**AP42 Section:** 9.5.3 Meat Rendering Plants

**Title:** Emission Factor Documentation for AP-42, Section 9.5.3 Meat Rendering Plants, Final Report, Appendices A, B, and C

September 1995

**AP-42 Section Number:** 9.5.3

**Reference Number:** 3

**Title:** Emission Factor Documentation for AP-42 Section 9.5.3, Meat Rendering Plants

EPA Contract No. 68-D2-0159

Midwest Research Institute

September 1995

Appendices A, B, C

# APPENDIX A

## EXCERPTS FROM REFERENCE 1

GENESIS

DARLINGS DELAWARE COMPANY
8737 KING GEORGE DRIVE, SUITE 200
DALLAS, TEXAS 75235

DARLINGS DELAWARE COMPANY
RENDERING PLANT
FRESNO, CALIFORNIA

EMISSION TESTING
JULY 30 & 31,1990

PREPARED BY:
GENESIS ENVIRONMENTAL SERVICES COMPANY
1145 WEST COLUMBUS AVENUE
BAKERSFIELD, CALIFORNIA 93301

REPORT # 7777-0190

TEST CONDUCTED BY MICHAEL L. BAKALOR
RESULTS VERFIED BY MICHAEL L. BAKALOR
OPERATIONS MANAGER

## Introduction

At the request of Mr. Mike Koewler of Darlings Daleware Company, Genesis Environmental Services conducted a series of emission tests at Darlings Delaware's rendering plant, located at 2354 Fruit Avenue, Fresno, California.

The purpose of this testing was to determine if a specific group of compounds were present at various point sources in the plant operation process. The four locations and their descriptions are Scrubber #1, a 75K Environmental Research Corporation wet scrubber, Scrubber #2, a 100K Stordbartz wet scrubber and a Waste Heat Incinerator (inlet and outlet), manufactured by Spencer Boiler Manufactures.

The 1990 Annual Compliance Test was conducted on July 30 & 31, 1990, by Mr. Michael Bakalor, Mr. Patrick Young and Mr. Kevin Orton of Genesis Environmental. Darlings Delaware representative Mr. Mike Koewler was present during the testing.

Table 1-1 is contians a summary of results from Scrubber #1 oulet. Table 1-2 contains a summay of results from Scrubber #2 outlet. Table 1-3 contains a summary of results from the Incinerator outlet. Table 1-4 contains a summary of results from the Incinerator inlet. Figure 1-1 contains calculations used to determine the results. The following is a summary of tests performed at Darlings Delaware.

Test Summary
Darlings Delaware
July 30 & 31, 1990

| Constituent | Quantity | Analytical Method |
|---|---|---|
| Trace Organics | Single | EPA TO-14 GC/MS |
| Formaldehyde | Single | CARB Method 430 |
| Mercaptans | Single | EPA TO-14 GC/MS |
| Amines | Single | Gastec Detector Tube |
| Organic Acids | Single | CARB Method 421 |
| $C_2$-$C_{10}$ Hydrocarbons | Single | GC/FID |

Genesis Environmental performed the sample collection of the above listed constituents. Coast to Coast Analytical Services performed analysis and sample train reagent preparation for the above listed methods.

TABLE 1-1
SUMMARY OF TEST RESULTS
SCRUBBER #1 OUTLET

| | |
|---|---|
| **Trace Organics** | |
| Acetone | 9.7 ppm |
| Benzene | < 0.10 ppm |
| 2-Butanone(MEK) | < 0.10 ppm |
| Chloroethane | < 0.10 ppm |
| Chloroform | < 0.10 ppm |
| Chloromethane | < 0.10 ppm |
| Dichloromethane | < 0.10 ppm |
| Ethylbenzene | < 0.10 ppm |
| Toluene | < 0.10 ppm |
| 1,1,1-Trichloroethane | < 0.10 ppm |
| Trichloroethane(TCE) | < 0.10 ppm |
| Xylenes | < 0.10 ppm |
| **Organic Acids** | |
| Propionic Acid | 19.7 ppm |
| **Hydrocarbons $C_2$ - $C_{10}$** | |
| Ethane | < 10.0 ppm |
| Propane | < 10.0 ppm |
| Butane | < 10.0 ppm |
| Isobutane | < 10.0 ppm |
| Pentanes | < 10.0 ppm |
| Hexanes | < 10.0 ppm |
| $C_6$ H14 Hexanes | < 1.0 ppm |
| $C_6$ H12 Hexanes | < 1.0 ppm |
| $C_7$ H16 Heptanes | < 1.0 ppm |
| $C_7$ H14 Heptanes | < 1.0 ppm |
| $C_8$ H18 Octanes | < 1.0 ppm |
| **Mercaptans** | |
| Not Detected | |
| **Formaldehydes** | < 1.0 ppm |

NOTE: All other constituents not listed above are detailed in Appendix A-1, were found to be not detected.

TABLE 1-2
SUMMARY OF TEST RESULTS
SCRUBBER #2 OUTLET

Trace Organics

| | |
|---|---|
| Acetone | < 0.10 ppm |
| Benzene | < 0.10 ppm |
| 2-Butanone(MEK) | < 0.10 ppm |
| Chlorobenzene | < 0.10 ppm |
| Chloroethane | < 0.10 ppm |
| Chloroform | < 0.10 ppm |
| Chloromethane | < 0.10 ppm |
| Dichloromethane | < 0.10 ppm |
| Ethylbenzene | < 0.10 ppm |
| 4-Methyl-2-Pentanone(MIBK) | < 0.10 ppm |
| Steryne | < 0.10 ppm |
| Toluene | < 0.10 ppm |
| 1,1,1-Trichloroethane | < 0.10 ppm |
| Xylenes | < 0.10 ppm |

Organic Acids

| | |
|---|---|
| Propionic Acid | 11.6 ppm |

Hydrocarbons $C_2$ - $C_{10}$

| | |
|---|---|
| Ethane | < 10.0 ppm |
| Propane | < 10.0 ppm |
| Butane | < 10.0 ppm |
| Isobutane | < 10.0 ppm |
| Pentanes | < 10.0 ppm |
| Hexanes | < 10.0 ppm |
| $C_6$ H14 Hexanes | < 1.0 ppm |
| $C_6$ H12 Hexanes | < 1.0 ppm |
| $C_7$ H16 Heptanes | < 1.0 ppm |
| $C_7$ H14 Heptanes | < 1.0 ppm |
| $C_8$ H18 Octanes | < 1.0 ppm |

Mercaptans
Not Detected

Formaldehydes < 1.0 ppm

Amines
Not Detected

NOTE: All other constituents not listed above are detailed in Appendix A-1, were found to be not detected.

TABLE 1-3
SUMMARY OF TEST RESULTS
INCINERATOR OUTLET

| | |
|---|---|
| **Trace Organics** | |
| Benzene | 0.16 ppm |
| 2-Butanone(MEK) | < 0.10 ppm |
| Chloroform | < 0.10 ppm |
| 1,2-Dichloroethane | < 0.10 ppm |
| Ethylbenzene | < 0.10 ppm |
| Toluene | < 0.10 ppm |
| Xylenes | < 0.10 ppm |
| **Organic Acids** | |
| Propionic Acid | 68.8 ppm |
| **Hydrocarbons $C_2$ - $C_{10}$** | |
| Ethane | < 10.0 ppm |
| Propane | < 10.0 ppm |
| Butane | < 10.0 ppm |
| Isobutane | < 10.0 ppm |
| Pentanes | < 10.0 ppm |
| Hexanes | < 10.0 ppm |
| $C_6$ H14 Hexanes | < 1.0 ppm |
| $C_6$ H12 Hexanes | < 1.0 ppm |
| $C_7$ H16 Heptanes | < 1.0 ppm |
| $C_7$ H14 Heptanes | < 1.0 ppm |
| $C_8$ H18 Octanes | < 1.0 ppm |
| **Mercaptans** | |
| Not Detected | |
| **Formaldehydes** | < 1.0 ppm |
| **Amines** | |
| Not Detected | |

NOTE: All other constituents not listed above are detailed in Appendix A-1, were found to be not detected.

TABLE 1-4
SUMMARY OF TEST RESULTS
INCINERATOR INLET

| | |
|---|---|
| **Trace Organics** | |
| Acetone | 1.0 ppm |
| Benzene | < 0.10 ppm |
| Bromodichloromethane | < 0.10 ppm |
| Bromoform | < 0.10 ppm |
| 2-Butanone(MEK) | 0.19 ppm |
| Chlorobenzene | < 0.10 ppm |
| Chloroform | < 0.10 ppm |
| Dichloromethane | < 0.10 ppm |
| Ethylbenzene | < 0.10 ppm |
| Styrene | < 0.10 ppm |
| 1,1,2,2-Tetrachloroethane | < 0.10 ppm |
| Toluene | < 0.10 ppm |
| 1,1,1-Trichloroethane | < 0.10 ppm |
| Xylenes | < 0.10 ppm |
| **Organic Acids** | |
| Propionic Acid | 155.8 ppm |
| **Hydrocarbons $C_2$ - $C_{10}$** | |
| Ethane | < 10.0 ppm |
| Propane | < 10.0 ppm |
| Butane | < 10.0 ppm |
| Isobutane | < 10.0 ppm |
| Pentanes | < 10.0 ppm |
| Hexanes | < 10.0 ppm |
| $C_6$ H14 Hexanes | < 1.0 ppm |
| $C_6$ H12 Hexanes | < 1.0 ppm |
| $C_7$ H16 Heptanes | < 1.0 ppm |
| $C_7$ H14 Heptanes | < 1.0 ppm |
| $C_8$ H18 Octanes | < 1.0 ppm |
| **Mercaptans** | |
| Not Detected | |
| **Formaldehydes** | < 1.0 ppm |
| **Amines** | 29.0 ppm |

NOTE: All other constituents not listed above are detailed in Appendix A-1, were found to be not detected.

# APPENDIX B

# EXCERPTS FROM REFERENCE 2

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

RECEIVED
NOV 1 ...
BUREAU OF
AIR MANAGEMENT

## 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.

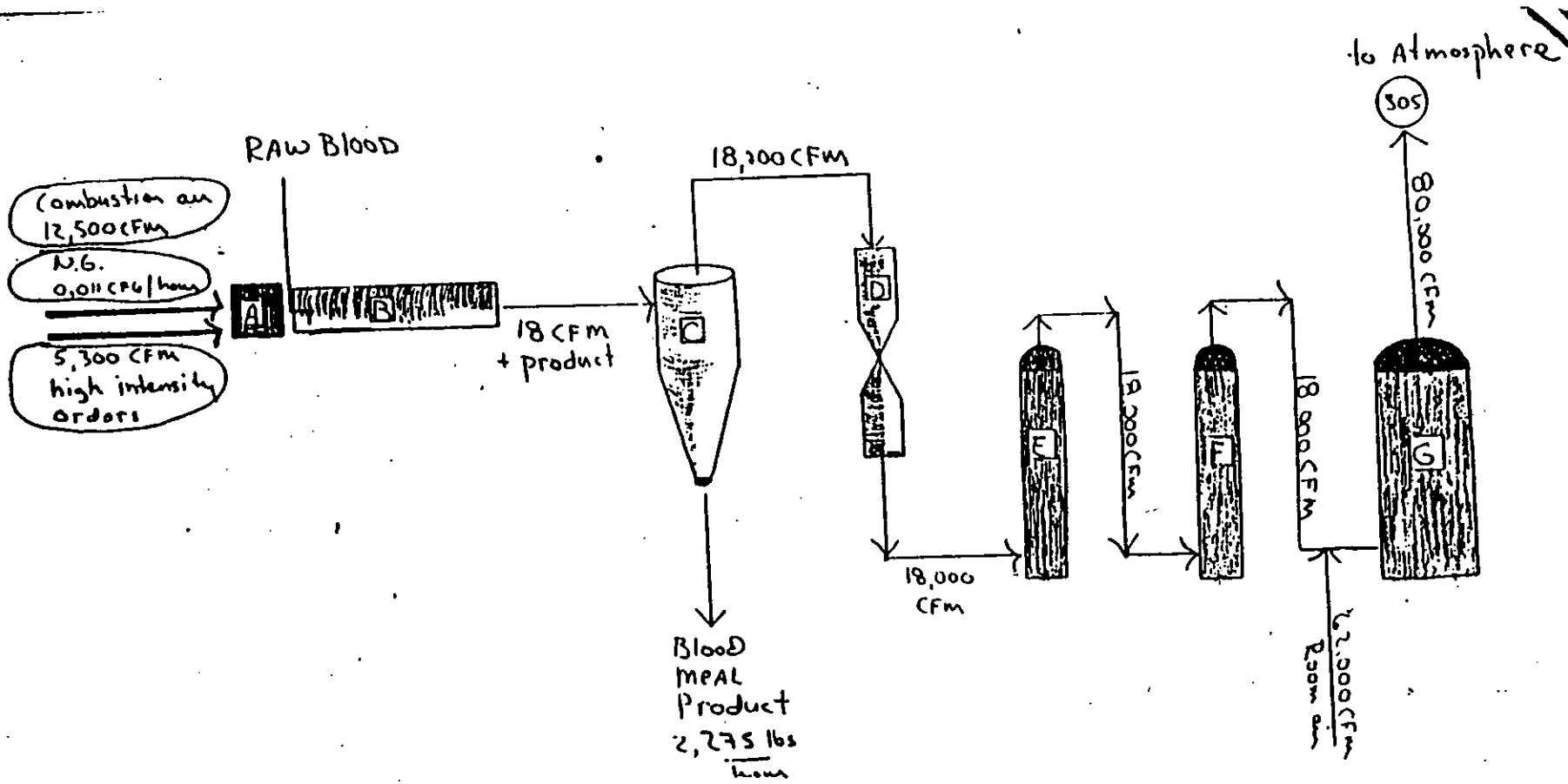
## II. Process Description

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




A = furnance
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

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.

T. Zapp 10/14/94
MRI

FEED RATES (ALL 3 RUNS):

RAW BLOOD FEED RATE: 26,300 lbs/hr = 13.15 tons/hr

DRIED BLOOD MEAL PRODUCTION RATE (ALL 3 RUNS):

PRODUCTION RATE = 2,275 lbs/hr = 1.14 tons/hr

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

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

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 (x2.03) | 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 |
| Sil 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 |

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. LAMP Verified by _____ (signature/date)

Phone Contact ☐
Meeting Notes ☐
Work Sheet ☒



I. PARTICULATE DISTRIBUTION BETWEEN FILTERABLE AND CONDENSIBLE:

RUN #1: TOTAL PARTICULATE = 0.0109 g

FILTERABLE = $\frac{0.0052 g}{0.0109 g}$ = 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 : ~~1.92~~ 1.917 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

MRI

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 ☒



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

~~PART TWO~~

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

MRI

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 ☒



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

# APPENDIX C

# EXCERPTS FROM REFERENCE 3

TABLE 1. Summary of the Results of the January 16, 1987, Particulate Emission Compliance Test on the Blood Dryer Stack at the Farmland Foods Plant Located in Iowa Falls, Iowa.

| ITEM | | Run 1 | Run 2 | Run 3 |
|---|---|---|---|---|
| Date of test | | 01-16-87 | 01-16-87 | 01-16-87 |
| Time runs were done | (HRS) | 746/ 848 | 920/1022 | 1047/1148 |
| Process Weight (Dry) | (LB/HR) | 1030 | 1030 | 1030 |
| Volumetric flow | | | | |
| actual | (ACFM) | 2908 | 3038 | 2926 |
| standard | (DSCFM) | 1839 | 1835 | 1790 |
| Gas temperature | (DEG-F) | 193 | 200 | 202 |
| Moisture content | (%V/V) | 24.42 | 25.13 | 23.93 |
| Gas composition | (%V/V,dry) | | | |
| carbon dioxide | | 1.40 | 2.00 | 1.80 |
| oxygen | | 18.80 | 17.80 | 18.20 |
| carbon monoxide | | 0.00 | 0.00 | 0.00 |
| nitrogen | | 79.80 | 80.20 | 80.00 |
| Isokinetic variation | (%) | 104.7 | 101.5 | 98.6 |
| Particulate concentration | | | | |
| actual | (GR/ACF) | .00483 | .00424 | .00545 |
| standard | (GR/DSCF) | .00784 | .00703 | .00891 |
| Part. emission rate | (LB/HR) | 0.12 | 0.11 | 0.14 |

* Run 1 - Dry catch only; Runs 2 & 3 - Dry plus organic wet catch

Test No. 1
Blood Dryer Stack

3.1 **Results of Orsat & Moisture Analyses——Methods 3 & 4( )**

| | Run 1 | Run 2 | 3 |
|---|---|---|---|
| Date of run | 01-16-87 | 01-16-87 | 01- 87 |
| **Dry basis (orsat)** | | | |
| carbon dioxide..... | 1.40 | 2.00 | 30 |
| oxygen..... | 18.80 | 17.80 | 20 |
| carbon monoxide..... | 0.00 | 0.00 | 00 |
| nitrogen..... | 79.80 | 80.20 | 80.00 |
| **Wet basis** | | | |
| carbon dioxide..... | 1.06 | 1.50 | 37 |
| oxygen..... | 14.21 | 13.33 | 25 |
| carbon monoxide..... | 0.00 | 0.00 | .00 |
| nitrogen..... | 60.31 | 60.04 | 86 |
| water vapor..... | 24.42 | 25.13 | 23.93 |
| Dry molecular weight..... | 29.98 | 29.03 | 29.02 |
| Wet molecular weight..... | 26.30 | 26.26 | 26.38 |
| Specific gravity..... | 0.908 | 0.907 | 0.911 |
| Water mass flow.....(LB/HR) | 1669 | 1728 | 1579 |
| FO | 1.500 | 1.[illegible] | 1.500 |

Test No. 1
Blood Dryer Stack

## 3.2 Results of Particulate Loading Determinations——Method 5

| | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Date of run | 01-16-87 | 01-16-87 | 01-16-87 |
| Time run start/end.....(HRS) | 746/ 848 | 920/1022 | 1047/1148 |
| Static pressure.....(IN.WC) | 0.32 | 0.32 | 0.32 |
| Cross sectional area (SQ.FT) | 0.92 | 0.92 | 0.92 |
| Pitot tube coefficient..... | .840 | .840 | .840 |
| Water in sample gas | | | |
| condenser.....(ML) | 220.0 | 0.0 | 0.0 |
| impingers.....(GRAMS) | 0.0 | 265.0 | 229.0 |
| desiccant.....(GRAMS) | 73.0 | 29.0 | 32.0 |
| total.....(GRAMS) | 293.0 | 294.0 | 261.0 |
| Total particulate material..... collected(grams) | 0.0217 | 0.0188 | 0.0226 |
| Gas meter coefficient..... | 1.0083 | 1.0053 | 1.0083 |
| Barometric pressure..(IN.HG) | 30.13 | 30.13 | 30.13 |
| Avg. orif.pres.drop..(IN.WC) | 1.53 | 1.45 | 1.32 |
| Avg. gas meter temp..(DEG-F) | 72.5 | 82.1 | 84.5 |
| Volume through gas meter.... | | | |
| at meter conditions...(F) | 42.27 | 41.62 | 39.63 |
| standard conditions.(DSCF) | 42.70 | 41.29 | 39.13 |
| Total sampling time....(MIN) | 60.00 | 60.00 | 60.00 |
| Nozzle diameter.....(IN) | .250 | .250 | .250 |
| Avg.stack gas temp ..(DEG-F) | 193 | 200 | 202 |
| Volumetric flow rate..... | | | |
| actual.....(ACFM) | 2988 | [illegible] | 2926 |
| dry standard.....(DSCFM) | 1839 | 1835 | 1790 |
| Isokinetic variation.....(%) | 104.7 | 101.5 | 98.6 |
| Particulate concentration... | | | |
| actual.....(GR/ACF) | 0.00483 | 0.00424 | 0.00545 |
| dry standard.....(GR/DSCF) | 0.00784 | 0.00703 | 0.00891 |
| Particle mass rate...(LB/HR) | 0.12 | 0.11 | 0.14 |

PARTICULATE EMISSION TEST
Blood Drying OPERATING DATA *
(Type of Source)

Owner Farmland Foods Inc. Run No. 1, 2, 3
Source I.D. 42-01-006 Date 1-16-87

Maximum Continuous Process Weight (Manufacturer's Rating) 1500 Lbs./Hr.
Historical Average Process Weight 1030 Lbs./Hr.
Historical Maximum Process Weight 1045 Lbs./Hr.
Type and Sources of Fuels Normally Burned Natural Gas

Approximate Quantities of Each of Above Fuels Burned Annually 30,000 MCF

Recycling Capability: Yes ____ No ✓

Process Data During Run (Averaged)

Process Weight (Dry) 1030 Lbs./Hr.
Percent Moisture 10% %
Process Weight (Wet) 2300 Lbs./Hr.
How Process Weight Determined Based on 680 hogs killed per hour at 8 pounds of raw blood per hog Number of hogs killed/hr limited to 680/hr by union contract.
Type of Fuel Burned During Run Natural Gas

Recycling in Progress: Yes ____ No ✓

Person Responsible for Data: Thomas D. Boelman
Signature: Thomas D. Boelman
Title/Position: Maint. Supervisor

*Averages of operating data taken during actual test run unless requested otherwise.

## AIR POLLUTION CONTROL EQUIPMENT OPERATING DATA*

Plant Farmland Foods Inc Location Iowa Falls, Ia 50126

Source Type Blood Drying Rated Production 1500 Process Pounds/Hr.

Date 1-16-87 Time _____ Actual Production 1030 Process Pounds/Hr

Air Flow Data _____ Run No. 1, 2, 3

**Mechanical Collector:**

Tube Diameter 14 in. No. of Tubes 1. Design Δp. 9 in. $H_2O$ @ Gas Temp. 200°F.

Observed Δp _____ in $H_2O$. Design cfm/tube @ Observed Δp _____ @ _____ °F.

Fan Rated H.P. _____. Operating Volts _____. Operating Amps _____.

**Electrostatic Precipitator:**

| Field No. | Primary Voltage (volts) | Primary Current (amps) | Secondary Voltage (KV) | Secondary Current (ma) | Spark Rate (per min.) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Scrubber:**

Type _____. Δp (across scrubber) _____ in. $H_2O$.

Fan Rated H.P. _____. Operating Volts _____. Operating Amps _____.

Liquid Circulation Rate _____ gal/min. % Make-up _____. Blowdown _____ gpm.

Scrubbing Water Change Interval _____.

Settling Tank Cleaning Interval _____.

**Baghouse:**

Pressure-Positive _____ Negative _____. No Compartments _____.

Type Cleaning _____. Clean Cycle _____ min.

Avg. Baghouse Δp _____ in $H_2O$. Δp Range _____ in. $H_2O$.

Fan: Rated H.P. _____. Operating Volts _____. Operating Amps _____.

**Cyclone:**

Type Helicline Δp 9" in. $H_2O$. Diameter 37" O.D., 14" Inlet

Fan Rated H.P. 30. Operating Volts 440. Operating Amps _____.

Person Responsible for Data: Thomas D. Bachman

Signature: Thomas D. Bachman

Title/Position: Maint. Supervisor

*Averages of operating data taken during actual test run unless requested otherwise.

(EPA Method 5) Impinger Wash (Wet Catch)
Gravimetric Analysis Lab: Organics/Inorganics

Date of Analysis 1-29-87 Data Sheet TR 42(160)

Technician RCV

Project No. _____

interpoll

Job _____ Date _____
City/State _____ J/N _____
Source _____
Test Site _____
Sample Type _____ Tech _____
Remarks: Test/Run _____
_____ of _____

Special Handling _____

☐ Organics
Evap. Dish No. _____
Blk. (Solv) Wt. _____ g
E. Dish Tare Wt. _____ g
E. Dish + Sample Wt. _____ g

☐ Inorganics
Evap. Dish No. _____
E. Dish Tare Wt. _____ g
E. Dish + Sample Wt. _____ g

Comments _____

760.7
795.9

interpoll

Job Farmland Foods/Iowa Falls Date 1-16-87
City/State Iowa Falls Log #4464-11
Source Blood Dryer
Test Site stack
Sample Type wet Catch Tech JB
Remarks: Test/Run 1/2

Special Handling _____

☑ Organics
Evap. Dish No. 43
Blk. (Solv) Wt. 0.0019 g
E. Dish Tare Wt. 92.3247 g
E. Dish + Sample Wt. 92.3368 g

☐ Inorganics
Evap. Dish No. _____
E. Dish Tare Wt. _____ g
E. Dish + Sample Wt. _____ g

Comments .0121 gms

760.7
795.9

interpoll

Job Farmland Foods Iowa Falls Date 1-16-87
City/State Iowa Falls Ia Log #4464-12
Source Blood Dryer
Test Site stack
Sample Type wet Catch Tech JB
Remarks: Test/Run 1/3
_____ of _____

Special Handling _____

☑ Organics
Evap. Dish No. 47
Blk. (Solv) Wt. 0.0019 g
E. Dish Tare Wt. 92.4713 g
E. Dish + Sample Wt. 92.4837 g

☐ Inorganics
Evap. Dish No. _____
E. Dish Tare Wt. _____ g
E. Dish + Sample Wt. _____ g

Comments .0121 gms

RESULTS:

| | 1 | 2 | 3 |
|---|---|---|---|
| ORGANICS | | 0.0102 | 0.0105 |
| INORGANICS | | | |



L-01880

INTERPOLL INC.
EPA Method 5 Probe (Cyclone) Wash
Gravimetric Analysis Laboratory Data Sheet
(CFR Title 40 Part 60 Appendix A)

Date of Analysis 1-22-87
Technician RCV

EPA-M5 Acetone R.B SPEC ≤ 7.8 µg/cc
Actual acetone residue blank 0 µg/cc

---

(1)

Interpoll
Job [illegible] Date 1-16-87
City/State [illegible] Log # 4466-02
Source [illegible]
Test Site Stack
Sample type [illegible] Tech JB
Remarks: Test/Run 1/1
of 1

Special Handling Required
Evaporating Dish No. 54
Volume of acetone 105 cc
E. Dish Tare Wt. 105.6931 g
E. Dish + Sample Wt. 105.7143 g
Comments

---

(2)

Interpoll
Job [illegible] Date 1-16-87
City/State [illegible] Log # 4466-05
Source [illegible]
Test Site Stack
Sample type [illegible] Tech JB
Remarks: Test/Run 1/2
of 1

Special Handling Required
Evaporating Dish No. 54
Volume of acetone 120 cc
E. Dish Tare Wt. 93.2591 g
E. Dish + Sample Wt. 93.2673 g
Comments

---

(3)

Interpoll
Job [illegible] Date 1-16-87
City/State [illegible] Log # 4466-08
Source [illegible]
Test Site Stack
Sample type [illegible] Tech JB
Remarks: Test/Run 1/3
of 1

Special Handling Required
Evaporating Dish No. 58
Volume of acetone 115 cc
E. Dish Tare Wt. 92.2579 g
E. Dish + Sample Wt. 92.2698 g
Comments

---

RESULTS:

0.0212 | 0.00821 | 0.0115

L-0185/Y

(EPA Method 5) Filter
Gravimetric Analysis Lab
Data Sheet
FR 42(160)

Date of Analysis 1-20-87
Technician Bcc

**interpoll**

1

Job Farmland Foods — Date 1-16-87
City/State — Log# 4466-03
Source Blood Dryer
Test Site Stack
Sample type — Tech JB
Remarks: — Test/Run 1/1
1 of 1

Special Handling Required
Filter No. 6446
Filter Type 4"G
Filter Tare Wt. 0.6546 g
Filter + Sample Wt. 0.6551 g
Comments

**interpoll**

2

Job Farmland Foods — Date 1-16-87
City/State — Log# 4466-06
Source Blood Dryer
Test Site Stack
Sample type — Tech JB
Remarks: — Test/Run 1/2
1 of 1

Special Handling Required
Filter No. 6450
Filter Type 4"G
Filter Tare Wt. 0.6437 g
Filter + Sample Wt. 0.6441 g
Comments

**interpoll**

3

Job Farmland Foods — Date 1-16-87
City/State — Log# 4466-09
Source Blood Dryer
Test Site Stack
Sample type — Tech JB
Remarks: — Test/Run 1/3
1 of 1

Special Handling Required
Filter No. 6451
Filter Type 4"G
Filter Tare Wt. 0.6464 g
Filter + Sample Wt. 0.6466 g
Comments

RESULTS:

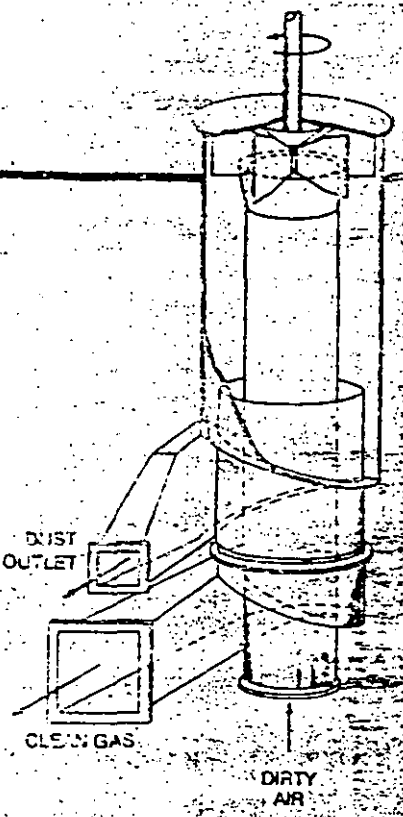
0.0005 | 0.0004 | 0.0002

0.02170 | D-8 | 0.0185 | 0.0226

L-0185/P

Ref. Farmland Foods Inc.

# HELICLONE™ SEPARATOR




JAN - 9 1987

The HELICLONE™ Separator is a mechanical centrifugal separator employing the principle of dynamic precipitation.

It combines the dual functions of air mover and dust separator. The central inlet tube directs particle laden gases into a fan wheel which imparts centrifugal motion to the gases at approximately its tip speed.

Gases are then spun into an outer cylindrical shell where the air borne particles have sufficient residence time in the very high centrifugal force field to migrate to the shell from which they are skimmed off with approximately 15% of the conveying gases, into an annular opening, to a dust receiver. From there the conveying gases can either be recycled to the inlet of the HELICLONE™ or they can be exhausted.

Inward gases of the annular skimming opening are clean and can either be exhausted or directed to a secondary cleaning stage such as a filter which in many instances allows air to recycle into the work area.

Mechanical parts of the HELICLONE™ such as fan wheel, shaft, bearings, etc. are in most cases of standard mechanical design. Therefore, the same considerations regarding spark resistant design, high temperature application, etc. apply as in the case of fans.

The name of the HELICLONE™ Separator is derived from the shape of the outlet housings, which have helical sides. The helical contour is used for expanding the outlet area.

The helical shape of the housing gives great rigidity to the support of the central feeder tube and the skimming tube. The pitch of the helix essentially follows the pitch of the spinning gases and thus gradually changes their axial flow component into a direction completely perpendicular to the longitudinal axis of the HELICLONE™ Separator.

In the vertical position, the separator can be used as a wet scrubber with the water spray injected into the fan wheel.

The helical design of the outlet housings allows drainage of the scrubbing water by gravity. The wet surfaces of the fan wheel and of the cylindrical shell capture the dust particles. From there they are directed into a small sludge receiver cyclone. The HELICLONE™ performs as the demister in this case.

The HELICLONE™ Separator has a low space requirement and since it is factory assembled, it also has a low installation cost. It is of rugged construction and is available in a variety of sizes ranging from 500 CFM to 50,000 CFM capacity.

design & equipment co., inc.

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03-03 Date/Time MARCH 22, 1995

Project Title MEAT RENDERING AP-42 EMISSION FACTOR CALCULATIONS

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

Phone Contact ☐
Meeting Notes ☐
Work Sheet ☒



I. PARTICULATE DISTRIBUTION BETWEEN FILTERABLE & CONDENSIBLE:

RUN #1: FILTERABLE ONLY 0.0217 g

RUN #2: FILTERABLE = $\frac{0.0086}{0.0188}$ = 0.457 = 46%

TOTAL = 0.0188 g

CONDENSIBLE = $\frac{0.0102}{0.0188}$ = 0.543 = 54%

RUN #3: FILTERABLE = $\frac{0.0121}{0.0226}$ = 0.535 = 53%

TOTAL = 0.0226 g

CONDENSIBLE = $\frac{0.0105}{0.0226}$ = 0.465 = 47%

II. PARTICULATE EMISSION RATES

TOTAL PARTICULATE EMISSION RATE
RUN 1 = 0.12 lb/hr
RUN 2 = 0.11 lb/hr
RUN 3 = 0.14 lb/hr

FILTERABLE

RUN #1: 0.12 lb/hr

RUN #2: 0.11 lb/hr * 0.46 = 0.051 lb/hr

RUN #3: 0.14 lb/hr * 0.53 = 0.074 lb/hr

CONDENSIBLE

RUN #2: 0.11 lb/hr * 0.54 = 0.059 lb/hr

RUN #3: 0.14 lb/hr * 0.47 = 0.066 lb/hr

III. EMISSION FACTORS -- DRIED BLOOD MEAL PRODUCTION BASIS

PRODUCTION RATE = 1,030 lbs/hr = 0.515 ton/hr (ALL 3 RUNS)

FILTERABLE

RUN #1: 0.12 lb/hr / 0.515 ton/hr = 0.23 lbs/ton

RUN #2: 0.051 lb/hr / 0.515 ton/hr = 0.099 lbs/ton

RUN #3: 0.074 lb/hr / 0.515 ton/hr = 0.14 lb/ton

AVERAGE 0.16 lbs/ton

MRI

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03-03 Date/Time MARCH 27, 1995

Project Title MEAT RENDERING AP-42 EMISSION FACTOR CALCULATIONS

Signature T.L. APP Verified by _____ (signature/date)

Phone Contact ☐
Meeting Notes ☐
Work Sheet ☒

Page 2 of 2

Condensible

Run #2: 0.059 lbs/hr / 0.515 tons/hr = 0.11 lbs/ton

Run #3: 0.066 lbs/hr / 0.515 tons/hr = 0.13 lbs/ton

AVERAGE 0.12 lbs/ton

MRI