AP42 Section: 11.1

Reference Number: 349

Title: Stack Emission Test, Payne & Dolan, Inc., Control 63 Asphalt Plant, Larsen, WI,

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

August 2, 1996.

Sec. 11.1
Ref. 349

Benzene

Report to

PAYNE & DOLAN, INC.
Waukesha, Wisconsin

for

STACK EMISSION TEST
CONTROL 63 ASPHALT PLANT
Larsen, Wisconsin

August 2, 1996

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION
13000 West Bluemound Road
Elm Grove, Wisconsin 53122
414-784-2434

SUMMARY

On August 2, 1996, Environmental Technology & Engineering Corporation personnel performed a stack emission test on the Northeast Asphalt, Inc. Control 63 asphalt plant located in Larsen, Wisconsin. The average of the three particulate tests show the emissions to be well below the limit of 0.039 grains of particulate matter (front half only) 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	0.004 gr/dscf	10.3 %
2	0.003	7.7
3	0.003	7.7
AVG	0.003 gr/dscf	8.5 %

The permit further limits the particulate emissions to be less than 0.3 pounds of total particulate per 1,000 pounds of exhaust gas. The measured emissions were also well below this limit as summarized below:

Test	Emissions	% of Allowable
1	0.011 lb/1000 lb	3.7 %
2	0.011	3.7
3	0.009	3.0
AVG	0.010 lb/1000 lb	3.4 %

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

Test	LB/HR	LB/TON
1	0.12 lb/hr	0.0003 lb/ton
2	0.26	0.0006
3	0.44	0.0011
AVG	0.27 lb/hr	0.0007 lb/ton

Additional testing was performed to determine the benzene emissions. The following table presents the numerical results:

Test	LB/HR	LB/TON
1	0.03 lb/hr	0.00007 lb/ton
2	0.03	0.00006
3	0.02	0.00005
AVG	0.03 lb/hr	0.00006 lb/ton

1.0 GENERAL

On Friday, August 2, 1996, Environmental Technology and Engineering Corporation personnel performed a stack emission test on the Northeast Asphalt Control 63 drum mix asphalt plant located in Larsen, Wisconsin. The test was a provision of an Air Pollution Control Permit No. issued by the State of Wisconsin Department of Natural Resources (DNR). The DNR has established a particulate emission limit of the more restrictive of 0.039 grains (front half only) per dry standard cubic foot (gr/dscf) or 0.3 pounds (front and back half) per 1,000 pounds of exhaust gas. 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. Additional tests were performed to establish plant specific emission factors for benzene.

The plant tested was a drum mix asphalt plant equipped with a baghouse for particulate control. During the test period, the plant production rate was approximately 420 tons per hour. The mix was composed of approximately 20 percent recycled material and 80 % virgin material. The plant was fired with waste oil. 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 Cindy Pieper of the Wisconsin DNR.

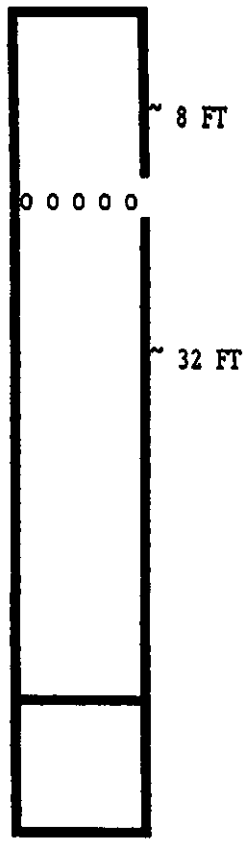
The following sections of this report document the activities and results of the test program. The report presents all of the relevant data collected and discussions on the interpretation of the data are provided where appropriate. The report, therefore, includes much necessary detail. The results, however,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

NORTHEAST ASPHALT
CONTROL 63 PLANT
TEST PORT & POINT LOCATIONS

FIGURE 2-1

DIMENSIONS 52 x 69.5 in

POINT	DISTANCE
1	8.7"
2	26.1"
3	43.4"
4	60.8"



2.0 RESULTS

2.1 Front Half 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 0.039 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	0.004 gr/dscf	10.3 %
2	0.003	7.7
3	0.003	7.7
AVG	0.003 gr/dscf	8.5 %

NORTHEAST ASPHALT CONTROL 63 LARSEN AUG 2. 1996 TABLE 2-1

TEST NO.	1			
BAROMETRIC PRESSURE	29.30	IN HG		
TIP DIAMETER	0.305	IN		
STACK DIMENSIONS	52	IN	69.5	IN
STACK AREA	25.097	FT3		
SAMPLING TIME PER POINT	3.0	MIN		
NUMBER OF POINTS	20			
METER VOLUME	33.63	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.003			
PARTICULATE COLLECTED (FH)	0.0081	GRAMS		
WATER COLLECTED	284	ML		
STATIC PRESSURE	-0.29	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
9.00%	9.00%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	260	0.22	0.88	70	32.43
2	265	0.23	0.92	73	33.27
3	270	0.30	1.20	75	38.13
4	270	0.34	1.36	76	40.59
5	270	0.20	0.80	79	31.13
6	270	0.28	1.12	80	36.84
7	272	0.36	1.44	81	41.83
8	275	0.40	1.60	85	44.18
9	275	0.32	1.28	87	39.52
10	275	0.25	1.00	89	34.93
11	275	0.25	1.00	90	34.93
12	280	0.30	1.20	91	38.39
13	280	0.32	1.28	95	39.65
14	280	0.30	1.20	97	38.39
15	280	0.28	1.12	98	37.09
16	285	0.25	1.00	99	35.16
17	285	0.24	0.96	100	34.45
18	285	0.28	1.12	101	37.21
19	285	0.30	1.20	102	38.52
20	285	0.25	1.00	103	35.16
AVERAGE	276		1.13	89	37.09

DRY STANDARD VOLUME	33.20	SCF
PERCENT WATER VAPOR	28.71	% VOL
FLOW RATE	55852	ACFM
	27950	DSCFM
	47492	M3/HR
PARTICULATE CONCENTRATION	0.004	GR/DSCF
PARTICULATE EMISSION RATE	0.89	LB/HR
LB PART PER 1000 LB GAS	0.006	
ISOKINETIC PERCENT	97.9	

NORTHEAST ASPHALT CONTROL 63 LARSEN AUG 2, 1996 TABLE 2-2

TEST NO.	2			
BAROMETRIC PRESSURE	29.30	IN HG		
TIP DIAMETER	0.305	IN		
STACK DIMENSIONS	52	IN	69.5	IN
STACK AREA	25.097	FT3		
SAMPLING TIME PER POINT	3.0	MIN		
NUMBER OF POINTS	20			
METER VOLUME	33.38	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.003			
PARTICULATE COLLECTED (FH)	0.0070	GRAMS		
WATER COLLECTED	281	ML		
STATIC PRESSURE	-0.3	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
8.80%	9.20%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	290	0.27	1.08	110	36.67
2	290	0.30	1.20	111	38.65
3	290	0.30	1.20	112	38.65
4	290	0.28	1.12	113	37.34
5	292	0.25	1.00	115	35.33
6	292	0.28	1.12	117	37.39
7	292	0.30	1.20	118	38.70
8	292	0.30	1.20	119	38.70
9	290	0.25	1.00	121	35.28
10	290	0.28	1.12	121	37.34
11	291	0.36	1.44	122	42.37
12	292	0.40	1.60	122	44.69
13	290	0.22	0.88	122	33.10
14	290	0.34	1.36	123	41.15
15	290	0.30	1.20	123	38.65
16	290	0.30	1.20	123	38.65
17	290	0.28	1.12	124	37.34
18	290	0.30	1.20	125	38.65
19	290	0.32	1.28	125	39.92
20	290	0.35	1.40	125	41.75
AVERAGE	291		1.20	120	38.52

DRY STANDARD VOLUME	33.08	SCF
PERCENT WATER VAPOR	28.56	% VOL
FLOW RATE	57998	ACFM
	28521	DSCFM
	48463	M3/HR
PARTICULATE CONCENTRATION	0.003	GR/DSCF
PARTICULATE EMISSION RATE	0.78	LB/HR
LB PART PER 1000 LB GAS	0.005	
ISOKINETIC PERCENT	95.6	

NORTHEAST ASPHALT CONTROL 63 LARSEN AUG 2. 1996 TABLE 2-3

TEST NO.	3			
BAROMETRIC PRESSURE	29.30	IN HG		
TIP DIAMETER	0.305	IN		
STACK DIMENSIONS	52	IN	69.5	IN
STACK AREA	25.097	FT3		
SAMPLING TIME PER POINT	3.0	MIN		
NUMBER OF POINTS	20			
METER VOLUME	34.24	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.003			
PARTICULATE COLLECTED (FH)	0.0068	GRAMS		
WATER COLLECTED	258	ML		
STATIC PRESSURE	-0.29	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
8.40%	10.60%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	245	0.28	1.12	98	35.89
2	255	0.28	1.12	99	36.15
3	260	0.30	1.20	100	37.54
4	270	0.30	1.20	100	37.80
5	275	0.22	0.88	100	32.48
6	280	0.30	1.20	101	38.06
7	285	0.30	1.20	101	38.19
8	285	0.28	1.12	101	36.90
9	290	0.28	1.12	103	37.02
10	295	0.25	1.00	104	35.10
11	295	0.38	1.52	105	43.27
12	292	0.40	1.60	106	44.31
13	292	0.26	1.04	108	35.72
14	292	0.30	1.20	109	38.37
15	292	0.30	1.20	110	38.37
16	290	0.25	1.00	111	34.98
17	290	0.25	1.00	111	34.98
18	292	0.30	1.20	112	38.37
19	295	0.30	1.20	112	38.45
20	292	0.35	1.40	112	41.44
AVERAGE	283		1.18	105	37.67

DRY STANDARD VOLUME	33.87	SCF
PERCENT WATER VAPOR	26.39	% VOL
FLOW RATE	56725	ACFM
	29032	DSCFM
	49332	M3/HR
PARTICULATE CONCENTRATION	0.003	GR/DSCF
PARTICULATE EMISSION RATE	0.76	LB/HR
LB PART PER 1000 LB GAS	0.005	
ISOKINETIC PERCENT	96.2	

2.2 Total Particulate Emissions

The same sample collected for the front half particulate test was further subjected to a condensible particulate analysis in accordance with DNR procedures. A brief summary of this method is included in section 3.0 of this report. The total 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 2-4, 2-5, and 2-6.

The results demonstrate the particulate emissions to be well below the permit limit of 0.3 pounds of total particulate per 1,000 pounds of exhaust gas. The measured emissions are summarized below:

Test	Emissions	% of Allowable
1	0.011 lb/1000 lb	3.7 %
2	0.011	3.7
3	0.009	3.0
AVG	0.010 lb/1000 lb	3.4 %

2.3 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	0.12 lb/hr	0.0003 lb/ton
2	0.26	0.0006
3	0.44	0.0011
AVG	0.27 lb/hr	0.0007 lb/ton

A summary of the field and lab data is included as Table 2-7.

NORTHEAST ASPHALT CONTROL 63 LARSEN AUG 2, 1996 TABLE 2-4

TEST NO.	1			
BAROMETRIC PRESSURE	29.30	IN HG		
TIP DIAMETER	0.305	IN		
STACK DIMENSIONS	52	IN	69.5	IN
STACK AREA	25.097	FT3		
SAMPLING TIME PER POINT	3.0	MIN		
NUMBER OF POINTS	20			
METER VOLUME	33.63	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.003			
PARTICULATE COLLECTED (TOTAL)	0.0154	GRAMS		
WATER COLLECTED	284	ML		
STATIC PRESSURE	-0.29	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
9.00%	9.00%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	260	0.22	0.88	70	32.43
2	265	0.23	0.92	73	33.27
3	270	0.30	1.20	75	38.13
4	270	0.34	1.36	76	40.59
5	270	0.20	0.80	79	31.13
6	270	0.28	1.12	80	36.84
7	272	0.36	1.44	81	41.83
8	275	0.40	1.60	85	44.18
9	275	0.32	1.28	87	39.52
10	275	0.25	1.00	89	34.93
11	275	0.25	1.00	90	34.93
12	280	0.30	1.20	91	38.39
13	280	0.32	1.28	95	39.65
14	280	0.30	1.20	97	38.39
15	280	0.28	1.12	98	37.09
16	285	0.25	1.00	99	35.16
17	285	0.24	0.96	100	34.45
18	285	0.28	1.12	101	37.21
19	285	0.30	1.20	102	38.52
20	285	0.25	1.00	103	35.16
AVERAGE	276		1.13	89	37.09

DRY STANDARD VOLUME	33.20	SCF
PERCENT WATER VAPOR	28.71	% VOL
FLOW RATE	55852	ACFM
	27950	DSCFM
	47492	M3/HR
PARTICULATE CONCENTRATION	0.007	GR/DSCF
PARTICULATE EMISSION RATE	1.70	LB/HR
LB PART PER 1000 LB GAS	0.011	
ISOKINETIC PERCENT	97.9	

NORTHEAST ASPHALT CONTROL 63 LARSEN AUG 2, 1996 TABLE 2-5

TEST NO.	2			
BAROMETRIC PRESSURE	29.30	IN HG		
TIP DIAMETER	0.305	IN		
STACK DIMENSIONS	52	IN	69.5	IN
STACK AREA	25.097	FT3		
SAMPLING TIME PER POINT	3.0	MIN		
NUMBER OF POINTS	20			
METER VOLUME	33.38	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.003			
PARTICULATE COLLECTED (TOTAL)	0.0164	GRAMS		
WATER COLLECTED	281	ML		
STATIC PRESSURE	-0.3	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
8.80%	9.20%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	290	0.27	1.08	110	36.67
2	290	0.30	1.20	111	38.65
3	290	0.30	1.20	112	38.65
4	290	0.28	1.12	113	37.34
5	292	0.25	1.00	115	35.33
6	292	0.28	1.12	117	37.39
7	292	0.30	1.20	118	38.70
8	292	0.30	1.20	119	38.70
9	290	0.25	1.00	121	35.28
10	290	0.28	1.12	121	37.34
11	291	0.36	1.44	122	42.37
12	292	0.40	1.60	122	44.69
13	290	0.22	0.88	122	33.10
14	290	0.34	1.36	123	41.15
15	290	0.30	1.20	123	38.65
16	290	0.30	1.20	123	38.65
17	290	0.28	1.12	124	37.34
18	290	0.30	1.20	125	38.65
19	290	0.32	1.28	125	39.92
20	290	0.35	1.40	125	41.75
AVERAGE	291		1.20	120	38.52

DRY STANDARD VOLUME	33.08	SCF
PERCENT WATER VAPOR	28.56	% VOL
FLOW RATE	57998	ACFM
	28521	DSCFM
	48463	M3/HR
PARTICULATE CONCENTRATION	0.008	GR/DSCF
PARTICULATE EMISSION RATE	1.83	LB/HR
LB PART PER 1000 LB GAS	0.011	
ISOKINETIC PERCENT	95.6	

NORTHEAST ASPHALT CONTROL 63 LARSEN AUG 2. 1996 TABLE 2-6

TEST NO.	3			
BAROMETRIC PRESSURE	29.30	IN HG		
TIP DIAMETER	0.305	IN		
STACK DIMENSIONS	52	IN	69.5	IN
STACK AREA	25.097	FT3		
SAMPLING TIME PER POINT	3.0	MIN		
NUMBER OF POINTS	20			
METER VOLUME	34.24	FT3		
PITOT COEFFICIENT	0.84			
METER COEFFICIENT	1.003			
PARTICULATE COLLECTED (TOTAL)	0.0138	GRAMS		
WATER COLLECTED	258	ML		
STATIC PRESSURE	-0.29	IN H2O		

ORSAT RESULTS

CO2	O2	CO	N2
8.40%	10.60%	0.00%	82.00%

POINT	STACK TEMP DEG F	DELTA P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	VELOCITY AFPS
1	245	0.28	1.12	98	35.89
2	255	0.28	1.12	99	36.15
3	260	0.30	1.20	100	37.54
4	270	0.30	1.20	100	37.80
5	275	0.22	0.88	100	32.48
6	280	0.30	1.20	101	38.06
7	285	0.30	1.20	101	38.19
8	285	0.28	1.12	101	36.90
9	290	0.28	1.12	103	37.02
10	295	0.25	1.00	104	35.10
11	295	0.38	1.52	105	43.27
12	292	0.40	1.60	106	44.31
13	292	0.26	1.04	108	35.72
14	292	0.30	1.20	109	38.37
15	292	0.30	1.20	110	38.37
16	290	0.25	1.00	111	34.98
17	290	0.25	1.00	111	34.98
18	292	0.30	1.20	112	38.37
19	295	0.30	1.20	112	38.45
20	292	0.35	1.40	112	41.44
AVERAGE	283		1.18	105	37.67

DRY STANDARD VOLUME	33.87	SCF
PERCENT WATER VAPOR	26.39	% VOL
FLOW RATE	56725	ACFM
	29032	DSCFM
	49332	M3/HR
PARTICULATE CONCENTRATION	0.006	GR/DSCF
PARTICULATE EMISSION RATE	1.53	LB/HR
LB PART PER 1000 LB GAS	0.009	
ISOKINETIC PERCENT	96.2	

PAYNE & DOLAN
CONTROLS3 PLANT
FORMALDEHYDE RESULTS

TABLE 2-7

Sample No.	Meter Vol. ft3	Meter Temp deg F	Standard Vol liters	Form Captured ug	Form Conc mg/m3	Flow Rate m3/hr	Form ER lb/hr	Prod Rate tph	Form ER lb/ton
63-1	2.10	92	57.21	64.23	1.12	47492	0.12	426	0.0003
63-2	2.00	101	53.61	128.8	2.40	48463	0.26	434	0.0006
63-3	2.20	93	59.83	244.12	4.08	49332	0.44	399	0.0011
		AVERAGE			2.54		0.27	420	0.0007

Meter Gama	1.027
Bar.Pressure	29.30

Calculations

Standard Volume = Meter Vol * Meter Gama*Bar.Pressure*28.32*528/(29.92*(460+Meter Temp))

Concentration = ug/liters = mg/m3

Emission Rate = mg/m3 * m3/hr/453600

2.4 Benzene Emissions

The benzene emissions were determined concurrently with the particulate testing using EPA Method 18. 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	0.03 lb/hr	0.00007 lb/ton
2	0.03	0.00006
3	0.02	0.00005
AVG	0.03 lb/hr	0.00006 lb/ton

A summary of the field and lab data is included as Table 2-8.

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.

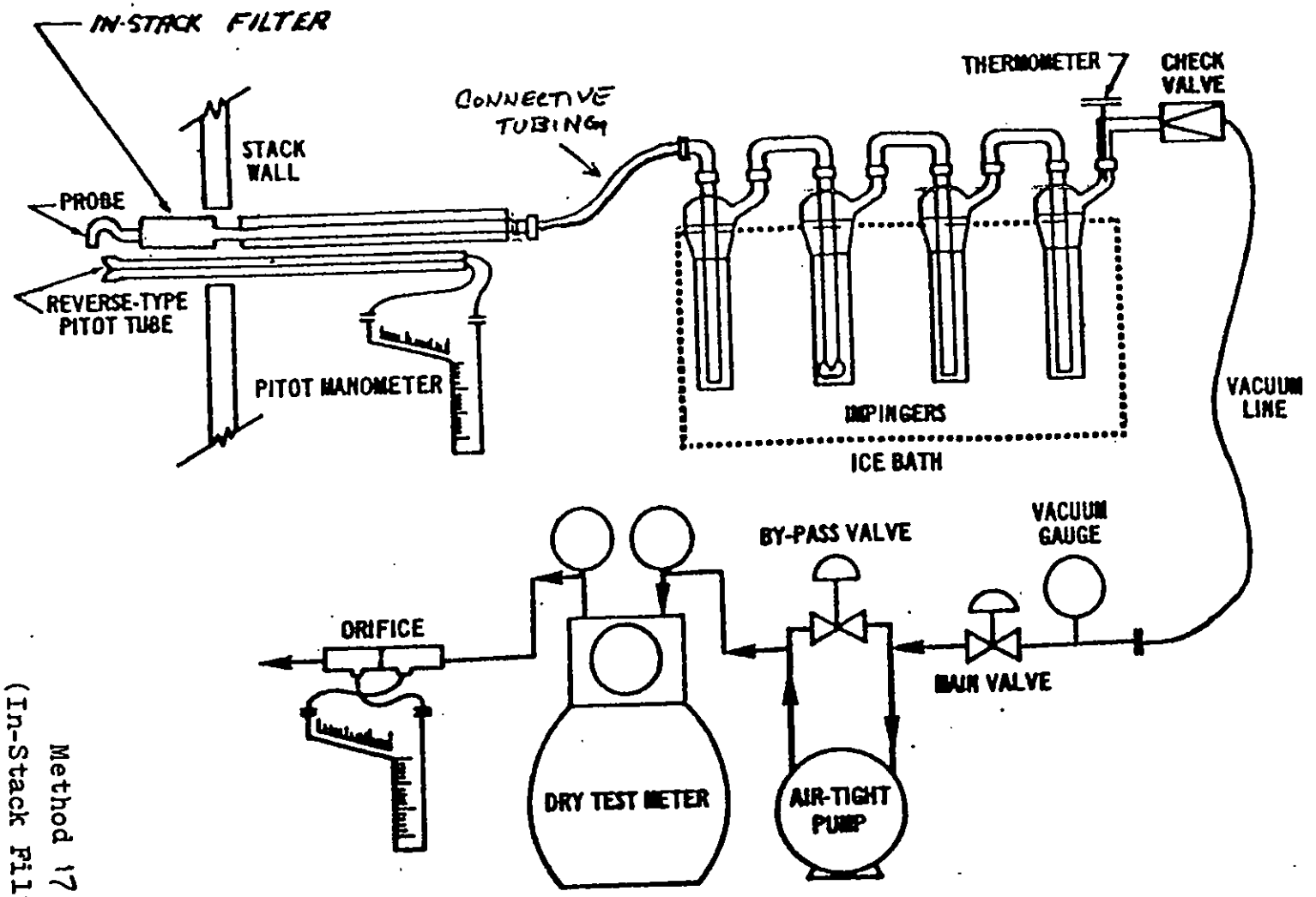
The sampling train consisted of a stainless steel probe tip, an in-stack filter, a heated stainless steel lined probe, a glass cyclone and flask, and a heated 125 millimeter Whatman 934-AH fiberglass back-up filter. A series of four impingers followed in an ice bath. The first was a modified Greenburg-Smith 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.

NORTHEAST ASPHALT Aug 2, 1996
CONTROL 63 LARSEN

TABLE 2-8

BENZENE (Benz)

Sample No.	Volume liters	FlowRate m3/hr	Benz ug	Benz mg/m3	Benz lb/hr	Production tph	Benz lb/ton
63-1	13.79	47492	3.9	0.28	0.03	426	0.00007
63-2	11.79	48463	2.8	0.24	0.03	434	0.00006
63-3	11.76	49332	2.1	0.17	0.02	399	0.00005
	AVERAGE EMISSIONS				0.02		0.00006



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 front half particulate emission rates. The condensible particulate was determined by analysis of the impinger contents in accordance with DNR procedures.

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.

3.3 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. At the completion of the tests the tubes were desorbed and analyzed by a gas chromatograph equipped with a flame ionization detector.

Column	DC 200
Temperature	50 C
Carrier Gas	Nitrogen at 20 cc/min

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 duct samples. Sample retention times and peak areas were used to quantify both the benzene 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).

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 =	0.305"
Pitot tube coeff.	Cp =	0.84
Orifice coeff.	dH@ =	1.872

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:

$$\text{Gama} = 1.003 + (Td - 70) \times .00012$$

where: Td = Dry Gas Meter Temperature

The most recent calibration was performed July 26, 1996.

APPENDIX A

FIELD & LABORATORY DATA SHEETS

dr ?
Back hoe ?

ASPHALT PLANT STACK TEST DATA

Control # 63

~3% moisture

Date August 2, 1996
FID # 999 187 860

Time*	Burner %	PSI Fuel Pressure	Production TPH	Aggregate TPH	A/C TPH	RAP TPH	Mix Temp	Stack Temp	Photo-helic	Magne-helic	Fuel Flow Rate	CO ppm	CO2 ppm	O2 %
8:45	69	28	404	319	14.9	73	290	257	1.8	2.8	9.5			
9:00	69	28	427	338	15.8	75	291	267	2.0	2.9	9.5			
9:15	77	27	435	341	15.9	78	289	277	1.9	3.2	10			
9:30	77	27	433	343	16.1	74	289	280	2.0	3.6	10			
9:45	77	27	432	342	15.9	77	294	286	2.1	2.6	10			
10:00	77	27	432	342	15.9	77	289	285	2.1	3.1	10			
10:15	77	27	436	340	16.1	79	288	285	2.1	3.1	10			
10:30	77	27	435	338	16.0	80	289	287	2.1	3.1	10			
10:45	77	27	435	341	16.1	76	286	285	2.0	3.5	10			
11:00	77	22	433	340	16.0	75	291	287	2.2	3.3	10			
1:05	73	28	402	315	14.9	72	292	232	2.1	2.7	9.5			
1:20	70	28	405	316	15.0	74	297	279	2.2	2.8	9.5			
1:35	69	28	399	309	14.4	74	298	290	2.1	3.2	9.5			
1:50	65	28	388	304	14.3	70	302	290	2.0	3.0	9.5			

Fuel Type Drain Oil Sulfur in Fuel 0.43 %

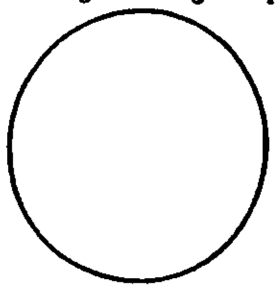
* Record time in 15-minute intervals during stack test runs.

C:\Air\LTUEST\DATA\WK1

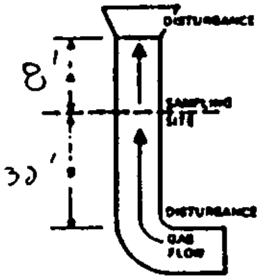
Ex Fan Amps 100

Technology & Engineering Corp.

PARTICULATE FIELD DATA



CROSS SECTION



PLANT Northeast Asphalt
DATE 8-2-96
LOCATION Larsen
OPERATOR WJO/CSH
STACK NO. Control 63
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 1

AMBIENT TEMPERATURE 70
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 30
PROBE LENGTH, in. 6'
NOZZLE DIAMETER, in. 5/16
STACK DIAMETER, in. 52 x 69½
PROBE HEATER SETTING –
HEATER BOX SETTING –

Y: 1.005 5-7-26-96
METER ΔH@ 1.865
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2
O2
CO
N2

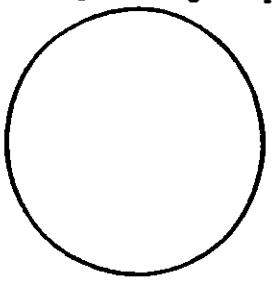
T-722

LEAK CHECK
ok Pre <.01 @ 5
ok Pitot ok
ok Post <.01
Pitot

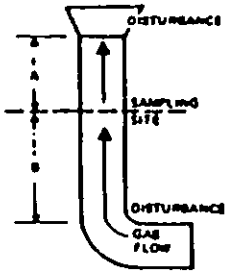
TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	Y: 1.027 / H2O 1 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	Ben 2 SKC#1 (515) VELOCITY fps
A1	0840		260	.22		.88		454.00		70			2	
2	43	-.30	265	.23		.92		55.6		73		825.50/86		[illegible]
3	46		270	.30		1.20		57.2		75		827.6/98		381.73
4	49		270	.34		1.36		59.0		76			3	
B5	52/52		270	.20		.80		60.8		79		210/92		[illegible]
6	[illegible]		270	.28		1.12		62.2		80				[illegible]
7	[illegible]	-.28	272	.36		1.44		63.9		81				
8	[illegible]		275	.40		1.60		65.9		85				
C9	[illegible]		275	.32		1.28		68.0		87				
10	[illegible]		275	.25		1.00		69.7		89			2	
11	[illegible]	-.30	275	.25		1.00		71.3		90				
12	[illegible]		280	.30		1.20		72.9		91				
D13	17/18		280	.32		1.28		74.6		95				
14	21	-.30	280	.30		1.20		76.3		97				
15	24		280	.28		1.12		78.0		98				
16	27		285	.25		1.00		79.6		99				
E 17	[illegible]		285	.24		.96		81.3		100				
18	[illegible]	-.26	285	.28		1.12		82.7		101				
19	[illegible]		285	.30		1.20		84.6		102				
20	[illegible]		285	.25		1.00		86.2		103				
	[illegible]							487.63						
			275											
				[illegible]				33.63						

Environmental Technology & Engineering Corp.

PARTICULATE FIELD DATA



CROSS SECTION



PLANT Northeast Asphalt
DATE 8.2.96
LOCATION Carlsen
OPERATOR WJD/GSH
STACK NO. Control 63
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 30
PROBE LENGTH, in. 6'+
NOZZLE DIAMETER, in. 5/16
STACK DIAMETER, in. 52 x 69
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH,
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2
O2
CO
N2

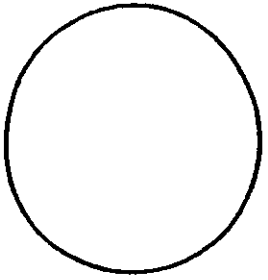
LEAK CHECKS
Pre 2"
@ Pitot 5
@ Post 0.012
@ Pitot 2.5

691

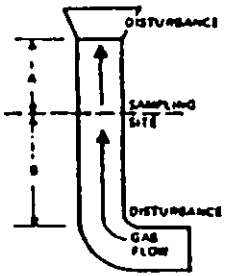
TRAVERSE POINT NUMBER	SAMPLING TIME (A), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER: INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), F	SAMPLE BOX TEMPERATURE F	HCOH: TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	BENZENE: VELOCITY fps
1	0956		290	.27	1.08		489.50		110		827.6 0/100	2	386575
2	55	-.32	290	.30	1.20		90.6		111		829.6 0/102		412655
3	02		290	.30	1.20		92.3		112		2.00/101		
4	05		290	.29	1.12		94.0		113				26.025
5	07/08		292	.25	1.08		95.6		115				11.10
6	11-		292	.29	1.12		97.2		117				
7	14+	-.32	292	.30	1.20		98.8		118				
8	17-		292	.30	1.20		00.4		119				
9	20/21		290	.25	1.00		02.2		121			2	
10	24		290	.29	1.12		03.7		121				
11	27	-.30	291	.36	1.44		05.3		122			3	
12	30		292	.40	1.60		07.1		122				
13	33/33+		290	.22	.88		09.1		122				
14	36+		290	.34	1.36		10.6		123				
15	39+	-.28	290	.30	1.20		12.4		123				
16	42/		290	.30	1.20		14.1		123				
17	45/46		290	.28	1.12		15.7		124				
18	49		290	.30	1.20		17.3		125				
19	52	-.28	290	.32	1.28		19.0		125				
20	55		290	.35	1.40		20.7		125				
	1058						522.38						
		-.30	~292	~.30			333.9						

Environmental Technologies Engineering Corp.

PARTICULATE FIELD DATA



CROSS SECTION



PLANT NUCLEAR ARMY
DATE 8-2-96
LOCATION LAWN
OPERATOR WJD/CJH
STACK NO. CONTROL 6 3
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. 1

AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 30
PROBE LENGTH, in. 6'+
NOZZLE DIAMETER, in. 5/16
STACK DIAMETER, in. 50 x 69 1/2
PROBE HEATER SETTING -
HEATER BOX SETTING -

METER ΔH,
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO2
O2
CO
N2
69 2

LEAK CHECK
@Pre .01 22
@Pitot 3"
@Post .01 2
@Pitot 3"

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	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET ($T_{m_{OUT}}$), F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	1303		245	.28	1.12		523.00		98		879.60/92	3	912655
2	06		255	.28	1.12		24.7		99		831.80/94		891662
3	09	-.30	260	.30	1.20		26.5		100		2.20/93		
4	12		270	.30	1.20		28.2		100			K	
B 5	15/15+		275	.24	.88		29.9		100				
6	18+	-.30	280	.30	1.20		31.5		101				
7	21+		285	.30	1.20		33.2		101				
8	24+		285	.28	1.12		34.9		101				
C 9	27/28		290	.28	1.12		36.7		103				
10	31		295	.28	1.40		38.4		104				
11	34	-.32	295	.38	1.52		40.0		105			5	
12	37		292	.40	1.60		42.0		106				
D 13	40/40+		292	.26	1.04		44.0		108				
14	43		292	.30	1.20		45.5		109				
15	46	-.32	292	.30	1.20		47.2		110				
16	49		290	.25	1.00		48.9		111				
E 17	52/52+		290	.25	1.00		50.6		111				
18	55+		292	.30	1.20		52.1		112			4	
19	58+	-.28	295	.30	1.20		53.7		112				
20	01+		292	.35	1.40		55.4		112				
	190430						557.24						
							34.24						

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME PHD Laisen (#62) DATE OF TEST 8-2-96

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 1 STACK Baghouse

SAMPLE BOX 1 FILTER T-722 WASH BOTTLE —

BEAKERS: FH Ace 10 BH Trichl 1 BH Ace 12 BH H_2O A

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	280	100	180
2	188	100	88
3	7	0	7
Si. Gel	703	694	9
		WATER TOTAL	284

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		1.0941	1.0904	0.0037
FH Wash	0.0003	104.2471	104.2434	0.0044
		FILTERABLE TOTAL		0.0081
Extract	0.0004	68.5791	68.5778	0.0009
Acetone	0.0006	105.4100	105.4041	0.0053
Water	0.0007	110.1235	110.1222	0.0011
		CONDENSIBLE TOTAL		0.0073
		PARTICULATE TOTAL		0.0154

PARTICULATE & WATER COLLECTED

JOB NAME FHD Larsen (#63) DATE OF TEST 8-2-96

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 2 STACK Baghouse

SAMPLE BOX 2 FILTER T-691 WASH BOTTLE —

BEAKERS: FH Ace 16 BH Trichl 2 BH Ace 18 BH H_2O B

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	767	100	167
2	150	100	50
3	53	0	53
Silica Gel	640	637	11
		WATER TOTAL	281

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		1.2337	1.2294	0.0043
FH Wash	0.0003	96.3294	96.3264	0.0027
			FILTERABLE TOTAL	0.0070
Extract	0.0004	70.2982	70.2944	0.0034
Acetone	0.0006	114.4223	114.4160	0.0047
Water	0.0002	111.2545	111.2530	0.0013
			CONDENSIBLE TOTAL	0.0094
			PARTICULATE TOTAL	0.0164

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME P+D Lasers (#63) DATE OF TEST 8-2-96

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 3 STACK Baghouse

SAMPLE BOX 3 FILTER T-692 WASH BOTTLE —

BEAKERS: FH Ace 22 BH Trichl 3 BH Ace 24 BH H_2O C

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	274	100	174
2	147	100	47
3	32	0	32
SIL Gel	634	629	5
		WATER TOTAL	258

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		1.1222	1.1190	0.0032
FH Wash	0.0003	102.5418	102.5379	0.0036
		FILTERABLE TOTAL		0.0068
Extract	0.0004	68.6541	63.6514	0.0023
Acetone	0.0006	103.7142	103.7099	0.0037
Water	0.0002	114.2251	114.2239	0.0010
		CONDENSIBLE TOTAL		0.0070
		PARTICULATE TOTAL		0.0138

NEA Control 63 (Larsen)
Benzene Analysis

STD $5 ml * .874 * \frac{g}{300g} = 5.82$ mg

AREA = 60672

K = 5.82/60672 = .0000958 mg/AREA UNIT

63-1 AREA = 41332

mg = 3.96 mg

63-2 AREA = 29263

mg = 2.81 mg

63-3 AREA = 21351

mg = 2.05 mg

WJD 8-8-94

DATA SUMMARY OF FORMALDEHYDE ANALYSIS

Project #0896012

Lab Id.:	Client Id.:	Total ug	Q
0896012-1	**63-1**	**68.51**	
0896012-2	**63-2**	**133.08**	
0896012-3	**63-3**	**248.40**	
0896012-4	**Blank**	**4.28**	

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