AP42 Section: 9.5.2

Background Chapter 4

Reference: 2

Title: KSI-2 & KSI-3 Continuous Smokehouses Stack Emissions Testing, Hillshire Farm & Kahn's, New London, WI,

September 19-20, 1991.

Section 4 Reference 2
AP-42 Reference __

Emission Test Report Review Checklist--Short Form

Reviewer: BRIAN SHRAGER
Review Date: 7/6/94

A. Background Information

1. Facility name: HILLSHIRE FARM & KAHN'S
   Location: NEW LONDON, WISCONSIN
2. Source category: MEAT SMOKEHOUSES
3. Test date: SEPTEMBER 19-20, 1991
4. Test sponsor: HILLSHIRE FARM & KAHN'S
5. Testing contractor: ENVIRONMENTAL TECHNOLOGY AND ENGINEERING
6. Purpose of test: Compliance
7. Pollutants measured (include test method and indicate if valid): VALID
   Total PM → EPA Method 5 front and back half analysis ✓
   Formaldehyde → NIOSH Method 3500 → Several Potential Biases ?
   Acetic Acid → EPA Method 18
   Total Organic Compounds → EPA Method 18 ✓
8. Process overview: Attach a process description and a block diagram. Identify processes tested with letters from the beginning of the alphabet (A, B, C, etc...) and APC systems with letters from the end of the alphabet (V, W, X, etc...). Also identify test locations with Arabic numerals (1,2,3, ...). Using the ID symbols from the diagram, complete the table below.

Test ID	Process	Process ID	Emissions tested		APCD (controlled emissions only)
			Uncontrolled	Controlled	
1	KSI-2 CONTINUOUS SMOKEHOUSE	A	✓		ID: [illegible] Type: Model #:
2	"	A		✓	ID: Z Type: Vortex Wet Scrubber Model #:
3	KSI-3 CONTINUOUS SMOKEHOUSE	A	✓		ID: Type: Model #:
4	"	A		✓	ID: Z Type: Vortex Wet Scrubber Model #:

B. Process Information

1. Provide a brief narrative description of the process and attach process flow diagram. (Note: If the process description provided in the test report is adequate, attach a copy here.)

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.

Both smokehouses were operating @ 8,000 lbs meat out/hr. See 1/21/93 report summary for flow diagram and sampling locations.

C. 1. List any APCD parameters (supplied in the test report) below.

APCD ID	Parameter	Units	Readings			
			Run 1	Run 2	Run 3	Run 4
Z	NO					
Type of APCD: Vortex wet Scrubber	PARAMETERS PROVIDED					
Type of APCD:						
Type of APCD:						

2. Include any additional information (such as capture techniques for fugitive systems) and descriptions of the air pollution control systems (use a separate page if necessary).

TEST DATA FROM HILLSHIRE FARMS 9/19,20/91 EMISSION TEST
FILENAME: F:\PRIVATE\BRI\AP42\SMOKEHSE\REF2DATA.WQ1
D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	131	130	133	
KSI-2	Moisture	%	10.06	9.99	11.14	
SMOKEHOU	Oxygen	%	20.4	20.4	20.4	
SCRUBBER	Volumetric flow, actual	acfm	7571.83	7694.88	7735.5	
INLET	Volumetric flow, standard	dscfm	5930.57	6036.77	5961.84	
	Isokinetic variation	%	97.83	94.9	95.57	
Production rate: Capacity: 4.5 TPH		TPH	4	4	4	
Wood usage rate		TPH	0.0518	0.0518	0.0518	
	Pollutant concentrations:					
	Total PM	gr/dscf	0.1069	0.0963	0.1164	
	Total organic compounds	NOT PROVIDED				
	Formaldehyde	NOT PROVIDED				
	Acetic acid	NOT PROVIDED				
	Pollutant mass flux rates:					
	Total PM	lb/hr	5.43	4.98	5.95	
	Total organic compounds	lb/hr	3.66	4.17	4.42	
	Formaldehyde	lb/hr	0.0660	0.0710	0.0640	
	Acetic acid	lb/hr	0.267	0.256	0.250	
	Emission factors: BASED ON TONS/HR OF MEAT OUT					AVERAGE
	Total PM	lb/ton	1.36	1.25	1.49	1.36
	TOC as acetaldehyde	lb/ton	0.92	1.04	1.11	1.02
	Formaldehyde	lb/ton	0.02	0.02	0.02	0.0168
	Acetic acid	lb/ton	0.07	0.06	0.06	0.0644
		TEST 1 EMISSION FACTORS--METRIC UNITS				
	Total PM	kg/Mg	0.679	0.623	0.744	0.682
	TOC as acetaldehyde	kg/Mg	0.458	0.521	0.553	0.510
	Formaldehyde	kg/Mg	0.00825	0.00888	0.00800	0.00838
	Acetic acid	kg/Mg	0.0334	0.0320	0.0313	0.0322

TEST 1 EMISSION FACTORS BASED ON TONS/HR OF WOOD USED

Total PM	lb/ton	105	96.2	115	105
Filterable PM	lb/ton	61.6	56.7	53.3	57.2
Condensible organic PM	lb/ton	12.3	16.9	19.4	16.2
Condensible inorganic PM	lb/ton	31.1	22.6	42.1	31.9
TOC as acetaldehyde	lb/ton	70.7	80.5	85.3	78.8
TOC as methane	lb/ton	25.7	29.3	31.0	28.7
Formaldehyde	lb/ton	1.27	1.37	1.24	1.29
Acetic acid	lb/ton	5.15	4.94	4.83	4.97
	TEST 1 EMISSION FACTORS--METRIC UNITS				
Total PM	kg/Mg	52.5	48.1	57.4	52.7
Filterable PM	kg/Mg	30.8	28.4	26.7	28.6
Condensible organic PM	kg/Mg	6.14	8.43	9.71	8.09
Condensible inorganic PM	kg/Mg	15.5	11.3	21.0	16.0
TOC as acetaldehyde	kg/Mg	35.3	40.3	42.7	39.4
TOC as methane	kg/Mg	12.8	14.6	15.5	14.3
Formaldehyde	kg/Mg	0.637	0.685	0.618	0.647
Acetic acid	kg/Mg	2.58	2.47	2.41	2.49

Filt. and cond. PM calculated using ratios of catch to total PM catch.

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
2	Stack temperature	Deg F	128	129	129	
KSI-2	Moisture	%	10.93	11.03	11.46	
SMOKEHOU	Oxygen	%	20.4	20.4	20.4	
SCRUBBER	Volumetric flow, actual	acfm	8107.45	8140.21	8081.4	
OUTLET	Volumetric flow, standard	dscfm	6350.97	6358.28	6281.82	
(STACK)	Isokinetic variation	%	98.37	96.26	97.81	
Production rate: Capacity: 4.5 TPH		TPH	4	4	4	
Wood usage rate		TPH	0.0518	0.0518	0.0518	
	Pollutant concentrations:					
	Total PM	gr/dscf	0.036	0.0271	0.0291	
	Total organic compounds		NOT PROVIDED			
	Formaldehyde		NOT PROVIDED			
	Acetic acid		NOT PROVIDED			
	Pollutant mass flux rates:					
	Total PM	lb/hr	1.96	1.48	1.57	
	Total organic compounds	lb/hr	0.72	0.59	0.56	
	Formaldehyde	lb/hr	0.0290	0.0390	0.0300	
	Acetic acid	lb/hr	0.193	0.161	0.119	
	Emission factors: BASED ON LB/TON OF MEAT OUT					AVERAGE
	Total PM	lb/ton	0.490	0.369	0.392	0.417
	TOC as acetaldehyde	lb/ton	0.180	0.148	0.140	0.16
	Formaldehyde	lb/ton	0.00725	0.00975	0.00750	0.00817
	Acetic acid	lb/ton	0.0483	0.0403	0.0298	0.0394
		TEST 2 EMISSION FACTORS--METRIC UNITS				
	Total PM	kg/Mg	0.245	0.185	0.196	0.208
	TOC as acetaldehyde	kg/Mg	0.090	0.074	0.070	0.078
	Formaldehyde	kg/Mg	0.00363	0.00488	0.00375	0.00408
	Acetic acid	kg/Mg	0.0241	0.0201	0.0149	0.0197

TEST 2 EMISSION FACTORS BASED ON TONS/HR OF WOOD USED

Total PM	lb/ton	37.8	28.5	30.2	32.2
Filterable PM	lb/ton	18.6	11.6	16.4	15.6
Condensible organic PM	lb/ton	8.12	5.99	5.41	6.51
Condensible inorganic PM	lb/ton	11.1	10.9	8.41	10.1
TOC as acetaldehyde	lb/ton	13.9	11.4	10.8	12.0
TOC as methane	lb/ton	5.05	4.14	3.93	4.38
Formaldehyde	lb/ton	0.560	0.753	0.579	0.631
Acetic acid	lb/ton	3.73	3.11	2.30	3.04
	TEST 2 EMISSION FACTORS--METRIC UNITS				
Total PM	kg/Mg	18.9	14.3	15.1	16.1
Filterable PM	kg/Mg	9.32	5.80	8.21	7.78
Condensible organic PM	kg/Mg	4.06	2.99	2.70	3.25
Condensible inorganic PM	kg/Mg	5.54	5.46	4.21	5.07
TOC as acetaldehyde	kg/Mg	6.95	5.69	5.41	6.02
TOC as methane	kg/Mg	2.53	2.07	1.97	2.19
Formaldehyde	kg/Mg	0.280	0.376	0.290	0.315
Acetic acid	kg/Mg	1.86	1.55	1.15	1.52

Filt. and cond. PM calculated using ratios of catch to total PM catch.

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
3	Stack temperature	Deg F	139	137	137	
KSI-3 SMOKEHOU SCRUBBER INLET	Moisture	%	15.08	15.21	16.69	
	Oxygen	%	20.4	20.4	20.4	
	Volumetric flow, actual	acfm	6995.46	7175.83	7163.83	
	Volumetric flow, standard	dscfm	5096.11	5241.36	5142.12	
	Isokinetic variation	%	107.11	101.12	102.72	
Production rate: Capacity: 4.5 TPH		TPH	4	4	4	
Wood usage rate		TPH	0.0518	0.0518	0.0518	
	Pollutant concentrations:					
	Total PM	gr/dscf	0.1402	0.1181	0.109	
	Total organic compounds		NOT PROVIDED			
	Formaldehyde		NOT PROVIDED			
	Acetic acid		NOT PROVIDED			
	Pollutant mass flux rates:					
	Total PM	lb/hr	6.12	5.31	4.80	
	Total organic compounds	lb/hr	2.34	3.30	2.66	
	Formaldehyde	lb/hr	0.0710	0.0570	0.0670	
	Acetic acid	lb/hr	0.214	0.222	0.202	
	Emission factors:					AVERAGE
	Total PM	lb/ton	1.53	1.33	1.20	1.35
	TOC as acetaldehyde	lb/ton	0.585	0.825	0.665	0.692
	Formaldehyde	lb/ton	0.0178	0.0143	0.0168	0.0163
	Acetic acid	lb/ton	0.0535	0.0555	0.0505	0.0532
		TEST 3 EMISSION FACTORS--METRIC UNITS				
	Total PM	kg/Mg	0.766	0.663	0.601	0.676
	TOC as acetaldehyde	kg/Mg	0.293	0.413	0.333	0.346
	Formaldehyde	kg/Mg	0.00888	0.00713	0.00838	0.00813
	Acetic acid	kg/Mg	0.0268	0.0278	0.0253	0.0266

TEST 3 EMISSION FACTORS BASED ON TONS/HR OF WOOD USED

Total PM	lb/ton	118	102	92.7	104
Filterable PM	lb/ton	53.4	38.8	40.1	44.1
Condensible organic PM	lb/ton	14.1	15.1	17.6	15.6
Condensible inorganic PM	lb/ton	50.7	48.5	35.1	44.8
TOC as acetaldehyde	lb/ton	45.2	63.7	51.4	53.4
TOC as methane	lb/ton	16.4	23.2	18.7	19.4
Formaldehyde	lb/ton	1.37	1.10	1.29	1.25
Acetic acid	lb/ton	4.13	4.29	3.90	4.11
	TEST 3 EMISSION FACTORS--METRIC UNITS				
Total PM	kg/Mg	59.1	51.2	46.4	52.2
Filterable PM	kg/Mg	26.7	19.4	20.0	22.0
Condensible organic PM	kg/Mg	7.06	7.55	8.78	7.80
Condensible inorganic PM	kg/Mg	25.4	24.3	17.6	22.4
TOC as acetaldehyde	kg/Mg	22.6	31.9	25.7	26.7
TOC as methane	kg/Mg	8.21	11.6	9.34	9.71
Formaldehyde	kg/Mg	0.685	0.550	0.647	0.627
Acetic acid	kg/Mg	2.07	2.14	1.95	2.05

Filt. and cond. PM calculated using ratios of catch to total PM catch.

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
4	Stack temperature	Deg F	135	135	136	
KSI-3	Moisture	%	15.41	16.18	16.96	
SMOKEHOU	Oxygen	%	20.4	20.4	20.4	
SCRUBBER	Volumetric flow, actual	acfm	7305.51	7252.03	7282.82	
OUTLET	Volumetric flow, standard	dscfm	5363.55	5275.57	5246.82	
(STACK)	Isokinetic variation	%	99.89	100.08	99.85	
Production rate: Capacity: 4.5 TPH		TPH	4	4	4	
Wood usage rate		TPH	0.0518	0.0518	0.0518	
	Pollutant concentrations:					
	Total PM	gr/dscf	0.0291	0.0314	0.0288	
	Total organic compounds		NOT PROVIDED			
	Formaldehyde		NOT PROVIDED			
	Acetic acid		NOT PROVIDED			
	Pollutant mass flux rates:					
	Total PM	lb/hr	1.34	1.42	1.30	
	Total organic compounds	lb/hr	0.57	0.66	0.65	
	Formaldehyde	lb/hr	0.0350	0.0260	0.0340	
	Acetic acid	lb/hr	0.136	0.139	0.129	
	Emission factors:					AVERAGE
	Total PM	lb/ton	0.334	0.355	0.324	0.338
	TOC as acetaldehyde	lb/ton	0.143	0.165	0.163	0.157
	Formaldehyde	lb/ton	0.00875	0.00650	0.00850	0.00792
	Acetic acid	lb/ton	0.0340	0.0348	0.0323	0.0337
		TEST 4 EMISSION FACTORS--METRIC UNITS				
	Total PM	kg/Mg	0.167	0.177	0.162	0.169
	TOC as acetaldehyde	kg/Mg	0.071	0.083	0.081	0.078
	Formaldehyde	kg/Mg	0.00438	0.00325	0.00425	0.00396
	Acetic acid	kg/Mg	0.0170	0.0174	0.0161	0.0168

TEST 4 EMISSION FACTORS BASED ON TONS/HR OF WOOD USED

Total PM	lb/ton	25.8	27.4	25.0	26.1
Filterable PM	lb/ton	10.5	10.1	12.8	11.1
Condensible organic PM	lb/ton	6.21	5.02	4.99	5.41
Condensible inorganic PM	lb/ton	9.08	12.3	7.18	9.53
TOC as acetaldehyde	lb/ton	11.0	12.7	12.5	12.1
TOC as methane	lb/ton	4.00	4.63	4.56	4.40
Formaldehyde	lb/ton	0.676	0.502	0.656	0.611
Acetic acid	lb/ton	2.63	2.68	2.49	2.60
	TEST 4 EMISSION FACTORS--METRIC UNITS				
Total PM	kg/Mg	12.9	13.7	12.5	13.0
Filterable PM	kg/Mg	5.27	5.04	6.42	5.57
Condensible organic PM	kg/Mg	3.11	2.51	2.49	2.70
Condensible inorganic PM	kg/Mg	4.54	6.16	3.59	4.76
TOC as acetaldehyde	kg/Mg	5.50	6.37	6.27	6.05
TOC as methane	kg/Mg	2.00	2.32	2.28	2.20
Formaldehyde	kg/Mg	0.338	0.251	0.328	0.306
Acetic acid	kg/Mg	1.31	1.34	1.25	1.30

Filt. and cond. PM calculated using ratios of catch to total PM catch.