AP-42 Section Number: 9.5.2

Reference Number: 4

Title: KSI-2 & KSI-3 Continuous Smokehouses Stack Emissions Testing

Hillshire Farms & Kahn's

September 1991

AP-42 Section 9.5.2
Reference 4
Report Sect. 4
Reference 2

Hillshire Farm
New London, WI
KSI-2 Smokehouse
Sept 20, 1991

Report to

HILLSHIRE FARM & KAHN'S
New London, Wisconsin

for

KSI-2 & KSI-3 CONTINUOUS SMOKEHOUSES
STACK EMISSIONS TESTING

September 19 & 20, 1991

KSI-3 Smokehouse
Sept 19, 1991

Received: 11/20/91

ETE

Reviewed: 11/2/92

Report to

HILLSHIRE FARM & KAHN'S
New London, Wisconsin

for

KSI-2 & KSI-3 CONTINUOUS SMOKEHOUSES STACK EMISSIONS TESTING

September 19 & 20, 1991

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION
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SUMMARY

Particulate Emissions

The particulate matter emission limit specified for KSI-2 in the permit is 1.824 lb/hr. The results of the KSI-2 particulate testing were as follows:

Test	Particulate into Scrubber Rate	Particulate Emissions Rate
1	5.38 lb/hr	1.95 lb/hr
2	4.86 lb/hr	1.45 lb/hr
3	5.81 lb/hr	1.55 lb/hr
Avg	5.35 lb/hr	1.65 lb/hr

The particulate matter emission limit specified for KSI-3 in the permit is 1.824 lb/hr. The results of the KSI-3 particulate testing were as follows:

Test	Particulate into Scrubber Rate	Particulate Emissions Rate
1	6.34 lb/hr	1.34 lb/hr
2	5.33 lb/hr	1.42 lb/hr
3	4.87 lb/hr	1.29 lb/hr
Avg	5.51 lb/hr	1.35 lb/hr

Formaldehyde Emissions

The formaldehyde emission limit specified for KSI-2 and KSI-3 in the permit is 0.007 lb/hr, however, a footnote in the permit indicates that this limit may be subject to change pending the test results. The results of the KSI-2 formaldehyde testing were as follows:

KSI-2 Test	Formaldehyde into Scrubber Rate	Formaldehyde Emissions Rate
1	0.066 lb/hr	0.029 lb/hr
2	0.071 lb/hr	0.039 lb/hr
3	0.064 lb/hr	0.030 lb/hr
Avg	0.067 lb/hr	0.033 lb/hr

The results of the KSI-3 formaldehyde testing were as follows:

KSI-3 Test	Formaldehyde into Scrubber Rate	Formaldehyde Emissions Rate
1	0.071 lb/hr	0.035 lb/hr
2	0.057 lb/hr	0.026 lb/hr
3	0.067 lb/hr	0.034 lb/hr
Avg	0.065 lb/hr	0.032 lb/hr

Acetic Acid Emissions

The acetic acid emission limit specified for KSI-2 and KSI-3 in the permit is 0.303 lb/hr. The results of the KSI-2 acetic acid testing were as follows:

KSI-2 Test	Acetic Acid into Scrubber Rate	Acetic Acid Emissions Rate
1	.267 lb/hr	.193 lb/hr
2	.256 lb/hr	.161 lb/hr
3	.250 lb/hr	.119 lb/hr
Avg	.258 lb/hr	.158 lb/hr

The results of the KSI-3 acetic acid testing were as follows:

KSI-3 Test	Acetic Acid into Scrubber Rate	Acetic Acid Emissions Rate
1	.214 lb/hr	.136 lb/hr
2	.222 lb/hr	.139 lb/hr
3	.202 lb/hr	.129 lb/hr
Avg	.213 lb/hr	.135 lb/hr

Organic Compounds

The permit for KSI-2 and KSI-3 specifies that organic compound emissions be controlled by at least 85 %. Organic compounds include acetic acid, formaldehyde, and the other unidentified organic compounds which were quantified as acetaldehyde. The results of the KSI-2 organic compound testing were as follows:

KSI-2 TOTAL ORGANIC COMPOUNDS

Test	into Scrubber Rate	Emissions Rate	Control Efficiency
1	3.66 lb/hr	0.72 lb/hr	80 %
2	4.17 lb/hr	0.59 lb/hr	86 %
3	4.42 lb/hr	0.56 lb/hr	87 %
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Avg	4.08 lb/hr	0.62 lb/hr	84 %

The results of the KSI-3 organic compound testing were as follows:

KSI-3 TOTAL ORGANIC COMPOUNDS

Test	into Scrubber Rate	Emissions Rate	Control Efficiency
1	2.34 lb/hr	0.57 lb/hr	76 %
2	3.30 lb/hr	0.66 lb/hr	80 %
3	2.66 lb/hr	0.65 lb/hr	75 %
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Avg	2.77 lb/hr	0.63 lb/hr	77 %

Visible Emissions

The permit for KSI-2 and KSI-3 specifies that the visible emissions not exceed 20 % opacity. The highest six minute average opacity for each smokehouse stack was as shown below:

STACK	OPACITY
KSI-2	10.0 %
KSI-3	10.2 %

1.0 GENERAL

On September 19 & 20, 1991, Environmental Technology & Engineering Corp personnel performed stack emissions testing on the KSI-2 and KSI-3 continuous smokehouse operations at the Hillshire Farm & Kahn's facility located in New London, Wisconsin. The purpose of the testing was to demonstrate compliance with the emission limits outlined in the DNR permit No. 89-RV-006.

Both smokehouses were in full operation throughout the testing; product was run through the smokehouses continuously during the testing. Five smoke generators were in operation on each house; four running chips at 20.4 lb/hr and one running "wundersmoke" sawdust at 22 lb/hr, thus a total wood rate of 103.6 lb/hr.

The field tests, corresponding laboratory analysis, and report preparation were performed by ETE personnel; Lowell Huenink was the test team leader.

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

2.0 RESULTS

Emission concentrations and exhaust flow rates were measured during the test efforts. Exhaust flow rates were measured in accordance with EPA Methods 1 through 4 using a pitot tube and inclined manometer. Concentrations of compounds in the exhaust gas stream were measured using a combination of standard EPA methods and Wisconsin DNR recommended methods as indicated below. The emission rates were then calculated as a product of the emission concentrations and exhaust flow rates.

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" found in 40 CFR, Part 60, Appendix A. A brief summary of this method is included in Section 3.1 of this report. The tests were performed in horizontal duct between the smokehouse and the scrubber and also in the final discharge stack, above the mist eliminator. The results of the testing to determine particulate matter emissions are shown in Tables 2-1 through 2-12. These results include both filterable and condensible ("back-half") particulate matter.

The results of the particulate matter tests showed the emissions to be within the permit limit of 1.824 lb/hr and are summarized below:

KSI-2:

Test	Particulate into Scrubber Rate	Particulate Emissions Rate
1	5.38 lb/hr	1.95 lb/hr
2	4.86 lb/hr	1.45 lb/hr
3	5.81 lb/hr	1.55 lb/hr
Avg	5.35 lb/hr	1.65 lb/hr

KSI-3:

Test	Particulate into Scrubber Rate	Particulate Emissions Rate
1	6.34 lb/hr	1.34 lb/hr
2	5.33 lb/hr	1.42 lb/hr
3	4.87 lb/hr	1.29 lb/hr
Avg	5.51 lb/hr	1.35 lb/hr

HILLSHIRE KSI 2 IN TEST 1 TABLE 2-1 9-20-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2450
STACK AREA, sq ft = 2.918
SAMPLING TIME PER POINT, min = 4.00
NUMBER OF POINTS = 16
GAS METER VOLUME, acf = 40.72
WATER COLLECTED, ml = 99.00
PARTICULATE COLLECTED, grams = 0.2887
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	0.540	0.63	97	45.48
2	132	0.570	0.66	99	46.81
3	132	0.470	0.54	99	42.50
4	130	0.370	0.43	101	37.65
5	130	0.500	0.58	105	43.76
6	130	0.540	0.63	109	45.48
7	130	0.460	0.53	110	41.98
8	130	0.340	0.40	112	36.09
9	130	0.620	0.70	117	48.73
10	130	0.650	0.75	118	49.90
11	132	0.490	0.57	119	43.40
12	132	0.350	0.41	120	36.68
13	130	0.580	0.67	121	47.13
14	132	0.640	0.73	122	49.60
15	132	0.420	0.49	123	40.18
16	130	0.350	0.41	125	36.61
AVG VALUES	131		0.571	112	43.25

TOTAL GAS WITHDRAWN, scf = 46.31
DRY GAS WITHDRAWN, scf = 41.65
WATER VAPOR WITHDRAWN, scf = 4.66
PERCENT WATER VAPOR = 10.06
ACTUAL WET FLOW RATE, acfm = 7,571.83
STANDARD DRY FLOW RATE, scfm = 5,930.57
PARTICULATE CONCENTRATION, grains/dscf = 0.1069
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.188
PARTICULATE EMISSION RATE, lb/hr = 5.38
PERCENT OF ISOKINETIC SAMPLING = 97.83

HILLSHIRE KSI 2 IN TEST 2 TABLE 2-2 9-20-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2450
STACK AREA, sq ft = 2.918
SAMPLING TIME PER POINT, min = 4.00
NUMBER OF POINTS = 16
GAS METER VOLUME, acf = 40.12
WATER COLLECTED, ml = 97.00
PARTICULATE COLLECTED, grams = 0.2568
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	0.550	0.64	126	45.89
2	132	0.550	0.64	125	45.97
3	132	0.510	0.59	127	44.27
4	130	0.360	0.42	128	37.13
5	130	0.630	0.72	129	49.12
6	130	0.600	0.69	129	47.93
7	130	0.520	0.60	130	44.62
8	130	0.380	0.44	130	38.15
9	130	0.640	0.73	132	49.51
10	130	0.660	0.76	132	50.27
11	130	0.550	0.64	133	45.89
12	130	0.400	0.47	133	39.14
13	130	0.480	0.56	135	42.87
14	130	0.540	0.63	137	45.47
15	130	0.460	0.53	136	41.97
16	130	0.320	0.37	139	35.01
AVG VALUES	130		0.589	131	43.95

TOTAL GAS WITHDRAWN, scf = 45.70
DRY GAS WITHDRAWN, scf = 41.13
WATER VAPOR WITHDRAWN, scf = 4.57
PERCENT WATER VAPOR = 9.99
ACTUAL WET FLOW RATE, acfm = 7,694.88
STANDARD DRY FLOW RATE, scfm = 6,036.77
PARTICULATE CONCENTRATION, grains/dscf = 0.0963
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.167
PARTICULATE EMISSION RATE, lb/hr = 4.86
PERCENT OF ISOKINETIC SAMPLING = 94.90

HILLSHIRE KSI 2 IN TEST 3 TABLE 2-3 9-20-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2450
STACK AREA, sq ft = 2.918
SAMPLING TIME PER POINT, min = 4.00
NUMBER OF POINTS = 16
GAS METER VOLUME, acf = 39.88
WATER COLLECTED, ml = 109.00
PARTICULATE COLLECTED, grams = 0.3085
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	0.500	0.58	130	43.86
2	130	0.550	0.63	131	46.00
3	130	0.480	0.56	131	42.97
4	130	0.360	0.42	132	37.21
5	130	0.580	0.67	133	47.24
6	135	0.630	0.72	134	49.44
7	135	0.550	0.63	135	46.19
8	135	0.380	0.44	136	38.40
9	135	0.600	0.69	138	48.25
10	135	0.630	0.72	138	49.44
11	135	0.540	0.62	138	45.77
12	130	0.340	0.40	138	36.17
13	135	0.520	0.60	139	44.91
14	135	0.580	0.67	139	47.43
15	135	0.540	0.62	140	45.77
16	135	0.370	0.43	140	37.89
AVG VALUES	133		0.588	136	44.18

TOTAL GAS WITHDRAWN, scf = 46.04
DRY GAS WITHDRAWN, scf = 40.91
WATER VAPOR WITHDRAWN, scf = 5.13
PERCENT WATER VAPOR = 11.14
ACTUAL WET FLOW RATE, acfm = 7,735.50
STANDARD DRY FLOW RATE, scfm = 5,961.84
PARTICULATE CONCENTRATION, grains/dscf = 0.1164
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.201
PARTICULATE EMISSION RATE, lb/hr = 5.81
PERCENT OF ISOKINETIC SAMPLING = 95.57

HILLSHIRE KSI 2 OUT TEST 1 TABLE 2-4 9-20-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 3.141
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 41.40
WATER COLLECTED, ml = 106.00
PARTICULATE COLLECTED, grams = 0.0950
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	125	0.480	1.36	41	42.68
2	125	0.540	1.55	42	45.27
3	130	0.600	1.70	42	47.92
4	130	0.600	1.70	42	47.92
5	125	0.600	1.70	43	47.72
6	130	0.580	1.65	43	47.11
7	130	0.580	1.65	44	47.11
8	130	0.600	1.70	45	47.92
9	130	0.540	1.55	46	45.46
10	125	0.380	1.08	47	37.97
11	125	0.300	0.86	48	33.74
12	125	0.280	0.82	48	32.60
13	125	0.280	0.82	52	32.60
14	130	0.340	0.98	54	36.07
15	130	0.540	1.55	55	45.46
16	125	0.640	1.85	56	49.28
17	130	0.640	1.85	57	49.49
18	130	0.640	1.85	58	49.49
19	125	0.580	1.65	59	46.91
20	125	0.580	1.65	60	46.91
21	130	0.540	1.55	60	45.46
22	130	0.440	1.25	62	41.04
23	125	0.300	0.86	62	33.74
24	125	0.280	0.82	63	32.60
AVG VALUES	128		1.417	51	43.02

TOTAL GAS WITHDRAWN, scf = 45.67
DRY GAS WITHDRAWN, scf = 40.68
WATER VAPOR WITHDRAWN, scf = 4.99
PERCENT WATER VAPOR = 10.93
ACTUAL WET FLOW RATE, acfm = 8,107.45
STANDARD DRY FLOW RATE, scfm = 6,350.97
PARTICULATE CONCENTRATION, grains/dscf = 0.0360
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.063
PARTICULATE EMISSION RATE, lb/hr = 1.95
PERCENT OF ISOKINETIC SAMPLING = 98.37

HILLSHIRE KSI 2 OUT TEST 2 TABLE 2-5 9-20-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 3.141
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 40.48
WATER COLLECTED, ml = 105.00
PARTICULATE COLLECTED, grams = 0.0700
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	125	0.480	1.36	60	42.69
2	125	0.580	1.65	60	46.92
3	130	0.620	1.78	60	48.72
4	130	0.620	1.78	61	48.72
5	130	0.620	1.78	62	48.72
6	125	0.600	1.70	62	47.72
7	125	0.600	1.70	62	47.72
8	130	0.600	1.70	62	47.93
9	130	0.520	1.50	62	44.62
10	130	0.400	1.15	62	39.13
11	125	0.320	0.92	63	34.85
12	125	0.280	0.82	64	32.60
13	125	0.280	0.82	69	32.60
14	130	0.340	0.98	70	36.08
15	130	0.520	1.50	71	44.62
16	130	0.640	1.85	71	49.50
17	130	0.640	1.85	72	49.50
18	130	0.620	1.78	73	48.72
19	130	0.600	1.70	73	47.93
20	130	0.580	1.65	74	47.12
21	130	0.500	1.45	75	43.75
22	130	0.440	1.25	75	41.04
23	130	0.300	0.86	76	33.89
24	130	0.260	0.74	77	31.55
AVG VALUES	129		1.428	67	43.19

TOTAL GAS WITHDRAWN, scf = 44.79
DRY GAS WITHDRAWN, scf = 39.85
WATER VAPOR WITHDRAWN, scf = 4.94
PERCENT WATER VAPOR = 11.03
ACTUAL WET FLOW RATE, acfm = 8,140.21
STANDARD DRY FLOW RATE, scfm = 6,358.28
PARTICULATE CONCENTRATION, grains/dscf = 0.0271
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.047
PARTICULATE EMISSION RATE, lb/hr = 1.45
PERCENT OF ISOKINETIC SAMPLING = 96.26

HILLSHIRE KSI 2 OUT TEST 3 TABLE 2-6 9-20-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 3.141
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 40.60
WATER COLLECTED, ml = 110.00
PARTICULATE COLLECTED, grams = 0.0755
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	125	0.280	0.82	68	32.63
2	125	0.360	0.96	69	37.00
3	130	0.540	1.55	70	45.51
4	130	0.620	1.78	70	48.76
5	130	0.640	1.85	70	49.54
6	130	0.640	1.85	71	49.54
7	130	0.580	1.65	72	47.16
8	130	0.540	1.55	72	45.51
9	125	0.540	1.55	73	45.31
10	130	0.460	1.32	73	42.00
11	125	0.300	0.86	73	33.78
12	125	0.280	0.82	74	32.63
13	130	0.460	1.32	77	42.00
14	130	0.380	1.65	78	38.17
15	130	0.600	1.70	78	47.97
16	125	0.620	1.78	78	48.55
17	130	0.620	1.78	79	48.76
18	130	0.600	1.70	79	47.97
19	130	0.600	1.70	79	47.97
20	130	0.580	1.65	79	47.16
21	130	0.540	1.55	79	45.51
22	130	0.400	1.15	79	39.17
23	125	0.300	0.86	80	33.78
24	130	0.280	0.82	80	32.77
AVG VALUES	129		1.426	75	42.88

TOTAL GAS WITHDRAWN, scf = 45.18
DRY GAS WITHDRAWN, scf = 40.00
WATER VAPOR WITHDRAWN, scf = 5.18
PERCENT WATER VAPOR = 11.46
ACTUAL WET FLOW RATE, acfm = 8,081.40
STANDARD DRY FLOW RATE, scfm = 6,281.82
PARTICULATE CONCENTRATION, grains/dscf = 0.0291
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.051
PARTICULATE EMISSION RATE, lb/hr = 1.55
PERCENT OF ISOKINETIC SAMPLING = 97.81

HILLSHIRE KSI 3 IN TEST 1 TABLE 2-7 9-19-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 2.918
SAMPLING TIME PER POINT, min = 4.00
NUMBER OF POINTS = 16
GAS METER VOLUME, acf = 39.92
WATER COLLECTED, ml = 154.00
PARTICULATE COLLECTED, grams = 0.3707
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	136	0.350	0.45	93	37.18
2	134	0.370	0.47	93	38.16
3	140	0.280	0.36	95	33.37
4	140	0.220	0.28	96	29.58
5	140	0.380	0.48	99	38.87
6	140	0.400	0.51	101	39.88
7	140	0.350	0.45	103	37.30
8	140	0.240	0.31	105	30.89
9	140	0.520	0.63	109	45.47
10	140	0.480	0.60	111	43.69
11	140	0.400	0.51	111	39.88
12	140	0.300	0.38	114	34.54
13	140	0.590	0.73	119	48.43
14	140	0.710	0.88	120	53.13
15	140	0.630	0.79	121	50.05
16	140	0.380	0.48	122	38.87
AVG VALUES	139		0.519	107	39.96

TOTAL GAS WITHDRAWN, scf = 48.05
DRY GAS WITHDRAWN, scf = 40.80
WATER VAPOR WITHDRAWN, scf = 7.25
PERCENT WATER VAPOR = 15.08
ACTUAL WET FLOW RATE, acfm = 6,995.46
STANDARD DRY FLOW RATE, scfm = 5,096.11
PARTICULATE CONCENTRATION, grains/dscf = 0.1402
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.249
PARTICULATE EMISSION RATE, lb/hr = 6.34
PERCENT OF ISOKINETIC SAMPLING = 107.11

HILLSHIRE KSI 3 IN TEST 2 TABLE 2-8 9-19-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 2.918
SAMPLING TIME PER POINT, min = 4.00
NUMBER OF POINTS = 16
GAS METER VOLUME, acf = 38.68
WATER COLLECTED, ml = 151.00
PARTICULATE COLLECTED, grams = 0.3032
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	140	0.450	0.57	119	42.32
2	140	0.380	0.48	118	38.89
3	140	0.320	0.41	119	35.68
4	140	0.220	0.28	120	29.59
5	140	0.400	0.51	120	39.90
6	140	0.430	0.54	121	41.36
7	140	0.370	0.47	122	38.37
8	140	0.230	0.29	123	30.25
9	140	0.540	0.67	125	46.35
10	134	0.550	0.68	126	46.55
11	132	0.460	0.58	127	42.50
12	132	0.270	0.34	128	32.56
13	134	0.550	0.68	129	46.55
14	132	0.760	0.94	129	54.62
15	132	0.680	0.84	130	51.67
16	132	0.380	0.48	130	38.63
AVG VALUES	137		0.547	124	40.99

TOTAL GAS WITHDRAWN, scf = 46.73
DRY GAS WITHDRAWN, scf = 39.62
WATER VAPOR WITHDRAWN, scf = 7.11
PERCENT WATER VAPOR = 15.21
ACTUAL WET FLOW RATE, acfm = 7,175.83
STANDARD DRY FLOW RATE, scfm = 5,241.36
PARTICULATE CONCENTRATION, grains/dscf = 0.1181
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.203
PARTICULATE EMISSION RATE, lb/hr = 5.33
PERCENT OF ISOKINETIC SAMPLING = 101.12

HILLSHIRE KSI 3 IN TEST 3 TABLE 2-9 9-19-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 2.918
SAMPLING TIME PER POINT, min = 4.00
NUMBER OF POINTS = 16
GAS METER VOLUME, acf = 38.52
WATER COLLECTED, ml = 168.00
PARTICULATE COLLECTED, grams = 0.2789
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	137	0.380	0.48	128	38.90
2	138	0.420	0.53	127	40.93
3	140	0.330	0.42	128	36.34
4	140	0.210	0.27	128	28.99
5	140	0.450	0.57	128	42.44
6	140	0.420	0.53	129	41.00
7	140	0.320	0.41	129	35.79
8	140	0.240	0.31	130	31.00
9	134	0.550	0.69	131	46.69
10	134	0.520	0.65	131	45.39
11	134	0.430	0.54	132	41.28
12	134	0.290	0.37	132	33.90
13	134	0.570	0.71	134	47.53
14	134	0.740	0.91	134	54.15
15	134	0.670	0.83	135	51.53
16	134	0.380	0.48	136	38.81
AVG VALUES	137		0.544	131	40.92

TOTAL GAS WITHDRAWN, scf = 47.39
DRY GAS WITHDRAWN, scf = 39.48
WATER VAPOR WITHDRAWN, scf = 7.91
PERCENT WATER VAPOR = 16.69
ACTUAL WET FLOW RATE, acfm = 7,163.83
STANDARD DRY FLOW RATE, scfm = 5,142.12
PARTICULATE CONCENTRATION, grains/dscf = 0.1090
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.187
PARTICULATE EMISSION RATE, lb/hr = 4.87
PERCENT OF ISOKINETIC SAMPLING = 102.72

HILLSHIRE KSI 3 OUT TEST 1 TABLE 2-10 9-19-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 3.141
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 35.52
WATER COLLECTED, ml = 135.00
PARTICULATE COLLECTED, grams = 0.0657
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	0.340	0.92	45	36.39
2	135	0.380	1.02	46	38.64
3	135	0.390	1.05	47	39.14
4	135	0.420	1.14	48	40.62
5	140	0.450	1.20	49	42.22
6	135	0.450	1.20	50	42.05
7	135	0.470	1.22	50	42.97
8	135	0.420	1.10	51	40.62
9	135	0.340	0.90	52	36.55
10	140	0.320	0.84	53	35.60
11	135	0.300	0.78	54	34.33
12	135	0.300	0.78	54	34.33
13	135	0.350	0.92	58	37.08
14	135	0.400	1.05	59	39.64
15	135	0.420	1.10	59	40.62
16	135	0.450	1.15	60	42.05
17	135	0.470	1.22	60	42.97
18	135	0.470	1.22	62	42.97
19	140	0.450	1.15	63	42.22
20	135	0.380	1.00	64	38.64
21	135	0.320	0.84	64	35.46
22	135	0.320	0.84	65	35.46
23	135	0.320	0.84	65	35.46
24	135	0.300	0.78	65	34.33
AVG VALUES	135		1.011	56	38.76

TOTAL GAS WITHDRAWN, scf = 41.24
DRY GAS WITHDRAWN, scf = 34.88
WATER VAPOR WITHDRAWN, scf = 6.35
PERCENT WATER VAPOR = 15.41
ACTUAL WET FLOW RATE, acfm = 7,305.51
STANDARD DRY FLOW RATE, scfm = 5,363.55
PARTICULATE CONCENTRATION, grains/dscf = 0.0291
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.050
PARTICULATE EMISSION RATE, lb/hr = 1.34
PERCENT OF ISOKINETIC SAMPLING = 99.89

HILLSHIRE KSI 3 OUT TEST 2 TABLE 2-11 9-19-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 3.141
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 35.00
WATER COLLECTED, ml = 141.00
PARTICULATE COLLECTED, grams = 0.0699
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	0.360	0.94	50	37.67
2	135	0.360	0.94	51	37.67
3	135	0.410	1.16	51	40.20
4	140	0.460	1.20	52	42.75
5	135	0.470	1.22	52	43.04
6	135	0.470	1.22	53	43.04
7	135	0.450	1.16	53	42.11
8	135	0.400	1.05	54	39.70
9	135	0.350	0.92	55	37.14
10	135	0.300	0.78	55	34.38
11	135	0.300	0.78	55	34.38
12	135	0.280	0.74	55	33.22
13	135	0.320	0.84	58	35.51
14	135	0.340	0.90	59	36.60
15	140	0.360	0.94	60	37.82
16	135	0.400	1.05	60	39.70
17	135	0.440	1.15	60	41.64
18	135	0.460	1.20	60	42.58
19	135	0.440	1.15	60	41.64
20	135	0.400	1.05	61	39.70
21	135	0.360	0.94	62	37.67
22	135	0.340	0.90	62	36.60
23	135	0.300	0.78	62	34.38
24	135	0.300	0.78	62	34.38
AVG VALUES	135		0.991	57	38.48

TOTAL GAS WITHDRAWN, scf = 41.01
DRY GAS WITHDRAWN, scf = 34.37
WATER VAPOR WITHDRAWN, scf = 6.64
PERCENT WATER VAPOR = 16.18
ACTUAL WET FLOW RATE, acfm = 7,252.03
STANDARD DRY FLOW RATE, scfm = 5,275.57
PARTICULATE CONCENTRATION, grains/dscf = 0.0314
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.053
PARTICULATE EMISSION RATE, lb/hr = 1.42
PERCENT OF ISOKINETIC SAMPLING = 100.08

HILLSHIRE KSI 3 OUT TEST 3 TABLE 2-12 9-19-91

BAROMETRIC PRESSURE, in Hg = 29.300
TIP DIAMETER, in .2500
STACK AREA, sq ft = 3.141
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 34.72
WATER COLLECTED, ml = 148.00
PARTICULATE COLLECTED, grams = 0.0637
CO2 = 0.20 O2 = 20.40 CO = 0.00 N2 = 79.40

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	0.330	0.86	52	36.12
2	135	0.350	0.92	53	37.20
3	135	0.370	0.98	54	38.25
4	140	0.400	1.05	54	39.93
5	135	0.440	1.15	54	41.71
6	135	0.460	1.20	54	42.64
7	135	0.430	1.12	55	41.23
8	140	0.400	1.05	56	39.93
9	135	0.370	0.98	57	38.25
10	135	0.320	0.84	58	35.57
11	135	0.300	0.78	59	34.44
12	135	0.300	0.78	59	34.44
13	135	0.350	0.92	61	37.20
14	135	0.360	0.94	62	37.73
15	135	0.400	1.05	62	39.77
16	140	0.460	1.20	62	42.82
17	135	0.470	1.22	63	43.11
18	135	0.480	1.25	64	43.56
19	135	0.440	1.15	64	41.71
20	135	0.400	1.05	65	39.77
21	135	0.360	0.94	65	37.73
22	135	0.340	0.88	65	36.66
23	135	0.300	0.78	65	34.44
24	135	0.280	0.74	65	33.27
AVG VALUES	136		0.993	60	38.64

TOTAL GAS WITHDRAWN, scf = 41.08
DRY GAS WITHDRAWN, scf = 34.11
WATER VAPOR WITHDRAWN, scf = 6.97
PERCENT WATER VAPOR = 16.96
ACTUAL WET FLOW RATE, acfm = 7,282.82
STANDARD DRY FLOW RATE, scfm = 5,246.82
PARTICULATE CONCENTRATION, grains/dscf = 0.0288
PARTICULATE EMISSIONS, lb/1000 lb wet gas = 0.049
PARTICULATE EMISSION RATE, lb/hr = 1.29
PERCENT OF ISOKINETIC SAMPLING = 99.85

2.2 Formaldehyde Emissions

Testing to determine the formaldehyde emissions was performed using the sampling and analytical procedures of NIOSH Method 3500. A further description of the method is included in Section 3.2.

The formaldehyde emission limit specified for KSI-2 and KSI-3 in the permit is 0.007 lb/hr, however, a footnote in the permit indicates that this limit may be subject to change pending the test results. The results of the formaldehyde testing were as follows:

KSI-2 Test	Formaldehyde into Scrubber Rate	Formaldehyde Emissions Rate
1	0.066 lb/hr	0.029 lb/hr
2	0.071 lb/hr	0.039 lb/hr
3	0.064 lb/hr	0.030 lb/hr
Avg	0.067 lb/hr	0.033 lb/hr

KSI-3 Test	Formaldehyde into Scrubber Rate	Formaldehyde Emissions Rate
1	0.071 lb/hr	0.035 lb/hr
2	0.057 lb/hr	0.026 lb/hr
3	0.067 lb/hr	0.034 lb/hr
Avg	0.065 lb/hr	0.032 lb/hr

2.3 Acetic Acid Emissions

Testing to determine the acetic acid emissions was performed using the sampling and analytical procedures outlined in EPA Method 18, direct interface with the gas chromatograph. A further description of the method is included in Section 3.3.

The acetic acid emission limit specified for KSI-2 and KSI-3 in the permit is 0.303 lb/hr. The test results are summarized below:

KSI-2:

Test	Acetic Acid into Scrubber Rate	Acetic Acid Emissions Rate
1	.267 lb/hr	.193 lb/hr
2	.256 lb/hr	.161 lb/hr
3	.250 lb/hr	.119 lb/hr
Avg	.258 lb/hr	.158 lb/hr

KSI-3:

Test	Acetic Acid into Scrubber Rate	Acetic Acid Emissions Rate
1	.214 lb/hr	.136 lb/hr
2	.222 lb/hr	.139 lb/hr
3	.202 lb/hr	.129 lb/hr
Avg	.213 lb/hr	.135 lb/hr

2.4 Organic Compound Emissions

The testing was performed using an on-site gas chromatograph as outlined in EPA Method 18 - "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography." A description of the method is given in Section 3.3.

The permit for KSI-2 and KSI-3 specifies that organic compound emissions be controlled by at least 85 %. Organic compounds include acetic acid, formaldehyde, and the other unidentified organic compounds which were quantified as acetaldehyde. The results of the testing were as follows:

KSI-2 TOTAL ORGANIC COMPOUNDS

Test	into Scrubber Rate	Emissions Rate	Control Efficiency
1	3.66 lb/hr	0.72 lb/hr	80 %
2	4.17 lb/hr	0.59 lb/hr	86 %
3	4.42 lb/hr	0.56 lb/hr	87 %
Avg	4.08 lb/hr	0.62 lb/hr	85 %

KSI-3

Test	TOTAL ORGANIC COMPOUNDS into Scrubber Rate	Emissions Rate	Control Efficiency
1	2.34 lb/hr	0.57 lb/hr	76 %
2	3.30 lb/hr	0.66 lb/hr	80 %
3	2.66 lb/hr	0.65 lb/hr	75 %
Avg	2.77 lb/hr	0.63 lb/hr	77 %

2.5 Visible Emissions

The visible emissions from each of the smokehouse stacks was observed in accordance with the procedures outlined in EPA Method 9. The permit for KSI-2 and KSI-3 specifies that the visible emissions not exceed 20 % opacity. The highest six minute average opacity for each smokehouse stack was as shown below:

STACK	MAXIMUM 6 MINUTE OPACITY
KSI-2	10.0 %
KSI-3	10.2 %

3.0 METHODS OF TESTING

3.1 Particulate Emissions

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 EPA Method 5 (40 CFR, Part 60, Appendix A).

The sampling train consisted of a stainless steel probe tip, a heated probe, a heated glass cyclone and flask, and a heated filter holder with a tared 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 of distilled 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 as Figure 3-1.

The temperatures of the stack gas stream, as well as 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 during the test.

The principle of the method was to collect a representative sample of the exhaust gas stream. This was done 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 samples were collected from the stack and analyzed on-site with an Orsat analyzer for percentage CO_2, O_2, and N_2.

At the completion of the test, the probe tip and probe 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 first three impingers, as well as the probe and glassware following the filter, were then rinsed with acetone which was placed in a tared beaker and evaporated to dryness at room temperature. The impinger water was subjected to organic compound extraction using 1,1,2-trichloro-1,2,2-trifluoroethane. The extract was evaporated in tared beakers at room temperature. Following the organic compound extraction, a 100 milliliter aliquot of the remaining water was evaporated to dryness in a tared beaker at 220 F.

The combined weight of the filter catch, the probe and tip washing residue and the three beaker residues from the "back-half" analysis for condensible particulate matter (acetone rinse, organic compound extract, and impinger water residue corrected to account for the aliquot size) were used to determine the 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 Emissions

Samples for formaldehyde were obtained using NIOSH Method 3500 as recommended by the Wisconsin DNR for toxic air emissions sampling.

The sampling train consisted of a glass probe connected to midget impingers by tygon tubing; a series of three midget impingers were placed in an ice bath. The first two impingers each contained 15 milliliters (ml) of absorbing solution (1% sodium bisulfite), and the third was dry to serve as a trap for carry-over of any liquid. The gas then passed through a silica gel tube to trap all water vapor prior to the sampling pump and dry gas meter. A schematic of the sampling train is included as Figure 3-2.

The principle of the method was to collect a representative sample of the exhaust gas stream by placing the probe at a single point in the duct and sampling for a 60 minute period at a nominal sampling rate of 1 liter per minute. The testing was coordinated with the particulate emissions test runs. At the completion of each test, a leak check was performed.

3.3 Acetic Acid and Total Organic Compound Emissions

Sampling for organic compounds 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 using a glass syringe, with volume of one cubic centimeter (cc). Samples taken from the stack were injected directly into the heated injection port of an Analytical Instruments Corporation (AID) Model 511 portable GC. The GC conditions were as follows:

Column	DC 200
Temperature	106 C
Carrier Gas	Nitrogen at 20 cc/min

Recorded chromatograms were obtained using a Hewlett Packard Model 3309A integrator.

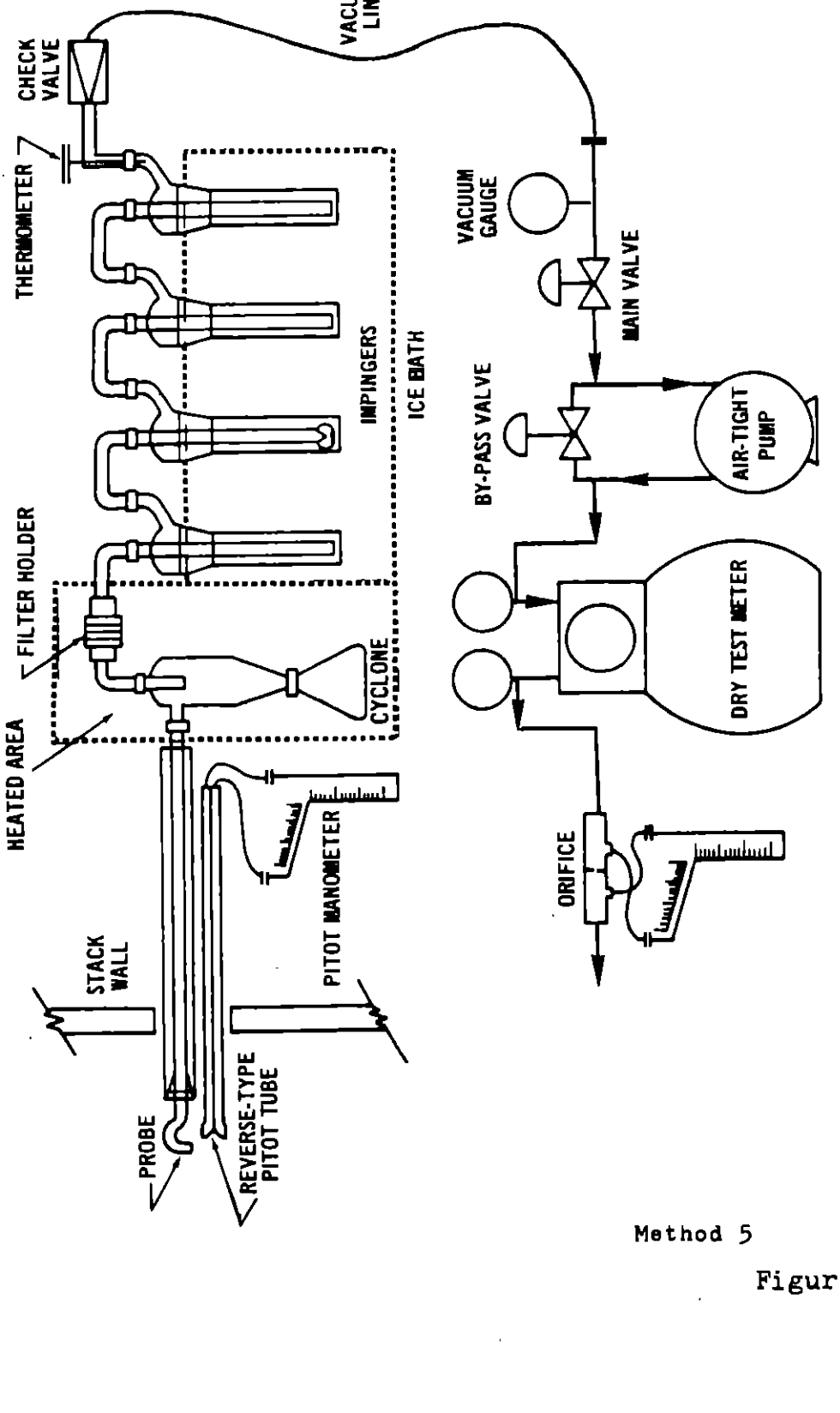
Standard concentrations of acetaldehyde and acetic acid were prepared by injecting a known quantity of each solvent into a 1 liter flask which was gently heated (hot water bath) to assure complete vaporization; after heating, the standard was allowed to return to standard temperature conditions.

A 1 cc sample of the calibration standard was injected into the GC and 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. Retention time was used to identify the acetic acid and the GC response to the acetic acid standard was used to quantify the acetic acid in the exhaust gas stream. The acetaldehyde standard was then used to quantify the remaining compounds seen on the chromatogram, that is, the area under all of the peaks except acetic acid were totaled and then compared to a standard concentration of acetaldehyde.

The compound concentrations were then used in conjunction with the exhaust gas flow rates to determine both the acetic acid and total organic compound emission rates in units of pounds per hour (lb/hr).

3.4 Visible Emissions

The visible emissions from each of the smokehouse stacks was observed in accordance with the procedures outlined in EPA Method 9.



Particulate sampling train.

Method 5

Figure 3-1

4.0 CALIBRATION DATA

The probe tips, pitot tube, dry gas meter, and orifices were calibrated prior to the particulate and particle sizing testing 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 diameters	d =	0.250"
Pitot tube coeff.	Cp =	0.85
Orifice coeff.	$\Delta H@$ =	1.77

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

$$Gama = 1.002 + ((Td - 70) \times .00012)$$

where: Td = Dry Gas Meter Temperature

The dry gas meter used for the formaldehyde testing was not temperature compensated; therefore, all of the sample volumes were corrected for temperature to 68 F. The coefficient of this meter was 1.020.

The most recent calibrations were performed August 5, 1991.

APPENDIX A

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

SAMPLE CALCULATIONS
for
Single Point (non-isokinetic) Sampling

1. DRY GAS SAMPLE VOLUME (Vm m3, std), std cubic meters

Vm m3, std = GAMA*(Vm)*(Pb)/29.92*528/Tmavg*0.02832

where: GAMA = dry gas meter calibration factor
Vm = volume of dry gas metered, cubic feet
Tmavg = average meter temperature, deg R (460+F)
528 = std temperature, deg R
0.02832 = cubic meters per cubic foot factor

2. EMISSION CONCENTRATION (EC), milligrams per std cubic meter

EC = (mg-mgb)/(Vm m3, std)

where: mg = milligrams of compound found in sample, determined from comparison to a generated standard curve.
mgb = milligrams of compound found in "blank" sampling media

3. EMISSION RATE (ER), pounds per hour

ER = EC*(Qs)*0.02832*60*(1/453600)

where: Qs = stack gas flow rate, std cubic feet per minute
60 = minutes per hour factor
1/453600 = pound per milligrams factor

APPENDIX B

FIELD & LABORATORY DATA SHEETS

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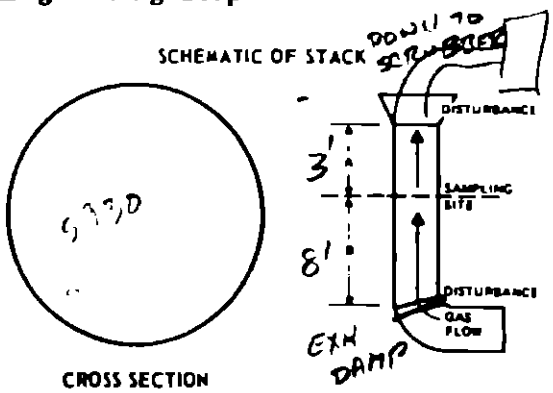
PARTICULATE FIELD DATA



PLANT Hillshire
DATE 9-19-91
LOCATION NEW LONDON
OPERATOR MJH
STACK NO. KST-2 INLET
RUN NO. 1
SAMPLE BOX NO. 4
METER BOX NO. 2

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 15%
PROBE LENGTH, in. 5'SS
NOZZLE DIAMETER, in. 1/4"
STACK DIAMETER, in. 20½ x 20½
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 0.2
O_2 20.4
CO
N_2 BAL

PRE LK OK
PITOT OK
POST LK OK

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{P_s}$)		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	SKC 2 ORG SAMPLE BOX TEMPERATURE F	HCOW 8:1.029 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in Hg gauge	VELOCITY fps
B 1	8:35		130	.54		.63		8218.40		97	008034	402.95		T = 83
2	39	-1.9	132	.57		.66		20.8		99	041180	407.16	(3)	T = 84
3	43		132	.47		.54		23.6		99	33146	4.21		
4	47		130	.37		.43		26.2		101				
A 1	51/54		130	.50		.58		28.5		105	ST:	8:38		
2	58	-1.9	130	.51		.63		31.1		109	F:	9:49	(3)	
3	902		130	.46		.53		35.8		110				
4	6		130	.34		.40		36.5		112				
C 1	10/16		130	.62		.70		38.5		117				
2	20	-2.0	130	.65		.75		41.3		118				
3	24		132	.49		.57		44.2		119				
4	28		132	.35		.41		46.7		120				
D 1	32/36		130	.58		.67		48.8		121				
2	40	-2.0	132	.64		.73		51.5		122				
3	44		132	.42		.49		54.3		123				
4	48		130	.35		.41		56.6		125				
	52							58.72						
								40.72						

Technology &
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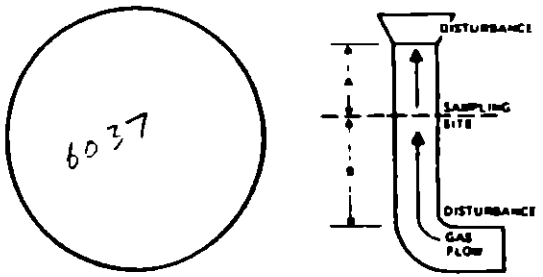
PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT HILLSHIRE
DATE 9-20-91
LOCATION NEW LONDON
OPERATOR MJH
STACK NO. KSI-2 IN
RUN NO. 2
SAMPLE BOX NO. 5
METER BOX NO. 2

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 15%
PROBE LENGTH, in. 5' S.S.
NOZZLE DIAMETER, in. 1/4"
STACK DIAMETER, in. (20 1/2)²
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 0.2
O_2
CO
N_2

PRE LK OK
PITOT OK
POST LK OK

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{P_s}$)	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 (SKC 2)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F (Y = 1.029)	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	10:20:00		130	.55	.64		8260.00		126	041180	407.16	(5)	T=85
2	24	-2.0	132	.55	.64		62.7		125	070546	410.13		T=88
3	28		132	.51	.59		65.3		127	29366	2.97		
4	32		130	.36	.42		67.8		128				
B 1	36/38		130	.63	.72		70.1		129				
2	42	-2.1	130	.60	.69		72.8		129	37	10:18		
3	46		130	.52	.60		75.5		130	F	11:22		
4	50		130	.38	.44		78.0		130				
C 1	54/58		130	.64	.73		80.2		132			(6)	
2	11:02	-2.0	130	.66	.76		83.0		132				
3	6		130	.55	.64		85.9		133				
4	10		130	.40	.47		88.4		133				
D 1	14/16		130	.48	.56		90.7		135				
2	20	-2.0	130	.54	.63		93.2		137				
3	24		130	.46	.53		95.7		136				
4	28		130	.32	.37		98.1		139				
	32						300.12						

40.12

Technology &
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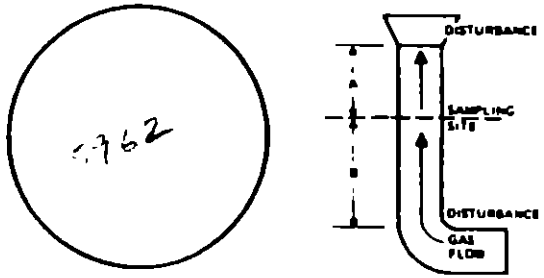
PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillshire
DATE 9-20-91
LOCATION NEW LONDON
OPERATOR MJH
STACK NO. KST-2 I/N
RUN NO. 3
SAMPLE BOX NO. 6
METER BOX NO. 2

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 15%
PROBE LENGTH, in. 5' S.S.
NOZZLE DIAMETER, in. 1/4"
STACK DIAMETER, in. (20 1/2)²
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE
ORSAT RESULTS
CO_2
O_2
CO
N_2
PROBE OK
PITOT OK
POSTLK

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{P_s}$)		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	SKC 2 SAMPLE BOX TEMPERATURE °F	γ = 1.029 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	1206:00		130	.50		.58		8301.00		130	070546	410.13		T=89
2	10	-1.9	130	.55		.63		3.5		131	098724	413.17	(6)	T=90
3	14		130	.48		.56		6.2		131	28178	3.04		
4	18		130	.36		.42		8.6		132				
B 1	22/24		130	.58		.67		10.8		133	ST: 12:08			
2	28	-2.0	135	.63		.72		13.4		134	F 13:11			
3	32		135	.55		.63		16.1		135				
4	36		135	.38		.44		18.7		136				
C 1	40/43		135	.60		.69		20.9		138			(7)	
2	47	-1.9	135	.63		.72		23.6		138				
3	51		135	.54		.62		26.3		138				
4	55		130	.34		.40		28.9		138				
D 1	59/01		135	.52		.60		31.0		139				
2	05	-1.9	135	.58		.67		33.5		139				
3	09		135	.54		.62		36.2		140				
4	13		135	.37		.43		38.7		140				
	17							40.88						
									39.88					

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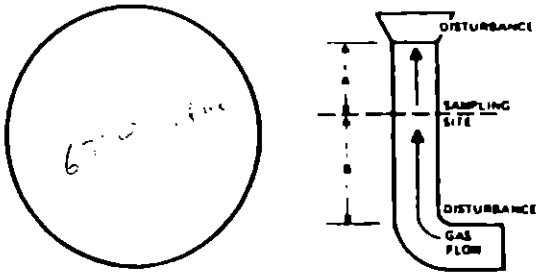
PARTICULATE FIELD DATA

Cp = 0.85
γ = 1.002 } 8-5-91

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillsmere
DATE 9-20-91
LOCATION New London
OPERATOR WJD
STACK NO. KSS 2 Out
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 1

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 5
PROBE LENGTH, in. 3'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 24
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH 1.77
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 0.2
O_2 20.9
CO
N_2

Pre Leak Check
Pitot Leak Ck

Post Leak Ck

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	SAMPLE BOX TEMPERATURE F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	0823-30		125	.48	1.36		7338.000		41	993.54/99	61 50 62		
2	35	-.28	125	.51	1.55		37		42	995.54/99	61 64 56		
3	37		130	.60	1.70		36.6		42				
4	40		130	.60	1.70		38.6		42	2.00/4			
5	43	-.26	125	.60	1.70		40.5		43				
6	45		130	.58	1.65		42.4		43				
7	48		130	.58	1.65		44.4		44				
8	50	-.30	130	.60	1.70		46.2		45				
9	52		130	.54	1.55		48.1		46				
10	55		125	.38	1.08		49.9		47				
11	57	-.26	125	.30	.86		51.5		48				
12	100		125	.28	.82		52.8		48				
B 13	02 05		125	.28	.82		54.2		52				
14	07	-.24	130	.34	.98		55.5		54				
15	10		130	.54	1.55		57.1		55				
16	12		125	.64	1.85		58.7		56				
17	15	-.26	130	.64	1.85		60.7		57				
18	18		130	.64	1.85		62.6		58				
19	20		125	.58	1.67		64.6		59				
20	23	-.28	125	.58	1.67		66.5		60				
21	25		130	.54	1.55		68.3		60				
22	28		130	.44	1.27		70.1	41.90	62				
23	30	-.24	125	.30	.86		71.7		62				
24	33		125	.28	.80		73.1		63				

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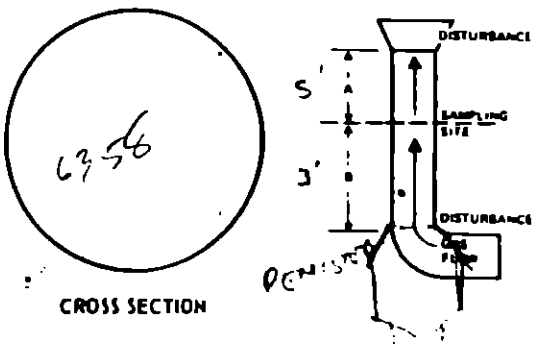
PARTICULATE FIELD DATA

SCHEMATIC OF STACK



PLANT Millstone
DATE 9-20-91
LOCATION New London
OPERATOR WJD
STACK NO. KSET 2 Out
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % SAT
PROBE LENGTH, in. 3'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 24
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
FACTOR
PROCESS WEIGHT RATE
ORSAT RESULTS
CO_2 20.0
O_2 20.0
CO
N_2
PRE LEAK OK
PITOT 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	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O DESIRED	GAS SAMPLE VOLUME (Vm), 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	IMPINGER SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in Hg gauge	VELOCITY fps
1	1020 00		125	.48	1.30		7376.00		60	995.50/48	67695		
2	03		125	.58	1.65		77.7		60	947.50/40	70150		
3	06	-.1	130	.62	1.70		79.6		60				
4	09		130	.62	1.78		81.5		61	2.00/54			
5	30		130	.62	1.78		83.4		62	"			
6	33		125	.60	1.70		85.4		62				
7	36	-.2	125	.60	1.70		87.3		62				
8	39		130	.60	1.70		89.2		62				
9	40		130	.52	1.50		91.0		62				
10	42		130	.40	1.14		92.7		62				
11	45		125	.32	.92		94.4		63				
12	48		125	.28	.82		95.7		64				
13	50/52		121	.28	.80		97.0		69				
14	53		130	.34	.98		98.3		70				
15	56	-.28	130	.52	1.50		99.6		71				
16	00		130	.64	1.85		01.2		71				
17	03		130	.64	1.85		03.4		72				
18	05		130	.62	1.78		05.3		73				
19	07		130	.60	1.70		07.1		73				
20	10		130	.58	1.65		09.0		74				
21	13		130	.50	1.45		10.8		75				
22	15		130	.44	1.21		12.4	(40.98)	75				
23	17		130	.30	.86		13.9		76				
24	20		130	.20	.74		15.2		77				

Technology &
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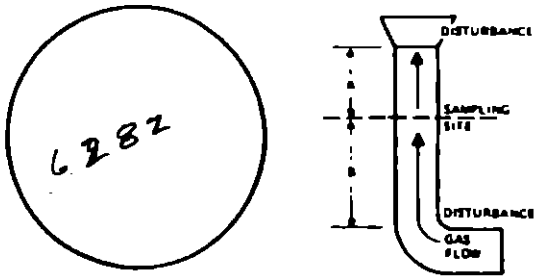
PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillsmere
DATE 7-22-91
LOCATION Newtown
OPERATOR WJD
STACK NO. ICST 2 0.05
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. 1

AMBIENT TEMPERATURE 55
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % SAT
PROBE LENGTH, in. 3'
NOZZLE DIAMETER, in. 1/2
STACK DIAMETER, in. 26
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH@
C FACTOR
PROCESS WEIGHT RATE
ORSAT RESULTS
CO_2
O_2
CO
N_2
Pr: Leak
Pitot 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	HCl SAMPLE BOX TEMPERATURE °F	SYS #3 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
1	1205:53		125	.28	.82		7418.10		68	947.50/56	701000		
2	07+		125	.36	96		19.5		69	999.50/56	723000		
3	10		130	.54	1.55		20.8		70				
4	12+	-.28	130	.62	1.70		22.6		70	2.00/55			
5	1?		130	.64	1.85		24.4		70				
6	1??		130	.64	1.85		26.4		71				
7	2?		130	.58	1.65		28.3		72				
8	2?-		130	.54	1.55		30.2		72				
9	2?		125	.54	1.55		31.9		73				
10	2?		130	.46	1.32		33.8		73				
11	??		125	.30	.86		35.4		75				
12	??		125	.28	.82		36.8		74				
13	3:37+		130	.46	1.32		38.1		77				
14	4?		130	.58	1.65		39.7		78				
15	4?+		130	.60	1.70		41.5		78				
16	4?	-.28	125	.62	1.78		43.3		78				
17	4?-		130	.62	1.78		45.3		79				
18	5?		130	.60	1.70		47.1		79				
19	5?+		130	.60	1.70		49.0		79				
20	5?		130	.58	1.65		50.9		79				
21	5?+		130	.54	1.55		52.7		79				
22	00		130	.40	1.15		54.4	40.60	79				
23	0?+		125	.30	.86		56.0		80				
24	0??		125	.28	.82		57.3		80				

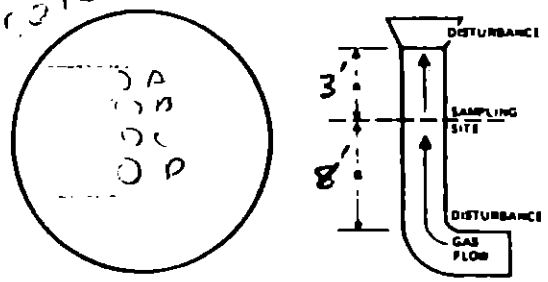
Technology & Engineering Corp.

.60 → .75

PARTICULATE FIELD DATA

SCHEMATIC OF STACK

.076



CROSS SECTION

PLANT Hillsmire
DATE 9-19-91
LOCATION Nonwood
OPERATOR MJH
STACK NO. KSI 3 - INLET
RUN NO. 1
SAMPLE BOX NO. 4
METER BOX NO. 2

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 10
PROBE LENGTH, in. 5' SS
NOZZLE DIAMETER, in. .76
STACK DIAMETER, in. 20.5 x 20.5
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 0.2 (BOTH)
O_2 20.4 "
CO 560 IN / 550 OUT BAG
N_2 - BAL -
INTEG

PROBE LK-OK
PITOT-OK
POST LK-OK

4 min/PT

SKC 2 ORGANICS

HCOH

γ = 1.029

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	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
B 1	1050		136	.35	.45		092.00		93	910634	394.00 T	81 (2)	
2	54	-2.1	134	.37	.47		94.4		93	945123	397.19 T	85	
3	58		140	.28	.36		96.8		95	34489	3.19		
4	1102		140	.22	.28		99.0		96	10:48 -	12:06		
A 5	06/07		140	.38	.48		8100 9		99				
6	11	-2.2	140	.40	.51		3.3		101			(2)	
7	15		140	.35	.45		5.8		103				
8	19		140	.24	.31		8.1		105				
C 9	23/26		140	.52	.63		10.0		109				
10	30	-2.3	140	.48	.60		12.7		111				
11	34		140	.40	.51		15.3		111			(2)	
12	38		140	.36	.38		17.6		114				
D 13	42/50		140	.59	.73		19.8		119				
14	54		140	.71	.88		22.6		120				
15	58	-2.3	140	.63	.79		25.6		121				
16	1202		140	.38	.48		28.		122				
	06						31.92						

3 9.92

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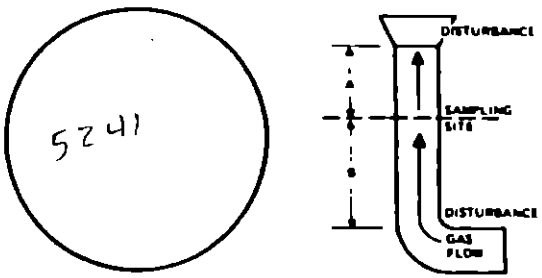
PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT HILLSHIRE
DATE 9-19-91
LOCATION NEW LONDON
OPERATOR MJH
STACK NO. KSI 3-IN
RUN NO. 2
SAMPLE BOX NO. 5
METER BOX NO. 2

AMBIENT TEMPERATURE 85
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 10
PROBE LENGTH, in. 5'SS
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. (20½)²
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE
ORSAT RESULTS
CO_2
O_2
CO
N_2
PROBE-OK
PITOT-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 (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), F	SAMPLE BOX TEMPERATURE F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	γ=1.029 HCON METER TEMP VELOCITY fps
								SKC 2	HCON				
B 1	1300:00		140	.45	.57		8134.00		119	945123	397.19	(5)	T:86
2	4	-2.2	140	.38	.48		36.5		118	974645	399.68		T=88
3	8		140	.32	.41		38.8		119	29522	2.49		
4	12		140	.22	.28		41.0		120				
A 1	16/17		140	.40	.51		42.9		120			(5)	
2	21	-2.3	140	.43	.54		45.3		121	ST 13:00			
3	25		140	.37	.47		47.8		122	F 14:06			
4	29		140	.23	.29		50.1		123				
C 1	33/36		140	.54	.67		51.8		125				
2	40	-2.3	134	.55	.68		54.5		126				
3	44		132	.46	.58		57.3		127				
4	48		132	.27	.34		59.8		128				
D 1	52/57		134	.55	.68		61.7		129				
2	1401	-2.3	132	.76	.94		64.4		129				
3	5		132	.68	.84		67.4		130				
4	9		132	.38	.48		70.4		130				
	13						72.68						
								38.68					

Technology &
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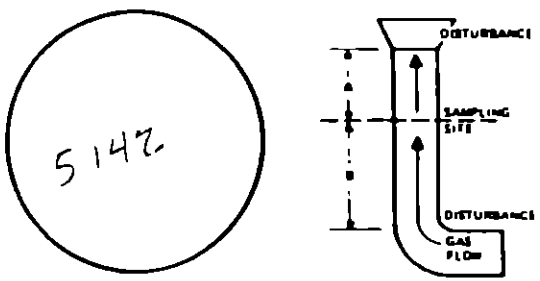
PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillsmere
DATE 9-19 91
LOCATION New London
OPERATOR MJH
STACK NO. KSI 3-IN
RUN NO. 3
SAMPLE BOX NO. 6
METER BOX NO. 2

AMBIENT TEMPERATURE 90
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 10
PROBE LENGTH, in. 5' S.S.
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. (20½)²
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2
O_2
CO
N_2

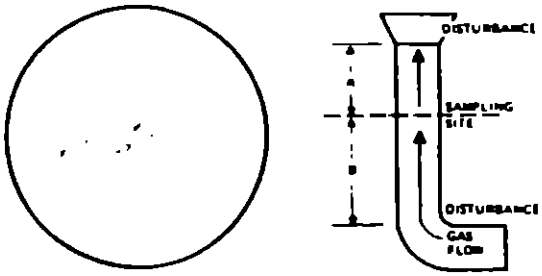
PROBE OK
PITOT OK
POSTICK - OK

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 (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), °F	SKC 2 ORG's SAMPLE BOX TEMPERATURE °F	γ = 1.029 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in Hg gauge	VELOCITY fps
A 1	14:50		137	.38	.48		8178.00		128	974645	400.94	(5)	T:88
2	54	-2.3	138	.42	.53		80.3		127	008035	402.95		T=88
3	58		140	.33	.42		82.7		128		2.01		
4	1502		140	.21	.27		84.9		128				
B 1	6/9		140	.45	.57		86.7		128	ST 14:52	15:01		
2	13	-2.3	140	.42	.53		89.2		129	F 16:06	16:06		
3	17		140	.32	.41		91.6		129			(5)	
4	21		140	.24	.31		93.8		130				
C 1	25/30		134	.55	.69		95.7		131				
2	34	-2.3	134	.52	.65		98.4		131				
3	38		134	.43	.54		201.0		132				
4	42		134	.29	.37		3.4		132			(5)	
D 1	46/48		134	.57	.71		5.5		134				
2	52	-2.3	134	.74	.91		8.2		134				
3	56		134	.67	.83		11.3		135				
4	1600		134	.38	.48		14.2		136				
	04						16.52						
							38.52						

Environmental
Technology &
Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillsmere Farm
DATE 9-19-91
LOCATION New London
OPERATOR WJO
STACK NO. KSC 3 - Outlet
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 1

AMBIENT TEMPERATURE 95
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % SAT (18%)
PROBE LENGTH, in. 3'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 24
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH 1.77
C FACTOR
PROCESS WEIGHT RATE

Cp: 0.81
γ: 1.002
8.5 91

ORSAT RESULTS
CO_2 0.2
O_2 20.4
CO
N_2

Pre Leak Post Leak
Pitot Leak

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{P_s}$)	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	HKOH γ 1.020 SAMPLE BOX TEMPERATURE °F	SKC #5 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps	
A 1	10 5000		130	.34	.92		7217.00		95	937.50/50	161796			1.0
2	504	-.20	135	.38	1.02		18.5		96	939.50/50	17 0796			1.6
3	55		137	.39	1.05		20.0		97		17000			2.8
4	514	-.26	135	.42	1.14		21.5		98	2.00/50				4.2
5	00		140	.45	1.20		23.1		99					5.0
6	054	-.26	135	.45	1.20		24.7		50					5.8
7	05		135	.47	1.22		26.4		50					
8	07+	-.22	135	.42	1.10		28.1		51					
9	10		135	.34	.90		29.7		52					
10	104	-.20	140	.32	.84		31.1		53					
11	15		135	.30	.78		32.9		50					
12	17+	-.22	135	.30	.78		33.6		56					
B 13	20/21		135	.35	.92		30.95		58					
14	25	-.20	135	.40	1.05		36.4		59					
15	29+		135	.42	1.10		37.9		59					
16	30	-.24	135	.45	1.15		39.4		60					
17	32+		135	.47	1.22		41.0		60					
18	35	-.24	135	.47	1.22		42.6		60					
19	37+		140	.45	1.15		44.3		63					
20	40	-.22	135	.38	1.00		45.9		64					
21	42		135	.33	.84		47.3		64					
22	45	-.20	135	.32	.84		48.6	35.52	65					
23	47		135	.35	.89		49.9		65					
24	50		135	.30	.78		51.2		65					

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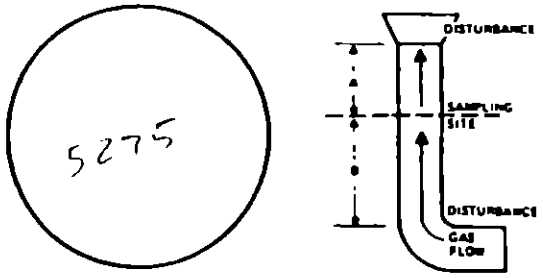
DROPLETS VISIBLE IN STACK

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillstreet
DATE 9-19-91
LOCATION New London
OPERATOR WJD
STACK NO. KSI3 Out
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE 91°
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 18
PROBE LENGTH, in. 3'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 2f
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 0.2
O_2 20.4
CO
N_2

PRE LK .01
PITOT LK .01

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 (Vm), 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	HEATER SAMPLE BOX TEMPERATURE °F	SKC #5 TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. H_g gauge	VELOCITY fps
B 1	125750		135	36	.96		7255.00		50	939.50/46	178000		
2	00		131	.36	.96		56.5		51	941.50/46	198300		
3	05		135	.41	1.16		57.9		51		19500		
4	10	-.22	140	.46	1.30		59.5		52	2.00/46			
5	15		135	.47	1.32		61.1		52				
6	20		135	.47	1.32		62.7		53				
7	25		135	.45	1.16		64.4		53				
8	30		135	.40	1.05		66.1		54				
9	35		135	.35	.92		67.5		55				
10	40		131	.30	.79		68.9		55				
11	45		135	.30	.78		70.3		55				
12	50		135	.28	.74		71.5		55				
13	55/30		135	.32	.84		72.7		58				
14	301		135	.34	.90		74.1		59				
15	35		140	.36	.94		75.6		60				
16	37	-.22	135	.40	1.05		76.9		60				
17	40		135	.44	1.15		78.4		60				
18	45		135	.46	1.20		80.0		60				
19	50		135	.44	1.15		81.6		60				
20	55		135	.40	1.05		83.2		61				
21	57		135	.36	.94		84.6		62				
22	301		135	.34	.90		86.1	35.00	62				
23	05		135	.30	.78		87.4		62				
24	10		135	.30	.78		88.7		62				

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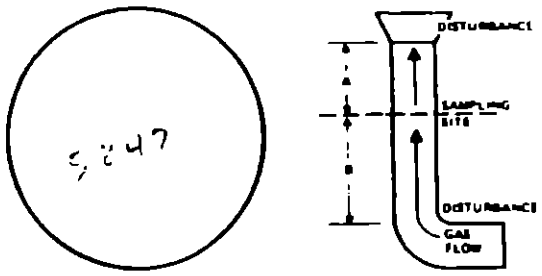
PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillsmare
DATE 9-19-91
LOCATION New London
OPERATOR WJD
STACK NO. KSI 3 OUT
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. 1

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 18
PROBE LENGTH, in.
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 24
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2
O_2
CO
N_2

Pitot leak on Pitot check

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{P_s}$)	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	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	1947.30		131	.33	.80		7291.100		52	941.50/248	198 300		
2	50		133	.35	.92		92.9		53	943.50/248	209 067		
3	52		135	.37	.99		93.7		54				
4	55	-.24	140	.40	1.05		95.2		54				
5	58		135	.44	1.15		96.7		54				
6	00		135	.46	1.20		98.2		54				
7	02		135	.43	1.12		00.0		55				
B	05		140	.40	1.05		01.5		56				
9	07		131	.37	0.98		03.0		57				
10	10		132	.32	.84		04.4		58				
11	12		135	.30	.78		05.8		59				
12	15		135	.30	.78		07.1		59				
13	17/20		131	.35	.92		08.4		61				
14	24		135	.36	.94		09.7		62				
15	27		135	.40	1.05		11.1		62				
16	29		140	.46	1.20		12.6		62				
17	33	-.24	135	.47	1.22		14.2		63				
18	37		135	.48	1.25		15.8		64				
19	39		135	.44	1.15		17.4		64				
20	42		135	.40	1.05		19.0		65				
21	45		135	.36	.94		20.5		65				
22	48		135	.34	.88		21.9		65				
23	51		131	.30	.78		23.3	34.72	65				
24	54		135	.28	.74		24.5		65				

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsh.e DATE OF TEST 9-20-91

JOB NO. _____ TEST ENGINEER MJH

RUN NO. 1 STACK KSI 2.ix

SAMPLE BOX 4 FILTER 1471 WASH BOTTLE —

BEAKERS: FH Ace 13 BH Trichl 7 BH Ace 14 BH H_2O F

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	152	100	52
2	138	100	38
3	3	0	3
SIC GEL	686	680	6
		WATER TOTAL	99

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.9332	0.7891	0.1441
FH Wash	0.0009	105.8740	105.8478	0.0253
		FILTERABLE TOTAL		0.1694
Extract	0.0005	67.5580	67.5231	0.0338
Acetone	0.0003	103.2673	103.2234	0.0436
Water	0.0002	115.3098	115.2953 (2.93)	0.0419
		CONDENSIBLE TOTAL		0.1193
		PARTICULATE TOTAL		0.2887

~~293~~ 293

(tot) / (aliq) 293/100 = 2.93

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillshire DATE OF TEST 9-20-91

JOB NO. _____ TEST ENGINEER MJH

RUN NO. 2 STACK KSI 2 in

SAMPLE BOX 5 FILTER 1472 WASH BOTTLE —

BEAKERS: FH Ace 15 BH Trichl 8 BH Ace 16 BH H_2O 6

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	169	100	69
2	120	100	20
3	2	0	2
SILGEL	676	670	6
		WATER TOTAL	97

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.9173	0.7878	0.1295
FH Wash	0.0009	95.5520	95.5292	0.0219
			FILTERABLE TOTAL	0.1514
Extract	0.0005	68.8462	68.8007	0.0450
Acetone	0.0003	96.1042	96.0761	0.0278
Water	0.0002	111.6614	111.6500 (2.91)	0.0326
			CONDENSIBLE TOTAL	0.1054

$\frac{(wt)}{(al.p)}$ $\frac{291}{100}$ = 2.91

PARTICULATE TOTAL 0.2568

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsboro DATE OF TEST 9-20-91

JOB NO. _____ TEST ENGINEER MJH

RUN NO. 3 STACK KSI 2 IN

SAMPLE BOX _____ FILTER 1473 WASH BOTTLE —

BEAKERS: FH Ace 17 BH Trichl 9 BH Ace 18 BH H_2O H

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	179	100	79
2	118	100	18
3	4	0	4
SILGEL	690	682	8
		WATER TOTAL	109

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.9289	0.8027	0.1262
FH Wash	0.0009	94.3646	94.3467	0.0170
		FILTERABLE TOTAL		0.1432
Extract	0.0005	72.7250	72.1723	0.0522
Acetone	0.0003	93.3389	93.3086	0.0300
Water	0.0002	109.7978	109.7700 (301)	0.0831
		CONDENSIBLE TOTAL		0.1653
		PARTICULATE TOTAL		0.3085

(hot)/(aliq) 301/100 = 3.01

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsboro DATE OF TEST 6-20-91

JOB NO. _____ TEST ENGINEER VJO

RUN NO. 1 STACK KSI Zone

SAMPLE BOX 1 FILTER 1468 WASH BOTTLE —

BEAKERS: FH Ace 1 BH Trichl 2 BH Ace 2 BH H_2O A

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	182	100	82
2	116	100	16
3	3	0	3
SILICA GEL	682	677	5
		WATER TOTAL	106

PARTICULATE COLLECTED

	blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.8230	0.8041	0.0189
FH Wash	0.0009	96.6341	96.6053	0.0279
			FILTERABLE TOTAL	0.0468
Extract	0.0005	70.3158	70.2949	0.0204
Acetone	0.0003	98.2491	98.2388	0.0100
Water	0.0007	110.1399	110.1338 (341)	0.0178
			CONDENSIBLE TOTAL	0.0482
			PARTICULATE TOTAL	0.0950

(tot)/(alt) 301/100 = 3.01

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillshire DATE OF TEST 6-20-91

JOB NO. _____ TEST ENGINEER WJM

RUN NO. 2 STACK KS1 2 out

SAMPLE BOX 7 FILTER 1469 WASH BOTTLE —

BEAKERS: FH Ace 3 BH Trichl 5 BH Ace 4 BH H_2O B

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	175	100	75
2	118	100	18
3	6	0	6
SiGel	639	633	6
		WATER TOTAL	105

PARTICULATE COLLECTED

	blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.8149	0.7939	0.0210
FH Wash	0.0009	102.6067	102.5983	0.0075
		FILTERABLE TOTAL		0.0285
Extract	0.0005	71.7433	71.7281	0.0147
Acetone	0.0003	95.3987	95.3880	0.0104
Water	0.0002	111.2661	111.2500 (2nd)	0.0164
		CONDENSIBLE TOTAL		0.0415
		PARTICULATE TOTAL		0.0700

(dscf) / (dscm) 299/100 = 2.99

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillshire DATE OF TEST 6-20-91

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 3 STACK KSI 2 out

SAMPLE BOX 3 FILTER 1470 WASH BOTTLE —

BEAKERS: FH Ace 5 BH Trichl 6 BH Ace 6 BH H_2O 6

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	180	100	80
2	122	100	22
3	3	0	3
SIL GEL	650	645	5
		WATER TOTAL	110

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.8206	0.7945	0.0261
FH Wash	0.0009	96.4518	96.4360	0.0149
		FILTERABLE TOTAL		0.0410
Extract	0.0005	69.6670	69.6530	0.0135
Acetone	0.0003	97.6942	97.6872	0.0067
Water	0.0002	105.6058	105.5902 3.05	0.0143
		CONDENSIBLE TOTAL		0.0345
		PARTICULATE TOTAL		0.0755

$\frac{(\#)}{(\text{alq})}$ $\frac{305}{100} = 3.05$

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsboro DATE OF TEST 6-19-91

JOB NO. _____ TEST ENGINEER MJH

RUN NO. 1 STACK KSI 3 IN

SAMPLE BOX 4 FILTER 1422 WASH BOTTLE _____

BEAKERS: FH Ace 1 BH Trichl 10 BH Ace 2 BH H_2O A

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	200	100	100
2	142	100	42
3	2	0	2
SILICA	640	630	10
		WATER TOTAL	154

PARTICULATE COLLECTED

	blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.9426	0.8072	0.1354
FH Wash	0.0009	96.6387	96.6059	0.0319
		FILTERABLE TOTAL		0.1673
Extract	0.0005	67.5141	67.4693	0.0443
Acetone	0.0003	98.2900	98.2390	0.0507
Water	0.0002	110.1669	110.1352 (344)	0.1084
		CONDENSIBLE TOTAL		0.2034
		PARTICULATE TOTAL		0.3707

tot alc $\frac{344}{100} = 3.44$

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsboro DATE OF TEST 6-19-91

JOB NO. _____ TEST ENGINEER MJH

RUN NO. 2 STACK GSI 3 IN

SAMPLE BOX 5 FILTER 1425 WASH BOTTLE —

BEAKERS: FH Ace 3 BH Trichl 11 BH Ace 4 BH H_2O B

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	215	100	115
2	120	100	20
3	4	0	4
SIL GEL	670	658	12
		WATER TOTAL	151

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.9027	0.8097	0.0930
FH Wash	0.0009	102.6214	102.5986	0.0219
			FILTERABLE TOTAL	0.1149
Extract	0.0005	68.6545	68.6093	0.0447
Acetone	0.0003	95.4262	95.3884	0.0375
Water	0.0002	111.2932	111.2617 (3rd)	0.1061
			CONDENSIBLE TOTAL	0.1883
			PARTICULATE TOTAL	0.3032

tot wtg 339/100 = 3.39

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsboro DATE OF TEST 6-19-91

JOB NO. _____ TEST ENGINEER MJH

RUN NO. 3 STACK KSI 3 N

SAMPLE BOX 6 FILTER 1426 WASH BOTTLE —

BEAKERS: FH Ace 5 BH Trichl 12 BH Ace 6 BH H_2O C

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	219	100	119
2	127	100	27
3	4	0	4
SILICA GEL	682	664	18
		WATER TOTAL	168

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.		Collected - g
Filter		0.9189	0.8139		0.1050
FH Wash	0.0009	96.4516	96.4352		0.0155
			FILTERABLE TOTAL		0.1205
Extract	0.0005	68.6053	68.6520		0.0528
Acetone	0.0003	97.7282	97.6878		0.0401
Water	0.0002	105.6207	105.6018	3.50	0.0655
			CONDENSIBLE TOTAL		0.1584
			PARTICULATE TOTAL		0.2789

(tot)/(alq) 350/100 = 3.50

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsboro DATE OF TEST 6-19-91

JOB NO. _____ TEST ENGINEER WJD

RUN NO. 1 STACK KSI 3 out

SAMPLE BOX 1 FILTER 1464 WASH BOTTLE —

BEAKERS: FH Ace 7 BH Trichl 10 BH Ace 8 BH H_2O A5

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	193	100	93
2	132	100	32
3	7	0	2
Silica	641	633	8
		WATER TOTAL	135

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.		Collected - g
Filter		0.8123	0.7972		0.0151
FH Wash	0.0009	938031	938905		0.0117
			FILTERABLE TOTAL		0.0268
Extract	0.0005	67.4855	67.4692		0.0158
Acetone	0.0003	103.1820	103.1750		0.0067
Water	0.0002	115.2988	115.2936	3.27	0.0164
			CONDENSIBLE TOTAL		0.0389
			PARTICULATE TOTAL		0.0657

$\frac{(tot)}{(alq)}$ $\frac{327}{100} = 3.27$

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillsboro DATE OF TEST 6-19-91

JOB NO. _____ TEST ENGINEER WJO

RUN NO. 2 STACK KSI 3 Out

SAMPLE BOX 2 FILTER 1465 WASH BOTTLE —

BEAKERS: FH Ace 9 BH Trichl 11 BH Ace 10 BH H_2O _____

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	198	100	98
2	129	100	29
3	9	0	9
Silica Gel	639	634	5
		WATER TOTAL	141

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.8130	0.7964	0.0166
FH Wash	0.0009	95.7735	95.7635 104.2438	0.0091
			FILTERABLE TOTAL	0.0257
Extract	0.0005	68.6227	68.6094	0.0128
Acetone	0.0003	104.2537	104.2438	0.0096
Water	0.0002	111.6540	111.6473 3.36	0.0218
			CONDENSIBLE TOTAL	0.0442
			PARTICULATE TOTAL	0.0699

$\frac{(tot)}{(aliq)}$ $\frac{336}{100} = 3.36$

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillshire DATE OF TEST 6-19-91

JOB NO. _____ TEST ENGINEER WJO

RUN NO. 3 STACK 4S1 3 out

SAMPLE BOX 3 FILTER 466 WASH BOTTLE —

BEAKERS: FH Ace 11 BH Trichl 12 BH Ace 13 BH H_2O 14

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	208	100	108
2	131	100	31
3	4	0	4
SILICA	666	661	5
		WATER TOTAL	148

PARTICULATE COLLECTED

	blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.8267	0.8061	0.0206
FH Wash	0.0009	102.2742	102.2612	0.0121
		FILTERABLE TOTAL		0.0327
Extract	0.0005	68.6648	68.6516	0.0127
Acetone	0.0003	105.4140	105.4053	0.0084
Water	0.0002	109.7721	109.7690 (3.43)	0.0099
		CONDENSIBLE TOTAL		0.0310
		PARTICULATE TOTAL		0.0637

(tot) / (wt.g) $\frac{343}{100} = 3.43$

Technology &
Engineering Corp.

Name of Company: Hillshire Kahns	Date: 9-20-91
Location	FID Number: KS1 Z Smokehouse
City, State, Zip Code: New London	Observer Certification Date: 4-9-91
Discharge Location: SAME	Control Device: Scrubber
Height of Discharge Above Ground: 75'	Steam Plume? Attached (Yes) No Detached

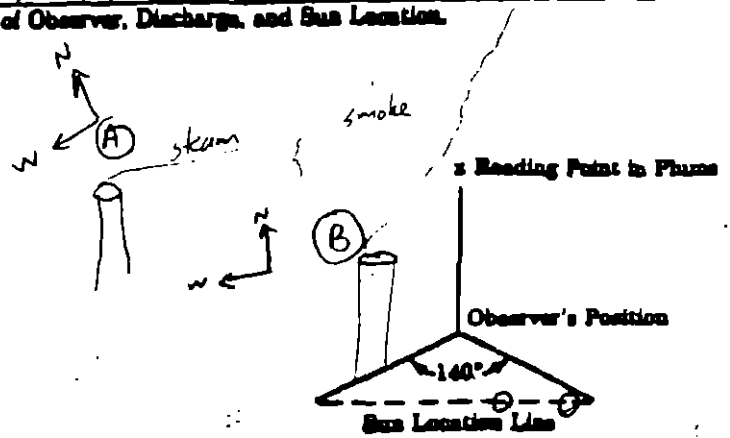
	Initial (A)	Final (B)
Time of Observation	0840 - 9:10	10:30 - 11:00
Observer Location: Distance to Discharge	100'	
Direction from Discharge	SE	
Height of Observation Point in Relation to Discharge	-20'	
Plume Description (Color, Length, etc.)	steam 50'	steam 25',
Plume Background Description	BL SKY	
Weather Conditions: Wind Direction	W	
Wind Speed	5-10	0-5
Ambient Temperature	50	
Sky Conditions (clear, overcast, % clouds, etc.)	CLR	

Describe Point in Plume at Which Opacity was Determined: 100 downstream (1st 50' steam).

Remarks: #2 run steam plume 25' + 25' d.s. read 50' downstream

Signature of Observer	Name of Observer (Please print)
C. Hill	Chris Hlavinka

Sketch of Observer, Discharge, and Sun Location.



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

Summary of Average Opacity
(From Computer Program)

Set Number	Time: Start — End	Opacity: Sum	Opacity: Average
		225	9.4
		210	8.7
		225	9.4
		190	7.9
		240	10
		175	7.3
		200	8.3
		165	6.9
		235	9.8
		215	8.9

Allowable Source Opacity

13020 W. Bluemound Rd.
Elm Grove, Wis. 53122
Phon
(414) 784-243

Technology &
Engineering Corp.

Name of Company: Hillshire Farms	Date: 9-20-91
Location	FID Number: KSI 2 Smokehouse
City, State, Zip Code: New London	Observer Certification Date: 4-9-91
Discharge Location: SAME	Control Device: Scrubber
Height of Discharge Above Ground: 75'	Steam Plume? (Yes) No; (Attached) Detached

	Initial (C)		Final
Time of Observation	12:00 - 12:30		
Observer Location: Distance to Discharge	100		
Direction from Discharge	SE		
Height of Observation Point in Relation to Discharge	-20		
Plume Description (Color, Length, etc.)	Steam		
Plume Background Description	Sky		
Weather Conditions: Wind Direction	W		
Wind Speed	0-5		
Ambient Temperature	60		
Sky Conditions (clear, overcast, % clouds, etc.)	Pt Cld - 50%		

Describe Point in Plume at Which Opacity was Determined: 50' downstream from discharge

Remarks:
- Wind shift at 12:15 to SW at 0-5 mph

(C)

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

Summary of Average Opacity
(From Computer Program)

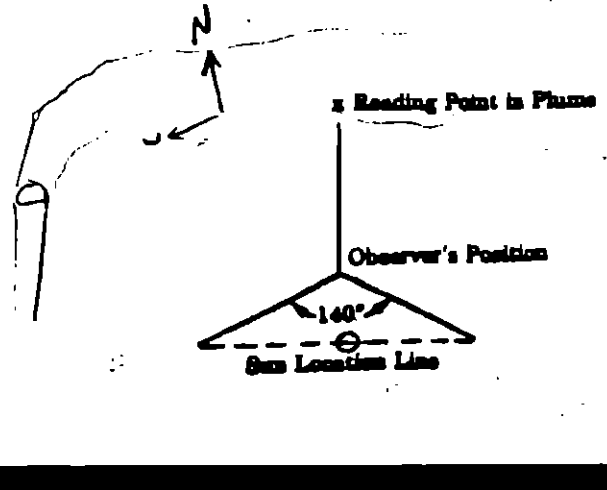
Set Number	Time: Start – End	Opacity: Sum	Opacity: Average
		200	8.3
		195	8.1
		205	8.5
		180	7.5
		200	8.3

Allowable Source Opacity

Signature of Observer: [signature]

Name of Observer (Please print): Chris Hunick

Sketch of Observer, Discharge, and Sun Location.



13020 W. BLUEMOUND RD.
ELM GROVE, WIS. 53122
PHO
(414) 784-24

SMOKE FORM
Form 4500-2[illegible] Rev. 6-85

Name of Company: Hillshire - Kahns	Date: 9-19-91
Location: New London	FID Number: KSI 3 - Smokehouse
City, State, Zip Code	Observer Certification Date: 4-9-91
Discharge Location: KSI Houses	Control Device: Scrubbers
Height of Discharge Above Ground: 75'	Steam Plume? Attached (Yes) Detached / No

	Initial (A)		Final (B)
Time of Observation	11:20	11:50 / 1330	14:00
Observer Location: Distance to Discharge	200'		
Direction from Discharge	WSW		
Height of Observation Point in Relation to Discharge	—		
Plume Description (Color, Length, etc.)	Steam 50'		
Plume Background Description	Trees		
Weather Conditions: Wind Direction	NW		
Wind Speed	10-20		
Ambiant Temperature	50		
Sky Conditions (clear, overcast, % clouds, etc.)	100% overcast		

Describe Point in Plume at Which Opacity was Determined: 25' after steam dissipates

Remarks:

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

Summary of Average Opacity
(From Computer Program)

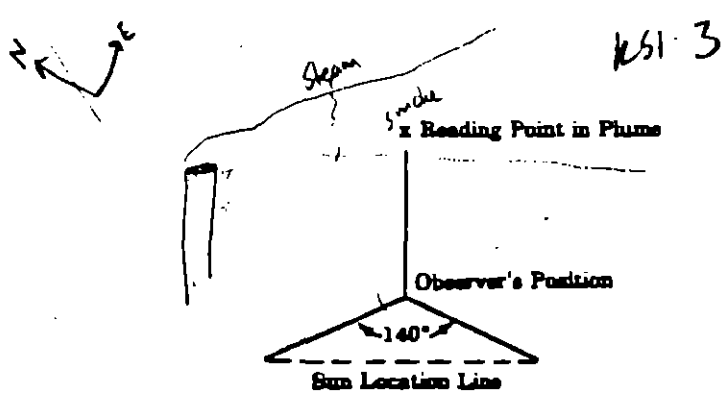
Set Number	Time: Start — End	Opacity: Sum	Opacity: Average

Allowable Source Opacity

Signature of Observer: [signature]

Name of Observer (Please print): Chris Hrenik

Sketch of Observer, Discharge, and Sun Location.



Technology &
Engineering Corp.

SMOKE FORM

Name of Company: Hillshire Farms	Date: 9-19-91
Location:	FID Number: KSI 3 SMOKEHOUSE
City, State, Zip Code: New London	Observer Certification Date: 4-9-91
Discharge Location: SAME	Control Device: SCRUBBER
Height of Discharge Above Ground: 75'	Steam Plume? (Yes) No — (Attached) Detached

	Initial		Final
Time of Observation	1620		1650
Observer Location: Distance to Discharge	~100'		
Direction from Discharge	N		
Height of Observation Point in Relation to Discharge	-5'		
Plume Description (Color, Length, etc.)	STEAM ~50' SLIGHT FAN TAIL		
Plume Background Description	DARK TREES		
Weather Conditions: Wind Direction	W		
Wind Speed	10-15		
Ambient Temperature	50		
Sky Conditions (clear, overcast, % clouds, etc.)	OVERCAST		

Describe Point in Plume at Which Opacity was Determined: AFTER STEAM GONE

Remarks: GOOD BACKGROUND - DARK TREES WITH PLUME ISOLATED FROM ALL OTHERS.

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

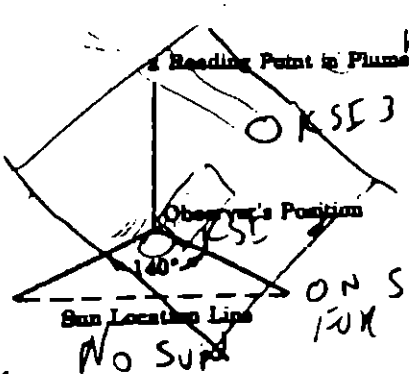
Summary of Average Opacity
(From Computer Program)

Set Number	Time: Start – End	Opacity: Sum	Opacity: Avera.
		245	10.2
		225	9.4
		235	9.8
		215	8.9
		245	10.2

Signature of Observer: William J. Dick

Name of Observer (Please print): WILLIAM J. DICK

Sketch of Observer, Discharge, and Sun Location.



Allowable Source Opacity

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