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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
June 9, 1993

Submitted to:

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MMT Report Number: 9993
MMT Project Number: 9374
Report Issued: June 18, 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 June 9, 1993

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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 June 9, 1993. This report presents the results of the test program along with all substantiating documentation.

The MMT sampling team consisted of Messrs. Ted Gibbons and Bill Anderson. Mr. Daniel D. Schultz represented L.C. Kruse & Sons, Inc. 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 0.136 grains per dry standard cubic foot and an average source particulate emission rate of 30.54 pounds per hour.

The visible emission test was performed concurrent with the third particulate test run. The observed plume opacity ranged from five (5) to twenty (20) percent with an overall average of 9.5 percent.

The average process weight rate (aggregate + asphalt) during the test period was 285 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
June 9, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1159	1330	1500	---
Finish	1311	1442	1612	---
Effluent Temperature, °F	182	184	180	182
Effluent Moisture Content, % v/v	37.4	37.0	37.9	37.4
Effluent Composition, % v/v dry:				
Carbon Dioxide Content	6.5	7.5	7.0	7.0
Oxygen Content	11.4	10.0	10.5	10.6
Effluent Volumetric Flow Rate:				
Actual Conditions, acfm	53,377	53,352	53,724	53,484
Standard Conditions, scfm	41,149	41,048	41,663	41,287
Dry Standard Conditions, dscfm	25,768	25,856	25,868	25,831
Sampling Isokinetic Variation, %	103.0	101.8	102.8	102.5
Effluent Particulate Concentration:				
Front Catch Only;				
Actual Conditions, gr/acf	0.0633	0.0570	0.0589	0.0597
Standard Conditions, gr/scf	0.0821	0.0741	0.0760	0.0774
Dry Standard Conditions, gr/dscf	0.1310	0.1176	0.1224	0.1237
Back Catch Only;				
Actual Conditions, gr/acf	0.0058	0.0054	0.0069	0.0060
Standard Conditions, gr/scf	0.0075	0.0070	0.0089	0.0078
Dry Standard Conditions, gr/dscf	0.0120	0.0111	0.0143	0.0125
Total Catch;				
Actual Conditions, gr/acf	0.0691	0.0624	0.0658	0.0658
Standard Conditions, gr/scf	0.0896	0.0811	0.0849	0.0852
Dry Standard Conditions, gr/dscf	0.1431	0.1287	0.1367	0.1362
Source Particulate Emission Rate:				
Classical Method, lb/hr	31.62	28.55	30.33	30.17
Ratio of Areas Method, lb/hr	32.56	29.03	31.16	30.92
Average of the Two Methods, lb/hr	32.09	28.79	30.75	30.54

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 (per Darrin Kruse 6/16/93).

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, Windom, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
June 9, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1159	1330	1500	---
Finish	1311	1442	1612	---
Process Weight Rate;				
Aggregate Usage, ton/hr	267.5	267.8	266.0	267.1
Asphalt Usage, ton/hr	17.6	17.6	17.4	17.5
Total Process Weight Rate, ton/hr	285.1	285.4	283.4	284.6
Aggregate Moisture Content, %	6.0	5.6	5.6	5.7
Burner Setting, %	95	95	95	95
Product Mix Temperature, °F	270	268	268	269
Scrubber Operating Parameters;				
Pressure Drop, in WC	15	15	15	15
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, 1993. 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.

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
June 9, 1993

SAMPLING LOCATION DATA

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

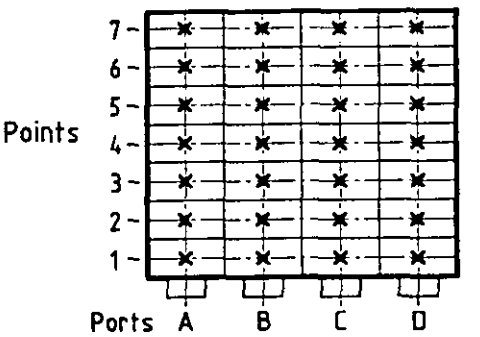
Length of straight, undisturbed flow;
- Before ports, inches..... 96.0
- After ports, inches 36.0
- Before ports, stack diameters..... 2.19
- After ports, stack diameters 0.82

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

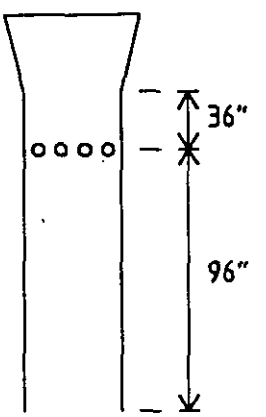
Particulate test sampling time;
- Minutes per point: 2.5
- Minutes per test run:..... 70.0

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.

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

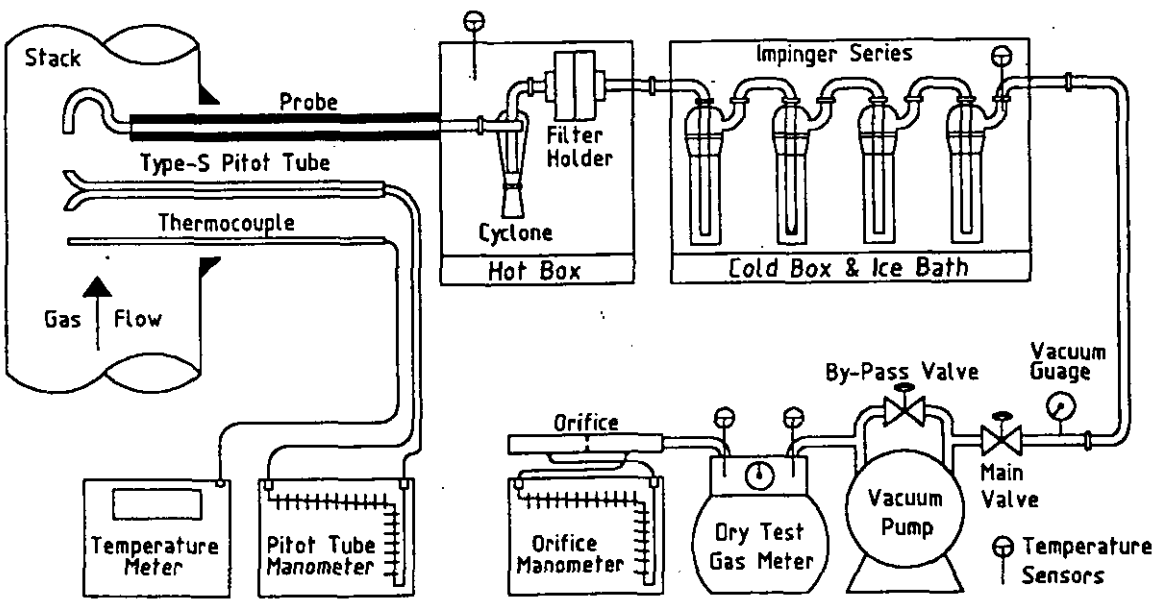
Sampling Train Manufacturer: ..... MMT Environmental Services, Inc.
Sampling Train Model: ..... Universal Stak Sampler

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 #L10, 0.243 inch diameter, stainless steel
Sampling Probe Used: .... MMT #72, 72 inch effective length with stainless steel liner
Pitot Tube Used: ..... MMT #60, S-type, 0.835 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

Generally, implementation of quality assurance procedures for source measurement is designed so the work is done:

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

Measuring devices, pitot tubes, dry gas meters, thermocouples and portable gas analyzers 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 samples analyzed. This program is based on the general guidelines given in "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" (EPA-600/4-79-019); March 1979 . This program suggests guidelines in the areas of:

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

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)
```

VOLUMETRIC FLOW RATE CALCULATION

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST DATE: 6-9-93 SOURCE: SCRUBBER OUTLET

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	165	TS
MOISTURE CONTENT DETERMINATION:		
EFFLUENT WET BULB TEMPERATURE, DEG F	158	TW
EFFLUENT DEW POINT TEMPERATURE, DEG F	158	TD
EFFLUENT RELATIVE HUMIDITY, %	84.9	RH
EFFLUENT MOISTURE CONTENT, % V/V	32.5	MC
DUCT PRESSURES;		
BAROMETRIC PRESSURE, IN HG	28.12	PB
STATIC PRESSURE, IN WC	-0.90	PS
ABSOLUTE PRESSURE, IN WC	28.05	PA
EFFLUENT COMPOSITION;		
CARBON DIOXIDE CONTENT, % V/V DRY	7.0	CD
OXYGEN CONTENT, % V/V DRY	10.5	OX
EFFLUENT MOLECULAR WEIGHT;		
DRY BASIS, LB/LB-MOLE	29.54	MD
WET BASIS, LB/LB-MOLE	25.78	MS
PITOT TUBE COEFFICIENT	0.835	CP

EFFLUENT VELOCITY PRESSURES, IN WC;

POINT	PORT A	PORT B	PORT C	PORT D
1	0.460	0.550	0.580	0.610
2	0.850	0.790	0.990	0.880
3	0.870	1.150	1.300	1.150
4	1.000	1.300	1.300	0.950
5	1.100	1.200	1.200	0.950
6	1.100	1.200	1.100	1.050
7	1.100	1.150	1.050	1.050

AVE. SQUARE-ROOT VELOCITY PRESSURE, IN WC	0.99	PV
EFFLUENT AVERAGE VELOCITY, FT/SEC	65.828	VS
EFFLUENT VOLUMETRIC FLOW RATE;		
ACTUAL, ACFM	52855	FA
STANDARD, SCFM	41874	FW
DRY STANDARD, DSCFM	28248	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

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 1 TIME: 6/ 9/93 1159-1311

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	0.460	0.780	169	81	83	0.678	45.67
A	2	0.780	1.320	174	82	82	0.883	59.71
A	3	1.050	1.770	179	83	81	1.025	69.54
A	4	0.960	1.620	184	84	81	0.980	66.76
A	5	0.850	1.240	185	84	81	0.922	62.87
A	6	1.050	1.530	188	86	82	1.025	70.03
A	7	1.200	1.750	187	85	83	1.095	74.81
B	1	1.350	1.970	179	85	83	1.162	78.86
B	2	1.050	1.530	180	85	83	1.025	69.60
B	3	0.950	1.390	184	85	83	0.975	66.41
B	4	0.970	1.420	181	85	83	0.985	66.95
B	5	0.810	1.180	186	85	83	0.900	61.42
B	6	0.700	1.020	185	85	83	0.837	57.05
B	7	0.750	1.090	188	85	83	0.866	59.19
C	1	0.610	0.890	182	86	84	0.781	53.13
C	2	1.000	1.460	184	87	84	1.000	68.13
C	3	1.250	1.830	181	87	85	1.118	76.00
C	4	1.300	1.900	183	86	85	1.140	77.62
C	5	1.150	1.680	185	86	85	1.072	73.12
C	6	1.100	1.610	187	86	85	1.049	71.63
C	7	1.000	1.460	182	86	85	1.000	68.03
D	1	0.590	0.860	184	85	84	0.768	52.33
D	2	0.840	1.230	171	86	85	0.917	61.81
D	3	1.200	1.750	165	85	85	1.095	73.53
D	4	1.150	1.680	186	85	85	1.072	73.18
D	5	1.050	1.530	188	85	85	1.025	70.03
D	6	1.000	1.460	187	85	85	1.000	68.29
D	7	0.930	1.360	187	84	85	0.964	65.86
AVERAGE		0.968	1.440	182	85	84	0.977	66.48

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 1 TIME: 6/ 9/93 1159-1311

TEST DATA

GAS METER COEFFICIENT	0.9816	Y	VOLUME OF LIQUID COLLECTED, ML	566.8	Vl
PITOT TUBE COEFFICIENT	0.835	Cp			
NOZZLE DIMENSIONS;			GAS COMPOSITION, % V/V DRY;		
DIAMETER, IN	0.243	Dn	CARBON DIOXIDE	6.50	CD
AREA, SF	0.000322	An	OXYGEN	11.40	OX
			CARBON MONOXIDE	0.00	CM
			NITROGEN (BY DIFFERENCE)	82.10	NI
STACK DIMENSIONS;					
DIAMETER/LENGTH, IN	47.00	Sl	AVE. TRAVERSE POINT DATA;		
WIDTH, IN	41.00	Sw	STACK TEMP., DEG F	182	Ts
AREA, SF	13.382	As	METER TEMP., DEG F	84	Tm
			ORIFICE PRESSURE, IN WC	1.440	Po
BAROMETRIC PRESSURE, IN HG	28.12	Pb	SQRT VELOCITY P., IN WC	0.977	Pv
STACK PRESSURES;			MASS OF PARTICULATE MATTER		
STATIC, IN WC	-0.91	Pg	COLLECTED, G;		
ABSOLUTE, IN HG	28.05	Ps	FRONT CATCH (91.6%)	0.3798	Wf
			BACK CATCH (8.4%)	0.0349	Wb
SAMPLING TIME, MIN	70.00	Ti	TOTAL CATCH	0.4147	Wt
VOLUME OF GAS SAMPLED AT METER, DCF	49.756	Vm			

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	44.696	Vms	GAS MOLECULAR WEIGHT;		
			DRY BASIS, LB/LB-MOLE	29.50	Md
			WET BASIS, LB/LB-MOLE	25.20	Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	26.679	Vw	AVERAGE GAS VELOCITY, FPS	66.48	Vs
GAS MOISTURE CONTENT;			GAS VOLUMETRIC FLOW RATE;		
VOLUME FRACTION	0.3738	Bws	ACTUAL, ACFM	53377	Qa
PERCENT BY VOLUME	37.38	Bwp	STANDARD, SCFM	41149	Qs
			DRY STANDARD, DSCFM	25768	Qsd
			ISOKINETIC VARIATION, %	103.02	I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0633 Caf	0.0058 Cab	0.0691 Cat
STANDARD, GR/SCF	0.0821 Csf	0.0075 Csb	0.0896 Cst
DRY STANDARD, GR/DSCF	0.1310 Csf	0.0120 Csb	0.1431 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	28.96 Rcf	2.66 Rcb	31.62 Rct
RATIO OF AREAS METHOD	29.82 Rrf	2.74 Rrb	32.56 Rrt

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

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 2 TIME: 6/ 9/93 1330-1442

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	0.520	0.760	180	85	85	0.721	48.84
A	2	0.810	1.190	184	85	85	0.900	61.15
A	3	0.940	1.380	183	85	85	0.970	65.82
A	4	0.980	1.440	184	85	85	0.990	67.26
A	5	1.050	1.540	185	85	85	1.025	69.67
A	6	1.050	1.540	182	85	85	1.025	69.51
A	7	1.200	1.760	181	85	85	1.095	74.25
B	1	0.540	0.790	182	85	85	0.735	49.85
B	2	0.690	1.010	183	85	86	0.831	56.39
B	3	0.940	1.380	181	86	86	0.970	65.72
B	4	1.200	1.760	187	85	85	1.095	74.60
B	5	1.350	1.980	185	85	85	1.162	79.00
B	6	1.300	1.910	186	86	86	1.140	77.59
B	7	1.250	1.840	186	87	86	1.118	76.08
C	1	0.600	0.880	185	87	86	0.775	52.67
C	2	0.810	1.190	184	86	86	0.900	61.15
C	3	1.000	1.470	186	86	86	1.000	68.05
C	4	1.050	1.540	185	86	86	1.025	69.67
C	5	1.200	1.760	185	86	86	1.095	74.49
C	6	1.200	1.760	186	86	86	1.095	74.54
C	7	1.100	1.620	184	86	86	1.049	71.26
D	1	0.490	0.720	186	86	86	0.700	47.63
D	2	0.740	1.080	187	86	86	0.860	58.58
D	3	0.960	1.410	185	86	86	0.980	66.62
D	4	1.050	1.540	186	86	86	1.025	69.73
D	5	1.100	1.620	188	86	86	1.049	71.48
D	6	1.100	1.620	181	86	86	1.049	71.09
D	7	1.000	1.470	184	86	86	1.000	67.94
AVERAGE		0.972	1.427	184	86	86	0.978	66.45

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 2 TIME: 6/ 9/93 1330-1442

TEST DATA

GAS METER COEFFICIENT	0.9816 Y	VOLUME OF LIQUID COLLECTED, ML	553.0 Vl
PITOT TUBE COEFFICIENT	0.835 Cp		
NOZZLE DIMENSIONS;		GAS COMPOSITION, % V/V DRY;	
DIAMETER, IN	0.243 Dn	CARBON DIOXIDE	7.50 CD
AREA, SF	0.000322 An	OXYGEN	10.00 OX
		CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	82.50 NI
STACK DIMENSIONS;			
DIAMETER/LENGTH, IN	47.00 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	41.00 Sw	STACK TEMP., DEG F	184 Ts
AREA, SF	13.382 As	METER TEMP., DEG F	86 Tm
		ORIFICE PRESSURE, IN WC	1.427 Po
BAROMETRIC PRESSURE, IN HG	28.16 Pb	SQRT VELOCITY P., IN WC	0.978 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	-0.94 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.09 Ps	FRONT CATCH (91.4%)	0.3379 Wf
		BACK CATCH (8.6%)	0.0319 Wb
SAMPLING TIME, MIN	70.00 Ti	TOTAL CATCH	0.3698 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	49.375 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	44.304 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.60 Md
		WET BASIS, LB/LB-MOLE	25.31 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	26.030 Vw	AVERAGE GAS VELOCITY, FPS	66.45 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.3701 Bws	ACTUAL, ACFM	53352 Qa
PERCENT BY VOLUME	37.01 Bwp	STANDARD, SCFM	41048 Qs
		DRY STANDARD, DSCFM	25856 Qsd
		ISOKINETIC VARIATION, %	101.77 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0570 Caf	0.0054 Cab	0.0624 Cat
STANDARD, GR/SCF	0.0741 Csf	0.0070 Csb	0.0811 Cst
DRY STANDARD, GR/DSCF	0.1176 Csf	0.0111 Csb	0.1287 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	26.08 Rcf	2.46 Rcb	28.55 Rct
RATIO OF AREAS METHOD	26.53 Rrf	2.50 Rrb	29.03 Rrt

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

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 3 TIME: 6/ 9/93 1500-1612

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	0.550	0.810	187	87	87	0.742	50.63
A	2	0.760	1.120	183	87	87	0.872	59.33
A	3	0.920	1.350	180	87	87	0.959	65.12
A	4	0.970	1.430	178	87	86	0.985	66.77
A	5	0.980	1.440	181	87	86	0.990	67.27
A	6	1.200	1.760	177	87	86	1.095	74.20
A	7	1.200	1.760	176	86	86	1.095	74.14
B	1	0.480	0.710	178	86	85	0.693	46.97
B	2	0.840	1.230	177	86	85	0.917	62.08
B	3	1.100	1.620	179	86	85	1.049	71.15
B	4	1.200	1.760	180	86	85	1.095	74.38
B	5	1.300	1.910	181	86	85	1.140	77.47
B	6	1.200	1.760	183	86	85	1.095	74.55
B	7	1.150	1.690	185	86	85	1.072	73.09
C	1	0.650	0.960	184	85	85	0.806	54.91
C	2	0.860	1.260	186	85	85	0.927	63.26
C	3	1.100	1.620	186	85	85	1.049	71.54
C	4	1.300	1.910	185	86	85	1.140	77.72
C	5	1.250	1.840	188	86	85	1.118	76.38
C	6	1.100	1.620	193	85	85	1.049	71.93
C	7	1.050	1.540	189	85	85	1.025	70.06
D	1	0.610	0.900	182	85	85	0.781	53.11
D	2	0.820	1.210	177	85	85	0.906	61.34
D	3	1.050	1.540	174	85	84	1.025	69.25
D	4	1.000	1.470	171	85	84	1.000	67.42
D	5	1.000	1.470	170	85	84	1.000	67.36
D	6	0.990	1.460	162	85	84	0.995	66.60
D	7	0.960	1.410	160	85	84	0.980	65.48
AVERAGE		0.985	1.449	180	86	85	0.986	66.91

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST NUMBER: 1 SOURCE: SCRUBBER OUTLET
RUN NUMBER: 3 TIME: 6/ 9/93 1500-1612

TEST DATA

GAS METER COEFFICIENT	0.9816 Y	VOLUME OF LIQUID COLLECTED, ML	580.9 Vl
PITOT TUBE COEFFICIENT	0.835 Cp	GAS COMPOSITION, % V/V DRY;	
NOZZLE DIMENSIONS;		CARBON DIOXIDE	7.00 CD
DIAMETER, IN	0.243 Dn	OXYGEN	10.50 OX
AREA, SF	0.000322 An	CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	82.50 NI
STACK DIMENSIONS;			
DIAMETER/LENGTH, IN	47.00 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	41.00 Sw	STACK TEMP., DEG F	180 Ts
AREA, SF	13.382 As	METER TEMP., DEG F	85 Tm
		ORIFICE PRESSURE, IN WC	1.449 Po
BAROMETRIC PRESSURE, IN HG	28.18 Pb	SQRT VELOCITY P., IN WC	0.986 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	-0.92 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.11 Ps	FRONT CATCH (89.5%)	0.3554 Wf
		BACK CATCH (10.5%)	0.0415 Wb
SAMPLING TIME, MIN	70.00 Ti	TOTAL CATCH	0.3969 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	49.851 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	44.780 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.54 Md
		WET BASIS, LB/LB-MOLE	25.16 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	27.343 Vw	AVERAGE GAS VELOCITY, FPS	66.91 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.3791 Bws	ACTUAL, ACFM	53724 Qa
PERCENT BY VOLUME	37.91 Bwp	STANDARD, SCFM	41663 Qs
		DRY STANDARD, DSCFM	25868 Qsd
		ISOKINETIC VARIATION, %	102.81 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0589 Caf	0.0069 Cab	0.0658 Cat
STANDARD, GR/SCF	0.0760 Cwf	0.0089 Cwb	0.0849 Cwt
DRY STANDARD, GR/DSCF	0.1224 Csf	0.0143 Csb	0.1367 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	27.16 Rcf	3.17 Rcb	30.33 Rct
RATIO OF AREAS METHOD	27.90 Rrf	3.26 Rrb	31.16 Rrt

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

TABLE ANALYSIS OF VISIBLE EMISSION TEST DATA

PROJECT NUMBER: 9374
DATE TESTED: 6-9-93
TIME OF TEST: 1500

COMPANY: L.C. KRUISE
SOURCE: SCRUBBER OUTLET
OBSERVER: MR. BILL ANDERSON
RE-CERTIFICATION DATE: 10-1-93

Test-Run # 1-3

PLUME OPACITY OBSERVATIONS

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

SUMMARY OF TEST DATA

PLUME OPACITY %	PERCENT OF TIME AT OPACITY	PERCENT OF TIME OPACITY EXCEEDED
0	0.00	100.00
5	32.08	67.92
10	46.67	21.25
15	19.58	1.67
20	1.67	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, %: 20
MINIMUM OBSERVED OPACITY, %: 5
ARITHMETIC MEAN OPACITY, %: 9.5

SIX-MINUTE AVERAGE OPACITY, %

MAXIMUM:	11.7 (25:00-30:45)
2nd LARGEST:	11.3 (46:00-51:45)
3rd LARGEST:	10.6 (36:15-42:00)
4th LARGEST:	9.8 (54:00-59:45)
5th LARGEST:	9.4 (19:00-24:45)

APPENDIX B: FIELD DATA FORMS

SOURCE EMISSION TEST
SITE DESCRIPTION DATA SHEET

TRAVERSE POINT LOCATION		
Traverse Point Number	Port Length: Inches From Wall	Inches From Port
1	3.36	
2	10,07	
3	16,78	
4	23,49	
5	30,20	
6	36,91	
7	43,62	
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

PRELIMINARY TRAVERSE DATA	
Effluent Temperature, °F:	
Ave. Velocity Pressure, IN WC:	

MMT Job Number: 9374 Date: June 1993

Company: L.C. Kruse + Sons

Address: Windom, MN

Source: Aggregate Dryer - Wet Scrubber

Source Cross-sectional Dimensions

Round Duct; diameter: NA

Rectangular Duct;

Length: 41" 47".

Width: 47" 41"

Equivalent diameter: 43.80" = 3.65'

$D_e = 2LW/(L+W)$

Distance to Nearest Flow Disturbance;

Before Ports: ~~8'~~ 8' = 2.19 diameters

After Ports: ~~3'~~ 3' = 0.82 diameters

Number of Sampling Points;

Required by EPA Method 1: 24-25

Actually Used: ~~24~~ 28

Number of ports: 4

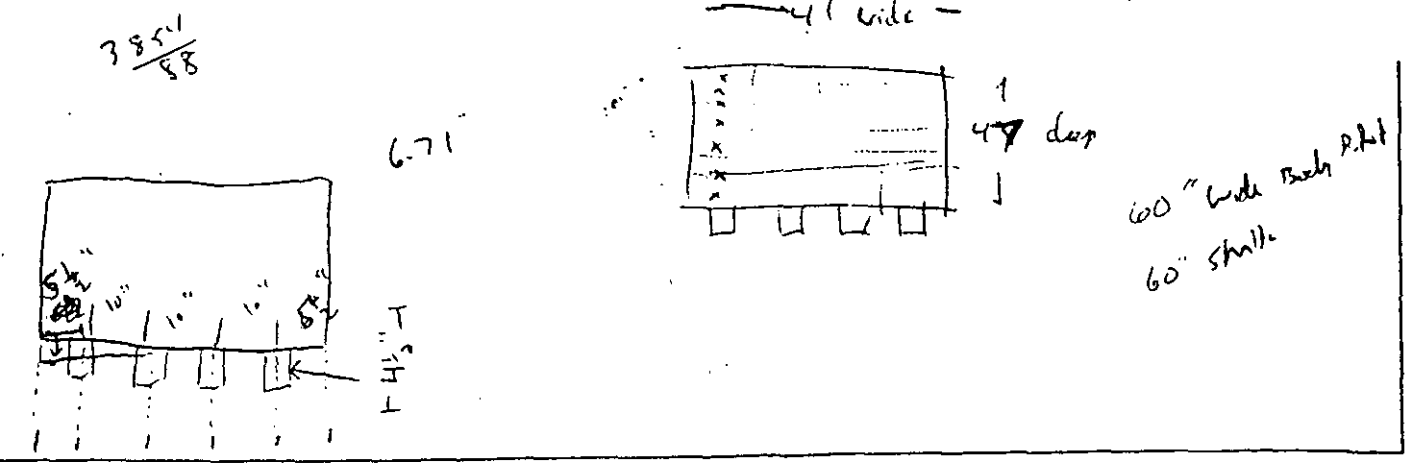
Points per port: 7

Sampling Time;

Minutes per Point: 2.5

Minutes per Test Run: 70

SITE SKETCH AND COMMENTS



FORM: S-FD-1c

EPA METHOD 2: VOLUMETRIC FLOW RATE DETERMINATION

Field Data Sheet

MMT Job Number: 9374 | Ambient Temperature, °F: 73

Date: 6.9.93 Wed. | Barometric Pressure, in. Hg.: 28.12

Company: L.C. Kruise + Sons | Static Pressure, in. WC: -0.90

Source: Scrubber Outlet | Dry Bulb Temp., °F: 165

Dimensions, inches: 47 x 41" | Wet Bulb Temp., °F: 158

Test Team Members: Bill + Ted | Relative Humidity, %:

Test No.: 0 | Run No.: Preliminary | Moisture Content, %: 31 ?. -32.41

VELOCITY TRAVERSE: Time: 1131 | Pitot Tube No: 60" | Coefficient: A = ~~.887~~ .835

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	3.36		.46	.55	.58	.61				
2	10.07		.95	.79	.99	.88				
3	16.78		.87	1.15	1.3	1.15				
4	23.49		~~1.0~~ 1.0	1.3	1.3	.95				
5	30.20		1.1	1.2	1.2	.95				
6	36.91		1.1	1.2	1.1	1.05				
7	43.62		1.1	1.15	1.05	1.05				
			P.t A	B	C	D				

$\bar{x}$ $\sqrt{p}$ in C = .999 ~ 1.0"

min $\sqrt{p}$ = .46

Max $\sqrt{p}$ = 1.3

Ideal Nozzle Dia., in = .239

Actual Nozzle = .243 "& Dia.

Nozzle ID: L/O

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: 9374	Control Unit No.: 5	ΔH@ 1.83
Date: Wed 6953	Gas Meter Coefficient: .983	TM 90
Company: L.C. Kruise + Sons	Sample Box No.: 5	MC 32-36
Source: Aggregate Dryer	Probe No.: 72 Length: 72 inches	PS/PM ≈ 1.0
Source Dimensions:	Pitot No.: 600 Coefficient: A = .847	C = .983
Test Team: Bill - Ted	Nozzle No.: L10 Diameter: .243 .835	TS 165
Test Procedure: EPA Methods 1-5	Filter No.: 8705	R
Ambient Temp., °F: 74	Barometric Pressure, in.Hg: 28.12	Static Pressure, in.WC: -.91

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.
1159	1	0	474.756	.46	.78	.78	7	169	81	83	241	247	78
	2		476.1	.78	1.32	1.32	10	174	82	82	240	249	68
1204	3	5	477.8	1.05	1.77	1.77	12	179	83	81	237	252	66
	4		479.8	.96	1.62	1.62	11	184	84	81	244	253	60
1209	5	10	481.7	.85	1.24	1.24	11	185	84	81	249	252	59
	6		483.4	1.05	1.53	1.53	12	188	86	82	251	251	59
1214	7	15	485.2	1.2	1.75	1.75	12	187	85	83	252	250	59
1216.5	End	17.5	487.2										
1217	1	~~17.5~~	X	1.35	1.97	1.97	14	179	85	83	251	248	60
	2	20	489.3	1.05	1.57	1.57	13	180	85	83	253	248	60
1222	3		491.1	.95	1.39	1.39	13	184	85	83	254	251	59
	4	25	492.9	.97	1.42	1.42	13	181	85	83	252	250	60
1227	5		494.6	.81	1.18	1.18	12	186	85	83	249	250	61
	6	30	496.1	.70	1.02	1.02	11	185	85	83	248	248	61
1232	7		497.8	.75	1.09	1.09	10	188	85	83	247	249	60
1234.5	End	35	499.3										
1235	1	~~35~~	X	.61	.89	.89	11	182	86	84	249	249	60
	2		500.7	1.0	1.46	1.46	14	184	87	84	248	252	60
1240	3	40	502.5	1.25	1.83	1.83	16	181	87	85	249	256	61
	4		504.5	1.3	1.90	1.90	16	183	86	85	251	258	61
1245	5	45	506.6	1.15	1.68	1.68	15	185	86	85	250	255	61
	6		508.5	1.1	1.61	1.61	15	187	86	85	252	254	60
1250	7	50	510.4	1.0	1.46	1.46	14	182	86	85	251	251	60
1252.5	End	55	512.2										
		Continue											

@ 1204 Dry 185 Wet 163

MOISTURE DETERMINATION

IMPINGER	1	2	3	4	5
Final					Not
Initial	100	100	0	876.5	Applied
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS

Time	Rate (cfm)	Vac. (in.Hg)
1151	.011	26"
1315	.014	27"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS

Sample Id: 1-1	Replicate 1 Buret Reading	Replicate 1 Percent Volume	Replicate 2 Buret Reading	Replicate 2 Percent Volume	Replicate 3 Buret Reading	Replicate 3 Percent Volume	Average Compound	Average Percent Volume
Initial Reading								
Carbon Dioxide		See	Orsat	Form			CO2	
Oxygen							O2	
Carbon Monoxide							CO	

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

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST:	RUN: 1
Page	of

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: ~~89374~~	Control Unit No.: 5	ΔH@ 1.83
Date: Wed 6-9-93	Gas Meter Coefficient: .983	TM 85
Company: L. C. Kruise + Sons	Sample Box No.: 5	MC 56
Source: Scrubber outlet	Probe No.: 72 Length: 72 inches	PS/PM = 1.0
Source Dimensions: 72 .41	Pitot No.: 60 Coefficient: A ~~.8??~~	C .983
Test Team: Bill + Ted	Nozzle No.: L10 Diameter: .243 .835	TS 185
Test Procedure: EPA 1-5	Filter No.: 8708	R
Ambient Temp., °F:	Barometric Pressure, in.Hg:	Static Pressure, in.WC:

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.
1253	1	52.5	X	.59	.86	.86	9	184	85	84	248	255	60
	2	55	513.6	.84	1.23	1.23	11	171	86	85	250	251	62
1258	3		515.2	1.2	1.75	1.75	15	165	85	85	251	252	62
	4	60	517.2	1.15	1.68	1.68	15	186	85	85	250	253	62
1303	5		519.1	1.05	1.53	1.53	14	188	85	85	252	254	63
	6	65	520.9	1.0	1.46	1.46	13	187	85	85	250	255	64
1308	7		522.8	.93	1.36	1.36	12	187	84	85	249	254	64
1310.5	End	70	524.512										

DCF = 49.756

Time = 70 minutes

MOISTURE DETERMINATION						SYSTEM LEAK CHECKS		
IMPINGER	1	2	3	4	5	Time	Rate (cfm)	Vac. (in.Hg)
Final								
Initial	100	100	0	876.5	X			
Difference								
Total Moisture Collected:								

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	
Oxygen							O2	
Carbon Monoxide							CO	

Total Sampling Time, min.: _____

Volume of Gas Sampled, DCF: _____

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:- 9374	Control Unit No.: 5	ΔH@ 1.83
Date: Wed 6-7-93	Gas Meter Coefficient: .983	TM 85
Company: L.C. Knisley & Sons	Sample Box No.: 5	MC 36
Source: Scrubber outlet	Probe No.: ~~72~~ 60 Length: ~~72~~ 72"	PS/PM=1.0
Source Dimensions: 42 x 41"	Pitot No.: 60 Coefficient: ~~A=.841~~ .835	C .983
Test Team: Bill & Ted	Nozzle No.: C10 Diameter: .243	TS 183
Test Procedure: EPA 1-5	Filter No.: 8709	R
Ambient Temp., °F: 77	Barometric Pressure, in.Hg: 29.16	Static Pressure, in.WC: -.94

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.
1330	1	0	525.521	.52	.76	.76	7	180	85	85	249	234	78
	2		526.8	.81	1.19	1.19	13	184	85	85	251	242	66
1335	3	5	528.4	.94	1.38	1.38	14	183	85	85	250	247	62
	4		530.2	.98	1.44	1.44	15	184	85	85	249	249	60
1340	5	10	531.9	1.05	1.54	1.54	15	185	85	85	250	251	60
1342.5	6		533.8	1.05	1.54	1.54	15	182	85	85	248	250	58
1345	7	15	535.7	1.2	1.76	1.76	16	181	85	85	247	249	57
1347.5	End	17.5	537.7										
1348	1	17.5	X	.54	.79	.79	8	182	85	85	249	251	58
	2	20	539.0	.69	1.01	1.01	9	183	85	86	251	252	58
1353	3		540.4	.94	1.38	1.38	14	181	86	86	250	251	59
	4	25	542.2	1.2	1.76	1.76	16	187	85	85	254	250	60
1358	5		544.2	1.35	1.98	1.98	17	185	85	85	256	250	60
	6	30	546.3	1.30	1.91	1.91	17	186	86	86	257	248	60
1403	7		548.3	1.25	1.84	1.84	17	186	87	86	258	247	60
1405.5	End	35	550.4										
1406	1	35	X	.60	.88	.88	7	185	87	86	251	249	57
	2		551.8	.81	1.19	1.19	11	184	86	86	250	251	56
1411	3	40	553.4	1.0	1.47	1.47	14	186	86	86	256	252	55
	4		555.2	1.05	1.54	1.54	15	185	86	86	254	251	56
1416	5	45	557.1	1.2	1.76	1.76	16	185	86	86	248	250	58
	6		559.0	1.2	1.76	1.76	16	186	86	86	248	250	60
1421	7	50	560.9	1.1	1.62	1.62	15	184	86	86	247	251	62
1423.5	End	52.5	562.9										
			Continued										

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	576.4	X
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1326	.009	26"
1445	.012	27"

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		All Orsat Form					CO2	
Oxygen							O2	
Carbon Monoxide							CO	

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

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: 9374	Control Unit No.: 5	ΔH@ 1.83
Date: Wed 6-9-93	Gas Meter Coefficient: .983	TM
Company: L.C. Ervice & Sons	Sample Box No.: 5	MC
Source: Scrubber Outlet	Probe No.: ~~B-72~~ Length: ~~72~~" 72"	PS/PM = 1.0
Source Dimensions: 47 x 41	Pitot No.: 60 Coefficient: A = ~~.844~~	C = .987
Test Team: Bill & Ted	Nozzle No.: C10 Diameter: .243 .835	TS
Test Procedure: EPA 1-5	Filter No.: 8709	R
Ambient Temp., °F: 74	Barometric Pressure, in.Hg: 28.16	Static Pressure, in.WC: -.94

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.
1424	1	52.5	X	.49	.72	.72	8	186	86	86	248	251	62
	2	55	564.1	.74	1.08	1.08	10	187	86	86	247	255	61
1429	3		565.7	.96	1.41	1.41	14	185	86	86	245	256	61
	4	60	567.5	1.05	1.54	1.54	15	186	86	86	249	255	61
1434	5		569.3	1.1	1.62	1.62	15	188	86	86	251	254	62
	6	65	571.2	1.1	1.62	1.62	15	181	86	86	252	255	62
1439	7		573.1	1.0	1.47	1.47	14	184	86	86	254	258	63
1441.5	End	70	574.896										

DCF = 49.375

Time = 70 minutes

MOISTURE DETERMINATION						SYSTEM LEAK CHECKS		
IMPINGER	1	2	3	4	5	Time	Rate (cfm)	Vac. (in.Hg)
Final								
Initial	100	100	0	876.4	X		See page 1 of 2	
Difference								
Total Moisture Collected:								

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			CO2	
Oxygen							O2	
Carbon Monoxide							CO	

Total Sampling Time, min.: _____

Volume of Gas Sampled, DCF: _____

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: 9374	Control Unit No.: 5	ΔH@ 1.83
Date: Wed 6.9.93	Gas Meter Coefficient: .983	TM 87
Company: L.C. Kruse + Sons	Sample Box No.: 5	MC 367.
Source: Scrubber Outlet	Probe No.: ~~A972~~ Length: ~~24~~ 72"	PS/PM = 1.0
Source Dimensions: 47" x 41" Width	Pitot No.: 600 Coefficient: A = .841	C .983
Test Team: Bill + Ted	Nozzle No.: L10 Diameter: .243 .235	TS 185
Test Procedure: EPA 1-5	Filter No.: 8710	R
Ambient Temp., °F: 77	Barometric Pressure, in.Hg: 28.18	Static Pressure, in.WC: -.92

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.
1500	~~1~~	0	575.990	.55	.81	.81	8	187	87	87	241	238	77
	2		577.3	.76	1.12	1.12	9	183	87	87	244	241	69
1505	3	5	578.9	.92	1.35	1.35	11	180	87	87	251	244	65
	4		580.6	.97	1.43	1.43	14	179	87	86	255	246	63
1510	5	10	582.4	.98	1.44	1.44	14	181	87	86	256	247	61
	6		584.2	1.2	1.76	1.76	15	177	87	86	255	250	60
1516	7	15	586.2	1.2	1.76	1.76	15	176	86	86	254	252	60
1517.5	End	17.5	588.2										
1518	1	17.5	X	.48	.71	.71	8	178	86	85	253	251	61
	2	20	589.4	.84	1.23	1.23	11	177	86	85	251	250	61
1523	3		591.1	1.1	1.62	1.62	15	179	86	85	252	254	62
	4	25	593.0	1.2	1.76	1.76	15	180	86	85	250	255	63
1528	5		594.9	1.3	1.91	1.91	16	181	86	85	249	254	63
	6	30	597.0	1.2	1.76	1.76	15	183	86	85	250	252	64
1533	7		578.9	1.15	1.69	1.69	15	185	86	85	251	251	64
1535.5	End	35	600.9										
1536	1	35	X	.65	.96	.76	7	184	85	85	252	253	65
	2		602.4	.86	1.26	1.26	12	186	85	85	251	253	63
1541	3	40	604.1	1.1	1.62	1.62	14	186	85	85	250	251	62
	4		605.9	1.3	1.91	1.91	16	185	86	85	250	250	62
1546	5	45	608.0	1.25	1.84	1.84	15	188	86	85	248	248	62
	6		610.0	1.1	1.62	1.62	14	193	85	85	249	248	62
1551	7	50	611.9	1.05	1.54	1.54	13	189	85	85	254	249	63
1552.5	End	52.5	613.8										
		Continued											

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	888.8	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1457	.011	24"
1615	.008	18"

Impinger Catch Description:

DETERMINATION OF GAS COMPOSITION BY ORSAT ANALYSIS								
Sample Id:	Replicate 1		Replicate 2		Replicate 3		Average	
17	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Compound	Percent Volume
Initial Reading								
Carbon Dioxide		See	Orsat	Form			CO_2	
Oxygen							O_2	
Carbon Monoxide							CO	

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

FORM: S-FD-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 3
Page	of 2 of 2

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9374	Control Unit No.: 5	ΔH@ 1.83
Date: Wed 6.9.93	Gas Meter Coefficient: .983	TM 86
Company: L.C. Krise + Sons	Sample Box No.: 5	MC = 36
Source: Scrubber Outlet	Probe No.: 84 72 Length: 24" 72"	PS/PM = 1.0
Source Dimensions: 47 deg + 41" wide	Pitot No.: 60 Coefficient: A=.841	C .983
Test Team: Bill + Ted	Nozzle No.: C/o Diameter: .243 .1835	TS 183
Test Procedure: EPA 1-5	Filter No.: 8710	R
Ambient Temp., °F: 75	Barometric Pressure, in.Hg: 28.18	Static Pressure, in.WC: -.92

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.
1554	1	52.5	X	.61	.90	.90	9	182	85	85	247	249	64
	2	75	615.2	.82	1.21	1.21	12	177	85	85	251	257	63
1559	3		616.8	1.05	1.54	1.54	14	174	85	84	254	249	64
	4	60	618.7	1.0	1.49	1.47	14	171	85	84	255	254	65
1604	5		620.5	1.0	1.47	1.47	14	170	85	84	254	250	65
	6	65	622.3	.99	1.46	1.46	14	162	85	84	251	248	66
1609	7		624.1	.96	1.41	1.41	14	160	85	84	250	250	66
1611.5	End	70	625.841										

DCF = 49.851

Time = 70 minutes

MOISTURE DETERMINATION						
IMPINGER	1	2	3	4	5	
Final						
Initial	100	100	0	888.8	X	
Difference						
Total Moisture Collected:						

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (inHg)
See page 1 of 2		

Impinger Catch Description: [illegible]

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

Total Sampling Time, min.: _____

Volume of Gas Sampled, DCF: _____

FORM: S-FD-5

Project # 9374

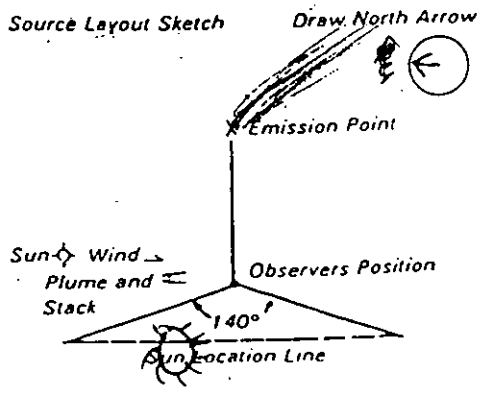
Test-Run # 1-3 1-3

Visible Emission Observation Form

SOURCE NAME L.C. Kruise + Sons	OBSERVATION DATE 6-9-93
ADDRESS Aggregate Dryer - Wet Scrubber	START TIME 1500
CITY / STATE / ZIP	STOP TIME 1600
PHONE / SOURCE ID NUMBER	
PROCESS EQUIPMENT Drum Mixer / OPERATING MODE	
CONTROL EQUIPMENT Scrubber / OPERATING MODE	
DESCRIBE EMISSION POINT START Stack STOP ✓	
HEIGHT ABOVE GROUND LEVEL START 30' STOP ✓	HEIGHT RELATIVE TO OBSERVER START 30' STOP ✓
DISTANCE FROM OBSERVER START 90' STOP ✓	DIRECTION FROM OBSERVER START STOP
DESCRIBE EMISSIONS START Plume STOP ✓	
EMISSION COLOR START White/Grey 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 water drop STOP	
DESCRIBE BACKGROUND START Sky STOP ✓	
BACKGROUND COLOR START White/Blue STOP ✓	SKY CONDITIONS START Partly cloudy STOP
WIND SPEED START 25-35 STOP ✓	WIND DIRECTION START E/SE STOP ✓
AMBIENT TEMP. START 69° STOP ✓	WET BULB TEMP. / RH, percent

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

Source Layout Sketch



AVERAGE OPACITY FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS MINIMUM	MAXIMUM
OBSERVER'S NAME (PRINT) Bill Anderson	
OBSERVER'S SIGNATURE Bill Anderson	DATE 6-9-93
ORGANIZATION MMT Environmental Services	
CERTIFIED BY Eastern Technical Associates	DATE 4.1.93
VERIFIED BY ETA	DATE 4.1.93

COMMENTS Very Windy Day

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE / TITLE / DATE

18.4
7
7-1.4
R1

7.5
18.5
R1
7.5-11
10?

ORSAT ANALYSIS

Job Number: 9374 Company: L.C. Kruise + Sons

SAMPLE DESCRIPTION	SAMPLE ANALYSIS							
Scrubber 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: Bill	Initial Reading	0.0	/	0.0	/	0.0	/	
Date Collected: 6.9.93 Wed	Carbon Dioxide	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Analyzed By: Ted	Oxygen	17.9	11.4	17.9	11.4	18.0	11.5	11.4
Date Analyzed: 6.9.93	Carbon Monoxide	Not Analyzed						F_o 1.462
Sample Id: 1-2								
Collected By: Bill	Initial Reading	0.0	/	0.0	/	0.0	/	
Date Collected: 6.9.93	Carbon Dioxide	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Analyzed By: Ted	Oxygen	17.5	10.0	17.5	10.0	17.5	10.0	10.0
Date Analyzed: 6.9.93	Carbon Monoxide							F_o = 1.45
Sample Id: 1-3								
Collected By: Ted	Initial Reading	0.0	/	0.0	/	0.0	/	
Dated Collected: 6.9.93	Carbon Dioxide	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Analyzed By: Ted	Oxygen	17.5	10.5	17.5	10.5	17.5	10.5	10.5
Date Analyzed: 6.9.93	Carbon Monoxide							F_o = 1.486

F_o 1.434 – 1.586 range for C_3H_8 propane fuel. [$F_o = (20.9 - \%O_2) \div \%CO_2$]

Form S-LB-3

APPENDIX C: LABORATORY REPORTS

SUMMARY OF PARTICULATE EMISSION TEST LABORATORY DATA

PROJECT NUMBER: 9374 COMPANY: L.C. KRUISE
TEST NUMBER: 1 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	0.0859	0.0000	0.2939	0.3798	0.0169	0.0180	0.0349	0.4147
2	0.0655	0.0000	0.2724	0.3379	0.0147	0.0172	0.0319	0.3698
3	0.0637	0.0000	0.2917	0.3554	0.0163	0.0252	0.0415	0.3969

* NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

LABORATORY REPORT: EPA Method 5

Project Number: 9374 Company: L.C. Kruse

Frontwashes 300 ml Acetone

Test-Run	1-1	1-2	1-3	Date
Dish #	374	371	380	- - - - -
1	2.8255	2.4264	2.2540	6.10.93
2	2.8253	2.4265	2.2544	6.11.93
3	2.8255	2.4263	2.2542	6.11.93
Tare	2.7391	2.3605	2.1900	6.24.92
Blank	.0003	.0003	.0003	- - - - -
Net	.0859	.0655	.0637	- - - - -

Solvent Blanks

Solvents	300 ml Acetone	150 ml Chloroform	150 ml Ether	Date
Dish #	371	372	373	- - - - -
1	2.7559	2.7180	2.7230	6.10.93
2	2.7557	2.7184	2.7229	6.11.93
3	2.7559	2.7183	2.7230	6.11.93
Tare	2.7554	2.7179	2.7229	6.24.92
Net	.0003	.0001	.0000	- - - - -

Backwashes 300 ml Acetone

Test-Run	1-1	1-2	1-3	Date
Dish #	375	378	381	- - - - -
1	2.7340	2.2722	2.3291	6.10.93
2	2.7343	2.2723	2.3289	6.11.93
3	2.7341	2.2722	2.3292	6.11.93
Tare	2.7157	2.2547	2.3034	6.24.92
Blank	.0003	.0003	.0003	- - - - -
Net	.0180	.0172	.0252	- - - - -

Glass Filters

Test-Run	1-1	1-2	1-3	Date
Filter #	8708	8709	8710	- - - - -
1	.7998	.7843	.7949	6.10.93
2	.7995	.7846	.7948	6.11.93
3	.7995	.7845	.7947	6.11.93
Tare	.5056	.5119	.5030	2.15.93
Net	.2939	.2724	.2917	- - - - -

Extractions 150 ml Chloroform - 150 ml Ethyl Ether

Test-Run	1-1	1-2	1-3	Date
Dish #	376	379	382	- - - - -
1	2.3156	2.2499	2.2856	6.10.93
2	2.3155	2.2498	2.2855	6.11.93
3	2.3157	2.2497	2.2853	6.11.93
Tare	2.2985	2.2349	2.2689	6.24.92
Blank	.0001	.0001	.0001	- - - - -
Net	.0169	.0147	.0163	- - - - -

COMMENTS

Lowest Final Weight
- Tare
- Blank(if applicable)

= Sample Net Gain (grams)

Signature Ted Gibbons Date 6.14.93

Laboratory Report: Moisture Content of Aggregate Samples

Project Number 9374 Company L.C. Kruse

Test 1-1

Trial #	1	2	3	Date
Dish #	383	384	385	
Tare	2.2390	2.2274	2.3437	10.30.92
Tare + Wet	45.5258	45.3995	45.5067	6.10.93
Wet	43.2868	43.0721	43.1630	
Dry	40.5305	40.6892	40.5839	
Dry + Tare	42.7695	42.9166	42.9276	6.10.93
% Moisture	6.37	5.58	5.98	

Test 1-2

Trial #	1	2	3	Date
Dish #	386	387	388	
Tare	2.3449	2.3722	2.3114	10.30.92
Tare + Wet	45.1699	45.2499	45.6197	6.10.93
Wet	42.825	42.0777	43.3083	
Dry	40.3011	40.5469	40.8954	
Dry + Tare	42.6460	42.9191	43.2068	6.10.93
% Moisture	5.89	5.44	5.57	

Test 1-3

Trial #	1	2	3	Date
Dish #	389	390	391	
Tare	2.2550	2.2599	2.2370	10.30.92
Tare + Wet	45.5770	45.4367	45.1255	6.10.93
Wet	43.3220	43.1768	42.8885	
Dry	40.8077	40.6644	40.7316	
Dry + Tare	43.0627	42.9243	42.9686	6.10.93
% Moisture	5.80	5.82	5.03	

Summary

	Mean	σ_{n-1} Deviation	% Error	
Test 1-1	5.98	.40	6.61	
1-2	5.63	.23	4.11	
1-3	5.55	.45	8.12	

Comments

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

100- % Solids = % Moisture

Signature Ted Gibbons Date 6.10.93

PROJECT # 9374 COMPANY L.C. Kruise & Sons
TEST DATE(S) June 1993 SOURCE Aggregate Dryer - Wet Scrubber
6.9.93

EPA METHOD 4 LABORATORY REPORT

FILTER #	TEST-RUN #	IMPINGER #	INITIAL	FINAL	GAIN	DESCRIPTION
#8708	1-1	1	100	399	299	
		2	100	269	169	
		3	0	61	61	cloudy
		4	876.5	914.3	37.8	
		5	X	X	X	
		TOTAL MOISTURE GAIN, ML =			566.8	
#8709	1-2	1	100	388	288	
		2	100	339	239	
		3	0	3	3	cloudy
		4	876.4	899.4	23.0	
		5	X	X	X	
		TOTAL MOISTURE GAIN, ML =			553.0	
#8710	1-3	1	100	320	220	
		2	100	423	323	
		3	0	11	11	cloudy
		4	888.8	915.7	26.9	
		5	Not	Applied	X	
		TOTAL MOISTURE GAIN, ML =			580.9	

APPENDIX D: CALIBRATION DATA

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Bill Anderson

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

238342
Certificate Number

Vice President

Minneapolis
Location

David B. Savage, Jr.
Program Manager

April 1, 1993
Date of Issue

CALIBRATION
DRY TEST METER/ORIFICE METER

Monday

Date: 6.7.93 Barometric Pressure, in. Hg. (Pb): 28.37

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 RH 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}	Temp. °F T_w	Dry Test Meter Volume, CF Initial V_{di}	Dry Test Meter Volume, CF Final V_{df}	Temperature, °F Inlet Initial T_{ii}	Inlet Final T_{if}	Outlet Initial T_{oi}	Outlet Final T_{of}	Elapsed Time, min. Q
0.5	0	zero	2.451	73	441.658	444.145	70	72	70	71	6
1.0	0	2.451	7.565	73	444.145	449.369	72	77	72	73	9
~~2.0~~	~~0~~	~~7.565~~			~~449.369~~						
3.0	0	8.772	15.577	73	467.132	474.131	93	98	76	77	7
2.0		0.000	8.772	73	458.113	467.132	87	94	74	76	11

COMPUTER PRINTOUT

Pre-Test L.C. Kruse

H	Vw	Tw	Vd	Td	Q	C	Hg
0.5	2.451	73	2.487	70.0	6.0	0.9801	1.7921
1.0	5.114	73	5.224	73.5	9.0	0.9773	1.8428
2.0	8.772	73	9.019	82.8	11.0	0.9853	1.8394
3.0	6.805	73	6.999	86.0	7.0	0.9883	1.8455

AVERAGE CORRECTION FACTOR: C = 0.9828
AVERAGE ORIFICE CONSTANT: Hg = 1.8299

EQUATIONS:

$V_w = V_{wf} - V_{wi}$

$V_d = V_{df} - V_{di}$

$T_d = (T_{ii} + T_{if} + T_{oi} + T_{of}) / 4$

$C = V_w * P_b * (T_d+460) / (V_d * (P_b+H/13.6) * (T_w+460))$

$H_g = 0.0317 * H * ((T_w+460)*Q/V_w)^2 / (P_b * (T_d+460))$

Calibration Performed by:

(Print) Ted Gibbons

CALIBRATION
DRY TEST METER/ORIFICE METER

Date: Thursday 6-10-93 Barometric Pressure, in. Hg. (Pb): 29.00

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	2.882	74	627.472	630.382	69	71	69	69	7
1.0	0	2.882	12.012	74	630380	639.700	72	84	69	72	16
2.0	0	12.012	22.375	74	639.700	650.386	84	96	72	75	13
3.0	0	22.375	33.038	74	650.386	661.426	95	103	75	78	11

COMPUTER PRINTOUT

Post Test Calibration

H	Vw	Tw	Vd	Td	Q	C	Ha
0.5	2.882	74	2.908	69.5	7.0	0.9815	1.7364
1.0	9.130	74	9.320	74.3	16.0	0.9776	1.7918
2.0	10.363	74	10.686	81.8	13.0	0.9789	1.8109
3.0	10.663	74	11.040	87.8	11.0	0.9832	1.8168

AVERAGE CORRECTION FACTOR: C = 0.9803
AVERAGE ORIFICE CONSTANT: Ha = 1.7890

EQUATIONS:

$Vw = Vwf - Vwi$

$Vd = Vdf - Vdi$

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

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

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

Prod Post Test $\bar{x}$ C = .9816

Calibration Performed by:

(Print) Ted M Gibbons

CALIBRATION

S-TYPE PITOT TUBE

Probe Length = 72"

Probe Sheath ID: 70"

Date: 4.5.93

S-Type Pitot Tube ID No.: 60" Wide Body

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 * Not Attached during calibration

Alignment Check	Pitot Tube Dimensions	Pitot Assembly Intercomponent Spacings
✓ α1<10°	External tubing diameter (D_t): 3/8"	Pitot to ____ nozzle (X): ____
✓ α2<10°	Base to Side A opening plane (P_A): ____	Pitot to probe sheath (Y): ____
✓ β1< 5°	Base to Side B opening plane (P_B): ____	Pitot to thermocouple, along probe (W): ____
✓ β2< 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	.12	.164	.12	.17
40	0.37	.36	.51	.34	.46
60	0.82	.83	1.18	.79	1.09
80	1.45	1.51	2.24	1.41	2.02
100	2.30				

COMPUTER PRINTOUT

SIDE A CALIBRATION

Pstd	Ps	Cp	Cp-Cp(A)
0.120	0.164	0.851	0.016
0.360	0.510	0.836	0.001
0.830	1.180	0.834	-0.000
1.510	2.240	0.817	-0.018

Cp(A) = 0.835

SIDE B CALIBRATION

Pstd	Ps	Cp	Cp-Cp(B)
0.120	0.170	0.836	-0.006
0.340	0.460	0.855	0.013
0.790	1.090	0.847	0.005
1.410	2.020	0.831	-0.011

Cp(B) = 0.842

Side A(σ) = .012

B(σ) = .009

Calibration Performed by:

(Print) Bill + Ted

(Signature) Bill Ted

FORM: SSOA-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	Nozzle Employed	.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.: 36" Std Inflex +15' flexible	MMT ID No.: –
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268-KF1
Length: 51 inches overall	SN: 747-4363
Length of connecting (extension) wire: 20 ft	

stack 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 $T_i - T_a$
39	41	2
68	69	1
176	175	-1
276	276	0
374	375	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.: 50" mini std flexible	MMT ID No.: Testing #1 Fluke
Mfg: FLUKE	Mfg: John Fluke MFG. Co
Type: Chromel - Alumel	Model: Fluke 51 K/J
Length: 50 inches	SN: 5210078
Length of connecting (extension) wire: 0 ft	

Probe 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 $T_i - T_a$
40	41	1
74	75	1
128	129	1
175	177	2
274	275	1
385	386	1

Calibration Performed by:

(Print) Bill + Ted

(Signature) Bill + Ted

Date: 4.6.93

CALIBRATION

THERMOCOUPLE/TEMPERATURE METER

Last impinger — EQUIPMENT IDENTIFICATION	
THERMOCOUPLE	TEMPERATURE METER
MMT ID No.: Andersen thermocouple	MMT ID No.: -
Mfg: Andersen	Mfg: Newport Laboratories
Type: Chromel-Alumel	Model: 268 - KF1
Length: 14"	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	41	1
66	68	2
104	103	-1
130	128	-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.: #5 Console Motor Inlet	MMT ID No.: -
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268- KFI
Length: 4,5"	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 $T_i - T_a$
39	40	1
66	66	0
103	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.: #5 Console Meter outlet	MMT ID No.: -
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268 - KF1
Length: 4,5 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	41	1
65	66	1
103	101	-2
128	129	1

Calibration Performed by:

(Print) Bill - Ted

(Signature) Bill - Ted

Date: 4-6-93

APPENDIX E: PROCESS DATA

HOT-MIX ASPHALT PLANT IDENTIFICATION AND OPERATING DATA

MMT Project Number: 9374 Date: June 1993

Company: L.C. Kruise + Sons

Location: Windom, Minnesota

Company Representatives:

Drum Mixer:

Manufacturer: Pioneer

Model: DM Serial Number: 113-36-DM-106

Effective Date: 1980 Capacity (Tons/Hr):

Fuel Burned: Waste Oil Fuel Usage: Propane

Fuel Oil (All Grades) Used Oil

Air Pollution Control Equipment:

Type: Venturi Scrubber

Manufacturer: Barber Greene

Model: CC 99 x 102 Serial Number: 114320

Effective Date: 5-92

Process Operating Data:

Time	Instantaneous Readings: Aggregate Feed Rate Tons/HR	Asphalt Feed Rate Tons/HR		Gas Temp. at Drum Outlet, °F	Product Temp. °F		Integrator Readings: Aggregate Tons		

FORM: S-GN-8

CENTRAL DATA FORM

Propane Gas as Combustion Fuel.

MTT Job Number: 9374 Date: Wed 6-9-93

Company: L.C. Kruise & Sons

Source: Scrubber Outlet

* if Applicable

	Time	Aggregate tons per hour	Asphalt tons per hour	Recycled Aggregate* tons per hour	Product Mix Temperature °F	Scrubber gallons per minute	Scrubber Pressure Dp, Inches	Burner setting % Open
	10 AM	260	16.9	No Recycled material consumed	260	350	15	95
	11 AM	265	17.5		270	350	15	95
#1	Noon	265	17.4		270	350	15	95
#1	1 PM	270	17.8		270	350	15	95
#1	1:45	272	17.9		270	350	15	95
#2	2:00 PM	270	17.6		265	350	15	95
#2	2:15	265	17.3		270	350	15	95
#2	2:30	265	17.5		270	350	15	95
#2	2:45	267	17.6		[illegible]	350	15	95
#3	3:00	265	17.4		265	350	15	95
#3	3:15	267	17.5		265	350	15	95
#3	3:30	265	17.4		265	350	15	95
#3	3:45	264	17.3		270	350	15	95
#3	4 PM	265	17.4		270	350	15	95
#3	4:15	270	17.6		270	350	15	95

helped Steve Fricke

Operator Name Print: David D. Schultz

Signature: David D. Schultz

FORM: S-GN-2

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