lb/hr (ER) = 5.325
PARTICULATE EMISSIONS, lb/1000 lb (EC) = 0.033
PERCENT OF ISOKINETIC SAMPLING (I) = 101.67

SAMPLE CALCULATIONS

1. DRY MOLECULAR WEIGHT (Md) lb/lb-mole

   Md = .44*% CO2 + .32*%O2 + .282*%N2 + .28*%CO

2. WATER VAPOR PERCENT (%H2O)

   Vw std = 0.04707*(Vf - Vi)

   where: Vw std = standard cubic feet of water vapor
   Vf = Final volume of impingers, ml
   Vi = Initial volume of impingers, ml

   %H2O = Vw std * 100/(Vm std + Vw std)

   where Vm std = standard cubic feet of gas sampled

3. WET MOLECULAR WEIGHT (Ms) lb/lb-mole

   Ms = Md*(1 - %H2O/100) + 18*%H2O/100

4. STACK PRESSURE (Ps) in. Hg

   Ps = Pb + Pg/13.6

   where: Pb = barometric pressure (uncorrected), in. Hg
   Pg = stack gauge pressure, in. H2O
   13.6 = specific gravity of mercury (Hg)

5. AVERAGE STACK VELOCITY (Vs) feet per second

   Vs = Kp*Cp* (DELP) Tsavg/(Ps*Ms)

   where: Kp = 85.49 unit conversion
   Cp = 0.85, pitot tube calibration factor
   DELP = square root of velocity head, in. H2O
   Tsavg = average stack temperature, deg R (460+F)
   Ps = stack pressure
   Ms = wet molecular weight

6. STACK GAS FLOW RATE (Qs) std cubic feet per minute

   Qs = 60*(1 - %H2O/100)*Vs*A*(528*Ps/Tsavg/29.92)

   where: A = stack area, ft2
   528 = std temperature, deg R
   29.92 = std pressure, in. Hg

7. DRY GAS VOLUME (Vm std) std cubic feet

Vm std = GAMA*(Vm-(AL-.02)t)*(Pb+DELH/13.6)/29.92

where: GAMA = dry gas meter calibration factor
Vm = volume of dry gas metered, cubic feet
AL = post test leak rate, cubic feet per minute
t = total time of test, minutes
DELH = average orifice pressure drop, in.H2O

8. PARTICULATE CONCENTRATION (Cs) grains/dry std cubic foot

Cs = Mn * 15.43/Vm std

where: Mn = particulate captured, grams
15.43 = grains per gram

9. EMISSION RATE (ER) pounds per hour

PMRA = Mn*A*60/(t*An*453.6) AREA METHOD lb/hr

PMRC = Cs*Qs*60/(15.43*453.6) CONC. METHOD lb/hr

ER = (PMRA + PMRC)/2

where: An = area of sampling nozzle, square feet

10. EMISSION CONCENTRATION (EC) lb/1000 lb exhaust gas

EC = ER * 386700 * (1-%H2O/100)/(Qs*60*Ms)

where: 386700 = cubic feet per lb mole * 1000

11. ISOKINETIC SAMPLING PERCENTAGE (I) %

I = PMRA/PMRC