AP-42 Section 9.5.3
Reference 4
Report Sect.
Reference

Mil. Tallow
Mil, WI
Blood Dryer
Sept 27, 1989

Per Devia

EIE

Received 11/6/89

CORRESPONDENCE/MEMORANDUM_____State of Wisconsin

4530

Date: November 14, 1989

To: SED Case File

From: Eileen F. Ingwersen EFI

Subject: Review of Stack Test Conducted at Milwaukee Tallow Co. on September 27, 1989 between 5:55 and 9:42 pm.

Receiv: 11/6/89

I. Source

Milwaukee Tallow Company
131 South Seventh Street
P.O. Box 1174
Milwaukee, Wisconsin 53233

Mr. Duane Hildreth, Plant Manager
(414) 276-5700

FID# 241043990
Permit# 89-VAR-211, issued on July 7, 1989
Process P10 Stack S10, Blood Dryer
Initial Operation Began on July 12, 1989.

II. Process Description

The source tested is a natural gas fired blood dryer. The maximum capacity of the dryer is 2275 pounds finished product per hour, 26300 pounds raw material per hour. High intensity room odors are vented to the blood dryer burner for incineration. These odor emissions are from the rendering operation and were previously controlled by a wet scrubber. An air/particulate cyclone separator follows the dryer for collection of blood meal product. A venturi wet scrubber and three packed bed scrubbers follow the cyclone in series. A sodium hypochlorite solution is the scrubbing medium for the three packed beds. (See the attached flow diagram.) During this stack test the blood dryer was operated at its rated capacity. The raw pounds input was monitored and maintained within 0.004 percent of 26300 pounds raw material per hour. During a major portion of the third run of the particulate test "overloading" of the process occurred.

III. Sampling Operation

A. Purpose of Test

Part I.B.2 of permit #89-VAR-211 requires that the emissions from the blood dryer be tested for compliance with the PM/PM10, hydrogen sulfide, ammonia, and opacity limits. This permit was issued on July 7, 1989. Initial operation of the blood dryer began on July 12, 1989. A notice of violation

was issued to Milwaukee Tallow Company on August 4, 1989 for construction of this blood dryer without a permit. No further enforcement action was taken.

B. Sampling Firm

These tests were conducted by Michael J. Huenink of Environmental Technology & Engineering Corp., 13020 West Bluemound Road, Elm Grove, WI 53122, (414) 784-2434.

C. Test Methods

Testing for particulate matter emissions was conducted in accordance with the procedures outlined in EPA Method 5 (40 CFR, Part 60, App. A). A six stage in-stack Cascade Impactor was used to collect a particle size sample for PM10 analysis.

Testing for hydrogen sulfide emissions was conducted in accordance with the procedures outlined in EPA Method 11 (40 CFR, Part 60, App. A).

Testing for ammonia emissions was conducted in accordance with the procedures outlined in NIOSH P & CAM Method 125.

Visible emissions were analyzed in accordance with the procedures outlined in EPA Method 9 (40 CFR, Part 60, App. A).

The PM/PM10 tests were conducted from two ports located in the final discharge stack ten feet downstream from the nearest obstruction, and six feet upstream from the stack outlet. The diameter of the stack is 70 inches. For the PM test twenty four points were sampled for 2.5 minutes per point for each of the three 60 minute runs. For the PM10 particle sizing a two hour test was taken along both traverses of the stack diameter.

The hydrogen sulfide and ammonia tests were conducted from a port just upstream from the PM/PM10 test ports. For each of these tests three 60 minute samples were drawn through a midget impinger train at one litre per minute. The hydrogen sulfide and ammonia tests were performed at the same time as the particulate matter tests.

Visible emissions were observed for one hour during the first run of the PM test. Lack of daylight prevented further readings.

The first run of these tests was witnessed by Marvin Patton, DNR.

IV. Summary of Results

Run#	PM/PM10 #/hr*	Isokinetic %	Hydrogen Sulfide #/hr	Ammonia #/hr	Opacity %
1	1.92	96.61	<0.005	0.94	0.42
2	2.05	97.18	<0.003	0.62	-
3	3.35	97.12	0.266	0.46	-
avg.	2.44	96.97	0.091	0.67	0.42
Permit Limits	0.81	-	8.85	1.95	20

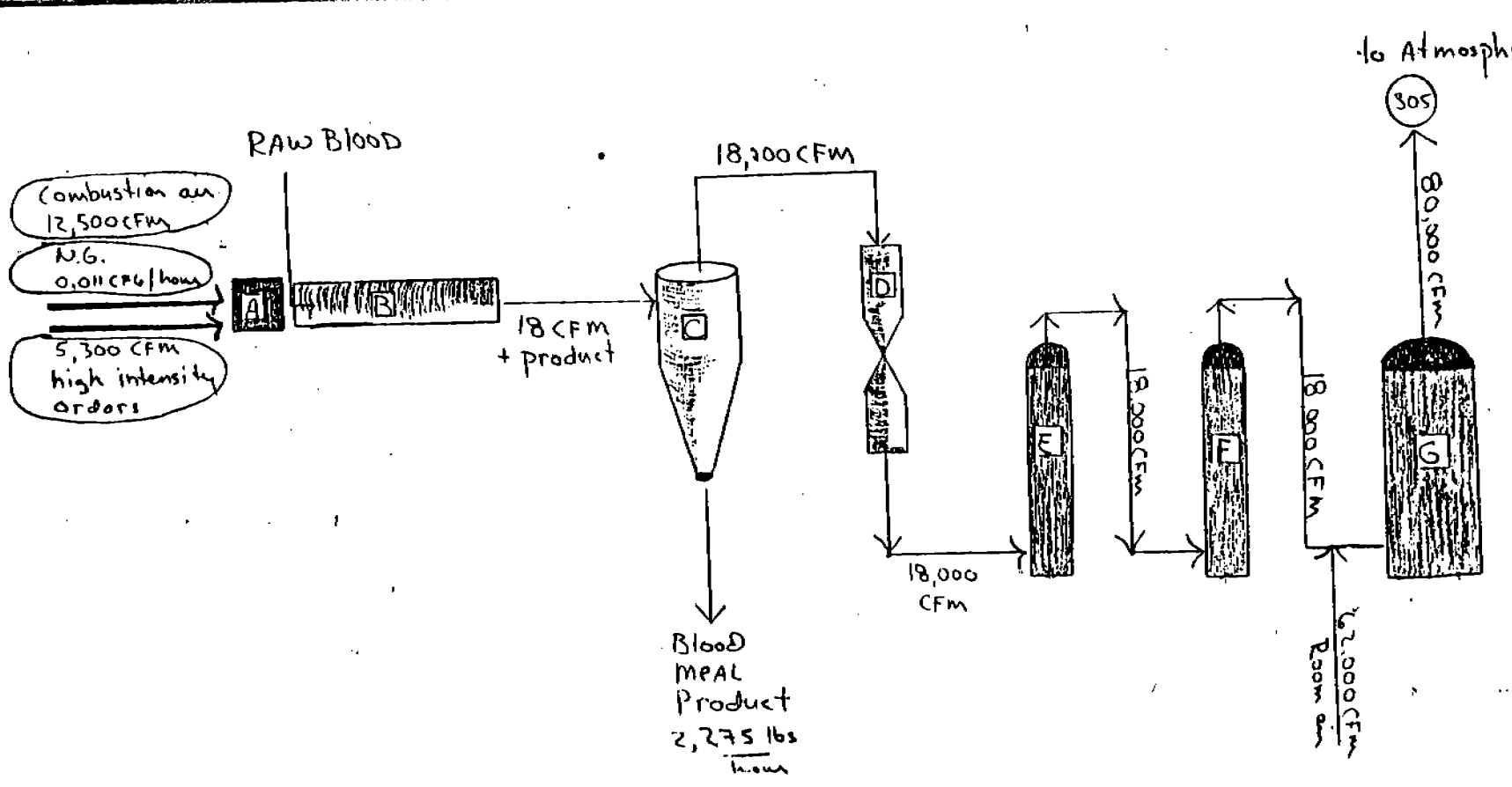
* The results of the particle sizing indicate that all the particulate sampled was less than ten microns in size.

V. Discussion of Results

The results of these tests indicate that Milwaukee Tallow operates this blood dryer in violation of the PM/PM10 emission limit of 0.81 pounds per hour, NR 415.03, Wis. Adm. Code, Permit #89-VAR-211. The test resulta also indicate that this blood drier is operated in compliance with the hydrogen sulfide, ammonia, and visible emission limits. These limits as set in Permit #89-VAR-211, are as follows: 8.85 pounds hydrogen sulfide per hour, NR 445.04(1); 1.95 pounds ammonia per hour, NR 445.04(1); and 20% opacity, NR 431.05(1), Wis. Adm. Code.

The report prepared by ET&E contains calibration data for the sampling equipment and a description of the production levels for the process during the testing. No deviations from standard US EPA testing procedures are noted in the report. The isokinetic ratio during the particulate test is within the 90 to 110% range set by the Department.

c: SED Case File
Joe Perez - AM/3
U.S. EPA Region V



A = furnace
B = Rotary dryer
C = cyclone separator
D = Venturi scrubber
E = 18,000 CFM scrubber ($NaOCl$)
F = 18,000 CFM scrubber ($NaOCl$)
G = 80,000 CFM scrubber ($NaOCl$)

] counter current flow

Milwaukee Tallow
New Blood Dryer
5/4/89
VAR

MILW TALLOW - BLOOD DRYER TEST 1 TABLE 2-1 9-27-89

BAROMETRIC PRESSURE, in Hg. = 29.200
TIP DIAMETER, in .2500
STACK AREA, sq ft = 26.730
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 52.25
WATER COLLECTED, ml = 13.00
PARTICULATE COLLECTED, grams = 0.0109
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	65	0.750	2.75	60	49.70
2	65	0.750	2.75	60	49.70
3	65	0.680	2.45	61	47.32
4	65	0.600	2.20	61	44.45
5	65	0.540	1.95	61	42.17
6	65	0.500	1.85	62	40.58
7	65	0.450	1.70	62	38.49
8	65	0.450	1.70	63	38.49
9	65	0.480	1.80	64	39.76
10	65	0.500	1.85	65	40.58
11	65	0.500	1.85	66	40.58
12	65	0.500	1.85	68	40.58
13	60	0.640	2.30	70	45.69
14	60	0.600	2.20	70	44.24
15	60	0.540	1.95	71	41.97
16	65	0.500	1.85	72	40.58
17	65	0.480	1.80	73	39.76
18	60	0.450	1.70	74	38.31
19	60	0.520	1.90	75	41.18
20	65	0.680	2.45	75	47.32
21	65	0.860	3.15	76	53.22
22	60	1.000	3.65	77	57.11
23	65	1.050	3.85	79	58.80
24	65	0.800	2.95	80	51.33
AVG VALUES	64		2.269	69	44.66

TOTAL GAS WITHDRAWN, scf = 52.04
DRY GAS WITHDRAWN, scf = 51.43
WATER VAPOR WITHDRAWN, scf = 0.61
PERCENT WATER VAPOR = 1.18
ACTUAL WET FLOW RATE, acfm = 71,627.06
STANDARD DRY FLOW RATE, scfm = 69,580.65
PARTICULATE CONCENTRATION, grains/dscf = 0.003
PARTICULATE EMISSION RATE, lb/hr = 1.917
PERCENT OF ISOKINETIC SAMPLING = 96.61

MILW. TALLOW - BLOOD DRYER TEST 2 TABLE 2-2 9-27-89

BAROMETRIC PRESSURE, in Hg = 29.200
TIP DIAMETER, in .2500
STACK AREA, sq ft = 26.730
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 51.70
WATER COLLECTED, ml = 24.00
PARTICULATE COLLECTED, grams = 0.0117
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	65	0.620	2.30	79	45.27
2	65	0.600	2.25	79	44.53
3	65	0.550	2.00	80	42.64
4	65	0.500	1.85	80	40.65
5	65	0.480	1.80	80	39.83
6	~~65~~ 60	0.460	1.70	81	38.99
7	65	0.460	1.70	81	38.99
8	65	0.720	2.65	81	48.78
9	65	0.880	3.20	81	53.93
10	65	0.980	3.65	81	56.91
11	65	1.050	3.85	81	58.91
12	65	0.880	3.20	81	53.93
13	65	0.700	2.60	82	48.10
14	65	0.680	2.50	83	47.41
15	65	0.680	2.50	83	47.41
16	65	0.580	2.15	83	43.78
17	65	0.580	2.15	83	43.78
18	65	0.500	1.85	84	40.65
19	65	0.460	1.70	84	38.99
20	65	0.460	1.70	84	38.99
21	65	0.460	1.70	84	38.99
22	65	0.460	1.70	84	38.99
23	65	0.440	1.65	84	38.14
24	65	0.500	1.85	84	40.65
AVG VALUES	65		2.258	82	44.55

TOTAL GAS WITHDRAWN, scf = 52.10
DRY GAS WITHDRAWN, scf = 50.97
WATER VAPOR WITHDRAWN, scf = 1.13
PERCENT WATER VAPOR = 2.17
ACTUAL WET FLOW RATE, acfm = 71,455.07
STANDARD DRY FLOW RATE, scfm = 68,552.81
PARTICULATE CONCENTRATION, grains/dscf = 0.004
PARTICULATE EMISSION RATE, lb/hr = 2.052
PERCENT OF ISOKINETIC SAMPLING = 97.18

MILW TALLOW - BLOOD DRYER TEST 3 TABLE 2-3 9-27-89

BAROMETRIC PRESSURE, in Hg = 29.200
TIP DIAMETER, in .2500
STACK AREA, sq ft = 26.730
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 51.64
WATER COLLECTED, ml = 23.00
PARTICULATE COLLECTED, grams = 0.0191
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	65	0.640	2.35	83	45.99
2	65	0.600	2.20	84	44.53
3	65	0.560	2.05	84	43.02
4	65	0.520	1.90	84	41.45
5	65	0.500	1.85	84	40.65
6	65	0.460	1.70	84	38.99
7	65	0.460	1.70	84	38.99
8	65	0.780	2.85	84	50.77
9	65	0.780	2.85	84	50.77
10	65	1.000	3.65	84	57.48
11	65	1.050	3.85	84	58.90
12	65	0.860	3.15	84	53.31
13	65	0.700	2.55	84	48.09
14	65	0.640	2.35	84	45.99
15	65	0.640	2.35	84	45.99
16	65	0.600	2.30	84	44.53
17	65	0.500	1.85	84	40.65
18	65	0.460	1.70	84	38.99
19	65	0.460	1.70	84	38.99
20	65	0.460	1.70	84	38.99
21	65	0.460	1.70	84	38.99
22	65	0.500	1.85	84	40.65
23	65	0.500	1.85	84	40.65
24	65	0.500	1.85	84	40.65
AVG VALUES	65		2.244	84	44.50

TOTAL GAS WITHDRAWN, scf = 52.00
DRY GAS WITHDRAWN, scf = 50.92
WATER VAPOR WITHDRAWN, scf = 1.08
PERCENT WATER VAPOR = 2.08
ACTUAL WET FLOW RATE, acfm = 71,365.50
STANDARD DRY FLOW RATE, scfm = 68,527.41
PARTICULATE CONCENTRATION, grains/dscf = 0.006
PARTICULATE EMISSION RATE, lb/hr = 3.351
PERCENT OF ISOKINETIC SAMPLING = 97.12

Report to

MILWAUKEE TALLOW CO., INC.
Milwaukee, Wisconsin

for

BLOOD DRYER OPERATION
STACK EMISSIONS TESTING

September 27, 1989

Michael J. Huenink
Industrial Hygienist
October 31, 1989

by

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORPORATION

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

SUMMARY

On September 27, 1989, Environmental Technology & Engineering Corp personnel performed stack emissions testing on the Blood Dryer Operation at the Milwaukee Tallow Company facility located in Milwaukee, Wisconsin. The purpose of the testing was to demonstrate compliance with the limits set forth in Wisconsin Department of Natural Resources Air Pollution Control Permit No. 89-VAR-211. Testing for particulate, "PM10" particulate, visible emissions, hydrogen sulfide, and ammonia was performed.

The results of the particulate testing indicated levels in excess of the particulate matter emission limitation of 0.81 pounds per hour (lbs/hr) and were as follows:

Test	Particulate Emissions Concentration	Particulate Emissions Rate
1	0.003 gr/dscf	1.92 #/hr
2	0.004 gr/dscf	2.05 #/hr
3 *	0.006 gr/dscf	3.35 #/hr
AVG	0.004 gr/dscf	2.44 #/hr

Particle size sampling was performed to determine the portion of particulate considered "PM10 catch" (less than 10 microns). The results indicated that all of the filterable particulate sampled was less than 10 microns in size.

Visible emissions were observed for one hour (darkness prevented further observation) during the testing. The observations indicated the greatest six minute average to be less than one percent; the vast majority of the observations made were zero percent opacity. These were well below the permit opacity limit of 20 percent.

The results of the hydrogen sulfide testing were well below the permit limit of 8.85 lbs/hr for hydrogen sulfide and were as follows:

Test	Hydrogen Sulfide Emissions Concentration	Hydrogen Sulfide Emissions Rate
1	< 0.02 mg/m3	< 0.005 #/hr
2	< 0.01 mg/m3	< 0.003 #/hr
3 *	1.04 mg/m3	0.266 #/hr
AVG	0.36 mg/m3	0.091 #/hr

The results of the ammonia testing were well below the permit emission limitation of 1.95 lbs/hr for ammonia and were as follows:

Test	Ammonia Emissions Concentration	Ammonia Emissions Rate
1	3.6 mg/m3	0.94 #/hr
2	2.4 mg/m3	0.62 #/hr
3 *	1.8 mg/m3	0.46 #/hr
AVG	2.4 mg/m3	0.67 #/hr

NOTES: * Operating conditions were not considered normal during the third test since "overloading" occurred during a major portion of the test period; however, the results of all three tests are included in the average reported.
- gr/dscf means grains per dry standard cubic foot
- #/hr means pounds per hour
- mg/m3 means milligrams of compound per cubic meter air

1.0 GENERAL

On September 27, 1989, Environmental Technology & Engineering Corp (ETE) personnel performed stack emissions testing on the Blood Dryer Operation at the Milwaukee Tallow Company facility located in Milwaukee, Wisconsin. The purpose of the testing was to demonstrate compliance with the limits set forth in Wisconsin Department of Natural Resources (DNR) Air Pollution Control Permit No. 89-VAR-211. Testing for particulate, "PM10" particulate, visible emissions, hydrogen sulfide, and ammonia was performed.

Messrs. Duane Hildreth and Clarence Ehrensberger of Milwaukee Tallow were responsible for maintaining operating conditions throughout the testing. The blood dryer was operated at its rated capacity as stated in the Source Test Plan filed with the DNR. The raw pounds input was monitored and maintained within 0.004 percent of the input as stated in the plan.

The field tests, corresponding laboratory analysis (except hydrogen sulfide analysis), and report preparation were performed by ETE personnel; Michael Huenink was the test team leader. Hydrogen sulfide analysis was completed by Wausau Insurance Environmental Health Lab personnel. The test procedures and operating conditions were witnessed by Mr. Marv Patton of the Wisconsin DNR, Southeast District Office.

The following sections of this report document the activities and results of the test program. The report presents all of the relevant data collected. 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

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. Although the particulate matter loading (grains per dry standard cubic foot) in the exhaust gas stream was relatively low, the emission rates were in excess of the permit limit of 0.81 lbs/hr.

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 PM10 Particulate

PM10 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 that all of the filterable particulate was less than 10 microns in size. Both the particle sizing and particulate matter emissions results were in agreement concerning the particulate matter emission rate from the stack. The particle size testing was performed at the same sampling locations and test points as the particulate matter testing.

2.3 Visible Emissions

The visible emissions (opacity) were observed for an hour-long period in accordance with the procedures outlined in EPA Method 9 - "Visible Determination of the Opacity of Emissions from Stationary Sources" found in 40 CFR, Part 60, Appendix A. The observation period coincided with the first particulate matter emissions test.

The actual observations are included in Appendix B. The highest six minute average of the readings was less than one percent, well below the permit limitation of 20 percent.

MILW TALLOW - BLOOD DRYER TEST 1 TABLE 2-1 9-27-89

BAROMETRIC PRESSURE, in Hg. = 29.200
TIP DIAMETER, in .2500
STACK AREA, sq ft = 26.730
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 52.25
WATER COLLECTED, ml = 13.00
PARTICULATE COLLECTED, grams = 0.0109
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	65	0.750	2.75	60	49.70
2	65	0.750	2.75	60	49.70
3	65	0.680	2.45	61	47.32
4	65	0.600	2.20	61	44.45
5	65	0.540	1.95	61	42.17
6	65	0.500	1.85	62	40.58
7	65	0.450	1.70	62	38.49
8	65	0.450	1.70	63	38.49
9	65	0.480	1.80	64	39.76
10	65	0.500	1.85	65	40.58
11	65	0.500	1.85	66	40.58
12	65	0.500	1.85	68	40.58
13	60	0.640	2.30	70	45.69
14	60	0.600	2.20	70	44.24
15	60	0.540	1.95	71	41.97
16	65	0.500	1.85	72	40.58
17	65	0.480	1.80	73	39.76
18	60	0.450	1.70	74	38.31
19	60	0.520	1.90	75	41.18
20	65	0.680	2.45	75	47.32
21	65	0.860	3.15	76	53.22
22	60	1.000	3.65	77	57.11
23	65	1.050	3.85	79	58.80
24	65	0.800	2.95	80	51.33
AVG VALUES	64		2.269	69	44.66

TOTAL GAS WITHDRAWN, scf = 52.04
DRY GAS WITHDRAWN, scf = 51.43
WATER VAPOR WITHDRAWN, scf = 0.61
PERCENT WATER VAPOR = 1.18
ACTUAL WET FLOW RATE, acfm = 71,627.06
STANDARD DRY FLOW RATE, scfm = 69,580.65
PARTICULATE CONCENTRATION, grains/dscf = 0.003
PARTICULATE EMISSION RATE, lb/hr = 1.917
PERCENT OF ISOKINETIC SAMPLING = 96.61

MILW-TALLOW - BLOOD DRYER TEST 2 TABLE 2-2 9-27-89

BAROMETRIC PRESSURE, in Hg = 29.200
TIP DIAMETER, in .2500
STACK AREA, sq ft = 26.730
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 51.70
WATER COLLECTED, ml = 24.00
PARTICULATE COLLECTED, grams = 0.0117
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	65	0.620	2.30	79	45.27
2	65	0.600	2.25	79	44.53
3	65	0.550	2.00	80	42.64
4	65	0.500	1.85	80	40.65
5	65	0.480	1.80	80	39.83
6	~~65~~ 60	0.460	1.70	81	38.99
7	65	0.460	1.70	81	38.99
8	65	0.720	2.65	81	48.78
9	65	0.880	3.20	81	53.93
10	65	0.980	3.65	81	56.91
11	65	1.050	3.85	81	58.91
12	65	0.880	3.20	81	53.93
13	65	0.700	2.60	82	48.10
14	65	0.680	2.50	83	47.41
15	65	0.680	2.50	83	47.41
16	65	0.580	2.15	83	43.78
17	65	0.580	2.15	83	43.78
18	65	0.500	1.85	84	40.65
19	65	0.460	1.70	84	38.99
20	65	0.460	1.70	84	38.99
21	65	0.460	1.70	84	38.99
22	65	0.460	1.70	84	38.99
23	65	0.440	1.65	84	38.14
24	65	0.500	1.85	84	40.65
AVG VALUES	65		2.258	82	44.55

TOTAL GAS WITHDRAWN, scf = 52.10
DRY GAS WITHDRAWN, scf = 50.97
WATER VAPOR WITHDRAWN, scf = 1.13
PERCENT WATER VAPOR = 2.17
ACTUAL WET FLOW RATE, acfm = 71,455.07
STANDARD DRY FLOW RATE, scfm = 68,552.81
PARTICULATE CONCENTRATION, grains/dscf = 0.004
PARTICULATE EMISSION RATE, lb/hr = 2.052
PERCENT OF ISOKINETIC SAMPLING = 97.18

MILW TALLOW - BLOOD DRYER TEST 3 TABLE 2-3 9-27-89

BAROMETRIC PRESSURE, in Hg = 29.200
TIP DIAMETER, in .2500
STACK AREA, sq ft = 26.730
SAMPLING TIME PER POINT, min = 2.50
NUMBER OF POINTS = 24
GAS METER VOLUME, acf = 51.64
WATER COLLECTED, ml = 23.00
PARTICULATE COLLECTED, grams = 0.0191
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	65	0.640	2.35	83	45.99
2	65	0.600	2.20	84	44.53
3	65	0.560	2.05	84	43.02
4	65	0.520	1.90	84	41.45
5	65	0.500	1.85	84	40.65
6	65	0.460	1.70	84	38.99
7	65	0.460	1.70	84	38.99
8	65	0.780	2.85	84	50.77
9	65	0.780	2.85	84	50.77
10	65	1.000	3.65	84	57.48
11	65	1.050	3.85	84	58.90
12	65	0.860	3.15	84	53.31
13	65	0.700	2.55	84	48.09
14	65	0.640	2.35	84	45.99
15	65	0.640	2.35	84	45.99
16	65	0.600	2.30	84	44.53
17	65	0.500	1.85	84	40.65
18	65	0.460	1.70	84	38.99
19	65	0.460	1.70	84	38.99
20	65	0.460	1.70	84	38.99
21	65	0.460	1.70	84	38.99
22	65	0.500	1.85	84	40.65
23	65	0.500	1.85	84	40.65
24	65	0.500	1.85	84	40.65
AVG VALUES	65		2.244	84	44.50

TOTAL GAS WITHDRAWN, scf = 52.00
DRY GAS WITHDRAWN, scf = 50.92
WATER VAPOR WITHDRAWN, scf = 1.08
PERCENT WATER VAPOR = 2.08
ACTUAL WET FLOW RATE, acfm = 71,365.50
STANDARD DRY FLOW RATE, scfm = 68,527.41
PARTICULATE CONCENTRATION, grains/dscf = 0.006
PARTICULATE EMISSION RATE, lb/hr = 3.351
PERCENT OF ISOKINETIC SAMPLING = 97.12

FIGURE 2-1

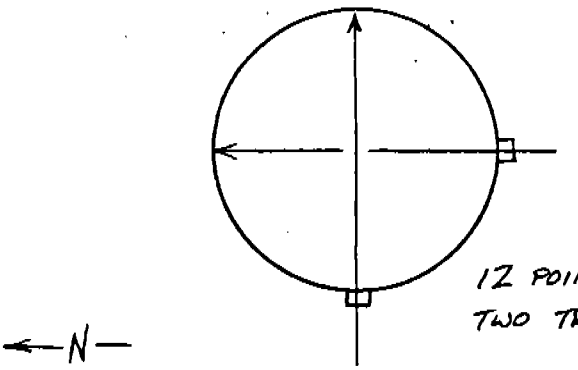
PLANT Milwaukee Tallow

LOCATION Milwaukee

SOURCE Blood Dryer
Final Discharge Stack

DIMENSIONS 70 in.

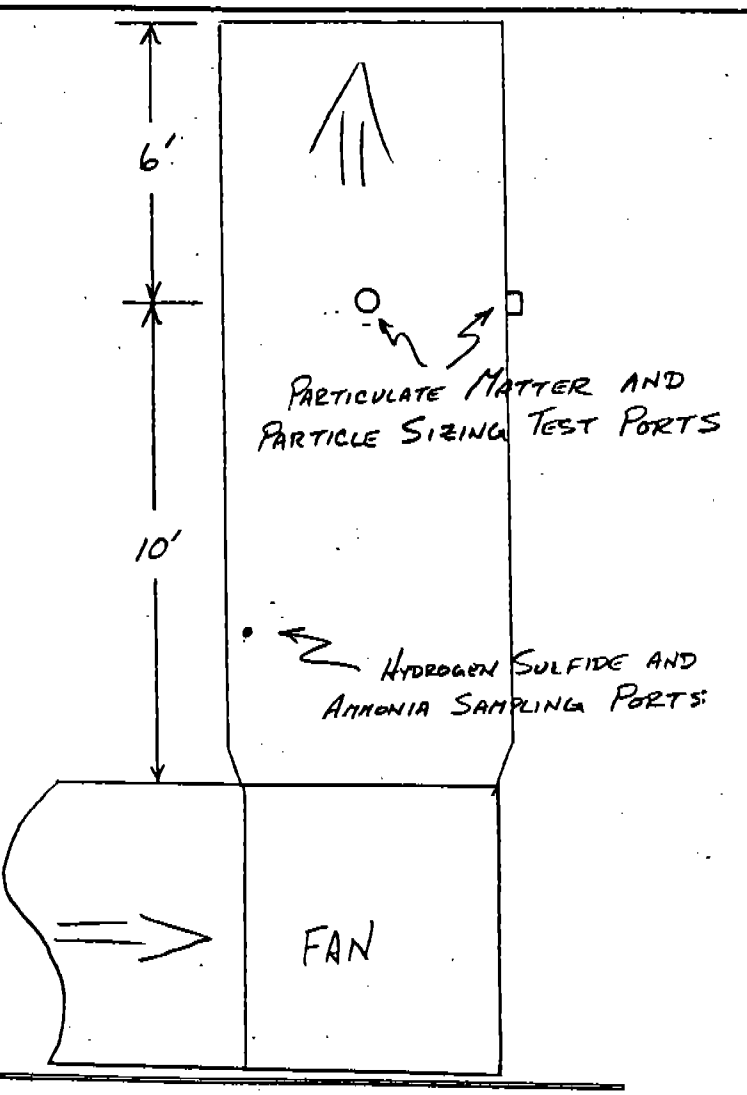
COMMENTS



TEST SECTION

POINT	DISTANCE FROM STACK WALL
1	1.5 in.
2	4.7
3	8.3
4	12.4
5	17.5
6	24.9
7	45.1
8	52.5
9	57.6
10	61.7
11	65.3
12	68.5

SAMPLING LOCATION



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

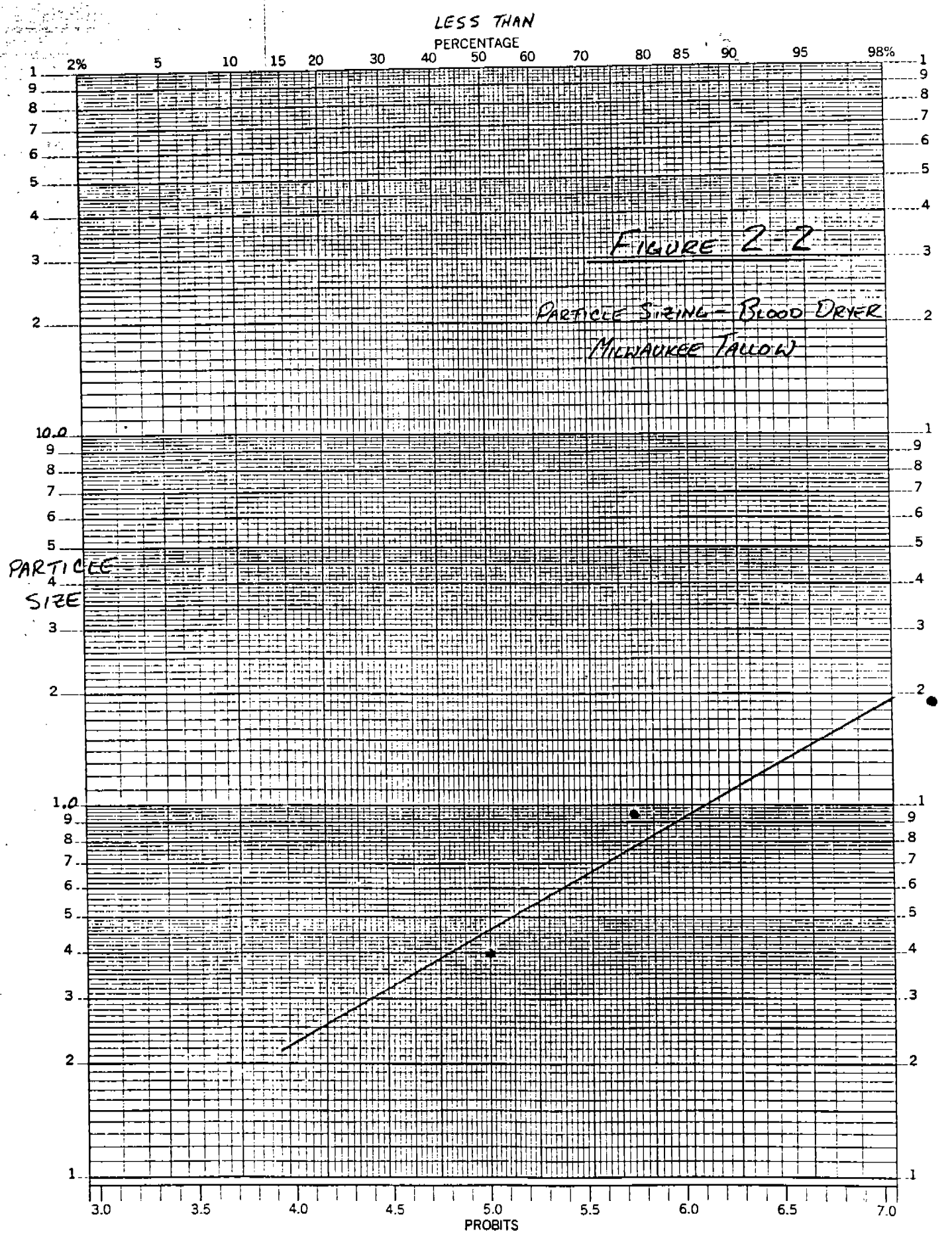


FIGURE 2-2

PARTICLE SIZING - BLOOD DRYER

MILWAUKEE TALLOW

2.4 Hydrogen Sulfide Emissions

The results of the testing to determine hydrogen sulfide emissions are shown in Table 2-4 and indicated levels well within the permit limitation of 8.85 lbs/hr. One of the tests (No. 3) indicated levels substantially different from the other two tests; this test was taken during an extended "overloading" period.

Testing to determine hydrogen sulfide emissions was performed based upon the procedures outlined in EPA Method 11 - "Determination of Hydrogen Sulfide Content of Fuel Gas Streams in Petroleum Refineries" found in 40 CFR, Part 60, Appendix A. A brief summary of the test method is included in Section 3.4 of this report. The sampling train utilized was designed to separate out sulfate interferences from the hydrogen sulfide fraction of the sample. These tests were also performed in the final discharge stack at the location shown in Figure 2-1.

2.5 Ammonia Emissions

The results of the testing to determine ammonia emissions are shown in Table 2-5 and indicated levels below the permit limitation of 1.95 lbs/hr.

Testing to determine ammonia emissions was performed based upon the procedures outlined in Physical and Chemical Analytical Method (P&CAM) No. 125 published by the National Institute of Occupational Safety and Health (NIOSH). A brief summary of this method is included in section 3.5 of this report. The tests were also performed in the final discharge stack at the location shown in Figure 2-1.

TABLE 2-4

Hydrogen Sulfide Emissions Sampling Results
Blood Dryer Operations
Milwaukee Tallow Co., Inc.
September 27, 1989

Test	Time	Hydrogen Sulfide Emissions Concentration	Hydrogen Sulfide Emissions Rate
1	17:53 - 18:57	< 0.02 mg/m3	< 0.005 #/hr
2	19:20 - 20:24	< 0.01 mg/m3	< 0.003 #/hr
3 *	20:40 - 21:40	1.04 mg/m3	0.266 #/hr
AVERAGE of Tests 1, 2, and 3		0.36 mg/m3	0.091 #/hr
AVERAGE of Tests 1 and 2		< 0.02 mg/m3	< 0.004 #/hr
Air Pollution Control Permit Limitation			8.85 #/hr

Notes: * Significant "overloading" of material into the process occurred during this test
mg/m3 means milligrams compound per cubic meter air
#/hr means pounds per hour

TABLE 2-5

Ammonia Emissions Sampling Results
Blood Dryer Operations
Milwaukee Tallow Co., Inc.
September 27, 1989

Test	Time	Ammonia Emissions Concentration	Ammonia Emissions Rate
1	17:53 - 18:57	3.6 mg/m3	0.94 #/hr
2	19:20 - 20:24	2.4 mg/m3	0.62 #/hr
3 *	20:40 - 21:40	1.8 mg/m3	0.46 #/hr
	AVERAGE of Tests 1, 2, and 3	2.4 mg/m3	0.67 #/hr
	AVERAGE of Tests 1 and 2	3.0 mg/m3	0.78 #/hr
Air Pollution Control Permit Limitation			1.95 #/hr

Notes: * Significant "overloading" of material into the process occurred during this test
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).

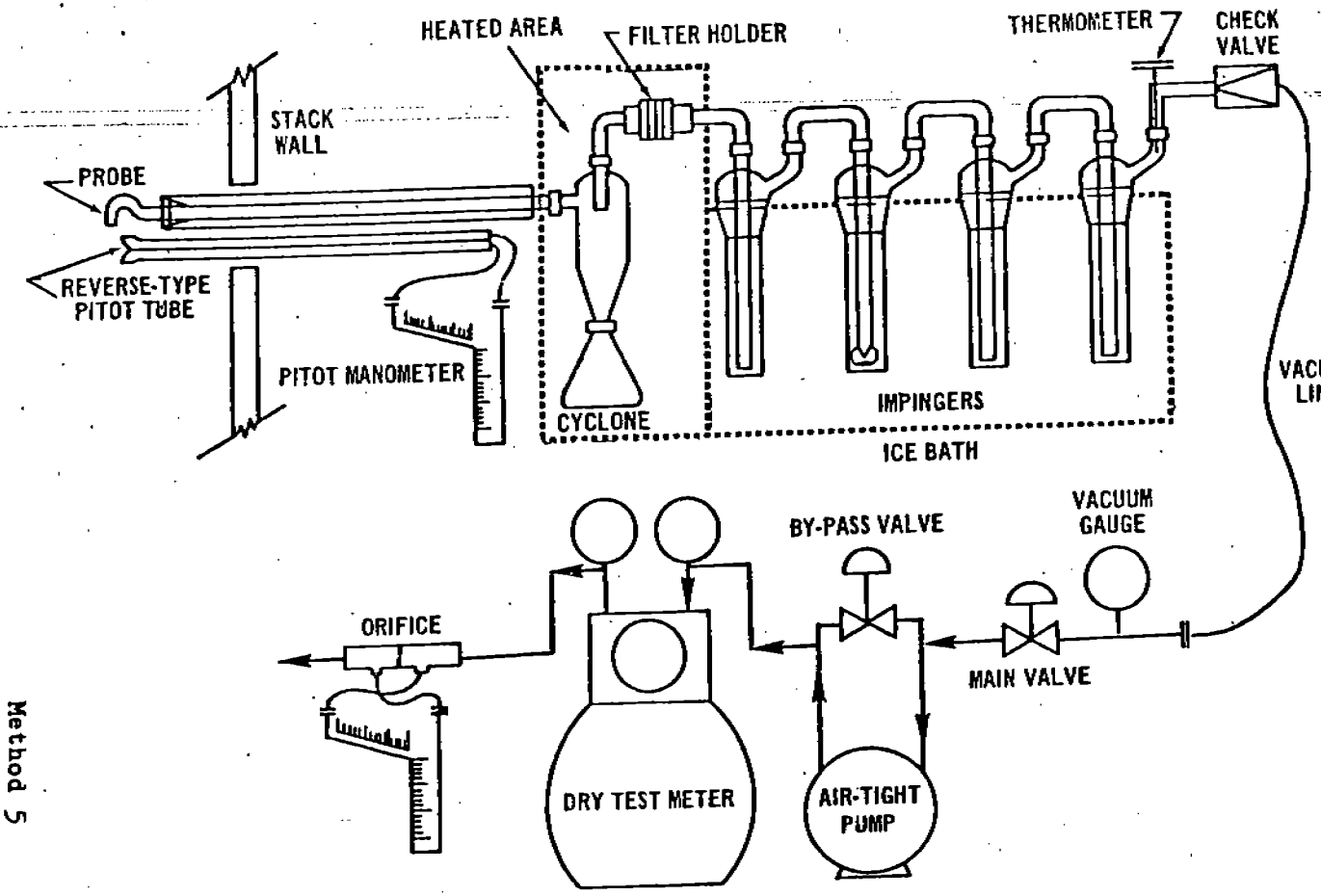
The sampling train consisted of a stainless steel probe tip, a heated probe, a heated glass cyclone and flask, and a heated filter holder with a tared filter. A series of four impingers followed in an ice bath. The first was a modified Greenburg-Smith impinger with 100 ml of distilled water; the second 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.



Particulate sampling train.

FIGURE 3-1

Method 5

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 PM10 Particulate

An Anderson Mark II (6 stage) In-Stack Cascade Impactor was used to collect a particle size sample. 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. For the particle size test, a two hour test was taken along both traverses of the stack diameter. 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.

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

3.2 (continued)

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 Visible Emissions

The visible emissions (opacity) were observed for one hour-long period which coincided with the first particulate matter emissions test. The DNR normally requires that three hours of observations be performed generally at the same time as the particulate testing; however, the blood dryer operations are run at night and accordingly, the testing was performed at a time when only the first test was performed in daylight.

The opacity was observed in accordance with the procedures outlined in EPA Method 9 - "Visible Determination of the Opacity of Emissions from Stationary Sources" found in 40 CFR, Part 60, Appendix A.

3.4 Hydrogen Sulfide Emissions

Samples were collected and analyzed in accordance with the procedures outlined in EPA Method 11 (40 CFR, Part 60, Appendix A).

The sampling train consisted of a glass probe connected to midget impingers by tygon tubing; a series of four midget impingers were placed in an ice bath. The first impinger contained 15 milliliters (ml) of 3% hydrogen peroxide, the second and third each contained 15 ml of alkaline cadmium sulfate solution, and the fourth was dry to serve as a trap for carry-over of any liquid. The train separated out any sulfur dioxide in the first impinger and hydrogen sulfide was collected in the second and third impingers. 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 and ambient air was purged through the sampling train for approximately 15 minutes.

FIGURE 3-2

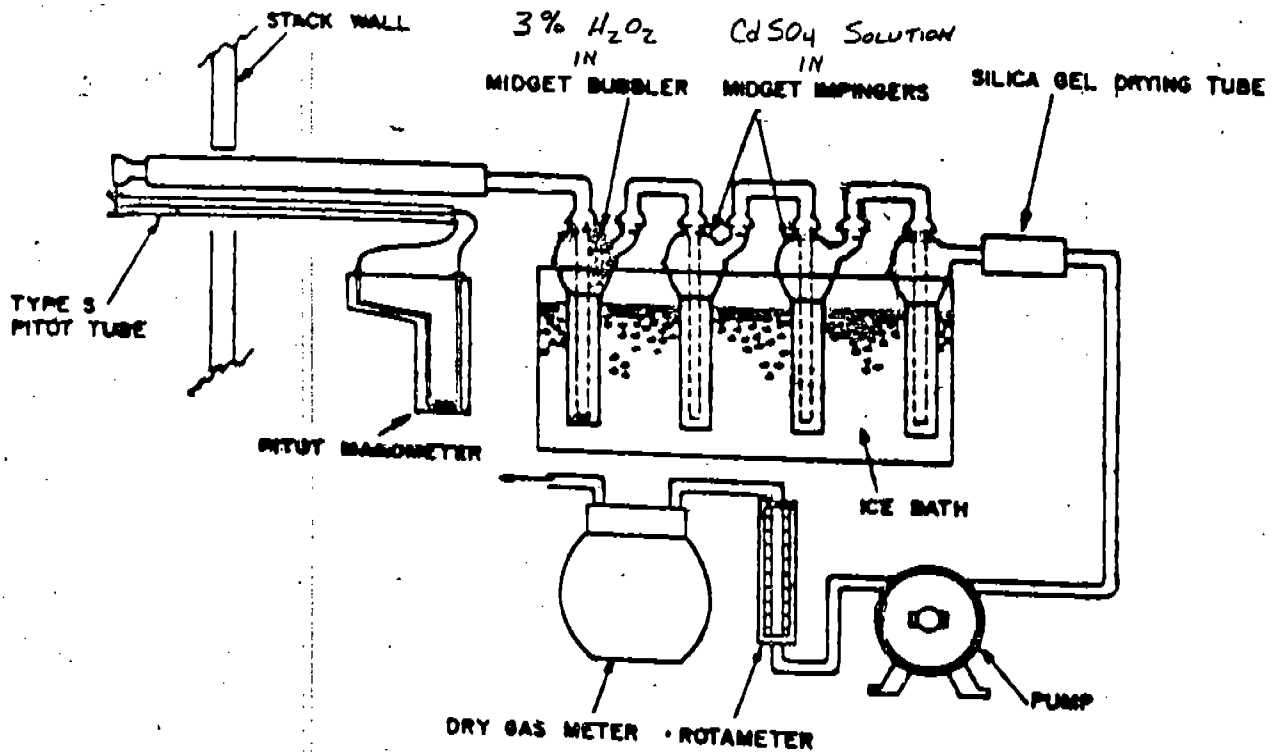


FIGURE: SAMPLING TRAIN FOR HYDROGEN SULFIDE

3.4 (continued)

The first impinger contents were then discarded while the second impinger contents were combined along with the washings from the connected tubing. Aliquots of the second and third impinger sampling solutions were then analyzed colorimetrically using the analytical procedures given in NIOSH P&CAM No. 126. A standard curve was also generated to quantify the samples and blanks submitted. This information was combined with the volume of gas sampled to determine the hydrogen sulfide concentration in the exhaust gas stream. The emission rates were then calculated using these concentrations and the volumetric flow rate.

3.5 Ammonia Emissions

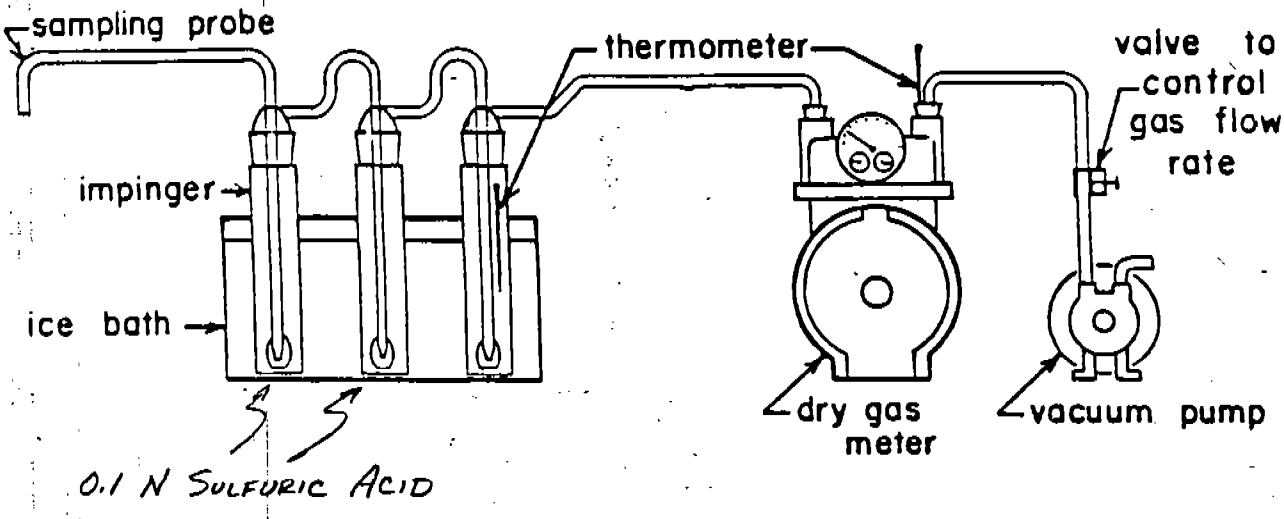
Samples were collected and analyzed in accordance with the procedures outlined in NIOSH P&CAM Method 125.

Similar to the hydrogen sulfide testing, the ammonia 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 and second impingers each contained 15 milliliters (ml) of 0.1 N sulfuric acid, 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 3-3.

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.

The first and second impinger contents were combined along with the washings from the connected tubing. Aliquots of this solution were then analyzed colorimetrically using the analytical procedures given in NIOSH P&CAM Method 125. A standard curve was also generated to quantify the samples and blanks submitted. This information was combined with the volume of gas sampled to determine the ammonia concentration in the exhaust gas stream. The emission rates were then calculated using these concentrations and the volumetric flow rate.

FIGURE 3-3



IMPINGER SAMPLING TRAIN FOR AMMONIA

3.6 Calibration Data

The probe tips, pitot tube, dry gas meters, 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.
- Particulate Matter *d*H@ = 1.663
- Particle Sizing *d*H@ = 0.748

The dry gas meters presently installed in the control boxes are temperature compensating meters. The correction factors for the dry gas meters are represented by:

Particulate Matter: Gama = 1.003 + ((Td - 70) x .00012)
Particle Sizing: Gama = 1.045 + ((Td - 70) x .00012)

where: Td = Dry Gas Meter Temperature

The dry gas meters used in the hydrogen sulfide and ammonia 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:

Hydrogen Sulfide: Gama = 1.014
Ammonia: Gama = 1.038

The most recent calibrations were performed August 7, 1989.

4.0 DISCUSSION

Both the particulate emissions and the particle sizing results indicated extremely low levels of filterable particulates using the standard EPA methods. The weight gains used to calculate the particulate emissions were approximately equal between the filterable and condensible particulate portions of the samples.

Realizing that the particulate loading in the stack would be quite low, the volume of air sampled was increased to more than 50 cubic feet (ft3) as compared to the standard sample size of 30 ft3. Additionally, the blank values used in the analysis were confirmed by performing a "dry run" in the lab by drawing 51 ft3 of filtered room air through the test apparatus and analyzing that run in accordance with the standard test procedures.

Visible emissions were essentially zero during normal operating conditions. At one point during the observation period, a "flameout" occurred. During the "flameout," visible emissions were observed on the order of 15 to 20 percent. The "flameout" was corrected within 30 seconds during the first test period.

An extended "overloading" of material into the dryer occurred during the third set of testing. Nevertheless, both the hydrogen sulfide and ammonia emissions were well within the permit limitations. As observed from the results, the hydrogen sulfide emissions are significantly effected during such an occurrence while ammonia emissions are not. Again, all three tests were averaged in this report; however, an average of the first two test results is likely a better representation of normal emission levels.

APPENDIX A

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

Part I. Dry Molecular Weight (M_d) lb/lb-mole

To obtain the dry molecular weight, use the formula:

$$M_d = .44\ (\%CO_2) + .32\ (\%O_2) + .282\ (\%N_2) + .28\ (\%CO)$$

Part II. Wet Molecular Weight (M_s) lb/lb-mole

The wet molecular weight (M_s) is calculated from the dry molecular weight (M_d) and the percent water vapor content (B_{wo}) using the formula:

$$M_s = M_d\ (\ 1 - B_{wo}\ ) + 18\ B_{wo}$$

Part III. Water Vapor Content (B_{wo})

The water vapor fraction is calculated directly from the volume of water captured in the condenser (impinger) portion of the sampling train as follows:

$$V_{w_{std}} = 0.04707(\ V_f - V_i\ )$$

where:

$V_{w_{std}}$ is volume of water vapor collected (standard conditions), cubic feet.

V_f is final volume of impinger contents, ml.

V_i is initial volume of impinger contents, ml.

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}}$$

where:

$V_{m_{std}}$ is volume of gas through the dry gas meter (standard conditions), cubic feet.

Part IV. Absolute Stack Pressure (P_s) in. Hg

$$P_s = P_b + \frac{P_g}{13.6}$$

where:

P_b is barometric pressure, in. Hg

P_g is stack gauge pressure, in. of water

13.6 is specific gravity of mercury

Part V. Average Stack Gas Velocity (V_s) feet per second

The average stack gas velocity (V_s) is determined using the following formula:

$$V_s = K_p C_p \sqrt{\Delta p}_{avg} \sqrt{\frac{T_{s\ avg}}{P_s M_s}}$$

where:

K_p	85.49, unit conversion factor
C_p	0.85, correction factor for "S" type pitot tube
$\sqrt{\Delta p}_{avg}$	Average of the square roots of the velocity head of the stack gas stream
$T_{s\ avg}$	Average stack gas temperature in degrees Rankine
P_s	Absolute Stack Pressure
M_s	Wet molecular weight of stack gases

Part VI. Stack Gas Discharge Rate (Q_s) cubic feet per hour

The volumetric discharge rate is determined using the following equation:

$$Q_s = 3600\ (1 - B_{wo})\ (V_s)\ A \left[\frac{T_{std}\ P_s}{T_{s\ avg}\ P_{std}} \right]$$

where:

A	Cross sectional area of stack, square feet
T_{std}	528° Rankine
P_{std}	29.92 inches of mercury
B_{wo}	Percent water vapor content, decimal form
V_s	Average stack gas velocity, ft/sec
$T_{s\ avg}$	Average stack gas temperature, ° Rankine
P_s	Absolute stack pressure, in. of Hg.

Part VII. Dry Gas Volume ($V_{m\ std}$) cubic feet

The dry gas volume measured through the dry gas meter is corrected to standard conditions using the formula:

$$V_{m\ std} = (V_m - (AL - .02)\theta) \left[\frac{P_b + \frac{\Delta H}{13.6}}{P_{std}} \right] \gamma$$

where:

T_m	Average dry gas meter temperature, ° Rankine
ΔH	Average pressure drop across orifice meter, in. H_2O
13.6	Specific gravity of mercury
V_m	Volume of dry gas metered
AL	Post test leak rate, cubic feet per minute
θ	Total time of test, minutes
γ	Calibration factor for dry gas meter

Part VIII. Concentration of Particulate (C_s) grams per cubic foot

The concentration of particulate (C_s) in the stack gas stream is calculated as follows:

$$C_s = \frac{M_n}{V_{m\ std}} \quad \text{or} \quad C_s' = \frac{M_n}{V_{m\ std}} \times 15.43, \text{ grains/ft}^3$$

where:

M_n	Total particulate captured, grams
$V_{m\ std}$	Dry gas volume at standard conditions
15.43	grains per gram

Part IX. Emission Rate (ER) pounds per hour

The emission rate (ER) is calculated from the particulate mass rate by area (PMRA) and the particulate mass rate by concentration (PMRC) as follows:

$$PMRA = \frac{M_n \quad A \quad 60}{\theta \quad A_n \quad 453.59} \quad \text{and} \quad PMRC = \frac{C_s \quad Q_s}{453.59}$$

$$ER = \frac{PMRA + PMRC}{2}$$

where:

M_n	Total particulate captured, grams
A	Stack area, square feet
60	minutes per hour
θ	Total sampling time, minutes
A_n	Area of sampling nozzel (probe tip), square feet
453.59	grams per pound
C_s	Concentration of particulate, grams per cubic foot
Q_s	Stack gas discharge rate, cubic feet per hour

Part X. Emission Concentration (EC) lb particulate per 1000 lb gas

To obtain the emission concentration (EC) use the following formula:

$$EC = \frac{ER \ 386{,}700 \ (1 - B_{wo})}{Q_s \ M_s}$$

where:

ER	Emission Rate, lb per hour
386,700	Cubic feet per lb-mole x 1000
B_{wo}	Water vapor content, volume fraction
Q_s	Stack gas discharge rate, cubic feet per hour
M_s	Wet molecular weight of stack gas, lb per lb-mole

Part XI. Emission Concentration Corrected to 12 % CO_2 (ECC) lb particulate per 1000 lb gas

$$ECC = \frac{EC \times 12}{\%CO_2}$$

where:

EC	Emission concentration, lb part. per 1000 lb gas
$\%CO_2$	Percent carbon dioxide in gas stream, %

Part XII. Isokinetic Sampling Percentage (I) %

$$I = \frac{PMRA}{PMRC}$$

Milw. Tallow - Particle Sizing

Sample I.D.	Nominal Particle Size	Final Weight	Tare Weight	mg Gain	Cum. Gain	10/2/89 Percent Less Than
7F	—	.2358	.2174	18.4	18.4	
7	0.4	.1561	.1461	10.0	28.4	49.9
5	0.95	.1712	.1630	8.2	36.6	77.0
4	1.9	.1450	.1447	0.3	36.9	99.2
3	3.1	.1632	.1634	0	36.9	100.0
1	6.5	.1461	.1462	0		
0	11.0	.1610	.1611	0		

Mill Tallow - Hydrogen Sulfide Calcs

10/16/89

Test 1

Sample Vol: 1.62 ft^3 Barom Press: 29.2

Meter: Temp - 57°F γ = 1.014

A) Sample Vol. Std. =

$= 1.62\ ft^3 (.02832\ m^3/ft^3)\left(\frac{460+68\ °R}{460+57\ °R}\right) 1.014 \left(\frac{29.2}{29.9}\right)$

$= 0.0464\ m^3$

B) Sample Concentration =

$= < 0.000\ mg / .0464\ m^3 = < 0.02\ mg/m^3$

C) Emission Rate Calcs -

Flow = 118,000 m^3/hr

Em Rate = $118{,}000\ m^3/hr\ (< 0.02\ mg/m^3)\left(\frac{1\ lb}{453{,}600\ mg}\right)$

$= < 0.005\ lb/hr$

Test 2

S Vol: 2.64 ft^3 Barom Pres: 29.2

Meter: Temp - 53F γ = 1.014

A) Sample Vol (Std) = $2.64(.02832)\left(\frac{528}{513}\right)1.014\left(\frac{29.2}{29.9}\right) = 0.0762\ m^3$

B) Sample Conc = $\frac{< 0.001\ mg}{.0762\ m^3} = < 0.01\ mg/m^3$

C) Emission Rate Calcs

Flow = 117,000 m^3/hr

E Rate = $117{,}000\ (< 0.01\ mg/m^3)\left(\frac{1}{453600}\right)$

$= < 0.003\ lb/hr$

Mill Tallow - Hydrogen Sulfide (Continued)

Test 3

S. Vol: 2.52 ft³ B Press = 29.2

Meter: Temp - 52°F γ = 1.014

A) Sample Vol (STD) =

$= 2.52 (.02832) \left(\frac{528}{512}\right) 1.014 \left(\frac{29.2}{29.9}\right)$

$= 0.0729\ m^3$

B) Sample Conc.

$= \frac{0.076\ mg}{.0729\ m^3} = 1.04\ mg/m^3$

C) Emission Rate Calcs

Flow = 116,000 m³/hr

$EmRate = 116{,}000 (1.04) \left(\frac{1}{453{,}600}\right)$

$= 0.266\ \#/hr$

3 Test Average

Test 1: < 0.005 #/hr

Test 2: < 0.003 #/hr

Test 3: 0.266 #/hr **

0.091 #/hr

** Test 3 - unusual operating conditions

MILW TALLOW - AMMONIA CALCULATIONS 10/16/89

TEST 1

SAMPLE VOL: 2.00 ft^3 BAROM PRES: 29.2

METER: TEMP - 57 F γ = 1.038

A) SAMPLE VOLUME (STD) =

$= 2.00\ ft^3 \left(0.02832\ m^3/ft^3\right) \times \left(\frac{460+68\ ^\circ R}{460+57\ ^\circ R}\right) \times 1.038 \times \frac{29.2}{29.9}$

$= 0.0586\ m^3$

B) SAMPLE CONC. =

$= \frac{210\ mg\ AMMONIA}{0.0586\ m^3} = 3.6\ mg/m^3$

C) EMISSION RATE CALCS

FLOW = 69600 SCFM (60 min/hr) (0.02832 m^3/ft^3)

$= 118{,}000\ m^3/hr$

EMISSION RATE = 118,000 m^3/hr (3.6 mg/m^3) ($\frac{1\#}{453600\ mg}$)

$= 0.94\ \#/hr$

TEST 2

S. VOL: 2.11 ft^3 B PRESS: 29.2

METER: TEMP - 53°F γ = 1.038

A) SAMPLE VOLUME (STD) = $2.11(.02832)\left(\frac{528}{513}\right) 1.038 \left(\frac{29.2}{29.9}\right)$

$= 0.0623\ m^3$

B) SAMPLE CONC. = $\frac{150\ mg}{.0623\ m^3} = 2.4\ mg/m^3$

C) EMISSION RATE CALCS

FLOW = 68600 (60) (.02832) = 117,000 m^3/hr

E. RATE = 117,000 (2.4) ($\frac{1}{453,600}$)

$= 0.62\ \#/hr$

MILW TALLOW - AMMONIA (CONTIN.)

TEST 3

S. VOL: 1.85 ft³ B. PRESS: 29.2

METER: TEMP - 52°F γ = 1.038

A) SAMPLE VOLUME (STD) = $1.85 (.02832) \left(\frac{528}{512}\right) 1.038 \left(\frac{29.2}{29.9}\right)$

= 0.0548 m³

B) SAMPLE CONC = $100 mg / .0548 m^3$ = 1.8 mg/m³

C) EMISSION RATE CALCS

FLOW = 68,500 (60) (.02832) = 116,000 m³/hr

E. RATE = 116,000 (1.8) ($\frac{1}{453,600}$)

= 0.46 #/hr

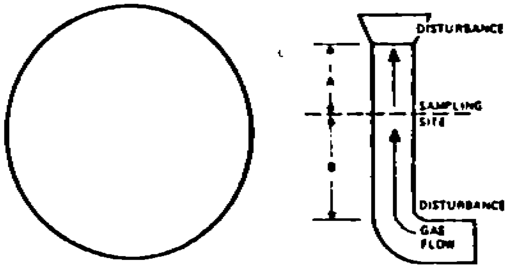
APPENDIX B

FIELD & LABORATORY DATA SHEETS

Technology &
Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Milwaukee Tallow
DATE 9-27-89
LOCATION Milwaukee
OPERATOR WJP
STACK NO. Blood Dryer
RUN NO. 1
SAMPLE BOX NO. 1
METER BOX NO. 4

AMBIENT TEMPERATURE 60
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % SAT
PROBE LENGTH, in. 78"
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 70
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

Y = 1.003 } 8-1-89
METER ΔH@ 1.663
C FACTOR 0.96
PROCESS WEIGHT RATE
ORSAT RESULTS
CO_2 0.0
O_2 20.7
CO
N_2 79.3

Pre Lk ok
Pitot Lk ok
Post Lk ok
PM10 .0075 cfm
P.S. ΔH = .75

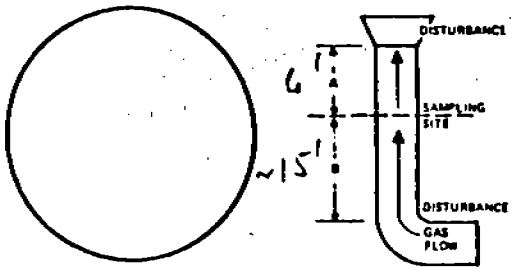
TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
A 1	1755.00		65	.75	1	2.75	2.75	5309.00		60	1758	9331.00	3	
2	5?1		65	.75	2	2.75	2.75	11.4		60		9450.00		
3	00	-.35	65	.68	3	2.45	2.45	13.8		61				
4	0?4		65	.60	4	2.20	2.20	16.2		61				
5	05		65	.54	5	1.95	1.95	18.4		61				
6	0?1		65	.50	6	1.85	1.85	20.5		62				
7	10		65	.45	7	1.70	1.70	22.5		62				
8	12?		65	.45	8	1.70	1.70	24.4		63				
9	15		65	.48	9	1.80	1.80	26.3		64				
10	17?		65	.50	10	1.85	1.85	28.3		65				
11	20		65	.50	11	1.85	1.85	30.3		66				
12	22?		65	.50	12	1.85	1.85	32.3		68				
B 13	25/27.3?		60	.64	1	2.30	2.30	34.30		70				
14	33		60	.60	2	2.20	2.20	36.5		70				
15	32?		60	.54	3	1.95	1.95	38.6		71				
16	35		65	.50	4	1.85	1.85	40.7		72				
17	3??	-.35	65	.48	5	1.80	1.80	42.7		73				
18	40		60	.45	6	1.70	1.70	44.6		74				
19	42?		60	.52	7	1.90	1.90	46.5		75				
20	45		65	.68	8	2.45	2.45	48.5		75				
21	47.??		65	.86	9	3.15	3.15	50.8		76				
22	50		60	1.00	10	3.65	3.65	53.3		77				
23	5?1		65	1.05	11	3.85	3.85	56.0	(52.25)	79				
24	55			.80	12	2.95	2.95	58.7		80				

1057.30 5361.28

Technology &
Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Milwaukee Tallow
DATE 9-27-89
LOCATION Milwaukee
OPERATOR WJO
STACK NO. Blood Dryer
RUN NO. 2
SAMPLE BOX NO. 2
METER BOX NO. 1

AMBIENT TEMPERATURE 55
BAROMETRIC PRESSURE
ASSUMED MOISTURE, %
PROBE LENGTH, in.
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 70
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH,
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 0.0
O_2 20.7
CO
N_2 79.3

PRETEST or POSTTEST
PITOT LEAK

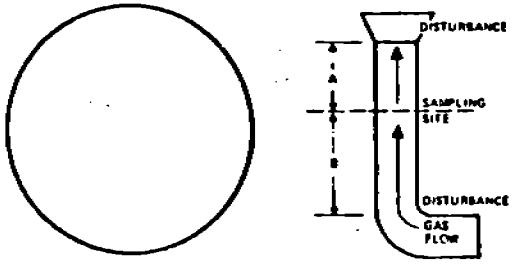
TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s) ($\sqrt{\Delta P_s}$)		PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET ($T_{m_{IN}}$), °F	OUTLET ($T_{m_{OUT}}$), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge	VELOCITY fps
B 1	1920:00		65	.62		2.30	2.30	5368.00		79				
2	22+		65	.60		2.25	2.25	70.3		79				
3	25		65	.55		2.00	2.00	72.4		80				
4	27+		65	.50		1.85	1.85	74.4		80				
5	30	-.35	65	.48		1.80	1.80	76.4		80				
6	32+		60	.46		1.70	1.70	78.4		81				
7	35		65	.46		1.70	1.70	80.4		81				
8	37+		65	.72		2.65	2.65	82.4		81				
9	40		65	.88		3.20	3.20	84.6		81				
10	42+		65	.98		3.65	3.65	87.1		81				
11	45		65	1.05		3.85	3.85	89.8		81				
5 12	47+		65	.88		3.20	3.20	92.6		81				
AE 13	50/53		65	.70	1	2.60	2.60	95.25		82				
14	57+		65	.68	2	2.50	2.50	97.6		83				
15	00	-.35	65	.68	3	2.50	2.50	99.7		83				
16	02		65	.58	4	2.15	2.15	01.1		83				
17	05		65	.58	5	2.15	2.15	04.3		83				
18	07+		65	.50	6	1.85	1.85	06.9		84				
19	10		65	.46	7	1.70	1.70	08.3		84				
20	12+		65	.46	8	1.70	1.70	10.2		84				
21	15		65	.46	9	1.70	1.70	12.2		84				
22	17+		65	.46	10	1.70	1.70	14.1		84				
23	20		65	.44	11	1.65	1.65	16.0	51.70	84				
W 24	22+		65	.50	12	1.85	1.85	17.8						

20:22:00 — 5419.70

Technology &
Engineering Corp.

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

PLANT Milwaukee Tallow
DATE 9-27-09
LOCATION Milwaukee
OPERATOR WJD
STACK NO. Bean Dryer
RUN NO. 3
SAMPLE BOX NO. 3
METER BOX NO 1

AMBIENT TEMPERATURE 55
BAROMETRIC PRESSURE
ASSUMED MOISTURE, % SAT
PROBE LENGTH, in.
NOZZLE DIAMETER, in. 1/4
STACK DIAMETER, in. 70
PROBE HEATER SETTING 250
HEATER BOX SETTING 250

METER ΔH,
C FACTOR
PROCESS WEIGHT RATE

ORSAT RESULTS
CO_2 0.0
O_2 20.7
CO
N_2 79.3

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), 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. H_g gauge	VELOCITY fps
B 1	30 0000		65	.64		2.35	2.35	5921.0		83				
2	03		65	.60		2.20	2.20	23.3		84				
3	06		65	.56		2.05	2.05	25.4		84				
4	09	-.35	65	.52		1.90	1.90	27.5		84				
5	12		65	.50		1.85	1.85	29.5		84				
6	15		65	.46		1.70	1.70	31.5		84				
7	18		65	.46		1.70	1.70	33.4		84				
8	21		65	.76		2.85	2.85	35.3		84				
9	24		65	.78		2.85	2.85	37.7		84				
10	27		65	1.00		3.65	3.65	40.1		84				
11	30		65	1.05		3.85	3.85	42.8		84				
12	33		65	.86		3.15	3.15	45.7		84				
#13	36/124		65	.70	1	2.55	2.55	48.25		84				
14	15		65	.64	2	2.35	2.35	50.5		84				
15	17		65	.61	3	2.35	2.35	52.7		84				
#16	20		65	.60	4	2.30	2.30	55.0		84				
17	23		65	.50	5	1.81	1.85	57.2		84				
18	25		65	.46	6	1.70	1.70	59.2		84				
19	28		65	.46	7	1.70	1.70	61.1		84				
20	31		65	.46	8	1.70	1.70	63.0		84				
21	34		65	.46	9	1.70	1.70	64.8		84				
22	37		65	.50	10	1.85	1.85	66.7		84				
23	39		65	.50	11	1.85	1.85	68.7	(5164)	84				
24	90		65	.50	12	1.85	1.85	70.6		84				

71933 5972.6

SMOKE FORM
Form 4500-29 Rev. 6-85

Name of Company: MILW TALLOW	Date: 9-27-89
Location: 131 S. 7TH	FID Number:
City, State, Zip Code: MILW. WISC	Observer Certification Date: MAY 3, 1989
Discharge Location: BLOOD DRYER	Control Device: WET SCRUBBER
Height of Discharge Above Ground: ~65 ft	Steam Plume? Attached Yes (No) Detached

	Initial		Final
Time of Observation	1755:00		1854:45
Observer Location			
Distance to Discharge	120'		120'
Direction from Discharge	WNW		WNW
Height of Observation Point in Relation to Discharge	-30'		-30'
Plume Description (Color, Length, etc.)	WHTSH, 100'		WHTSH, 100'
Plume Background Description	BRN PENTHOUSE ON TOP OF GRAIN SILOS		(SAME)
Weather Conditions			
Wind Direction	SSE		SSE
Wind Speed	~10 MPH		5 MPH
Ambient Temperature	60		55
Sky Conditions (clear, overcast, % clouds, etc.)	CLR		CLR

Describe Point in Plume at Which Opacity was Determined
IMMEDIATELY ABOVE STACK

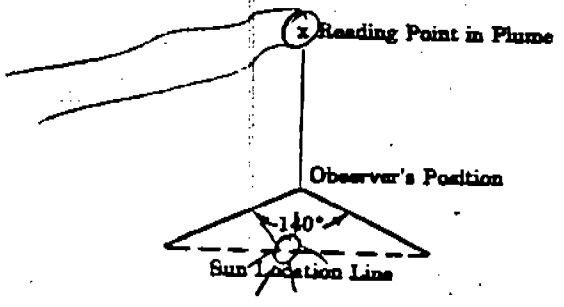
Remarks:

- SUN BEHIND BRIDGE + STACK IN SHADOWS FOR FIRST 30 min.
- (41) SUNDOWN FOR TOP OF STACK - STILL FELT OPACITY COULD BE DETERMINED TIL 1900

Signature of Observer

Name of Observer (Please print): MICHAEL J. HUENINK

Sketch of Observer, Discharge, and Sun Location.



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

Summary of Average Opacity
(From Computer Program)

Set Number	Time: Start — End	Opacity: Sum	Opacity: Average
1	1755 - 1801	—	0
2	1801 - 07	—	0
3	1807 - 13	—	0
4	1813 - 19	—	0
5	1819 - 25	—	0
6	1825 - 31	—	0
7	1831 - 37	—	0
8	1837 - 43	20	<1
9	1843 - 49	5	<1
10	1849 - 55	—	0

Allowable Source Opacity

FIELD SAMPLING DATA

GENERAL
Facility MILW TALLOW Contact D. HILDRETH
Address _____ Test Date 9-27-89
_____ Witnesses M. PATTON - SE DNR

Process Description BLOOD DRYER

Stack Number _____

SAMPLING DATA

A. Pump # 5 Flow Rate _____ L/min

Sample	Start Time	Rotameter	Stop Time
A-1	1753	916.82 T=59	1857 T=54
	Time	918.82	
DGM #1		_____	
1.038		_____	
		_____	
		_____	

B. Pump # AB12 Flow Rate _____ L/min

Sample	Start Time	Rotameter	Stop Time
S-1	1753	086.35 T=59	1857 T=54
DGM #2	Time	87.97	
1.014		_____	
		_____	
		_____	

FLOW DATA

d = _____
L x W = _____
Cp = _____

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

COMMENTS _____

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

FIELD SAMPLING DATA

GENERAL

Facility MILW TALLOW — Contact D. HILDRETH

Address 131 S. 7TH — Test Date 9-27-89

Witnesses M PATTON

Process Description BLOOD DRYER

Stack Number _____

SAMPLING DATA

A. Pump # 1 — Flow Rate ~1 L/min

Sample	Start Time	Rotameter		Stop Time	
A-2	19:20	918.82	T=54	20:24	T=52
γ = 1.038	Time	920.95			

B. Pump # AB12 — Flow Rate ~1 L/min

Sample	Start Time	Rotameter		Stop Time	
S-2	19:20	088.18	T=54	20:24	T=52
γ = 1.014	Time	090.82			

FLOW DATA

d = _____

L x W = _____

Cp = _____

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

COMMENTS _____

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

FIELD SAMPLING DATA

GENERAL
Facility MILW TALLOW Contact D HILDRETH
Address 131 S 7TH ST Test Date 9-27-89
Witnesses M PATTON

Process Description BLOOD DRYER

Stack Number _____

SAMPLING DATA

A. Pump # 1 Flow Rate ~1 L/min

Sample	Start Time	Rotameter	Stop Time
A-3	20:40	920.93 T=52	21:40 T=52
	Time	922.78	

B. Pump # AB12 Flow Rate ~1 L/min

Sample	Start Time	Rotameter	Stop Time
S-3	20:40	091.12 T=52	21:40 T=52
	Time	093.64	

FLOW DATA

d = _____
L x W = _____
Cp = _____

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

COMMENTS SUBSTANTIAL FLAMEOUT THIS TEST

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

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Milwaukee Tallow DATE OF TEST 9/27/89

JOB NO. 89-1114 TEST ENGINEER MJH

RUN NO. 1 STACK Blood Dryer

SAMPLE BOX 1 FILTER 1152 WASH BOTTLE —

BEAKERS: FH Ace 2FH BH Trichl 9 BH Ace 5 BH H_2O 27

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	93	100	-7
2	107	100	7
3	3	0	3
Sil Gel	631	621	10
		WATER TOTAL	13

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.7790	0.7790	0.0000
FH Wash	0.0008	97.6900	97.6840	0.0052
		FILTERABLE TOTAL		0.0052
Extract	0.0005	72.1717	72.1711	<0.0005
Acetone	0.0004	96.4378	96.4350	0.0024
Water	0.0002	109.3523	109.3507 (x203)	0.0028
		CONDENSIBLE TOTAL		0.0057
		PARTICULATE TOTAL		0.0109

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Milwaukee Tallow — DATE OF TEST 9/27/89

JOB NO. 89-1114 — TEST ENGINEER MJH

RUN NO. 2 — STACK Blood Dryer

SAMPLE BOX 2 — FILTER 1153 — WASH BOTTLE —

BEAKERS: FH Ace 9 — BH Trichl 10 — BH Ace 7 — BH H_2O 31

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	86	100	-14
2	120	100	20
3	4	0	4
Sil Gel	641	627	14
		WATER TOTAL	24

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.7912	0.7902	0.0010
FH Wash	0.0008	95.7683	95.7620	0.0055
		FILTERABLE TOTAL		0.0065
Extract	0.0005	67.4687	67.4679	<0.0005
Acetone	0.0004	93.8916	93.8890	0.0022
Water	0.0002	111.0807	111.0793 (x2.1)	0.0025
		CONDENSIBLE TOTAL		0.0052
		PARTICULATE TOTAL		0.0117

LABORATORY DATA SHEET
PARTICULATE & WATER COLLECTED

JOB NAME Milwaukee Tallow DATE OF TEST 9/27/89

JOB NO. 89-N14 TEST ENGINEER MJH

RUN NO. 3 STACK Blood Dryer

SAMPLE BOX 3 FILTER 1154 WASH BOTTLE —

BEAKERS: PH Ace 24 BH Trichl 12 BH Ace 23 BH H_2O 35

WATER COLLECTED

Impinger No.	Final Wt. - g	Initial Wt. - g	Collected - g
1	98	100	-2
2	94	100	-6
3	20	0	20
Si Gel	679	668	11
		WATER TOTAL	23

PARTICULATE COLLECTED

	Blank	Final Wt.	Tare Wt.	Collected - g
Filter		0.7900	0.7799	0.0101
PH Wash	0.0008	99.0470	99.0420	0.0042
			FILTERABLE TOTAL	0.0143
Extract	0.0005	68.6512	68.6505	<0.0005
Acetone	0.0004	94.3485	94.3443	0.0038
Water	0.0002	110.3795	110.3790 (x2.1)	<0.0005
			CONDENSIBLE TOTAL	0.0048
			PARTICULATE TOTAL	0.0191

Wausau Insurance Companies

A Member of the Nationwide® Group

ENVIRONMENTAL HEALTH LABORATORY

Michael Huenink
Env.Tech. & Engineering
13020 West Bluemound Road
Elm Grove WI 53122

October 5, 1989

The results of the analysis of the samples you submitted are as follows:

Sample Number	Our Lab Number	Hydrogen Sulfide (ug/sample)
S-1	10-03-89-10	ND <1
S-2 Front	10-03-89-11	ND <0.6
S-2 Back	10-03-89-12	ND <0.6
S-3	10-03-89-13	76
Blank	10-03-89-14	ND <1
METHOD	----------	----

2000 Westwood Drive • Wausau, Wisconsin 54401 • (715) 842-6810
Mailing Address: Box 8017 • Wausau, WI 54402-8017

AIHA Certified (#34) NVLAP Certified (#1079)

Ammonia Analysis

10/16/89

Std Solns:

1 ml = 20 µg

5 ml = 100 µg
10 ml = 200 µg
20 ml = 400 µg
30 ml = 600 µg
40 ml = 800 µg

Samples

A-1

R_{DA} = 0.054 ≅ 10.6 ml of STD SOLN
≅ 210 µg AMMONIA

A-2

R_{DA} = 0.051 ≅ 7.5 ml of STD SOLN
≅ 150 µg AMMONIA

A-3

R_{DA} = 0.049 ≅ 5.0 ml of STD SOLN
≅ 100 µg AMMONIA

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03-03 Date/Time Oct. 14, 1994

Project Title MEAT RENDERING AP-42 Emission FACTORS CALCULATIONS

Signature T. LAPP Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

Page 1 of 3

I. PARTICULATE DISTRIBUTION BETWEEN FILTERABLE AND CONDENSIBLE:

RUN #1: TOTAL PARTICULATE = 0.0109 g

FILTERABLE = $\frac{0.00523}{0.0109\ g}$ = 0.48 = 48%

CONDENSIBLE = $\frac{0.0057\ g}{0.0109\ g}$ = 0.52 = 52%

RUN #2: TOTAL PARTICULATE = 0.0117 g

FILTERABLE = $\frac{0.0065\ g}{0.0117\ g}$ = 0.56 = 56%

CONDENSIBLE = $\frac{0.0052\ g}{0.0117\ g}$ = 0.44 = 44%

RUN #3: TOTAL PARTICULATE = 0.0191 g

FILTERABLE = $\frac{0.0143}{0.0191}$ = 0.75 = 75%

CONDENSIBLE = $\frac{0.0048}{0.0191}$ = 0.25 = 25%

II. PARTICULATE EMISSION RATES

FILTERABLE:

RUN #1: 1.917 +.92 lbs/hr * 0.48 = 0.92 lbs/hr

RUN #2: 2.052 lbs/hr * 0.56 = 1.15 lbs/hr

RUN #3: 3.351 lbs/hr * 0.75 = 2.51 lbs/hr

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03-03 Date/Time Oct. 14, 1994

Project Title MEAT RENDERING AP-42 Emission Factors Calculations

Signature T. Rapp Verified by _____ (signature/date)

Phone Contact ☐ Meeting Notes ☐ Work Sheet ☒

Condensible:

Run #1: 1.917 lbs/hr * 0.52 = 1.00 lbs/hr

Run #2: 2.052 lbs/hr * 0.44 = 0.90 lbs/hr

Run #3: 3.351 lbs/hr * 0.25 = 0.84 lbs/hr

III. Emission Factors -- Raw Blood Feed Basis

Particulate: Raw Material Feed Rate = 13.15 tons/hr

Filterable -- Run #1 0.92 lbs/hr / 13.15 tons/hr = 0.070 lbs/ton

Run #2 1.15 lbs/hr / 13.15 tons/hr = 0.084 lbs/ton

Run #3 2.51 lbs/hr / 13.15 tons/hr = 0.191 lbs/ton

Average = $\frac{0.070 + 0.084 + 0.191}{3}$ = 0.115 lbs/ton

Condensible -- Run #1 1.00 lbs/hr / 13.15 tons/hr = 0.076 lbs/ton

Run #2 0.90 lbs/hr / 13.15 tons/hr = 0.068 lbs/ton

Run #3 0.84 lbs/hr / 13.15 tons/hr = 0.064 lbs/ton

Average = $\frac{0.076 + 0.068 + 0.064}{3}$ = 0.069 lbs/ton

Hydrogen Sulfide: Run #1 0.005 lb/hr / 13.15 tons/hr = 0.00038 lbs/ton

Run #2 0.003 lb/hr / 13.15 tons/hr = 0.00023 lbs/ton

Run #3 0.266 lbs/hr / 13.15 tons/hr = 0.02023 lbs/ton

Average = $\frac{0.00038 + 0.00023 + 0.02023}{3}$ = 0.0069 lbs/ton

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03-03 Date/Time Oct. 14, 1994

Project Title Meat Rendering AP-42 Emission Factors Calculations

Signature T. Lapp Verified by _____ (signature/date)

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AMMONIA: Run #1 0.94 lbs/hr / 13.15 tons/hr = 0.071
Run #2 0.62 / 13.15 = 0.047
Run #3 0.46 / 13.15 = 0.035

Average = $\frac{0.071 + 0.047 + 0.035}{3}$ = 0.051 lbs/ton

EMISSION FACTORS -- Dried Blood Meal Production Basis

PARTICULATE: Dried Blood Meal Production Rate = 1.14 tons/hr

Filterable -- Run #1 0.92 lbs/hr / 1.14 tons/hr = 0.81 lbs/ton
Run #2 1.15 / 1.14 = 1.01 lbs/ton
Run #3 2.51 / 1.14 = 2.20 lbs/ton

Average = $\frac{0.81 + 1.01 + 2.20}{3}$ = 1.34 lbs/ton

Condensible -- Run #1 1.00 lbs/hr / 1.14 tons/hr = 0.88 lbs/ton
Run #2 0.90 / 1.14 = 0.79 lbs/ton
Run #3 0.84 / 1.14 = 0.74 lbs/ton

Average = $\frac{0.88 + 0.79 + 0.74}{3}$ = 0.80 lbs/ton

Hydrogen Sulfide: Run #1 0.005 lbs/hr / 1.14 tons/hr = 0.004 lbs/ton
Run #2 0.003 / 1.14 = 0.003 lbs/ton
Run #3 0.266 / 1.14 = 0.233 lbs/ton

Average = $\frac{0.004 + 0.003 + 0.233}{3}$ = 0.08 lbs/ton

Ammonia: Run #1 0.94 lbs/hr / 1.14 lbs/hr = 0.82 lbs/ton
Run #2 0.62 / 1.14 = 0.54 lbs/ton
Run #3 0.46 / 1.14 = 0.40 lbs/ton

Average = $\frac{0.82 + 0.54 + 0.40}{3}$ = 0.59 lbs/ton

MRI