AP42 Section: 11.1

Reference Number: 59

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 28, 1993.

Retest #2 33%

MMT Environmental Services, Inc.
4610 North Churchill Street
St. Paul, MN 55126-5892
Phone (612) 483-9595 Fax (612) 483-2699

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 19, 1993**

Submitted to:

L.C. Kruse & Sons, Inc.
P.O. Box 899
Lakefield, MN 56150
Attn: Mr. Darrin L. Kruse

Prepared by:

Ted Gibbons
Ted Gibbons
Sampling Team Leader

Prepared by:

Alan L. Trowbridge
Alan L. Trowbridge
Director of Technical Services

MMT Report Number: 9999
MMT Project Number: 9409
Report Issued: July 28, 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 19, 1993

MMT Report Number 9999
MMT Project Number 9409
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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 19, 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 0.115 grains per dry standard cubic foot and an average source particulate emission rate of 17.19 pounds per hour.

The visible emission test was performed concurrent with the third particulate test run. The observed plume opacity ranged from zero (0) to ten (10) percent with an overall average of 3.5 percent.

The average process weight rate (aggregate + asphalt) during the test period was 284 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 mass concentration standard 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 19, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1325	1500	1633	---
Finish	1427	1602	1734	---
Effluent Temperature, °F	181	179	177	179
Effluent Moisture Content, % v/v	40.3	41.2	40.9	40.8
Effluent Composition, % v/v dry:				
Carbon Dioxide Content	8.6	7.8	8.5	8.3
Oxygen Content	9.2	10.4	9.3	9.6
Effluent Volumetric Flow Rate:				
Actual Conditions, acfm	36,045	36,164	35,602	35,937
Standard Conditions, scfm	28,473	28,636	28,262	28,457
Dry Standard Conditions, dscfm	16,992	16,837	16,702	16,844
Sampling Isokinetic Variation, %	107.2	106.9	106.7	106.9
Effluent Particulate Concentration:				
Front Catch Only;				
Actual Conditions, gr/acf	0.0483	0.0495	0.0447	0.0475
Standard Conditions, gr/scf	0.0611	0.0625	0.0563	0.0600
Dry Standard Conditions, gr/dscf	0.1024	0.1062	0.0953	0.1013
Back Catch Only;				
Actual Conditions, gr/acf	0.0069	0.0069	0.0054	0.0064
Standard Conditions, gr/scf	0.0088	0.0087	0.0068	0.0081
Dry Standard Conditions, gr/dscf	0.0147	0.0147	0.0116	0.0137
Total Catch;				
Actual Conditions, gr/acf	0.0552	0.0563	0.0501	0.0539
Standard Conditions, gr/scf	0.0699	0.0711	0.0631	0.0680
Dry Standard Conditions, gr/dscf	0.1171	0.1210	0.1068	**0.1150**
Source Particulate Emission Rate:				
Classical Method, lb/hr	17.07	17.47	15.30	16.61
Ratio of Areas Method, lb/hr	18.29	18.66	16.32	17.76
Average of the Two Methods, lb/hr	17.68	18.07	15.81	17.19

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.

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 19, 1993

Parameter	Run #1	Run #2	Run #3	Average
Time of Test, hr				
Start	1325	1500	1633	---
Finish	1427	1602	1734	---
Process Weight Rate;				
Aggregate Usage, ton/hr	261.0	267.0	274.0	267.3
Asphalt Usage, ton/hr	16.2	16.5	17.1	16.6
Total Process Weight Rate, ton/hr	277.2	283.5	291.1	283.9
Aggregate Moisture Content, %	5.6	5.8	5.6	5.7
Burner Setting, %	64	62	69	65
Product Mix Temperature, °F	286	284	280	283
Scrubber Operating Parameters;				
Pressure Drop, in WC	9.8	9.0	9.0	9.3
Water Flow Rate, gpm	361	350	350	354

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.

A test for cyclonic flow was performed using the S-tube null-reading technique of EPA Method 1, Section 2.4. The test yielded an average yaw angle of 7.6 degrees. This indicates that the sampling location was acceptable as the yaw angle criteria of less than 20 degrees was met.

4.2 EFFLUENT VOLUMETRIC FLOW RATE

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

4.3 EFFLUENT COMPOSITION AND MOLECULAR WEIGHT

The density of the effluent was determined per EPA Method 3 which is entitled "Gas analysis for the determination of dry molecular weight". One 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.

Figure 4.1 Site Description Form
L.C. Kruse & Sons, Inc. Asphalt Plant, Windom, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
July 19, 1993

SAMPLING LOCATION DATA

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

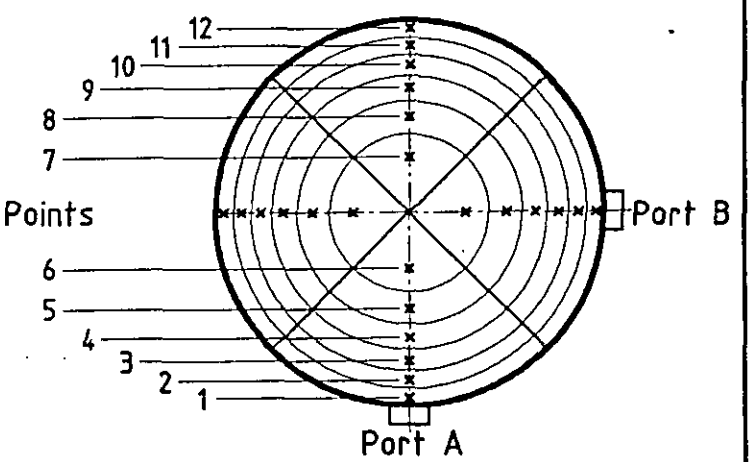
Length of straight, undisturbed flow;
- Before ports, inches 134
- After ports, inches 36
- Before ports, stack diameters 2.25
- After ports, stack diameters 0.60

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

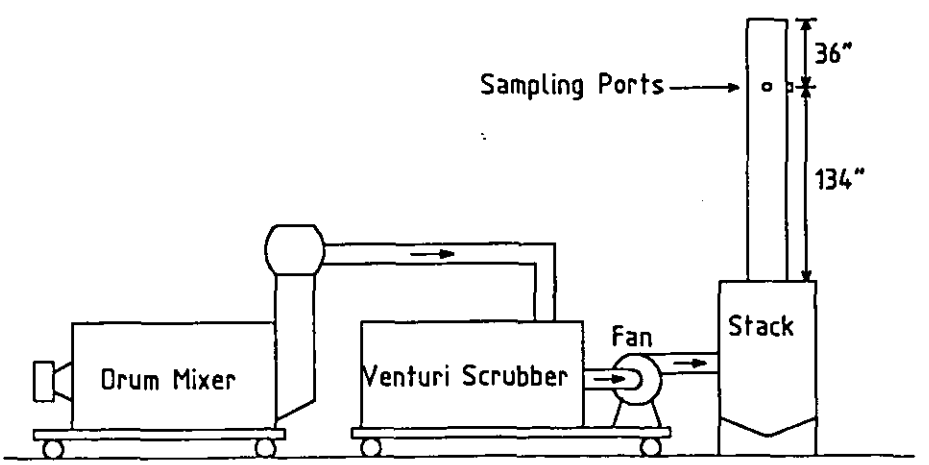
Particulate test sampling time;
- Minutes per point 2.5
- Minutes per test run 60.0

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



4.4 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.

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.

Figure 4.2 Sampling Train Description
L.C. Kruse & Sons, Inc. Asphalt Plant, Windom, Minnesota
Aggregate/Asphalt Drum Mix Operation Scrubber Exhaust
July 19, 1993

PARTICULATE SAMPLING TRAIN IDENTIFICATION

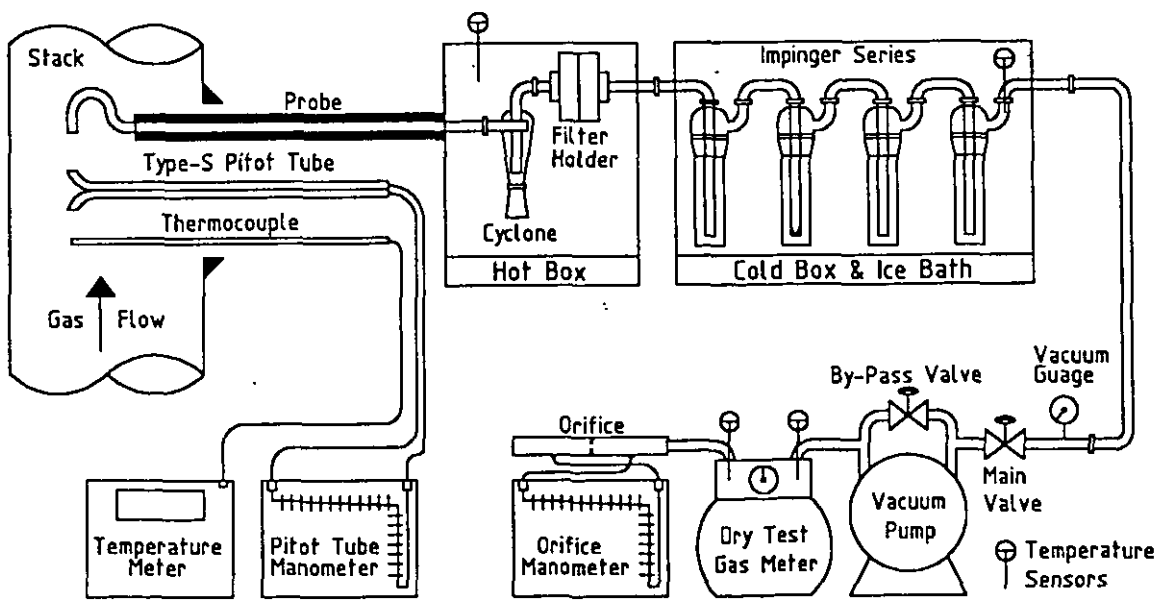
Sampling Train Manufacturer: ..... MMT Environmental Services, Inc.
Sampling Train Model: ..... Universal Stak Sampler

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 #L3, 0.361 inch diameter, stainless steel
Sampling Probe Used: .... MMT #70, 70 inch effective length with stainless steel liner
Pitot Tube Used: ..... MMT #67, S-type, 0.841 coefficient

PARTICULATE SAMPLING TRAIN SCHEMATIC



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

The impingers and all connecting pieces between the filter paper and the desiccant column were then rinsed with acetone and these rinsings were placed in Container #4. The desiccant column was then weighed and its contents transferred to a waste desiccant container.

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

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)
```

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

VOLUMETRIC FLOW RATE CALCULATION

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST DATE: 7-19-93 SOURCE: SCRUBBER OUTLET

Preliminary Flowrate Determination

DUCT DIMENSIONS;		
LENGTH, INCHES	57.25	LN
WIDTH, INCHES	62.00	WD
CROSS-SECTIONAL AREA, SQ FT	24.649	AR
EFFLUENT TEMPERATURE, DEG F	170	TS
MOISTURE CONTENT DETERMINATION:		
EFFLUENT WET BULB TEMPERATURE, DEG F	164	TW
EFFLUENT DEW POINT TEMPERATURE, DEG F	164	TD
EFFLUENT RELATIVE HUMIDITY, %	87.0	RH
EFFLUENT MOISTURE CONTENT, % V/V	36.8	MC
DUCT PRESSURES;		
BAROMETRIC PRESSURE, IN HG	28.67	PB
STATIC PRESSURE, IN WC	0.02	PS
ABSOLUTE PRESSURE, IN WC	28.67	PA
EFFLUENT COMPOSITION;		
CARBON DIOXIDE CONTENT, % V/V DRY	8.6	CD
OXYGEN CONTENT, % V/V DRY	9.2	OX
EFFLUENT MOLECULAR WEIGHT;		
DRY BASIS, LB/LB-MOLE	29.74	MD
WET BASIS, LB/LB-MOLE	25.42	MS
PITOT TUBE COEFFICIENT	0.841	CP

EFFLUENT VELOCITY PRESSURES, IN WC;

POINT	PORT A	PORT B
1	0.110	0.090
2	0.170	0.120
3	0.250	0.140
4	0.240	0.170
5	0.280	0.190
6	0.270	0.180
7	0.250	0.290
8	0.200	0.270
9	0.210	0.280
10	0.210	0.240
11	0.190	0.190
12	0.170	0.190

AVE. SQUARE-ROOT VELOCITY PRESSURE, IN WC ..	0.45	PV
EFFLUENT AVERAGE VELOCITY, FT/SEC	29.898	VS
EFFLUENT VOLUMETRIC FLOW RATE;		
ACTUAL, ACFM	44218	FA
STANDARD, SCFM	35518	FW
DRY STANDARD, DSCFM	22452	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)

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER
RUN NUMBER: 1 TIME: 7/19/93 1325-1427

		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	0.100	0.710	168	79	79	0.316	21.28
A	2	0.150	1.070	183	80	79	0.387	26.37
A	3	0.250	1.790	180	80	79	0.500	33.96
A	4	0.210	1.500	179	80	79	0.458	31.10
A	5	0.150	1.070	182	80	79	0.387	26.35
A	6	0.240	1.710	180	81	80	0.490	33.28
A	7	0.270	1.930	181	82	80	0.520	35.32
A	8	0.280	2.000	180	82	80	0.529	35.94
A	9	0.270	1.930	181	83	80	0.520	35.32
A	10	0.230	1.640	181	83	80	0.480	32.60
A	11	0.250	1.790	180	83	80	0.500	33.96
A	12	0.180	1.290	177	84	80	0.424	28.75
B	1	0.110	0.790	176	83	81	0.332	22.46
B	2	0.130	0.930	182	84	81	0.361	24.53
B	3	0.140	1.000	180	84	81	0.374	25.42
B	4	0.170	1.210	181	84	81	0.412	28.03
B	5	0.200	1.430	183	85	82	0.447	30.45
B	6	0.280	2.000	182	85	82	0.529	36.00
B	7	0.270	1.930	182	85	82	0.520	35.35
B	8	0.290	2.070	183	86	82	0.539	36.66
B	9	0.260	1.860	183	86	82	0.510	34.72
B	10	0.240	1.710	183	86	82	0.490	33.35
B	11	0.220	1.570	183	87	82	0.469	31.93
B	12	0.200	1.430	183	87	83	0.447	30.45
AVERAGE		0.212	1.515	181	83	81	0.456	30.98

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER
RUN NUMBER: 1 TIME: 7/19/93 1325-1427

TEST DATA

GAS METER COEFFICIENT	0.9663 Y	VOLUME OF LIQUID COLLECTED, ML	574.9 Vl
PITOT TUBE COEFFICIENT	0.841 Cp		
		GAS COMPOSITION, % V/V DRY;	
NOZZLE DIMENSIONS;		CARBON DIOXIDE	8.60 CD
DIAMETER, IN	0.361 Dn	OXYGEN	9.20 OX
AREA, SF	0.000711 An	CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	82.20 NI
STACK DIMENSIONS;			
DIAMETER/LENGTH, IN	59.63 Sl	AVE. TRAVERSE POINT DATA;	
WIDTH, IN	0.00 Sw	STACK TEMP., DEG F	181 Ts
AREA, SF	19.394 As	METER TEMP., DEG F	82 Tm
		ORIFICE PRESSURE, IN WC	1.515 Po
BAROMETRIC PRESSURE, IN HG	28.67 Pb	SQRT VELOCITY P., IN WC	0.456 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	0.03 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.67 Ps	FRONT CATCH (87.4%)	0.2659 Wf
		BACK CATCH (12.6%)	0.0382 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.3041 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	44.226 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	40.049 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.74 Md
		WET BASIS, LB/LB-MOLE	25.01 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	27.061 Vw	AVERAGE GAS VELOCITY, FPS	30.98 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.4032 Bws	ACTUAL, ACFM	36045 Qa
PERCENT BY VOLUME	40.32 Bwp	STANDARD, SCFM	28473 Qs
		DRY STANDARD, DSCFM	16992 Qsd
		ISOKINETIC VARIATION, %	107.24 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0483 Caf	0.0069 Cab	0.0552 Cat
STANDARD, GR/SCF	0.0611 Cwf	0.0088 Cwb	0.0699 Cwt
DRY STANDARD, GR/DSCF	0.1024 Csf	0.0147 Csb	0.1171 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	14.92 Rcf	2.14 Rcb	17.07 Rct
RATIO OF AREAS METHOD	15.99 Rrf	2.30 Rrb	18.29 Rrt

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

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER
RUN NUMBER: 2 TIME: 7/19/93 1500-1602

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	0.120	0.850	178	85	85	0.346	23.56
A	2	0.160	1.130	180	86	85	0.400	27.25
A	3	0.210	1.480	179	87	85	0.458	31.20
A	4	0.260	1.830	178	88	84	0.510	34.69
A	5	0.290	2.040	178	89	84	0.539	36.63
A	6	0.270	1.900	179	90	84	0.520	35.37
A	7	0.220	1.550	179	91	84	0.469	31.93
A	8	0.210	1.480	179	91	84	0.458	31.20
A	9	0.170	1.200	178	92	84	0.412	28.05
A	10	0.150	1.060	178	92	85	0.387	26.35
A	11	0.180	1.270	180	92	85	0.424	28.91
A	12	0.200	1.410	179	93	85	0.447	30.44
B	1	0.140	0.990	179	91	85	0.374	25.47
B	2	0.170	1.200	178	90	85	0.412	28.05
B	3	0.190	1.340	181	90	85	0.436	29.72
B	4	0.180	1.270	180	89	86	0.424	28.91
B	5	0.210	1.480	180	89	86	0.458	31.22
B	6	0.270	1.900	180	89	86	0.520	35.40
B	7	0.290	2.040	180	89	86	0.539	36.69
B	8	0.300	2.110	179	89	86	0.548	37.29
B	9	0.240	1.690	178	89	86	0.490	33.32
B	10	0.230	1.620	178	89	86	0.480	32.62
B	11	0.200	1.410	179	89	86	0.447	30.44
B	12	0.210	1.480	179	89	86	0.458	31.20
AVERAGE		0.211	1.489	179	90	85	0.457	31.08

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER
RUN NUMBER: 2 TIME: 7/19/93 1500-1602

TEST DATA

GAS METER COEFFICIENT	0.9663 Y	VOLUME OF LIQUID COLLECTED, ML	588.7 Vl
PITOT TUBE COEFFICIENT	0.841 Cp	GAS COMPOSITION, % V/V DRY;	
NOZZLE DIMENSIONS;		CARBON DIOXIDE	7.80 CD
DIAMETER, IN	0.361 Dn	OXYGEN	10.40 OX
AREA, SF	0.000711 An	CARBON MONOXIDE	0.00 CM
		NITROGEN (BY DIFFERENCE)	81.80 NI
STACK DIMENSIONS;		AVE. TRAVERSE POINT DATA;	
DIAMETER/LENGTH, IN	59.63 Sl	STACK TEMP., DEG F	179 Ts
WIDTH, IN	0.00 Sw	METER TEMP., DEG F	87 Tm
AREA, SF	19.394 As	ORIFICE PRESSURE, IN WC	1.489 Po
BAROMETRIC PRESSURE, IN HG	28.67 Pb	SQRT VELOCITY P., IN WC	0.457 Pv
STACK PRESSURES;		MASS OF PARTICULATE MATTER	
STATIC, IN WC	0.03 Pg	COLLECTED, G;	
ABSOLUTE, IN HG	28.67 Ps	FRONT CATCH (87.8%)	0.2724 Wf
		BACK CATCH (12.2%)	0.0378 Wb
SAMPLING TIME, MIN	60.00 Ti	TOTAL CATCH	0.3102 Wt
VOLUME OF GAS SAMPLED AT METER, DCF	44.099 Vm		

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	39.542 Vms	GAS MOLECULAR WEIGHT;	
		DRY BASIS, LB/LB-MOLE	29.66 Md
		WET BASIS, LB/LB-MOLE	24.86 Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	27.710 Vw	AVERAGE GAS VELOCITY, FPS	31.08 Vs
GAS MOISTURE CONTENT;		GAS VOLUMETRIC FLOW RATE;	
VOLUME FRACTION	0.4120 Bws	ACTUAL, ACFM	36164 Qa
PERCENT BY VOLUME	41.20 Bwp	STANDARD, SCFM	28636 Qs
		DRY STANDARD, DSCFM	16837 Qsd
		ISOKINETIC VARIATION, %	106.86 I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0495 Caf	0.0069 Cab	0.0563 Cat
STANDARD, GR/SCF	0.0625 Cwf	0.0087 Cwb	0.0711 Cwt
DRY STANDARD, GR/DSCF	0.1062 Csf	0.0147 Csb	0.1210 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	15.34 Rcf	2.13 Rcb	17.47 Rct
RATIO OF AREAS METHOD	16.38 Rrf	2.27 Rrb	18.66 Rrt

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

TRAVERSE POINT DATA SUMMARY AND VELOCITY PROFILE

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER
RUN NUMBER: 3 TIME: 7/19/93 1633-1734

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	0.080	0.560	177	86	85	0.283	19.20
A	2	0.130	0.920	177	86	85	0.361	24.48
A	3	0.160	1.130	179	85	85	0.400	27.20
A	4	0.210	1.480	179	85	85	0.458	31.16
A	5	0.230	1.620	178	84	85	0.480	32.58
A	6	0.190	1.340	178	84	85	0.436	29.62
A	7	0.180	1.270	177	84	85	0.424	28.80
A	8	0.270	1.900	179	84	85	0.520	35.33
A	9	0.290	2.040	177	84	85	0.539	36.56
A	10	0.260	1.830	176	85	85	0.510	34.59
A	11	0.240	1.690	177	85	85	0.490	33.26
A	12	0.250	1.760	176	85	85	0.500	33.92
B	1	0.120	0.850	176	85	85	0.346	23.50
B	2	0.170	1.200	177	85	85	0.412	27.99
B	3	0.190	1.340	175	86	84	0.436	29.55
B	4	0.220	1.550	176	86	84	0.469	31.82
B	5	0.230	1.620	176	87	84	0.480	32.53
B	6	0.240	1.690	176	87	84	0.490	33.23
B	7	0.190	1.340	177	87	84	0.436	29.59
B	8	0.250	1.760	177	87	85	0.500	33.95
B	9	0.290	2.040	177	87	85	0.539	36.56
B	10	0.260	1.830	177	88	85	0.510	34.62
B	11	0.170	1.200	177	88	85	0.412	27.99
B	12	0.150	1.060	176	88	85	0.387	26.27
AVERAGE		0.207	1.459	177	86	85	0.451	30.60

PARTICULATE EMISSION TEST CALCULATIONS

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER
RUN NUMBER: 3 TIME: 7/19/93 1633-1734

TEST DATA

GAS METER COEFFICIENT	0.9663	Y	VOLUME OF LIQUID COLLECTED, ML	576.1	Vl
PITOT TUBE COEFFICIENT	0.841	Cp			
NOZZLE DIMENSIONS;			GAS COMPOSITION, % V/V DRY;		
DIAMETER, IN	0.361	Dn	CARBON DIOXIDE	8.50	CD
AREA, SF	0.000711	An	OXYGEN	9.30	OX
			CARBON MONOXIDE	0.00	CM
			NITROGEN (BY DIFFERENCE)	82.20	NI
STACK DIMENSIONS;					
DIAMETER/LENGTH, IN	59.63	Sl	AVE. TRAVERSE POINT DATA;		
WIDTH, IN	0.00	Sw	STACK TEMP., DEG F	177	Ts
AREA, SF	19.394	As	METER TEMP., DEG F	85	Tm
			ORIFICE PRESSURE, IN WC	1.459	Po
BAROMETRIC PRESSURE, IN HG	28.65	Pb	SQRT VELOCITY P., IN WC	0.451	Pv
STACK PRESSURES;			MASS OF PARTICULATE MATTER		
STATIC, IN WC	0.04	Pg	COLLECTED, G;		
ABSOLUTE, IN HG	28.65	Ps	FRONT CATCH (89.2%)	0.2420	Wf
			BACK CATCH (10.8%)	0.0294	Wb
SAMPLING TIME, MIN	60.00	Ti	TOTAL CATCH	0.2714	Wt
VOLUME OF GAS SAMPLED AT METER, DCF	43.562	Vm			

CALCULATED RESULTS

VOLUME OF GAS SAMPLED AT METER, DSCF	39.177	Vms	GAS MOLECULAR WEIGHT;		
			DRY BASIS, LB/LB-MOLE	29.73	Md
			WET BASIS, LB/LB-MOLE	24.93	Ms
EQUIVALENT VOLUME OF WATER VAPOR COLLECTED, SCF	27.117	Vw	AVERAGE GAS VELOCITY, FPS	30.60	Vs
GAS MOISTURE CONTENT;			GAS VOLUMETRIC FLOW RATE;		
VOLUME FRACTION	0.4090	Bws	ACTUAL, ACFM	35602	Qa
PERCENT BY VOLUME	40.90	Bwp	STANDARD, SCFM	28262	Qs
			DRY STANDARD, DSCFM	16702	Qsd
			ISOKINETIC VARIATION, %	106.73	I

PARTICULATE EMISSION PARAMETER	FRONT CATCH	BACK CATCH	TOTAL CATCH
PARTICULATE CONCENTRATION			
ACTUAL, GR/ACF	0.0447 Caf	0.0054 Cab	0.0501 Cat
STANDARD, GR/SCF	0.0563 Csf	0.0068 Csb	0.0631 Cst
DRY STANDARD, GR/DSCF	0.0953 Csf	0.0116 Csb	0.1068 Cst
PARTICULATE EMISSION RATE, LB/HR			
CLASSICAL METHOD	13.65 Rcf	1.66 Rcb	15.30 Rct
RATIO OF AREAS METHOD	14.56 Rrf	1.77 Rrb	16.32 Rrt

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

TABLE SUMMARY OF PARTICULATE EMISSION TEST RESULTS

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER

TEST PARAMETER	RUN 1	RUN 2	RUN 3	
TEST DATE	7/19/93	7/19/93	7/19/93	Average
TIME OF TEST, HR;				
START	1325	1500	1633	
FINISH	1427	1602	1734	
EFFLUENT TEMPERATURE, DEGREES F	181	179	177	179
BAROMETRIC PRESSURE, IN HG	28.67	28.67	28.65	
EFFLUENT MOISTURE CONTENT, % V/V	40.3	41.2	40.9	40.8
EFFLUENT COMPOSITION, % V/V DRY;				
CARBON DIOXIDE	8.6	7.8	8.5	8.3
OXYGEN	9.2	10.4	9.3	9.6
CARBON MONOXIDE	0.0	0.0	0.0	
EFFLUENT VOLUMETRIC FLOW RATE;				
ACTUAL CONDITIONS, ACFM	36045	36164	35602	35,937
STANDARD CONDITIONS, SCFM	28473	28636	28262	28,457
DRY STANDARD CONDITIONS, DSCFM	16992	16837	16702	16,844
ISOKINETIC VARIATION, %				
EFFLUENT PARTICULATE CONCENTRATION;	107.2	106.9	106.7	106.9
EFFLUENT FRONT HALF PARTICULATE CONCENTRATION;				
ACTUAL CONDITIONS, GR/ACF	0.0483	0.0495	0.0447	0.0475
STANDARD CONDITIONS, GR/SCF	0.0611	0.0625	0.0563	0.0600
DRY STANDARD CONDITIONS, GR/DSCF	0.1024	0.1062	0.0953	0.1013
EFFLUENT BACK HALF PARTICULATE CONCENTRATION;				
ACTUAL CONDITIONS, GR/ACF	0.0069	0.0069	0.0054	0.0064
STANDARD CONDITIONS, GR/SCF	0.0088	0.0087	0.0068	0.0081
DRY STANDARD CONDITIONS, GR/DSCF	0.0147	0.0147	0.0116	0.0137
EFFLUENT TOTAL PARTICULATE CONCENTRATION;				
ACTUAL CONDITIONS, GR/ACF	0.0552	0.0563	0.0501	0.0539
STANDARD CONDITIONS, GR/SCF	0.0699	0.0711	0.0631	0.0680
DRY STANDARD CONDITIONS, GR/DSCF	0.1171	0.1210	0.1068	0.1150
SOURCE PARTICULATE EMISSION RATE;				
CLASSICAL METHOD, LB/HR	17.07	17.47	15.30	16.61
RATIO OF AREAS METHOD, LB/HR	18.29	18.66	16.32	17.76
	17.68	18.07	15.81	17.19

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

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

TABLE ANALYSIS OF VISIBLE EMISSION TEST DATA

PROJECT NUMBER: 9409
DATE TESTED: 7-19-93
TIME OF TEST: 1640

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

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

SUMMARY OF TEST DATA

PLUME OPACITY %	PERCENT OF TIME AT OPACITY	PERCENT OF TIME OPACITY EXCEEDED
0	36.25	63.75
5	57.50	6.25
10	6.25	0.00
15	0.00	0.00
20	0.00	0.00
25	0.00	0.00
30	0.00	0.00
35	0.00	0.00
40	0.00	0.00
45	0.00	0.00
50	0.00	0.00
55	0.00	0.00
60	0.00	0.00
65	0.00	0.00
70	0.00	0.00
75	0.00	0.00
80	0.00	0.00
85	0.00	0.00
90	0.00	0.00
95	0.00	0.00
100	0.00	0.00

OPACITY RANGE,%	TIME OPACITY IN RANGE % OF TIME	MIN/HR
0 - 20	100.00	60.00
25 - 40	0:00	0.00
45 - 60	0.00	0.00
> 60	0.00	0.00

MAXIMUM OBSERVED OPACITY, %: 10
MINIMUM OBSERVED OPACITY, %: 0
ARITHMETIC MEAN OPACITY, %: 3.5

SIX-MINUTE AVERAGE OPACITY, %

MAXIMUM:	5.0 (00:00-05:45)
2nd LARGEST:	4.8 (34:15-40:00)
3rd LARGEST:	4.8 (18:00-23:45)
4th LARGEST:	3.8 (12:00-17:45)
5th LARGEST:	3.5 (49:45-55:30)

APPENDIX B: FIELD DATA FORMS

mmt environmental services, inc.

PRELIMINARY DATA FORM
for circular stacks

Project No: 9409 Date: 7/19/93
Company: L.C. Kruse & Sons
Location: Windom, MN
Source: Asphalt plant scrubber

Stack/Duct inside diameter, inch: 57.25/62.0

Lengths of straight, undisturbed gas flow:
- Upstream of ports, inches: 134
- equivalent duct diameters: 2.25
- Downstream of ports, inches: 36
- equivalent duct diameters: 0.60

Number of sampling points:
- Required by EPA Method 1: 24
- Number actually used: 24
- Ports: 2 Points per port: 12

Sampling time/point, minutes: 2.5
Total time/test run, minutes: 60.0

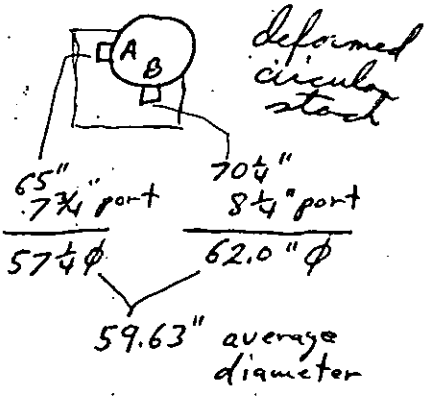
Point	Sampling Point Locations EPA Method 1					Preliminary Traverse Data pitot tube coefficient: _____				Cyclonic Flow Check EPA Method 1, Section 2.4	
		inches from		inches from		Port A		Port B		Port A	Port B
	% diameter	A wall	B	A port	B	ΔP in WC	Temp °F	ΔP in WC	Temp °F	yaw angle α, degrees	yaw angle α, degrees
1	2.1	1.2	1.3	9.0	9.6					8	4
2	6.7	3.8	4.2	11.6	12.4					6	7
3	11.8	6.8	7.3	14.5	15.6					5	11
4	17.7	10.2	11.0	17.9	19.2					7	10
5	25.0	14.3	15.5	22.1	23.8					9	10
6	35.6	20.4	22.1	28.1	30.3					10	8
7	64.4	36.9	39.9	44.6	48.2					5	5
8	75.0	42.9	46.5	50.7	54.8					6	8
9	82.3	47.1	51.0	54.9	59.3					8	6
10	88.2	50.5	54.7	58.2	62.9					10	7
11	93.3	53.4	57.9	61.2	66.1					8	6
12	97.9	56.0	60.7	63.8	68.9					9	9

Barometric pressure, in Hg: _____
Static pressure, in WC: _____
Dry bulb temperature, °F: 170
Wet bulb Temperature, °F: 164
Moisture content, % v/v: _____

Maximum ΔP: _____
Minimum ΔP: _____
Average ΔP: _____
Average °F: _____

Average α: 7.6

Note that the sampling site is not acceptable if the average yaw angle (α) is greater than 20 degrees.



MMT form: S-FD-2d 7/16/93

~~ODOR TEST~~

Field Data Sheet

MMT Job Number _____ Ambient Temperature, °F 79

Date 7-19-93 Barometric Pressure, in. Hg 28.69

Company L.E. Cruse Static Pressure, in. WC .02

Source 57.25 / 62.0 Dry Bulb Temp., °F 170

Dimensions, inches Scrubber Outlet Wet Bulb Temp., °F 164

Test Team Members TG - BA Moisture Content, % 37 %

VELOCITY TRAVERSE: Time 1058 Pitot Tube Coefficient @ .841

Traverse point number	Inches from wall	Inches from port	PORT A ΔP in. H_2O	PORT A 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		~~XX~~	.11		.09			
2	3.8	4.2			.17		.12			
3	6.8	7.3			.25		.14			
4	10.2	11.0			.24		.17			
5	14.3	15.5			.28		.19			
6	20.4	22.1			.27		.18			
7	36.9	39.9			.25		.29			
8	42.9	46.5		~~XX~~	.20		.27			
9	47.1	51.0			.21		.28			
10	50.5	54.7			.21		.24			
11	53.4	57.9			.19		.19			
12	56.0	60.7		~~XX~~	.17		.19			

ODOR SAMPLES

Bag Id.	Time

OBSERVERS

Name	Organization

COMMENTS

~~XX~~ $\overline{X}\sqrt{p} = .204$

Max = .29

Min = .11

Ideal Nozzle = .364

Actual Nozzle = .361

ID is 3

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 1
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: ~~9409~~ 9409	Control Unit No.: 5	ΔH@ 1.81
Date: 7-19-93	Gas Meter Coefficient: 0.9634	TM 90
Company: L.C. Kruse	Sample Box No.: 5	MC 37
Source: Asphalt Plant Scrubber	Probe No.: P Length: 72"	PS/PM ≈ 1
Source Dimensions: 59.63"Ø	Pitot No.: 67 Coefficient: A = .841	C .96
Test Team: TG + BA	Nozzle No.: L3 Diameter: .361 "D DA.	TS 170
Test Procedure: EPA 1-5	Filter No.: 8723	R
Ambient Temp., °F: 80	Barometric Pressure, in.Hg: 28.67	Static Pressure, in:WC: .03

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.
1325	-1	0	238.811	.10	.71	.71	6	168	79	79	241	256	75
	2	2.5	240.1	.15	1.07	1.07	9	183	80	79	252	257	70
1330	3	5	241.7	.25	1.79	1.79	13	180	80	79	251	255	66
	4	7.5	243.7	.21	1.5	1.5	11	179	80	79	257	249	52
1335	5	10	245.5	.15	1.07	1.07	9	182	80	79	254	252	53
	6	12.5	247.1	.24	1.71	1.71	12	180	81	80	251	247	53
1340	7	15	249.1	.27	1.93	1.93	14	181	80	80	250	249	53
	8	17.5	251.2	.28	2.0	2.0	15	180	82	80	252	251	53
1345	9	20	253.3	.27	1.93	1.93	14	181	83	80	251	250	53
	10	22.5	255.4	.23	1.64	1.64	11	181	83	80	251	248	53
1350	11	25	257.4	.25	1.79	1.79	12	180	83	80	249	251	53
	12	27.5	259.4	.18	1.29	1.29	10	177	84	80	250	250	53
1355	end	30	261.1										
1357	-1	0		.11	.79	.79	6	176	83	81	247	245	54
	2	2.5	262.4	.13	.93	.93	7	182	84	81	249	249	57
1402	3	5	263.9	.14	1.0	1.0	7	180	84	81	250	254	59
	4	7.5	265.4	.17	1.21	1.21	8	181	84	81	249	253	58
1407	5	10	267.1	.20	1.43	1.43	10	183	85	82	247	251	59
	6	12.5	268.9	.28	2.0	2.0	15	182	85	82	248	250	59
1412	7	15	271.0	.27	1.93	1.93	14	182	85	82	244	252	60
	8	17.5	273.1	.29	2.07	2.07	15	183	86	82	246	249	61
1417	9	20	275.3	.26	1.86	1.86	14	183	86	82	247	250	62
	10	22.5	277.4	.24	1.71	1.71	12	183	86	82	251	251	62
1422	11	25	279.7	.22	1.57	1.57	13	183	87	82	250	250	61
	12	25.5	281.2	.20	1.43	1.43	12	183	87	83	254	246	60
1427	end	30	283.037										

.2121

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	844.8	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1252	.001	22"
1320	.001	21"
1430	.005	25"

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							CO_2	
Oxygen							O_2	
Carbon Monoxide							CO	

Total Sampling Time, min.: 60
Volume of Gas Sampled, DCF: 44.226

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: 9409	Control Unit No.: 5	ΔH@ 1.81
Date: 7-19-93	Gas Meter Coefficient: .963	TM 85
Company: L. C. Kruse	Sample Box No.: 5	MC 3.7
Source: Asphalt Plant Scrubber	Probe No.: 70 Length: 70"	PS/PM ~ 1
Source Dimensions: 59.63" ø	Pitot No.: 67 Coefficient: A = .841	C .96
Test Team: TG + BA	Nozzle No.: 23 Diameter: .361	TS 182
Test Procedure: EPA 1-5	Filter No.: 8724	R
Ambient Temp., °F: 81	Barometric Pressure, in.Hg: 28.67	Static Pressure, in.WC: .03

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	286.292	.12	.85	.85	8	178	85	85	241	251	79
	2	2.5	287.7	.16	1.13	1.13	9	180	86	85	247	250	69
1505	3	5	289.3	.21	1.48	1.48	10	179	87	85	253	249	61
	4	7.5	291.1	.26	1.83	1.83	13	178	88	84	252	249	57
1510	5	10	293.2	.29	2.04	2.04	14	178	89	84	251	247	56
	6	12.5	295.4	.27	1.9	1.9	13	179	90	84	252	249	56
1515	7	15	297.5	.22	1.55	1.55	11	179	91	84	251	250	56
	8	17.5	299.3	.21	1.48	1.48	10	179	91	84	250	252	56
1520	9	20	301.2	.17	1.20	1.20	9	179	92	84	249	253	56
	10	22.5	302.8	.15	1.06	1.06	9	178	92	85	248	251	57
1525	11	25	304.4	.18	1.27	1.27	9	180	92	85	250	250	57
	12	27.5	306.1	.20	1.41	1.41	10	179	93	85	251	252	57
1530	end	30	307.9	X	X	X	X	X	X	X	X	X	X
1532	-1	0	X	.14	.99	.99	9	179	91	85	250	255	59
	2	2.5	309.7	.17	1.20	1.20	10	178	90	85	247	251	61
1537	3	5	311.1	.19	1.34	1.34	10	181	90	85	249	250	60
	4	7.5	312.8	.18	1.27	1.27	10	180	89	86	254	249	56
1542	5	10	314.5	.21	1.48	1.48	11	180	89	86	251	251	55
	6	12.5	316.4	.27	1.9	1.9	14	180	89	86	249	250	56
1547	7	15	318.5	.29	2.04	2.04	15	180	89	86	251	250	57
	8	17.5	320.6	.30	2.11	2.11	15	179	89	86	253	252	58
1552	9	20	322.8	.24	1.69	1.69	12	178	89	86	252	252	58
	10	22.5	324.8	.23	1.62	1.62	12	178	89	86	250	253	58
1557	11	25	326.7	.20	1.41	1.41	11	179	89	86	251	254	60
	12	25.5	328.5	.21	1.48	1.48	11	179	89	86	246	254	61
1602	end	30	330.391	X	X	X	X	X	X	X	X	X	X

.21125

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					X
Initial	100	100	0	904.1	X
Difference					X
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac., (in.Hg)
1453	.011	28"
1606	.009	25"

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		X		X		X	CO2	
Carbon Dioxide							% O2	
Oxygen							CO	
Carbon Monoxide								

Total Sampling Time, min.: 60
Volume of Gas Sampled, DCF: 44.099

FORM: S-F9-5

SOURCE EMISSION TEST
FIELD DATA SHEET

TEST: 1	RUN: 3
Page 1 of 1	

TEST IDENTIFICATION	EQUIPMENT IDENTIFICATION	NOMOGRAPH PARAMETERS
MMT Job Number: 9409	Control Unit No.: 5	ΔH@ 1.81
Date: 7-19-93	Gas Meter Coefficient: .9634	TM 89
Company: L.C. Kruse	Sample Box No.: 5	MC 37
Source: Asphalt Plant Scrubber	Probe No.: 70 Length: 70"	PS/PM ≈ 1
Source Dimensions: 59.63" ø	Pitot No.: 67 Coefficient: A=.841	C .963
Test Team: TG + BA	Nozzle No.: 13 Diameter: .361	TS 180
Test Procedure: EPA 1-5	Filter No.: 8275	R
Ambient Temp., °F: 81	Barometric Pressure, in.Hg: 28.65	Static Pressure, in.WC: .04

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.
1633	-1	0	337.144	.08	.56	.56	5	177	86	85	254	241	80
	2	2.5	338.3	.13	.92	.92	6	177	86	85	252	249	66
1638	3	5	339.7	.16	1.13	1.13	7	179	85	85	253	258	60
	4	7.5	341.3	.21	1.48	1.48	9	179	85	85	254	261	57
1643	5	10	343.2	.23	1.62	1.62	10	178	84	85	252	257	56
	6	12.5	345.1	.19	1.34	1.34	8	178	84	85	250	254	56
1648	7	15	346.9	.18	1.27	1.27	8	177	84	85	251	251	55
	8	17.5	348.6	.27	1.9	1.9	12	179	84	85	249	252	55
1653	9	20	350.7	.29	2.04	2.04	13	177	84	85	250	251	55
	10	22.5	352.8	.26	1.83	1.83	12	176	85	85	252	253	55
1658	11	25	354.9	.24	1.69	1.69	11	177	85	85	250	254	55
	12	27.5	356.9	.25	1.76	1.76	11.5	176	85	85	251	255	56
1703	end	30	358.9	X	X	X	X	X	X	X	X	X	X
1704	-1	0	X	.12	.85	.85	6	176	85	85	248	251	58
	2	2.5	360.3	.17	1.20	1.20	7	177	85	85	249	250	58
1709	3	5	361.9	.19	1.34	1.34	8	175	86	84	252	247	57
	4	7.5	363.7	.22	1.55	1.55	11	176	86	84	255	250	59
1714	5	10	365.6	.23	1.62	1.62	12	176	87	84	256	251	60
	6	12.5	367.5	.24	1.69	1.69	12	176	87	84	254	252	60
1719	7	15	369.5	.19	1.34	1.34	9	177	87	84	252	251	61
	8	17.5	371.2	.25	1.76	1.76	12	177	87	85	251	255	62
1724	9	20	373.3	.29	2.04	2.04	14	177	87	85	250	254	63
	10	22.5	375.4	.26	1.83	1.83	13	177	88	85	251	251	64
1725	11	25	377.5	.17	1.20	1.20	7	177	88	85	251	250	64
	12	25.5	379.1	.15	1.06	1.06	7	176	88	85	250	245	65
1734	end	30	380.706	X	X	X	X	X	X	X	X	X	X

MOISTURE DETERMINATION					
IMPINGER	1	2	3	4	5
Final					
Initial	100	100	0	873.4	
Difference					
Total Moisture Collected:					

SYSTEM LEAK CHECKS		
Time	Rate (cfm)	Vac. (in.Hg)
1627	.013	27"
1739	.015	23"

Impinger Catch Description:

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

Total Sampling Time, min.: 60
Volume of Gas Sampled, DCF: 43.562

FORM: S-FD-5

Visible Emission Observation Form

SOURCE NAME: L.C. Cruse

ADDRESS:

CITY: Windom | STATE: MN | ZIP:

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Asphalt Plant | OPERATING MODE:

CONTROL EQUIPMENT: 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 N STOP ✓

DESCRIBE EMISSIONS
START Plume STOP ✓

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 Droplets STOP ✓

DESCRIBE BACKGROUND
START Sky STOP ✓

BACKGROUND COLOR
START Blue STOP ✓

SKY CONDITIONS
START Clear STOP ✓

WIND SPEED
START 7-10 STOP 7-10

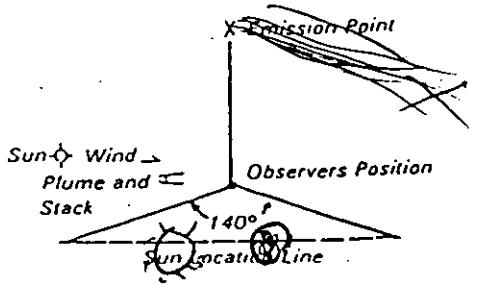
WIND DIRECTION
START SE STOP ✓

AMBIENT TEMP.
START 80° STOP 82

WET BULB TEMP.:

RH, percent:

Source Layout Sketch — Draw North Arrow



COMMENTS:

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

OBSERVATION DATE: 7-19-93 | START TIME: 16:40 | STOP TIME: 17:40

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

AVERAGE OPACITY FOR HIGHEST PERIOD: | NUMBER OF READINGS ABOVE % WERE:

RANGE OF OPACITY READINGS: MINIMUM 0 MAXIMUM 10

OBSERVER'S NAME (PRINT): Bill Anderson

OBSERVER'S SIGNATURE: Bill Anderson | DATE: 7-19-93

ORGANIZATION: MMT Environmental

CERTIFIED BY: ETA | DATE: 4-2-93

VERIFIED BY: | DATE:

APPENDIX C: LABORATORY REPORTS

SUMMARY OF PARTICULATE EMISSION TEST LABORATORY DATA

PROJECT NUMBER: 9409 COMPANY: L.C. KRUSE
TEST NUMBER: 3 SOURCE: ASPHALT PLANT SCRUBBER

	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	0.0153	0.0000	0.2506	0.2659	0.0225	0.0157	0.0382	0.3041
2	0.0396	0.0000	0.2328	0.2724	0.0167	0.0211	0.0378	0.3102
3	0.0300	0.0000	0.2120	0.2420	0.0184	0.0110	0.0294	0.2714

• NOT APPLICABLE

** CHLOROFORM/ETHYL ETHER EXTRACTION

LABORATORY REPORT: EPA Method 5

Project Number: 9409 Company: L.C. Kruse (Test # 3)

Frontwashes				
Test-Run	1-1	1-2	1-3	Date
Dish #	0469	0472	0475	- - - - -
1	2.3808	2.2800	2.2789	7-21-93
2	2.3807	2.2798	2.2787	7-22-93
3	2.3809	2.2799	2.2787	7-23-93
Tare	2.3652	2.2400	2.2485	10-30-92
Blank	0.0002	0.0002	0.0002	- - - - -
Net	0.0153	0.0396	0.0300	- - - - -

Solvent Blanks				
Solvents	Acetone	Chloroform	Ether	Date
Dish #	0466	0467	0468	- - - - -
1	2.2997	2.3552	2.3246	7-21-93
2	2.2997	2.3553	2.3247	7-22-93
3	2.2996	2.3554	2.3247	7-23-93
Tare	2.2994	2.3551	2.3245	10-30-93
Net	0.0002	0.0001	0.0001	- - - - -

Backwashes				
Test-Run	1-1	1-2	1-3	Date
Dish #	0470	0473	0476	- - - - -
1	2.3138	2.2683	2.2865	7-21-93
2	2.3133	2.2684	2.2863	7-22-93
3	2.3134	2.2684	2.2862	7-23-93
Tare	2.2973	2.2470	2.2750	10-30-93
Blank	0.0002	0.0002	0.0002	- - - - -
Net	0.0157	0.0211	0.0110	- - - - -

Glass Filters				
Test-Run	1-1	1-2	1-3	Date
Filter #	8723	8724	8725	- - - - -
1	0.7659	0.7475	0.7267	7-21-93
2	0.7658	0.7474	0.7267	7-22-93
3	0.7657	0.7472	0.7269	7-23-93
Tare	0.5151	0.5144	0.5147	2-15-93
Net	0.2506	0.2328	0.2120	- - - - -

Extractions				
Test-Run	1-1	1-2	1-3	Date
Dish #	0471	0474	0477	- - - - -
1	2.2531	2.2603	2.2319	7-21-93
2	2.2529	2.2604	2.2321	7-22-93
3	2.2528	2.2603	2.2321	7-23-93
Tare	2.2301	2.2434	2.2133	10-30-93
Blank	0.0002	0.0002	0.0002	- - - - -
Net	0.0225	0.0167	0.0184	- - - - -

COMMENTS

Lowest Final Weight
- Tare
- Blank(if applicable)

= Sample Net Gain (grams)

Signature Bill Anderson Date 7-26-93

Laboratory Report: Moisture Content of Aggregate Samples

Project Number 9409 Company L.C. Kruse - Retest #2

Test 1-1

Trial #	1	2	3	Date
Dish #	478	479	480	481
Tare	2.2540	2.2351	2.2331	2.2042
Tare + Wet	42.5742	42.7153	42.4324	42.7893
Wet	40.3202	40.4802	40.1993	40.5851
Dry	37.9409	38.2962	37.9544	38.3278
Dry + Tare	40.1949	40.5313	40.1852	40.5320
% Moisture	5.90	5.40	5.58	5.56

Test 1-2

Trial #	1	2	3	Date
Dish #	482	483	484	485
Tare	2.2288	2.2438	2.2470	2.2524
Tare + Wet	42.7409	42.7652	42.9220	42.7406
Wet	40.5121	40.5214	40.6750	40.4882
Dry	38.3459	38.1104	38.2900	38.1247
Dry + Tare	40.5747	40.3542	40.5370	40.3771
% Moisture	5.35	5.95	5.86	5.84

Test 1-3

Trial #	1	2	3	Date
Dish #	486	487	488	489
Tare	2.2539	2.2717	2.3253	2.3372
Tare + Wet	42.5645	42.5552	42.7920	42.7076
Wet	40.3106	40.2835	40.4667	40.3704
Dry	38.1030	37.9801	38.3110	38.0155
Dry + Tare	40.3569	40.2518	40.6363	40.3527
% Moisture	5.48	5.72	5.33	5.83

Summary

	Mean	Deviation	% Error
Test 1-1	5.61	0.21	3.74
1-2	5.75	0.27	4.70
1-3	5.59	0.23	4.11

Comments

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

100- % Solids = % Moisture

Signature Bill Anderson Date 7-23-93

ORSAT ANALYSIS

Job Number: 9409 Company: LC Kruse

SAMPLE DESCRIPTION		SAMPLE ANALYSIS						
stack outlet		Replicate 1		Replicate 2		Replicate 3		
	Parameter Measured	Buret Reading	Percent Volume	Buret Reading	Percent Volume	Buret Reading	Percent Volume	
Sample Id: 3-1								Average
Collected By: BA	Initial Reading	0	–	0	–	0	–	
Date Collected: 7-19-93	Carbon Dioxide	8.6	8.6	8.6	8.6	8.5	8.5	8.6
Analyzed By: TG	Oxygen	17.8	9.2	17.9	9.3	17.7	9.2	9.2
Date Analyzed: 7-19-93	Carbon Monoxide	NA	–	–	–	–	–	F_o = 1.3
Sample Id: 3-2								
Collected By: BA	Initial Reading	0	–	0	–	0	–	
Date Collected: 7-19-93	Carbon Dioxide	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Analyzed By: TG	Oxygen	18.2	10.4	18.2	10.4	18.2	10.4	10.4
Date Analyzed: 7-19-93	Carbon Monoxide	NA	–	–	–	–	–	F_o = 1.3
Sample Id: 3-3								
Collected By: BA	Initial Reading	0	–	0	–	0	–	
Dated Collected: 7-19-93	Carbon Dioxide	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Analyzed By: TG	Oxygen	17.8	9.3	17.8	9.3	17.8	9.3	9.3
Date Analyzed: ~~Et~~ 7-19-93	Carbon Monoxide	NA	–	–	–	–	–	F_o = 1.3

[Residual Fuel Oil F_o range 1.21 – 1.37]

PROJECT # 9409 COMPANY L.C. Kruse

TEST DATE(s) Monday 7-19-93 SOURCE Aggregate Dryer

EPA METHOD 4 LABORATORY REPORT

Filter #	TEST-RUN #	IMPINGER #	INITIAL	FINAL	GAIN	DESCRIPTION
8723	1-1	1	100	327	227	cloudy white
		2	100	316	216	
		3	0	108	108	
		4	844.8	868.7	23.9	
		5	Not Applied			
		TOTAL MOISTURE GAIN, ML =			574.9	
8724	TEST-RUN #	1	100	363	263	cloudy white
		2	100	347	247	
		3	0	40	40	
	1-2	4	904.1	942.8	38.7	
		5				
		TOTAL MOISTURE GAIN, ML =			588.7	
8725	TEST-RUN #	1	100	397	297	cloudy white
		2	100	283	183	
		3	0	72	72	
	1-3	4	873.4	897.5	24.1	
		5				
		TOTAL MOISTURE GAIN, ML =			576.1	

Note: Third test @ this site within last 45 days.

Extractions required 200 ml of both Chloroform followed by 200 ml Ethyl Ether.

APPENDIX D: CALIBRATION DATA

CALIBRATION
DRY TEST METER/ORIFICE METER

Date: 7-16-93 Barometric Pressure, in. Hg. (Pb): 28.75

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	5.374	77	204.410	209.955	75	79	75	76	13
1.0	0	5.374	12.205	77	209.955	217.089	79	87	76	78	13
2.0	0	12.205	23.547	77	217.089	227.932	85	93	78	79	11
3.0	0	23.547	33.247	77	227.932	239.123	96	96	79	81	11

COMPUTER PRINTOUT

H	Vw	Tw	Vd	Td	Q	C	Hθ
0.5	5.374	77	5.545	76.3	13.0	0.9666	1.7349
1.0	6.831	77	7.134	80.0	12.0	0.9604	1.8171
2.0	10.342	77	10.843	83.8	13.0	0.9609	1.8479
3.0	10.700	77	11.191	86.5	11.0	0.9656	1.8447

AVERAGE CORRECTION FACTOR: C = 0.9634
AVERAGE ORIFICE CONSTANT: Hθ = 1.8111

EQUATIONS:

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

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

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

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

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

Calibration Performed by:

(Print) Bill Anderson
Bill Anderson

CALIBRATION
DRY TEST METER/ORIFICE METER

Tuesday
Date: 7.20.93 Barometric Pressure, in. Hg: (Pb): 28.80

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	4.112	77	383.937	388.137	73	79	73	74	10
1.0	0	4.112	8.652	77	388.137	392.853	74	79	87	75	8
2.0	0	8.652	19.232	77	392.853	403.862	79	77	77	94	13
3.0	0	19.232	38.632	77	403.863	424.056	77	106	92	82	20

10 sec delay

COMPUTER PRINTOUT

Post Test Calibration

H	Vw	Tw	Vd	Td	Q	C	Ha
0.5	4.112	77	4.200	74.8	10.0	0.9737	1.7552
1.0	4.540	77	4.716	78.8	8.0	0.9634	1.8293
2.0	10.580	77	11.010	81.8	13.2	0.9645	1.8157
3.0	19.400	77	20.193	89.3	20.0	0.9752	1.8426

AVERAGE CORRECTION FACTOR: C = 0.9692
AVERAGE ORIFICE CONSTANT: Ha = 1.8107

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 = 0.9663

Calibration Performed by:

(Print) Ted Gibbons

(Signature)

CALIBRATION

S-TYPE PITOT TUBE

Date: 4.5.93

Probe Sheath ID: .70"

S-Type Pitot Tube ID No.: 67"

Ambient Temperature, °F: 66

Standard Pitot Tube ID No.: 18"

Barometric Pressure, in. Hg.: 29.18

Standard Pitot Tube Coefficient: 0.995

PITOT TUBE EXAMINATION

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

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

COMPUTER PRINTOUT

SIDE A CALIBRATION				SIDE B CALIBRATION			
Pstd	Ps	Cp	Cp-Cp(A)	Pstd	Ps	Cp	Cp-Cp(B)
0.125	0.173	0.846	0.005	0.125	0.173	0.846	0.005
0.360	0.503	0.842	0.001	0.370	0.520	0.839	-0.001
0.850	1.200	0.837	-0.003	0.810	1.150	0.835	-0.005
1.420	2.000	0.838	-0.002	1.430	2.000	0.841	0.001
Cp(A) = 0.841				Cp(B) = 0.840			

Side A (σ) = .004

Side B (σ) = .004

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	Nozzle Employed	.362	.360	.361	0.361
L-4		.493	.488	.493	0.491
L-5		.125	.124	.123	0.124
L-6		.302	.300	.305	0.302
L-7		.181	.177	.181	0.180
L-8		.489	.492	.494	0.492
L-9		.743	.747	.745	0.745
L-10		.246	.241	.242	0.243
L-11		.251	.253	.248	0.251
L-12		.240	.241	.241	0.241
L-13		.243	.241	.239	0.241
L-14		.199	.199	.199	0.199
L-15		.369	.369	.374	0.371
L-81		.567	.562	.562	0.564

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

Calibration Performed by:

(Print) Ted Gibbons

(Signature) Ted Gibbons

Date: 3.29.93

FORM: SSQA-3

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 Temp Thermocouple

EQUIPMENT CALIBRATION		
Reference temperature by mercury-in-glass thermometer, °F T_a	Temperature indicated by thermocouple and temperature meter, °F T_i	Deviation, °F $T_i - T_a$
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.: 18" Std Flexible	MMT ID No.: - - - -
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268 - KF1
Length: 1.5 Feet	SN: 747 - 4363
Length of connecting (extension) wire: 20 feet	

* Probe Thermocouple

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

Calibration Performed by:

(Print) Ted Gibbons

(Signature) Ted Gibbons

Date: 4.6.93

CALIBRATION

THERMOCOUPLE/TEMPERATURE METER

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

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

Calibration Performed by:

(Print) Bill + Ted

(Signature) Bill + Ted

Date: 4.6.93

CALIBRATION _

THERMOCOUPLE/TEMPERATURE METER

EQUIPMENT IDENTIFICATION	
THERMOCOUPLE	TEMPERATURE METER
MMT ID No.: #5 Console Motor Inlet	MMT ID No.: -
Mfg: Omega	Mfg: Newport Laboratories
Type: Chromel - Alumel	Model: 268 - KF1
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

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

APPENDIX E: PROCESS DATA

GENERAL DATA FORM

EMT Job Number: 9409 Date: Monday 7.19.93

Company: L.C. Kruse

Source: Asphalt Plant - Aggregate Drum Dryer

	Time	Burner setting	Aggregate TONS/HR.	AC/ TONS/HOUR	DRUM EXIT TEMP	pressure drop	scrubber water flow rate
	12:45	60	260	16.1	285	10	360
	1:00	60	260	16.1	285	10	360
	1:15	~~60~~	265	16.4	285	10	360
1	1:30	65	265	16.3	290	10	360
1	1:45	65 (64)	260	16.1 (16.2)	285 (286)	10 (9.8)	360 (361)
1	2:00	65	260 (261)	16.2	285	9	365
1	2:15	65	260	16.1	285	10	360
1	2:30	60	260	16.1	285	10	360
	2:45						
	3:00	60	265	16.4	290	9	350
2	3:15	60 (62)	265 (267)	16.4	285	9	350
2	3:30	60	265	16.3 (16.5)	285 (284)	9 (9.0)	350 (350)
2	3:45	65	270	16.8	280	9	350
2	4:00	65	270	16.8	280	9	350
	4:15						
	4:30	65	270	16.6	280	9	350
3	4:45	70	275	17.1	280	9	350
3	5:00	70 (69)	275 (274)	17.1 (17.1)	280 (280)	9 (9.0)	350 (350)
3	5:15	70	275	17.2	280	9	350
3	5:30	70	275	17.1	280	9	350

Operator Name: Daniel D Schultz

Signature: X

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