AP42 Section: 11.1

Reference Number: 60

Title: Results Of A Source Emission Compliance Test On A Hot-Mix Asphalt Plant Process Scrubber Operated By L. C. Kruse & Sons, Inc., Windom, Minnesota,

MMT Environmental Services, Inc., St. Paul, MN,

September 2, 1993.

AP-42 Section 11.1
Reference
Report Sect. 4
Reference 60

Reject #3

325

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**RESULTS OF A
SOURCE EMISSION COMPLIANCE TEST
ON A HOT-MIX ASPHALT PLANT
PROCESS SCRUBBER
OPERATED BY
L.C. KRUSE & SONS, INC.
TALCOT LAKE, MINNESOTA
August 16, 1993**

Submitted to:

L.C. Kruse & Sons, Inc.
P.O. Box 899
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Attn: Mr. Darrin L. Kruse

Prepared by:

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Sampling Team Leader

Approved by:

Alan L. Trowbridge
Director of Technical Services

MMT Report Number: 10004
MMT Project Number: 9425
Report Issued: September 2, 1993

TABLE OF CONTENTS

RESULTS OF A SOURCE EMISSION COMPLIANCE TEST ON A HOT-MIX ASPHALT PLANT PROCESS SCRUBBER OPERATED BY L.C. KRUSE & SONS, INC. TALCOT LAKE, MINNESOTA August 16, 1993

MMT Report Number 10004
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1 INTRODUCTION

MMT Environmental Services, Inc. (MMT) was contracted by L.C. Kruse & Sons Inc. to perform a source emission compliance test on a single source at their portable hot-mix asphalt plant operating near Talcot Lake, Minnesota. The plant is a Portec, Inc., Pioneer Division, model DM with serial number 113-36-DM-106. Emissions generated by the plant's aggregate/asphalt drum mix operation are controlled by a Barber-Greene model CC99X102 venturi scrubber. The scrubber exhaust was tested for particulate and visible emissions on August 16, 1993. This report presents the results of the test program along with all substantiating documentation.

The MMT sampling team consisted of Messrs. Ted Gibbons, Bill Anderson and Alan Trowbridge. Mr. Daniel D. Schultz of L.C. Kruse & Sons, Inc. and Mr. Wayne Jacobson of Jacobson Engineering Inc., a consultant to L.C. Kruse & Sons, were present throughout the test period The Minnesota Pollution Control Agency was invited to witness the test proceedings but declined to do so.

2 TEST RESULTS

The results of the particulate emission test are presented in Table 2.1. The data indicates an average effluent particulate concentration of 0.075 grains per dry standard cubic foot and an average source particulate emission rate of 16.34 pounds per hour.

The visible emission test was performed concurrent with the second particulate test run. The maximum observed plume opacity was zero (0) percent; i.e. no visible emissions were observed during the test period.

The average process weight rate (aggregate + asphalt) during the test period was 252 tons per hour.

Minnesota Air Emission Permit number 323-B-89-OT-1 states that the asphalt concrete plant shall not exhaust any gases (1) which contain particulate matter in excess of 0.04 grains per dry standard cubic foot or (2) which exhibit 20 percent or greater opacity. The test data indicates that the source emissions did not comply with the mass concentration standard during the test period.

Table 2.1
Summary of Particulate Emission Test Results
L.C. Kruse & Sons, Inc. Asphalt Plant, Talcot Lake, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
August 16, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1247	1456	1630	---
Finish	1359	1608	1742	---
Effluent Temperature, °F	168	171	159	166
Effluent Moisture Content, % v/v	38.3	39.9	33.0	37.1
Effluent Composition, % v/v dry:				
Carbon Dioxide Content	6.0	5.8	6.5	6.1
Oxygen Content	13.0	13.2	12.7	13.0
Effluent Volumetric Flow Rate:				
Actual Conditions, acfm	49,572	50,578	50,932	50,361
Standard Conditions, scfm	39,625	40,195	41,279	40,366
Dry Standard Conditions, dscfm	24,451	24,146	27,638	25,412
Sampling Isokinetic Variation, %	104.8	101.0	95.2	100.3
Effluent Particulate Concentration:				
Front Catch Only;				
Actual Conditions, gr/acf	0.0288	0.0254	0.0299	0.0280
Standard Conditions, gr/scf	0.0360	0.0319	0.0368	0.0349
Dry Standard Conditions, gr/dscf	0.0584	0.0531	0.0550	0.0555
Back Catch Only;				
Actual Conditions, gr/acf	0.0087	0.0108	0.0098	0.0098
Standard Conditions, gr/scf	0.0109	0.0136	0.0121	0.0122
Dry Standard Conditions, gr/dscf	0.0177	0.0227	0.0180	0.0195
Total Catch;				
Actual Conditions, gr/acf	0.0376	0.0362	0.0396	0.0378
Standard Conditions, gr/scf	0.0470	0.0456	0.0489	0.0472
Dry Standard Conditions, gr/dscf	0.0761	0.0759	0.0731	**0.0750**
Source Particulate Emission Rate:				
Classical Method, lb/hr	15.97	15.71	17.32	16.33
Ratio of Areas Method, lb/hr	16.72	15.86	16.48	16.35
Average of the Two Methods, lb/hr	16.35	15.79	16.90	16.34

Standard Conditions: 68°F, 29.92 in. Hg

3 PROCESS DATA

During the test period the burner on the plant's aggregate/asphalt drum mix operation was fired with waste oil. A sample of the fuel was collected but not analyzed.

Scrubber water was 100 percent recycled.

Production data is presented in Appendix E and summarized in Table 3.1.

Table 3.1
Summary of Process Data
L.C. Kruse & Sons, Inc. Asphalt Plant, Talcot Lake, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
August 16, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1247	1456	1630	---
Finish	1359	1608	1742	---
Process Weight Rate;				
Aggregate Usage, ton/hr	230.0	242.2	241.0	237.7
Asphalt Usage, ton/hr	13.2	14.1	14.3	13.9
Total Process Weight Rate, ton/hr	243.2	256.3	255.3	251.6
Aggregate Moisture Content, %	5.8	5.7	5.4	5.6
Burner Setting, %	54	55	55	55
Product Mix Temperature, °F	290	290	290	290
Scrubber Operating Parameters;				
Pressure Drop, in WC	12	12	12	12
Water Flow Rate, gpm	400	400	400	400

4 TEST PROCEDURES

In order to determine the pollutant emission rate from stationary sources, the Environmental Protection Agency (EPA) has established a series of reference methods which specify the manner in which tests must be performed. These reference methods are found in the Code of Federal Regulations (40 CFR 60) under Title 40 "Protection of the Environment"; Chapter 1 "Environmental Protection Agency"; Subchapter C "Air Programs"; Part 60 "Standards of Performance for New Stationary Sources"; Appendix A "Reference Methods". Unless otherwise noted, the tests presented in this report were performed according to the EPA Reference Methods as revised on July 1, 1992. A brief description of the test procedures used follows.

4.1 SAMPLING POINTS

The number of sampling points and their location with in the source stack/duct was determined per EPA Method 1 which is entitled "Sample and velocity traverses for stationary sources". In this method the number of sampling points is based on the length of straight, undisturbed flow both before and after the sampling port location. Site specific data is presented in Figure 4.1.

A test for cyclonic flow was performed using the S-tube null-reading technique of EPA Method 1, Section 2.4. The test yielded an average yaw angle of 2.8 degrees. This indicates that the sampling location was acceptable as the yaw angle criteria of less than 20 degrees was met.

4.2 EFFLUENT VOLUMETRIC FLOW RATE

The effluent volumetric flow rate was determined per EPA Method 2 which is entitled "Determination of stack gas velocity and volumetric flow rate (Type S pitot tube)". Gas velocity pressure (head) and temperature data were obtained during each EPA Method 5 particulate test run by traversing each of the sampling points defined by EPA Method 1. This data along with gas density (EPA Method 3) and moisture content (EPA Method 4) data was used to calculate the gas velocity at each sampling point. The source volumetric flow rate was calculated by multiplying the average gas velocity by the stack/duct cross-sectional area at the point of measurement.

4.3 EFFLUENT COMPOSITION AND MOLECULAR WEIGHT

The density of the effluent was determined per EPA Method 3 which is entitled "Gas analysis for the determination of dry molecular weight". One sample was collected during each EPA Method 5 particulate test run. The gas samples were analyzed for carbon dioxide and oxygen concentrations with a standard Orsat analyzer using commercially prepared solutions. For calculations of gas density the balance of the gas was assumed to be nitrogen and carbon monoxide.

4.4 EFFLUENT MOISTURE CONTENT

The effluent moisture content was determined per EPA Method 4 which is entitled "Determination of moisture content in stack gases". Data for making the gas moisture content determinations was collected simultaneously with each EPA Method 5 particulate test run. The gas moisture content was calculated from the mass and/or volume of liquid collected in the Method 5 sampling train cold box impingers and the volume of gas sampled.

Figure 4.1 Site Description Form
L.C. Kruse & Sons, Inc. Asphalt Plant, Talcot Lake, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
August 16, 1993

SAMPLING LOCATION DATA

Stack Cross-Sectional Dimension;
- Depth (traverse dimension), inches... 47.0
- Width, inches..... 41.0
- Equivalent diameter, inches..... 43.8

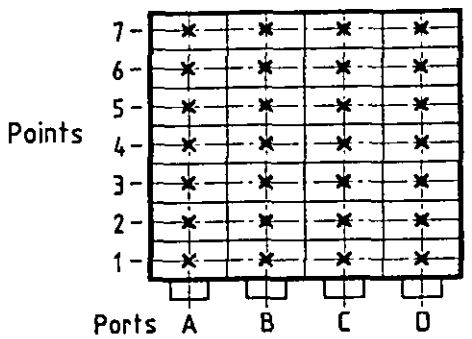
Length of straight, undisturbed flow;
- Before ports, inches..... 96.0
- After ports, inches 36.0
- Before ports, stack diameters..... 2.19
- After ports, stack diameters 0.82

Number of sampling points;
- Required by EPA Method 1 25
- Actually used..... 28
  - Number of ports 4
  - Number of points per port..... 7

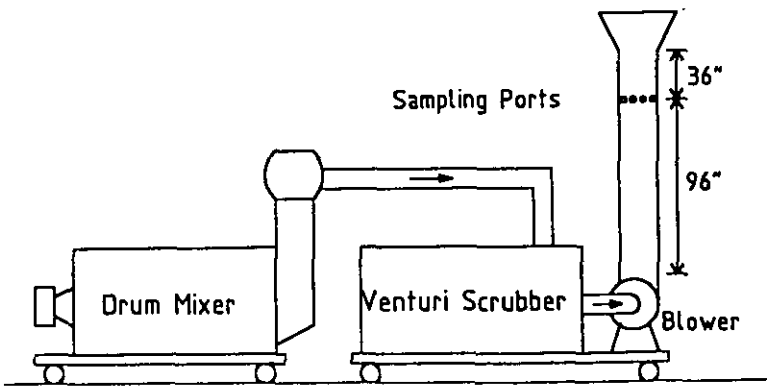
Particulate test sampling time;
- Minutes per point: 2.5
- Minutes per test run:..... 70.0

SAMPLING POINT LOCATION WITHIN STACK CROSS-SECTION

Point Number	Percent of Traverse	Inches from Wall
1	7.14	3.4
2	21.43	10.1
3	35.71	16.8
4	50.00	23.5
5	64.29	30.2
6	78.57	36.9
7	92.86	43.6



SAMPLING SITE SCHEMATIC



4.5 EFFLUENT PARTICULATE CONCENTRATION

The effluent particulate concentration was determined per EPA Method 5 which is entitled "Determination of particulate emissions from stationary sources". For each test run, particulate matter was isokinetically withdrawn from the gas stream at each of the EPA Method 1 defined sampling points and collected on a glass fiber filter which was maintained at constant temperature (248±25°F). Water vapor, organic vapors and other matter in vapor form which passed through the filter was collected in an ice-cooled impinger trap who's exit temperature was maintained at less than 68°F.

The EPA Method 5 sampling train (Figure 4.2) consists of a heated sampling probe with attached nozzle, thermocouple and S-type pitot tube. The probe attaches to the front sample case (hot box) which houses a glass cyclone (optional) and an all-glass in-line filter holder in a temperature controlled environment. The front sample case is connected to the back sample case (cold box) which houses a series of glass impingers and a desiccant column in an ice bath. The back sample case is connected to the control unit which contains the sample vacuum pump, pressure and temperature indicators and all operating controls.

A representative particulate sample was acquired by sampling for equal periods of time at the center of a number of equal area regions within the stack/duct. At each sampling point the gas velocity head and temperature were measured and the sampling rate rapidly adjusted to isokinetic conditions with the aid of a nomograph or programmable computing device. Sample gas drawn into the nozzle flowed through the probe to the glass fiber filter where the particulate matter was collected. The gases then passed through the ice-cooled condenser (impingers and desiccant column) which quantitatively sorbed all moisture from the gas stream. The gas then passed through the vacuum pump, the dry test meter and the calibrated orifice.

Leak checks to detect any dilution air being pulled into the sampling line were performed at the beginning and end of each test run and also when and if any sample line connections were broken.

After completion of each test run, the sampling train was removed to the clean-up area for sample recovery. The filter was removed from the filter holder and placed in Container #1. Particulate matter collected in the nozzle, probe and all connecting glassware in front of the filter was quantitatively transferred to Container #2 by means of a distilled water wash followed by an acetone wash. A stiff brush was used in the probe cleaning step to help dislodge deposits. The water collected in each of the impingers (desiccant column excluded) was measured and transferred to Container #3. The impingers and all connecting pieces between the filter paper and the desiccant column were then rinsed with distilled water and these rinsings were added to Container #3. The impingers and all connecting pieces between the filter paper and the desiccant column were then rinsed with acetone and these rinsings were placed in Container #4. The desiccant column was then weighed and its contents transferred to a waste desiccant container.

Figure 4.2 Sampling Train Description
L.C. Kruse & Sons, Inc. Asphalt Plant, Talcot Lake, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
August 16, 1993

PARTICULATE SAMPLING TRAIN IDENTIFICATION

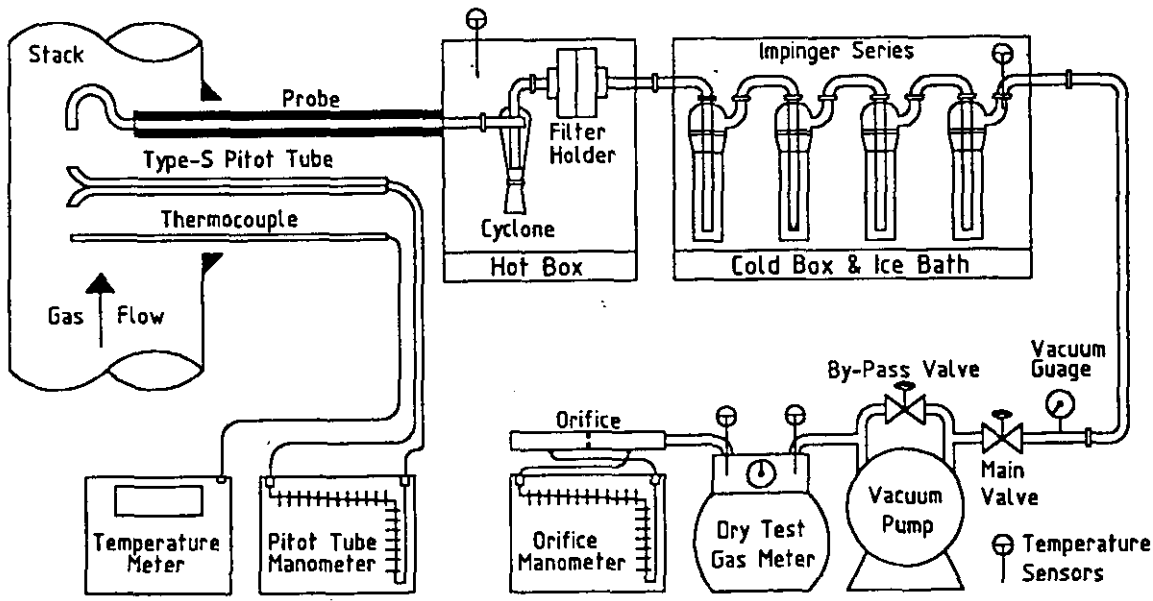
Sampling Train Manufacturer: ..... MMT Environmental Services, Inc.
Sampling Train Model: ..... Universal Stak Sampler

Hot Box Set-up and Operating Temperature;
- Cyclone used: ..... No
- Filter Media: ..... Glass Fiber Filter, Whatman GF/C, 11.0 cm diameter
- Filtration Temperature: ..... 248 ± 25 degrees Fahrenheit

Cold Box Set-up; Impinger Type and Initial Contents
- Impinger #1: ..... Modified Greenburg-Smith design, 100 ml deionized, distilled water
- Impinger #2: ..... Standard Greenburg-Smith design, 100 ml deionized, distilled water
- Impinger #3: ..... Modified Greenburg-Smith design, empty
- Impinger #4: ..... Modified Greenburg-Smith design, ≈ 250 grams silica gel, indicating type

Probe Nozzle Used: ..... MMT #L13, 0.241 inch diameter, stainless steel
Sampling Probe Used: .... MMT #70, 70 inch effective length with stainless steel liner
Pitot Tube Used: ..... MMT #67, S-type, 0.841 coefficient

PARTICULATE SAMPLING TRAIN SCHEMATIC



Sample analysis was performed at MMT's laboratory. The filter was dried in a 105°C oven for three hours and then desiccated to constant weight. The contents of Container #2 were transferred to a tared beaker, evaporated to near dryness and then desiccated to a constant weight. The contents of Container #3 were analyzed for condensable organic compounds using the chloroform/ethyl ether extraction procedure described in Minnesota Rule 7005.0500. The collected extract was transferred to a tared beaker, evaporated to near dryness and then desiccated to a constant weight. The contents of Container #4 were also transferred to a tared beaker, evaporated to near dryness and then desiccated to a constant weight.

The mass of particulate matter collected and the volume of gas sampled was used to calculate the effluent particulate concentration. The source particulate mass emission rate was calculated by multiplying the effluent particulate concentration by the source volumetric flow rate. Separate calculations were performed for total catch, front catch only (Containers 1 & 2) and back catch only (Containers 3 & 4).

4.6 SOURCE PLUME OPACITY

The source visible emissions were determined by the visual observations of a certified visible emissions evaluator per EPA Method 9 which is entitled "Visual determination of the opacity of emissions from stationary sources".

In this procedure, the observer positions himself at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140 degree sector to his back. Consistent with this requirement, the observer's line of site was, as much as possible, perpendicular to the plume's direction.

Opacity observations were made at the point of greatest opacity in that portion of the plume where condensed water vapor was not present. Observations were made at 15-second intervals and recorded to the nearest 5 percent opacity.

5 QUALITY ASSURANCE

The project manager is responsible for implementation of the quality assurance program as applied to any specific project.

5.1 SAMPLING QUALITY ASSURANCE

Source sampling quality assurance procedures are implemented to ensure work is performed:

- by competent, trained individuals experienced on the specific methodologies being used
- using properly calibrated equipment
- using approved procedures for sample handling and documentation

All measuring devices (pitot tubes, dry gas meters, thermocouples, portable gas analyzers, etc.) are uniquely identified and calibrated with documented procedures and acceptance criteria before and after each field effort. Records of all calibration data are maintained in the files. Prior to the test program, MMT provides the following:

- filter numbers and tare weights of all filters available for the test
- results of an acetone residue analysis on the acetone to be used during the test
- calibrations of all pitot tubes, dry gas meters, orifice meters, thermocouples and probes

Specific details of MMT's QA program for stationary air pollution sources may be found in "Quality Assurance Handbook for Air Pollution Measurement Systems", Volume III (EPA-600/4-7-027b).

5.2 ANALYTICAL QUALITY CONTROL

MMT maintains a vigorous quality control program for all sample analyses. This program is based on the general guidelines given in "Handbook for Analytical Quality Control in Water and Waste water Laboratories" (EPA-600/4-79-019); March 1979 . This program suggests guidelines in the areas of:

- Laboratory services
- Glassware
- Solvents
- Analytical performance
- Instrument selection
- Reagents
- Gases
- Laboratory safety

Standards and curves are determined for each analysis using the appropriate standard. Least square linear regression calculations are used in determining "best fit" to the data. Correlation coefficients are also calculated.

5.3 CALIBRATION GASES

MMT uses either EPA Protocol 1 or Acublend Certified Master gases (Scott Specialty Gases) when performing all calibrations in order to ensure tolerances on gas concentrations have been verified and are negligible. Certifications of all calibration gas bottles used during testing are presented in each report.

APPENDIX A: CALCULATIONS

DEFINITION OF UNIT ABBREVIATIONS

ACFM ..... ACTUAL CUBIC FEET PER MINUTE

DEG F ..... DEGREES FAHRENHEIT

DCF ..... DRY CUBIC FEET

DSCF ..... DRY STANDARD CUBIC FEET

DSCFM ..... DRY STANDARD CUBIC FEET PER MINUTE

FPS ..... FEET PER SECOND

G ..... GRAMS

GR/ACF ..... GRAINS PER ACTUAL CUBIC FOOT

GR/DSCF ..... GRAINS PER DRY STANDARD CUBIC FOOT

GR/SCF ..... GRAINS PER STANDARD CUBIC FOOT

IN ..... INCHES

IN HG ..... INCHES OF MERCURY

IN WC ..... INCHES OF WATER

LB/HR ..... POUNDS PER HOUR

LB/LB-MOLE .. POUND PER POUND-MOLE

MIN ..... MINUTES

ML ..... MILLILITERS

SCF ..... STANDARD CUBIC FEET

SCFM ..... STANDARD CUBIC FEET PER MINUTE

SF ..... SQUARE FEET

% V/V DRY ... PERCENT BY VOLUME, DRY BASIS

DEFINITION OF STANDARD CONDITIONS

STANDARD TEMPERATURE ..... 68 DEGREES FAHRENHEIT

STANDARD PRESSURE ..... 29.92 INCHES OF MERCURY

DEFINITION OF VARIABLES

An .... CROSS-SECTIONAL AREA OF NOZZLE, SF
As .... CROSS-SECTIONAL AREA OF STACK, SF
Bwp ... EFFLUENT MOISTURE CONTENT, PERCENT BY VOLUME
Bws ... EFFLUENT MOISTURE CONTENT, PROPORTION BY VOLUME
Ca* ... EFFLUENT PARTICULATE CONCENTRATION AT ACTUAL CONDITIONS, GR/ACF; *=f,b,t; Caf: FRONT CATCH ONLY; Cab: BACK CATCH ONLY; Cat: TOTAL CATCH
CD .... EFFLUENT CARBON DIOXIDE CONCENTRATION, % V/V DRY
CM .... EFFLUENT CARBON MONOXIDE CONCENTRATION, % V/V DRY
Cp .... PITOT TUBE COEFFICIENT, DIMENSIONLESS
Cs* ... EFFLUENT PARTICULATE CONCENTRATION AT DRY STANDARD CONDITIONS, GR/DSCF; *=f,b,t; Csf: FRONT CATCH ONLY; Csb: BACK CATCH ONLY; Cst: TOTAL CATCH
Cw* ... EFFLUENT PARTICULATE CONCENTRATION AT STANDARD CONDITIONS, GR/SCF; *=f,b,t; Cwf: FRONT CATCH ONLY; Cwb: BACK CATCH ONLY; Cwt: TOTAL CATCH
Dn .... NOZZLE DIAMETER, IN
I ..... ISOKINETIC VARIATION, %
Md .... EFFLUENT MOLECULAR WEIGHT, LB/LB-MOLE, DRY BASIS
Ms .... EFFLUENT MOLECULAR WEIGHT, LB/LB-MOLE, WET BASIS
NI .... EFFLUENT NITROGEN CONCENTRATION, % V/V DRY
OX .... EFFLUENT OXYGEN CONCENTRATION, % V/V DRY
Pb .... BAROMETRIC PRESSURE, IN HG
Pg .... STACK STATIC PRESSURE, IN WC
Po .... AVERAGE PRESSURE DROP ACROSS THE METERING ORIFICE, IN WC
Ps .... STACK ABSOLUTE PRESSURE, IN HG
Pv .... AVERAGE SQUARE-ROOT VELOCITY PRESSURE, IN WC
Qa .... EFFLUENT FLOW RATE AT ACTUAL CONDITIONS, ACFM
Qs .... EFFLUENT FLOW RATE AT STANDARD CONDITIONS, SCFM
Qsd ... EFFLUENT FLOW RATE AT STANDARD CONDITIONS, DRY BASIS, DSCFM
Rc* ... SOURCE PARTICULATE EMISSION RATE, CLASSICAL METHOD, LB/HR; *=f,b,t; Rcf: FRONT CATCH ONLY; Rcb: BACK CATCH ONLY; Rct: TOTAL CATCH
Rr* ... SOURCE PARTICULATE EMISSION RATE, RATIO OF AREAS METHOD, LB/HR; *=f,b,t; Rrf: FRONT CATCH ONLY; Rrb: BACK CATCH ONLY; Rrt: TOTAL CATCH
Sl .... STACK DIAMETER OR LENGTH, IN
Sw .... STACK WIDTH, IN
Ti .... TOTAL SAMPLING TIME, MIN
Tm .... AVERAGE DRY GAS METER TEMPERATURE, DEG F
Ts .... AVERAGE EFFLUENT TEMPERATURE, DEG F
Vl .... VOLUME OF LIQUID COLLECTED, ML
Vm .... VOLUME OF GAS SAMPLED AT METER CONDITIONS, DCF
Vms ... VOLUME OF GAS SAMPLED AT STANDARD CONDITIONS, DSCF
Vs .... AVERAGE EFFLUENT VELOCITY, FPS
Vw .... VOLUME OF WATER VAPOR COLLECTED AT STANDARD CONDITIONS, SCF
Wb .... MASS OF PARTICULATE MATTER COLLECTED IN THE BACK (WET) CATCH, G
Wf .... MASS OF PARTICULATE MATTER COLLECTED IN THE FRONT (DRY) CATCH, G
Wt .... TOTAL MASS OF PARTICULATE MATTER COLLECTED, G
Y ..... DRY GAS METER COEFFICIENT, DIMENSIONLESS

EQUATIONS USED TO CALCULATE PARTICULATE EMISSIONS

```
An = 0.005454154 * Dn * Dn

As = 0.005454154 * Si * Si      (FOR ROUND STACKS)

As = Si * Sw / 144.0      (FOR RECTANGULAR STACKS)

Ps = Pb + Pg/13.6

NI = 100.0 - CD - OX - CM

Wt = Wf + Wb

Vms = (528/29.92) * Vm * Y * (Pb + Po/13.6) / (Tm + 460.0)

Vw = 0.04707 * Vl

Bws = Vw / (Vw + Vms)

Bwp = 100.0 * Bws

Md = 0.440 * CD  +  0.320 * OX  + 0.280 * (NI + CM)

Ms = Md * (1.0 - Bws)  +  18.0 * Bws

Vs = 85.49 * Cp * Pv * SQRT( (Ts+460.0)/(Ms*Ps) )

Qa = 60.0 * Vs * As

Qs = Qa * (528/29.92) * Ps / (Ts + 460.0)

Qsd = Qs * (1.0 - Bws)

I = 0.09450 * (Ts+460.0) * Vms / (Ps * Vs * An * Ti * (1.0-Bws) )

Csf = 15.42 * Wf / Vws
Csb = 15.42 * Wb / Vws
Cst = 15.42 * Wt / Vws

Cwf = Csf / (1.0 - Bws)
Cwb = Csb / (1.0 - Bws)
Cwt = Cst / (1.0 - Bws)

Caf = Cwf * (29.92/528.0) * (Ts+460.0) / Ps
Cab = Cwb * (29.92/528.0) * (Ts+460.0) / Ps
Cat = Cwt * (29.92/528.0) * (Ts+460.0) / Ps

Rcf = 0.008578 * Csf * Qsd
Rcb = 0.008578 * Csb * Qsd
Rct = 0.008578 * Cst * Qsd

Rrf = 0.008578 * Csf * (Vms/Ti) * (As/An)
Rrb = 0.008578 * Csb * (Vms/Ti) * (As/An)
Rrt = 0.008578 * Cst * (Vms/Ti) * (As/An)
```

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE
RUN NUMBER: 1 TIME: 8/16/93 1247-1359

SAMPLING LOCATION PORT	POINT	TRAVERSE POINT DATA: VELOCITY PRESSURE IN WC	ORIFICE PRESSURE IN WC	TEMPERATURE, DEG.F STACK GAS	METER INLET	METER OUTLET	VELOCITY PROFILE: SQRT VELOCITY PRESSURE	GAS VELOCITY FT/SEC
A	1	0.340	0.570	151	78	78	0.583	38.81
A	2	0.550	0.920	160	81	79	0.742	49.72
A	3	0.730	1.220	163	83	79	0.854	57.42
A	4	0.870	1.150	165	85	79	0.933	62.79
A	5	1.050	1.750	167	86	79	1.025	69.09
A	6	1.150	1.450	167	87	79	1.072	72.30
A	7	1.250	1.580	168	87	80	1.118	75.44
B	1	0.470	0.590	169	88	80	0.686	46.30
B	2	0.610	0.770	166	88	80	0.781	52.62
B	3	0.940	1.190	167	89	80	0.970	65.37
B	4	1.150	1.450	167	90	81	1.072	72.30
B	5	1.150	1.450	167	90	81	1.072	72.30
B	6	1.100	1.390	170	90	81	1.049	70.88
B	7	1.200	1.520	170	90	82	1.095	74.04
C	1	0.400	0.510	170	88	82	0.632	42.74
C	2	0.650	0.820	170	88	82	0.806	54.49
C	3	0.840	1.060	170	89	82	0.917	61.94
C	4	1.100	1.390	169	90	83	1.049	70.83
C	5	1.050	1.330	170	90	83	1.025	69.25
C	6	1.100	1.390	169	90	83	1.049	70.83
C	7	1.150	1.450	168	90	83	1.072	72.36
D	1	0.300	0.380	171	88	83	0.548	37.05
D	2	0.590	0.750	169	87	83	0.768	51.87
D	3	0.740	0.930	170	89	83	0.860	58.14
D	4	0.780	0.990	169	91	83	0.883	59.64
D	5	0.890	1.120	166	91	83	0.943	63.56
D	6	1.000	1.260	169	92	83	1.000	67.53
D	7	1.050	1.330	173	92	83	1.025	69.42
AVERAGE		0.864	1.132	168	88	81	0.915	61.74

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE
RUN NUMBER: 1 TIME: 8/16/93 1247-1359

TEST DATA

GAS METER COEFFICIENT	1.0110 Y	VOLUME OF LIQUID COLLECTED, ML	559.4 Vl
PITOT TUBE COEFFICIENT	0.841 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.241 Dn	CARBON DIOXIDE	6.00 CD
AREA, SF	0.000317 An	OXYGEN	13.00 OX
		CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	81.00 NI
STACK DIMENSIONS;			
DIAMETER/LENGTH, IN	47.00 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	41.00 Sw	STACK TEMP., DEG F	168 Ts
AREA, SF	13.382 As	METER TEMP., DEG F	85 Tm
		ORIFICE PRESSURE, IN WC	1.132 Po
BAROMETRIC PRESSURE, IN HG	28.48 Pb	SQRT VELOCITY P., IN WC	0.915 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	-0.77 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.42 Ps	FRONT CATCH (76.7%)	0.1607 Wf
		BACK CATCH (23.3%)	0.0488 Wb
SAMPLING TIME, MIN	70.00 Ti	TOTAL CATCH	0.2095 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	45.352 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	42.429 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.48 Md
		WET BASIS, LB/LB-MOLE	25.08 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	26.331 Vw	AVERAGE GAS VELOCITY, FPS	61.74 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.3829 Bws	ACTUAL, ACFM	49572 Qa
PERCENT BY VOLUME	38.29 Bwp	STANDARD, SCFM	39625 Qs
		DRY STANDARD, DSCFM	24451 Qsd
		ISOKINETIC VARIATION, %	104.78 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0288 Caf	0.0087 Cab	0.0376 Cat
STANDARD, GR/SCF	0.0360 Csf	0.0109 Csb	0.0470 Cst
DRY STANDARD, GR/DSCF	0.0584 Csf	0.0177 Csb	0.0761 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	12.25 Rcf	3.72 Rcb	15.97 Rct
RATIO OF AREAS METHOD	12.83 Rrf	3.90 Rrb	16.72 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE
RUN NUMBER: 2 TIME: 8/16/93 1456-1608

SAMPLING LOCATION PORT	POINT	TRAVERSE POINT DATA: VELOCITY PRESSURE IN WC	ORIFICE PRESSURE IN WC	TEMPERATURE, DEG.F: STACK GAS	METER INLET	METER OUTLET	VELOCITY PROFILE: SQRT VELOCITY PRESSURE	GAS VELOCITY FT/SEC
A	1	0.380	0.480	171	85	85	0.616	41.88
A	2	0.590	0.740	170	86	85	0.768	52.15
A	3	0.720	0.900	170	87	85	0.849	57.60
A	4	0.780	0.980	170	88	85	0.883	59.96
A	5	0.810	1.020	169	89	85	0.900	61.05
A	6	0.990	1.240	170	90	85	0.995	67.55
A	7	1.100	1.380	170	91	85	1.049	71.20
B	1	0.320	0.400	170	91	86	0.566	38.40
B	2	1.000	1.250	169	92	86	1.000	67.83
B	3	1.100	1.380	170	94	86	1.049	71.20
B	4	1.150	1.440	172	95	87	1.072	72.92
B	5	1.100	1.380	171	95	87	1.049	71.26
B	6	1.100	1.380	172	96	88	1.049	71.31
B	7	1.150	1.310	171	97	89	1.072	72.86
C	1	0.380	0.430	170	95	89	0.616	41.85
C	2	0.620	0.700	170	95	89	0.787	53.45
C	3	0.850	0.970	169	97	89	0.922	62.54
C	4	0.990	1.120	169	97	89	0.995	67.49
C	5	1.050	1.190	170	98	90	1.025	69.56
C	6	1.150	1.310	171	99	90	1.072	72.86
C	7	1.200	1.360	173	99	90	1.095	74.54
D	1	0.590	0.670	170	97	91	0.768	52.15
D	2	0.600	0.680	170	98	91	0.775	52.59
D	3	0.670	0.760	170	98	91	0.819	55.57
D	4	0.880	1.000	169	99	91	0.938	63.63
D	5	1.100	1.250	169	100	91	1.049	71.14
D	6	1.150	1.310	175	101	92	1.072	73.09
D	7	1.250	1.420	177	100	92	1.118	76.32
AVERAGE		0.885	1.052	171	95	88	0.927	62.99

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE
RUN NUMBER: 2 TIME: 8/16/93 1456-1608

TEST DATA

GAS METER COEFFICIENT	1.0110	Y	VOLUME OF LIQUID COLLECTED, ML	570.3	Vl
PITOT TUBE COEFFICIENT	0.841	Cp			
NOZZLE DIMENSIONS;			GAS COMPOSITION, % V/V DRY;		
DIAMETER, IN	0.241	Dn	CARBON DIOXIDE	5.80	CD
AREA, SF	0.000317	An	OXYGEN	13.20	OX
			CARBON MONOXIDE	0.00	CM
			NITROGEN (BY DIFFERENCE)	81.00	NI
STACK DIMENSIONS;			AVE. TRAVERSE POINT DATA;		
DIAMETER/LENGTH, IN	47.00	Sl	STACK TEMP., DEG F	171	Ts
WIDTH, IN	41.00	Sw	METER TEMP., DEG F	91	Tm
AREA, SF	13.382	As	ORIFICE PRESSURE, IN WC	1.052	Po
BAROMETRIC PRESSURE, IN HG	28.44	Pb	SQRT VELOCITY P., IN WC	0.927	Pv
STACK PRESSURES;			MASS OF PARTICULATE MATTER		
STATIC, IN WC	-0.56	Pg	COLLECTED, G;		
ABSOLUTE, IN HG	28.40	Ps	FRONT CATCH (70.1%)	0.1392	Wf
			BACK CATCH (29.9%)	0.0595	Wb
SAMPLING TIME, MIN	70.00	Ti	TOTAL CATCH	0.1987	Wt
VOLUME OF GAS SAMPLED AT METER, DCF	43.769	Vm			

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	40.387	Vms	GAS MOLECULAR WEIGHT;		
			DRY BASIS, LB/LB-MOLE	29.46	Md
			WET BASIS, LB/LB-MOLE	24.88	Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	26.844	Vw	AVERAGE GAS VELOCITY, FPS	62.99	Vs
GAS MOISTURE CONTENT;			GAS VOLUMETRIC FLOW RATE;		
VOLUME FRACTION	0.3993	Bws	ACTUAL, ACFM	50578	Qa
PERCENT BY VOLUME	39.93	Bwp	STANDARD, SCFM	40195	Qs
			DRY STANDARD, DSCFM	24146	Qsd
			ISOKINETIC VARIATION, %	101.00	I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0254 Caf	0.0108 Cab	0.0362 Cat
STANDARD, GR/SCF	0.0319 Cwf	0.0136 Cwb	0.0456 Cwt
DRY STANDARD, GR/DSCF	0.0531 Csf	0.0227 Csb	0.0759 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	11.01 Rcf	4.71 Rcb	15.71 Rct
RATIO OF AREAS METHOD	11.11 Rrf	4.75 Rrb	15.86 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE
RUN NUMBER: 3 TIME: 8/16/93 1630-1742

SAMPLING LOCATION PORT	POINT	TRAVERSE POINT DATA: VELOCITY PRESSURE IN WC	ORIFICE PRESSURE IN WC	TEMPERATURE, DEG.F: STACK GAS	METER INLET	METER OUTLET	VELOCITY PROFILE: SQRT VELOCITY PRESSURE	GAS VELOCITY FT/SEC
A	1	0.570	0.650	168	91	92	0.755	50.31
A	2	0.770	0.880	165	92	91	0.877	58.33
A	3	0.830	0.950	152	93	91	0.911	59.93
A	4	0.920	1.050	158	94	91	0.959	63.40
A	5	1.020	1.160	152	96	91	1.010	66.43
A	6	1.150	1.310	147	96	91	1.072	70.25
A	7	1.200	1.370	148	96	91	1.095	71.82
B	1	0.570	0.650	149	95	91	0.755	49.54
B	2	0.970	1.350	143	95	91	0.985	64.31
B	3	0.850	1.190	147	96	91	0.922	60.40
B	4	1.150	1.610	148	96	91	1.072	70.31
B	5	1.100	1.540	159	95	91	1.049	69.38
B	6	1.100	1.540	165	95	91	1.049	69.72
B	7	1.150	1.610	158	94	91	1.072	70.89
C	1	0.550	0.750	161	93	91	0.742	49.14
C	2	0.910	1.250	159	93	91	0.954	63.11
C	3	1.000	1.370	168	94	90	1.000	66.63
C	4	1.000	1.370	165	93	90	1.000	66.47
C	5	1.100	1.420	160	93	90	1.049	69.44
C	6	1.150	1.490	168	92	90	1.072	71.46
C	7	1.200	1.550	170	92	90	1.095	73.11
D	1	0.500	0.640	165	91	89	0.707	47.00
D	2	0.720	0.930	162	92	89	0.849	56.27
D	3	0.770	0.990	152	93	89	0.877	57.72
D	4	0.870	1.120	166	93	89	0.933	62.05
D	5	0.910	1.170	152	92	89	0.954	62.75
D	6	0.980	1.260	167	93	90	0.990	65.91
D	7	1.100	1.420	169	92	90	1.049	69.94
AVERAGE		0.933	1.199	159	94	90	0.959	63.43

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE
RUN NUMBER: 3 TIME: 8/16/93 1630-1742

TEST DATA

GAS METER COEFFICIENT	1.0110 Y	VOLUME OF LIQUID COLLECTED, ML	457.0 Vl
PITOT TUBE COEFFICIENT	0.841 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.241 Dn	CARBON DIOXIDE	6.50 CD
AREA, SF	0.000317 An	OXYGEN	12.70 OX
		CARBON MONOXIDE	0.00 CM
STACK DIMENSIONS;		NITROGEN (BY DIFFERENCE)	80.80 NI
DIAMETER/LENGTH, IN	47.00 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	41.00 Sw	STACK TEMP., DEG F	159 Ts
AREA, SF	13.382 As	METER TEMP., DEG F	92 Tm
		ORIFICE PRESSURE, IN WC	1.199 Po
BAROMETRIC PRESSURE, IN HG	28.46 Pb	SQRT VELOCITY P., IN WC	0.959 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	-0.63 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.41 Ps	FRONT CATCH (75.3%)	0.1555 Wf
		BACK CATCH (24.7%)	0.0510 Wb
SAMPLING TIME, MIN	70.00 Ti	TOTAL CATCH	0.2065 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	47.234 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	43.583 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.55 Md
		WET BASIS, LB/LB-MOLE	25.73 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	21.511 Vw	AVERAGE GAS VELOCITY, FPS	63.43 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.3305 Bws	ACTUAL, ACFM	50932 Qa
PERCENT BY VOLUME	33.05 Bwp	STANDARD, SCFM	41279 Qs
		DRY STANDARD, DSCFM	27638 Qsd
		ISOKINETIC VARIATION, %	95.22 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0299 Caf	0.0098 Cab	0.0396 Cat
STANDARD, GR/SCF	0.0368 Cwf	0.0121 Cwb	0.0489 Cwt
DRY STANDARD, GR/DSCF	0.0550 Csf	0.0180 Csb	0.0731 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	13.04 Rcf	4.28 Rcb	17.32 Rct
RATIO OF AREAS METHOD	12.41 Rrf	4.07 Rrb	16.48 Rrt

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG * NON-APPLICABLE DATA

TABLE SUMMARY OF PARTICULATE EMISSION TEST RESULTS

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE

TEST PARAMETER	RUN 1	RUN 2	RUN 3
TEST DATE	8/16/93	8/16/93	8/16/93
TIME OF TEST, HR;			
START	1247	1456	1630
FINISH	1359	1608	1742
EFFLUENT TEMPERATURE, DEGREES F	168	171	159
BAROMETRIC PRESSURE, IN HG	28.48	28.44	28.46
EFFLUENT MOISTURE CONTENT, % V/V	38.3	39.9	33.0
EFFLUENT COMPOSITION, % V/V DRY;			
CARBON DIOXIDE	6.0	5.8	6.5
OXYGEN	13.0	13.2	12.7
CARBON MONOXIDE	0.0	0.0	0.0
EFFLUENT VOLUMETRIC FLOW RATE;			
ACTUAL CONDITIONS, ACFM	49572	50578	50932
STANDARD CONDITIONS, SCFM	39625	40195	41279
DRY STANDARD CONDITIONS, DSCFM	24451	24146	27638
ISOKINETIC VARIATION, %	104.8	101.0	95.2
EFFLUENT PARTICULATE CONCENTRATION;			
EFFLUENT FRONT HALF PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.0288	0.0254	0.0299
STANDARD CONDITIONS, GR/SCF	0.0360	0.0319	0.0368
DRY STANDARD CONDITIONS, GR/DSCF	0.0584	0.0531	0.0550
EFFLUENT BACK HALF PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.0087	0.0108	0.0098
STANDARD CONDITIONS, GR/SCF	0.0109	0.0136	0.0121
DRY STANDARD CONDITIONS, GR/DSCF	0.0177	0.0227	0.0180
EFFLUENT TOTAL PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.0376	0.0362	0.0396
STANDARD CONDITIONS, GR/SCF	0.0470	0.0456	0.0489
DRY STANDARD CONDITIONS, GR/DSCF	0.0761	0.0759	0.0731
SOURCE PARTICULATE EMISSION RATE;			
CLASSICAL METHOD, LB/HR	15.97	15.71	17.32
RATIO OF AREAS METHOD, LB/HR	16.72	15.86	16.48

PARTICULATE CONCENTRATION AND EMISSION RATES BASED ON ANALYSIS OF THE SAMPLING TRAIN FRONT AND BACK CATCHES.

STANDARD CONDITIONS: 68 DEGREES FAHRENHEIT, 29.92 INCHES OF MERCURY.

TABLE ANALYSIS OF VISIBLE EMISSION TEST DATA

PROJECT NUMBER: 9425
DATE TESTED: 8-16-93
TIME OF TEST: 1454

COMPANY: LC KRUSE-TALCOT LAKE
SOURCE: AGGREGATE DRUM DRYER
OBSERVER: MR. ALAN TROWBRIDGE
RE-CERTIFICATION DATE: 10-1-93

Test-Run 1-2

PLUME OPACITY OBSERVATIONS

MIN-UTE	**	SECONDS 00	15	30	45	**	MIN-UTE	**	SECONDS 00	15	30	45	**	MIN-UTE	**	SECONDS 00	15	30	45	**
0		0	0	0	0		20		0	0	0	0		40		0	0	0	0	
1		0	0	0	0		21		0	0	0	0		41		0	0	0	0	
2		0	0	0	0		22		0	0	0	0		42		0	0	0	0	
3		0	0	0	0		23		0	0	0	0		43		0	0	0	0	
4		0	0	0	0		24		0	0	0	0		44		0	0	0	0	
5		0	0	0	0		25		0	0	0	0		45		0	0	0	0	
6		0	0	0	0		26		0	0	0	0		46		0	0	0	0	
7		0	0	0	0		27		0	0	0	0		47		0	0	0	0	
8		0	0	0	0		28		0	0	0	0		48		0	0	0	0	
9		0	0	0	0		29		0	0	0	0		49		0	0	0	0	
10		0	0	0	0		30		0	0	0	0		50		0	0	0	0	
11		0	0	0	0		31		0	0	0	0		51		0	0	0	0	
12		0	0	0	0		32		0	0	0	0		52		0	0	0	0	
13		0	0	0	0		33		0	0	0	0		53		0	0	0	0	
14		0	0	0	0		34		0	0	0	0		54		0	0	0	0	
15		0	0	0	0		35		0	0	0	0		55		0	0	0	0	
16		0	0	0	0		36		0	0	0	0		56		0	0	0	0	
17		0	0	0	0		37		0	0	0	0		57		0	0	0	0	
18		0	0	0	0		38		0	0	0	0		58		0	0	0	0	
19		0	0	0	0		39		0	0	0	0		59		0	0	0	0	

SUMMARY OF TEST DATA

PLUME OPACITY %	PERCENT OF TIME AT OPACITY	PERCENT OF TIME OPACITY EXCEEDED
0	100.00	0.00
5	0.00	0.00
10	0.00	0.00
15	0.00	0.00
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
40	0.00	0.00
45	0.00	0.00
50	0.00	0.00
55	0.00	0.00
60	0.00	0.00
65	0.00	0.00
70	0.00	0.00
75	0.00	0.00
80	0.00	0.00
85	0.00	0.00
90	0.00	0.00
95	0.00	0.00
100	0.00	0.00

OPACITY RANGE,%	TIME OPACITY IN RANGE % OF TIME	MIN/HR
0 - 20	100.00	60.00
25 - 40	0.00	0.00
45 - 60	0.00	0.00
> 60	0.00	0.00

MAXIMUM OBSERVED OPACITY, %: 0
MINIMUM OBSERVED OPACITY, %: 0
ARITHMETIC MEAN OPACITY, %: 0.0

SIX-MINUTE AVERAGE OPACITY, %

MAXIMUM:	0.0	(54:00-59:45)
2nd LARGEST:	0.0	(48:00-53:45)
3rd LARGEST:	0.0	(42:00-47:45)
4th LARGEST:	0.0	(36:00-41:45)
5th LARGEST:	0.0	(30:00-35:45)

VOLUMETRIC FLOW RATE CALCULATION

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE TALCOT LAKE, MN
TEST DATE: 8-16-93 SOURCE: AGGREGATE DRUM DRYER

Preliminary Flowrate Determination

DUCT DIMENSIONS;		
LENGTH, INCHES	47.00	LN
WIDTH, INCHES	41.00	WD
CROSS-SECTIONAL AREA, SQ FT	13.382	AR
EFFLUENT TEMPERATURE, DEG F	150	TS
MOISTURE CONTENT DETERMINATION:		
EFFLUENT WET BULB TEMPERATURE, DEG F	150	TW
EFFLUENT DEW POINT TEMPERATURE, DEG F	150	TD
EFFLUENT RELATIVE HUMIDITY, %	100.0	RH
EFFLUENT MOISTURE CONTENT, % V/V	26.6	MC
DUCT PRESSURES;		
BAROMETRIC PRESSURE, IN HG	28.48	PB
STATIC PRESSURE, IN WC	-0.92	PS
ABSOLUTE PRESSURE, IN WC	28.41	PA
EFFLUENT COMPOSITION;		
CARBON DIOXIDE CONTENT, % V/V DRY	6.0	CD
OXYGEN CONTENT, % V/V DRY	13.0	OX
EFFLUENT MOLECULAR WEIGHT;		
DRY BASIS, LB/LB-MOLE	29.48	MD
WET BASIS, LB/LB-MOLE	26.42	MS
PITOT TUBE COEFFICIENT	0.841	CP

EFFLUENT VELOCITY PRESSURES, IN WC;

POINT	PORT A	PORT B	PORT C	PORT D
1	0.430	0.620	0.300	0.370
2	° 0.640	0.650	0.530	0.480
3	0.850	0.840	0.830	0.760
4	1.050	1.100	1.100	1.000
5	1.200	1.100	1.200	1.050
6	1.250	1.200	1.200	1.100
7	0.880	0.900	1.200	1.300

AVE. SQUARE-ROOT VELOCITY PRESSURE, IN WC	0.93	PV
EFFLUENT AVERAGE VELOCITY, FT/SEC	60.438	VS
EFFLUENT VOLUMETRIC FLOW RATE;		
ACTUAL, ACFM	48527	FA
STANDARD, SCFM	39894	FW
DRY STANDARD, DSCFM	29266	FD

EQUATIONS USED TO CALCULATE THE VOLUMETRIC FLOW RATE

AR = LN * WD / 144.0

PA = PB + PS/13.6

MD = 0.44*CD + 0.32*OX + 0.28*(100-CD-OX)

MS = MD*(1-MC/100) + 0.18*MC

VS = 85.48 * CP * PV * SQRT((460+TS)/(MS*PA))

FA = 60 * VS * AR

FW = 17.65 * FA * PA / (TS+460)

FD = FW * (1-MC/100)

STANDARD CONDITIONS: 68 DEG F, 29.92 IN HG

APPENDIX B: FIELD DATA FORMS

EPA METHOD 2: VOLUMETRIC FLOW RATE DETERMINATION

Field Data Sheet

MMT Job Number: 9425 | Ambient Temperature, °F: 78

Date: Monday 8.16.93 | Barometric Pressure, in. Hg.: 28.48

Company: L.D. Kinne Talcot Lake | Static Pressure, in. WC: -0.92

Source: Aggregate Drum Dryer | Dry Bulb Temp., °F: 150

Dimensions, inches: 47 Depth - 41" Width | Wet Bulb Temp., °F: 150

Test Team Members: AT-BA-TG | Relative Humidity, %:

Test No.: 0 | Run No.: Preliminary | Moisture Content, %: 26.5 *

VELOCITY TRAVERSE: Time: 1120 | Pitot Tube No: 67 | Coefficient: A = .841

Traverse Point Number	Inches From Wall	Inches From Port	PORT A ΔP in. H2O	PORT A Temp. °F	PORT B ΔP in. H2O	PORT B Temp. °F	PORT C ΔP in. H2O	PORT C Temp. °F	PORT D ΔP in. H2O	PORT D Temp. °F
1	3.4		.43	.62	.30	.37	7	5	1	2
2	10.1		.64	.65	.53	.48	4	1	3	3
3	16.8		.85	.84	.83	.76	0	2	4	5
4	23.5		1.05	1.1	1.1	1.0	2	4	0	4
5	30.2		1.2	1.1	1.2	1.05	3	3	2	2
6	36.9		1.25	1.2	1.2	1.10	2	3	4	1
7	43.6		.88	.90	1.2	1.3	3	2	2	3
									$\bar{\alpha}$ =	2.75°
			Port A	B	C	D				
		* if	stack Temp	Rises	to	185	% H_2O = 60			
						180			= 54	
						175			= 48	
$\bar{x}$ Vp =	.90					170			= 43	
Max =	.3					165			= 38	
Min =	1.3					160			= 34	
						155			= 30	
Ident Nozzle = .235" Dia,										
Actual Nozzle ID = 1/4					Previous test $\bar{x}$		% H_2O = 38 %			
		Diameter = .241				$\bar{x}$ Temp = 184° F				

FORM: S-FD-2b

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1 | RUN: 1
Page 1 of 2

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9425	Control Unit No.: 4	ΔH@ 1.6
Date: Monday 8-16-93	Gas Meter Coefficient: 1.01	TM 80
Company: L.L. Kruse Talbot Lake	Sample Box No.: 4	MC 27-37
Source: Aggregate Drum Dryer	Probe No.: 70 Length: 70"	Ps/Pm ≈ 1.0
Source Dimensions: 47" x 41" Width	Pitot No.: 67 Coefficient: A=.841	C = 1.01
Test Team: AT-BA-TG	Nozzle No.: C13 Diameter: .241" ODn.	TS 150
Test Procedure: EPA 1-5	Filter No.: 6733 6734	R
Ambient Temp., °F: 75	Barometric Pressure, in.Hg: 28.48	Static Pressure, in.WC: -.77

753.077

CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAST IMP.
1247	1	0	750.094	.34	.57	.57	5	151	78	78	228	230	77
1249.5	2	2.5	754.2	.55	.92	.92	9	160	81	79	253	246	67
1252	3	5.0	755.7	.73	1.22	1.22	11	163	83	79	247	251	64
	4		757.4	.87	1.45	1.45	13	165	85	79	246	247	65
1257	5	10	759.2	1.05	1.75	1.75	15	167	86	79	252	250	65
	6		761.3	1.15	1.45	1.45	13	167	87	79	249	251	65
1302	7	15	763.2	1.25	1.58	1.58	14	168	87	80	252	250	63
1304.5	End	17.5	765.1										
1305	1	17.5		.47	.59	.59	7	169	88	80	249	250	61
	2	20	766.3	.61	.77	.77	8	166	88	80	250	252	61
1310	3		767.6	.94	1.19	1.19	12	167	89	81	247	255	60
	4	25	769.3	1.15	1.45	1.45	14	167	90	81	248	248	59
1315	5		771.1	1.15	1.45	1.45	14	167	90	81	253	252	58
	6	30	773.0	1.1	1.39	1.39	14	170	90	81	249	254	58
1320	7		774.8	1.2	1.52	1.52	17	170	90	82	249	243	57
1322.5	End	35	776.7										
1323	1	35		.40	.51	.51	6	170	88	82	250	250	57
	2		777.8	.65	.82	.82	10	170	88	82	251	249	58
1328	3	40	779.2	.84	1.06	1.06	13	170	89	82	249	247	58
	4		780.8	1.1	1.39	1.39	15	169	90	83	251	246	58
1333	5	45	782.6	1.05	1.33	1.33	15	170	90	83	262	251	58
1335.5	6		784.4	1.1	1.39	1.39	17	169	90	83	248	249	58
1338	7	50	786.2	1.15	1.45	1.45	17	168	90	83	248	254	58
1340.5	End	52.5	788.0										
			Continued on page #2										

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					Not Applied
Initial	100	100	0	788.3	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1242	.008	28"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS — Bill Acquired for Analysis								
Sample Id: 1-1	Replicate 1		Replicate 2		Replicate 3		Average	
	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide		See Orsat Form					CO2	6.0
Oxygen							O2	13.0
Carbon Monoxide							CO	Fo = 1.32

Total Sampling Time, min.: 70
Volume of Gas Sampled, DCF: 45.352

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1 | RUN: 1
Page 2 of 2

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9425	Control Unit No.: 4	ΔH@ 1.6
Date: 8.16.93	Gas Meter Coefficient: 1.01	TM 83
Company: L.C. Kiruu Talcot Lake	Sample Box No.: 4	MC 37
Source: Aggregate Drum Dryer	Probe No.: 70 Length: 70 inches	PS/PM 1.0
Source Dimensions: 47 + 41 inches	Pitot No.: 67 Coefficient: A=.841	C 1.01
Test Team: AT - BA - TG	Nozzle No.: L17 Diameter: .241	TS 169
Test Procedure: EPA 1-5	Filter No.: 87 34	R
Ambient Temp., °F: 83	Barometric Pressure, in.Hg: 28.48	Static Pressure, in.WC: -.77

788.0

CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAST IMP.
1341	1	52.5	X	.30	.38	.38	5	171	88	83	252	250	58
	2	55	789.0	.59	.75	.75	8	169	87	83	262	247	59
1346	3		790.3	.74	.93	.93	11	170	89	83	258	251	60
1348.5	4	60	791.8	.78	.99	.99	11	169	91	83	250	250	61
1351	5		793.3	.89	1.12	1.12	13	166	91	83	247	244	62
	6	65	794.9	1.0	1.26	1.26	13	169	92	83	248	249	63
1356	7		796.7	1.05	1.33	1.33	13	173	92	83	248	251	64
1358.5	End	70	798.429										

Time = 70 minutes
DCF = 45.352

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	788.3	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1403	.010	27"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	Replicate 1		Replicate 2		Replicate 3		Average	
1-1	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide		See	Orsat		Form		CO2	6.0
Oxygen							O2	13.0
Carbon Monoxide							CO	= 1.32

Total Sampling Time, min.: 70
Volume of Gas Sampled, DCF: 45.352

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1 | RUN: 2
Page 1 of 2

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9425	Control Unit No.: 4	ΔH@ 1.6
Date: Monday 8.16.93	Gas Meter Coefficient: 1.01	TM 85
Company: L.L. Kruse Talbot Lake	Sample Box No.: 4	MC 38-44
Source: Aggregate Drum Dryer	Probe No.: 70 Length: 70"	PS/PM ≈ 1.0
Source Dimensions: 47" x 41" Width	Pitot No.: 67 Coefficient: A=.841	C = 1.01
Test Team: AT-BA-TG	Nozzle No.: C13 Diameter: .241	TS 170
Test Procedure: EPA 1-5	Filter No.: 8735	R
Ambient Temp., °F: 81	Barometric Pressure, in.Hg: 28.44	Static Pressure, in.WC: -.56

CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAST IMP.
1456	1	0	799.786	.38	.48	.48	4	171	85	85	228	236	78
	2	2.5	800.8	.59	.74	.74	7	170	86	85	241	246	59
1501	3	5.0	802.2	.72	.90	.90	8	170	87	85	251	244	58
	4		803.6	.78	.98	.98	8	170	88	85	252	252	58
1506	5	10	805.2	.81	1.02	1.02	8.5	169	89	85	246	254	58
	6		806.7	.99	1.24	1.24	10	170	90	85	252	248	55
1511	7	15	808.4	1.1	1.38	1.38	11	170	91	85	248	247	55
1513.5	End	17.5	810.2										
1514	1	17.5	X	.32	.40	.40	5	170	91	86	245	247	56
	2	20	811.2	1.0	1.25	1.25	11	169	92	86	245	248	56
1519	3		812.9	1.1	1.38	1.38	11	170	94	86	246	247	56
	4	25	814.8	1.15	1.44	1.44	12	172	95	87	249	255	57
1524	5		816.6	1.1	1.38	1.38	11	171	95	87	251	253	57
	6	30	818.4	1.1	1.38	1.38	12	172	96	88	250	254	57
1529	7		820.2	1.15	1.31	1.31	13	171	97	89	259	251	60
1531.5	End	35	821.9										
1532	1	35	X	.38	.43	.43	6	170	95	89	241	252	64
	2		823.0	.62	.70	.70	7	170	95	89	241	251	62
1537	3	40	824.3	.85	.97	.97	9	169	97	89	255	250	62
	4		825.8	.99	1.12	1.12	12	169	97	89	251	253	61
1542	5	45	827.5	1.05	1.19	1.19	12	170	98	90	241	251	60
	6		829.2	1.15	1.31	1.31	12.5	171	99	90	253	249	59
1547	7	50	830.9	1.2	1.36	1.36	13	173	99	90	256	252	60
1549.5	End	52.5	832.7										
			Continued on page #2										

MOISTURE DETERMINATION

IMPINGER	1	2	3	4	5
Final					Not
Initial	100	100	0	755.8	Applied
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS

Time	Rate (cfm)	Vac. (in.Hg)
1447	.004	24"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS

Sample Id:	Replicate 1		Replicate 2		Replicate 3		Average	
1-2	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide		See Orsat Form					CO_2	5.8
Oxygen							O_2	13.2
Carbon Monoxide							CO	F_o = 1.33

Total Sampling Time, min.: 70
Volume of Gas Sampled, DCF: 43.769

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1 | RUN: 2
Page 2 of 2

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9425	Control Unit No.: 4	ΔH@ 1.6
Date: 8.16.93	Gas Meter Coefficient: 1.01	TM 88
Company: L.C. Kruse Talcot Lake	Sample Box No.: 4	MC 37
Source: Aggregate Drum Dryer	Probe No.: 70 Length: 70 inches	PS/PM 1.0
Source Dimensions: 47 + 41 inches	Pitot No.: 67 Coefficient: A-.841	C 1.01
Test Team: AT - BA - TG	Nozzle No.: 43 Diameter: .241	TS 170
Test Procedure: EPA 1-5	Filter No.: 8735	R
Ambient Temp., °F: 82	Barometric Pressure, in.Hg: 28.44	Static Pressure, in.WC: -.56

832.7

CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAST IMP.
1550	1	52.5	X	.59	.67	.67	7	170	97	91	256	254	61
	2	55	834.0	.60	.68	.68	7	170	98	91	250	255	60
1555	3		835.3	.67	.76	.76	8	170	98	91	247	248	62
	4	60	836.6	.88	1.0	1.0	11	169	99	91	258	250	63
1600	5		838.2	1.1	1.25	1.25	12.5	169	100	91	250	249	64
	6	65	839.9	1.15	1.31	1.31	13	175	101	92	258	253	64
1605	7		841.7	1.25	1.42	1.42	14	177	100	92	256	249	67
1607.5	End	70	843.555										

Time = 70 minutes
DCF = 43.769

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	755.8	X
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1609	.009	25"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	Replicate 1		Replicate 2		Replicate 3		Average	
1-7	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide		See Orsat form					CO2	5.8
Oxygen							O2	13.0
Carbon Monoxide							CO	E = 1.33

Total Sampling Time, min.: 70
Volume of Gas Sampled, DCF: 43.769

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1 | RUN: 3
Page 1 of 2

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9425	Control Unit No.: 4	ΔH@ 1.6
Date: Monday 8.16.93	Gas Meter Coefficient: 1.01	TM 95
Company: L. L. Knox Talbot Lake	Sample Box No.: 4	MC 41-35
Source: Aggregate Drum Dryer	Probe No.: 70 Length: 70"	PS/PM = 1.0
Source Dimensions: 47" x 41" Width	Pitot No.: 67 Coefficient: A=.841	C = 1.01
Test Team: AT-BA-TG	Nozzle No.: C13 Diameter: .241	TS 170
Test Procedure: EPA 1-5	Filter No.: 8736	R
Ambient Temp., °F: 84	Barometric Pressure, in.Hg: 28.46	Static Pressure, in.WC: -.63

0.88

CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAST IMP.
1630	1	0	843.954	.57	.65	.65	6	168	91	92	228	229	78
	2	2.5	845.2	.77	.88	.88	12	165	92	91	251	246	62
1635	3	5.0	846.7	.83	.95	.95	12	152	93	91	244	252	59
	4		848.2	.92	1.05	1.05	13	158	94	91	243	249	55
1640	5	10	849.8	1.02	1.16	1.16	14	152	96	91	260	251	55
	6		851.4	1.15	1.31	1.31	17	147	96	91	250	251	55
1645	7	15	853.2	1.2	1.37	1.37		148	96	91	253	249	55
1647.5	End	17.5	855.0										
1648	1	17.5		.57	.65	.65	7	149	95	91	250	248	56
	2	20	856.3	.97	1.35	1.35	15	143	95	91	251	246	57
1653	3		858.1	.85	1.19	1.19	15	147	96	91	247	240	58
	4	25	859.8	1.15	1.61	1.61	17	148	96	91	245	250	59
1658	5		861.8	1.1	1.54	1.54	16	157	95	91	247	250	59
	6	30	863.7	1.1	1.54	1.54	16	165	95	91	258	247	59
1703	7		865.6	1.15	1.61	1.61	17	158	94	91	252	257	58
1705.5	End	35	867.6										
1706	1	35		.55	.75	.75	10	161	93	91	244	247	59
	2		868.9	.91	1.25	1.25	16	159	93	91	246	249	59
1711	3	40	870.7	1.0	1.37	1.37	17	168	94	90	251	252	58
	4		872.5	1.0	1.37	1.37	17	165	93	90	248	260	59
1716	5	45	874.3	1.1	1.42	1.42	18	160	93	90	247	250	59
	6		876.1	1.15	1.48	1.48	17.5	168	92	90	248	253	59
1721	7	50	878.0	1.2	1.55	1.55	18.0	170	92	90	245	247	59
1723.5	End	52.5	880.0										
			Continued on page #2										

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					Not Applied
Initial	100	100	0	820.7	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1627	.011	23"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	Replicate 1		Replicate 2		Replicate 3		Average	
1-3	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide		See Orsat Form					CO_2	6.5
Oxygen							O_2	12.7
Carbon Monoxide							~~CO~~ No 1.26	

Total Sampling Time, min.: 75
Volume of Gas Sampled, DCF: 47.234

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1 | RUN: 3
Page 2 of 2

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9425	Control Unit No.: 4	ΔH@ 1.6
Date: 8.16.93	Gas Meter Coefficient: 1.01	TM 95
Company: L.C. Knox Talcot Lake	Sample Box No.: 4	MC 41
Source: Aggregate Drum Dryer	Probe No.: 70 Length: 70 inches	PS/PM 1.0
Source Dimensions: 47 + 41 inches	Pitot No.: 67 Coefficient: A=.841	C 1.01
Test Team: AT - BA - TG	Nozzle No.: C/3 Diameter: .241	TS 170
Test Procedure: EPA 1-5	Filter No.: 6736	R
Ambient Temp., °F: 84	Barometric Pressure, in.Hg: 28.46	Static Pressure, in.WC: -.63

880.0

CLOCK TIME hours	TRAVERSE POINT NUMBER	SAMPLE TIME min.	SAMPLE VOLUME cu.ft.	VELOCITY HEAD in.WC	ORIFICE ΔH, in.WC REQ.	ORIFICE ΔH, in.WC ACT.	PUMP VAC. inHG	TEMPERATURE, DEG F STACK GAS	GAS METER IN	GAS METER OUT	OVEN	PROBE	LAST IMP.
1724	1	52.5	X	.150	.64	.64	9	165	91	89	247	254	60
	2	55	881.2	.172	.93	.93	11	162	92	89	248	248	59
1729	3		882.7	.177	.99	.99	14	152	93	89	245	252	60
	4	60	884.3	.187	1.12	1.12	16	166	93	89	251	251	62
1734	5		885.9	.91	1.17	1.17	16	152	92	89	246	250	63
	6	65	887.6	.98	1.26	1.26	18	167	93	90	250	244	63
1739	7		889.3	1.1	1.42	1.42	18	169	92	90	247	251	64
1741.5	End	70	891.188										

Time = 70 minutes
DCF = 47.234

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	820.7	X
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1745	.004	24"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	Replicate 1		Replicate 2		Replicate 3		Average	
(-7)	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide		See Orsat Form					CO_2	Gas
Oxygen							O_2	12.7
Carbon Monoxide								EF 1.26

Total Sampling Time, min.: 70
Volume of Gas Sampled, DCF: 47.234

FORM: S-FD-5

ORSAT ANALYSIS

Job Number: 9425 Company: L.G. Kruse - Tulsat Lake

SAMPLE DESCRIPTION		SAMPLE ANALYSIS						
stack outlet		Replicate 1		Replicate 2		Replicate 3		
	Parameter Measured	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	
Sample Id: 1-1								Average
Collected By: BA	Initial Reading	0.0	/	0.0	/	0.0	/	
Date Collected: 8.16.93	Carbon Dioxide	6.0	6.0	6.0	6.0	6.1	6.1	6.0
Analyzed By: TG	Oxygen	19.0	13.0	19.0	13.0	19.1	13.0	13.0
Date Analyzed: 8.16.93	Carbon Monoxide	Not Analyzed						F_o = 1.32
Sample Id: 1-2								
Collected By: BA	Initial Reading	0.0	/	0.0	/	0.0	/	
Date Collected: 8.16.93	Carbon Dioxide	5.8	5.8	5.88	5.9	5.8	5.8	5.8
Analyzed By: TG	Oxygen	19.0	13.2	19.1	13.2	19.0	13.2	13.2
Date Analyzed: 8.16.93	Carbon Monoxide							F_o = 1.33
Sample Id: 1-3								
Collected By: BA	Initial Reading	0.0	/	0.0	/	0.0	/	
Dated Collected: 8.16.93	Carbon Dioxide	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Analyzed By: TG	Oxygen	19.2	12.7	19.2	12.7	19.2	12.7	12.7
Date Analyzed: 8.16.93	Carbon Monoxide							F_o = 1.26

Residual Fuel oil, F_o range 1.21 - 1.36

Project # 9425 Test-Run # 1-2

Visible Emission Observation Form

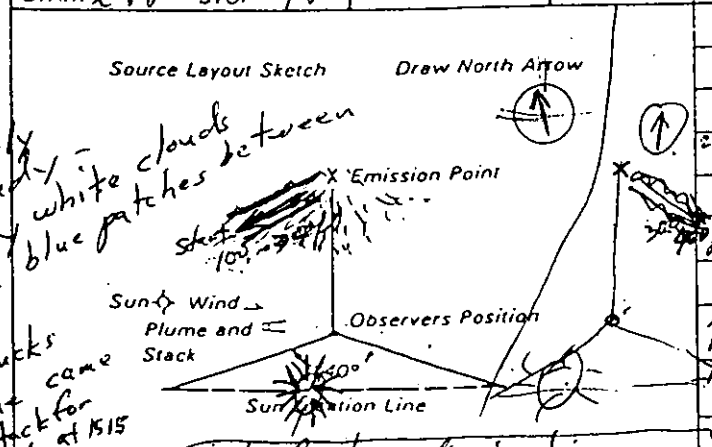
SOURCE NAME: L.G. Kruse Tuket Lake
ADDRESS:
CITY: STATE: MN ZIP:
PHONE: SOURCE ID NUMBER:
PROCESS EQUIPMENT: Hot Mix asphalt Plant OPERATING MODE: normal
CONTROL EQUIPMENT: Venturi Scrubber OPERATING MODE: normal
DESCRIBE EMISSION POINT: START Rectangular Steel stack STOP same
HEIGHT ABOVE GROUND LEVEL: START ≈30' STOP ≈30' HEIGHT RELATIVE TO OBSERVER: START ≈24' STOP ≈24'
DISTANCE FROM OBSERVER: START ≈300' STOP ≈300' DIRECTION FROM OBSERVER: START N-NW STOP N-NW
DESCRIBE EMISSIONS: START white steam plume, nothing visible after dissipation STOP same
EMISSION COLOR: START white steam STOP same PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☐ YES ☒ IF WATER DROPLET PLUME: ATTACHED ☒ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START after steam dissipation STOP same
DESCRIBE BACKGROUND: START SKY STOP SKY
BACKGROUND COLOR: START blue/white STOP same SKY CONDITIONS: START PC STOP PC
WIND SPEED: START 3-10 mph STOP same WIND DIRECTION: START NE STOP NW
AMBIENT TEMP.: START ≈78 STOP ≈78 WET BULB TEMP.: — RH, percent: —

OBSERVATION DATE: Monday 8.16.93 START TIME: 1454 STOP TIME: 1554

MIN \ SEC	0	15	30	45
54 1	0	0	0	0
55 2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0

SEC \ MIN	0	15	30	45
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0
60	0	0	0	0

Source Layout Sketch — Draw North Arrow



Partly cloudy - white clouds billowy with blue patches between

large chucks of scale for about 1 min at 1515

point of steam dissipation

AVERAGE OPACITY FOR HIGHEST PERIOD: 0 NUMBER OF READINGS ABOVE 0 % WERE 0
RANGE OF OPACITY READINGS MINIMUM: 0 MAXIMUM: 0
OBSERVER'S NAME (PRINT): Alan L. Trowbridge
OBSERVER'S SIGNATURE: Alan L Trowbridge DATE: 8/16/93
ORGANIZATION: MMT Environmental Services, Inc.
CERTIFIED BY: ETA DATE: 4/1/93
VERIFIED BY: DATE:

COMMENTS: ranged from 100' to 300' downwind and from 60' to 150' above grade / 54m up high

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE
TITLE DATE

APPENDIX C: LABORATORY REPORTS

SUMMARY OF PARTICULATE EMISSION TEST LABORATORY DATA

PROJECT NUMBER: 9425 COMPANY: L.C. KRUSE
TEST NUMBER: 1 SOURCE: TALCOT LAKE

	MASS OF PARTICULATE MATTER COLLECTED, GRAMS							
	FRONT CATCH				BACK CATCH			TOTAL PARTICULATE MASS COLLECTED
RUN NUMBER	FRONT WASH	CYCLONE CATCH	FILTER CATCH	FRONT TOTAL	IMPINGER CATCH **	IMPINGER WASH	BACK TOTAL	
1	0.0331	0.0000	0.1276	0.1607	0.0208	0.0280	0.0488	0.2095
2	0.0143	0.0000	0.1249	0.1392	0.0181	0.0414	0.0595	0.1987
3	0.0250	0.0000	0.1305	0.1555	0.0199	0.0311	0.0510	0.2065

* NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

LABORATORY REPORT: EPA Method 5

Project Number: 9425 Company: L.C. Kruse Talcot Lake, MN Test date Monday 8.16.93

Frontwashes 400 ml Acetone

Test-Run	1-1	1-2	1-3	Date
Dish #	505	508	511	- - - - -
1	2.3517	2.3766	2.2443	8.23.93
2	2.3515	2.3763	2.2443	8.24.93
3	2.3516	2.3763	2.2444	8.24.93
Tare	2.3181	2.3617	2.2190	11.12.92
Blank	.0003	.0003	.0003	- - - - -
Net	.0331	.0143	.0250	- - - - -

Solvent Blanks

Solvents	Acetone 400 ml	Chloroform 150 ml	Ether 150 ml
Dish #	502	503	504
1	2.3348	2.2043	2.2447
2	2.3344	2.2042	2.2448
3	2.3346	2.2044	2.2449
Tare	2.3341	2.2040	2.2445
Net	.0003	.0002	.0002

Backwashes 400 ml Acetone

Test-Run	1-1	1-2	1-3	Date
Dish #	506	509	512	- - - - -
1	2.4289	2.3046	2.3287	8.23.93
2	2.4290	2.3045	2.3285	8.24.93
3	2.4290	2.3044	2.3286	8.24.93
Tare	2.4006	2.2627	2.2971	11.12.92
Blank	.0003	.0003	.0003	- - - - -
Net	.0280	.0414	.0311	- - - - -

Glass Filters

Test-Run	1-1	1-2	1-3	Date
Filter #	8734	8735	8736	-
1	.6427	.6349	.6407	8.23.93
2	.6425	.6354	.6409	8.24.93
3	.6428	.6353	.6410	8.24.93
Tare	.5149	.5100	.5102	2.15.93
Net	.1276	.1249	.1305	- - - - -

Extractions 150 ml of each Extraction Solvent was required

Test-Run	1-1	1-2	1-3	Date
Dish #	507	510	513	- - - - -
1	2.3855	2.4213	2.3205	8.23.93
2	2.3856	2.4217	2.3202	8.24.93
3	2.3857	2.4216	2.3206	8.24.93
Tare	2.3643	2.4028	2.2999	11.12.92
Blank	.0004	.0004	.0004	- - - - -
Net	.0208	.0181	.0199	- - - - -

Impinger Liquid

Test-Run	1-1	1-2	1-3
Dish #			
1	Not Applicable		
2			
3			
Tare			
Blank			
Net			

Signature Ted Gibbons Date 8.26.93

Laboratory Report: Moisture Content of Aggregate Samples

Project Number 9425 Company L.C. Kruse Talcot Lake, MN 8.1693 Test date

Test 1-1

Trial #	1	2	3	Date
Dish #	529	530	531	
Tare	2.2077	2.2507	2.4787	11.12.92
Tare + Wet	45.7910	45.4095	45.4473	8.2693
Wet	43.5833	43.1588	42.9686	
Dry	41.0945	40.7525	40.5877	
Dry + Tare	43.3022	42.7032	43.0664	8.27.93
% Moisture	5.71	6.27	5.54	

Test 1-2

Trial #	1	2	3	Date
Dish #	532	533	534	
Tare	2.3540	2.2849	2.2355	11.12.92
Tare + Wet	45.7410	46.0208	45.8590	8.2693
Wet	43.3870	43.7359	43.6235	
Dry	40.9536	41.2101	41.0855	
Dry + Tare	43.3076	43.4950	43.3210	8.2793
% Moisture	5.61	5.78	5.82	

Test 1-3

Trial #	1	2	3	Date
Dish #	535	536	537	
Tare	2.3173	2.2405	2.1991	11.12.92
Tare + Wet	45.7079	45.5486	45.5915	8.2693
Wet	43.3906	43.3081	43.3924	
Dry	41.0156	40.8908	41.2257	
Dry + Tare	43.3329	43.1333	43.4248	8.27.93
% Moisture	5.47	5.58	4.99	

Summary

	Mean	Deviation	% Error	
Test 1-1	5.84	.38	6.54	
1-2	5.74	.11	1.94	
1-3	5.35	.31	5.86	

Comments

$\frac{\text{Dry}}{\text{Wet}} * 100 =$ % Solids

100- % Solids = % Moisture

Signature Ted Gibbon Date 8.27.93

PROJECT # 9425 COMPANY L.C. Kruse Talcot Lake

TEST DATE(s) 8-16-93 Monday SOURCE ~~Aggregate Dam Pipe~~

EPA METHOD 4 LABORATORY REPORT

Filter #	TEST-RUN #	IMPINGER #	INITIAL	FINAL	GAIN	DESCRIPTION
~~8733~~ 8734	1-1	1	100	299	199	
		2	100	282	182	
		3	0	150	150	cloudy
		4	788.3	816.7	28.4	
		5				
		TOTAL MOISTURE GAIN, ML =			559.4	
8735	1-2	1	100	305	205	
		2	100	311	211	
		3	0	133	133	cloudy
		4	755.8	777.1	21.3	
		5				
		TOTAL MOISTURE GAIN, ML =			570.3	
8736	1-3	1	100	~~330~~	~~230~~	
		2	100	~~[illegible]~~	~~[illegible]~~	
		3	0	~~[illegible]~~	~~[illegible]~~	cloudy
		4	820.7	~~[illegible]~~	~~19.6~~	
		5				
		TOTAL MOISTURE GAIN, ML =			~~249.6~~ 457.0	

Actual total

APPENDIX D: CALIBRATION DATA

CALIBRATION
DRY TEST METER/ORIFICE METER

Date: Sat. 8.14.93 Barometric Pressure, in. Hg. (Pb): 28.68

EQUIPMENT IDENTIFICATION			
Control Unit 4	Dry Test Meter	Wet Test Meter	Calibration Type
Mfg: Andersen	Mfg: rockwell	Mfg: GCA Corporation	General: x
Model: Universal	Model: S-175	Model: Precision	Post-test: x
SN: 591-544	SN: 83	SN: 11 AH 12	

EQUIPMENT CALIBRATION

Orifice Pressure Drop in. WC H	Pump Vac. in.Hg	Wet Test Meter Volume, CF Initial V_{wi}	Wet Test Meter Volume, CF Final V_{wf}	Wet Test Meter Temp. °F T_w	Dry Test Meter Volume, CF Initial V_{di}	Dry Test Meter Volume, CF Final V_{df}	Dry Test Meter Temperature, °F Inlet Initial T_{ii}	Dry Test Meter Temperature, °F Inlet Final T_{if}	Dry Test Meter Temperature, °F Outlet Initial T_{oi}	Dry Test Meter Temperature, °F Outlet Final T_{of}	Elapsed Time, min. Q
0.5	0	Zero	5.539	79	717.271	722.798	78	79	78	83	12
1.0	0	5.539	9.822	79	722.798	727.095	82	79	80	88	7
2.0	0	9.822	19.063	79	727.095	736.286	86	81	80	96	11
3.0	0	19.063	31.128	79	736.286	748.070	94	81	83	102	12

COMPUTER PRINTOUT

Pretest

H	Vw	Tw	Vd	Td	Q	C	Hα
0.5	5.539	79	5.527	79.5	12.0	1.0018	1.3968
1.0	4.283	79	4.297	82.3	7.0	1.0002	1.5818
2.0	9.241	79	9.191	85.8	11.0	1.0128	1.6674
3.0	12.065	79	11.784	90.0	12.0	1.0368	1.7327

AVERAGE CORRECTION FACTOR: C = 1.0129
AVERAGE ORIFICE CONSTANT: Hα = 1.5947

EQUATIONS:

$V_w = V_{wf} - V_{wi}$
$V_d = V_{df} - V_{di}$
$T_d = (T_{ii} + T_{if} + T_{oi} + T_{of}) / 4$
$C = V_w * P_b * (T_d+460) / (V_d * (P_b+H/13.6) * (T_w+460))$
$H\alpha = 0.0317 * H * ((T_w+460)*Q/V_w)^2 / (P_b * (T_d+460))$

Calibration Performed by:

(Print) Ted Gibbons

(Signature)

CALIBRATION
DRY TEST METER/ORIFICE METER

Date: Monday 8.23.93 Barometric Pressure, in. Hg. (Pb): 28.32

EQUIPMENT IDENTIFICATION			
Control Unit 4	Dry Test Meter	Wet Test Meter	Calibration Type
Mfg: Andersen	Mfg: rockwell	Mfg: GCA Corporation	General: x
Model: Universal	Model: S-175	Model: Precision	Post-test: x
SN: 591-544	SN: 83	SN: 11 AH 12	

EQUIPMENT CALIBRATION

Orifice Pressure Drop in. WC H	Pump Vac. in.Hg	Wet Test Meter Volume, CF Initial Vwi	Wet Test Meter Volume, CF Final Vwf	Wet Test Meter Temp. oF Tw	Dry Test Meter Volume, CF Initial Vdi	Dry Test Meter Volume, CF Final Vdf	Dry Test Meter Temperature, oF Inlet Initial Tii	Dry Test Meter Temperature, oF Inlet Final Tif	Dry Test Meter Temperature, oF Outlet Initial Toi	Dry Test Meter Temperature, oF Outlet Final Tof	Elapsed Time, min. Q
0.5	0	Zero	4.225	77	196.336	200.603	78	78	79	84	10
1.0	0	4.225	10.038	77	200.603	206.419	83	79	80	93	10
2.0	0	10.038	24.584	77	206.419	221.021	92	80	84	106	18
3.0	0	24.584	32.413	77	221.021	228.910	101	83	86	109	8

COMPUTER PRINTOUT

Post-Test:

H	Vw	Tw	Vd	Td	Q	C	Hø
0.5	4.225	77	4.267	79.8	10.0	0.9939	1.6745
1.0	5.813	77	5.816	83.8	10.0	1.0094	1.7561
2.0	14.546	77	14.602	90.5	18.0	1.0159	1.7951
3.0	7.829	77	7.889	94.8	8.0	1.0173	1.8220

AVERAGE CORRECTION FACTOR: C = 1.0091
AVERAGE ORIFICE CONSTANT: Hø = 1.7619

EQUATIONS:

$Vw = Vwf - Vwi$

$Vd = Vdf - Vdi$

$Td = (Tii + Tif + Toi + Tof) / 4$

$C = Vw * Pb * (Td+460) / (Vd * (Pb+H/13.6) * (Tw+460))$

$Hø = 0.0317 * H * ((Tw+460)*Q/Vw)^2 / (Pb * (Td+460))$

Average C = 1.011

Calibration Performed by:

(Print) Ted Gibbons

(Signature)

CALIBRATION

S-TYPE PITOT TUBE

Probe Sheath ID: .70"

Date: 4.5.93

S-Type Pitot Tube ID No.: 67"

Ambient Temperature, °F: 66

Standard Pitot Tube ID No.: 18"

Barometric Pressure, in. Hg.: 29.18

Standard Pitot Tube Coefficient: 0.995

PITOT TUBE EXAMINATION		
Alignment Check	Pitot Tube Dimensions	Pitot Assembly Intercomponent Spacings
✓ $\alpha 1 < 10°$	External tubing diameter (D_t): 3/8"	Pitot to _____ nozzle (X): _____
✓ $\alpha 2 < 10°$	Base to Side A opening plane (P_A): _____	Pitot to probe sheath (Y): _____
✓ $\beta 1 < 5°$	Base to Side B opening plane (P_B): _____	Pitot to thermocouple, along probe (W): _____
✓ $\beta 2 < 5°$		Pitot to thermocouple, perpendicular to probe (Z): _____
✓ Q < 1/8 in.		
✓ R < 1/32 in.		

DESIRED CALIBRATION POINT		SIDE A CALIBRATION		SIDE B CALIBRATION	
Velocity ft/sec	P_{std} in. WC	P_{std} in. WC	P_s in. WC	P_{std} in. WC	P_s in. WC
20	0.09	.125	.173	.125	.173
40	0.37	.36	.503	.37	.52
60	0.82	.85	1.2	.81	1.15
80	1.45	1.42	2.00	1.43	2.00
100	2.30				

COMPUTER PRINTOUT

SIDE A CALIBRATION

Pstd	Ps	Cp	Cp-Cp(A)
0.125	0.173	0.846	0.005
0.360	0.503	0.842	0.001
0.850	1.200	0.837	-0.003
1.420	2.000	0.838	-0.002

Cp(A) = 0.841

SIDE B CALIBRATION

Pstd	Ps	Cp	Cp-Cp(B)
0.125	0.173	0.846	0.005
0.370	0.520	0.839	-0.001
0.810	1.150	0.835	-0.005
1.430	2.000	0.841	0.001

Cp(B) = 0.840

side A (σ) = .004

side B (σ) = .004

Calibration Performed by:

(Print) Bill - Ted

(Signature) Bill - Ted

FORM: SSQA-2

CALIBRATION

NOZZLE DIAMETER

L = Long

Nozzle Number	Nominal Diameter, in.	Measured Diameter, in. D1	D2	D3	Nozzle* Diameter, in.
L-1		.169	.172	.174	0.172
L-2		.249	.244	.248	0.247
L-3		.362	.360	.361	0.361
L-4		.493	.488	.493	0.491
L-5		.125	.124	.123	0.124
L-6		.302	.300	.305	0.302
L-7		.181	.177	.181	0.180
L-8		.489	.492	.494	0.492
L-9		.743	.747	.745	0.745
L-10		.246	.241	.242	0.243
L-11		.251	.253	.248	0.251
L-12		.240	.241	.241	0.241
L-13		.243	.241	.239	0.241
L-14		.199	.199	.199	0.199
L-15		.369	.369	.374	0.371
L-81		.567	.562	.562	0.564

* Nozzle diameter = (D1 + D2 + D3)/3

Calibration Performed by:

(Print) Ted Gibbons

(Signature) Ted Gibbons

Date: 3.29.93

CALIBRATION
THERMOCOUPLE/TEMPERATURE METER

EQUIPMENT IDENTIFICATION	
THERMOCOUPLE	TEMPERATURE METER
MMT ID No.: 81 Flexible	MMT ID No.: —
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268-KF1
Length: 81"	SN: 747-4363
Length of connecting (extension) wire: 20 ft.	

Stack Temp thermocouple

EQUIPMENT CALIBRATION		
Reference temperature by mercury-in-glass thermometer, °F T_a	Temperature indicated by thermocouple and temperature meter, °F T_i	Deviation, °F $T_i - T_a$
69	69	0
126	127	1
269	271	2
376	375	-1

Calibration Performed by:

(Print) Bill and Ted

(Signature) Bill - Ted

Date: 4.6.93

CALIBRATION

THERMOCOUPLE/TEMPERATURE METER

EQUIPMENT IDENTIFICATION	
THERMOCOUPLE	TEMPERATURE METER
MMT ID No.: 18" Std flexible	MMT ID No.: - - - -
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel-Alumel	Model: 268-KF1
Length: 1.5 Feet	SN: 747-4363
Length of connecting (extension) wire: 20 Feet	

* Probe Thermocouple on 70" SS Probe

EQUIPMENT CALIBRATION		
Reference temperature by mercury-in-glass thermometer, °F T_a	Temperature indicated by thermocouple and temperature meter, °F T_i	Deviation, °F $T_i - T_a$
38	39	1
70	71	1
132	131	-1
212	210	-2
319	317	-2
407	408	1

Calibration Performed by:

(Print) Ted Gibbons

(Signature) Ted Gibbons

Date: 4.6.93

CALIBRATION

THERMOCOUPLE/TEMPERATURE METER

Last Impinger = Dial	EQUIPMENT IDENTIFICATION
THERMOCOUPLE	TEMPERATURE METER
MMT ID No.: Dial Thermometer	MMT ID No.: —
Mfg: Premium Instruments	Mfg: Newport Laboratories
Type: Dial	Model: 268-KF1
Length: 4 inches	SN: 747-4363
Length of connecting (extension) wire: 20 ft.	

EQUIPMENT CALIBRATION		
Reference temperature by mercury-in-glass thermometer, °F T_a	Temperature indicated by thermocouple and temperature meter, °F T_i	Deviation, °F $T_i - T_a$
40	42	2
67	66	-1
101	100	-1
127	129	2

Calibration Performed by:

(Print) Bill + Ted

(Signature) Bill + Ted

Date: 4.6.93

CALIBRATION

THERMOCOUPLE/TEMPERATURE METER

EQUIPMENT IDENTIFICATION	
THERMOCOUPLE	TEMPERATURE METER
MMT ID No.: Anderson #4 Moto Inlet	MMT ID No.: -
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268-KF1
Length: 5 inches	SN: 747 - 4363
Length of connecting (extension) wire: 20 ft.	

EQUIPMENT CALIBRATION		
Reference temperature by mercury-in-glass thermometer, °F T_a	Temperature indicated by thermocouple and temperature meter, °F T_i	Deviation, °F $T_i - T_a$
40	40	0
66	65	-1
101	102	1
129	130	1

Calibration Performed by:

(Print) Bill + Ted

(Signature) Bill - Ted

Date: 4.6.93

CALIBRATION

THERMOCOUPLE/TEMPERATURE METER

EQUIPMENT IDENTIFICATION	
THERMOCOUPLE	TEMPERATURE METER
MMT ID No.: Anderson #4 Mate outlet	MMT ID No.: –
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268-KF1
Length: 4 inches	SN: 747-4363
Length of connecting (extension) wire: 20 ft.	

EQUIPMENT CALIBRATION		
Reference temperature by mercury-in-glass thermometer, °F T_a	Temperature indicated by thermocouple and temperature meter, °F T_i	Deviation, °F $T_i - T_a$
40	39	-1
66	68	2
101	103	2
128	131	3

Calibration Performed by:

(Print) Bill + Ted

(Signature) Bill Ted

Date: 4.6.93

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Alan Hawsbridge

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

President

238375
Certificate Number

Vice President

Minneapolis
Test Location

David B. Savage, Jr.
Program Manager

April 1, 1993
Date of Issue

APPENDIX E: PROCESS DATA

Asphalt Plant Operating Conditions During Stack Testing

Rev/YH/93

Test Date(s) 8/16/93 L.C. Kruse

Plant Mfr. & Model _____ Type (circle one): Drum Mix Conventional

Other (list): _____

Pollution Control Equipment: Baghouse Venturi Scrubber *wet scrubber* cyclone multiclone
(circle one)

If wet scrubbing: 100 % scrubber water recycled

List model: _____ Normal pressure drop across control equipment: _____ inches water

Air flow through control equipment: _____ acfm at _____ F Was control equipment operating normally during testing? _____

Date & procedures of last maintenance/cleaning of control equipment _____

Fuel:

Itemize all fuels and materials added to the combustion process during the test period. List fuel type used during testing (if oil, specify grade) _____. If other units of measure are used, specify and calculate appropriate heat input.

Test No.___	Fuel Input (Gal/hr)	BTU/GAL (as received)	Heat Input (BTU/HR)	%Moisture (as received in aggregate) Virgin	recycle	combined
Run 1						
Run 2						
Run 3						

Is the above fuel substantially the highest sulfur containing fuel normally burned? _____

Production specific fuel usage: (circle one) measured or calculated: _____ cubic foot/ ton hot mix

_____ gal/ton hot mix

No. of Burners: _____ Burner(s) rating: _____ MMBTU/HR = 100% setting

Operation:

	time 15 min. intervals	burner setting %	aggregate tons per hour	recycle tons per hour	asphalt tons per hour	Drum Mix temp. F	dust collector pressure drop inches water	scrubber water flow rate gpm	Other (list)
2	4:00	55	240	[illegible]	14.0	290	12	400	
	4:15	55	241	0	14.0	290	12	400	
3	4:30	55	245	0	14.4	290	12	400	
	4:45	55	243	0	14.4	290	12	400	
	5:00	55	240	0	14.3	290	12	400	
	5:15	56	240	0	14.3	290	12	400	
	5:30	55	238	0	14.1	290	12	400	
	5:45	55	240	0	14.1	290	12	400	

Plant Operator's Certification: I certify that the information submitted herein is accurate and correct and that no information requested was withheld from the Division Manager.

By: [signature] , Phone: (____) _____

Position: Operator

Note: All information required must be completed and submitted as part of the performance test. Failure to submit the required information will result in an incomplete performance test report.

Asphalt Plant Operating Conditions During Stack Testing

Rev/YH/93

Test Date(s) 8/16/93 L.C. Kruse

Plant Mfr. & Model _____

Type (circle one): Drum Mix Conventional

Other (list): _____

Pollution Control Equipment: Baghouse Venturi Scrubber wet scrubber cyclone multiclone
(circle one)

If wet scrubbing: _____% scrubber water recycled

List model: _____

Normal pressure drop across control equipment: _____ inches water

Air flow through control equipment: _____ acfm at _____F

Was control equipment operating normally during testing? _____

Date & procedures of last maintenance/cleaning of control equipment _____

Fuel:

Itemize all fuels and materials added to the combustion process during the test period. List fuel type used during testing (if oil, specify grade) _____. *If other units of measure are used, specify and calculate appropriate heat input.*

Test No.___	Fuel Input (Gal/hr)	BTU/GAL (as received)	Heat Input (BTU/HR)	%Moisture (as received in aggregate) Virgin	recycle	combined
Run 1						
Run 2						
Run 3						

Is the above fuel substantially the highest sulfur containing fuel normally burned? _____

Production specific fuel usage: (circle one) measured or calculated: _____cubic foot/ ton hot mix

_____gal/ton hot mix

No. of Burners: _____ Burner(s) rating: _____ MMBTU/HR = 100% setting

Operation:

	time 15 min. intervals	burner setting %	aggregate tons per hour	recycle tons per hour	asphalt tons per hour	Drum Mix. temp. F	dust collector pressure drop inches water	scrubber water flow rate gpm	Other (list)
1	12:45	50	221	0	12.8	290	12	400	
	1:00	5.0	225	0	12.9	290	12	400	
	1:15	56	228	0	13.1	290	12	400	
	1:30	55	234	0	13.4	290	12	400	
	1:45	60	237	0	13.6	290	12	400	
	200	55	235	0	13.5	290	12	400	
	2:15	55	235	0	13.5	290	12	400	
	2:30	55	237	0	13.7	290	12	400	
	2:45	55	240	0	14.1	290	12	400	
2	3:00	55	241	0	14.1	290	12	400	
	3:15	55	246	0	14.2	290	12	400	
	3:30	55	245	0	14.2	290	12	400	
	3:45	55	240	0	14.00	290	12	400	

Plant Operator's Certification: I certify that the information submitted herein is accurate and correct and that no information requested was withheld from the Division Manager.

By: _____, Phone: (____)_____

Position: Operator

Note: All information required must be completed and submitted as part of the performance test. Failure to submit the required information will result in an incomplete performance test report.

APPENDIX F: TEST PLAN & PROTOCOL

Minnesota Pollution Control Agency
Division of Air Quality
Stack Testing Protocol

The following is a summary of the testing requirements for the facility owned by L.C. Kruse and Sons:

I. Test Methods

A. EPA Method 1 for the location of sampling ports and points. Location of the sampling ports must be approved before the test.

Check for cyclonic flow must be done whenever there is a cyclonic type of device directly upstream of the sampling location. Correction of cyclonic flow by straightening vanes must also be verified by checking the cyclonic flow before the test.

If the location does not meet the minimum requirements in Method 1, the testing firm must conduct the flow pattern evaluation and testing according to the alternative procedures in part 2.5 of EPA Method 1 (Three-dimensional directional probe).

B. EPA Method 2 for velocity and volumetric flow rate. Three determinations: one measurement concurrently with each test run for pollutant.

C. EPA Method 3 for gas analysis. Three determinations: one measurement on an integrated sample taken concurrently with each test run for pollutant.

D. EPA Method 4 for the determination of moisture in the flue gases. Three determinations: one measurement concurrently with each test for pollutant.

E. EPA Method 5 as amended in Exhibit C and Minn. Rules 7005.0500 for the determination of particulate matter emissions. Three one-hour determinations are required. The sampling time for each run must be at least 60 minutes and the sampling rate must be at least 0.9 dscm/hr (0.53 dscf/min). Report the results as dry catch only, and wet and dry catch separately.

F. EPA Method 9 for the determination of visible emissions as amended in Minn. Rules part 7005.1860. Three hours of opacity readings are required for initial compliance.

One Hour per Yolanda Hernandez

AQD File No.: 323B

NOTE: The protocol, testplan, and information required in Exhibit C shall be submitted as part of the performance test report. Please note the new Asphalt Plant Operating Conditions During Stack Testing Sheet.

I. GENERAL INFORMATION

Permittee:	L C Kruse and Sons, Inc.
Contact person:	Darrin Kruse
Telephone number:	507/662-5205
Mailing address:	Box 899, Lakefield, Minnesota
AQD File No.	323B
MPCA permitting engineer:	GGS
Applicable regulations for each source tested (be specific):	
Reason for testing:	Permit requirement
Is this test for initial compliance demonstration:	No
Drawings showing location of sampling ports included:	Shall be submitted to Tom Kosevich, Compliance Determination Unit
Location of the plant at the time of the test:	To be provided at pre-test meeting
Date when test plan was discussed and agreed upon with the Permittee, or Pre-test meeting needed:	Pre-test meeting is scheduled for 21 May, 1993

II. NOTIFICATION REQUIREMENTS:

The Permittee must contact the Agency at least two weeks before the scheduled test to have a pre-test meeting and obtain all necessary approvals.

It is very important to allow at least two weeks before the test to review the testing requirements in order to avoid last minute cancellations due to inadequate testing conditions.

Among the potential problems that may need to be solved before the test are:

1. Unsuitable location of sampling ports. The stack may need to be extended and/or straightening vanes be installed.

2. Permittee must schedule the test at a time when the plant can be operated at 100% of rated capacity, and at maximum recycle rate if applicable.

3. Permittee must be ready to burn specified fuel. waste oil

4. Permittee may have to install pressure drop taps and gauges, as well as water flow rate measuring devices.

5. Permittee may have to install sampling taps on the fuel feeding line to the burner.

III. TEST PLAN

The following is the test plan developed for

A. Emission point(s) to be tested: (specify plant maker and model)

B. Parameters to be tested at each emission point:

C. Fuel sampling and analysis. (Fuel oils and used oil)

This is part of the compliance demonstration requirements. Please note that the test report will not be accepted without complete submittal of fuel analysis results of samples taken at the time of the test.

1. Sampling. One tap sample per particulate test run must be taken. The sample must be taken as close as possible to the burner,(somewhere in feeding line) to be representative of the fuel burned at the time of the test. The sample may be taken in a pint-size clean container, and according to the procedures in ASTM Method D 270-2546. Mix the three samples taken into a composite.

2. Analysis. The composite shall be analyzed in accordance with Exhibit D (dated 8 April, 1993).

D. Moisture content in the virgin and recycle aggregate.

1. Take two samples of each: the virgin and recycle aggregate per test run of particulates. Sample must be taken as close as possible to the feeding conveyor and during the corresponding run. Mix samples of virgin aggregate with the samples of recycle material in the same proportion as they enter the dryer, this will give one composite recycle/virgin sample per test run.

2. Perform one analysis of moisture content in each composite recycle/virgin aggregate sample as per ASTM or other recognized methodologies. A total of three analysis shall be performed, one per test run for particulates.

D. Moisture content in the virgin aggregate

1. Take two samples the virgin aggregate per test run of particulates. Sample must be taken as close as possible to the feeding conveyor and during the corresponding run. Mix the two samples of virgin aggregate, this will give one composite sample per test run.

2. Perform one analysis of moisture content in each composite sample as per ASTM or other recognized methodologies. A total of three analysis shall be performed, one per test run for particulates.

E. Operating Conditions during the Test

1. Operation must be at 100% of design capacity at the existing aggregate moisture content - no deliberate reduction of feed rate or fan speed during testing, except for nominal damper adjustment for proper combustion. - The test report must include copies of the manufacturer's specifications that define the design capacity of the plant as a function of the moisture content of the aggregate.

2. Must burn 100% of the highest emitting fuel to be listed in and allowed by the permit: Used oil (waste oil, crank oil), No. 6 fuel oil, No. 5 fuel oil, No. 4 fuel oil, No. 3 fuel oil (sometimes described as clarified or industrial fuel oil), No. 2 fuel oil, No. 1 fuel oil, LPG and natural gas.

3. The permit is to authorize recycling, then testing must be conducted while recycling and at the maximum ratio of recycle to virgin aggregate to be allowed by the permit:

4. Normal operation of the plant will be recycling of scrubber water, the test must be done under the same conditions:

5. Normal operation of the plant will be with recycling of collected ashes from the baghouse into the dryer, the test must be conducted under the same conditions.

F. Operating Data to Be Recorded during the Test

Operating data must be recorded during the test in its entirety i.e., particulates and visible emission observations. Operating data must be recorded every fifteen minutes. Please use the attached data sheet or equivalent.

Note: No test report will be accepted without a complete data sheet included.

1. During testing the following measurements must be made:

a) Pressure drop across the baghouse or venturi scrubber throat.

b) Scrubber water flow rate. If the measurement is done indirectly from a pump pressure gauge, the test report must include calculations, nomograms or calibration data used to compute gallons per minute of water.

c) Virgin and recycle aggregate input (ton per hour) as well as asphalt input (ton per hour). Provide the manufacturer's rating of the asphalt plant at different moisture contents in the aggregate.

d) Moisture content of the aggregate, and if applicable, the recycling material.

2. Please provide the following data:

a) Average fuel consumption rate (calculated or measured)

b) Quality of the scrubber water: recycling percent

c) Cleaning cycles of the baghouse

d) Operating data sheet enclosed

G. Testing schedules and testing firm:

Schedule:	6/9/93
Firm:	MMT

H. Permitting engineer to witness the test: No