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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,

July 20, 1993.

Retest #1 3237

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DRAFT COPY

**RESULTS OF A
SOURCE EMISSION COMPLIANCE TEST
ON A HOT-MIX ASPHALT PLANT
PROCESS SCRUBBER
OPERATED BY
L.C. KRUSE & SONS, INC.
WINDOM, MINNESOTA
July 6, 1993**

Submitted to:

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Prepared by:

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MMT Report Number: 9997
MMT Project Number: 9408
Report Issued: July 20, 1993

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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. WINDOM, MINNESOTA July 6, 1993

MMT Report Number 9997
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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 hot-mix asphalt plant operating in Windom, 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 July 6, 1993. This report presents the results of the test program along with all substantiating documentation.

The MMT sampling team consisted of Messrs. Alan Trowbridge and Bill Anderson. Mr. Daniel D. Schultz represented L.C. Kruse & Sons, Inc. throughout the test period. Mr. Steve Sommer of the Minnesota Pollution Control Agency witnessed a portion of the test proceedings.

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 0.477 grains per dry standard cubic foot and an average source particulate emission rate of 70.84 pounds per hour.

The visible emission test was performed concurrent with the first particulate test run. The observed plume opacity ranged from zero (0) to fifteen (15) percent.

The average process weight rate (aggregate + asphalt) during the test period was 300 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 either of these standards during the test period.

Table 2.1
Summary of Particulate Emission Test Results
L.C. Kruse & Sons, Inc. Asphalt Plant, Windom, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
July 6, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1323	1516	1735	---
Finish	1429	1651	1840	---
Effluent Temperature, °F	166	*	195	181
Effluent Moisture Content, % v/v	44.1	*	42.8	43.5
Effluent Composition, % v/v dry:				
Carbon Dioxide Content	8.5	*	8.5	8.5
Oxygen Content	9.0	*	8.8	8.9
Effluent Volumetric Flow Rate:				
Actual Conditions, acfm	40,763	*	36,061	38,412
Standard Conditions, scfm	32,449	*	27,478	29,964
Dry Standard Conditions, dscfm	18,154	*	15,721	16,938
Sampling Isokinetic Variation, %	109.2	*	103.5	106.4
Effluent Particulate Concentration:				
Front Catch Only;				
Actual Conditions, gr/acf	0.1633	*	0.2153	0.1893
Standard Conditions, gr/scf	0.2052	*	0.2825	0.2439
Dry Standard Conditions, gr/dscf	0.3667	*	0.4939	0.4303
Back Catch Only;				
Actual Conditions, gr/acf	0.0220	*	0.0196	0.0208
Standard Conditions, gr/scf	0.0277	*	0.0258	0.0268
Dry Standard Conditions, gr/dscf	0.0495	*	0.0450	0.0473
Total Catch;				
Actual Conditions, gr/acf	0.1854	*	0.2349	0.2102
Standard Conditions, gr/scf	0.2329	*	0.3083	0.2709
Dry Standard Conditions, gr/dscf	0.4163	*	0.5389	**0.4776**
Source Particulate Emission Rate:				
Classical Method, lb/hr	64.82	*	72.67	68.75
Ratio of Areas Method, lb/hr	70.73	*	75.15	72.94
Average of the Two Methods, lb/hr	67.78	*	73.91	70.84

Standard Conditions: 68°F, 29.92 in. Hg

* Run #2 was voided. During the test run a sample line connection inadvertantly opened. The volume of outside air drawn into the sample is unknown and no correction could be made.

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.

Production data is presented in Appendix E.

Table 3.1
Summary of Process Data
L.C. Kruse & Sons, Inc. Asphalt Plant, Windom, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
July 6, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1323	1516	1735	---
Finish	1429	1651	1840	---
Process Weight Rate;				
Aggregate Usage, ton/hr	275.0	285.0	285.4	281.8
Asphalt Usage, ton/hr	17.7	18.3	18.4	18.1
Total Process Weight Rate, ton/hr	292.7	303.3	303.8	299.9
Aggregate Moisture Content, %	4.81	4.70	4.75	4.75
Burner Setting, %	65	70	70	68
Product Mix Temperature, °F	291	292	291	291
Scrubber Operating Parameters;				
Pressure Drop, in WC	8.8	8.9	9.0	8.9
Water Flow Rate, gpm	350	350	350	350

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. Note that the stack cross-section was out-of-round. Sampling point locations were established separately for each port. The average diameter was used for calculating the stack cross-sectional area.

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 grab 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, Windom, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
July 6, 1993

SAMPLING LOCATION DATA

Stack Cross-Sectional Dimension;
- Average diameter, inches 59.63
- (out-of-round diameters: 57.25" & 62.0")

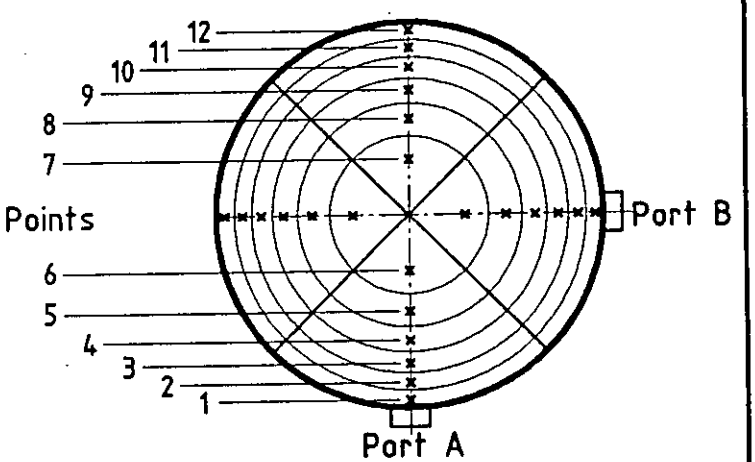
Length of straight, undisturbed flow;
- Before ports, inches 134
- After ports, inches 36
- Before ports, stack diameters 2.25
- After ports, stack diameters 0.60

Number of sampling points;
- Required by EPA Method 1 24
- Actually used 24
  - Number of ports 2
  - Number of points per port 12

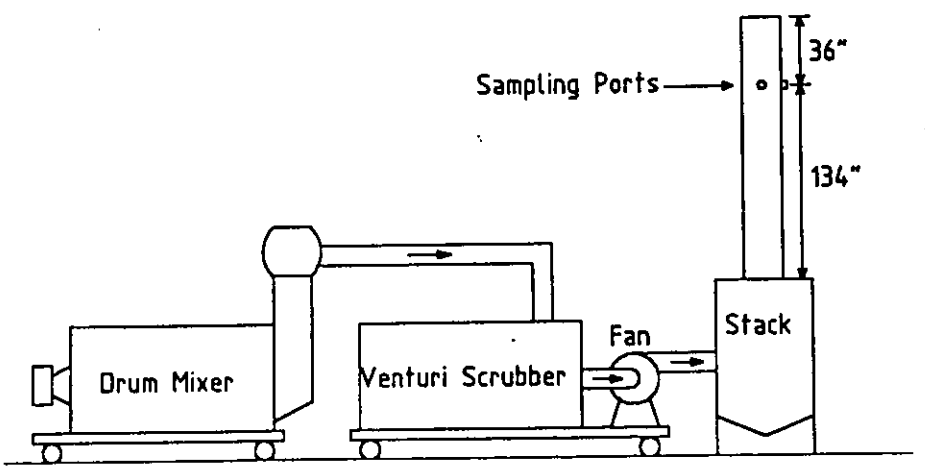
Particulate test sampling time;
- Minutes per point 2.5
- Minutes per test run 60.0

SAMPLING POINT LOCATION WITHIN STACK CROSS-SECTION

Point Number	Percent of Traverse	Inches from Inside Walls
1	2.1	1.2/1.3
2	6.7	3.8/4.2
3	11.8	6.8/7.3
4	17.7	10.2/11.0
5	25.0	14.3/15.5
6	35.6	20.4/22.1
7	64.4	36.9/39.9
8	75.0	42.9/46.5
9	82.3	47.1/51.0
10	88.2	50.5/54.7
11	93.3	53.4/57.9
12	97.9	56.0/60.7



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.

Figure 4.2 Sampling Train Description
L.C. Kruse & Sons, Inc. Asphalt Plant, Windom, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
June 9, 1993

PARTICULATE SAMPLING TRAIN IDENTIFICATION

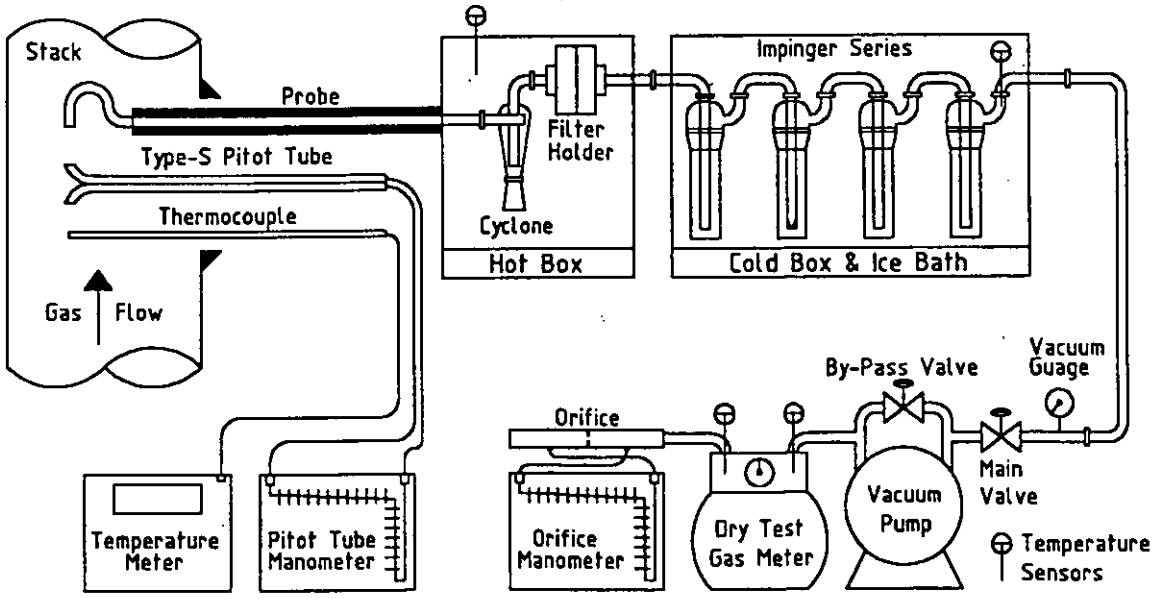
Sampling Train Manufacturer: ..... MMT Environmental Services, Inc.
Sampling Train Model: ..... Universal Stak Sampler

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 #L6, 0.302 inch diameter, stainless steel
Sampling Probe Used: .... MMT #75, 75 inch effective length with stainless steel liner
Pitot Tube Used: ..... MMT #67, S-type, 0.841 coefficient

PARTICULATE SAMPLING TRAIN SCHEMATIC



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.

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 * Sl * Sl      (FOR ROUND STACKS)

As = Sl * 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: ~~9374~~ 9408 COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 1 TIME: 7/ 6/93 1323-1429

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	0.200	0.770	162	76	76	0.447	30.46
A	2	0.180	0.690	164	77	76	0.424	28.94
A	3	0.270	1.000	166	78	76	0.520	35.50
A	4	0.310	1.200	166	78	76	0.557	38.04
A	5	0.380	1.400	166	79	76	0.616	42.12
A	6	0.470	1.800	167	79	76	0.686	46.88
A	7	0.430	1.700	164	80	77	0.656	44.73
A	8	0.280	1.100	163	80	77	0.529	36.07
A	9	0.250	0.950	162	80	77	0.500	34.05
A	10	0.250	0.950	162	80	77	0.500	34.05
A	11	0.220	0.800	161	80	78	0.469	31.92
A	12	0.180	0.690	161	80	78	0.424	28.87
B	1	0.120	0.450	164	78	78	0.346	23.63
B	2	0.170	0.640	166	78	78	0.412	28.17
B	3	0.190	0.710	168	79	78	0.436	29.83
B	4	0.140	0.530	168	79	78	0.374	25.61
B	5	0.190	0.720	169	80	78	0.436	29.85
B	6	0.250	0.950	170	80	78	0.500	34.27
B	7	0.360	1.400	170	80	78	0.600	41.13
B	8	0.370	1.400	169	80	78	0.608	41.66
B	9	0.390	1.500	170	81	78	0.624	42.81
B	10	0.390	1.500	168	81	78	0.624	42.74
B	11	0.270	1.000	166	81	79	0.520	35.50
B	12	0.250	0.950	165	82	80	0.500	34.14
AVERAGE		0.271	1.033	166	79	77	0.513	35.04

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: ~~9374~~ 9468 COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 1 TIME: 7/ 6/93 1323-1429

TEST DATA

GAS METER COEFFICIENT	0.9699	Y	VOLUME OF LIQUID COLLECTED, ML	510.1	Vl
PITOT TUBE COEFFICIENT	0.841	Cp			
NOZZLE DIMENSIONS;			GAS COMPOSITION, % V/V DRY;		
DIAMETER, IN	0.302	Dn	CARBON DIOXIDE	8.50	CD
AREA, SF	0.000497	An	OXYGEN	9.00	OX
			CARBON MONOXIDE	0.00	CM
			NITROGEN (BY DIFFERENCE)	82.50	NI
STACK DIMENSIONS;			AVE. TRAVERSE POINT DATA;		
DIAMETER/LENGTH, IN	59.63	Sl	STACK TEMP., DEG F	166	Ts
WIDTH, IN	0.00	Sw	METER TEMP., DEG F	78	Tm
AREA, SF	19.390	As	ORIFICE PRESSURE, IN WC	1.033	Po
BAROMETRIC PRESSURE, IN HG	28.21	Pb	SQRT VELOCITY P., IN WC	0.513	Pv
STACK PRESSURES;			MASS OF PARTICULATE MATTER		
STATIC, IN WC	0.20	Pg	COLLECTED, G;		
ABSOLUTE, IN HG	28.22	Ps	FRONT CATCH (88.1%)	0.7252	Wf
			BACK CATCH (11.9%)	0.0979	Wb
SAMPLING TIME, MIN	60.00	Ti	TOTAL CATCH	0.8231	Wt
VOLUME OF GAS SAMPLED AT METER, DCF	33.911	Vm			

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	30.491	Vms	GAS MOLECULAR WEIGHT;		
			DRY BASIS, LB/LB-MOLE	29.72	Md
			WET BASIS, LB/LB-MOLE	24.56	Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	24.010	Vw	AVERAGE GAS VELOCITY, FPS	35.04	Vs
GAS MOISTURE CONTENT;			GAS VOLUMETRIC FLOW RATE;		
VOLUME FRACTION	0.4405	Bws	ACTUAL, ACFM	40763	Qa
PERCENT BY VOLUME	44.05	Bwp	STANDARD, SCFM	32449	Qs
			DRY STANDARD, DSCFM	18154	Qsd
			ISOKINETIC VARIATION, %	109.18	I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.1633 Caf	0.0220 Cab	0.1854 Cat
STANDARD, GR/SCF	0.2052 Cwf	0.0277 Cwb	0.2329 Cwt
DRY STANDARD, GR/DSCF	0.3667 Csf	0.0495 Csb	0.4163 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	57.11 Rcf	7.71 Rcb	64.82 Rct
RATIO OF AREAS METHOD	62.32 Rrf	8.41 Rrb	70.73 Rrt

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

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: ~~9374~~ 9408 COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 2 TIME: 7/ 6/93 1516-1651

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	0.110	0.410	188	79	79	0.332	22.06
A	2	0.120	0.450	188	79	79	0.346	23.05
A	3	0.280	1.000	190	79	79	0.529	35.26
A	4	0.200	0.710	190	79	79	0.447	29.80
A	5	0.200	0.710	191	80	79	0.447	29.82
A	6	0.210	0.750	190	80	79	0.458	30.53
A	7	0.300	1.100	192	81	79	0.548	36.55
A	8	0.390	1.400	192	81	79	0.624	41.67
A	9	0.180	0.640	192	81	79	0.424	28.31
A	10	0.240	0.860	193	82	79	0.490	32.72
A	11	0.380	1.400	189	82	79	0.616	41.04
A	12	0.530	1.900	188	82	79	0.728	48.43
B	1	0.130	0.460	179	82	80	0.361	23.82
B	2	0.170	0.610	190	82	80	0.412	27.47
B	3	0.190	0.670	191	82	80	0.436	29.07
B	4	0.230	0.820	192	82	80	0.480	32.00
B	5	0.270	0.960	193	82	80	0.520	34.70
B	6	0.270	0.960	193	83	80	0.520	34.70
B	7	0.250	0.890	194	83	80	0.500	33.42
B	8	0.210	0.750	194	83	80	0.458	30.63
B	9	0.190	0.680	194	83	80	0.436	29.13
B	10	0.170	0.610	195	84	80	0.412	27.58
B	11	0.160	0.570	195	84	80	0.400	26.75
B	12	0.140	0.500	194	84	81	0.374	25.01
AVERAGE		0.230	0.825	191	82	80	0.471	31.40

PARTICULATE EMISSION TEST CALCULATIONS

9409

PROJECT NUMBER: ~~9374~~ COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 2 TIME: 7/ 6/93 1516-1651

TEST DATA

GAS METER COEFFICIENT	0.9699 Y	VOLUME OF LIQUID COLLECTED, ML	200.4 Vl
PITOT TUBE COEFFICIENT	0.841 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.302 Dn	CARBON DIOXIDE	8.50 CD
AREA, SF	0.000497 An	OXYGEN	8.70 OX
		CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	82.80 NI
STACK DIMENSIONS;		AVE. TRAVERSE POINT DATA;	
DIAMETER/LENGTH, IN	59.63 Sl	STACK TEMP., DEG F	191 Ts
WIDTH, IN	0.00 Sw	METER TEMP., DEG F	81 Tm
AREA, SF	19.390 As	ORIFICE PRESSURE, IN WC	0.825 Po
BAROMETRIC PRESSURE, IN HG	28.26 Pb	SQRT VELOCITY P., IN WC	0.471 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER COLLECTED, G;	
STATIC, IN WC	0.20 Pg	FRONT CATCH (90.9%)	0.1039 Wf
ABSOLUTE, IN HG	28.27 Ps	BACK CATCH (9.1%)	0.0104 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.1143 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	31.358 Vm		

Major Leak

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	28.118 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.71 Md
		WET BASIS, LB/LB-MOLE	26.77 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	9.433 Vw	AVERAGE GAS VELOCITY, FPS	31.40 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.2512 Bws	ACTUAL, ACFM	36526 Qa
PERCENT BY VOLUME	25.12 Bwp	STANDARD, SCFM	27991 Qs
		DRY STANDARD, DSCFM	20959 Qsd
		ISOKINETIC VARIATION, %	87.21 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0327 Caf	0.0033 Cab	0.0360 Cat
STANDARD, GR/SCF	0.0427 Cwf	0.0043 Cwb	0.0469 Cwt
DRY STANDARD, GR/DSCF	0.0570 Csf	0.0057 Csb	0.0627 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	10.24 Rcf	1.03 Rcb	11.27 Rct
RATIO OF AREAS METHOD	8.93 Rrf	0.89 Rrb	9.82 Rrt

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

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

9403

PROJECT NUMBER: ~~9374~~ COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 3 TIME: 7/ 6/93 1735-1840

		TRAVERSE POINT DATA					VELOCITY PROFILE	
SAMPLING LOCATION PORT	POINT	VELOCITY PRESSURE IN WC	ORIFICE PRESSURE IN WC	TEMPERATURE, DEG.F STACK GAS	METER INLET	METER OUTLET	SQRT VELOCITY PRESSURE	GAS VELOCITY FT/SEC
A	1	0.130	0.410	195	78	78	0.361	25.11
A	2	0.170	0.530	196	79	78	0.412	28.74
A	3	0.190	0.590	197	79	78	0.436	30.40
A	4	0.220	0.690	196	79	78	0.469	32.69
A	5	0.250	0.780	196	80	78	0.500	34.85
A	6	0.280	0.870	196	80	78	0.529	36.88
A	7	0.270	0.840	196	81	79	0.520	36.21
A	8	0.220	0.690	195	81	79	0.469	32.66
A	9	0.190	0.590	195	81	79	0.436	30.36
A	10	0.180	0.560	194	81	79	0.424	29.52
A	11	0.170	0.530	194	82	79	0.412	28.69
A	12	0.140	0.440	193	82	79	0.374	26.02
B	1	0.110	0.340	188	81	80	0.332	22.97
B	2	0.130	0.410	190	81	80	0.361	25.01
B	3	0.140	0.440	196	81	80	0.374	26.08
B	4	0.170	0.530	197	82	80	0.412	28.76
B	5	0.200	0.620	195	82	80	0.447	31.14
B	6	0.270	0.840	198	82	80	0.520	36.27
B	7	0.310	0.970	196	82	80	0.557	38.80
B	8	0.300	0.940	195	82	80	0.548	38.14
B	9	0.220	0.840	193	81	80	0.469	32.61
B	10	0.270	0.840	194	81	79	0.520	36.16
B	11	0.210	0.660	193	81	80	0.458	31.86
B	12	0.120	0.370	192	81	80	0.346	24.07
AVERAGE		0.203	0.638	195	81	79	0.445	31.00

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: ~~9374~~ 9403 COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 3 TIME: 7/ 6/93 1735-1840

TEST DATA

GAS METER COEFFICIENT	0.9699 Y	VOLUME OF LIQUID COLLECTED, ML	397.6 Vl
PITOT TUBE COEFFICIENT	0.841 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.302 Dn	CARBON DIOXIDE	8.50 CD
AREA, SF	0.000497 An	OXYGEN	8.80 OX
		CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	82.70 NI
STACK DIMENSIONS;		AVE. TRAVERSE POINT DATA;	
DIAMETER/LENGTH, IN	59.63 Sl	STACK TEMP., DEG F	195 Ts
WIDTH, IN	0.00 Sw	METER TEMP., DEG F	80 Tm
AREA, SF	19.390 As	ORIFICE PRESSURE, IN WC	0.638 Po
BAROMETRIC PRESSURE, IN HG	28.25 Pb	SQRT VELOCITY P., IN WC	0.445 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	0.20 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.26 Ps	FRONT CATCH (91.6%)	0.8014 Wf
		BACK CATCH (8.4%)	0.0731 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.8745 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	27.900 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	25.023 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.71 Md
		WET BASIS, LB/LB-MOLE	24.70 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	18.715 Vw	AVERAGE GAS VELOCITY, FPS	31.00 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.4279 Bws	ACTUAL, ACFM	36061 Qa
PERCENT BY VOLUME	42.79 Bwp	STANDARD, SCFM	27478 Qs
		DRY STANDARD, DSCFM	15721 Qsd
		ISOKINETIC VARIATION, %	103.47 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.2153 Caf	0.0196 Cab	0.2349 Cat
STANDARD, GR/SCF	0.2825 Cwf	0.0258 Cwb	0.3083 Cwt
DRY STANDARD, GR/DSCF	0.4939 Csf	0.0450 Csb	0.5389 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	66.60 Rcf	6.07 Rcb	72.67 Rct
RATIO OF AREAS METHOD	68.87 Rrf	6.28 Rrb	75.15 Rrt

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

TABLE SUMMARY OF PARTICULATE EMISSION TEST RESULTS

9403

PROJECT NUMBER: ~~9374~~ COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET

TEST PARAMETER	RUN 1	RUN 2	RUN 3
TEST DATE	7/ 6/93	7/ 6/93	7/ 6/93
TIME OF TEST, HR;			
START	1323	1516	1735
FINISH	1429	1651	1840
EFFLUENT TEMPERATURE, DEGREES F	166	191	195
BAROMETRIC PRESSURE, IN HG	28.21	28.26	28.25
EFFLUENT MOISTURE CONTENT, % V/V	44.1	25.1	42.8
EFFLUENT COMPOSITION, % V/V DRY;			
CARBON DIOXIDE	8.5	8.5	8.5
OXYGEN	9.0	8.7	8.8
CARBON MONOXIDE	0.0	0.0	0.0
EFFLUENT VOLUMETRIC FLOW RATE;			
ACTUAL CONDITIONS, ACFM	40763	36526	36061
STANDARD CONDITIONS, SCFM	32449	27991	27478
DRY STANDARD CONDITIONS, DSCFM	18154	20959	15721
ISOKINETIC VARIATION, %	109.2	87.2	103.5
EFFLUENT PARTICULATE CONCENTRATION;			
EFFLUENT FRONT HALF PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.1633	0.0327	0.2153
STANDARD CONDITIONS, GR/SCF	0.2052	0.0427	0.2825
DRY STANDARD CONDITIONS, GR/DSCF	0.3667	0.0570	0.4939
EFFLUENT BACK HALF PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.0220	0.0033	0.0196
STANDARD CONDITIONS, GR/SCF	0.0277	0.0043	0.0258
DRY STANDARD CONDITIONS, GR/DSCF	0.0495	0.0057	0.0450
EFFLUENT TOTAL PARTICULATE CONCENTRATION;			
ACTUAL CONDITIONS, GR/ACF	0.1854	0.0360	0.2349
STANDARD CONDITIONS, GR/SCF	0.2329	0.0469	0.3083
DRY STANDARD CONDITIONS, GR/DSCF	0.4163	0.0627	0.5389
SOURCE PARTICULATE EMISSION RATE;			
CLASSICAL METHOD, LB/HR	64.82	11.27	72.67
RATIO OF AREAS METHOD, LB/HR	70.73	9.82	75.15

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.

Run #2 void
Major leak at end of test

TABLE ANALYSIS OF VISIBLE EMISSION TEST DATA

9403

PROJECT NUMBER: ~~9374~~
DATE TESTED: 7-6-93
TIME OF TEST: 1320

COMPANY: L.C. KRUSE
SOURCE: SCRUBBER OUTLET
OBSERVER: BILL ANDERSON
RE-CERTIFICATION DATE: 10-2-93

PLUME OPACITY OBSERVATIONS

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

SUMMARY OF TEST DATA

PLUME OPACITY %	PERCENT OF TIME AT OPACITY	PERCENT OF TIME OPACITY EXCEEDED
0	20.83	79.17
5	52.50	26.67
10	25.00	1.67
15	1.67	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, %: 15
MINIMUM OBSERVED OPACITY, %: 0
ARITHMETIC MEAN OPACITY, %: 5.4

SIX-MINUTE AVERAGE OPACITY, %

MAXIMUM:	8.3 (51:45-57:30)
2nd LARGEST:	8.1 (38:15-44:00)
3rd LARGEST:	7.1 (29:30-35:15)
4th LARGEST:	6.5 (11:45-17:30)
5th LARGEST:	5.8 (21:00-26:45)

APPENDIX B: FIELD DATA FORMS

~~ODOR TEST~~

Field Data Sheet

MMT Job Number ~~9344~~ 9408 — Ambient Temperature, °F

Date 7-6-93 — Barometric Pressure, in. Hg

Company L.E. Kruse & Sons — Static Pressure, in. WC

Source Scrubber Outlet — Dry Bulb Temp., °F 182

Dimensions, inches — Wet Bulb Temp., °F 162

Test Team Members AT - BA — Moisture Content, %

VELOCITY TRAVERSE: Time _____ Pitot Tube Coefficient _____

Traverse point number	Inches from wall		Inches from port		PORT A/B ΔP in. H_2O	PORT A/B ~~Temp.~~ °F	PORT B ΔP in. H_2O	PORT B Temp. °F	PORT C ΔP in. H_2O	PORT C Temp. °F	PORT D ΔP in. H_2O	PORT D Temp. °F
1	1.2	1.3	9.0	9.6	0.20	0.28						
2	3.8	4.2	11.6	12.4	0.25	0.33						
3	6.8	7.3	14.5	15.6	0.28	0.35						
4	10.2	11.0	17.9	19.2	0.26	0.35						
5	14.3	15.5	22.1	23.8	0.33	0.45						
6	20.4	22.1	28.1	30.3	0.41	0.53						
7	36.9	39.9	44.6	48.2	0.60	0.50						
8	42.9	46.5	50.7	54.8	0.66	0.42						
9	47.1	51.0	54.9	59.3	0.50	0.35						
10	50.5	54.7	58.2	62.9	0.48	0.32						
11	53.4	57.9	61.2	66.1	0.40	0.33						
12	56.0	60.7	63.9	68.4	0.33	0.30						

~~ODOR SAMPLES~~

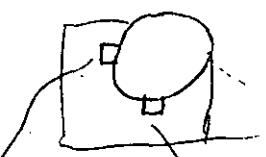
Bag Id.	Time

OBSERVERS

Name	Organization

COMMENTS

L6 0.302 Nozzle



deformed stack out-of-round

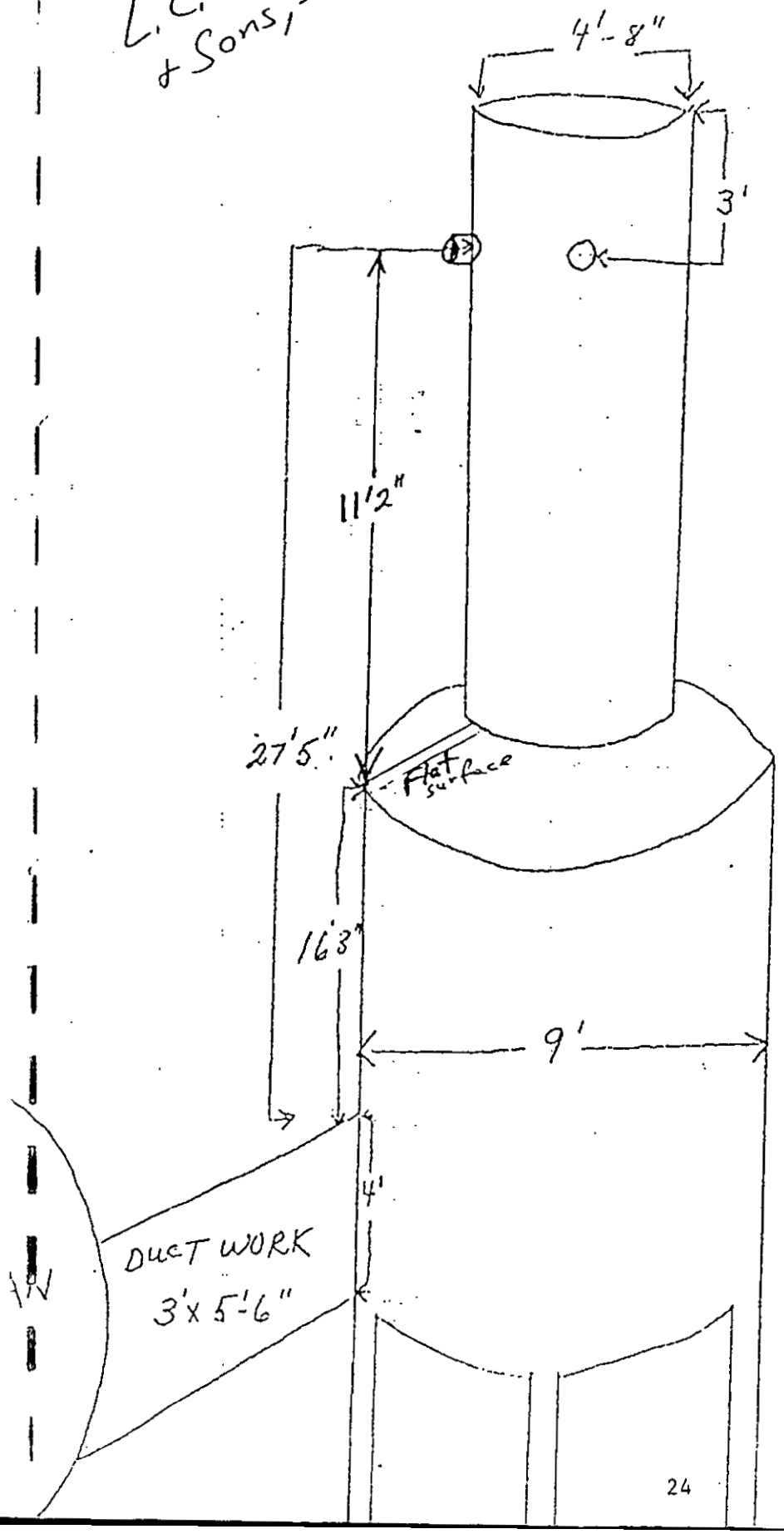
65.0" 7.75 port — 57.25" ϕ

70.125" 8.25" port 36" after port — 62.0" ϕ

59.625" ϕ average

Form: S-OD-2

L. C. Kruse & Sons, Inc.



59.63"

Diameter = ~~5'6"~~

Before Ports
11'2" = 134"

2.25 ~~2.39~~ diameters

After Ports
36"

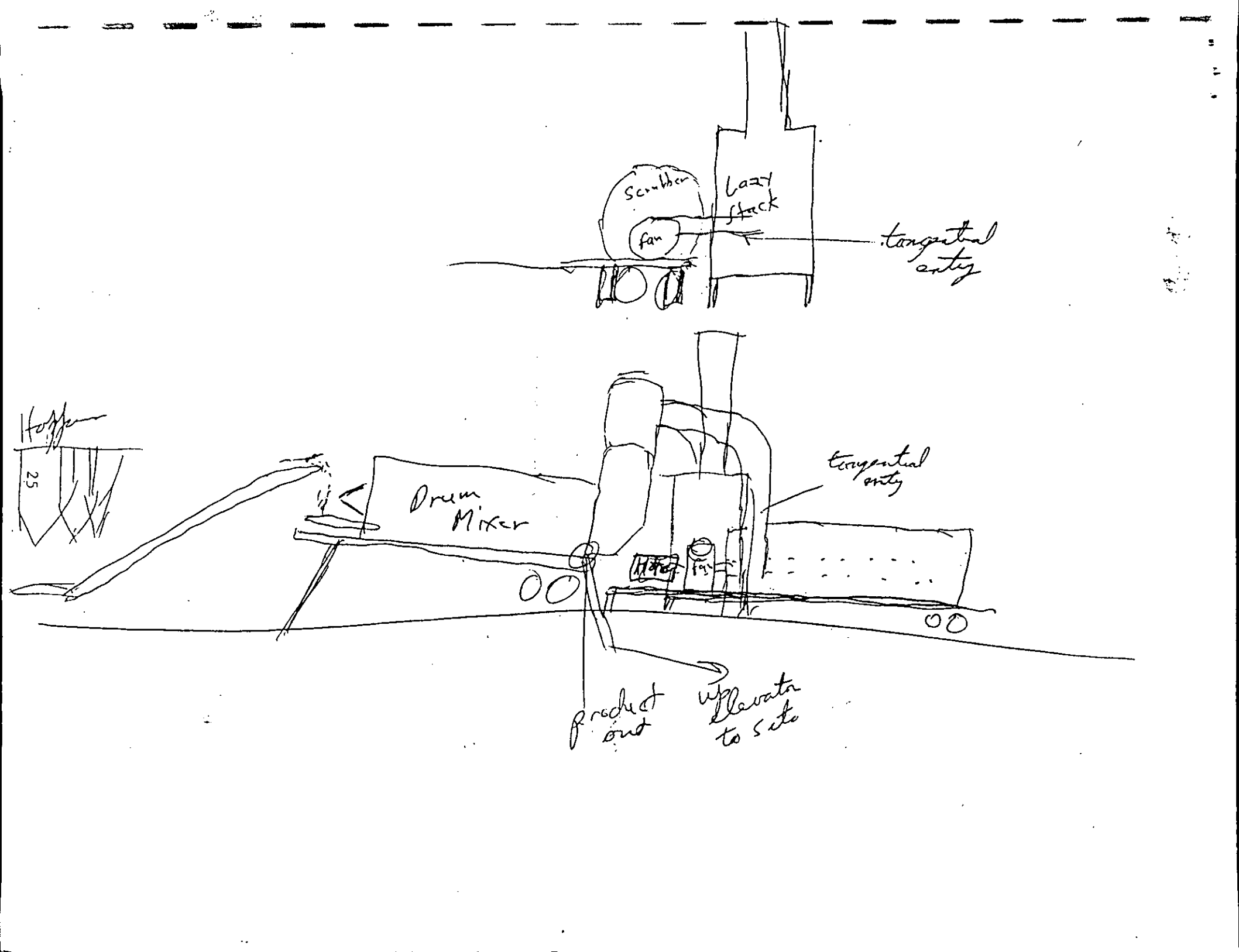
0.60 ~~0.64~~ diameters

24 sampling points required

2 ports x 12 points

2.5 minutes/point

60 minutes/test run


Scrubber
Lazy stack
fan
tangential entry
Hopper
25
Drum Mixer
tangential entry
fan
product out
Elevator to silo

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 1
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: ~~9377~~ 9408	Control Unit No.: 5	ΔH@ 1.82
Date: 7-6-93	Gas Meter Coefficient: 0.994	TM 85
Company: L.C. Kruse	Sample Box No.: 5	MC 35
Source: Scrubber Outlet	Probe No.: 75" Length: 75"	PS/PM
Source Dimensions: 59.625	Pitot No.: 67" Coefficient: 0.841 (A)	C
Test Team: AT - BA	Nozzle No.: 16 Diameter: 0.302	TS
Test Procedure: EPA 1-5	Filter No.: 8714	R-
Ambient Temp., °F:	Barometric Pressure, in.Hg: 28.21	Static Pressure, in.WC: 0.2

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.
1323	1	0	858.505	0.20	0.77	0.77	5.0	162	76	76	250	232	68
—	2	2.5	859.7	0.18	0.69	0.69	5.0	164	77	76	250	232	67
1328	3	5	860.9	0.27	1.0	1.0	6.5	166	78	76	250	231	67
—	4	7.5	862.4	0.31	1.2	1.2	8.0	166	78	76	250	231	66
1333	5	10	864.0	0.38	1.4	1.4	11.0	166	79	76	250	231	65
—	6	12.5	865.8	0.47	1.8	1.8	15.0	167	79	76	250	232	66
1338	7	15	867.5	0.43	1.7	1.7	15.0	167	80	77	250	233	65
—	8	17.5	868.8	0.28	1.1	1.1	12.5	164	80	77	250	235	66
1343	9	20	870.7	0.25	0.95	0.95	9.5	163	80	77	250	234	65
—	10	22.5	—	0.25	0.95	0.95	9.5	162	80	77	250	234	64
1348	11	25	873.1	0.22	0.80	0.80	8.0	162	80	78	250	232	63
—	12	27.5	874.5	0.18	0.69	0.69	7.0	161	80	78	250	235	64
1353	End	30	875.761	~	~	~	~	~	~	~	~	~	~
1357	1	0	875.761	0.12	0.45	0.45	5.5	164	78	78	250	233	64
—	2	2.5	876.7	0.17	0.64	0.64	6.0	166	78	78	250	235	64
1404	3	5	877.8	0.19	0.71	0.71	7.5	168	79	78	250	235	64
—	4	7.5	879.0	0.14	0.53	0.53	6.0	168	79	78	250	234	64
1409	5	10	880.1	0.19	0.72	0.72	7.5	169	80	78	250	234	65
—	6	12.5	881.3	0.25	0.95	0.95	9.5	170	80	78	250	235	64
1414	7	15	882.7	0.36	1.4	1.4	14.0	170	80	78	250	234	64
—	8	17.5	884.3	0.37	1.4	1.4	15.0	169	80	78	250	233	65
1419	9	20	885.11	0.39	1.5	1.5	15.0	170	81	78	250	232	65
—	10	22.5	887.9	0.39	1.5	1.4	15.0	168	81	78	250	233	66
1424	11	25	889.0	0.27	1.0	1.0	14.0	166	81	79	250	233	66
—	12	27.5	890.9	0.25	0.95	0.95	11.5	165	82	80	250	235	67
1429	End	30	892.416	—	—	—	—	—	—	—	—	—	—

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	8118	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1305	0.015	20
1431	0.005	15

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	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							CO_2	
Oxygen							O_2	
Carbon Monoxide							CO	

Total Sampling Time, min.: 60
Volume of Gas Sampled, DCF: 33.911

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 2
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: ~~9377~~ 9408	Control Unit No.: 5	ΔH@ 1.82
Date: 7-6-93	Gas Meter Coefficient: 0.974	TM 85
Company: L.C. Kruse	Sample Box No.: 5	MC 38
Source: Scrubber Outlet	Probe No.: 75" Length: 75"	PS/PM 1.0
Source Dimensions: 59.625	Pitot No.: 67" Coefficient: 0.841 (A)	C —
Test Team: AT - BA	Nozzle No.: 26 Diameter: 0.302	TS 190
Test Procedure: EPA 1-5	Filter No.: 8717	R —
Ambient Temp., °F:	Barometric Pressure, in.Hg: 29.26	Static Pressure, in.WC: 0.2

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.
1516	1	0	892.811	0.11	0.41	0.41	3.5	188	79	79	225	215	58
	2	2.5	893.7	0.12	0.45	0.45	4.0	188	79	79	230	220	65
1550 ~~1529~~	3	5	894.7	0.28	1.0	1.0	5.0	190	79	79	230	233	64
1552.5	4	7.5	896.1	0.20	0.71	0.71	4.0	190	79	79	235	233	64
1555	5	10	897.4	0.20	0.71	0.71	4.0	191	80	79	238	232	65
—	6	12.5	898.6	0.21	0.75	0.75	4.0	190	80	79	240	232	65
1600	7	15	900.0	0.30	1.1	1.1	5.5	192	81	79	238	232	65
—	8	17.5	901.4	0.39	1.4	1.4	7.0	192	81	79	240	233	65
1605	9	20	903.1	0.18	0.64	0.64	4.0	192	81	79	242	234	65
—	10	22.5	904.3	0.24	0.86	0.86	5.5	193	82	79	240	234	65
1610	11	25	905.7	0.39	1.4	1.4	11.0	189	82	79	238	235	65
—	12	27.5	907.4	0.53	1.9	1.9		188	82	79	235	235	65
15 1615	End	30	909.6	—									
1621	1	0	909.4	0.13	0.46	0.46	3.5	179	82	80	233	232	66
—	2	2.5	910.4	0.17	0.61	0.61	4.0	190	82	80	231	232	65
1626	3	5	911.5	0.19	0.67	0.67	4.0	191	82	80	240	231	65
—	4	7.5	912.7	0.23	0.82	0.82	4.5	192	82	80	249	230	64
1631	5	10	914.0	0.27	0.96	0.96	5.0	193	82	80	248	233	65
—	6	12.5	915.5	0.27	0.76	0.96	5.0	193	83	80	245	235	65
1636	7	15	916.9	0.25	0.89	0.89	4.5	194	83	80	243	235	66
—	8	17.5	918.3	0.21	0.75	0.75	4.0	194	83	80	240	234	66
1641	9	20	919.6	0.19	0.68	0.69	4.0	194	83	80	234	234	66
—	10	22.5	920.8	0.17	0.61	0.61	4.0	195	84	80	228	234	66
1646	11	25	921.9	0.16	0.57	0.57	4.0	195	84	80	236	231	67
—	12	27.5	923.0	0.14	0.50	0.50	4.0	194	84	81	243	230	67
1651	End	30	924.169	—									

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	789.3	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1508	0.004	18
1652	major leak found open fitting at connector to filter	

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	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							CO_2	
Oxygen							O_2	
Carbon Monoxide							CO	

Total Sampling Time, min.: 60
Volume of Gas Sampled, DCF: 31.358

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 3
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: ~~9374~~ 9408	Control Unit No.: 5	ΔH@ 1.82
Date: 7-6-93	Gas Meter Coefficient: 0.974	TM 82
Company: L.C. Kruse	Sample Box No.: 5	MC 40
Source: Scrubber Outlet	Probe No.: 75" Length: 75"	PS/PM 1.0
Source Dimensions: 59.6 05	Pitot No.: 67" Coefficient: 0.841 (A)	C —
Test Team: AT - BA	Nozzle No.: LC Diameter: 0.302	TS 180
Test Procedure: EPA 1-5	Filter No.: 8716	R —
Ambient Temp., °F: 70	Barometric Pressure, in.Hg: 28.25	Static Pressure, in.WC: 0.2

of heat line

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.
1735	1	0	925.404	0.13	0.41	0.41	3.5	195	78	78	237	233	70
—	2	2.5	926.3	0.17	0.53	0.53	6.0	196	79	78	234	233	68
1740	3	5	927.4	0.19	0.59	0.59	6.5	197	79	78	227	234	67
—	4	7.5	928.5	0.22	0.69	0.69	7.5	196	79	78	225	232	65
1745	5	10	929.7	0.25	0.78	0.78	8.5	196	80	78	236	231	65
—	6	12.5	931.0	0.28	0.87	0.87	10.5	196	80	78	237	233	66
1750	7	15	932.4	0.27	0.84	0.84	10.5	196	81	78	245	240	65
—	8	17.5	933.7	0.22	0.69	0.69	10.0	195	81	79	230	230	65
1755	9	20	934.9	0.19	0.59	0.59	8.5	195	81	79	223	231	64
—	10	22.5	936.1	0.18	0.56	0.56	8.0	194	81	79	230	235	64
1800	11	25	937.2	0.17	0.53	0.53	7.5	194	82	79	249	233	64
—	12	27.5	938.2	0.14	0.44	0.44	7.0	193	82	79	228	233	64
1805	End	30	939.280	—	—	—	—	—	—	—	—	—	—
1810	1	0	939.280	0.11	0.34	0.34	6.0	188	81	80	230	232	66
—	2	2.5	940.0	0.13	0.41	0.41	6.5	190	81	80	230	230	65
1815	3	5	941.0	0.14	0.44	0.44	6.5	196	81	80	234	231	64
—	4	7.5	941.9	0.17	0.53	0.53	8.0	197	82	80	231	233	69
1820	5	10	943.0	0.20	0.62	0.62	9.0	195	82	80	229	231	63
—	6	12.5	944.2	0.27	0.84	0.84	13.0	198	82	80	236	233	63
1825	7	15	945.5	0.31	0.97	0.97	17.0	196	82	80	244	233	64
—	8	17.5	946.9	0.30	0.94	0.94	17.0	195	82	80	240	234	65
1830	9	20	948.3	0.27	0.84	0.84	17.0	193	81	79	237	235	64
—	10	22.5	949.7	0.27	0.84	0.84	17.0	194	81	80	225	232	65
1835	11	25	951.0	0.21	0.66	0.66	14.0	193	81	80	237	241	65
—	12	27.5	952.2	0.12	0.37	0.37	8.0	192	81	80	225	239	66
1840	End	30	953.304	—	—	—	—	—	—	—	—	—	—

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	850.3	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1725	0.006	18
1842	0.001	19

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	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							CO_2	
Oxygen							O_2	
Carbon Monoxide							CO	

Total Sampling Time, min.: 60
Volume of Gas Sampled, DCF: 27.9

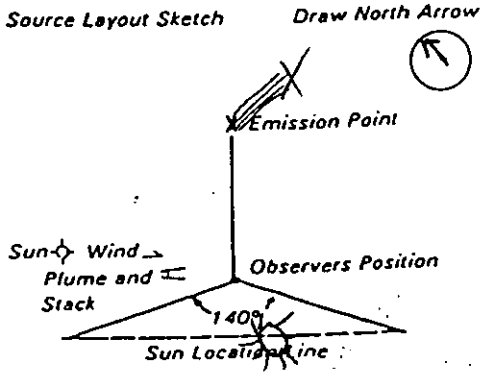
FORM: S-FD-5

Project # ~~9404~~ 9408 Test Run # 1

Visible Emission Observation Form

SOURCE NAME: L.C.-Kruse
ADDRESS:
CITY: Windom STATE: MN ZIP:
PHONE: SOURCE ID NUMBER:
PROCESS EQUIPMENT: Drum Dryer OPERATING MODE:
CONTROL EQUIPMENT: Wet Scrubber OPERATING MODE:
DESCRIBE EMISSION POINT: START STACK STOP ✓
HEIGHT ABOVE GROUND LEVEL: START 40' STOP ✓ HEIGHT RELATIVE TO OBSERVER: START 40' STOP ✓
DISTANCE FROM OBSERVER: START 100' STOP ✓ DIRECTION FROM OBSERVER: START NE STOP NE
DESCRIBE EMISSIONS: START White Plume STOP Plume
EMISSION COLOR: START white STOP ✓ 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 Drops STOP ✓
DESCRIBE BACKGROUND: START Sky. STOP ✓
BACKGROUND COLOR: START Blue STOP Blue SKY CONDITIONS: START clear STOP clear
WIND SPEED: START 25-30. STOP WIND DIRECTION: START NE STOP NE
AMBIENT TEMP.: START 75 STOP 77 WET BULB TEMP.: RH,percent:

Source Layout Sketch — Draw North Arrow



OBSERVATION DATE: 7.6.93 START TIME: 13:20 STOP TIME: 14:20

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	5	5	0	5	31	10	5	5	10
2	5	0	5	5	32	5	10	10	5
3	5	0	0	0	33	5	10	0	5
4	0	0	5	0	34	10	15	10	10
5	5	5	5	5	35	5	10	10	0
6	0	5	5	5	36	0	5	5	0
7	0	5	5	0	37	5	5	5	5
8	5	10	10	0	38	5	5	0	5
9	5	5	0	5	39	5	5	10	5
10	5	0	10	0	40	5	5	10	10
11	0	5	0	5	41	10	10	10	10
12	5	0	5	10	42	10	5	5	10
13	5	10	0	5	43	5	10	5	5
14	5	5	10	0	44	10	5	15	10
15	10	5	10	10	45	10	0	0	0
16	5	10	5	10	46	5	10	5	0
17	10	5	5	5	47	5	0	0	5
18	5	5	5	5	48	5	5	5	5
19	5	0	5	0	49	0	5	5	0
20	0	5	5	5	50	10	5	5	5
21	5	5	10	0	51	5	5	5	5
22	5	5	10	5	52	5	0	0	5
23	0	10	5	5	53	5	5	10	5
24	5	5	0	5	54	10	5	15	10
25	5	5	10	5	55	10	10	10	15
26	5	5	5	10	56	5	5	10	10
27	10	10	10	0	57	10	5	10	10
28	0	5	10	0	58	5	5	10	0
29	0	5	0	0	59	5	5	10	5
30	0	0	10	5	60	5	5	5	5

AVERAGE OPACITY FOR HIGHEST PERIOD:
NUMBER OF READINGS ABOVE % WERE:
RANGE OF OPACITY READINGS MINIMUM: MAXIMUM:
OBSERVER'S NAME (PRINT): B. Il Anderson
OBSERVER'S SIGNATURE: Bill Anderson DATE: 7-6-93
ORGANIZATION: MNT Environmental
CERTIFIED BY: ETA DATE: 4-5-93
VERIFIED BY: DATE:

COMMENTS:

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: 9374 COMPANY: L.C. KRUSE
TEST NUMBER: 2 SOURCE: SCRUBBER OUTLET

	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	0.1241	0.0000	0.6011	0.7252	0.0484	0.0495	0.0979	0.8231
2	0.0464	0.0000	0.0575	0.1039	0.0014	0.0090	0.0104	0.1143
3	0.1514	0.0000	0.6500	0.8014	0.0262	0.0469	0.0731	0.8745

* NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

LABORATORY REPORT: EPA Method 5

Project Number: ~~9314~~ 9408 Company: L.C. Kruse (Test # 2)

Frontwashes

Test-Run	1-1	1-2	1-3	Date
Dish #	0421	0424	0427	- - - - -
1	2.3805	2.3630	2.4449	7-8-93
2	2.3804	2.3629	2.4450	7-9-93
3	2.3805	2.3629	2.4450	7-12-93
Tare	2.2560	2.3164	2.2934	10-30-92
Blank	0.0001	0.0001	0.0001	- - - - -
Net	0.1241	0.0464	0.1514	- - - - -

Solvent Blanks

Solvents	Acetone	Chloroform	Ether	Date
Dish #	0418	0419	0420	- - - - -
1	2.2193	2.1947	2.1934	7-8-93
2	2.2193	2.1946	2.1934	7-9-93
3	2.2193	2.1946	2.1934	7-12-93
Tare	2.2193	2.1944	2.1932	10-30-92
Net	0.0001	0.0002	0.0002	- - - - -

Backwashes

Test-Run	1-1	1-2	1-3	Date
Dish #	0422	0425	0428	- - - - -
1	2.4309	2.3082	2.2797	7-8-93
2	2.4310	2.3081	2.2797	7-9-93
3	2.4307	2.3082	2.2799	7-12-93
Tare	2.3811	2.2990	2.2327	10-30-92
Blank	0.0001	0.0001	0.0001	- - - - -
Net	0.0495	0.0090	0.0469	- - - - -

Glass Filters

Test-Run	1-1	1-2	1-3	Date
Filter #	8714	8715/8717	8716	- - - - -
1	1.1073	1.0909	1.1701	7-8-93
2	1.1074	1.0906	1.1701	7-9-93
3	1.1073	1.0908	1.1700	7-12-93
Tare	0.5061	1.0333	0.5200	10-30-92
Net	0.6011	0.0575	0.6500	- - - - -

Extractions

Test-Run	1-1	1-2	1-3	Date
Dish #	0423	0426	0429	- - - - -
1	2.3050	2.3097	2.3194	7-8-93
2	2.3049	2.3098	2.3195	7-9-93
3	2.3048	2.3099	2.3193	7-12-93
Tare	2.2560	2.3079	2.2927	10-30-92
Blank	0.0004	0.0004	0.0004	- - - - -
Net	0.0484	0.0014	0.0262	- - - - -

COMMENTS

Lowest Final Weight
- Tare
- Blank(if applicable)

= Sample Net Gain (grams)

Signature Bill Anderson Date 7-12-93

Laboratory Report: Moisture Content of Aggregate Samples

Project Number 9408 Company L.C. Kruse (Test #2)

Test 1-1

Trial #	1	2	3	Date
Dish #	0430	0431	0432	—
Tare	2.2997	2.2784	2.2632	10-30-92
Tare + Wet	44.4509	44.6872	44.8049	7-12-93
Wet	42.1512	42.4088	42.5417	—
Dry	40.1082	40.2970	40.5863	—
Dry + Tare	42.4079	42.5754	42.8495	7-13-93
% Moisture	4.85	4.98	4.60	—

Test 1-2

Trial #	1	2	3	Date
Dish #	0433	0434	0435	—
Tare	2.1830	2.2569	2.2159	10-30-92
Tare + Wet	44.7369	44.7412	44.7900	7-12-93
Wet	42.5539	42.4843	42.5741	—
Dry	40.5464	40.5794	40.4886	—
Dry + Tare	42.7294	42.8363	42.7045	7-13-93
% Moisture	4.72	4.48	4.90	—

Test 1-3

Trial #	1	2	3	Date
Dish #	0436	0437	0438	—
Tare	2.1872	2.1961	2.2713	10-30-92
Tare + Wet	44.7747	44.7069	44.9335	7-12-93
Wet	42.5875	42.5108	42.6622	—
Dry	40.5525	40.4266	40.7172	—
Dry + Tare	42.7397	42.6227	42.9885	7-13-93
% Moisture	4.78	4.90	4.56	—

Summary

	Mean	Deviation	% Error	
Test 1-1	4.81	0.19	3.95	
1-2	4.70	0.21	4.47	
1-3	4.75	0.17	3.58	

Comments

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

100- % Solids = % Moisture

Signature Bill Anderson Date 7-13-93

ORSAT ANALYSIS

Job Number: ~~9394~~ 9408 Company: LC Kruse

SAMPLE DESCRIPTION		SAMPLE ANALYSIS						
		Replicate 1		Replicate 2		Replicate 3		
Stack Outlet	Parameter Measured	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	
Sample Id: 1-1	Initial Reading	0.0	/	0.0	/	0.0	/	
Collected By: BA	Carbon Dioxide	8.5	8.5	8.4	8.4	8.5	8.5	8.5
Date Collected: 7-6-93	Oxygen	8.9	17.4	9.1	17.5	8.9	17.4	9.0
Analyzed By: BA	Carbon Monoxide	Not Analyzed						
Date Analyzed: 7-6-93								
Sample Id: 1-2	Initial Reading	0.0	/	0.0	/	0.0	/	
Collected By: BA	Carbon Dioxide	8.7	8.7	8.4	8.4	8.5	8.5	8.5
Date Collected: 7-6-93	Oxygen	8.5	17.2	8.9	17.3	8.8	17.3	8.7
Analyzed By: BA	Carbon Monoxide							
Date Analyzed: 7-6-93								
Sample Id: 1-3	Initial Reading	0.0	/	0.0	/	0.0	/	
Collected By: BA	Carbon Dioxide	8.6	8.6	8.4	8.4	8.4	8.4	8.4
Dated Collected: 7-6-93	Oxygen	8.8	17.4	8.6	17.2	9.1	17.5	8.8
Analyzed By: BA	Carbon Monoxide							
Date Analyzed: 7-6-93								

PROJECT # 9408 COMPANY L.C. Ickes
TEST DATE(s) 7-6-93 SOURCE Outlet Scrubber

EPA METHOD 4 LABORATORY REPORT

TEST-RUN #	IMPINGER #	INITIAL	FINAL	GAIN	DESCRIPTION
1	1	100	330	230	
	2	100	335	235	
	3	0	37	37	cloudy
8714	4	811.8	829.9	18.1	
	5	—	—	—	
	TOTAL MOISTURE GAIN, ML =			510.1	
TEST-RUN #	1	100	230	130	
	2	100	170	70	
	3	0	0	0	cloudy
2	4	789.3	799.7	10.4	
	5	—	—	—	
	TOTAL MOISTURE GAIN, ML =			200.4	
TEST-RUN #	1	100	441	341	
	2	100	137	37	
	3	0	2	2	cloudy
3	4	850.3	867.9	17.6	
8716	5	—	—	—	
	TOTAL MOISTURE GAIN, ML =			397.6	

APPENDIX D: CALIBRATION DATA

CALIBRATION
DRY TEST METER/ORIFICE METER

Date: 7-8-93 Barometric Pressure, in. Hg. (Pb): 28.45

EQUIPMENT IDENTIFICATION			
Control Unit 5	Dry Test Meter	Wet Test Meter	Calibration Type
Mfg: mmt	Mfg: Rockwell	Mfg: GCA Corporation	General: X
Model: Universal	Model:	Model: Precision	Post-test: X
SN: 92-9093	SN: EEI-C89	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	5.691	75	6.149	13.059	83	84	80	80	14
1.0	0	5.691	14.202	75	13.059	20.964	84	91	80	80	15
2.0	0	14.202	24.594	75	20.964	31.865	88	95	80	82	13
3.0	0	Zero	9.735	75	44.571	54.828	80	84	80	80	10

COMPUTER PRINTOUT

H	Vw	Tw	Vd	Td	Q	C	Ha
0.5	5.691	75	5.910	81.5	14.0	0.9734	1.7821
1.0	8.511	75	8.905	83.8	15.0	0.9689	1.8218
2.0	10.392	75	10.901	86.3	13.0	0.9683	1.8273
3.0	9.735	75	10.257	81.0	10.0	0.9524	1.8661

AVERAGE CORRECTION FACTOR: C = 0.9657
AVERAGE ORIFICE CONSTANT: Ha = 1.8243

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

Average C = 0.9699

Calibration Performed by:

37 (Print) Bill Anderson

APPENDIX E: PROCESS DATA

Asphalt Plant Operating Conditions During Stack Testing

Rev/YH/93

Test Date(s) 7-6-93

Plant Mfr. & Model L. C. Kruse & Sons Windom, MN

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)
12:30	60	260	—	16.9	288	9	350	52 1/2
12:45	65	270	—	17.3	290	9	350	52
1:00	60	275		17.8	290	9	350	52
1:15	65	277		17:8	290	9	350	52
1:30	65	275	275.0	17:7	290	8 1/2	350	52
1:45	65	275		17:7	290	8 1/2	350	52
2:00	65	275	17.7	17:6	290	9	350	52
2:15	65	273		17:5	290	9	350	52
2:30	65	275		17.8	295	9	350	52
2:45	65	273		17.5	290	9	350	52
3:00	65	280		17.9	294	9	350	52
3:15	70	285		18.3	290	9	350	52
3:30	70	285		18.3	290	8 1/2	350	52

#1

Run 2

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: _____ Daniel D Schulte

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) 7-6-93

Plant Mfr. & Model L.C. Krause & Sons Windom, MN

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)
3:45	70	285	—	18.3	295	9	350	52
4:00	70	285	—	18.4	295	9	350	52
4:15	70	285		18.3	295	9	350	52
4:30	70	285		18.3	290	9	350	52
4:45	70	285		18.30	290	9	350	52
5:00	70	288		18.4	290	9	350	52
5:15	70	285		18.3	290	9	350	52
5:30	70	285		18.4	293	9	350	52
5:45	70	288		18.4	290	9	350	52
6:00	70	285		18.3	290	9	350	52
6:15	70	285		18.4	290	9	350	52
6:30	70	284		18.3	290	9	350	52

Run 2

Run 3

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: _____ Daniel D Schultz

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

July 7, 1993

Mr. Alan L. Trowbridge
MMT Environmental Services, Inc.
4610 North Churchill Street
St. Paul, Minnesota 55126-5892

Dear Mr. Trowbridge:

RE: June 30, 1993, Fax Notification Of Retest

The Air Quality Division (AQD) has received the retest notification submitted June 30, 1993, for the LC Kruse & Sons, Inc. asphalt plant.

The port locations submitted are acceptable. No pretest meeting is necessary since the retest shall follow the same testplan and protocol agreed to for the initial test.

The scheduled test date is July 6, 1993. Notify Mr. Steve Sommer, at the Marshall Regional Office, of where you will be located during the retest. Mr. Sommer may be reached at (507)537-7146.

Sincerely,

for Yolanda Hernandez
Compliance Determination Unit
Compliance and Enforcement Section
Air Quality Division

YH:mlp4757

cc: Mr. Darrin Kruse, L.C. Kruse & Sons, Inc.
Steve Sommer, Marshall Regional Office
Greg Siems, AQD
AQD File No. 323B

mmt environmental services, inc.

FACSIMILE TRANSMISSION

From: Alan L. Trowbridge MMT Environmental Services, Inc. Phone: 483-9595 Fax: 483-2699 Date: June 30, 1993	**To:** Ms. Yolanda Hernandez Compliance and Enforcement Section *Air Quality Division* Minnesota Pollution Control Agency Fax: 297-7709

Re: Intent-to-Test Notification - L.C. Kruse & Sons, Inc.

Dear Yolanda:

On June 9, 1993, MMT Environmental, Inc. (MMT) conducted a source emission compliance test on the portable hot-mix asphalt plant operated by L.C. Kruse & Sons, Inc. near Windom, Minnesota. The test results were not favorable and the plant would like to schedule a re-test for Tuesday, July 6, 1993.

Since the initial test, the plant has gone through the scrubbing system and has installed a new, lower velocity exhaust stack which is shown on the attached sketch. Except for the change in exhaust stack configuration, the test plan remains unchanged.

If you have any questions or comments, please call Darrin Kruse (507-662-5205) or myself (483-9595) as soon as possible.

Sincerely,

Alan L. Trowbridge

Alan L. Trowbridge
Director of Technical Services

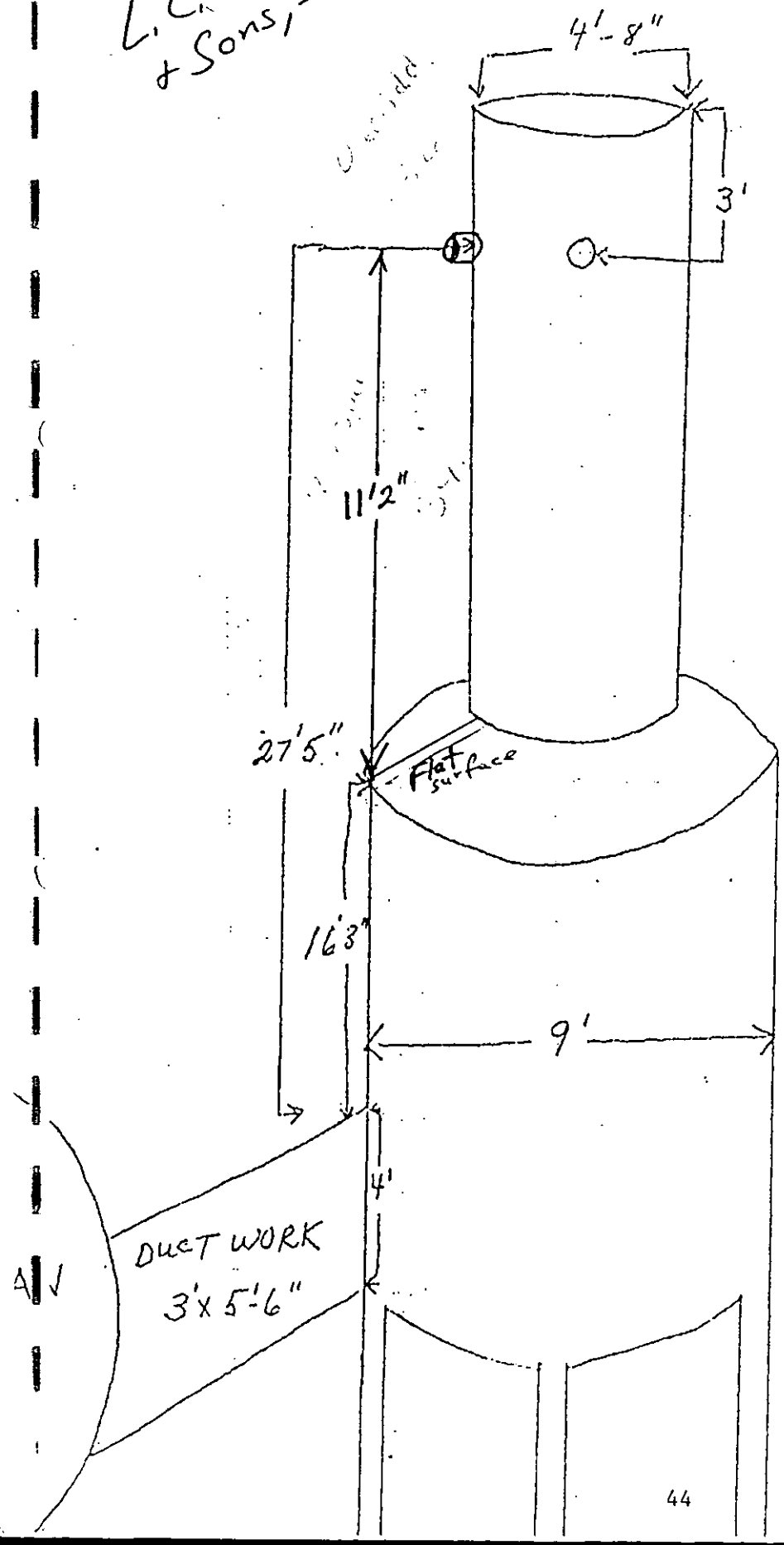
enclosure
cc: Darrin Kruse, L.C. Kruse & Sons, Inc.

Faxed to MPCA
4:29 PM 6/30/93

Faxed to L.C. Kruse
4:33 PM 6/30/93

4610 N. Churchill St. • St. Paul, MN 55126-5892 • 612 / 483-9595 • FAX 612 / 483-2699

L. C. Kruse & Sons, Inc.



Diameter = ~~56~~ 59.63"

Before Ports
11'2" = 134"
2.25 ~~2.39~~ diameters

After Ports
36"
0.60 ~~0.64~~ diameters

24 sampling points required

2 ports x 12 points

2.5 minutes/point

60 minutes/test run

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