Background Report Reference

AP-42 Section Number: 9.5.2

Background Chapter: 4

Reference Number: 5

Title: Written Correspondence from A. Seeber, Wisconsin Department of Natural Resources, Madison, WI, to Wisconsin Department of Natural Resources Files

February 1993

Section 4 Reference 5

AP-42 Section 9.5.2
Reference —
Report Sect. 4
Reference 5

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: February 22, 1993

FILE REF: 4530

TO: FILES

Received 2/17/93

FROM: Andy Seeber -AM/7 AS

SUBJECT: Review of Stack Test Performed at Hillshire Farm, New London

I. SOURCE

Hillshire Farm
Box 227
New London, WI 54961
FID #445 031 730
Stack S36, Process P36
Permit#: 89-RV-006A, Issued 11/1/90

VOC =Method 25A
HCOH =EPA 0011

Test Date: 1/21/93
Test Firm: CAE
500 W. Wood St.
Palatine, IL 60067
Crew Chief: Mr. J. Bojan (708) 991-3300

II. SOURCE DESCRIPTION

Hillshire Farm processes meat into smoke meat products. Three continuous flow and thirty-three batch smoking ovens utilize liquid and natural smoke. They tested KSI-2 a continuous flow smokehouse. It is equipped with a vortex wet scrubber and an in-stack demister. It is rated at 8,000 lbs. meat out/hr and was tested at 8,000 lbs. meat out/hr.

III. SUMMARY OF RESULTS

TABLE 1

Process	Pollutant	Emission	Limit	Compliance
KSI-2	VOC	55%	≥85% control	N
	HCOH	0.010	0.0033 #/hr	N
		46.2%	≥95% control	N

IV. DISCUSSION OF RESULTS

The following is a comparison between Hillshire's 9/91 compliance test and the 1/93 compliance test:

TABLE 2

Date	Pollutant	Test Method	Emissions
9/20/91	HCOH	NIOSH 3500	0.033 #/hr
9/20/91	VOC	Method 18	84% control
1/21/93	HCOH	EPA 0011	0.010 #/hr
1/21/93	VOC	Method 25A	55% control

The test results are shown in Table 1. The KSI-2 continuous flow smokehouse failed all emissions tested. The smokehouse is required to meet both HCOH limits. The Table 2 results show a drop in HCOH emissions using method 0011 but a decline in the efficiency using method 25A for VOC.

The report contained production data during the test and calibration data for the equipment.

cc: Rick Wulk -LMD
Joe Perez -AM/7
USEPA Region V
Tom Steidl -LC/5

HILLSHIRE FARM & KAHN'S
CAE Project No: 6508-1

TABLE 1 - Summary of Test Results

THC

EPA Method 25A
Hydrocarbons
Smokehouse Scrubber Inlet and Smokehouse Stack

Run No.	2	3	4*	Average
Date (1993)	January 21	January 21	January 21	
Start Time (approx.)	11:53	14:19	15:30	
Stop Time (approx.)	12:53	15:19	16:30	
SMOKEHOUSE SCRUBBER INLET				
Gas Conditions				
Temperature (° F)	115	115	115	115
Moisture (volume %)	5.7	8.8	7.3	7.3
O_2(dry volume %)	20.9	20.9	20.9	20.9
CO_2(dry volume %)	0.0	0.0	0.0	0.0
Volumetric Flow Rate				
acfm	8,051	7,227	7,639	7,639
dscfm	6,772	5,873	6,323	6,323
Total Hydrocarbons as Propane				
ppm_{dv}	98	99	87	~~95~~
lb/hr	4.55	3.98	3.76	4.10
SMOKEHOUSE STACK				
Gas Conditions				
Temperature (° F)	119	117	118	118
Moisture (volume %)	8.7	9.2	9.0	9.0
O_2(dry volume %)	20.9	20.9	20.9	20.9
CO_2(dry volume %)	0.0	0.0	0.0	0.0
Volumetric Flow Rate				
acfm	6,670	6,749	6,710	6,710
dscfm	5,428	5,470	5,449	5,449
Total Hydrocarbons as Propane				
ppm_{dv}	43	48	56	~~49~~
lb/hr	1.59	1.80	2.09	1.83
REMOVAL EFFICIENCY				
Based on lb/hr (%)	64.96	54.66	44.46	54.69

C_3H_8 : 44
CH_4 " 16

*See Comments on page 4-1.

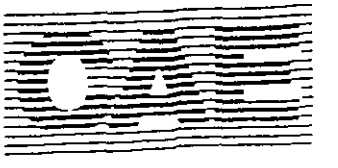

TABLE 2 - Summary of Test Results

BIF Method 0011
Formaldehyde
Smokehouse Scrubber Inlet and Smokehouse Stack

Run No.	1	2	3	Average
Date (1993)	January 21	January 21	January 21	
Start Time (approx.)	9:05	11:35	14:00	
Stop Time (approx.)	10:35	12:45	15:19	
SMOKEHOUSE SCRUBBER INLET				
Gas Conditions				
Temperature (° F)	116	115	115	115
Moisture (volume %)	10.5	5.7	8.8	8.3
O_2 (dry volume %)	20.9	20.9	20.9	20.9
CO_2 (dry volume %)	0.0	0.0	0.0	0.0
Volumetric Flow Rate				
acfm	7,800	8,051	7,227	7,693
dscfm	6,213	6,772	5,873	6,286
Formaldehyde				
lb/dscf	5.29E-08	5.49E-08	4.72E-08	5.16E-08
mg/dscm	0.85	0.88	0.76	0.83
lb/hr	0.020	0.022	0.017	0.020
SMOKEHOUSE STACK				
Gas Conditions				
Temperature (° F)	119	119	117	118
Moisture (volume %)	9.3	8.7	9.2	9.1
O_2 (dry volume %)	20.9	20.9	20.9	20.9
CO_2 (dry volume %)	0.0	0.0	0.0	0.0
Volumetric Flow Rate				
acfm	6,691	6,670	6,749	6,703
dscfm	5,407	5,428	5,470	5,435
Formaldehyde				
lb/dscf	2.69E-08	2.98E-08	3.72E-08	3.13E-08
mg/dscm	0.43	0.48	0.60	0.50
lb/hr	0.009	0.010	0.012	0.010
COLLECTION EFFICIENCY				
Based on lb/hr (%)	~~55.7~~ 55.0	~~56.4~~ 54.6	~~28.6~~ 29.4	~~46.2~~

.166 ppmv

0.40 ppmv

$\frac{0.02 - 0.}{0.02}$

$\frac{55 + 54.6 + 29.4}{3} = 46.3$

HILLSHIRE FARM & KAHN'S
CAE Project No: 6508-1
Smokehouse Scrubber Inlet

FORMALDEHYDE PARAMETERS

Run No.	1	2	3
Date (1993)	January 21	January 21	January 21
Start Time (approx.)	9:05	11:35	14:00
Stop Time (approx.)	10:21	12:45	15:13
Vmstd	49.83	52.04	46.46
dscfm	6,213	6,772	5,873
Blank(s)			
field blank, µg	5.2	5.2	5.2
Formaldehyde			
µg, gross	1,200	1,300	1,000
µg, net	1,195	1,294.8	994.8
lb/dscf	5.29E-08	5.49E-08	4.72E-08
mg/dscm	0.85	0.88	0.76
lb/hr	0.020 ✓	0.022 ✓	0.017 ✓

HILLSHIRE FARM & KAHN'S
CAE Project No: 6508-1
Smokehouse Stack

FORMALDEHYDE PARAMETERS

Run No.	1	2	3
Date (1993)	January 21	January 21	January 21
Start Time (approx.)	9:05	11:35	14:00
Stop Time (approx.)	10:35	12:43	15:19
Vmstd	43.03	43.22	43.53
dscfm	5,407	5,428	5,470
Blank(s)			
field blank, µg	5.2	5.2	5.2
Formaldehyde			
µg, gross	530	590	740
µg, net	524.8	584.8	734.8
lb/dscf	2.69E-08	2.98E-08	3.72E-08
mg/dscm	0.431	0.478	0.596
lb/hr	0.009	0.010	0.012

HILLSHIRE FARM & KAHN'S
CAE Project No: 6508-1
Smokehouse Scrubber Inlet

TOTAL HYDROCARBONS CONCENTRATION

ppm as propane

RUN NO.	2	3	4*
Date (1993)	January 21	January 21	January 21
Start Time (approx)	11:53	14:19	15:30
Stop Time (approx)	12:53	15:19	16:30
dscfm	6,772	5,873	6,323
Bwo	0.0573	0.0855	0.0714
ZERO I	0	5	0
CAL I	295	285	273
ZERO F	5	0	5
CAL F	285	273	271
ppm	108	102	89
CAL GAS	250.9	250.9	250.9
ppm, wet (drift calibrated)	92	90	81
ppm, dry	98	99	87
lb/dscf	1.12E-05	1.13E-05	0.99E-05
lb/hr	4.55	3.98	3.76

*See Comments on page 4-1.

HILLSHIRE FARM & KAHN'S
CAE Project No: 6508-1
Smokehouse Stack

TOTAL HYDROCARBONS CONCENTRATION

ppm as propane

RUN NO.	2	3	4*
Date (1993)	January 21	January 21	January 21
Start Time (approx)	11:53	14:19	15:30
Stop Time (approx)	12:53	15:19	16:30
dscfm	5,428	5,470	5,449
Bwo	0.0865	0.0921	0.0893
ZERO I	0	-0.9	0
CAL I	261	231	244
ZERO F	-0.9	0	1
CAL F	231	244	230
ppm	38	41	49
CAL GAS	250.9	250.9	250.9
ppm, wet (drift calibrated)	39	44	51
ppm, dry	43	48	56
lb/dscf	4.89E-06	5.50E-06	6.39E-06
lb/hr	1.59	1.80	2.09

*See Comments on page 4-1.

AIR TOXICS LTD.

Stationary Source Test Method - Aldehydes

(CARB Method 430)

High Pressure Liquid Chromatography

Field Sample I.D.	Lab Sample I.D.	File Name	Sample Date	Analyzed For	Total Volume (mL)	Dilution Factor	MDL (uG)	Amount (uG)
Run 1 Inlet	9301113-01A	4012503	1/21/93	Formaldehyde	72	41	21	1200
Run 1 Inlet Duplicate	9301113-01AA	4012504	1/21/93	Formaldehyde	72	41	21	1100
Run 2 Inlet	9301113-01B	4012505	1/21/93	Formaldehyde	56	41	21	1300
Run 3 Inlet	9301113-01C	4012507	1/21/93	Formaldehyde	79	41	21	1000
Run 1 Stack	9301113-02A	4012603	1/21/93	Formaldehyde	127	51	26	530
Run 2 Stack	9301113-02B	4012509	1/21/93	Formaldehyde	83	41	21	590
Run 3 Stack	9301113-02C	4012510	1/21/93	Formaldehyde	110	41	21	740
Blank	9301113-03A	4012511	1/21/93	Formaldehyde	10.0	1.0	0.50	5.2
Methylene Chloride Blank	9301113-04A	4012512	1/21/93	Formaldehyde	10.0	1.0	0.50	Not Detected
H2O Blank	9301113-05A	4012515	1/21/93	Formaldehyde	10.0	1.0	0.50	Not Detected
Protest Probe Wash #04-01	9301113-06A	4012516	1/21/93	Formaldehyde	10.0	1.0	0.50	1.4
Protest Probe Wash #03-04	9301113-07A	4012517	1/21/93	Formaldehyde	10.0	1.0	0.50	1.8
Trip Blank	9301113-08A	4012518	NA	Formaldehyde	10.0	1.0	0.50	Not Detected
Lab Blank	9301113-10A	4012520	NA	Formaldehyde	10.0	1.0	0.50	Not Detected
Spiked Samples								% Recovery
Run 2 Inlet Matrix Spike	9301113-01B-MS	4012508	1/21/93	Formaldehyde	58	41	21	Not Recovered
Trip Spike	9301113-09A	4012519	NA	Formaldehyde	11.0	1.0	0.50	68 Q
Lab Spike	9301113-11A	4012521	NA	Formaldehyde	11.0	1.0	0.50	83

Extraction Date: 1/22/93

Analysis Date: 1/25/93

COMMENTS: NA=Not Applicable

Q = Exceeds Quality Control limits of +/- 30%.

JP.

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: November 2, 1992 FILE REF: 4530

TO: FILES

Received 11/20/91

FROM: Andy Seeber -AM/7 AS

SUBJECT: Review of Stack Test Performed at Hillshire Farms, New London

I. SOURCE

Hillshire Farm
Box 227
New London, WI 54961
FID #445 031 730
Stack S36, S38; Process P36, P37
Permit#: 89-RV-006, Issued 12/11/89

Particulates =Method 5 + backhalf
VOC =Method 18
Acetic Acid =Method 18
HCOH =Method 3500

Test Date: 9/19-20/91
Test Firm: ET&E
13020 W. Bluemound Rd.
Elm Grove, WI 53122
Crew Chief: Mr. L. Huenink (414) 784-2434

II. SOURCE DESCRIPTION

Hillshire Farm processes meat into smoke meat products. Three continuous flow and thirty-three batch smoking ovens utilize liquid and natural smoke. They tested KSI-2 and KSI-3 continuous flow smokehouses. Each is equipped with a vortex wet scrubber and an in-stack demister. Each is rated at 9,000 #/hr and was tested at 8,000 #/hr. of meat out

III. SUMMARY OF RESULTS

TABLE 1

Process	Pollutant	Emission	Limit	Compliance
KSI-2	TSP	1.65	1.824 #/hr	Y
	HCOH	0.033	0.007 #/hr	N
	Acetic Acid	0.158	0.303 #/hr	Y
	VOC	84%	≥85% control	N
	VE	10%	20% opacity	Y
KSI-3	TSP	1.35	1.824 #/hr	Y
	HCOH	0.032	0.007 #/hr	N
	Acetic Acid	0.135	0.303 #/hr	Y
	VOC	77%	≥85% control	N
	VE	10.2%	20% opacity	Y

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IV. DISCUSSION OF RESULTS

The test results are shown in Table 1. Both continuous flow smokehouses passed particulates, acetic acid and visible emissions. In addition, they both failed HCOH and VOC control.

The report contained production data during the test and calibration data for the equipment.

cc: Rick Wulk -LMD
Joe Perez -AM/7
USEPA Region V

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 %
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 %
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 %

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 Test	TOTAL ORGANIC COMPOUNDS 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 %

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
ISOKINETIC SAMPLING = 97.81

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