AP42 Section: **9.5.2 Meat Smokehouses**

Title: **Comments and correspondence on section**

Colorado State University

Department of Food Science
and Human Nutrition
Fort Collins, Colorado 80523
(303) 491-5093
FAX: (303) 491-7252

December 12, 1994

Mr. Dallas W. Safriet
U. S. Environmental Protection Agency
Emission Inventory Branch (MD-14)
Research Triangle Park, North Carolina 27711

Dear Mr. Safriet:

I have had the opportunity to review the draft version and supporting data of section 9.5.2, Meat Smokehouses, that you plan to publish in AP-42, Compilation of Air Pollutant Emission Factors. Below, please find my comments:

1. Recent and realistic data were used to summarize the tabular data in the draft report.

2. Draft version 9.5.2-1, Line 3: There are also "meat smokehouses" that process cheese products.

3. Draft version 9.5.2-4, Line 3: In addition, liquid smoke can be incorporated during product formulation.

4. I have no new data that is applicable.

These are my only comments.

Sincerely,

J. A. Maga
Professor

JAM:il

December 15, 1994

Mr. Dallas Safriet
Environmental Engineer
United States Environmental Protection Agency
Emission Inventory Branch (MD-14)
Research Triangle Park, North Carolina 27711

SUBJECT: Emission Factor Documentation for AP-42 Section 9.5.2
Technical Comments & Confidentiality Issues

Dear Mr. Safriet:

As we discussed on the telephone Oscar Mayer Foods Corporation has some confidentiality concerns and technical comments on the EPA emission factor documentation report[1] which was recently sent to them for review. The following comments and confidentiality concerns are presented on behalf of Oscar Mayer Foods Corporation.

Section 1 Comments: No comments

Section 2 Comments:

To more accurately characterize the meat smokehouse industry the following comments should be considered:

- Page 5, second paragraph - The last sentence suggests liquid smoke is applied either through atomization or directly to the meat (assumed prior to loading in the smokehouse). Drenching, spraying, or dipping are other methods typically used.

- Page 5 third paragraph - The fifth sentence states that "heat zones in continuous smokehouses may also be a source of small amounts of gaseous pollutants". The only reference for this section is the Air Pollution Engineering Manual. The section in this manual on meat smokehouses was reviewed and this statement was not found. The correct reference should be noted or this statement should be struck.

- Humidity could be added to the last sentence in this paragraph as a parameter affecting emissions.

- Page 6, second paragraph - The middle of this paragraph presents vortex scrubber performance data and references Oscar Mayer correspondence to WDNR as the source of that data. This reference is wrong. Neither I or Oscar Mayer ever presented this information.

[1]USEPA, Emission Factor Documentation for AP-42 Section 9.5.2, Meat Smokehouses, Draft Report. EPA Contract No. 68-D2-0159 September, 1994.

- Page 5 and 6 - Within the discussion of control technology two references to fabric filter baghouses are made. This would be a poor choice of controls for smokehouse exhausts. None are known to be in existence. This technology should not be suggested as a viable control technology due to the nature of the particulate (condensed organic matter). Vortex scrubbers are also mentioned. I believe this is taken from Hillshire Farm & Kahn's files. However, from what I know of this system it should not be recommended as a control option.

Section 3 Comments: No comments

Section 4 Comments:

Following the tables of data in this section (Tables 4-1, and 4-2) a discussion follows on how the final AP-42 numbers were arrived at. Some inconsistencies were found within this discussion. It is recommended that this discussion be reviewed carefully before publication. Some examples are:

- Page 23, third paragraph - Emission factors for uncontrolled filterable PM emissions from continuous smokehouses were developed from five A rated tests and 3 B-rated tests (not four A-rated and four B-rated tests as stated).

- Page 24, last paragraph - Emission factors for uncontrolled TOC from continuous smokehouses were developed from two A-rated, four B-rated, and two C-rated tests (not three A-rated and three B-rated tests as stated).

Section 5 Comments:

Technical comments on this section are similar to those made in section 2.

- Page 9.5.2-4, first paragraph - The last sentence suggests liquid smoke is applied either through atomization or directly to the meat (assumed prior to loading in the smokehouse). Drenching, spraying, or dipping are other methods typically used.

- Page 9.5.2-4 second paragraph - The fifth sentence states that "heat zones in continuous smokehouses may also be a source of small amounts of gaseous pollutants". The only reference for this section is the Air Pollution Engineering Manual. The section in this manual on meat smokehouses was reviewed and this statement was not found. The correct reference should be noted or this statement should be struck.

- Humidity could be added to the last sentence in this paragraph as a parameter affecting emissions.

- Page 9.5.2-5, first paragraph - The middle of this paragraph discusses vortex scrubber performance data. This time Smoke in Food Processing is referenced as the source of data. Again, this reference is wrong as previously mentioned.

- Within the discussion of control technology a references to fabric filter baghouses and vortex scrubbers are made which again, would be poor choices of control.

Confidentiality Issues

With regard to the emissions data used from Oscar Mayer Foods Corporation, some of the supporting data and information raise two confidentially issues. The first is the narrative discussion of continuous processes used at Oscar Mayer's Madison facility. The second is the production data presented in Appendix C. The combination of this information reveals the production capacity and operational data on the Madison plant—information which is typically closely guarded in the competitive food processing industry. Furthermore, the CWPs and CLSP are equipment developed by Oscar Mayer for their exclusive use. These pieces of equipment have been guarded for a many years and the production capacities have always been considered confidential. This equipment is unique to Oscar Mayer and is not used anywhere else in the meat industry. Its emissions do not reflect other equipment used in the industry. We are also addressing this confidentiality issue with the State of Wisconsin, where you obtained the information.

It is therefore recommended that confidentiality be acknowledged for Oscar Mayer by making the following changes to the report.

- Remove specific references to "Continuous Wiener Process No.1", "CWP-1", "No.9 Dry Sausage Smokehouse", Continuous Large Sausage Process", "CLSP", "CWP-2", "CLWP" in sections 4.2.1.3 and 4.2.1.4. Generic use of the words "continuous" or "batch" smokehouses should be used instead.

- Black out descriptions of smokehouses throughout stack test reports and tables in Appendix B and C.

- Remove March 21 letter to Bill Ansell from David Love from Appendix C and treat as confidential information.

I suggest that the confidential production data be used but not published in the public domain. If there are any procedures for declaring this data confidential, please let us know. If you have any questions regarding the contents of this response, please feel free to contact David Love, Oscar Mayer Foods Corporation (608-241-3311) or myself (608-277-2840).

Sincerely,
BT², Inc.

for JMJ

Jeffrey M. Jaeckels, P.E.
Senior Engineer

Colorado State University

Department of Food Science
and Human Nutrition
Fort Collins, Colorado 80523
(303) 491-5093
FAX: (303) 491-7252

December 12, 1994

Mr. Dallas W. Safriet
U. S. Environmental Protection Agency
Emission Inventory Branch (MD-14)
Research Triangle Park, North Carolina 27711

Dear Mr. Safriet:

I have had the opportunity to review the draft version and supporting data of section 9.5.2, Meat Smokehouses, that you plan to publish in AP-42, Compilation of Air Pollutant Emission Factors. Below, please find my comments:

1. Recent and realistic data were used to summarize the tabular data in the draft report.

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These are my only comments.

Sincerely,

J. A. Maga
Professor

JAM:il

AMERICAN MEAT INSTITUTE
Serving The Industry Since 1906.

Deborah M. Atwood
Vice President
Legislative and Regulatory Affairs

December 16, 1994

Mr. Dallas W. Safriet
Environmental Engineer
Emission Inventory Branch
U.S. EPA
Research Triangle Park, N.C. 27711

Dear Mr. Safriet:

The American Meat Institute is pleased to submit comments in response to your letter dated October 21, 1994, regarding Environmental Protection Agency's draft version of Section 9.5.2, Meat Smokehouses, that you propose to publish in AP-42, Compilation Of Air Pollutant Emission Factors.

The American Meat Institute (AMI) represents packers and processors of meat and other animal protein products, as well as equipment, ingredient, packaging and service suppliers to the meat and poultry industry. AMI's member companies provide more than 95 percent of the red meat and approximately 60 percent of the turkey produced in the United States. AMI's members employ over 500,000 people.

AMI reviewed the information in the draft AP-42 report for Meat Smokehouses. The following represents the industry's view of the document:

- The quality and quantity of the data do not accurately represent the industry. The data has significant variations in the reported emission factors. Furthermore, all the data presented in the report comes from only two locations. This data should be rated an "E" at best because of the limited ability to characterize other smokehouses.

- The extreme variability in the processes used by different companies should be taken into consideration when developing the emission factors. In addition, data should not be used from unique processes. It is erroneous to assume that all equipment and processes produce the same emission factors. It is noteworthy to point out that even companies using the same equipment have highly variable emissions. This is due to operating conditions and procedures.

Post Office Box 3556, Washington, DC 20007 • 1700 North Moore Street, Arlington, VA 22209
Phone: 703/841-2400 Fax: 703/527-0938

- All references to liquid smoke should be eliminated from the AP-42 because there is no data to support emission factors coming from smokehouses using liquid smoke. In addition, the report suggests liquid smoke is applied either through atomization or directly to the meat. These examples are only two of many methods of applying liquid smoke typically used in the industry.

- Sampling and testing methods for formaldehyde are not uniform, and as a result, this leads to inaccurate data.

In conclusion, we believe that the AP-42 does not have a sound technical basis for EPA, state and local air pollutant agencies to use as guidelines in developing emission estimates for Meat Smokehouses. EPA should qualify that the data used is source specific, and the applicability to other locations is very limited. If you have any questions, I can be reached at (703) 841-2400.

Sincerely,

Deborah M. Atwood

Deborah M. Atwood
Vice President
Legislative and Regulatory Affairs

cc: J. Patrick Boyle

WISCONSIN
DEPT. OF NATURAL RESOURCES

George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
TELEFAX 608-267-3579
TDD 608-267-6897
AIR MGMT FAX 608-267-0560

July 14, 1994

File Code: 4530
FID #: 113 004 650

Brian Schraeger
Midwest Research Institute
Suite 350
41 Harrison Oaks Blvd.
Cary, NC 27513-2412

SUBJECT: Smokehouse Emission Data

Dear Mr. Schraeger:

In response to your questions concerning stack emission test data from Oscar Mayer Foods Corporation, Madison, I am sending you a copy of the latest stack emission test data, February 1994. I spoke with David Love of Oscar Mayer about the process weight rates recorded during the stack emission tests. He informed me that the weights are based on percent utilization and represent the after smoked weight, as the meat products lose weight on processing.

I hope the information is helpful in updating the emission factors for AP-42. If I can be of any further assistance, please call me at 608/267-0567.

Sincerely,

Susan Lindem

Susan Lindem, Engineer
Compliance Section, AM/7
Bureau of Air Management

FILE COPY

MIDWEST RESEARCH INSTITUTE
Suite 350
401 Harrison Oaks Boulevard
Cary, North Carolina 27513-2412
Telephone (919) 677-0249
FAX (919) 677-0065

July 15, 1994

Greg Ehrle -- (414) 982-2611
Hillshire Farm & Kahn's
N 3620 County Highway D
New London, Wisconsin 54961

Dear Mr. Ehrle,

Midwest Research Institute is currently working under contract to the U. S. Environmental Protection Agency, to revise the AP-42 section for smokehouses and their associated air emissions. We have obtained several emission test reports from the Wisconsin Department of Natural Resources (DNR), including three emission tests from the Hillshire Farm & Kahn's (Hillshire) facility in New London, Wisconsin, and two emission tests conducted at the Oscar Mayer Foods Corporation's facility in Madison, Wisconsin.

From discussions with DNR personnel, we are proposing to base the new emission factors on weight of wood or sawdust used, rather than on weight of meat processed. Accordingly, we are requesting the wood usage rate from the January 21, 1993 and November 17, 1989 emission tests conducted at Hillshire. The other Hillshire report (September 19-20, 1991) and the Oscar Mayer tests include wood usage data, and we would like to be able to supplement these data with the data from the two additional Hillshire tests. In addition, the 1991 and 1993 Hillshire reports include data for emissions controlled by a vortex wet scrubber. However, scrubber specifications are not included in the reports. Without these specifications, particularly the pressure drop across the scrubber, we cannot accurately characterize these emissions. We are therfore requesting the pressure drop and other available scrubber specifications.

We would appreciate your cooperation in providing these details so that we can develop emission factors that are accurate and representative. I will call you next week to discuss this request. If you have any questions, please call me at (919) 677-0249, extension 5224. Thank you.

Sincerely,

Brian Shrager
Environmental Engineer

6.10.2

CATAGORY

SMOKEHOUSE

HILLSHIRE FARM & KAHN'S NEW LONDON, WI

KS1-2 CONTINOUS SMOKEHOUSE STACK EMISSIONS TESTING

by ENVIRONMENTAL TECH & ENGINEERING CORP. NOV 17, 1989

A/B

The report contains a brief description of the process with inputs. They tested for particulate matter, specific organic compounds (phenol, formaldehyde, acetaldehyde, and acetic acid), and total Organic compounds.

The exhaust flow rates were measured in accordance with EPA methods 1-4. Concentrations of compounds were measured using a combination of standard EPA methods and Wisconsin DNR recommended methods.

Isokinetic sampling for particulate matter was performed in accordance with the procedures outlined in EPA Method 5.

Phenol Emissions testing was performed using procedures outlined in (NIOSH) National Institute of Occupational Safety and Health Sampling and Analytical Method 3502. Formaldehyde Emissions testing used NIOSH method 3500. Organic Compound Emissions used EPA method 18 for testing. Nitrosoamine Emissions were tested using Thermosorb tubes and sent to ThermoSorb for analysis.

It Contains raw data

Tests Great!

Bor 1 ---- Great 5 Rate ~~4~~ 4.5

14

Report to

HILLSHIRE FARM & KAHN'S
New London, Wisconsin

for

RSI-2 CONTINUOUS SMOKEHOUSE STACK EMISSIONS TESTING

November 17, 1989

Michael J. Huenink
Industrial Hygienist
January 22, 1990

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION

13020 WEST BLUEMOUND ROAD • ELM GROVE, WISCONSIN 53122 • TELEPHONE (414) 784-2434

David Reisdorph

WISCONSIN DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

Lake Michigan District Headquarters
Box 10448, 1125 N. Military Avenue
Green Bay, Wisconsin 54307-0448
MAIN# 414-492-5800/FAX# 414-492-5913

March 25, 1992

File Ref: 4500

Dallas Safriet
EPA
MD-14
EIB
RTP, NC 27711

Dear Mr. Safriet:

RE: Emission Factors For Meat Smokehouses

In a phone conversation last week you expressed an interest in obtaining documentation to develop emission factors for air toxics. Please find enclosed a copy of a stack test report which documents emissions of several organic compounds from a continuous smokehouse.

Please let me know if I may be of further assistance. I may be reached at 414-492-5794.

Sincerely,

Jim Crawford, P.E.
Air Management

Enclosure

David

Attached is a test report I got from Wisconsin on a smokehouse

Dallas

SUMMARY

On November 17, 1989, Environmental Technology & Engineering Corp personnel performed stack emissions testing on the KSI-2 Continuous Smokehouse operations at the Hillshire Farm & Kahn's facility located in New London, Wisconsin. The purpose of the testing was to quantify the emissions of select contaminants from those operations; the data would then be used in selecting appropriate control devices and in the permitting process. Testing for particulate matter (both filterable and condensible), particle sizing, phenol, formaldehyde, acetaldehyde, acetic acid, "total organic compounds," and nitrosoamines was performed.

Particulate Emissions

The results of the particulate testing were as follows:

Test	Particulate Emissions Concentration	Particulate Emissions Rate	Condensible Fraction of Part. Emissions
1	0.104 gr/dscf	5.36 #/hr	69.8 %
2	0.095 gr/dscf	4.70 #/hr	55.0 %
3	0.089 gr/dscf	4.50 #/hr	49.5 %
AVG	0.096 gr/dscf	4.85 #/hr	58.1 %

Particle size sampling was performed to determine both the mean particle size and the portion of particulate considered "PM10 catch." The mean particle size (50 percent by weight greater than or less than) was 1.2 microns. The results indicated that virtually all of the filterable particulate sampled was less than 10 microns in size and would be considered "PM10."

Organic Compounds

Testing for specific organic compounds (phenol, formaldehyde, acetaldehyde, and acetic acid) and total organic compounds was performed.

The results of the phenol testing were as follows:

Test	Phenol Emissions Concentration	Phenol Emissions Rate
1	0.27 mg/m3	0.0059 #/hr
2	0.22 mg/m3	0.0046 #/hr
3	0.28 mg/m3	0.0059 #/hr
AVG	**0.26 mg/m3**	**0.0055 #/hr**

The results of the formaldehyde testing were as follows:

Test	Formaldehyde Emissions Concentration	Formaldehyde Emissions Rate
1	2.97 mg/m3	0.065 #/hr
2	2.68 mg/m3	0.056 #/hr
3	2.88 mg/m3	0.061 #/hr
AVG	**2.84 mg/m3**	**0.061 #/hr**

Total organic compounds were quantified by gas chromatograph using acetaldehyde as the reference compound. Additionally, the acetaldehyde and acetic acid portions of the organics were quantified. Approximately ten separate samples were analyzed and then averaged. The results were as follows:

Parameter	Average Emission Concentration	Average Emission Rate
Total Organics (including acetic acid and acetaldehyde)	250 mg/m3	5.3 #/hr
Acetic Acid	19 mg/m3	0.41 #/hr
Acetaldehyde	16 mg/m3	0.34 #/hr

Nitrosoamines

Testing for nitrosoamines in the exhaust gas stream was performed; no detectable levels were found. The limits of detection for each specific nitrosoamine in terms of emission concentration and rate are shown below:

Test	Nitroso Compound Group	Emission Concentration	Emission Rate
1	A	< 0.07 ug/m3	< 0.000001 #/hr
	B	< 0.11 ug/m3	< 0.000002 #/hr
	C	< 0.13 ug/m3	< 0.000003 #/hr
2	A	< 0.08 ug/m3	< 0.000002 #/hr
	B	< 0.14 ug/m3	< 0.000003 #/hr
	C	< 0.17 ug/m3	< 0.000004 #/hr
3	A	< 0.08 ug/m3	< 0.000002 #/hr
	B	< 0.13 ug/m3	< 0.000003 #/hr
	C	< 0.16 ug/m3	< 0.000003 #/hr

Group A compounds: N-nitrosodimethylamine,
N-nitrosomethylvinylamine

Group B compounds: N-nitrosodiethylamine
N-nitrosodi-n-propylamine
N-nitrosomorpholine
N-nitrosopiperidine
N-nitrosopyrrolidine

Group C compounds: N-nitrosodi-n-butylamine

NOTES:
- gr/dscf means grains per dry standard cubic foot
- #/hr means pounds per hour
- mg/m3 means milligrams of compound per cubic meter air
- ug/m3 means micrograms of compound per cubic meter air
- < means less than

1.0 GENERAL

On November 17, 1989, Environmental Technology & Engineering Corp (ETE) personnel performed stack emissions testing on the KSI-2 Continuous Smokehouse at the Hillshire Farm & Kahn's facility located in New London, Wisconsin. The purpose of the testing was to obtain information regarding the emissions from both the KSI-2 and KSI-3 operations. Prior to the test efforts, several specific parameters and compounds were identified which would likely be included in air pollution control permits generated by the Wisconsin Department of Natural Resources (DNR).

The KSI-2 smokehouse was in full operation throughout the testing; product was run through the smokehouse continuously during the testing, with only an occasional, short gap occurring. All six smoke generators were in use - five containing "SaniChips" and one containing "Wundersmoke." The operators reported the smoke generators to be operating as follows:

Test	Time	Smoke Generator Operating Level
1	10:00-11:30	SaniChips - 2 @ 80%, 3 @ 100% Wundersmoke - 100%
2	11:30-13:00	SaniChips - 4 @ 80%, 1 @ 100% Wundersmoke - 100%
3	13:00-14:30	SaniChips - 1 @ 80%, 4 @ 100% Wundersmoke - 100%

The field tests, corresponding laboratory analysis (except nitrosoamines), and report preparation were performed by ETE personnel; Michael Huenink was the test team leader. Nitrosoamine analysis was completed by Thermedics, Inc..

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 report, therefore, includes much necessary detail. 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

The results of the testing to determine particulate matter emissions are shown in Tables 2-1, 2-2, and 2-3. These results include both filterable and condensible ("back-half") particulate matter. For each of the tests, between 50 and 70 percent of the total particulate was comprised of condensible particulates.

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 the final discharge stack at the location shown in Figure 2-1. This same figure also depicts the location of the exact test points relative to the stack wall.

2.2 Particle Sizing

The size distribution of the particulate matter emissions were determined by performing particle size sampling and analysis. A description of the methodology is included in Section 3.2. A plot of the particle sizing results are shown in Figure 2-2.

The plots indicated the mean particle size (as determined on a weight basis) to be approximately 1.2 microns. The plots also show that virtually all of the filterable particulate was less than 10 microns in size. The particle size testing was performed at the same sampling locations as the particulate matter testing.

HILLSHIRE KSI-2 TEST 1 TABLE 2-1 11-17-89

BAROMETRIC PRESSURE, in Hg = 29.000
TIP DIAMETER, in .2500
STACK AREA, sq ft = 2.278
SAMPLING TIME PER POINT, min = 5.00
NUMBER OF POINTS = 12
GAS METER VOLUME, acf = 56.60
WATER COLLECTED, ml = 127.00
PARTICULATE COLLECTED, grams = 0.3746
CO2 = 0.00 O2 = 20.70 CO = 0.00 N2 = 79.30

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	135	2.800	2.35	35	55.74
2	135	2.760	2.20	37	54.33
3	130	2.680	2.00	38	51.17
4	130	2.620	1.85	39	48.86
5	130	2.840	2.50	40	56.88
6	135	2.840	2.50	42	57.12
7	135	2.840	2.50	42	57.12
8	135	2.720	2.15	45	52.88
9	135	2.880	2.60	47	58.46
10	135	2.890	2.60	48	58.46
11	135	2.820	2.40	49	56.43
12	135	2.680	2.00	51	51.39
AVG VALUES	134		2.304	43	54.90

TOTAL GAS WITHDRAWN, scf = 61.47
DRY GAS WITHDRAWN, scf = 55.50
WATER VAPOR WITHDRAWN, scf = 5.98
PERCENT WATER VAPOR = 9.72
ACTUAL WET FLOW RATE, acfm = 7,504.04
STANDARD DRY FLOW RATE, scfm = 5,834.49
PARTICULATE CONCENTRATION, grains/dscf = 0.1042
PARTICULATE EMISSION RATE, lb/hr = 5.364
PERCENT OF ISOKINETIC SAMPLING = 105.96

HILLSHIRE KSI-2 TEST 2 TABLE 2-2 11-17-89

BAROMETRIC PRESSURE, in Hg = 29.000
TIP DIAMETER, in .2500
STACK AREA, sq ft = 2.278
SAMPLING TIME PER POINT, min = 5.00
NUMBER OF POINTS = 12
GAS METER VOLUME, acf = 54.80
WATER COLLECTED, ml = 188.00
PARTICULATE COLLECTED, grams = 0.3314
CO2 = 0.00 O2 = 20.70 CO = 0.00 N2 = 79.30

SAMPLING POINT	STACK TEMP deg F	SQRT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	0.860	2.55	50	58.05
2	130	0.880	2.60	52	58.72
3	130	0.840	2.50	52	57.37
4	130	0.670	2.05	54	51.24
5	130	0.840	2.50	54	57.37
6	135	0.840	2.50	56	57.62
7	135	0.790	2.30	56	55.88
8	135	0.630	1.90	56	49.90
9	135	0.640	1.95	58	50.29
10	135	0.780	2.30	60	55.52
11	130	0.740	2.20	61	53.85
12	135	0.640	1.95	62	50.29
AVG VALUES	133		2.275	56	54.68

TOTAL GAS WITHDRAWN, scf = 62.66
DRY GAS WITHDRAWN, scf = 53.81
WATER VAPOR WITHDRAWN, scf = 8.85
PERCENT WATER VAPOR = 14.12
ACTUAL WET FLOW RATE, acfm = 7,473.07
STANDARD DRY FLOW RATE, scfm = 5,538.99
PARTICULATE CONCENTRATION, grains/dscf = 0.0950
PARTICULATE EMISSION RATE, lb/hr = 4.697
PERCENT OF ISOKINETIC SAMPLING = 108.22

HILLSHIRE KSI-2 TEST 3 TABLE 2-3 11-17-89

BAROMETRIC PRESSURE, in Hg = 29.000
TIP DIAMETER, in .2500
STACK AREA, sq ft = 2.278
SAMPLING TIME PER POINT, min = 5.00
NUMBER OF POINTS = 12
GAS METER VOLUME, acf = 55.60
WATER COLLECTED, ml = 162.00
PARTICULATE COLLECTED, grams = 0.3161
CO2 = 0.00 O2 = 20.70 CO = 0.00 N2 = 79.30

SAMPLING POINT	STACK TEMP deg F	PITOT DEL P inches	ORIFICE METER inches	GAS METER OUTLET T deg F	GAS VELOCITY fps
1	130	2.700	2.15	59	52.18
2	135	2.760	2.30	60	54.60
3	130	2.700	2.15	60	52.18
4	130	2.620	1.85	61	49.11
5	135	2.840	2.50	60	57.40
6	135	2.870	2.60	60	58.42
7	135	2.820	2.45	60	56.71
8	135	2.670	2.00	60	51.26
9	130	2.880	2.60	62	58.50
10	130	2.880	2.60	63	58.50
11	130	2.840	2.50	64	57.16
12	130	2.700	2.15	65	52.18
AVG VALUES	132		2.321	61	54.85

TOTAL GAS WITHDRAWN, scf = 62.26
DRY GAS WITHDRAWN, scf = 54.64
WATER VAPOR WITHDRAWN, scf = 7.63
PERCENT WATER VAPOR = 12.25
ACTUAL WET FLOW RATE, acfm = 7,497.02
STANDARD DRY FLOW RATE, scfm = 5,682.08
PARTICULATE CONCENTRATION, grains/dscf = 0.0893
PARTICULATE EMISSION RATE, lb/hr = 4.502
PERCENT OF ISOKINETIC SAMPLING = 107.11

FIGURE 2-1

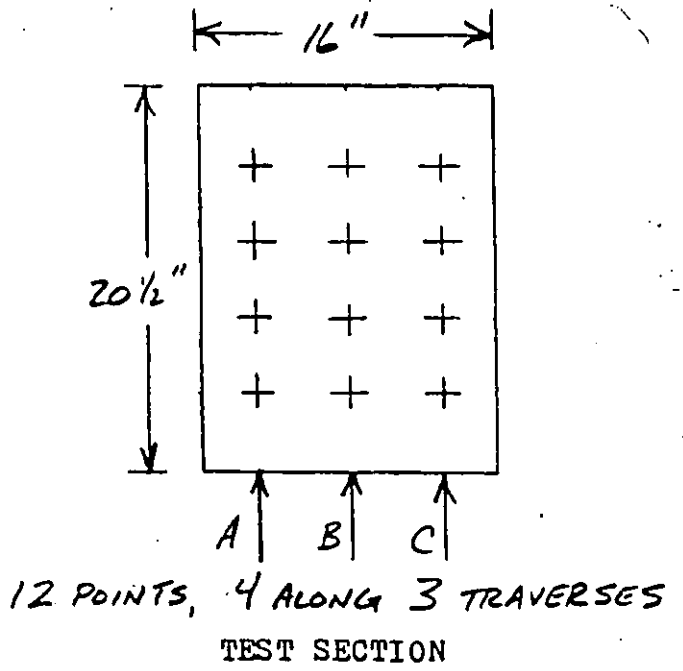
PLANT Hillshire

LOCATION New London, WI

PROCESS KSI-2
Contin. Smokehouse

DIMENSIONS 16" x 20½"

COMMENTS

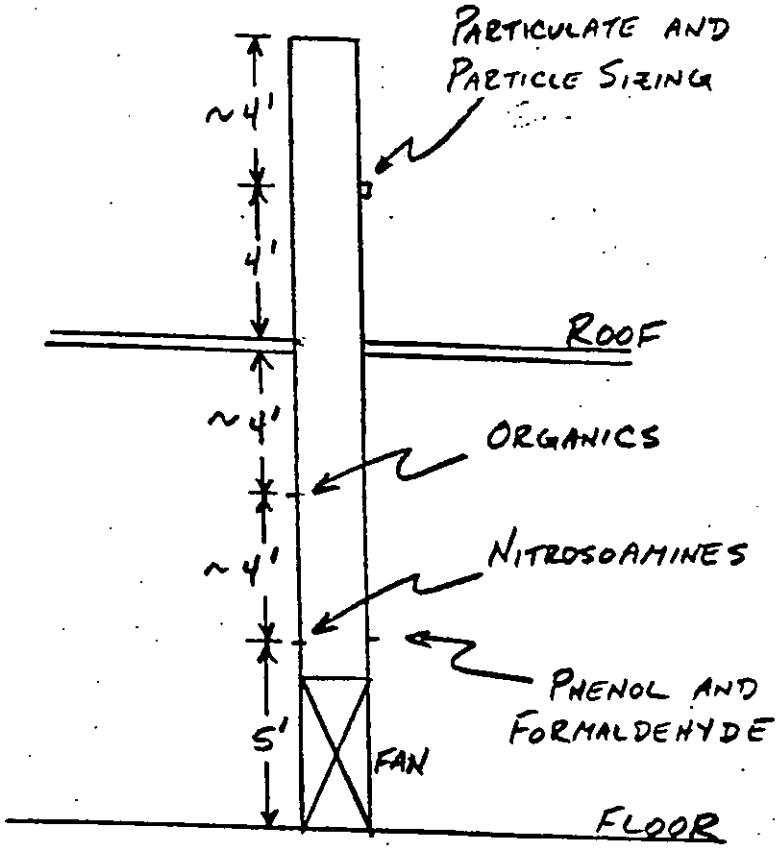


12 POINTS, 4 ALONG 3 TRAVERSES

TEST SECTION

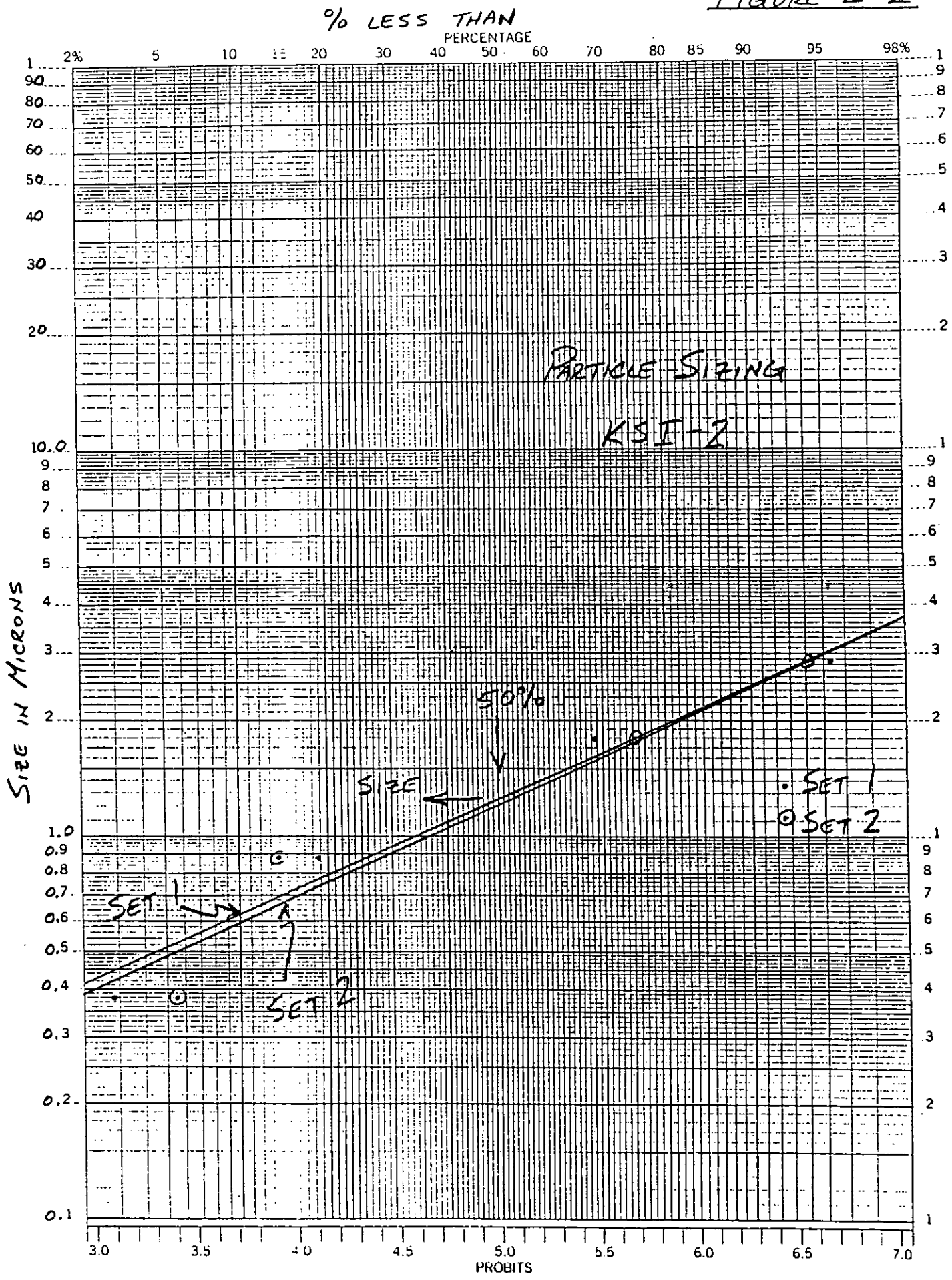
POINT	DISTANCE FROM STACK WALL
1	4.1 in
2	8.2 in
3	12.3 in
4	16.4 in

SAMPLING LOCATION



13020 WEST BLUEMOUND ROAD • ELM GROVE, WISCONSIN 53122 • TELEPHONE (414) 784-2434

FIGURE 2-2


% LESS THAN
PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PARTICLE SIZING
KSI-2
SIZE IN MICRONS
50%
SIZE
SET 1
SET 2
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
46 8080
K·E PROBABILITY X 3 LOG CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

2.3 Phenol Emissions

The results of the testing to determine phenol emissions are shown in Table 2-4. Testing to determine phenol emissions was performed using the procedures outlined in National Institute of Occupational Safety and Health (NIOSH) Sampling and Analytical Method 3502. The samples were obtained at a single point in the final discharge stack, approximately 12 feet below (upstream) the particulate sampling location. A further description of the method is included in Section 3.3.

2.4 Formaldehyde Emissions

The results of the testing to determine formaldehyde emissions are shown in Table 2-5. Testing to determine the emissions was performed using the sampling and analytical procedures of NIOSH Method 3500. Similar to phenol, the samples were obtained at a single point in the final discharge stack, approximately 12 feet below the particulate sampling location. A further description of the method is included in Section 3.3.

2.5 Organic Compound Emissions

The results of the testing to determine organic compound emissions are shown in Table 2-6. Total organics (quantified using acetaldehyde as the reference), acetaldehyde, and acetic acid were measured.

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 3.4. The samples were obtained at a single point in the final discharge stack, approximately 8 feet below the particulate sampling location and 4 feet above (downstream) the phenol sampling location.

2.6 Nitrosoamine Emissions

The results of the nitrosoamine testing are given in Table 2-7 and indicated levels below the analytical limits of detection. Sampling was performed using ThermoSorb tubes as supplied as Thermedics Inc. (further discussion is included in Section 3.5. The tubes were then submitted to Thermedics for analysis. The sampling was performed adjacent to the formaldehyde and phenol sampling locations.

TABLE 2-4

Phenol Emissions Sampling Results
HSI-2 Smokehouse Operations
Hillshire Farm & Kahn's - New London, Wisconsin
November 17, 1989

Test	Time	Phenol Emissions Concentration	Phenol Emissions Rate
1	10:20 - 11:20	0.27 mg/m3	0.0059 #/hr
2	12:03 - 13:03	0.22 mg/m3	0.0046 #/hr
3	13:19 - 14:18	0.28 mg/m3	0.0059 #/hr
	AVERAGE	**0.26 mg/m3**	**0.0055 #/hr**

Notes: mg/m3 means milligrams compound per cubic meter air
#/hr means pounds per hour

TABLE 2-5

Formaldehyde Emissions Sampling Results
KSI-2 Smokehouse Operations
Hillshire Farm & Kahn's - New London, Wisconsin
November 17, 1989

Test	Time	Formaldehyde Emissions Concentration	Formaldehyde Emissions Rate
1	10:16 - 11:16	2.97 mg/m3	0.065 #/hr
2	12:03 - 13:03	2.68 mg/m3	0.056 #/hr
3	13:19 - 14:16	2.88 mg/m3	0.061 #/hr
	AVERAGE	2.84 mg/m3	0.061 #/hr

Notes: mg/m3 means milligrams compound per cubic meter air
#/hr means pounds per hour

TABLE 2-6

Organic Compounds Emissions Sampling Results
KSI-2 Smokehouse Operations
Hillshire Farm & Kahn's - New London, Wisconsin
November 17, 1989

Time	Total Organics (1) Concentration	Acetaldehyde Concentration	Acetic Acid Concentration
10:30	268 mg/m3	14 mg/m3	22 mg/m3
10:50	260	18	22
11:10	--	16	28
11:20	234	16	18
11:45	200	14	18
11:50	--	14	15
12:05	--	16	15
12:31	--	18	18
12:40	288	14	26
13:00	253	18	11
13:35	--	18	--
AVERAGE	250 mg/m3	16 mg/m3	19 mg/m3

Emission Rates:

Total Organics (1) -	5.3 #/hr
Acetaldehyde -	0.34 #/hr
Acetic Acid -	0.41 #/hr

Notes: (1) Total organic compounds, including acetaldehyde and acetic acid, quantified using acetaldehyde as the reference compound
-- means no measurement taken at that time
mg/m3 means milligrams compound per cubic meter air
#/hr means pounds per hour

TABLE 2-7

Nitrosamine Emissions Sampling Results
HSI-2 Smokehouse Operations
Hillshire Farm & Kahn's - New London, Wisconsin
November 17, 1989

Test	Time	Nitroso Compound Group	Nitrosoamine Emission Concentration	Nitrosoamine Emission Rate
1	10:25-	A	< 0.07 ug/m3	< 0.000001 #/hr
	11:28	B	< 0.11 ug/m3	< 0.000002 #/hr
		C	< 0.13 ug/m3	< 0.000003 #/hr
2	12:01-	A	< 0.08 ug/m3	< 0.000002 #/hr
	13:01	B	< 0.14 ug/m3	< 0.000003 #/hr
		C	< 0.17 ug/m3	< 0.000004 #/hr
3	13:19-	A	< 0.08 ug/m3	< 0.000002 #/hr
	14:28	B	< 0.13 ug/m3	< 0.000003 #/hr
		C	< 0.16 ug/m3	< 0.000003 #/hr

Group A compounds: N-nitrosodimethylamine
N-nitrosomethylvinylamine

Group B compounds: N-nitrosodiethylamine
N-nitrosodi-n-propylamine
N-nitrosomorpholine
N-nitrosopiperidine
N-nitrosopyrrolidine

Group C compounds: N-nitrosodi-n-butylamine

Notes: < means less than the analytical limit of detection
mg/m3 means milligrams compound per cubic meter air
#/hr means pounds per hour

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.

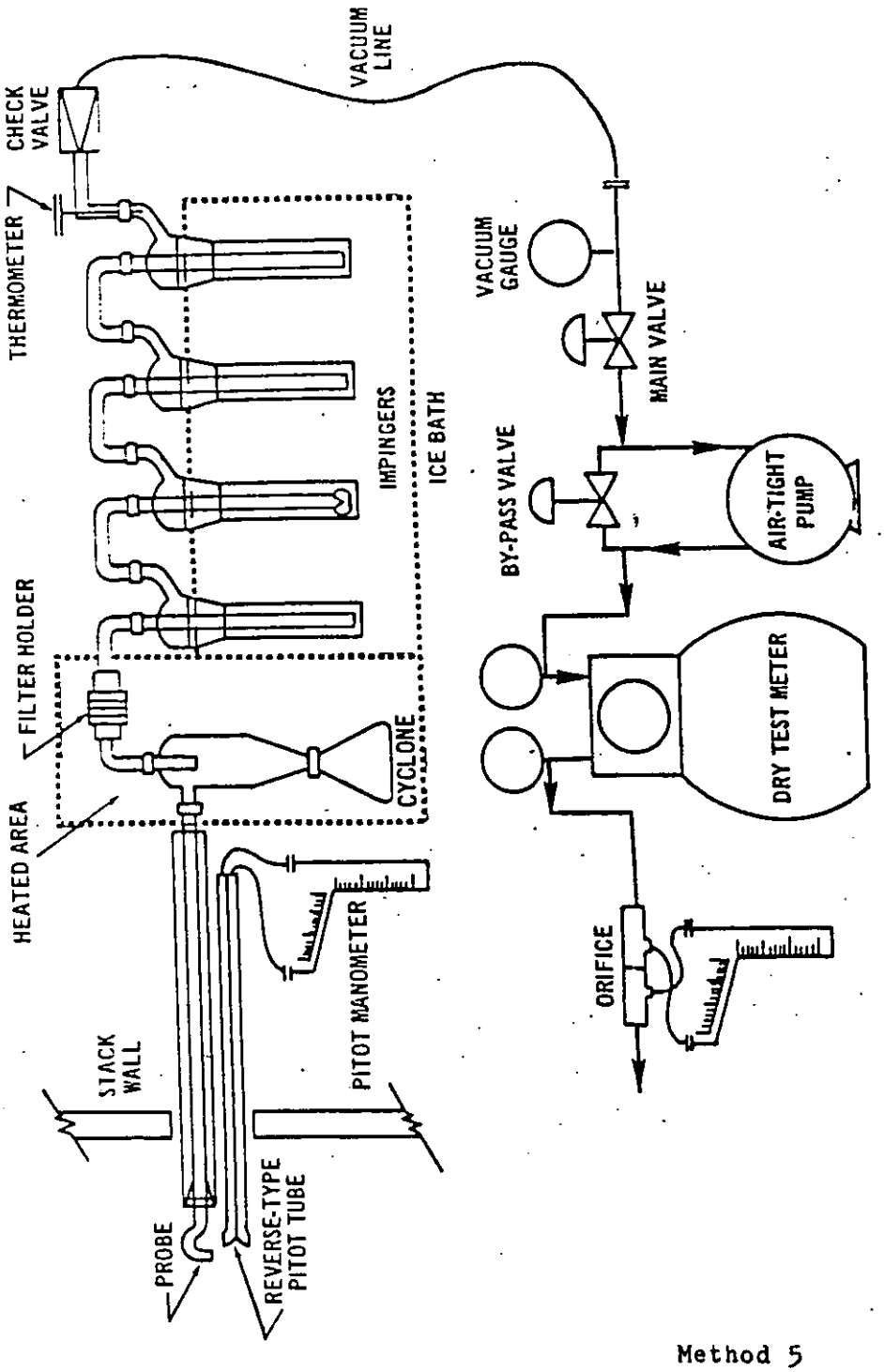
The temperatures of the stack gas stream, as well as strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit.

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 CO2, O2, and N2.

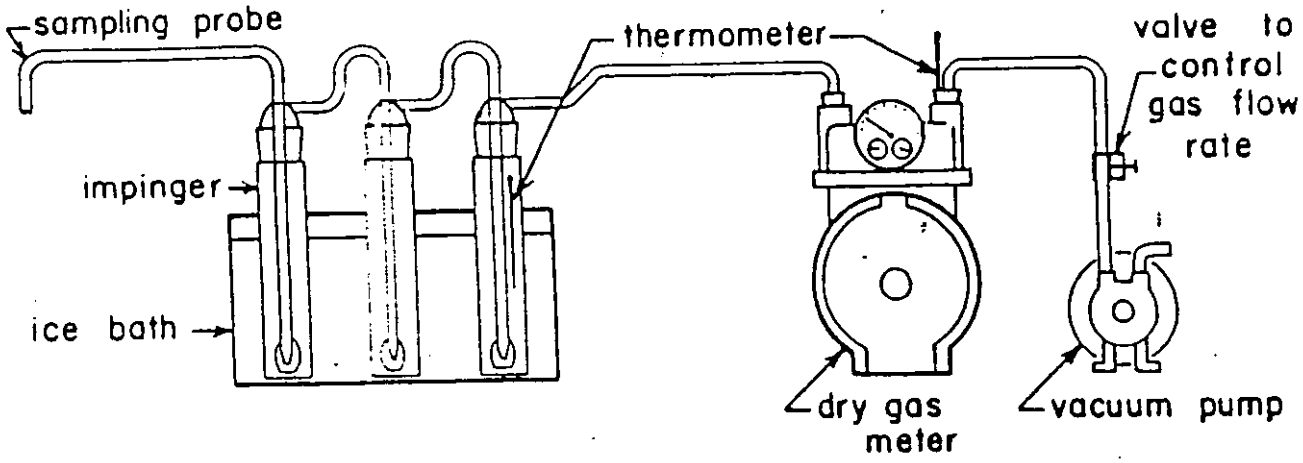
FIGURE 3-1



Particulate sampling train.

Method 5

FIGURE 3-2



IMPINGER SAMPLING TRAIN

3.1 (continued)

At the completion of the test, the impinger contents were measured and weighed for determination of the actual moisture content of the exhaust gas stream. The impinger solution and glassware washings were first subjected to an extraction with freon in a similar manner to oil and grease extractions in water. The freon was then evaporated to dryness and an aliquot of the remaining water was also evaporated. The sum of these two is considered the "back-half" or condensible particulate matter. This procedure was published by the Wisconsin DNR in the AIR MANAGEMENT OPERATIONS HANDBOOK as "The Proposed Method for Condensible Particulate."

The probe tip, probe, and glassware preceding the filter were washed with acetone and placed in a tared beaker and evaporated at room temperature. The filter and beaker were then desiccated to the tared humidity conditions and weighed. The combined weight of the filter catch and the washing residue was used for the determination of emission rates and emission concentrations.

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 Particle Sizing

An Anderson Mark II (6 stage) In-Stack Cascade Impactor was used to collect particle size samples. A preliminary velocity profile was performed using a pitot tube, inclined manometer, and thermometer. A single velocity was then selected and the cascade impactor was placed at the same sample points used for the particulate sampling. The testing approximated an isokinetic sample.

Following the testing, the impactor was disassembled and the collection filters were desiccated and reweighed. The weight gains on each filter (stage) were used in conjunction with the curves generated by the manufacturer to determine the particle size distribution.

The mean particle size is given as the size where 50 percent of the particles collected are above or below (by weight) that size. The percentage of particles less than 10 microns in size were also determined from the plots to determine the impact of "PM 10" regulations.

3.2 (continued)

All data presented is based on spherical particles of density equal to 1.0. Generally, there is no need to correct the data for the actual particle shape and density since these spherical unit density particles are used as reference calibration particles. Results are then presented in terms of equivalents of these reference particles. If, however, it is desired to correct the curve, the actual diameter would be the measured diameter divided by one over the square root of the actual particle density. For example, given a particle density of 4.0, the actual diameters would be one half the reported diameters.

3.3 Phenol and Formaldehyde Emissions

Samples for phenol and formaldehyde were obtained using *NIOSH* Methods 3502 and 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 (0.1 N sodium hydroxide for phenol and 1% sodium bisulfite for formaldehyde), 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.

For phenol, aliquots of the first and second impinger sampling solutions were then analyzed by gas chromatograph; formaldehyde was analyzed colorimetrically. For both compounds, a standard curve was also generated to quantify the samples and blanks of the sampling solution. This information was combined with the volume of gas sampled to determine the phenol and formaldehyde concentrations in the exhaust gas stream. The emission rates were then calculated using these concentrations and the volumetric flow rate.

3.4 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	SE 30
Temperature	130 C
Carrier Gas	Nitrogen at 20 cc/min

Recorded chromatograms were obtained using an Esterline Angus Model MS 401 8B recorder at a chart speed of 300 cm/hr.

Standard concentrations of the 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 VOC concentrations of the exhaust gas stream were then determined by comparing the response of the standards to the response to the exhaust duct samples. Sample retention times and peak heights were used to quantify both the acetaldehyde and acetic acid emissions. The acetaldehyde standard was then used to quantify the entire chromatogram (all of the peaks from each sample injection); that is, the area under all of the peaks from a given sample was 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 organic compound emission rates in units of pounds per hour (lb/hr).

3.5 Nitrosoamine Emissions

Sampling for nitrosoamines was accomplished through the use of ThermoSorb sampling cartridges manufactured by Thermedics, Inc.. These cartridges are recommended by OSHA for determination of nitrosoamine levels in the workplace; they contain a resin capable of capturing the nitrosoamines as well as compounds which inhibit their production or breakdown in the cartridge during and after sampling.

3.5 (cont.)

Thermedics personnel were contacted requiring the use of the cartridges at the stack temperatures and humidity levels which were anticipated. Technical personnel recommended that two cartridges be used in series to ensure high collection efficiency despite elevated temperature and humidity levels.

Again, sampling was performed at a single point located near the phenol and formaldehyde sampling locations. Following sampling, the cartridges were sealed and submitted to Thermedics for analysis. Analysis included the elution of the sorbent with solvent and injection of solvent aliquots into a combined gas-liquid chromatography system equipped with thermal energy analyzer (TEA). Output was then compared to standard concentrations of the various nitrosoamines analyzed.

3.6 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.	*d*H@ =	1.613

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:

$$Gama = 1.029 + ((Td - 70) \times .00012)$$

where: Td = Dry Gas Meter Temperature

The dry gas meters used in the phenol, formaldehyde, and nitrosoamine testing were not temperature compensating meters; therefore, all of the sample volumes were corrected for temperature to 68 F. The correction factors for the meters were:

Phenol:	Gama = 1.014
Formaldehyde:	Gama = 1.038
Nitrosoamines:	Gama = 0.980

The most recent calibrations were performed October 16, 1989.

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

   $$Vs = Kp*Cp*\overline{(DELP)_{AVG}}\sqrt{Tsavg/(Ps*Ms)}$$

   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

Environmental
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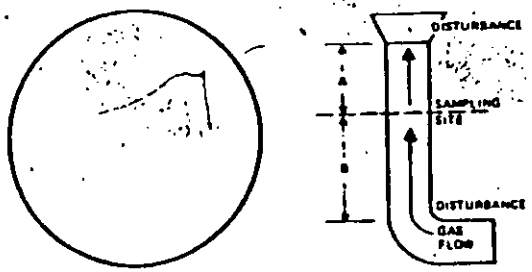
Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillsdale
DATE 11-17-09
LOCATION N. of London
OPERATOR WJD
STACK NO. ICSE 2
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 1

AMBIENT TEMPERATURE 20
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 5
PROBE LENGTH, in. 4'
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 16 x 20 1/2
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

α = 0.85
Y = 1.009
METER ΔH 1.63
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2
O_2
CO
N_2

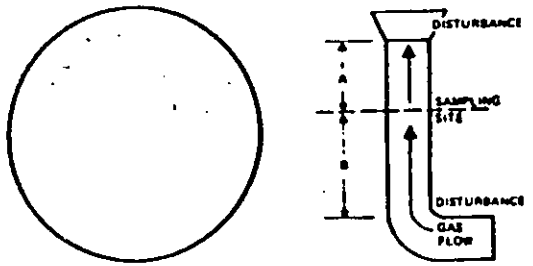
Pb Leak Pitot Leak Post/Prior

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD ($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft^3	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	10 or 00		135	.80	2.35		8217.00		35				
2	09		135	.76	2.20		17.0		37				
3	14	-0.20	137	.68	2.00		21.7		38				
4	19		130	.62	1.85		26.2		39				
C 5	24/29		130	.84	2.50		30.5		40				
6	30	-0.30	135	.85	2.50		35.5		42				
7	35		135	.86	2.50		40.4		42				
8	40		135	.77	2.15		45.2		45				
B 9	45/46		137	.88	2.60		49.6		47				
10	51		135	.88	2.60		54.5		48				
11	56	-0.35	135	.82	2.40		59.4		49				
12	01		135	.68	2.00		61.3		51				
	06						68.60						
							(56.60)			PS	#1	ΔH = 2.50	
									1117	8270.00	50F		
									1132	8286.00	54F		
										16.00			

Environmental
Technology &
Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Millstone
DATE 11-17-89
LOCATION New London
OPERATOR WJD
STACK NO. KS12
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE 25° F
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % 5%
PROBE LENGTH, in. 4'
NOZZLE DIAMETER, in. 1/4"
STACK DIAMETER, in. 16 x 70½"
PROBE HEATER SETTING 750
HEATER BOX SETTING 250

METER ΔH@ 1.613
C FACTOR 0.85 x 1.009
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2
O_2
CO
N_2

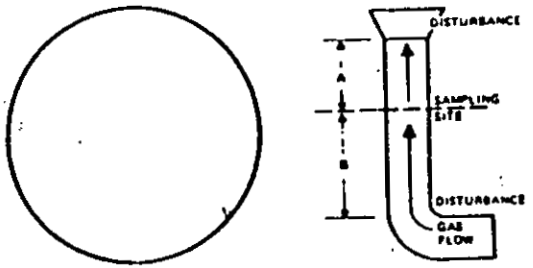
PROBE and PITOT K

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
B1	1141.00		130	.81	2.55		8285.00		50				
2			130	.88	2.60		90.0		52				
3			130	.84	2.50		95.0		57				
4			130	.67	2.05		99.7		54				
C 1	1201.00		130	.84	2.60		04.3		54				
2	07		135	.84	2.50		08.8		56				
3	12		135	.79	2.30		13.6		56				
4	17		135	.63	1.90		17.3		56				
A B	2253		135	.64	1.95		22.2		57				
2	28		135	.78	2.30		26.5		60				
3	33		130	.74	2.25		31.2		61				
4	38			.64	1.95		35.5						
	1243						8339.80						
							(STRT)						
											PS - SET 10		
									1255		8390.00	DH = 2.50	
									1255		45.00		

Environmental
Technology &
Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Hillsthre
DATE 11-17-89
LOCATION New London
OPERATOR WJD
STACK NO. K-SI-2
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO. _____

AMBIENT TEMPERATURE _____
BAROMETRIC PRESSURE _____
ASSUMED MOISTURE, % _____
PROBE LENGTH, in. _____
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 16 x 20 1/2
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH, _____
C FACTOR _____
PROCESS WEIGHT RATE _____

ORSAT RESULTS
CO_2 _____
O_2 _____
CO _____
N_2 _____

Pre 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), ft^3	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	13:03		130	.70	2.15		834.90		59				
2	11		135	.71	2.30		495		60				
3	16		130	.70	2.15		543		60				
4	21		130	.62	1.85		586		61				
C 5	26/27		135	.84	2.50		638		60				
6	32		135	.82	2.60		675		60				
7	37		135	.82	2.60		724		60				
8	42		135	.67	2.00		772		60				
B 9	47/48		130	.88	2.60		818		62				
10	53		130	.86	2.60		866		63				
11	58		130	.84	2.50		915		64				
12	03		130	.70	2.15		962		65				
	1600						8400.60						
							55.160						
										PS - SET 13			

PARTICULATE & WATER COLLECTED

JOB NAME Hillshire — DATE OF TEST 11-17-89

JOB NO. — TEST ENGINEER WJD

RUN NO. 1 — STACK KS1-2

SAMPLE BOX 1 — FILTER 1162 — WASH BOTTLE —

BEAKERS: FH Ace 20 — BH Trichl 6 — BH Ace 21 — BH H_2O A

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	114	100	14
2	160	100	160
3	25	0	25
SIL GEL	672	644	28
		WATER TOTAL	127

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter	-.0005	0.8876	0.8050	.0831
150 FH Wash	.0035	94.2094	94.1760	.0299
		FILTERABLE TOTAL		.1130
Extract	.0005	69.7043	69.6500	.0538
100 Acetone	.0024	97.4405	97.3735	.0646
Water	.0008	107.9605	107.9238 (3.99)	.1432
		CONDENSIBLE TOTAL		.2616
		PARTICULATE TOTAL		.3746

+ 100 ml water rinse

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillshire — DATE OF TEST 11-17-89

JOB NO. — TEST ENGINEER WJD

RUN NO. 2 — STACK KS12

SAMPLE BOX 2 — FILTER 1167 — WASH BOTTLE —

BEAKERS: FH Ace 2FH — BH Trichl 8 — BH Ace 4 — BH H_2O 27

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	177	100	77
2	159	100	59
3	18	0	18
SIL GEL	689	655	34
		WATER TOTAL	188

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter	-.0005	0.9125	0.7930	0.1200
150 PH Wash	.0035	97.7184	97.6857	.0292
		FILTERABLE TOTAL		.1492
Extract	.0005	68.8561	68.7964	.0592
100 Acetone	.0024	95.4190	95.3862	.0304
Water	.0008	109.3730	109.3518 (4.54)	.0926
		CONDENSIBLE TOTAL		.1822
		PARTICULATE TOTAL		.3314

+ 100 ml H_2O

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Hillshire — DATE OF TEST 11-17-89

JOB NO. _____ — TEST ENGINEER WJD

RUN NO. 3 — STACK KSI 2

SAMPLE BOX 3 — FILTER 1168 — WASH BOTTLE —

BEAKERS: PH Ace 7 — BH Trichl 9 — BH Ace 16 — BH H_2O 31

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	198	100	98
2	125	100	25
3	14	0	14
SIL GEL	710	685	25
		WATER TOTAL	162

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter	-.0005	0.9101	0.8020	0.1086
150 PH Wash	.0035	93.9436	93.8891	0.0510
		FILTERABLE TOTAL		0.1596
Extract	.0005	72.7796	72.1688	0.0603
Acetone	.0024	96.0963	96.0729	0.0210
100 Water	.0008	111.0980	111.0800 (4.37)	0.0752
		CONDENSIBLE TOTAL		0.1565
		PARTICULATE TOTAL		0.3161

+100 ml H_2O

FIELD SAMPLING DATA - PHENOL

GENERAL
Facility HILLSHIRE
Address NEW LONDON
Contact VERN WICHMANN
Test Date 4/12/89
Witnesses EVERETT NELSON - MAINT SMOKEHS
ED BEISNER - OPERATOR

Process Description CONTINUOUS SMOKEHOUSE
12:00 - 11:30 - 5 SANICHIPS GENERATORS - 2 @ 80% 3 @ 100%
1 WUNDERSMOKE GENERATOR - 100% ~130 # SAWDUST/H

Stack Number KSI 2

SAMPLING DATA
A. Sample ID P-1 Pump # 3 DGM 2

γ = 1.014

	Time	Rotameter	Flow Rate	Minutes	Volume
Start	1020	413.32	T=96		
	1020	415.55	T=97		
	----	---------	----		
	----	---------	----		
Stop	1203	415.55	T=96		
P-2	1303	418.18	T=95		

B. Sample ID P-3 Pump # ____

	Time	Rotameter	Flow Rate	Minutes	Volume
Start	1319	418.18	T=94		
	1418	420.30	T=93		
	----	---------	----		
	----	---------	----		
Stop	----	---------	----		

FLOW DATA

d = _____
L x W = _____
Cp = _____

Point	Del P	Del P
1		
2		
3		
4		
5		
6		
7		
8		
T =		

COMMENTS 1ST SOLN BROWNISH, FILMY BUBBLES; 2ND IMP ALSO GOLDEN, VERY LITTLE RESIDUE ON GLASS

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

FIELD SAMPLING DATA – FORMALDEHYDE

GENERAL
Facility HILLSHIRE — Contact VERN WICHMAN
Address NEW LONDON — Test Date 11/17/89
Witnesses DAVE JONES – V. PRES.

Process Description 12:00 – 1:00 – SAME EXCEPT 4 OUT OF 5 SMOKE GENERATORS WERE RUNNING AT 75-80 %

Stack Number KSI 2

SAMPLING DATA

A. Sample ID F-1 — Pump # 1 DGM #1

γ = 1.038

	Time	Rotameter	Flow Rate	Minutes	Volume
Start	1018	189.58	T=95		
	1018	192.34	T=97		
F-2 Stop	1203	192.34	T=96		
	1303	195.04	T=95		

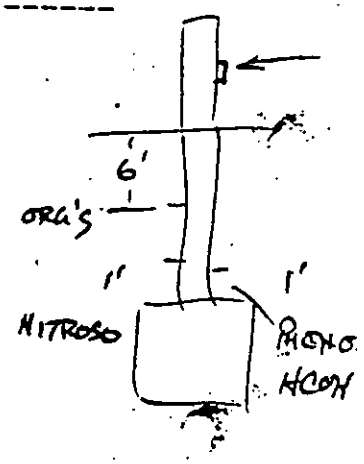
B. Sample ID F-3 — Pump #

	Time	Rotameter	Flow Rate	Minutes	Volume
Start	1319	195.04	T=94		
	1418	197.49	T=93		
Stop					

FLOW DATA

d = ———
L x W = ———
Cp = ———

Point	Del P	Del P
1		
2		
3		
4		
5		
6		
7		
8		
T =		



COMMENTS VOL-RRN RESIDUE ON GLASSWARE, LITTLE IN SOL'N NOT AS FILMY AS PHENOL SOL'N

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Elm Grove, Wisconsin 53122
414-784-2434

AP42 Section: 9.5.3 Meat Rendering Plants

Title: Correspondence and comments