Janesville Bituma 300 Asphalt Plant Nov 13, 1991

Report to

WM.J. KENNEDY & SON, INC.
Janesville, Wisconsin

for

STACK EMISSION TEST
~~BOEING~~ Bituma 300 PLANT
Janesville, Wisconsin

November 13, 1991

by

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

Received: 12/2/91

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: Jan 11, 1992

File Code: 4530

PRELIMINARY* STACK TEST REVIEW

Received 12/2/92

By: Joe Perez JWP

Test Date: Nov 13, 1991

Name of Source: Kennedy & Sons

FID #: 999523470

Address: Townline Rd & HWY 51

Stack #: 01

City: Beloit, WI 53511

Process #: 01

Permit #: 87-POY-037A

Date Issued: 1987

Description of Source Tested: Bitumz 300 drum mix asphalt plant rated at 300 T/Hr. During test, the plant was using 70% virgin and 30% recycle.

Description of Control Equipment: Venturi scrubber using 420GPM. ΔP was 19" H_2O

Test Firm: Environmental Technology & Eng., Mil, WI

Crew Chief & Phone#: Mr Bill Dick (414) 784-2434

Pollutant Tested: Particulate — Test Method: Method 5

Pollutant Tested: Formaldehyde — Test Method: NIOSH 3500

Pollutant Tested: _____ — Test Method: _____

[redacted]

Rated Production Level: 300 T/Hr

Discussion of Results:

Poll. Test Ave. - 0.041 Gr Part/DSCF — Limit - 0.040 Gr Part./DSCF — In Compliance? Y (N)

Poll. Test Ave. - 0.42 Lb HCOH/Hr — Limit - _____ — In Compliance? Y N

Poll. Test Ave. - 3,679 Lb HCOH/Yr — Limit - 250 Lb/Yr — In Compliance? Y (N)

Poll. Test Ave. - _____ — Limit - _____ — In Compliance? Y N

Is This a Valid Test? (Y) N If answer is no see page 2.

* Test may be reviewed in depth later, if necessary.

CC Joe Perez-AM/10
US EPA Region V
Tom Roushar-SD

PARTICULATE CHECKLIST

Name of Source: Kennedy & Sons Test Date: Nov 13, 1991

1. Are the isokinetics per run between 90 and 110%? YES ✓ NO__
   If the %I for a run is outside the range, void the run. See 5.

2. Is the sample volume per run ≥ 30 DSCF? YES ✓ NO__
   If the sample volume for a run is < 30 DSCF, void the run. See 5.

3. Is the sample time per run ≥ 60 min.? YES ✓ NO__
   If the sample time for a run is < 60 min., void the run. See 5.

4. Is the sample time per sample point ≥ two min.? YES ✓ NO__
   If the sample time per point for a run is < two min., void the run. See 5.

5. A stack test shall consist of three valid runs or, at a minimum, two valid runs if one run is voided. Is this a valid test? YES ✓ NO__
   If no, inform the District or the source that the test is unacceptable and should be redone. Your review is over.

6. Is the total particulate per run added correctly? YES ✓ NO__
   If an incorrect total is found, correct the total and the results or call the consultant and ask for a correction.

7. Was the backhalf included in the total particulate? NSPS source YES__ NO ✓
   NSPS sources are exempt from including the backhalf. All other sources must include the backhalf. If they don't, the test is invalid. See 5.

Eq. 1 Gr/DSCF = 15.43* g of part./sample volume of run in DSCF

Eq. 2 Gr/DSCF @ 12% CO_2 = (Gr/DSCF)*12/Stack CO_2

Eq. 3 Gr/DSCF @ 7% O_2 = (Gr/DSCF)*(20.9-7)/(20.9-Stack O_2)

Eq. 4 Lb/DSCF = (Gr/DSCF)/7000 Eq. 5 $Lb/MLb_{DRY} = 385.6*10^3*(Lb/DSCF)/MW_{DRY}$

Eq. 6 $Lb/MLb_{WET} = 385.6*10^3*(Lb/DSCF)*(1-(\%\ Moisture/100))/MW_{WET}$

Eq. 7 Lb/Hr = 60*DSCFM*(Lb/DSCF) Eq. 8 $Lb/10^6$ BTU = (Lb/Hr)/(10^6 BTU/Hr)

Eq. 9 $Lb/10^6$ BTU = (Lb/DSCF)*F Factor*20.9/(20.9-Stack O_2)

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8. If the emission limit is in Gr/DSCF, Lb/DSCF, Lb/MLb, Lb/Hr or $Lb/10^6$ BTU, solve Eq. 1-9. Do your results match the consultant's? YES ✓ NO__
   If no, fix the problem or call the consultant for a correction.

9. Is the three run(or two run) average correct? YES ✓ NO__
   If no, write in the correct average.

10. Is the average result in compliance? YES__ NO ✓
    If no, the District should issue an NOV.

11. Was the source operating at a level representative of full capacity? 89.0 % YES__ NO ✓
    If no, the permit release may need to provide conditions to cap the source at the test level until a stack test at a higher production level(showing compliance) is performed. If the test was not for permit release, other actions may be warranted.

SUMMARY

On November 13, 1991, Environmental Technology & Engineering Corporation personnel performed a stack emission test on the Wm.J. Kennedy & Son, Inc. ~~Boeing~~ Bitumat 300 drum mix asphalt plant located in Janesville, Wisconsin. The average of the three particulate tests show the emissions to be slightly above 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	0.033 gr/dscf	82 %
2	0.046	115
3	0.044	110
AVG	0.041 gr/dscf	102 %

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

Test	LB/HR	LB/TON
1	0.48 lb/hr	0.0018 lb/ton
2	0.35	0.0013
3	0.44	0.0016
AVG	0.42 lb/hr	0.0016 lb/ton

The permit also required that opacity observations be performed concurrently with the particulate test. All individual readings were either 0 % or 5 % and thus the six minute average opacities were all well below the permit limit of 20 %.

1.0 GENERAL

On Wednesday, November 13, 1991, Environmental Technology and Engineering Corporation personnel performed a stack emission test on the Wm.J. Kennedy & Son, Inc. asphalt plant located in Janesville, Wisconsin. The test was a provision of an Air Pollution Control Permit. 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 and that opacity observations be performed by a certified reader.

The plant tested was a ~~Boeing~~ Birdsboro 300 drum mix plant equipped with a wet scrubber for particulate control. During the test period, the plant production rate was approximately 270 tons per hour and the mix was composed of approximately 70 % virgin material and 30 % recycled material. The plant was fired with natural gas. Dave Barkley of Wm.J. Kennedy was responsible for plant operation during the tests. A copy of the plant production log is included in the APPENDIX to this report. The field tests, corresponding laboratory analysis and report preparation were coordinated by Bill Dick of ETE. The test procedures, plant operating conditions, and stack opacity were witnessed by Tom Roushar 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.

KENNEDY ~~BOEING~~ Bitumz 300 PLANT TEST 1 TABLE 2-1 11-13-91

BAROMETRIC PRESSURE, in Hg = 29.150
TIP DIAMETER, in .2500
STACK AREA, sq ft = 8.727
SAMPLING TIME PER POINT, min = 3.00
NUMBER OF POINTS = 20
GAS METER VOLUME, acf = 38.71
WATER COLLECTED, ml = 344.00
PARTICULATE COLLECTED, grams = 0.0804
CO2 = 6.20 O2 = 11.80 CO = 0.00 N2 = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	150	0.680	1.45	42	53.62
2	150	0.620	1.32	43	51.20
3	155	0.620	1.32	44	51.41
4	155	0.660	1.42	45	53.05
5	150	0.660	1.42	46	52.83
6	155	0.660	1.42	48	53.05
7	155	0.650	1.30	50	52.64
8	160	0.600	1.20	51	50.78
9	160	0.580	1.16	51	49.93
10	155	0.500	1.00	51	46.17
11	155	0.600	1.20	53	50.58
12	155	0.640	1.28	54	52.24
13	155	0.660	1.32	54	53.05
14	155	0.680	1.36	55	53.84
15	155	0.680	1.36	56	53.84
16	155	0.650	1.30	56	52.64
17	160	0.620	1.24	57	51.62
18	160	0.600	1.20	58	50.78
19	160	0.550	1.10	59	48.62
20	155	0.500	1.00	60	46.17
AVG VALUES	156		1.269	52	51.40

TOTAL GAS WITHDRAWN, scf = 54.32
DRY GAS WITHDRAWN, scf = 38.13
WATER VAPOR WITHDRAWN, scf = 16.19
PERCENT WATER VAPOR = 29.81
ACTUAL WET FLOW RATE, acfm = 26,915.66
STANDARD DRY FLOW RATE, scfm = 15,771.08
, m3/hr = 26,798.21
PARTICULATE CONCENTRATION, grains/dscf = 0.033
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.049
PARTICULATE EMISSION RATE, lb/hr = 4.47
PERCENT OF ISOKINETIC SAMPLING = 103.17

KENNEDY ~~BOEING~~ Bitumz 300 PLANT TEST 2 TABLE 2-2 11-13-91

BAROMETRIC PRESSURE, in Hg = 29.150
TIP DIAMETER, in .2500
STACK AREA, sq ft = 8.727
SAMPLING TIME PER POINT, min = 3.00
NUMBER OF POINTS = 20
GAS METER VOLUME, acf = 38.45
WATER COLLECTED, ml = 367.00
PARTICULATE COLLECTED, grams = 0.1141
CO2 = 6.40 O2 = 11.60 CO = 0.00 N2 = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	160	0.700	1.40	61	55.01
2	155	0.660	1.32	62	53.20
3	160	0.660	1.32	63	53.42
4	155	0.640	1.28	64	52.39
5	155	0.640	1.28	66	52.39
6	160	0.700	1.40	67	55.01
7	160	0.650	1.30	68	53.01
8	155	0.600	1.20	69	50.73
9	155	0.560	1.12	70	49.01
10	155	0.500	1.00	71	46.31
11	160	0.640	1.28	75	52.60
12	160	0.640	1.28	76	52.60
13	160	0.640	1.28	77	52.60
14	155	0.600	1.20	77	50.73
15	160	0.660	1.32	78	53.42
16	160	0.660	1.32	79	53.42
17	155	0.650	1.30	80	52.80
18	155	0.580	1.16	81	49.87
19	155	0.560	1.12	81	49.01
20	155	0.500	1.00	81	46.31
AVG VALUES	157		1.244	72	51.69

TOTAL GAS WITHDRAWN, scf = 55.24
DRY GAS WITHDRAWN, scf = 37.96
WATER VAPOR WITHDRAWN, scf = 17.27
PERCENT WATER VAPOR = 31.27
ACTUAL WET FLOW RATE, acfm = 27,066.61
STANDARD DRY FLOW RATE, scfm = 15,484.52
, m3/hr = 26,311.29
PARTICULATE CONCENTRATION, grains/dscf = 0.046
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.069
PARTICULATE EMISSION RATE, lb/hr = 6.30
PERCENT OF ISOKINETIC SAMPLING = 104.63

KENNEDY ~~BOEING~~ Bitumar 300 PLANT TEST 3 TABLE 2-3 11-13-91

BAROMETRIC PRESSURE, in Hg = 29.150
TIP DIAMETER, in .2500
STACK AREA, sq ft = 8.727
SAMPLING TIME PER POINT, min = 3.00
NUMBER OF POINTS = 20
GAS METER VOLUME, acf = 37.03
WATER COLLECTED, ml = 359.00
PARTICULATE COLLECTED, grams = 0.1051
CO2 = 6.20 O2 = 11.60 CO = 0.00 N2 = 82.20

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	160	0.660	1.32	80	53.48
2	160	0.680	1.36	80	54.28
3	155	0.680	1.36	80	54.06
4	160	0.680	1.36	80	54.28
5	160	0.650	1.30	81	53.07
6	155	0.650	1.30	81	52.86
7	155	0.620	1.24	82	51.62
8	160	0.600	1.20	82	50.99
9	155	0.560	1.12	83	49.06
10	155	0.500	1.00	84	46.36
11	160	0.650	1.30	86	53.07
12	160	0.650	1.30	87	53.07
13	160	0.660	1.32	87	53.48
14	155	0.660	1.32	87	53.26
15	155	0.650	1.30	88	52.86
16	155	0.620	1.24	88	51.62
17	155	0.620	1.24	89	51.62
18	160	0.600	1.20	89	50.99
19	160	0.560	1.12	90	49.26
20	155	0.500	1.00	90	46.36
AVG VALUES	158		1.245	85	51.78

TOTAL GAS WITHDRAWN, scf = 53.51
DRY GAS WITHDRAWN, scf = 36.62
WATER VAPOR WITHDRAWN, scf = 16.90
PERCENT WATER VAPOR = 31.58
ACTUAL WET FLOW RATE, acfm = 27,113.82
STANDARD DRY FLOW RATE, scfm = 15,436.61
, m3/hr = 26,229.90
PARTICULATE CONCENTRATION, grains/dscf = 0.044
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.065
PARTICULATE EMISSION RATE, lb/hr = 5.90
PERCENT OF ISOKINETIC SAMPLING = 101.23

KENNEDY & SONS BITUMS 300

FORMALDEHYDE CALCULATIONS

P_b = 29.15

γ = 1.028

TEST 1

270 TPH V_M = 2.00 T_M = 50

$$V_{M\,std} = V_M * \gamma * \frac{528}{T_M} * \frac{P_b}{29.92}$$

= 2.07 SCF = .059 m^3

$$C = \frac{0.475\ mg}{.059\ m^3} = 8.05\ mg/m^3$$

ER = 0.48 #/hr. = .0018 #/ton

TEST 2

V_M = 2.50 T_M = 53

$V_{M\,std}$ = 2.58 SCF = .073 m^3

$$C = \frac{0.440}{.073} = 6.03\ mg/m^3$$

ER = 0.35 #/hr = .0013 #/ton

TEST 3

V_M = 1.25 T_M = 54

$V_{M\,std}$ = 1.29 SCF = .036 m^3

$$C = \frac{0.273}{.036} = 7.58\ mg/m^3$$

ER = 0.44 #/hr = .0016 #/ton

SUMMARY

On November 13, 1991, Environmental Technology & Engineering Corporation personnel performed a stack emission test on the Wm.J. Kennedy & Son, Inc. Cedar 300 drum mix asphalt plant located in Janesville, Wisconsin. The average of the three particulate tests show the emissions to be slightly above 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	0.033 gr/dscf	82 %
2	0.046	115
3	0.044	110
AVG	0.041 gr/dscf	102 %

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

Test	LB/HR	LB/TON
1	0.48 lb/hr	0.0018 lb/ton
2	0.35	0.0013
3	0.44	0.0016
AVG	0.42 lb/hr	0.0016 lb/ton

The permit also required that opacity observations be performed concurrently with the particulate test. All individual readings were either 0 % or 5 % and thus the six minute average opacities were all well below the permit limit of 20 %.

1.0 GENERAL

On Wednesday, November 13, 1991, Environmental Technology and Engineering Corporation personnel performed a stack emission test on the Wm.J. Kennedy & Son, Inc. asphalt plant located in Janesville, Wisconsin. The test was a provision of an Air Pollution Control Permit. 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 and that opacity observations be performed by a certified reader.

The plant tested was a ~~Boeing~~ Bitumar 300 drum mix plant equipped with a wet scrubber for particulate control. During the test period, the plant production rate was approximately 270 tons per hour and the mix was composed of approximately 70 % virgin material and 30 % recycled material. The plant was fired with natural gas. Dave Barkley of Wm.J. Kennedy was responsible for plant operation during the tests. A copy of the plant production log is included in the APPENDIX to this report. The field tests, corresponding laboratory analysis and report preparation were coordinated by Bill Dick of ETE. The test procedures, plant operating conditions, and stack opacity were witnessed by Tom Roushar 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 5 - "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 slightly above 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	0.033 gr/dscf	82 %
2	0.046	115
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AVG	0.041 gr/dscf	102 %

FIGURE 2-1

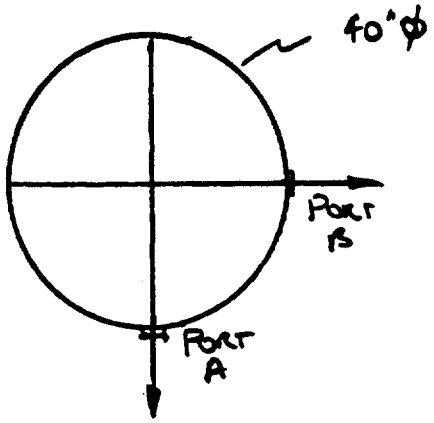
PLANT Wm J KENNEDY

LOCATION JANESVILLE

PROCESS BOEING 300 TPH PLANT

DIMENSIONS 40" ϕ

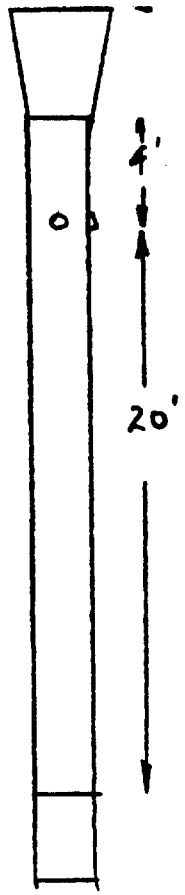
COMMENTS



TEST SECTION

POINT	DISTANCE FROM STACK WALL
1	1.0
2	3.3
3	5.8
4	9.0
5	13.7
6	26.3
7	31.0
8	34.2
9	36.7
10	39.0

SAMPLING LOCATION



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PARTICULATE COLLECTED, grams = 0.0804
CO2 = 6.20 O2 = 11.80 CO = 0.00 N2 = 82.00

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	150	0.680	1.45	42	53.62
2	150	0.620	1.32	43	51.20
3	155	0.620	1.32	44	51.41
4	155	0.660	1.42	45	53.05
5	150	0.660	1.42	46	52.83
6	155	0.660	1.42	48	53.05
7	155	0.650	1.30	50	52.64
8	160	0.600	1.20	51	50.78
9	160	0.580	1.16	51	49.93
10	155	0.500	1.00	51	46.17
11	155	0.600	1.20	53	50.58
12	155	0.640	1.28	54	52.24
13	155	0.660	1.32	54	53.05
14	155	0.680	1.36	55	53.84
15	155	0.680	1.36	56	53.84
16	155	0.650	1.30	56	52.64
17	160	0.620	1.24	57	51.62
18	160	0.600	1.20	58	50.78
19	160	0.550	1.10	59	48.62
20	155	0.500	1.00	60	46.17
AVG VALUES	156		1.269	52	51.40

TOTAL GAS WITHDRAWN, scf = 54.32
DRY GAS WITHDRAWN, scf = 38.13
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PERCENT WATER VAPOR = 29.81
ACTUAL WET FLOW RATE, acfm = 26,915.66
STANDARD DRY FLOW RATE, scfm = 15,771.08
, m3/hr = 26,798.21
PARTICULATE CONCENTRATION, grains/dscf = 0.033
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.049
PARTICULATE EMISSION RATE, lb/hr = [redacted]
PERCENT OF ISOKINETIC SAMPLING = 103.17

KENNEDY BOEING 300 PLANT TEST 2 TABLE 2-2 11-13-91

BAROMETRIC PRESSURE, in Hg = 29.150
TIP DIAMETER, in .2500
STACK AREA, sq ft = 8.727
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NUMBER OF POINTS = 20
GAS METER VOLUME, acf = 38.45
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3	160	0.660	1.32	63	53.42
4	155	0.640	1.28	64	52.39
5	155	0.640	1.28	66	52.39
6	160	0.700	1.40	67	55.01
7	160	0.650	1.30	68	53.01
8	155	0.600	1.20	69	50.73
9	155	0.560	1.12	70	49.01
10	155	0.500	1.00	71	46.31
11	160	0.640	1.28	75	52.60
12	160	0.640	1.28	76	52.60
13	160	0.640	1.28	77	52.60
14	155	0.600	1.20	77	50.73
15	160	0.660	1.32	78	53.42
16	160	0.660	1.32	79	53.42
17	155	0.650	1.30	80	52.80
18	155	0.580	1.16	81	49.87
19	155	0.560	1.12	81	49.01
20	155	0.500	1.00	81	46.31
AVG VALUES	157		1.244	72	51.69

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PARTICULATE CONCENTRATION, grains/dscf = 0.046
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.069
PARTICULATE EMISSION RATE, lb/hr = [redacted]
PERCENT OF ISOKINETIC SAMPLING = 104.63

KENNEDY BOEING 300 PLANT TEST 3 TABLE 2-3 11-13-91

BAROMETRIC PRESSURE, in Hg = 29.150
TIP DIAMETER, in .2500
STACK AREA, sq ft = 8.727
SAMPLING TIME PER POINT, min = 3.00
NUMBER OF POINTS = 20
GAS METER VOLUME, acf = 37.03
WATER COLLECTED, ml = 359.00
PARTICULATE COLLECTED, grams = 0.1051
CO2 = 6.20 O2 = 11.60 CO = 0.00 N2 = 82.20

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	160	0.660	1.32	80	53.48
2	160	0.680	1.36	80	54.28
3	155	0.680	1.36	80	54.06
4	160	0.680	1.36	80	54.28
5	160	0.650	1.30	81	53.07
6	155	0.650	1.30	81	52.86
7	155	0.620	1.24	82	51.62
8	160	0.600	1.20	82	50.99
9	155	0.560	1.12	83	49.06
10	155	0.500	1.00	84	46.36
11	160	0.650	1.30	86	53.07
12	160	0.650	1.30	87	53.07
13	160	0.660	1.32	87	53.48
14	155	0.660	1.32	87	53.26
15	155	0.650	1.30	88	52.86
16	155	0.620	1.24	88	51.62
17	155	0.620	1.24	89	51.62
18	160	0.600	1.20	89	50.99
19	160	0.560	1.12	90	49.26
20	155	0.500	1.00	90	46.36
AVG VALUES	158		1.245	85	51.78

TOTAL GAS WITHDRAWN, scf = 53.51
DRY GAS WITHDRAWN, scf = 36.62
WATER VAPOR WITHDRAWN, scf = 16.90
PERCENT WATER VAPOR = 31.58
ACTUAL WET FLOW RATE, acfm = 27,113.82
STANDARD DRY FLOW RATE, scfm = 15,436.61
, m3/hr = 26,229.90
PARTICULATE CONCENTRATION, grains/dscf = 0.044
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.065
PARTICULATE EMISSION RATE, lb/hr = [redacted]
PERCENT OF ISOKINETIC SAMPLING = 101.23

2.2 Formaldehyde Emissions

The formaldehyde emissions were determined concurrently with the particulate and opacity observations using NIOSH Method 3500. 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	0.48 lb/hr	0.0018 lb/ton
2	0.35	0.0013
3	0.44	0.0016
AVG	0.42 lb/hr	0.0016 lb/ton

2.3 Visible Emissions (Opacity)

The visible emissions (opacity) was observed for three sixty minute periods which coincided with the particulate emission tests. The opacity was observed in accordance with the procedures outlined in EPA Method 9 -Visible Determination of the Opacity of Emissions from Stationary Sources. All individual opacity readings were either 0 % or 5 % and thus the six minute average opacities were well below the permit limit of 20 %. Copies of the field data observation sheets are included in the APPENDIX to this report.

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 5 - Determination of Particulate Emissions from Stationary Sources.

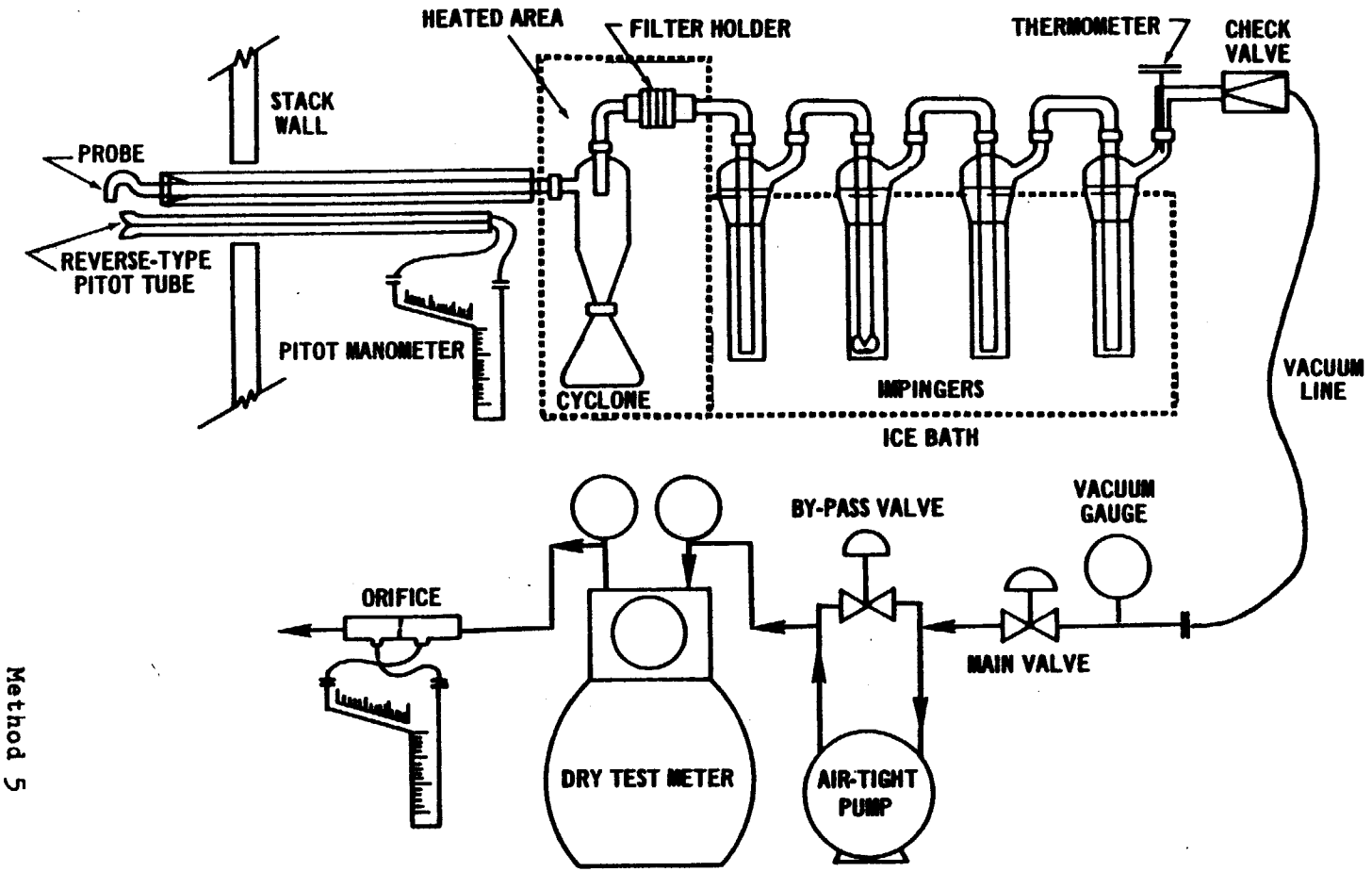
The sampling train consisted of a stainless steel probe tip, a heated stainless steel lined probe, a glass cyclone and flask, and a heated 125 millimeter Whatman 934-AH fiberglass filter. A series of four impingers followed in an ice bath. The first was a modified Greenburg-Smith impinger with 100 ml 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.

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, integrated bag samples were collected and analyzed on-site with an Orsat analyzer for percentage CO2, O2, CO, and N2.



Particulate sampling train.

At the completion of the test, the probe and glassware preceding the filter were 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 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 NIOSH Method 3500, the method accepted 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 each contained 15 milliliters of a one percent sodium bisulfite solution and the third was dry to serve as 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 brought back to the lab for analysis. The samples were analyzed via colorimetric methods as described in the NIOSH procedures. Each impinger was analyzed separately to insure the complete absorption of all formaldehyde in the solution.

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 =	0.85
Orifice coeff.	dH@ =	1.779

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:

$$\text{Gama} = 1.010 + (Td - 70) \times .00012$$

where: Td = Dry Gas Meter Temperature

The most recent calibration was performed October 9, 1991.

APPENDIX A

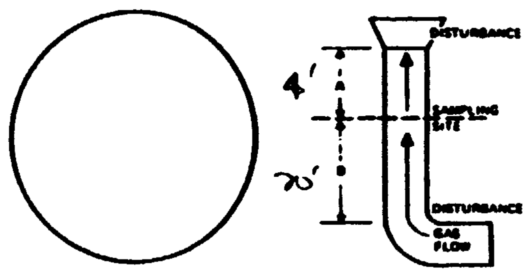
FIELD & LABORATORY DATA SHEETS

Environmental Technology & Engineering Corp.

* ADJUST Σ T, %H₂O → 78 (155)

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT: KENNEDY
DATE: 11-13-91
LOCATION: JANESVILLE
OPERATOR: WJD
STACK NO.: 1
RUN NO.: 1
SAMPLE BOX NO.: 1
METER BOX NO.: 1

AMBIENT TEMPERATURE: 40
BAROMETRIC PRESSURE: 29.15
ASSUMED MOISTURE, %: SAT (~25%)
PROBE LENGTH, in.: 52"
NOZZLE DIAMETER, in.: 1/4
STACK DIAMETER, in.: 40
PROBE HEATER SETTING: 250
HEATER BOX SETTING: 250

Cp = 0.85
γ 1.010 } 10-9-91
METER ΔH@: 1.779
C FACTOR:
PROCESS WEIGHT RATE: 260-270 TPH

ORSAT RESULTS
CO_2 6.2
O_2 11.8
CO
N_2 82.0

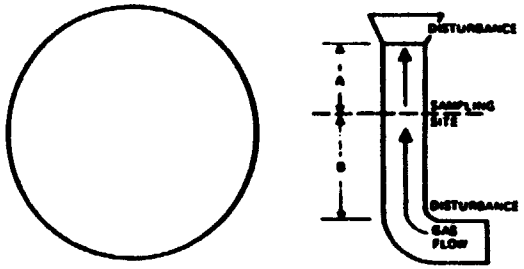
PRE LK OK
PITOT LK OK
POST LK OK

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	HCOH γ 1.078 SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	0558/050		150	.68		1.45		9408.00		42	746.26/43			
2	03		150	.62		1.32		10.1		43	743.26/52			
3	[illegible]	-.40	155	.62		1.32		12.1		44				
4	[illegible]		155	.66		1.42		14.1		45	2.04/50			
5	[illegible]		150	.66		1.42		16.2		46				
Y 6	[illegible]	-.50	155	.66		1.42		18.3		48				
7	[illegible]		155	.65		1.30		20.3		50				
8	[illegible]		160	.60		1.20		22.3		51				
9	[illegible]	-.50	160	.58		1.16		24.2		51				
10	[illegible]		155	.50		1.00		26.0	(0.50)	51				
B 11	15		155	.60		1.20		27.71	28.21	53				
12	18		155	.64		1.28		30.1		54				
13	21	-.50	155	.66		1.32		32.0		54				
14	24		155	.68		1.34		34.0		55				
15	27		155	.68		1.36		36.0		56				
16	[illegible]	-.50	155	.65		1.30		38.0		56				
17	[illegible]		160	.62		1.24		39.9		57				
18	36		160	.60		1.20		41.8		58				
19	39	-.40	160	.55		1.10		43.7		59				
20	12		155	.50		1.06		45.5		60				
	[illegible]							9447.21						
								38.71						

Environmental Technology & Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT KENNEDY
DATE 11-13-91
LOCATION JANESVILLE
OPERATOR WJD
STACK NO. 1
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE 95
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % SAT
PROBE LENGTH, in. 8 8"
NOZZLE DIAMETER, in. Y4
STACK DIAMETER, in. 40
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 6.4
O_2 11.6
CO
N_2 82.0

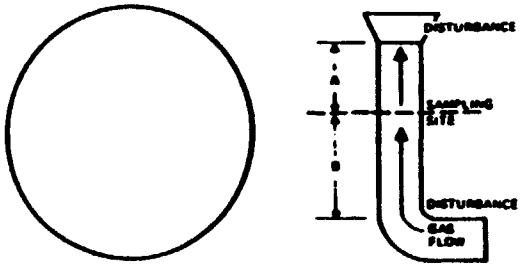
Pre Leak
Post Leak
Post Leak

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 (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), F	HCON SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A1	10:15:00		160	.70	1.40		9451.00		61	74/0.76/53			
2	"	-.50	155	.66	1.32		53.0		62	75/0.76/54			
3	"		160	.66	1.32		55.0		63				
4	"		155	.64	1.28		56.9		64	2.50/55			
5	"		155	.64	1.28		58.8		66				
6	"		160	.70	1.40		60.8		67				
7	"		160	.65	1.30		62.8		68				
8	"		155	.60	1.20		64.7		69				
9	"		155	.56	1.12		66.5		70				
10	"		155	.50	1.00		68.3	(70.51)	71				
B 11	11:51		160	.69	1.38		70.60	70.50	75				
12	50		160	.66	1.38		72.4		76				
13	51		160	.64	1.28		74.3		77				
14	52	-.50	155	.60	1.20		76.2		77				
15	53		160	.66	1.33		78.0		78				
16	54		160	.66	1.32		79.9		79				
17	55		155	.65	1.30		81.8		80				
18	56		155	.58	1.16		83.7		81				
19	57		155	.56	1.12		85.5		81				
20	58		155	.50	1.00		87.2		81				
	12:21						9488.95						
							(38.45)						

Environmental Technology & Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT KENNEDY
DATE 11-13-91
LOCATION JANESVILLE
OPERATOR WJD
STACK NO. 1
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. 1

AMBIENT TEMPERATURE 50
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % SAT.
PROBE LENGTH, in. 52
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 40
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 6.2
O_2 11.6
CO
N_2 82.2

PRE LK ON
PITOT LK ON
POST LK ON

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{\Delta P_s}$)	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), ft^3	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	1144.00		160	.66	1.32		9990.00		80				
2	47		160	.68	1.36		91.9		80				
3	50	-0.5	155	.68	1.36		93.9		80				
4	53		160	.68	1.36		95.8		80				
5	56		160	.65	1.30		97.7		81				
6	59		155	.65	1.30		99.6		81				
7	02		155	.62	1.24		01.5		82	753.42	51		
8	05		160	.62	1.20		03.3		82	754.60	54		
9	08		155	.58	1.12		05.1	1	83	1.25			
10	11		155	.50	1.00		0[illegible]0.9	(-0.50)	84				
B11	14/19		160	.65	1.30		08.58	09.08	86				
12	22		160	.65	1.30		10.9		87				
13	25	-.50	160	.66	1.32		12.8		87				
14	28		155	.66	1.32		14.7		87				
15	31		155	.65	1.30		16.7		88				
16	34		155	.62	1.24		18.6		88				
17	37		155	.62	1.24		20.5		89				
18	40		160	.60	1.20		22.3		89				
19	43		160	.56	1.12		24.2		90				
20	46		155	.50	1.00		25.9		90				
	1249.00						9537.53						
							(37.03)						

CALIBRATE H_2O TEMP @ 152 °F

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Kennedy Asphalt - Jonesville DATE OF TEST 11-13-91

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 1 STACK Scrubber

Sample Box 1 Filter 1492 Wash Bottle —

Beaker No. 7

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	233	100	133
2	192	100	92
3	89	0	89
SILICA	731	701	30
		TOTAL	344

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	0.8226	0.7910	0.0316
Washings (.0009)	939404	938907	0.0488
		TOTAL	0.0804

WATER COLLECTED 344 GRAMS

PARTICULATE COLLECTED 0.0804 GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Kennedy Asphalt - Jamesville DATE OF TEST 11-13-91

JOB NO. _____ TEST ENGINEER WJO

RUN NO. 2 STACK Scrubber

Sample Box 2 Filter 1494 Wash Bottle —

Beaker No. B

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	227	100	127
2	230	100	130
3	102	0	102
SIL GEL	688	620	68
		TOTAL	367

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	0.8369	0.8003	0.0366
Washings (.0009)	103.2533	103.1749	0.0775
		TOTAL	0.1141

WATER COLLECTED 367 GRAMS

PARTICULATE COLLECTED 0.1141 GRAMS

NOTES:

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Kennedy Asphalt - Jamesville DATE OF TEST 11-13-91

JOB NO. _____ TEST ENGINEER WJO

RUN NO. 3 STACK Scrubber

Sample Box 3 Filter 1495 Wash Bottle —

Beaker No. 9

WATER COLLECTED

Impinger No.	Final Wt. g	Initial Wt. g	Collected grams
1	240	100	140
2	182	100	82
3	133	0	133
SIL GEL	641	637	4
		TOTAL	359

PARTICULATE COLLECTED

	Final Wt. g	Tare Wt. g	Collected grams
Filter	0.8346	0.8045	0.0301
Washings (.0009)	95.8400	95.7641	0.0750
		TOTAL	0.1051

WATER COLLECTED 359 GRAMS

PARTICULATE COLLECTED 0.1051 GRAMS

NOTES:

HCOH - ANALYSIS 11/15/91

KENNEDY	LIQ VOL	LIQ ALIQ		RDG	RDG - BLK	mg/ALIQ	mg/SAMP		TOTAL
1A	29.2	1.0	1.0	1.134	1.103	14.35	419		475
1B	16.5	3.0		.827	.796	10.25	56.4		
2A	30.1	1.0		1.062	1.031	13.00	391.3		440
2B	14.2	3.0		.829	.798	10.27	48.6		
3A	22.3	1.0		.971	.940	12.15	270.9		273
3B	9.3	3.0		.096	.065	0.77	2.4		
FLD BLANK	—	3.0	√	.031	—				

Technology &
Engineering Corp.

Name of Company: KENNEDY	Date: 11-13-91
Location	EEB Number
City, State, Zip Code: BELOIT, WISC	Observer Certification Date: OCT '91
Discharge Location: SCRUBBER - FINAL EXHAUST	Control Device: WET SCRUBBER
Height of Discharge Above Ground: ~ 35 FT	Steam Plume? (Attached) (Yes) Detached No

	Initial		Final
Time of Observation	8:40:00		9:40
Observer Location: Distance to Discharge	500'		
Direction from Discharge	NE		
Height of Observation Point in Relation to Discharge	-30 FT		
Plume Description (Color, Length, etc.)	WHITE, 500'		
Plume Background Description	BLUE SKY		
Weather Conditions: Wind Direction	SOUTH		
Wind Speed	0-5		
Ambient Temperature	40 F		
Sky Conditions (clear, overcast, % clouds, etc.)	CLEAR, 10% WISPY CLOUDS		

Describe Point in Plume at Which Opacity was Determined
END OF STEAM DISSIPATION

Remarks:

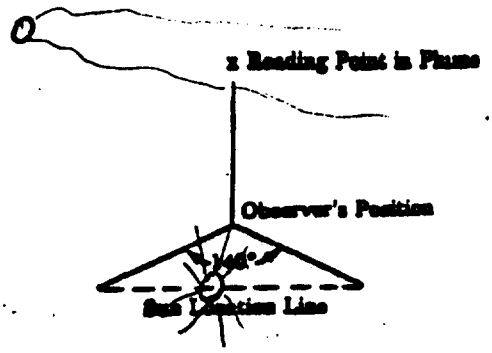
SEC MIN	0	15	30	45	SEC MIN	0	15	30	45
0	-	-	-	5	30	-	5	5	-
1	-	5	-	5	31	5	-	-	-
2	-	-	5	-	32	-	5	-	-
3	5	5	-	-	33	5	-	-	-
4	-	5	5	-	34	-	-	5	-
5	-	-	5	5	35	-	5	5	5
6	-	5	5	-	36	-	-	5	5
7	5	-	-	5	37	5	-	-	5
8	-	5	-	5	38	-	5	-	-
9	5	-	5	-	39	5	-	-	5
10	5	5	5	-	40	5	-	5	-
11	-	5	-	5	41	-	-	-	5
12	5	-	5	-	42	-	5	-	-
13	-	5	-	5	43	5	-	5	-
14	5	5	-	-	44	-	5	-	5
15	5	-	5	-	45	-	5	5	-
16	-	5	5	-	46	5	-	5	5
17	-	5	-	5	47	10	5	-	5
18	5	-	5	5	48	-	5	-	-
19	-	5	-	5	49	5	-	5	-
20	-	-	-	5	50	-	5	-	-
21	5	-	5	-	51	5	-	5	-
22	-	5	-	5	52	-	-	5	-
23	5	-	5	-	53	5	5	-	5
24	-	5	-	-	54	-	-	-	-
25	5	-	-	5	55	5	5	-	5
26	-	5	5	5	56	-	-	5	-
27	5	-	-	5	57	5	5	-	-
28	-	-	-	-	58	-	5	5	-
29	5	-	5	-	59	5	5	-	-

Summary of Average Opacity
(From Computer Program)

Set Number	Time: Start – End	Opacity: Sum	Opacity: Average
1		50	
2		65	
3		60	
4		60	
5		50	
6		45	
7		50	
8		70	
9		50	
10		50	

Signature of Observer: Michael Huening
Name of Observer (Please print): MICHAEL HUENINK

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity

13020 W. BLUEMOUND RD.
ELM GROVE, WIS. 53122
PHONE
(414) 784-2434

Technology &
Engineering Corp.

SMOKE FORM

Name of Company: KENNEDY	Date: 11-13-91
Location:	FID Number:
City, State, Zip Code: BELOIT	Observer Certification Date: OCT '91
Discharge Location: ASPHALT PLANT - FINAL DISCHARGE	Control Device: WET SCRUBBER
Height of Discharge Above Ground: ~35 FT	Steam Plume? (Yes) Attached / (No) Detached

	Initial		Final
Time of Observation	10:15:00		11:15:00
Observer Location: Distance to Discharge	~450'		S
Direction from Discharge	ENE		
Height of Observation Point in Relation to Discharge	-30 FT		A
Plume Description (Color, Length, etc.)	WHITE, 450 FT		
Plume Background Description	SKY (BLUE)		M
Weather Conditions: Wind Direction	S		
Wind Speed	0-5		E
Ambient Temperature	45		
Sky Conditions (clear, overcast, % clouds, etc.)	CLEAR, 10% CLOUDS		

Describe Point in Plume at Which Opacity was Determined: END OF STEAM DISSIPATION

Remarks:

SEC MIN	0	15	30	45	SEC MIN	0	15	30	45
0	-	5	5	-	30	5	-	5	-
1	-	-	5	-	31	-	5	-	5
2	5	-	-	5	32	-	-	5	5
3	-	-	-	-	33	-	5	-	5
4	-	5	-	-	34	5	-	5	-
5	-	-	5	-	35	-	5	5	-
6	5	-	-	-	36	5	-	-	-
7	-	-	-	5	37	-	5	-	-
8	-	-	5	-	38	-	-	5	-
9	-	5	-	5	39	-	5	-	-
10	5	-	-	-	40	5	-	-	5
11	-	-	5	-	41	-	-	5	-
12	-	5	-	-	42	-	5	-	-
13	-	-	5	-	43	-	-	5	-
14	5	5	-	-	44	-	-	-	-
15	-	-	-	5	45	5	-	-	-
16	-	5	-	-	46	-	5	-	-
17	5	-	5	-	47	5	-	-	5
18	-	5	-	-	48	-	5	-	-
19	5	-	-	-	49	5	-	-	-
20	-	5	-	-	50	-	-	-	-
21	-	5	-	-	51	-	-	5	5
22	5	-	5	5	52	-	5	-	-
23	5	-	-	5	53	-	-	-	5
24	5	-	5	5	54	-	-	-	5
25	-	5	5	-	55	-	5	-	-
26	5	-	5	5	56	5	-	-	5
27	-	5	-	-	57	-	-	-	-
28	5	-	5	5	58	5	-	5	-
29	-	5	-	5	59	-	-	-	-

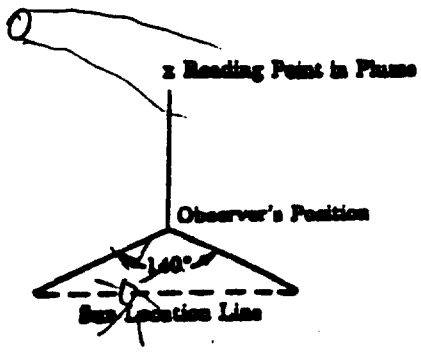
Summary of Average Opacity
(From Computer Program)

Set Number	Time: Start – End	Opacity: Sum	Opacity: Average
1		35	
2		35	
3		40	
4		45	
5		70	
6		60	
7		35	
8		30	
9		30	
10		30	

Signature of Observer: Michael Huenink

Name of Observer (Please print): MICHAEL HUENINK

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity

13020 W. BLUEMOUND RD.
ELM GROVE, WIS. 53122
PHONE
(414) 784-2434

SMOKE FORM

Technology & Engineering Corp.

Name of Company: KENNEDY + SON	Date: 11-13-91
Location	FID Number
City, State, Zip Code: BELOIT, WISC	Observer Certification Date: OCT '91
Discharge Location: ASPHALT PLANT SCRUBBER STACK	Control Device: WET SCRUBBER
Height of Discharge Above Ground: ~35 FT	Steam Plume? (Attached) Yes / Detached No

	Initial		Final
Time of Observation	11:45:00		12:45
Observer Location: Distance to Discharge	250 FT		S
Direction from Discharge	EAST		
Height of Observation Point in Relation to Discharge	~30 FT		A
Plume Description (Color, Length, etc.)	WHITE, 300 FT		
Plume Background Description	BLUE SKY		M
Weather Conditions: Wind Direction	SOUTH		
Wind Speed	0-5 MPH		C
Ambient Temperature	45		
Sky Conditions (clear, overcast, % clouds, etc.)	CLEAR, 10% CLOUDS		

Describe Point in Plume at Which Opacity was Determined: END OF STEAM DISSIPATION

Remarks:

SEC MIN	0	15	30	45	SEC MIN	0	15	30	45
0	—	—	—	—	30	—	—	—	5
1	—	5	—	5	31	—	—	—	—
2	—	—	5	—	32	—	—	5	—
3	5	—	—	—	33	5	—	—	—
4	—	—	—	—	34	—	—	—	—
5	—	5	—	—	35	—	—	—	5
6	—	—	—	5	36	—	—	—	—
7	—	—	—	—	37	—	5	—	—
8	5	—	—	—	38	—	—	—	—
9	—	—	5	—	39	5	—	—	—
10	—	5	—	—	40	—	—	5	—
11	5	—	—	5	41	—	—	—	—
12	—	—	—	—	42	—	—	—	5
13	—	—	—	5	43	5	—	—	—
14	—	—	5	—	44	—	—	—	—
15	—	—	—	5	45	—	5	—	—
16	—	—	5	—	46	—	—	—	—
17	—	—	—	—	47	5	—	—	—
18	5	—	5	—	48	—	—	—	—
19	—	—	5	—	49	—	—	5	—
20	—	—	—	—	50	—	—	—	—
21	—	—	—	—	51	—	—	—	—
22	—	5	—	—	52	—	—	—	—
23	—	—	—	—	53	5	—	—	—
24	—	—	—	5	54	—	—	—	—
25	—	—	—	—	55	—	—	—	—
26	5	—	—	—	56	5	—	—	—
27	—	5	—	—	57	—	—	5	—
28	—	—	—	—	58	—	—	—	—
29	5	—	—	—	59	—	—	5	—

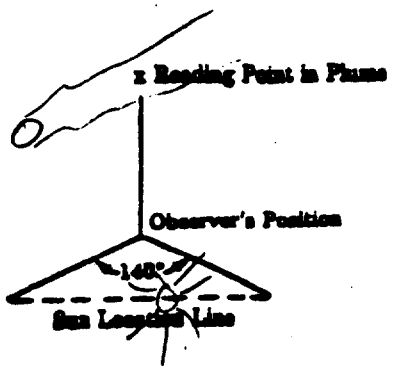
Summary of Average Opacity (From Computer Program)

Set Number	Time: Start – End	Opacity: Sum	Opacity: Average
1		25	
2		30	
3		20	
4		20	
5		20	
6		20	
7		15	
8		20	
9		10	
10		15	

Signature of Observer: Michael J. Huenink

Name of Observer (Please print): MICHAEL HUENINK

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity

13020 W. BLUEMOUND RD.
ELM GROVE, WIS. 53122
PHONE (414) 784-2434

Wm J. KENNEDY and SON, Inc.

P.O. Box 813
Janesville, Wisconsin 53547
(608) 752-8944
FAX (608) 365-8146

November 15, 1991

Mr. Bill Dick
Environmental Technology &
Engineering Corp.
13020 West Bluemound Rd.
Elm Grove, WI 53122

Dear Bill:

Enclosed is a copy of the production log taken during the stack test performed on Wednesday, November 13th. If you have any questions or need additional information, please contact me.

Sincerely,

WM. J. KENNEDY AND SON, INC.

Dave Barkley cmh

Dave Barkley
Plant Superintendent

DB:cmh

NAPA
NATIONAL ASPHALT PAVEMENT ASSOCIATION

ROAD BUILDERS

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	179	82	11.1	67	0	13	105	79
TOTAL TON	283.6	130.1	17.3	107	+	22	170	126
BLEND %	68.6	31.4	4.0	25.4	0.0	4.9	39.7	29.9
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 271 TPH 260 F 5.3 %mAC [290 F 8.58 lb/gal 4.0 %rAC] 11/13/91 09:00

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	178	83	10.6	66	0	13	104	78
TOTAL TON	328.1	150.6	20.1	123	+	25	196	146
BLEND %	68.2	31.8	4.0	25.1	0.0	5.1	39.8	30.0
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 267 TPH 278 F 5.3 %mAC [290 F 8.58 lb/gal 4.0 %rAC] 11/13/91 09:15

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	174	78	10.5	65	0	14	105	79
TOTAL TON	372.0	170.7	22.8	140	+	28	222	165
BLEND %	69.1	30.9	4.1	24.8	0.0	5.1	40.1	29.9
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 267 TPH 286 F 5.3 %mAC [291 F 8.58 lb/gal 4.0 %rAC] 11/13/91 09:30

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	180	81	10.8	65	0	13	105	78
TOTAL TON	416.2	190.6	25.5	156	+	32	248	185
BLEND %	68.9	31.1	4.0	24.9	0.0	5.1	40.0	30.0
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 266 TPH 264 F 5.3 %mAC [291 F 8.58 lb/gal 4.0 %rAC] 11/13/91 09:45

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	176	82	10.7	65	0	13	104	79
TOTAL TON	460.0	210.6	28.3	172	+	35	275	204
BLEND %	68.1	31.9	4.0	24.9	0.0	5.1	39.8	30.1
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 205 TPH 285 F 5.3 %mAC [292 F 8.58 lb/gal 4.0 %rAC] 11/13/91 10:00

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	117	54	7.3	43	0	9	69	52
TOTAL TON	492.6	225.9	30.4	184	+	37	294	219
BLEND %	68.5	31.5	4.1	25.1	0.0	5.1	39.8	30.0
No of ERRs	7	0	3	0	0	0	0	0

MIX # 19 196 TPH 307 F 5.3 %mAC [293 F 8.58 lb/gal 4.0 %rAC] 11/13/91 10:15

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	178	80	11.3	65	0	14	105	79
TOTAL TON	526.2	240.5	32.4	197	+	40	314	234
BLEND %	69.1	30.9	4.2	24.8	0.0	5.2	40.0	30.0
No of ERRs	8	14	3	0	0	0	0	0

MIX # 19 270 TPH 267 F 5.3 %mAC [294 F 8.58 lb/gal 4.0 %rAC] 11/13/91 10:30

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	178	80	11.0	65	0	13	106	78
TOTAL TON	570.9	260.6	35.2	213	+	43	340	253
BLEND %	69.1	30.9	4.1	24.8	0.0	5.0	40.4	29.8
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 268 TPH 260 F 5.3 %mAC [295 F 8.58 lb/gal 4.0 %rAC] 11/13/91 10:45

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	178	78	11.1	65	0	13	105	79
TOTAL TON	615.1	280.6	37.9	230	+	47	366	273
BLEND %	69.5	30.5	4.2	24.9	0.0	5.0	40.0	30.2
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 269 TPH 240 F 5.3 %mAC [296 F 8.58 lb/gal 4.0 %rAC] 11/13/91 11:00

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	176	82	10.9	67	0	13	104	79
TOTAL TON	659.5	300.7	40.7	246	+	50	392	293
BLEND %	68.1	31.9	4.0	25.3	0.0	5.0	39.6	30.1
No of ERRs	0	0	0	0	0	0	0	0

RATE dTPH	180	80	10.7		65	0	13	105	79	
TOTAL TON	703.5	321.0	43.4		262	+	53	418	312	
BLEND %	69.3	30.7	4.0		24.9	0.0	5.1	40.0	30.0	
No of ERRs	0	0	0		0	0	0	0	0	

MIX # 19 225 TPH 268 F 5.3 %mAC [298 F 8.58 lb/gal 4.0 %rAC] 11/13/91 11:30

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	106	47	6.6	38	0	8	61	45
TOTAL TON	739.4	337.4	45.7	275	+	56	439	328
BLEND %	69.0	31.0	4.2	24.9	0.0	5.1	40.2	29.8
No of ERRs	10	7	3	0	0	0	0	0

MIX # 19 198 TPH 296 F 5.3 %mAC [299 F 8.58 lb/gal 4.0 %rAC] 11/13/91 11:45

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	180	79	11.2	66	0	14	106	78
TOTAL TON	773.7	352.2	47.8	288	+	58	460	343
BLEND %	69.5	30.5	4.2	24.9	0.0	5.2	40.3	29.7
No of ERRs	8	15	3	0	0	0	0	0

MIX # 19 267 TPH 276 F 5.3 %mAC [300 F 8.58 lb/gal 4.0 %rAC] 11/13/91 12:00

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	174	77	10.9	66	0	13	105	78
TOTAL TON	818.0	371.8	50.5	305	+	62	486	363
BLEND %	69.3	30.7	4.1	25.1	0.0	5.0	40.0	29.9
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 267 TPH 245 F 5.3 %mAC [300 F 8.58 lb/gal 4.0 %rAC] 11/13/91 12:15

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	176	75	11.3	65	0	13	103	77
TOTAL TON	862.3	391.5	53.3	321	+	65	512	382
BLEND %	70.0	30.0	4.3	25.1	0.0	5.0	39.9	30.0
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 264 TPH 241 F 5.3 %mAC [300 F 8.58 lb/gal 4.0 %rAC] 11/13/91 12:30

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	178	78	11.1	64	0	13	103	77
TOTAL TON	906.3	410.9	56.0	337	+	68	538	402
BLEND %	69.4	30.6	4.2	24.9	0.0	5.0	40.1	29.9
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 265 TPH 248 F 5.3 %mAC [300 F 8.58 lb/gal 4.0 %rAC] 11/13/91 12:45

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	177	77	10.9	64	0	13	103	77
TOTAL TON	950.3	430.5	58.7	353	+	71	564	421
BLEND %	69.6	30.4	4.2	25.0	0.0	5.1	40.0	29.9
No of ERRs	0	0	0	0	0	0	0	0

MIX # 19 225 TPH 266 F 5.3 %mAC [300 F 8.58 lb/gal 4.0 %rAC] 11/13/91 13:00

	VScale	RScale	+AC	1 Vir	2 Vir	3 Vir	4 Vir	5 Rap
MOISTURE %	3.8	3.5		3.5	4.0	3.0	4.0	3.5
RATE dTPH	116	49	6.6	43	0	9	68	51
TOTAL TON	986.6	446.7	61.0	366	+	74	585	437
BLEND %	70.4	29.6	4.0	25.0	0.0	5.1	39.8	30.0
No of ERRs	7	8	3	0	0	0	0	0

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

KENNEDY & SONS

FORMALDEHYDE CALCULATIONS

P_b: 29.15

γ: 1.023

TEST 1

270 TPH V_M: 2.00 T_M: 50

$$V_{M\,std} = V_M * \gamma * \frac{528}{T_M} * \frac{P_b}{29.92}$$

$$= 2.07 \text{ SCF} = .059 \text{ m}^3$$

$$C = \frac{0.475 \text{ mg}}{.059 \text{ m}^3} = 8.05 \text{ mg/m}^3$$

ER: 0.48 #/hr. = .0018 #/tm

TEST 2

V_M: 2.50 T_M: 53

$V_{M\,std}$: 2.58 SCF = .073 m³

$$C = \frac{0.440}{.073} = 6.03 \text{ mg/m}^3$$

ER: 0.35 #/hr = .0013 #/tm

TEST 3

V_M: 1.25 T_M: 54

$V_{M\,std}$: 1.29 SCF = .036 m³

$$C = \frac{0.273}{.036} = 7.58 \text{ mg/m}^3$$

ER: 0.44 #/hr = .0016 #/tm